

SUNPOWER®

Safety and Installation Instructions

United States and Canada

This document applies to all SunPower modules listed in Table 1.

This document includes references to SunPower **E-Series, X-Series, P-Series, A-Series** and NE modules. These modules do not have grounding restrictions and all are compatible with high-efficiency transformerless inverters.

Contents of this manual are subject to change without notice.
For the latest US & Canada manual please refer to www.sunpower.com/PVInstallGuideUS



SunPower Corporation
www.sunpower.com

For the latest for Europe, Asia, Australia, Latin America and Africa manual please refer to
www.sunpower.com/PVInstallGuideIEC

For the latest US & Canada technical specifications please refer to
www.sunpower.com/PVResidentialSTS (for residential modules)
www.sunpower.com/PVCommericalSTS (for commercial and utility modules)

Safety and Installation Instructions (United States and Canada)

1.0 Introduction

This manual provides safety and installation instructions for UL Listed SunPower photovoltaic (PV) modules that have the UL logo on the product label:



IMPORTANT! Please read this manual in its entirety before installing, wiring, or using this product in any way. Failure to comply with these instructions will invalidate the SunPower Limited Warranty for PV Modules.

1.1 Disclaimer of Liability

The installation techniques, handling, and use of this product are beyond company control. Therefore, SunPower assumes no responsibility for loss, damage or expense resulting from improper installation, handling, or use.

1.2 Underwriters Laboratories (UL) Listing Information

This product meets or exceeds the requirements set forth by UL 1703, ULC/ORD-C1703-01 for PV Modules and UL1741 for modules with -MLSD. These Standards cover flat-plate PV modules and panels intended for installation on buildings or those intended to be freestanding. To satisfy the Listing for this product the modules must be mounted with a rack or standoff structure. The Listing does not include integration into a building surface because additional requirements may apply. This product is not intended for use where artificially concentrated sunlight is applied to the module.

1.3 Limited Warranty

Module limited warranties are described in full in the SunPower warranty certificates obtainable at www.sunpower.com. In summary, the Limited Warranties do not apply to any of the following:

Modules which in SunPower's absolute judgment have been subjected to misuse, abuse, neglect or accident; alteration; or improper installation, application or removal. This includes, but is not limited to, installation, application, or removal by any party other than a SunPower authorized dealer; non-observance of SunPower's installation, user's and/or maintenance instructions; repair or modifications by someone other than an approved service technician of SunPower; power failure surges, lightning, flood, fire, accidental breakage, or other events beyond SunPower's control.

2.0 Safety Precautions

Before installing this product, read all safety instructions in this document.

DANGER! Module interconnection cables pass direct current (dc) and are sources of voltage when the module is under load and when it is exposed to light. **Direct current can arc across gaps and may cause injury or death if improper connection or disconnection is made; or if contact is made with module leads that are frayed or torn.** Do not connect or disconnect modules when a current source is energizing the conductors. Modules may contain high voltage when interconnected with other modules.

- All installations must be performed in compliance with the National Electrical Code (NEC) and any applicable local codes.
- For Canadian jurisdictions, installations shall be in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1
- There are no user-serviceable parts within the module. Do not attempt to repair any part of the module.
- Installation should be performed only by qualified personnel.
- Do not stand on, drop, scratch, or allow objects to fall on modules as it may damage them and void the warranty.

- Do not place anything on the modules, even for a moment because resulting residue may damage or stain the glass surface.
- If the front glass is broken, or the backsheet is torn, contact with any module surface or module frame can cause electric shock.
- Broken J-boxes or connectors are electrical hazards as well as laceration hazards. Installers should remove any such module from the array and contact SunPower for disposal instructions.
- Do not install or handle the modules when they are wet or during periods of high wind.
- Do not block drain holes or allow water to pool in or near module frames.
- SunPower recommends a conservative minimum cable bend radius of equal to or greater than 40 mm (1.5").
- Unconnected connectors must always be protected from pollution (e.g dust, humidity, foreign particles, etc), prior to installation. Do not leave unconnected (unprotected) connectors exposed to the environment. A clean assembly environment is therefore essential to avoid performance degradation.
- Contact SunPower if maintenance is necessary.
- Save these instructions!

2.1 Fire Rating

The module fire rating is Type 2 per UL1703, 2013 edition and Class C per UL1703, 2002 edition. Fire rating classification for any PV system using UL1703:2013 can only establish a fire rating in combination with the mounting system ratings normally found in the mounting system installation instructions.

3.0 Electrical Characteristics

Electrical characteristics of the modules are described in Table 1 below. Each module contains three bypass diodes. For all modules, the maximum series fuse rating is 15A and 20A for A-Series modules. Under normal conditions, a photovoltaic module may experience conditions that produce more current and/or voltage than reported at Standard Test Conditions. Accordingly, the values of ISC and VOC marked on UL Listed modules should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor capacities, fuse sizes and size of controls connected to the module output. Refer to Section 690-8 of the NEC for an additional 1.25 Safety factor which may be applicable.

Table 1: Electrical Characteristics¹

Module	Rated Power (W)	Voltage at Rated Power V _{mpp} (V)	Current at Rated Power, I _{mpp} (A)	Open Circuit Voltage Voc (V)	Short Circuit Current, I _{sc} (A)	Maximum System Voltage UL V _{max} (V)
SPR-X21-470-COM	470	77.6	6.06	91.5	6.45	1000
SPR-X21-460-COM	460	77.3	5.95	90.5	6.39	1000
SPR-X21-445-COM	445	76.5	5.82	90.0	6.24	1000
SPR-X22-370-COM	370	59.1	6.26	69.5	6.66	1000
SPR-X22-370						600
SPR-X22-365-COM	365	59.1	6.18	69.5	6.57	1000
SPR-X22-360-COM	360	59.1	6.09	69.5	6.48	1000
SPR-X22-360						600
SPR-X21-350-BLK	350	57.3	6.11	68.2	6.50	600
SPR-X21-345-COM	345	57.3	6.02	68.2	6.39	1000
SPR-X21-345						600
SPR-X21-335	335	57.3	5.85	67.9	6.23	600
SPR-X21-335-BLK						
SPR-X19-315-COM	315	57.3	5.50	67.3	5.90	1000
SPR-X19-315-BLK						600

(Continued the next page)

¹ For models not shown here, please contact SunPower technical support or visit www.sunpower.com. Electrical parameters are measured at Standard Test Conditions (STC). The series fuse must have an interrupting rating that is equal to or greater than the maximum fault current that the fuse is required to interrupt, including contributions from all connected sources of energy. Refer to NEC Article 100, Part II as to what type of series fuse is acceptable for modules rated at higher than 600 V dc system voltage.

Module	Rated Power (W)	Voltage at Rated Power Vmpp (V)	Current at Rated Power, Imp (A)	Open Circuit Voltage Voc (V)	Short Circuit Current, Isc (A)	Maximum System Voltage UL Vmax (V)
SPR-X20-327-COM	327	57.3	5.71	67.6	6.07	1000
SPR-X20-327						600
SPR-X20-327-BLK						600
SPV-X19-310-COM	310	57.3	5.41	67.2	5.82	1000
SPR-X19-310						600
SPR-X19-310-BLK						600
SPR-X22-360-COM-MLSD	360	59.1	6.18	69.5	6.66	1000
SPR-X21-345-COM-MLSD	345	57.3	6.02	68.2	6.39	1000
SPR-X21-335-COM-MLSD	335	57.3	5.85	67.9	6.23	1000
SPR-X20-327-COM-MLSD	327	57.3	5.71	67.6	6.07	1000
SPR-E20-450-COM	450	72.9	6.18	86.5	6.65	1000
SPR-E20-445-COM	445	72.9	6.11	86.5	6.57	1000
SPR-E20-440-COM	440	72.9	6.04	86.5	6.5	1000
SPR-E20-435-COM	435	72.9	5.97	85.6	6.43	1000, 1500
SPR-E19-420-COM	420	72.9	5.77	85.6	6.20	1000
SPR-E19-410-COM	410	72.9	5.62	85.3	6.01	1000
SPR-E21-340-COM	340	54.7	6.21	64.9	6.71	1000
SPR-E20-327-BLK	327	54.7	5.98	64.8	6.46	600
SPR-E20-327						600
SPR-E20-327-COM						1000
SPR-E19-320	320	54.7	5.86	64.7	6.24	600
SPR-E19-320-COM	320					600
SPR-E19-315	315	54.7	5.76	64.6	6.14	600
SPR-E19-315-BLK						600
SPR-E19-310-COM	310	54.7	5.67	64.4	6.05	1000
SPV-E19-310-COM						1000
SPR-E18-305	305	54.7	5.58	64.2	5.96	600
SPR-E18-300-COM	300	54.7	5.49	64.0	5.87	1000
SPR-E18-300-BLK						600
SPR-E18-300						600
SPR-E18-295-COM	295	54.2	5.45	63.3	5.83	1000
SPR-E20-330-COM	330	54.7	6.04	64.9	6.52	1000
SPR-E20-330-COM-MLSD	330	54.7	6.04	64.9	6.52	1000
SPR-E20-327-COM-MLSD	327	54.7	5.98	64.8	6.46	1000
SPR-E19-320-COM-MLSD	320	54.7	5.86	64.7	6.24	1000
SPR-P19-400-COM	400	43.4	9.22	52.7	9.80	1500
SPR-P19-395-COM	395	43.2	9.14	52.5	9.72	1500
SPR-P19-390-COM	390	43.1	9.05	52.3	9.64	1500
SPR-P19-385-COM	385	42.8	8.99	52.0	9.58	1500
SPR-P19-380-COM	380	42.6	8.92	51.8	9.49	1500
SPR-P19-380-COM-MLSD	380	43.3	8.78	52.2	9.43	1500
SPR-P19-385-COM-MLSD	385	43.8	8.80	52.5	9.44	1500
SPR-P19-390-COM-MLSD	390	44.1	8.85	52.9	9.45	1500
SPR-P19-395-COM-MLSD	395	44.4	8.90	53.4	9.47	1500
SPR-P19-400-COM-MLSD	400	44.8	8.93	53.6	9.5	1500
SPR-A430-COM	430	42.7	10.1	51.2	10.9	1500
SPR-A440-COM	440	43.4	10.2	51.6	10.9	1500
SPR-A440-COM-MLSD						1500
SPR-A450-COM	450	44	10.2	51.9	11.0	1500
SPR-A450-COM	450	44	10.2	51.9	11.0	1500
SPR-A410	410	40	10.2	48.2	10.9	1000
SPR-A415	415	40.3	10.3	48.2	10.9	1000
SPR-A20	420	40.5	10.4	48.2	10.9	1000

4.0 Electrical Connections and System Monitoring

Modules may be connected in series or parallel to achieve the desired electrical output provided certain conditions are met.

SunPower recommends using the same brand connector in a PV system. Currently approved compatible connectors found on SunPower modules are: Tyco Solarlok PV4 and PV4S, Yukita (YS-254/YS-255) and Multicontact MC4 (PVKBT4/6II, PVKST4/6II). SunPower warrants the connectors delivered on SunPower supplied modules and harnesses as being compatible.

4.1 Equipment Grounding

To reduce the possibility of electrical shock, ground the frame of the module or array per NEC before wiring the circuit. In order to install in accordance with their UL Listing, SunPower modules must be grounded using grounding hardware that meets requirements for grounding systems in UL 467, UL 1703, or UL 1741; on anodized aluminum frames. SunPower recommends using one of the following methods of grounding the module frame. In addition, to avoid corrosion due to the use of dissimilar metals SunPower recommends stainless steel between copper and aluminum. For the Generation 5 (G5) frame, only methods 1 and 2 apply.

- 1) Attach a lay-in lug (Ilco GBL-4DBT, Burndy CL50-DB-T or Tyco Solklip 1954381-2) to one of the grounding holes on the module frame, and attach the ground conductor to the lug. Use stainless steel hardware (bolt, washers, and nut). Use an external-tooth star washer between the lug and the module frame in order to pierce the anodizing and establish electrical contact with the aluminum frame. The assembly must end with a nut that's torqued to 20–25 in-lb (for a #10-32 bolt). A lock washer or other locking mechanism is required to maintain tension between the bolt and the assembly. The conductor must be attached to the ground lug using the lug's set screw. Refer to NEC 690.
- 2) SunPower modules may also be grounded through the use of SunPower IFF clips which are UL Listed (1703 and 1741). IFF clip torque value is 35–45 in-lbs for a 1/4-20 or M6 bolt, but may be higher in specific applications. When using IFF clips, the module mounting system must be grounded as per NEC 250.

Note: Method 3 is evaluated to UL 1703 by ETL. As such, the use of these devices is not considered part of the UL Listing of these modules.

- 3) If the Unirac SOLARMOUNT system is used for mounting the modules, grounding is achieved using either a BURNDY Wiley WEEB-UMC or WEEB-UGC-1 grounding clip in combination with Unirac's Mid or End clamps and 1/4-20 bolt and flanged nut, torqued to 120 in-lbs. If the Solarmount-I system is used grounding is achieved with the UniRac UGC-2 grounding clips in combination with UniRac's Mid or End clamps and Sliders with a 1/4-20 bolt and flanged nut torqued to 120 in-lbs.

Note: Method 4 was evaluated to UL 2703 by TUV. As such, the use of these devices is not considered part of the UL Listing of these modules.

- 4) SunPower modules may also be grounded using a WEEB-9.5NL ground clip in between the module and supporting structure. This combination is secured with a 1/4" stainless steel rivet or a 1/4-20 by 3/4" zinc-plated bolt with zinc-plated K-nut torqued to min. 6 ft-lbs to secure the module to minimum 12 ga. G90 coated steel or Z-purlin, either painted or unpainted. The WEEB-9.5NL is for single use only.
- 5) Other grounding methods may be used in conjunction with a module mounting system tested to UL2703. For these installations, the SunPower module and frame style must be tested and part of the instructions for the listed mounting product. The SunPower module must be installed in accordance with these instructions as well as the mounting system's listed instructions.
- 6) SunPower G5-frame modules may be grounded through the use of an InvisiMount™ mid clamp that bonds the module frame to the InvisiMount™ rail. InvisiMount™ rail sections must be bonded and connected to a grounding conductor using methods and materials specified in the InvisiMount™ manual.

When using methods 2, 3, 4, 5 or 6 the module mounting structure must be grounded as per NEC 250. To ensure system safety and structural integrity, strict adherence to application-specific SunPower documentation is required.

4.2 System Grounding

Review the Table 2 below for the proper grounding techniques for the installation of your particular SunPower modules.

Table 2: Module Grounding Key

Module Model Grounding Key ²	
SunPower A-Series, P-Series, E-Series, X-Series,	Legacy modules must be

² YY is a number ranging from 15 to 22 and ZZZ is panel wattage.

and NE modules have no grounding restrictions:		positively grounded:
All model numbers starting with "SPR-AZZZ", "SPR-PYY", "SPR-EYY" or "SPR-XYX"	SPR-ZZZNE-BLK-D SPR-ZZZNE-WHT-D	SPR-ZZZE-WHT-D SPR-ZZZ-WHT-D SPR-ZZZE-BLK-D SPR-ZZZ-BLK-D
IMPORTANT! For optimal performance, SunPower modules listed above as needing positive grounding must be configured as described. Failure to comply with this requirement will reduce system performance and invalidate SunPower's Limited Power Warranty for PV Modules.		

4.3 NEC 2017 690.12 Compliance

Modules containing -MLSD in the product name come with a pre-installed SunSpec compliant rapid shutdown receiver from Tigo Energy Inc that, when used and installed with approved equipment, constitute a UL1741 listed array meeting the requirements of NFPA 70, 2017 article 690.12(B)(2). Please refer to Tigo Energy's list of approved equipment for additional details and requirements.

5.0 Module Mounting

The SunPower Limited Warranty for PV Modules is contingent upon modules being mounted in accordance with the requirements described in this section.

5.1 Site Considerations

SunPower modules should only be mounted in locations that meet the following requirements:

Operating Temperature: All SunPower modules must only be mounted in environments that ensure they will operate within the following temperatures:

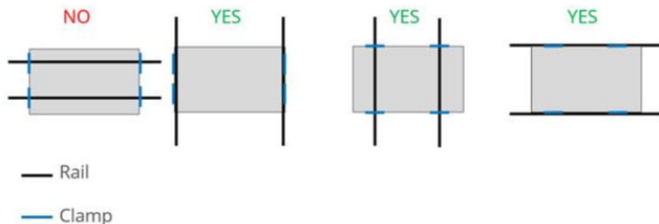
Operating Temperature range	-40°C to +85 °C -40°F to +185 °F
Operating Temperature range (w/ MLSD)	-40°C to +75 °C -40°F to +167 °F

Care should be taken to provide ventilation behind or underneath the modules, especially in hot environments.

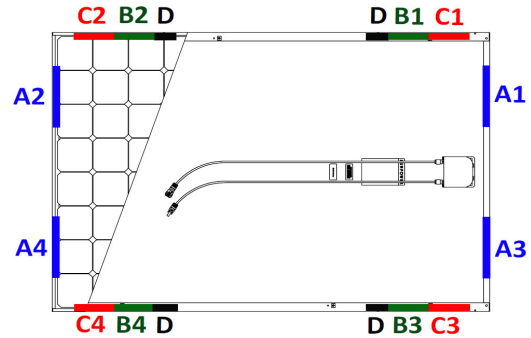
Design Strength: SunPower modules are designed to meet a maximum positive (or up/down, e.g. wind) and negative (or downward, e.g. static or snow load) design pressure described in the Table 3. Design strength of 2400Pa wind load corresponds approximately to a wind speed of 130 km/h (approximately ±800 Pa, per IEC reference) with a safety factor of 3 for gusty winds. Modules have also been evaluated by UL for a maximum negative or positive design load of 30 psf. P19 modules have been evaluated by UL for a maximum negative design load of 75 psf and maximum positive design load of 125 psf.

Figure 1: Mounting locations for SunPower Modules shows where to mount to the module frame. Table 3 defines mounting options, attachment locations and resulting load rating achieved for each module configuration.

Figure 1: Mounting locations for SunPower modules



For 96 cells, A-Series:



For 128 cells and P-Series:

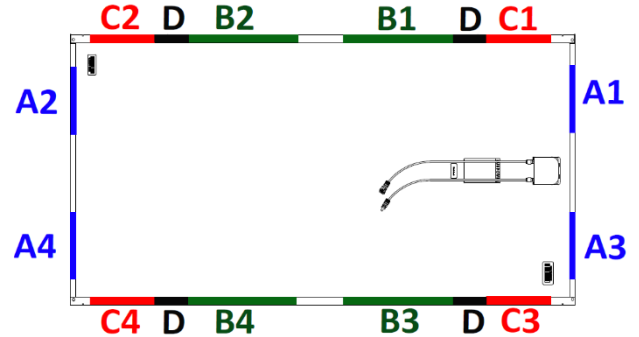


Table 3: Mounting Configurations and Load Resistance

Module Configuration		Mounting zone distance from corner in (mm) ¹		
Module size	Frame type	A (1&2&3&4)	B (1&2&3&4)	C (1&2&3&3)
96 cell	G3	50-350	150-620 ^D	50-150
96 cell	G5	50-400	300-400	50-300
128 cell & P-Series	G4.x	50-350	375-880 ^D	50-375
A-Series 72c	G4.2/5.1	50-350	296-536	50-296, 536-796
A-Series 66c	G5.2	50-350	300-500	50-300

D – There is a 20mm zone at 388-408mm from the corner where mounting is not allowed due to the module stacking pin feature. Not applicable for all residential modules.

1) No part of the module clamp may extend beyond this area.

Table 3.1: Mounting Zone Load Ratings for Racking system without rail support (units in Pa)

Module Configuration		Wind (up & down) / Snow (down)		
Module size	Frame type	End Mount A (1&2&3&4)	B (1&2&3&4)	C(1&2&3&4) or B + C (B1&3 + C2&4 or B2&4 + C1&3) Or A + B (A1&3 + B2&4 or A2&4 + B1&3) Or A + C (A1&3 + C2&4 or A2&4 + C1&3)
96 cell	G3	2400/ 2400(*)	2400/ 5400	2400/2400
96 cell	G5	3000/3000	3000/ 3000	3000/3000
128 cell & P-Series	G4.x	Not applicable (**)	3600/ 3600	2400/2400
A-Series 72c	G4.2/5.1	Not applicable (**)	3600/ 3600	1600/1600
A-Series 66c	G5.2	2000/2000	3600/ 3600	1600/1600

(*): 5400Pa is allowed with clamps and mounting rail support underneath short length of frame edge

(**): 2400/2400Pa are allowed with clamps and mounting rail support underneath short length of frame edge

Table 3.2: Mounting Zone Load Ratings for Racking with rail support underneath length of frame edge (units in Pa)

Module Configuration		Wind (up & down) / Snow (down)	
Module size	Frame type	B (1&2&3&4)	C (1&2&3&3)
96 cell	G3	2400/ 2500	2400/2400
96 cell	G5	3000/3000	3000/6000
128 cell & P-Series	G4.x	3600/ 5400	2400/3600
A-Series 72c	G4.2/5.1	3600/3600	2800/2800
A-Series 66c	G5.2	3600/6000	2800/2800

Excluded Operating Environments

Certain operating environments are not recommended for SunPower modules, and are excluded from the SunPower Limited Warranty.

Performance Series Mounting Orientation

Commercial Performance Series (P-Series) modules are designed to be installed in landscape orientation. In landscape orientation, P-series modules maintain higher power under row to row shading and edge soiling.

5.2 Mounting Configurations

Modules integrated into or mounted over a roofing system must be mounted over a fire-resistant roof covering rated for the application. Modules may be mounted at any angle, from horizontal to vertical. To reduce soiling, modules should be mounted at a minimum of 10 degrees.

Residential (black) module frames have two profile types, G3 and G5. Commercial (silver) module frames have permanently attached stacking pins. **Mounting system hardware used with commercial modules must account for the presence of these stacking pins.** Mechanical specifications for modules are shown in Table 4.

In order to prevent water from entering the junction box, which could present a safety hazard, modules should be oriented with the junction box in the uppermost position and *not* be mounted such that the cell faces downward (e.g. on a tracking structure that positions the modules with the junction box facing skyward during sleep mode).

For 128-cell and P- Series modules a minimum of 4" of clearance between the module frames and the structure (or grade) is required; for all other modules a minimum of 1.5" of clearance is required. The required clearance between installed modules is a minimum of ¼ inch distance.

The module is only UL Listed for use when its factory frame is fully intact. Do not remove or alter the module frame, and do not create additional mounting holes because doing so may compromise the integrity of the frame.

Modules may be mounted using the following methods only:

- 1) Frame Holes:** Secure the module to the structure using the factory mounting holes. Four 1/4" stainless steel bolts, with nuts, washers, and lock washers are recommended per module; tightened to a min. torque of 10 in-lbs. Refer to Table 4 for the module dimensions and hole locations. This method has been certified by a third-party organization according to UL 1703. For frame hole mounting, modules must be secured using the holes located at 322mm from the short end of the module for 96 cell modules and 433mm from the end of the module for 128 cell modules. For carport installations the supporting structure has been pre-drilled. For 128 cell modules for carport assembly, modules must be secured using only the holes located 433mm from the ends of the module and hardware described above in Section 4.1, Item 5. See Figure 2 for carport assembly details.
- 2) Clamps or Clips:** Mount the module with the IFF clips on the longer sides of the module. The centerline of the clips must be 50mm-400mm for G5 frame (150–380mm for G3 frame) from the corner of the module. Ensure that the clamps are of sufficient strength to allow for the maximum design pressure of the module. The IFF clip hardware must be

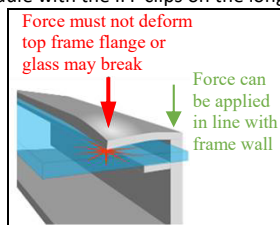


Figure 1a: Clamp Force Locations

tightened to a torque of 35-45 in-lbs. Clamps that secure to the top of the frame must not deform the top flange. Clamps must apply force collinear with the 'wall' of the module frame and not only to the top flange. Clamps or installation procedures that put excessive force on the top flange will deform the frame, void the module warranty and risk glass breakage. **Figure 1a** illustrates locations for top frame clamp force. Avoid clamping within 50mm of module corners to reduce risk of frame corner deflection and glass breakage. When clamping to the module frame, torque should never exceed 120 in-lbs to reduce chances of frame deformation. Maximum allowable torque may be less than 120 in-lbs depending on clamp design. Mounting systems should be evaluated for compatibility before installing.

- 3) End Mount:** End mounting is the attachment of the shorter side of the module frame to a supporting rail using IFF clips tightened to a torque of 35-45 in-lbs. The centerline of the clips must be 50-400mm from the corner of the module. The end-mounting rail and clips or clamps must be of sufficient strength to allow for the maximum design pressure of the module. Verify this capacity before installation.
- 4) Helix Mounting System:** See UL2703 Helix system installation manual for details.
- 5) SunPower-specified or SunPower-supplied mounting systems:** Mount modules with strict adherence to SunPower documentation, using hardware systems supplied by or specified by SunPower.

5.3 Module Handling

Use gloves when handling modules. The module glass is sensitive to oils and abrasive surfaces, which may lead to scratches and irregular soiling. Do not place modules such that the glass comes in contact with abrasive surfaces, and minimize any contact with the glass in general. Do not place anything on the modules, even for a moment. Never lift or move the module using the cables or the junction box under any circumstances. Remove any fingerprints by washing the module glass as described in Section 6.0 below.

6.0 Maintenance and Cleaning

Trained SunPower dealer or trained SunPower support personnel should inspect all modules annually for safe electrical connections, sound mechanical connections, and freedom from corrosion.

Periodic cleaning of module glass has resulted in improved performance levels, especially in regions with low levels of annual precipitation; therefore SunPower recommends periodic cleaning of the modules.

To clean a module, wash its glass surface with potable, non-heated water. Normal water pressure is adequate, but pressurized water (up to 1500 psi) may be used. Some fingerprints, stains, or accumulations of dirt on the glass may be removed with over-the-counter glass cleaners (such as Windex® or equivalent), or with a 3% soap-and-water solution. For smaller systems, wet the module glass with the solution, let it stand for five minutes, and then wet them again and use a soft sponge or seamless cloth to wipe the glass surface in a circular motion. For large systems, wet the modules with the cleaning solution, let them stand for five minutes, and then rinse them with high-pressure water or a soft squeegee. Do not use harsh industrial-strength cleaning materials such as scouring powder, steel wool, scrapers, blades, or other sharp instruments to clean the module glass. Use of such materials will void the product warranty.

Figure 2: Carport Assembly

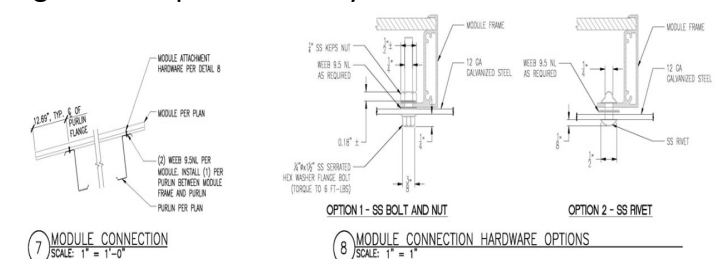
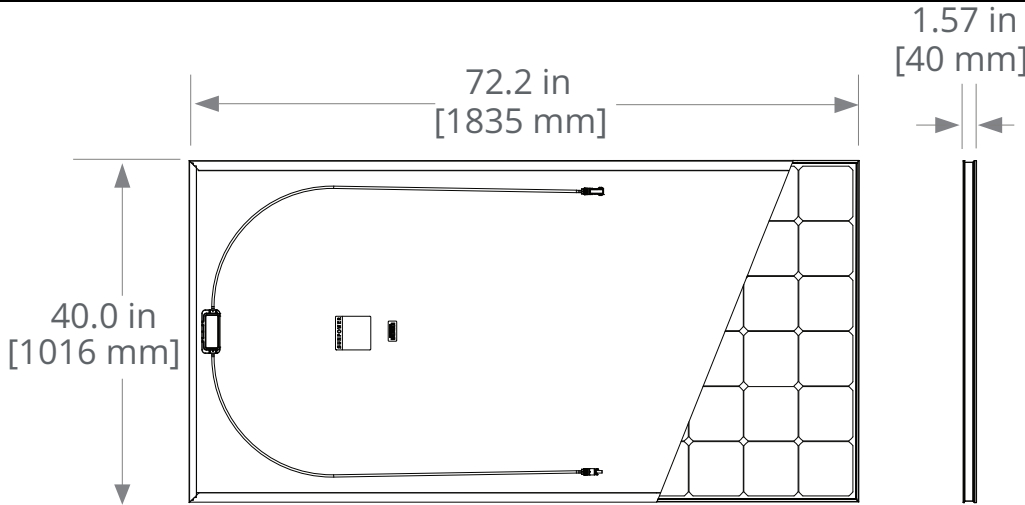


Table 4: Module Frame Details

Platform	Module mounting and ground hole detail			
	RESIDENTIAL G3 FRAME ONLY		RESIDENTIAL G5 FRAME ONLY (a.k.a., INVISIMOUNT COMPATIBLE FRAME)	
Residential Modules	96 CELL MODULE FRAME DETAIL 		96 CELL MODULE (NO MOUNTING HOLES) 	
	SIDE FRAME PROFILE	END FRAME PROFILE	SIDE FRAME PROFILE	END FRAME PROFILE
FOR COMMERCIAL (SILVER FRAME) MODULES ONLY, INCLUDES STACKING PINS				
Commercial Modules	96 CELL COMMERCIAL MODULE 		128 CELL COMMERCIAL MODULE 	
	SIDE FRAME PROFILE	END FRAME PROFILE	SIDE FRAME PROFILE	END FRAME PROFILE
	With Stacking Pins			

Platform		Module mounting and ground hole detail	
FOR COMMERCIAL (SILVER FRAME) MODULES ONLY, INCLUDES STACKING PINS		FOR GEN 6 FRAME MODULE ONLY	
Commercial Modules	96 CELL with MLSD 		128 CELL MODULE
	SIDE FRAME PROFILE 	END FRAME PROFILE 	SIDE FRAME PROFILE
	With Stacking Pins 		
	FOR P-SERIES COMMERCIAL GEN 4.0 FRAME MODULE 		
Commercial Modules	SIDE FRAME PROFILE 	END FRAME PROFILE 	
	With Stacking Pins 		

Platform		Module mounting and ground hole detail			
		FOR P-SERIES GEN 4.1 FRAME MODULE			
Commercial Modules	P19-COM		P19-COM with MLSD		
	SIDE FRAME PROFILE		END FRAME PROFILE		
		FOR A-SERIES MODULES			
Commercial Modules	Gen 4.2 FRAME MODULE (72-CELL)		Gen 5.1 FRAME MODULE (72-CELL)		
	SIDE FRAME PROFILE	END FRAME PROFILE	SIDE FRAME PROFILE	END FRAME PROFILE	

Platform	Module mounting and ground hole detail	
FOR A-SERIES MODULES		
Residential Modules	Gen 5.2 FRAME MODULE (66-CELL)	
		
	SIDE FRAME PROFILE	END FRAME PROFILE
	