



SunWize® SWPB Series Solar Modules GENERAL INSTALLATION & USER GUIDE

Introduction

This guide contains application and user safety information you should become familiar with before using your SWPB series solar electric modules. Contact your local authorized SunWize distributor for further design or sizing assistance. **Read this guide completely before installing or using SunWize SWPB solar modules.**

Disclaimer of Liability

The information contained in this guide is based on SunWize Power & Battery's knowledge and experience, but such information does not constitute a warranty expressed or implied. Since the method of installation and maintenance of the solar module are beyond control of SunWize, SunWize Power & Battery assumes no responsibility and expressly disclaims liability for any loss, damage or expense associated with the installation or use of this product. Any liability of SunWize is limited strictly to the Limited Warranty attached hereto. SunWize reserves the right to make changes to this product, user guide or specifications without notice.

General Information

Solar electric modules produce DC electricity when exposed to light. The power of a single solar module is not considered hazardous. However, when multiple modules are connected together the shock hazard increases. Small (12 volt) solar module installations may not require a licensed electrician. However, we suggest that a qualified contractor or licensed electrician install higher voltage systems. Solar electric installations should comply with local regulations and the National Electric Code (NEC). When installing a solar system, review the user guides of other manufacturer's related equipment or components for use with solar modules.

Rated electrical characteristics are within 10% of measured values at Standard Test Conditions of 1000 W/m², 25° C cell temperature and AM 1.5 solar spectral irradiance. 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 National Electric Code for an additional multiplying factor of 1.25 which may be applicable.

Warning: Solar modules produce electricity when exposed to sunshine or bright light. When modules are "series" connected, voltages are additive; when "parallel" connected, currents are additive. Solar module systems above 24 VDC can produce lethal voltages. To reduce the risk of shock or burn during wiring, solar modules should be interconnected with the glass facing down, away from the sun or covered with an opaque material. Artificially concentrated sunlight shall not be directed on the module.

Safety Precautions

- Keep solar module(s) in original packing until point of assembly/installation to reduce risk of damage.
- Do not lay modules on rocky or uneven surfaces during assembly.
- Use insulated tools when wiring to solar module terminals or batteries.
- Do not touch live wires/terminals located in the module junction box.
- Wear rubber gloves to eliminate shock or burn potential when wiring solar modules or batteries.
- Although module glass is strong, do not walk on or allow objects to fall on the solar module.



SWPB Module Manual REVA

- Make wiring connections in areas free of flammable gas vapors.
- Avoid short circuit hazards; locate and avoid existing wiring during the installation of solar electric systems.

Installation Tips

- Qualified persons familiar with DC and AC circuits should perform the solar module installation.
- Local housing inspectors may need to be notified prior to the solar installation if permits are needed.
- Follow the requirements of the National Electric Code - article 690 (NEC 690).
- Do not attempt to remove any part or label from the solar module.
- Do not drill holes in the module frame without protecting the plastic back skin.
- Sunlight should not be reflected or concentrated on solar module.
- For best performance, install modules away from trees, poles or shading from adjacent buildings.
- If possible, connect the module cabling before permanently mounting the modules.
- Use only sunlight resistant, outdoor rated wire for module connections or approved flexible conduit with liquid tight fittings.
- Insure the solar electric system is properly grounded to earth in accordance with NEC 690.
- Install solar modules in locations away from children and animals.
- Observe proper wiring polarity and color codes when connecting modules to other electrical components.

Mounting

SWPB series modules should be firmly fixed in place, suitable to withstand wind and snow loads. The tempered glass face of the laminated solar module is rated to withstand 110MPH wind speeds sustained, 133MPH gusts. A module support structure should be equally rated for such loads for the number of modules to be supported.

The glass surface is impact resistant and rated to withstand up to 1" diameter hailstones at 50MPH, but a hard impact by a rock or tool may cause breakage. Use caution when assembling solar modules on the mounting frame and avoid leaning solar modules or panel assemblies upright, as winds can cause them to fall and break. Repairs to broken glass are not possible.

For tilted mounting, the solar module frames have intermediate mounting holes on the longer sides. These mounting holes are positioned to provide the best possible location for mechanical attachment of supporting structures. Four stainless steel 1/4"-20 x 3/4" bolts are recommended.

For flush mounting, the solar module frames have end frame mounting holes on the short sides, for bolted structural attachment. These mounting holes are positioned to provide an alternate option for mechanical attachment of supporting structures. Four stainless steel 1/4"-20 x 3/4" bolts are recommended.

In all mounting applications, allow at least a 3" of clearance between the solar module and mounting surface to let air flow across the back of the module for cooling and to provide space for output cabling to exit. Do not relocate mounting holes as this may result in loss of strength and void the warranty.

Use proper support structure anchoring fasteners in order to provide maximum holding strength to the supporting material in which attachment is to be made. Ground or pole mounted systems require concrete footing design to withstand the forces based on array area and general soil condition. Roof systems require seal roof penetrations to avoid water penetration.

Always refer to the specific rack manufacturer's installation guide for requirements.



Orientation

A tilted solar module will allow for more daily power output than modules mounted horizontally. Choose a location with good solar exposure and orient the module so the tilted surface will receive maximum sunlight. Adjust the solar array to face true South (in northern latitudes), or true North (in southern latitudes). For off-grid systems, use the table below to optimize worst case performance. Seasonal adjustment is not necessary. For grid-tie systems, the optimal tilt angle is typically latitude tilt. This will provide the greatest seasonal benefit.

Site Latitude	Horizontal Tilt Angle
0-10	= 10 degrees
11-20	= latitude
21-30	= latitude +5 degrees
31-40	= latitude +10 degrees
41+	= latitude +15 degrees

The module should never tilt shallower than 10 degrees to allow for water and debris shedding.

Wiring

SunWize SWPB solar modules are supplied with a rear electrical junction box. This j-box contains both positive and negative power terminals for wiring connections along on some models with an isolated 'spare' terminal. The junction box includes 4 openings for 1/2"NPT conduit fittings (7/8" OD) suitable for use with outdoor liquid tight flexible conduit.

For field connections not in conduit, interconnect wiring jacket material should be UV resistant, type UF, TC, RHW or USE-2, copper wiring, rated for a minimum 90°C - and a minimum #14 AWG. A watertight cable strain relief fitting should be used at the entry of each cable into the junction box.

For field connections in conduit, interconnect wiring jacket material should be type THHN, THWN-2, copper wiring, rated for a minimum 90°C - and a minimum #14 AWG. A watertight conduit fitting should be used at the entry of each cable into the junction box.

UL listed crimp on ring terminals properly sized for the wire and connecting screw should be used for module positive and negative connections. Examples include Molex P/N 19070-0123 or Molex P/N 19193-0109

Proper wiring polarity is necessary to prevent incorrect wiring and possible damage of the power system.

For low voltage (12 – 150VDC) battery based solar systems, wiring color is:

Red	=	positive (+)
Black (White)	=	negative (-)
Green	=	ground (GND)

For higher voltage (150 – 600VDC) inverter direct grid tie solar systems, without battery, wiring color is:

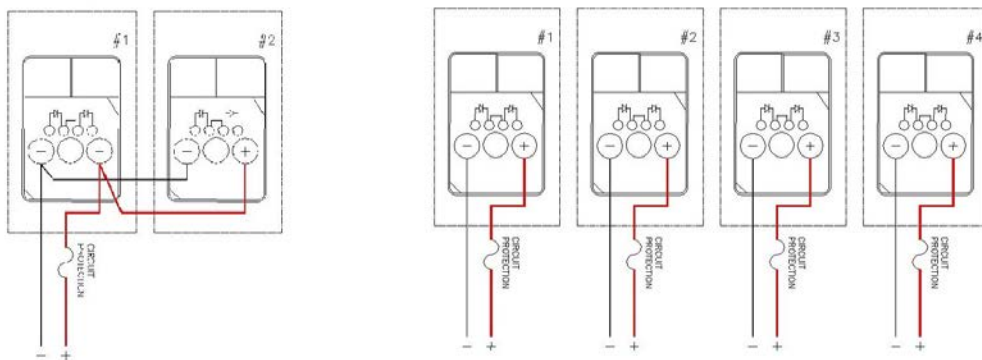
Black	=	positive (+)
White	=	negative (-)
Green	=	ground (GND)

SunWize Power & Battery SWPB modules can be series connected up to 600VDC maximum open circuit voltage. SWPB modules are ETL approved for 48VDC charging systems maximum in Class I, Div II, Groups A, B, C, D hazardous locations. All modules are listed to UL 1703.

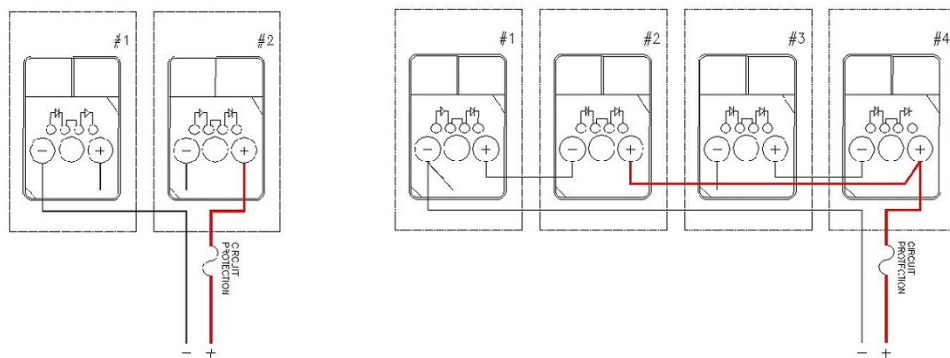
Wiring SWPB modules for 12, 24 or 48VDC battery charging systems may use a combination of parallel or series connected modules. For a 12-volt system, multiple modules can be connected together in parallel to increase current (amps). The maximum number of modules that can be connected in series in a single string is that which will result in an Open Circuit Voltage (Voc) of less than 600VDC.

PV modules are a source circuit requiring over-current protection. You can combine modules in multiple configurations to achieve a string. Circuit protection is required whenever a series/parallel combination of modules will exceed the individual strings module maximum series fuse rating.

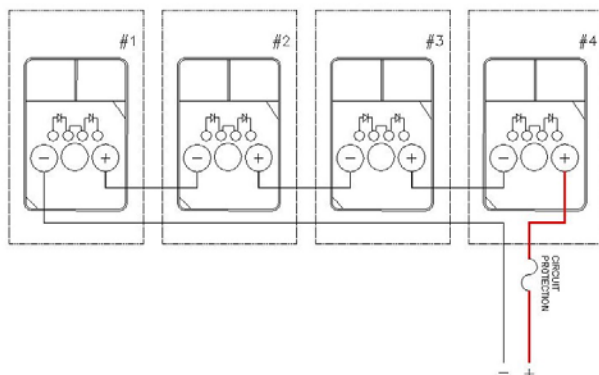
In a 12V parallel 2-module configuration, you only require 1 circuit protection device as long as you are below the series fuse rating. In 12V parallel 3-module or more configurations, you require 1 circuit protection per string:



In these 24V parallel configurations, you only require 1 circuit protection device:



In this 48V series configuration, you only require 1 circuit protection device:



For over-current protection on PV systems with maximum open circuit voltage of 150VDC, an approved hydraulic/magnetic circuit breaker can be used. For PV systems over 150VDC, a 600VDC rated midget fuse up to 30A is recommended.

Equipment Grounding

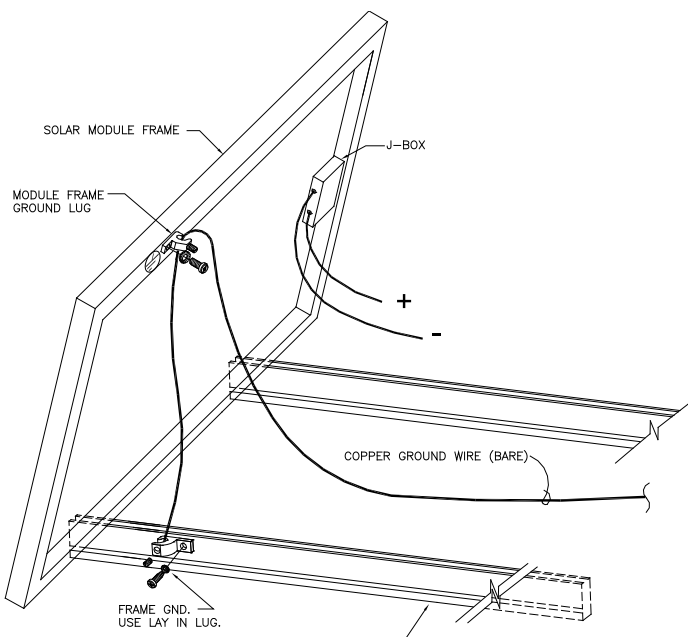
All solar modules in a PV system must be grounded using a dedicated grounding conductor. The grounding conductor continuity can not be broken if any one module is removed for service.

Connect the solar module frame(s) with an 'equipment' grounding conductor (a conductor not normally carrying current) to an earth ground electrode, regardless of system voltage in accordance with NEC 690. The wire size of the grounding conductor must be equal to the size of the 'array' current-carrying conductor (NEC 690-45) or at least 125% of the array short circuit current. Modules assembled to a supporting rack may need to have each module frame interconnected with copper ground wire.

Install a direct burial rated, tinned-copper ground lug to the module frame. You can utilize an unused existing hole or drill a new hole as needed. If drilling a hole, care must be taken not to damage the solar module backing, or the warranty will be void. Since the module frame is clear anodized coated, a biting washer is required to insure adequate continuity to the frame.

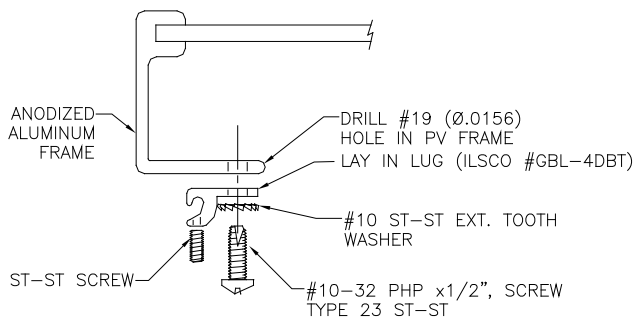
Install a direct burial rated, tinned-copper ground lug to the support structure. You can utilize an unused existing hole or drill a new hole as needed. Since the support structure may be clear anodized coated or painted, a biting washer is required to insure adequate continuity to the frame.

Connect a continuous bonding wire between the individual modules ground lugs and the support structure ground lug.



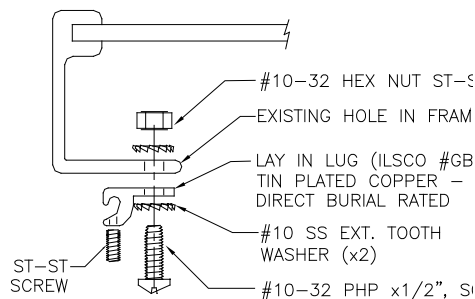
Note: if using #10 hardware, drill a hole with #19 size bit for attachment to the ground lug to the module frame with self tapping hardware.

Use of hardware to bond the solar module directly to the racking frame, utilizing the racking frame as the grounding conductor is also allowed. See racking manufacturer installation manual for details on proper grounding using this method.



**GROUND LUG DETAIL -
SELF TAPPING SCREW ATTACHMENT**

TORQUE TO 20 in-lb



**GROUND LUG DETAIL -
BOLTED ATTACHMENT**

USING EXISTING MODULE FRAME H
TORQUE TO 30 in-lb



System Grounding

A stand-alone two-wire PV system, operating over 50VDC requires one DC conductor to be grounded (NEC 690). This conductor should not contain over-current devices or potential for open circuit. This grounding will enhance personnel safety and minimize effects of lightning surges on equipment. A ground conductor should be #8AWG minimum or equal to the largest 'system' conductor size supplied by the system, connected to a single earth ground point (bonded to equipment ground).

It is important for the installer to review the system design, and review recommendation of inverter or charge controller manufacturers, to insure the system is bonded at the correct location. A system should only be DC bonded at a single point to avoid potential ground loop issues and issues with ground fault detection circuitry.

Bypass Diodes

Shading of individual cells and solar modules in series strings can cause a reverse voltage across the module. This results in currents being forced through the shaded areas creating undesirable heating called hot spots. All of the SWPB series modules include bypass diodes wired in the junction box to allow a shaded or damaged module to bypass other solar modules in the circuit. This will minimize hot spots and significant loss in array power. If damage (for example caused by a lightning strike) occurs to factory installed bypass diodes, contact SunWize Customer Service (tel: 866-827-6527) for repair or replacement.

Blocking Diodes

A diode can be placed in line with the positive output from the solar module. This prevents reverse current from back feeding from battery into the solar module at night or in shade, which could potentially drain the battery. A dedicated charge regulator is preferred and recommended instead of using a blocking diode.

Charge Regulation

Due to the SWPB series high peak voltage, it is recommended all modules be used with a battery charge regulator to prevent battery overcharge. PWM or relay type charge regulators do not need blocking diodes. Insure correct selection of the charge regulator, to include the necessary 125% de-rating required by code (NEC690).

Over-current Protection

The NEC minimum fuse rating is figured by multiplying the module short circuit current rating (I_{sc}) times $x 1.56$ for standard fuses and breakers. If selecting a circuit breaker rated for 100% continuous use, than the correct sizing factor is 1.25. It is important to select wiring of the proper ampacity for solar array output cabling. Refer to the NEC 310, table 310-16, Ampacities for conductors.

The wire gauge must be of sufficient size to reduce voltage drop potential from solar array to battery. Refer to the NEC art. 215-2 for voltage drop calculation. The voltage should be limited to 0.5VDC for a 12VDC system, 1.0VDC for a 24VDC system, and 2.0VDC for a 48VDC system

Maintenance

During operation, keep the module clean of excessive dirt and debris by using only soapy water and a soft cloth or sponge. Once a year check the integrity of wiring connections in the junction box. Inspect for signs of damage to module glass or frame. Shallow tilt mounted modules may need to be cleaned more often.



Limited Warranty - One Year Repair, Replacement or Refund Remedy

SunWize Power & Battery guarantees that all SWPB series modules to be free from defects in workmanship and material under normal application, installation, use and service conditions. If the product fails to conform to this warranty, then for a period of twelve (12) months from the date of sale to the original purchaser, SunWize will, at its option, either repair or replace the product, or refund the purchase price. The repair or replacement remedy shall be the sole and exclusive remedy provided under the warranty and shall not extend beyond the twelve-month period.

Limited Warranty - Limited Remedy

If, within twenty (20) years from the date of sale to the original purchaser, any SWPB module, or if within twenty-five (25) years from the date of sale to the original purchaser, any SWPB module exhibits a power output less than 80% of the minimum power specified at the time of purchase, then, provided that such loss of power is determined, at the sole and absolute discretion of SunWize, to be due to defects in material or workmanship, SunWize will replace such loss in power by either providing additional modules to make up the total wattage loss, or by repairing or replacing the module, at the option of SunWize. This remedy shall be the sole and exclusive remedy provided under the extended term warranty.

The limited warranties do not apply to any module, which in SunWize sole and absolute judgment has been subjected to misuse, neglect or accident, or has been damaged through abuse, alteration, improper installation or application, or has been repaired or tampered with by anyone other than SunWize. The limited warranties do not cover transportation costs for return of module or for reshipment of any repaired or replaced module, or cost associated with installation removal or reinstallation of modules. The limited warranties are expressly in lieu of all other express or implied warranties, including but not limited to merchantability and of fitness for a particular purpose, use, or application, and all other obligations or liabilities on the part of SunWize.