SUNPOWER

Safety and Installation Instructions

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

Contents of this manual are subject to change without notice.
For the latest manual please refer to www.sunpower.maxeon.com

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Safety and Installation Instructions

1.0 Introduction

This manual provides safety and installation instructions for SunPower flexible photovoltaic (PV) modules.

> ***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 Limited Warranty

The Limited Warranties do not apply to any of the following:

PV Modules subjected to: (1) misuse, abuse, neglect or accident; (2) alteration or improper installation (improper installation includes, without limitation, installation or array that does not comply with all SunPower installation and wiring instructions (as may be amended and updated from time to time at SunPower's sole discretion); SunPower operations and maintenance instructions of any type (as may be amended and updated from time to time at SunPower's sole discretion), and all national, state, and local laws, codes, ordinances, and regulations); (3) repair or modification by someone other than a SunPower approved service technician; (4) conditions exceeding the voltage, wind, snow load specifications, and any other operational specification; (4) power failure surges, lightning, flood, or fire; (5) damage from persons, insects, animals, or industrial chemical exposure; (6) panel breakage from impact or other events outside SunPower's control. Additional terms and conditions apply. Please see the SunPower Limited Warranty for full terms and conditions.

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 energized when the panel is exposed to light. Current may also be flowing if the panel is connected to a battery or other power source regardless of illumination.
>
> *Direct current will arc across a gap and may cause injury or death when improper connection or disconnection is made;*
>
> *Contacts and cable with frayed or exposed conducts should not be used. Contact with exposed conductors may result in electrical shock, injury and possible death.*
>
> DO NOT connect or disconnect modules when they are energized by exposure to light or external power sources such as a battery. Disconnection under load will result in Arcing and damage to the connector.
>
> DO NOT short the leads together. If inadvertent shorting occurs, Cover the panel completely with opaque material, obscuring all light, before attempting to disconnect the cables.
>
> High voltage may be present when modules are interconnected in series. High currents may be present when modules are connected in parallel.

- All installations must be performed in compliance with any applicable local codes.
- For United States jurisdictions, installations shall 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 and any applicable local codes.
- 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 WALK ON THE PANELS.
- DO NOT CARRY THE PANELS BY THE ELECTRICAL CABLES OR JUNCTION BOX.
- Do not place anything on the modules, even for a moment because resulting residue may damage or stain the surface.
- If the front sheet or the back sheet is torn, contact with any module surface or module frame can cause electric shock.
- Broken or cracked J-boxes, cables and/or connectors are electrical hazards as well as laceration hazards. Customers should remove any such module from service and contact SunPower for disposal instructions.
- Broken or cracked metal ribbons in the panel are electrical hazards. Customers should remove any such module from service 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 allow water to pool on or near the module.
- SunPower recommends a conservative minimum cable bend radius equal to or greater than 40 mm (1.5").
- Contact SunPower if maintenance is necessary.
- Retain these instructions for future reference!

3.0 Electrical Characteristics

Electrical characteristics of the modules are described in Table 1 below. For all modules, the maximum series fuse rating is 15A. 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 the 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 Characteristics[1]

Typical Electrical Data at STC: 25°C, 1000 W/m² and AM 1.5					
Model	SPR-E-Flex-50	SPR-E-Flex-100	SPR-E-Flex-110	SPR-E-Flex-170 (4x12)	SPR-E-Flex-170 (6x8)
Nominal Power (Pnom)	50 W	100 W	110 W	170 W	170 W
Power Tolerance	+/-5%	+6/–3%	+6/–3%	+/-3%	+/-3%
Rated Voltage (Vmpp)	17.7 V	17.1 V	18.8 V	29.9 V	29.4 V
Rated Current (Impp)	2.8 A	5.9 A	5.9 A	5.79 A	5.84 A
Open circuit voltage (Voc)	21.5 V	21.4 V	22.8 V	34.8 V	34.6 V
Short curcuit current (Isc)	3.1 A	6.3 A	6.3 A	6.10 A	6.15 A
Power Temp Coeffiecient	–0.35%/° C		–0.30%/° C	–0.30%/° C	
Voltage Temp Coefficient	–58.9 mV/° C		–55.8 mV/° C	–83.7 mV/° C	
Current Temp Coefficient	2.6 mA/° C		3.5 mA/° C	3.5 mA/° C	
Max. System Voltage	SPWR's flex panels are design to be used in battery charging applications, e.g. 12V or 24V batteries. NOTE: As per various electrical codes and regulations, solar panels operating at system voltages > 50VDC must be UL certified for the US and IEC certified for most of the rest of the world. SunPower Flex panels are presently not UL or IEC certified.				
Series Fuse Rating	15 A				

Rated electrical characteristics are within 10% of measured values at Standard Test Conditions of: 1000W/m², 25°C cell temperature and solar spectral irradiation of AM 1.5 spectrum.

4.0 Electrical Connections

The connectors used in these panels allows for modules to be connected in series or parallel. However, connecting the panels in this manner can put the by-pass diode in the panel and the battery at risk for damage and could create a safety issue. Please read the DANGER! note below.

Series Connection

Connecting the panels in series increases the voltage of the system, so the two panels produce double the voltage as compared to one panel. This high voltage can cause damage to the battery and could cause a safety issues. Please read the DANGER! note below.

To connect panels in series, connect the negative (-) plug of panel #1 to the positive (+) plug of the panel #2. See Figure1 left.

Parallel Connection

Connecting the panels in parallel increases the current of the system, so the two panels produce double the current as compared to one panel. This high current may cause damage to the battery and the by-pass diode in the junction box and cause a safety issue. Please read the DANGER! note below.

To connect panels in parallel, connect the positive (+) plug of panel #1 to the positive (+) plug panel #2 Connect the negative (-) plug of panel #1 to the negative (-) plug of panel #2. See Figure 1 Right. In this configuration, cable adapters will be needed.

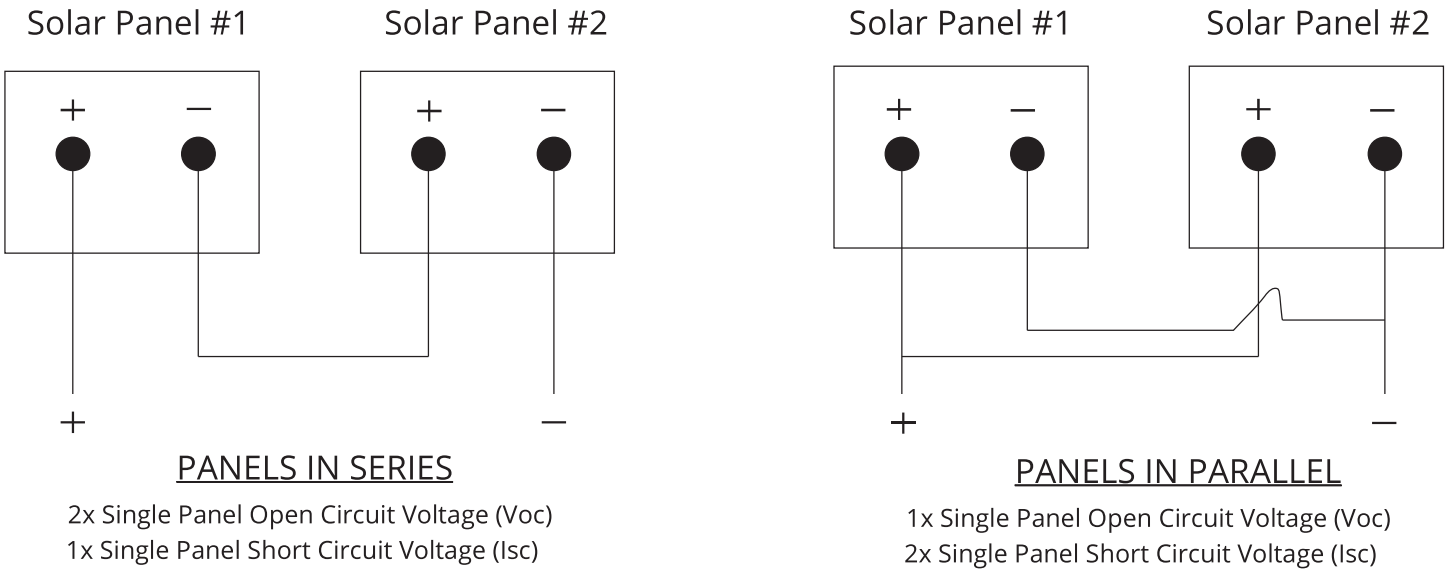

Figure 1: Schematic of two panels in series and parallel.

[1] For models not shown here, please contact SunPower technical support or visit www.sunpower.maxeon.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.

DANGER!

- Connecting panels in series will increase the voltage output of the panels.
- DC voltages may reach levels greater than 40 V DC, in high illumination conditions (>1000 W/m^2).
- If attached to a low voltage battery, e.g. a 12 V battery, this high voltage could cause damage to the battery and could cause a safety issue.
- The charging characteristics of any battery should always be checked for compatibility with the current and voltage output of the panels prior to use.

DANGER!

- SunPower does not recommend connecting these panels in parallel without proper system and safety protection.
- Connecting panels in parallel will double the current output of the panels. DC Currents may be greater than 12 amps for 100 W, 110 W and 170 W, and greater than 6amps for 50 W, in high illumination conditions (>1000 W/m^2).
- If shading occurs without additional electronic components, such as a blocking diode, the by-pass diodes may be damaged leading to further panel damage and unsafe conditions including fire.
- If Paralleled panels are attached to a battery for charging, the high current may cause damage to the battery and subsequent safety issues.
- The charging characteristics of any battery should always be checked for compatibility with the current and voltage output of the panels prior to use.

SunPower recommends using the same brand connector in a PV system as is supplied with the module. 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).

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

Care should be taken to provide ventilation behind or underneath the modules, especially in hot environments. In cold environments of less than 0° C (32° F), care should be taken to avoid flexing of the panel or impact to the panel.

Excluded Operating Environments

Certain operating environments are not recommended for SunPower modules and are excluded from the SunPower Limited Warranty. These include but are not limited to flooding, immersion in water or other fluids, contact with liquids with pH greater than 8.5 or less than 6.5, hail and other projectiles, fire, meteorites, lava flow and volcanic eruptions. SunPower flex modules can withstand high wind environments when securely attached to a substrate such that the module does not flap with the wind.

5.2 Mounting Configurations

Modules integrated 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.

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. The junction box should not be mounted in a depression when mounted on a flat surface. Note that the junction box manufacturer rates this junction box with an ingress protection rating of IP67.

Modules may be mounted using the grommet holes as attachment points or using an adhesive on the panel backside. SunPower makes no claim to preferred attachment method nor to the safety of the attachment.

5.3 Module Handling

Use gloves when handling modules. The module is sensitive to oils and abrasive surfaces, which may lead to scratches and irregular soiling. Do not place modules such that the module encounters abrasive surfaces and minimize any contact with the module 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 as described in Section 6.0 below.

Modules should be handled without excess bending or bending at sharp angles or twisting of the panels. The panels are designed to withstand a 30-degree bend in the panel, top to bottom where the top is the side with the junction box. This is approximately 8cm of deflection. Additionally, no sharp objects should be placed in contact with the panel. This can result in puncture of the panel and/or damage to the solar cells or connectors in the panel, resulting in decreased power output and potentially a safety hazard, see section 2.

Junction boxes, cables and connectors should never be subjected to a sharp or blunt force. This can result in a broken or cracked junction box, cable or connectors such that the panel should not be used. See section 2.

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 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 surface with potable, non-heated water. Normal water pressure is adequate. Some fingerprints, stains, or accumulations of dirt on the surface may be removed with over-the-counter cleaners (such as Windex® or equivalent), or with a 3% soap-and-water solution. Wet the module surface 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 surface in a circular motion. Do not use harsh industrial-strength cleaning materials such as aggressive chemicals, scouring powder, steel wool, scrapers, blades, or other sharp instruments to clean the module. Use of such materials will void the product warranty.