

Solar Modules Installation & Maintenance manual

Disclaimer of Liability

Novergy does not assume responsibility and expressly disclaims liability for loss, damage, or expense arising out of, or in any way connected with installation, operation, use or maintenance by using this manual.

WARNINGS & SAFETY

- Solar modules generate electricity when exposed to light. Arrays of many modules can cause lethal shock and burn hazards. Only authorized and trained personnel should have access to these modules. To reduce the risk of electrical shock or burns, modules should be covered with a dense, opaque material during installation to avoid shocks or burns.
- The shock hazard increases as modules are connected in parallel, producing higher current, and as modules are connected in series producing higher voltages.
- Do not touch live terminals with bare hands. Use insulated tools for electrical connections.
- To avoid the hazard of electric shock, work only in dry conditions, with dry modules and dry tools.
- Do not stand or step on a module to avoid the hazard of injury and damage to module.
- Do not puncture or damage the back sheet of a module, to avoid the hazard of electric shock and fire.
- To avoid hazard of electric shock and injury, be sure to completely ground all modules
- Unauthorized persons – except the qualified licensed professional – should not open the cover of the junction box to avoid the hazard of electric shock.
- Provide suitable guards to prevent yourself from direct contact with 50VDC or higher.
- When carrying a module, two or more people should carry it by its frame and wear non-slip gloves to avoid injury by a slipping module, to a foot, or cuts by the edge of a frame, and so on)
- Do not carry modules by its wires or junction box, to avoid the hazard of electric shock or injury or damage to the module.
- Do not drop anything on the surface of the module.
- Do not drop a module.
- Do not artificially concentrate sunlight on a module to avoid the hazard of fire or damage.
- Do not change the wiring of bypass diodes to avoid the hazard of electric shock and injury.
- Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the value of I_{sc} and V_{oc} marked on the solar module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor current ratings, fuse sizes and size of controls connected to the PV output.
- The maximum open circuit voltage of the solar panels string should not exceed 1000VDC under any condition.
- The modules are qualified for application class A : Hazardous voltage (IEC61730 : higher than 50VDC ; EN61730 : higher than 120VDC), hazardous power applications (higher than 240w) where general contact access is anticipated.

PERMISSIONS

Before installing your solar system, contact local authorities to determine the necessary permit, installation and inspection requirements.

INSTALLATION AND OPERATION

General

- Please read this guide completely before installation or use of the modules.
- Systems should be installed by qualified personnel only. The system involves electricity, and can be dangerous if the personnel are not familiar with the appropriate safety procedures.
- Modules should be firmly fixed in place in a manner suitable to withstand all expected loads, including wind and snow loads.
- The drilling and addition of ground holes is permitted, but should be avoided when possible, to prevent damage to the module.
- Appropriate material should be used for mounting hardware to prevent the module frame, mounting structure and hardware itself from corrosion.
- Install modules where they are not shaded by obstacles like buildings and trees. Especially pay attention to avoid partially shading the modules by objects during daytime.
- The minimum spacing of 0.6 in. (15 mm) is required between the solar module and the mounting surface around the perimeter of the solar module. Module may be installed in various applications utilizing a variety of support structure options and attachment methods. For optimal performance in all applications, clearance between the module frame and the mounting surface is required to allow cooler ambient air to circulate around the back of the module.

Operating conditions

- Terrestrial applications only.
- Ambient temperature must be within -20°C to $+80^{\circ}\text{C}$
- The wind pressure load of the installation site should be less than $2,400\text{N/m}^2$ (50PSF)

Special conditions

Modules must not be installed nor operated in areas where

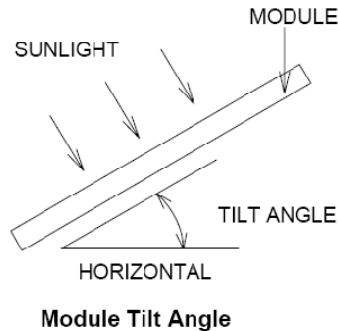
- Salt damage is excessive
- Hail and snow damage is excessive
- Sand and dust damage is excessive
- Air pollution, chemically active vapors, acid rain, soot, etc. are excessive

SITE SELECTION

- In most applications, modules should be installed in a location where they will receive maximum sunlight throughout the year. In the Northern Hemisphere, the modules should typically face south, and in the Southern Hemisphere, the modules should typically face north.
- Modules facing 30 degrees away from true South (or North) will lose approximately 10 to 15 percent of their power output. If the module faces 60 degrees away from true South (or North), the power loss will be 20 to 30 percent.
- When choosing a site, avoid trees, buildings or obstructions, which could cast shadows on the solar modules especially during the winter months when the arc of the sun is lowest over the horizon.

MODULE TILT ANGLE

Modules produce the most power when they are pointed directly at the sun. For stand alone installations the solar modules should be tilted for optimum winter performance. As a general rule, if the system power production is adequate in the winter, it will be satisfactory during the rest of the year. The solar module tilt angle is measured between the solar modules and the ground. Refer to the recommended module tilt angle table for your site.



Recommended Tilt Angles for Stand Alone Fixed Systems—Based on Winter Performance

Site Latitude in Degrees	Fixed Tilt Angle
0 to 15	15
15 to 25	Same as latitude
25 to 30	Latitude + 5
30 to 35	Latitude + 10
35 to 40	Latitude + 15
40 -	Latitude + 20

For grid tie installations where the solar modules are attached to a permanent structure, the solar modules should be tilted at an angle equal to the site's latitude. This will typically result in the highest annual energy output.

SUPPORT STRUCTURE

Module may be attached to a support structure by the following methods:

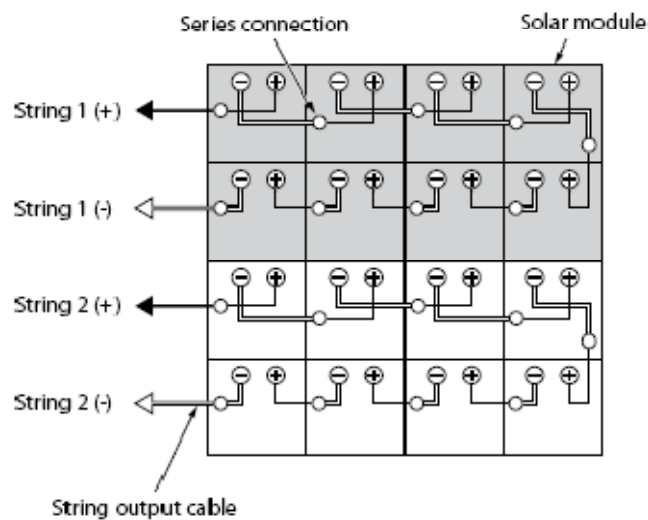
- **STANDARD:** Utilizing ¼" or 6mm stainless steel hardware through the existing 0.28" diameter (7 mm) mounting holes in the module frame and then through Novergy module mounting holes on the support structure. The stainless steel hardware used for securing the module frame should secure with an applied torque of 6 foot-pounds (8 Newton-meters).
- **CLAMPING:** Top or bottom clamping methods certified by a registered professional engineer, and in compliance with local codes.
- **OTHER:** Other method(s) certified by a registered professional engineer, and in compliance with local codes.

WIRING

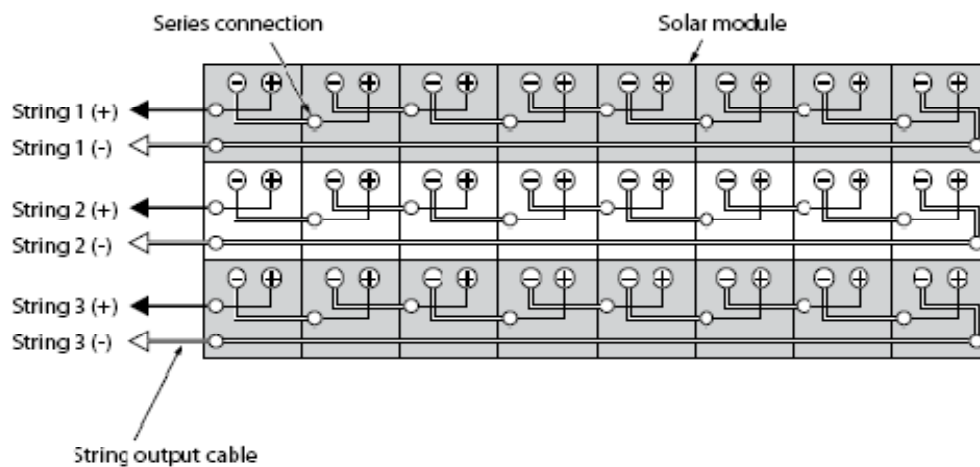
General

- All wiring should be done in accordance with applicable electrical codes.
- A qualified, licensed professional should do all wiring.
- Wiring should be protected to help ensure personal safety and to prevent its damage.
- All modules connected in series should be of the same model number and/or type.
- Do not connect modules in parallel without using a connection box.
- The number of modules that can be connected in series is limited by the maximum short circuit voltage of the array. Under no circumstance should this exceed 1000VDC.

BELOW ARE ILLUSTRATIONS OF TYPICAL SERIES STRING WIRING CONNECTIONS



Solar module connections example, 4 rows, 4 columns



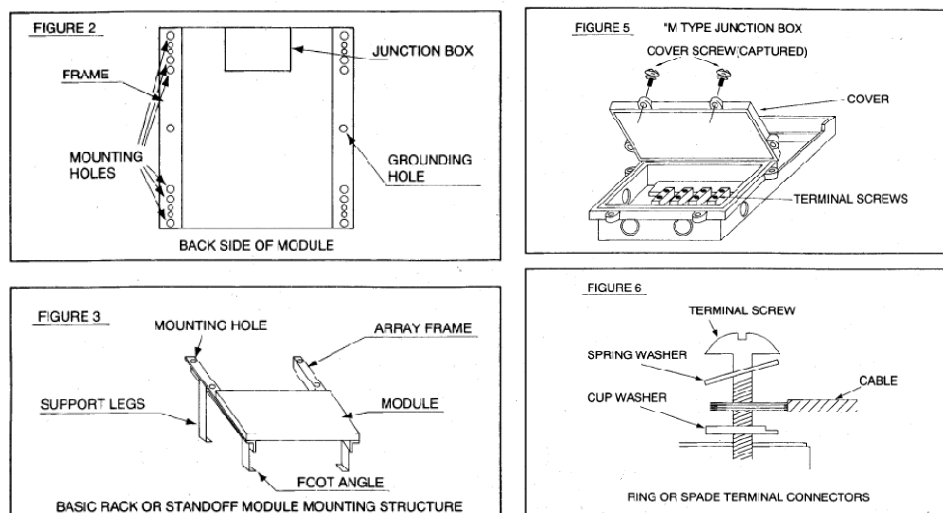
Solar module connections example, 3 rows, 3 columns

EARTH GROUND WIRING

- Grounding should be carried out by attachment to the module or array frame, to avoid hazards of electric shock.
- Grounding means should be isolated from live parts by reinforced insulation.
- Suitable earthing pit should be prepared in accordance with national codes (if one does not exist) to do the earth ground wiring.
- The other components in the solar system like Charge controller, inverter, etc. Should also be properly ground.
- The grounding conductor, or strap, may be copper, copper alloy, or another material acceptable for use as an electrical conductor per NEC. The grounding conductor must then make a connection to earth using a suitable earth ground electrode.
- Ensure positive electrical contact

JUNCTION BOX OF THE MODULE

A junction box as a terminal enclosure is equipped for electrical connections on the back of Novergy modules.

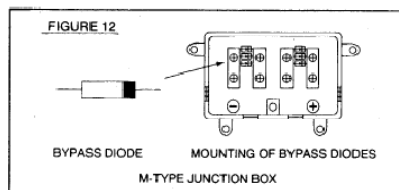
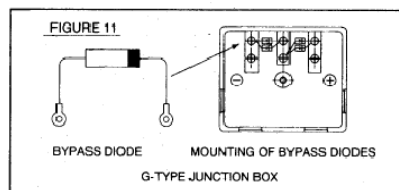


BLOCKING DIODES

- In systems utilizing a battery, blocking diodes are typically placed between the battery and the solar module output to prevent battery discharge at night. Novergy modules are made of crystalline cells with high electrical "back flow" resistance to night-time battery discharging. As a result, Novergy modules do not contain a blocking diode when shipped from the factory. However, most PV charge regulators and inverter incorporate night-time disconnect feature.

BYPASS DIODES

- Partial shading of an individual module in a source circuit string (i.e. two or more modules connected in series) can cause a reverse voltage across the shaded cells within the module. Module output current is then forced through the shaded area by the remaining illuminated cells and other solar modules in series with the partially shaded module(s). The current forced through the shaded cells within the module (or modules) causes additional module heating and severe loss of power.
- The purpose of bypass diodes is to provide a low-resistance current path around the shaded cells, thereby minimizing module heating and array current losses.



INSPECTION

- Follow the requirements of applicable local and national electrical codes.

MAINTENANCE

- Modules are designed for long life and require very little maintenance.
- If the module surface becomes dirty, it may reduce output power.
- Under most weather conditions, normal rainfall is sufficient to keep the module glass surface clean.
- However If dirt build-up becomes excessive, clean the glass surface only with a soft cloth using mild detergent and water. A mild non-abrasive detergent may be applied for persistent dirt.
- Use caution when cleaning the back surface of the module to avoid penetrating back sheet.
- Modules that are mounted flat (0° tilt angle) should be cleaned more often, as they will not "self clean" as effectively as modules mounted at a 15° tilt or greater.
- Once a year, check the general condition of the wiring and check to be sure that mounting hardware is tight. Loose connections will result in a damaged module or array.