PHOTOVOLTAIC SOLAR MODULE MANUAL

Operation/Maintenance and Installation

2012

HELIOS SOLAR WORKS

INSTALLATION MANUAL – 2012

INDEX

TECHNICAL CHARACTERISTICS

Helios Solar Works solar modules belong to the latest generation of mono-crystalline and multi-crystalline 6 in. (156mm) cells. Their contoured surface and triple conduction band systems provide higher generating power and homogeneous aesthetics.

Each module consists of 60, 72, or 96 high-quality cells in serial configuration to achieve optimal power and voltage for photovoltaic systems, either connected to the grid or not.

Before designing, assembling, operating, or proceeding with the maintenance of the 6T, 7T2 and 9T6 Series photovoltaic module, please carefully read all of the instructions and recommendations in this manual.

Helios Solar Works disclaims any liability for breakage, deterioration or the loss of performance of any of our modules resulting from the incorrect installation, use, and/or maintenance.

The junction box has a level of protection of IP65 against infiltration of dust and water and houses the connection of the metallic output bands of the module to the cables (positive and negative). The bypass diodes are connected inside the junction box ensuring the thermal stability of the cells in case of shading during the hours of irradiation.

Two isolated copper cables, 4mm^2 (see annex A for AWG mm^2 sizing) and 1.2 m long emerge from the junction box. Each cable is connected at its end with MC compatible plugs, one male, and one female, which facilitate the connection of the modules by forming serial connections to reach the adequate voltage for the system.

In order to protect the module against electrical shorting, fast acting fuses of 15 amps are to be used when connecting in series.

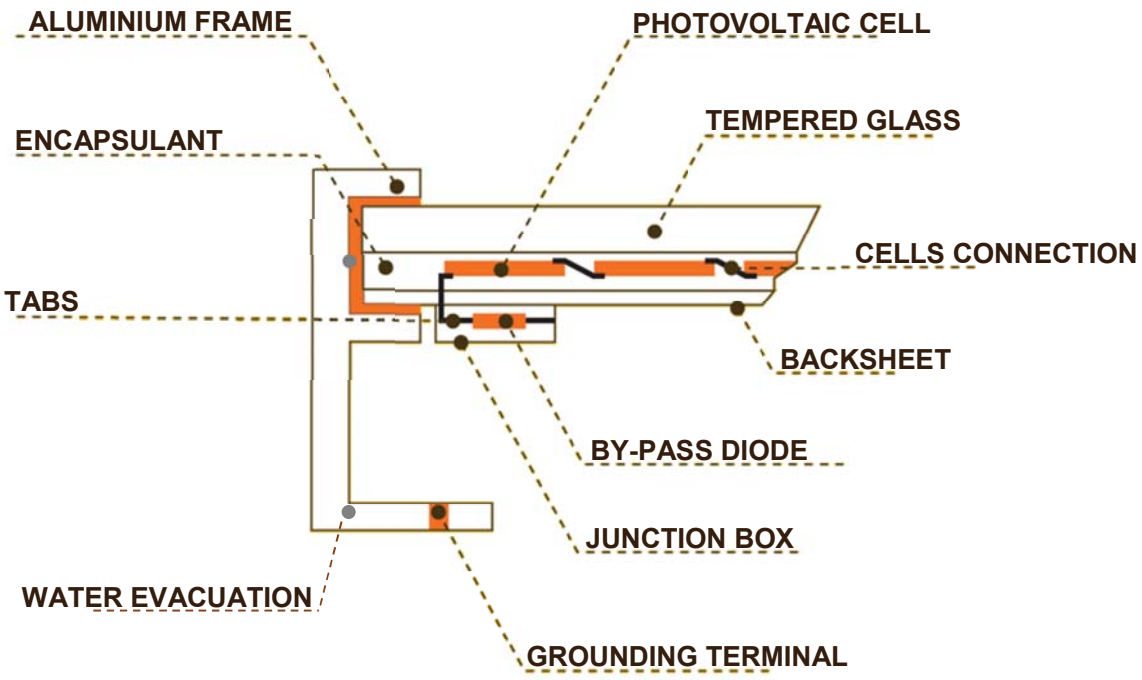
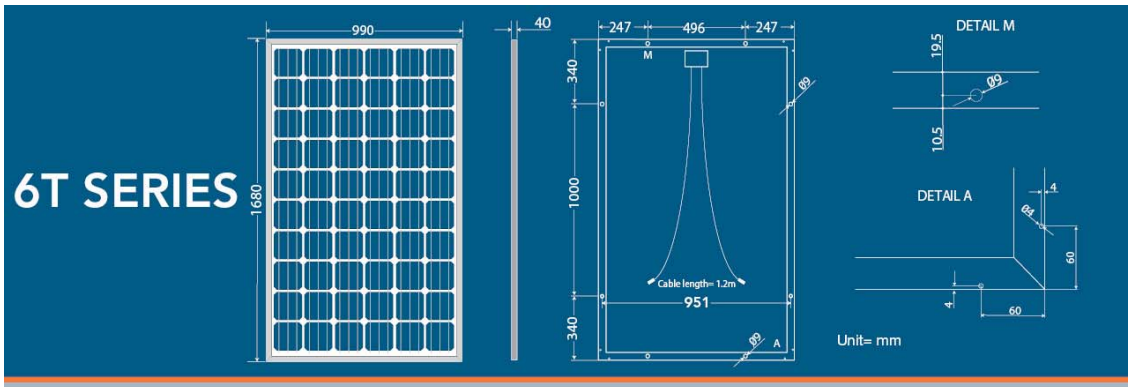


Figure 1. Cross-section of a module identifying different components.

6T Series



ELECTRICAL DATA STC		6T 260	6T 255	6T 250	6T 245	6T 240
Rated Power PMPP (W)	=	260	255	250	245	240
MPP Voltage (V)	=	30.84	30.65	30.30	30.03	30.00
MPP Current (A)	=	8.46	8.32	8.22	8.18	8.00
Open Circuit Voltage (V)	=	37.73	37.50	37.40	37.26	36.80
Short Circuit Current (A)	=	8.90	8.86	8.72	8.71	8.70

Measured at (STC) Standard Test Conditions 25° C, insolation 1,000 W/m^2, AM 1.5.

ELECTRICAL DATA NOCT		6T 260	6T 255	6T 250	6T 245	6T 240
Rated Power PMPP (W)	=	190	187.00	183.00	179.00	175.00
MPP Voltage (V)	=	27.77	27.50	27.30	27.10	27.00
MPP Current (A)	=	6.84	6.80	6.70	6.60	6.50
Open Circuit Voltage (V)	=	34.90	34.60	34.50	34.40	34.30
Short Circuit Current (A)	=	7.32	7.30	7.25	7.20	7.15

Nominal Operating Cell Temperature (NOCT) values are typical values, 45°C.

Typical cell temperature: insolation 800W/m^2, ambient temperature 20°C, wind speed 1m/s.

OTHER ELECTRICAL PARAMETERS					
System Voltage (V)	=	600/1,000	Temp. Coefficient PMPP (% / °C)	=	-0.41
Temp. Coefficient ISC (% / °C)	=	0.03	Temp. Coefficient UOC (% / °C)	=	-0.32

DESIGN					
Cells	=	60 mono-crystalline, 3 bus bar	Backside	=	Multilayer sheet
Cell Dimensions	=	156 mm x 156 mm, pseudo-square	Frame	=	Anodized aluminum (clear or black)
Front glass	=	4mm solar glass, highly transparent and anti-reflective	Connection	=	2 x 1.2 m solar cables with MC4 connectors or compatible
Encapsulation	=	EVA - Solar Cells - EVA	Bypass Diodes	=	3 pieces

LIMIT VALUES	QUALIFICATIONS
Module Temperature -40°C to +80°C	IEC 61215, IEC 61730, ULC/ORD-C1703-01, CEC, FSEC, TÜV NORD, CE
WARRANTY	**PERFORMANCE OUTPUT**
25-year linear performance warranty. Also 10 years workmanship.	-0/+3 percent

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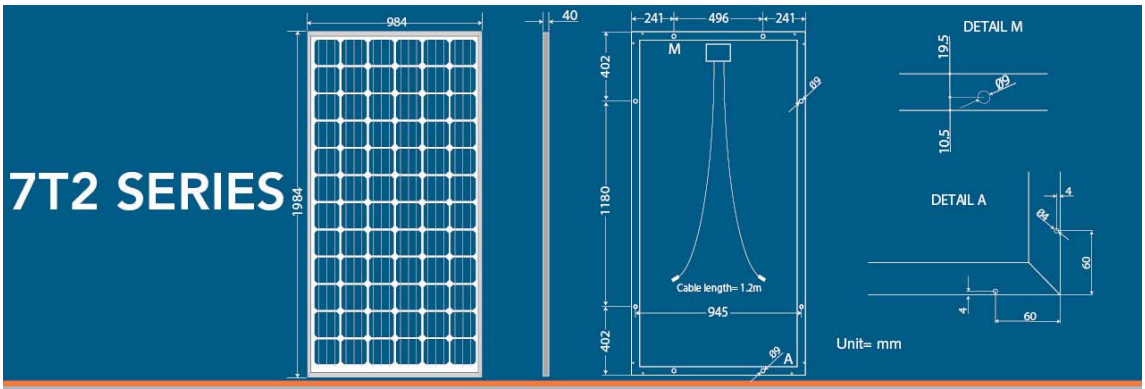
7T2 Series



ELECTRICAL DATA STC		7T2 310	7T2 305	7T2 300	7T2 295	7T2 290	7T2 285
Rated Power PMPP (W)	=	310	305	300	295	290	285
MPP Voltage (V)	=	36.77	36.65	36.55	36.40	36.25	36.10
MPP Current (A)	=	8.43	8.32	8.20	8.10	8.00	7.90
Open Circuit Voltage (V)	=	45.40	45.10	44.96	44.77	44.65	44.40
Short Circuit Current (A)	=	8.90	8.86	8.77	8.67	8.56	8.45

Measured at (STC) Standard Test Conditions 25° C, insolation 1,000 W/m^2, AM 1.5.

ELECTRICAL DATA NOCT		7T2 310	7T2 305	7T2 300	7T2 295	7T2 290	7T2 285
Rated Power PMPP (W)	=	232	229	225	221	218	214
MPP Voltage (V)	=	33.91	33.80	33.72	33.59	33.45	33.31
MPP Current (A)	=	6.84	6.76	6.67	6.59	6.51	6.43
Open Circuit Voltage (V)	=	41.88	41.61	41.48	41.31	41.20	40.97
Short Circuit Current (A)	=	7.24	7.21	7.14	7.05	6.96	6.88

Nominal Operating Cell Temperature (NOCT) values are typical values, 45°C.

Typical cell temperature: insolation 800W/m^2, ambient temperature 20°C, wind speed 1m/s.

OTHER ELECTRICAL PARAMETERS

System Voltage (V)	=	600/1,000	Temp. Coefficient PMPP (% / °C)	=	-0.41
Temp. Coefficient ISC (% / °C)	=	0.03	Temp. Coefficient UOC (% / °C)	=	-0.32

DESIGN

Cells	=	72 mono-crystalline, 3 bus bar	Backside	=	Multilayer sheet
Cell Dimensions	=	156 mm x 156 mm, pseudo-square	Frame	=	Anodized aluminum (clear or black)
Front glass	=	4mm solar glass, highly transparent and anti-reflective	Connection	=	2 x 1.2 m solar cables with MC4 connectors or compatible
Encapsulation	=	EVA - Solar Cells - EVA	Bypass Diodes	=	3 pieces

LIMIT VALUES

Module Temperature -40°C to +80°C

QUALIFICATIONS

IEC 61215, IEC 61730, ULC/ORD-C1703-01, CEC, FSEC, TÜV NORD, CE

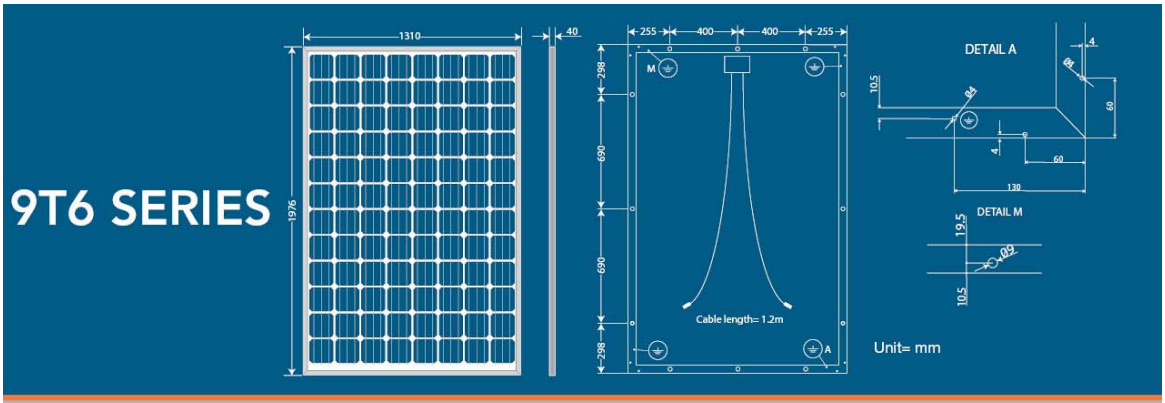
WARRANTY

25-year linear performance warranty. Also 10 years workmanship.

PERFORMANCE OUTPUT

-0/+3 percent

9T6 Series



ELECTRICAL DATA STC		9T6 420	9T6 415	9T6 410	9T6 405	9T6 400	9T6 395	9T6 390
Rated Power PMPP (W)	=	420	415	410	405	400	395	390
MPP Voltage (V)	=	49.53	49.23	48.98	48.68	48.43	48.17	47.91
MPP Current (A)	=	8.48	8.43	8.37	8.32	8.26	8.2	8.14
Open Circuit Voltage (V)	=	60.55	60.40	60.25	60	59.8	59.5	59.3
Short Circuit Current (A)	=	9	8.95	8.9	8.86	8.82	8.67	8.62

Measured at (STC) Standard Test Conditions 25° C, insolation 1,000 W/m^2, AM 1.5.

ELECTRICAL DATA NOCT		9T6 420	9T6 415	9T6 410	9T6 405	9T6 400	9T6 395	9T6 390
Rated Power PMPP (W)	=	320	315	310	305	300	295	291
MPP Voltage (V)	=	45.78	45.59	45.35	45.15	44.96	44.79	44.59
MPP Current (A)	=	6.99	6.91	6.83	6.75	6.67	6.59	6.51
Open Circuit Voltage (V)	=	56.20	55.98	55.77	55.54	55.31	55.08	54.93
Short Circuit Current (A)	=	7.42	7.35	7.28	7.21	7.14	7.05	6.96

Nominal Operating Cell Temperature (NOCT) values are typical values, 45°C.

Typical cell temperature: insolation 800W/m^2, ambient temperature 20°C, wind speed 1m/s.

OTHER ELECTRICAL PARAMETERS

System Voltage (V)	=	600/1,000	Temp. Coefficient PMPP (% / °C)	=	-0.41
Temp. Coefficient ISC (% / °C)	=	0.03	Temp. Coefficient UOC (% / °C)	=	-0.32

DESIGN

Cells	=	96 mono-crystalline, 3 bus bars	Backside	=	Multilayer sheet
Cell Dimensions	=	156 mm x 156 mm, pseudo-square	Frame	=	Anodized aluminum (clear or black)
Front glass	=	4 mm solar glass, highly transparent and anti-reflective	Connection	=	2 x 1.2 m solar cables with MC4 connectors or compatible
Encapsulation	=	EVA - Solar Cells - EVA	Bypass Diodes	=	4 pieces

LIMIT VALUES

Module Temperature -40°C to +80°C

QUALIFICATIONS

IEC 61215, IEC 61730, UL1703, CEC, FSEC, ULC/ORD-C1703-01, TÜV NORD, CE

WARRANTY

25 year linear performance warranty. Also 10 years workmanship.

PERFORMANCE OUTPUT

-0/+3 percent

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The maximum power value, open circuit voltage and short circuit current of any individual module will be -0% to +3% of these values. Specifications are subject to change.

Electrical Values

In actual conditions, the variation of the parameters of operation for the cells will be related to the variation of irradiation received and the actual temperature. These parameters show the indicated values in the previous charts.

The variations of the working point of the model according to the modification of different operation parameters are shown in the next page.

Amps/Voltage Curves Variation due to Solar Radiance & Temperature

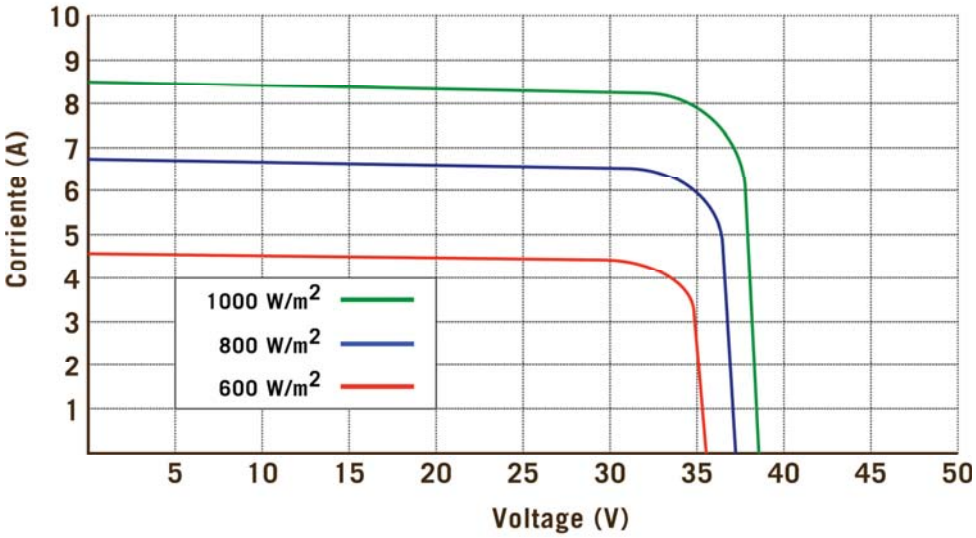


Figure 2. Variation of the work curve Amps-Voltage according to the incidental solar radiance to a cell temperature of 25 °C

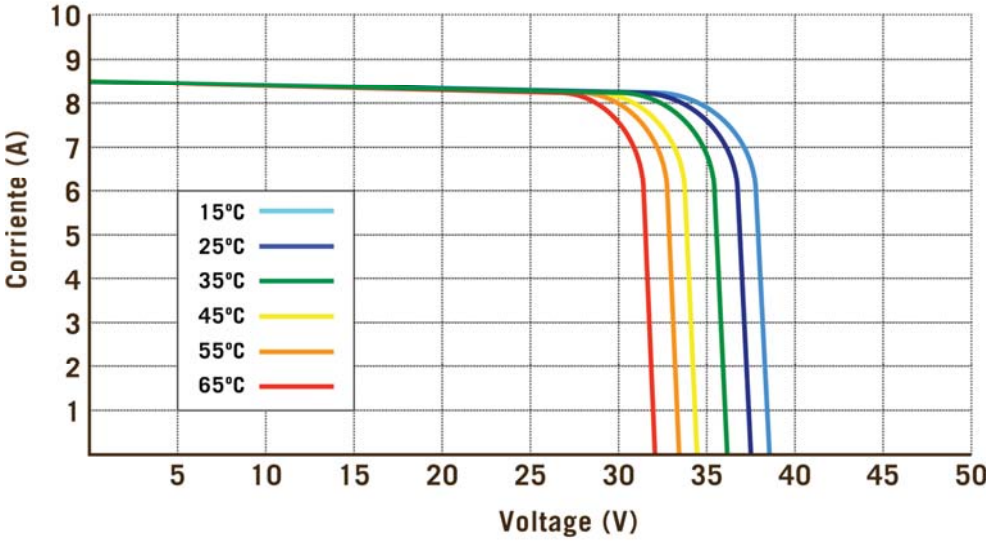


Figure 3. Variation of the work curve Amps-Voltage according to the temperature of the cell

Potential Power Curve

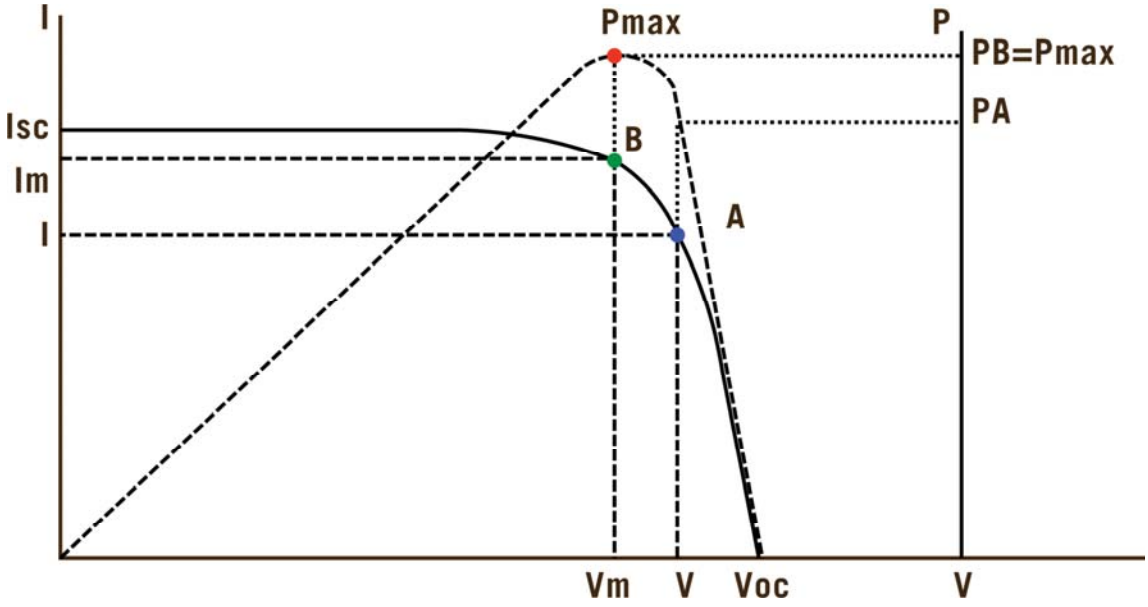


Figure 4. Curve of the potential produced by a photovoltaic module in reference to the working point.

In the above figure, it can be observed that there is a point for which the product (I x V) reaches its maximum. This point, called the maximum power point, determines the expressed peak power using the units (Wp).

The ability of the system to trace this point in relation to the variation of working conditions of the module is called, "tracing of the point of maximum potential (MPPT)".

JUNCTION BOX

The junction box can be found on the backside of the module. The module's cells are soldered in a series and terminate at four points within the junction box where the current passes through two bypass diodes, the circuit board, and +/- outputs before entering two isolated copper cables with multi-type connectors.

The junction box does not require any extra field wiring at the terminals.

NOTE: Changing wires or modifying any piece of the junction box will void the module's warranty.

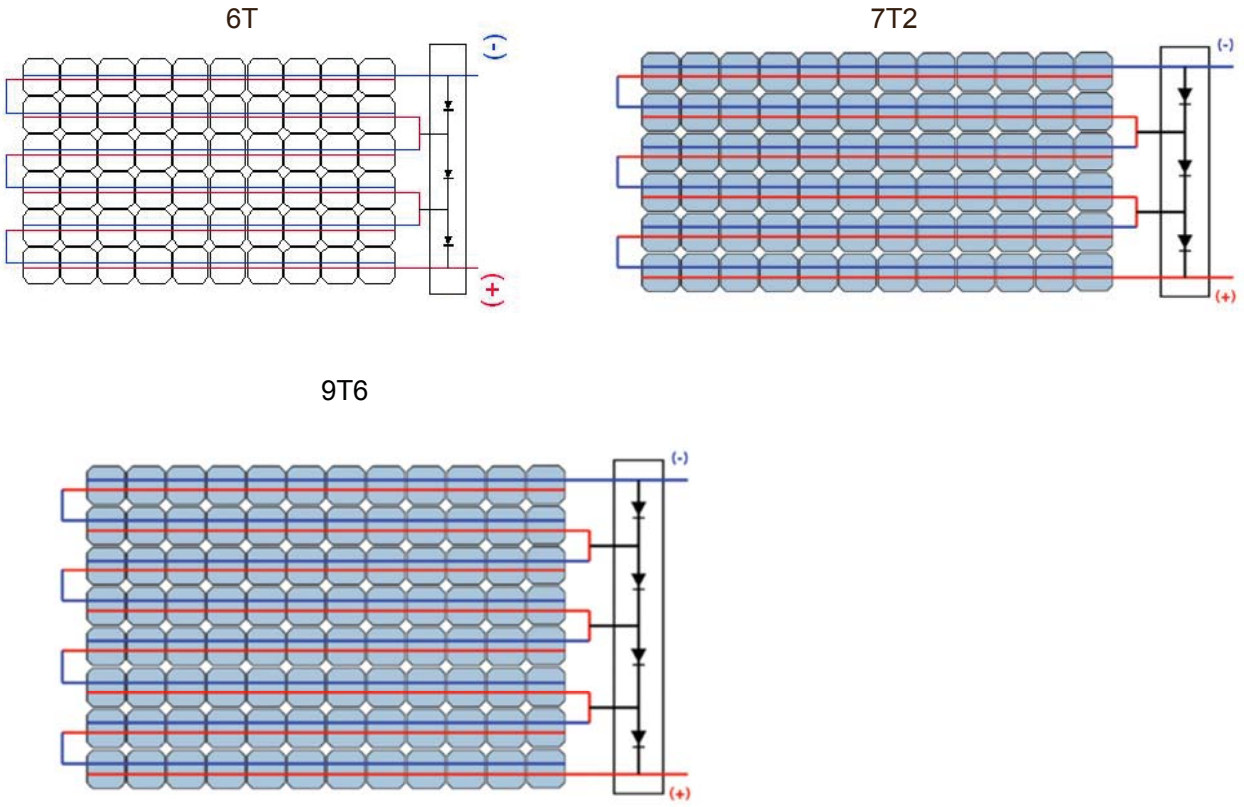


Figure 5. Electrical outline of the connection between the cells and the diodes, that interacts in the photovoltaic solar module.

Any shadowing of cells resulting from the projection of any object or from the accumulation of dirt or debris can result in reverse voltage. The junction box contains three bypass diodes to avoid this problem.

The reverse polarization of a cell can lead to consuming the energy produced by the rest of the system. The dissipation of this energy can lead to dangerous overheating and affect the cell. Damage can include, but is not limited to, the release of its anti-reflection cap, the perforation of the P-N union or the breakage of the soldering.

Bypass diodes have the capacity to run a current larger than the maximum produced by the module and block the reverse current generated by the system itself to avoid overheating.

Diode Characteristics

The 6T and 7T2 Series contain three by-pass diodes each, the 9T6 contain four by-pass diodes, with the following characteristics:

Model Type	ULTRAFAST RECTIFIERS
Maximum Average Forward Current	15 A

WARNINGS AND ELECTRICAL RISKS

• Each Module produces a direct current (DC) when it is exposed to sunlight or other light sources. Contact with any of the electrically active parts of the module, such as terminals, can result in injury or death, regardless of whether or not the module is connected.

• The modules must be handled and installed only by certified electricians.

• The modules are packed and protected to avoid shipping/handling damage. This packaging must not be removed until installation to avoid damage.

• The modules should be stored in a dry and temperature controlled place prior to their installation, always in a well-balanced position. Please note that dropping can result in glass breakage. A module with a broken glass must not be installed. Broken glass can produce fragments that may cause injury to personnel handling it.

• The module's glass is tempered and therefore has higher resistance to impact. However, impact of a tool can cause serious damage to it. Modules should be handled with extreme caution to avoid impact from any tool or other heavy objects. Walking on the modules should also be avoided. (Maximum load rating is 146.5 Kg/m^2)

• DO NOT disassemble the module or remove any of its parts. Improper handling of the junction box may produce loss of the waterproof rating and electrical protection, which may lead to deterioration and/or corrosion of the unit. DO NOT handle the bypass diodes or bypass connections.

• The module already contains all the necessary wiring for its connection, so the junction box must not be interfered with in its installation.

• The photovoltaic solar module has been designed to work with levels of incidental irradiance normally found on the Earth´s surface. DO NOT concentrate the radiation without the express consent of Helios Solar Works as this concentration without rigorous and uniform control can produce malfunctions and can affect some cells of the module.

• The photovoltaic module produces a voltage in the form of current that always continues as long as the unit is illuminated. As a precaution, it is recommended that the module should be covered for its handling and/or connection or otherwise the connection should be done in hours of low irradiance intensity.

• The tools used to connect the modules must comply with provincial electrical safety regulations. They must be dry and have the correct level of insulation.

• The connection and disconnection of the photovoltaic modules can produce sparks. DO NOT attempt to connect or disconnect the modules in the presence of flammable substances.

• 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 values of ISC and VOC marked on this module 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 PV output. Please refer to the local electrical safety code for additional information.

CONNECTION LIMIT OF THE MODULES

The thickness and composition of the back sheet provides Helios Solar Works modules with electrical insulation of 600 VDC subject as per UL regulation. As a result, when installing within North America:

6T series module can be connected to each other in groups of up to 13.*

7T2 series module can be connected to each other in groups of up to 11.*

9T6 series module can be connected to each other in groups of up to 8.*

* values were calculated using standard test conditions (STC).

Back sheet thickness and composition are also IEC certified, providing Helios Solar Works modules with electrical insulation of 1000 VDC. Therefore, when installing modules where IEC standards hold precedence

6T series module can be connected to each other in groups of up to 21.*

7T2 series module can be connected to each other in groups of up to 17.*

9T6 series module can be connected to each other in groups of up to 13.*

* values were calculated using standard test conditions (STC).

There is no limit to the connection of modules in parallel, as the operation of one does not affect the others, however, they must all work at the same voltage level. Therefore, all the modules connected in parallel must have an equal number of cells, in order to avoid the recirculation of current between rows of modules.

In case of a parallel connection, the new maximum intensity allowable to the inverter is the limit of the number of modules to be installed.

Module Wirings

• The wiring must ensure that the loss of nominal potential is ~1% and no more greater than 2%

•The recommended rating for wiring connections is 6mm^2 and never less than 4mm^2, (10 AWG recommended and never less than 12 AWG). Use only cable listed by UL 4703 PV Wire, 90ºC/194ºF thermal insulated in accordance with local fire, building and electrical code.

RECOMMENDATIONS FOR INSTALLATION

The modules must be secured to structures that can support them using anchors that take into account the constraints imposed by the resulting movements of the processes of thermal expansion and contraction.

To achieve the maximum annual yield the installer shall determine the optimum orientation and tilt of the PV modules. Generation of maximum power occurs when sunlight shines perpendicularly onto the front surface PV modules.

Avoid Shading

Even the slightest partial shading (e.g., from dirt deposits) will cause a reduction in yield. A module is considered "shadow-free" if it is unobstructed across its entire surface regardless of the time of year. Even on the shortest day of the year unobstructed sunlight should reach the module's front surface.

Reliable Ventilation

Sufficient clearance between the module frame and the mounting surface is required to allow cooling air to circulate around the back of the module. The clearance should also allow any resulting condensation or moisture to dissipate.

The solar module should be assembled in the best possible orientation (South) and kept free from shadows, including partial shadows, to be able to obtain a good performance. Calculate the best inclination of the system depending on the latitude. In order to achieve a good self-cleaning effect through precipitation, the modules should be installed on at least a 20° angle.

• Each module should be situated with at least 15cm or 6in. of open space behind it to ensure that the ventilation dissipates the heat produced by the cells, and that the losses from this effect are minimal.

• If the modules are installed one beside the other, the height of the hardware should be levelled to avoid the projection of shadows.

• The anchors that connect the module frame to the structure and the structure to the building must comply with the standards for wind resistance outlined by the local building code.

• Prior to the installation of modules, contact the appropriate authorities to determine installation permits and inspections.

• Check applicable building codes to ensure that the construction or structure (roof, facade, support, etc.) where the modules are being installed has appropriate strength.

• When installing the modules, please ensure the assembly is mounted over a fire resistant roof covering rated for the application and required a slope less than 5in/ft (127 mm/305 mm) to maintain a fire class rating.

• The modules must not be installed in the proximity of highly flammable substances (e.g., filling stations, gas containers, paint equipment) since the connection and disconnection process may produce sparks.

• The modules must not be installed near open flames or flammable materials.

• Do not expose modules to artificially concentrated light sources.

• The modules must not be immersed or continuously exposed to water

• There is a risk of corrosion when modules are exposed to salt (i.e., marine environments) or sulphur (i.e., sulphur sources, volcanoes).

Installation Requirements

• Ensure that the modules meet technical requirements of the PV system as designed.

• Ensure that other system components do not exert damaging mechanical or electrical influence on the modules.

• Modules can be wired in series to increase voltage or in parallel to increase current. To connect in series, connect cables from the positive terminal of one module to the negative terminal of the following one. To connect in parallel, connect cables from the positive terminal of one module to the positive terminal on the following.

• Connect the quantity of modules that match the voltage specifications of the inverters used in the system. The modules must not be connected together to create a voltage higher than the permitted system voltage.

• In order to avoid (or minimize) mismatch effects in arrays, it is recommended that identical electrical performance of modules should be connected within the same series.

• Modules should be firmly fixed in place in a manner suitable to withstand all expected loads, including wind and snow loads.

• The small openings on the underside of the modules allow rain to run out. Make sure that these openings are not obstructed after mounting.

Grounding

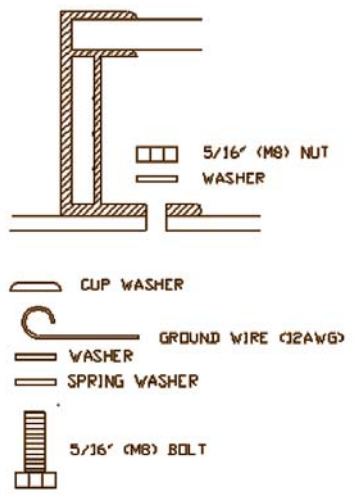
The modules are certified double insulated, however it is recommended that they be grounded. In U.S. and Canada only: all PV modules must be grounded by electrical connection from the module frames to the ground. A UL-listed grounding lug should be used.

Ensure compliance with all local electrical codes and regulations.

Several different methods of grounding can be used to provide the required connection through the anodized frame; the following methods of performing this task are acceptable.

A UL-listed grounding lug may be used. The existing grounding holes in the module frames should be used as the point of attachment to the module frame (the diameter M8 –5/16"- groundings holes on the module frame, identified with a yellow label). To ensure a conductive connection, i.e. to penetrate the non-conductive coating on the frame, a combination of screw, spring washer and lock nut must be used to mount the grounding lug onto the frame. The spring washer must be placed between the frame and the grounding lug. Use all stainless steel hardware to mount the lug to the module frame.

Ground using a bolt and nut and wire



The grounding lug has to be capable of accepting a 4-14 AWG (see annex A for AWG mm^2 sizing) copper conductor. Modules can be grounded using clip systems provided they have been tested and certified to local regulation on anodized aluminum frame and are installed according to the manufacture's specified instructions.

Connect module frames to each other using cables with cable lugs. All the connections on the conductive connection must be fixed.

Metal containing iron in the conductive connection should be treated against corrosion by anodization, spray-painting, or galvanization to prevent rusting and corrosion. Another method is to ground the frame of the module to racking structure in accordance with NEC requirements for grounding solar electrical systems.

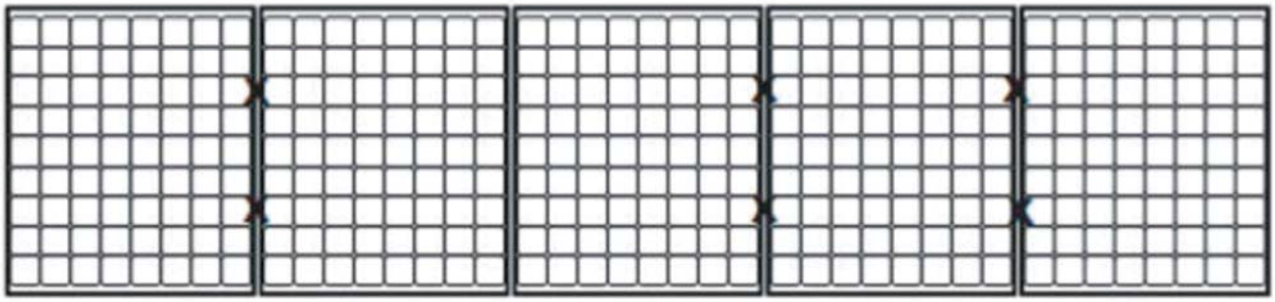
Alternative Method:

UGC-1 + WEEBlug 6.7 used in conjunction with SolarMount rails from UNIRAC

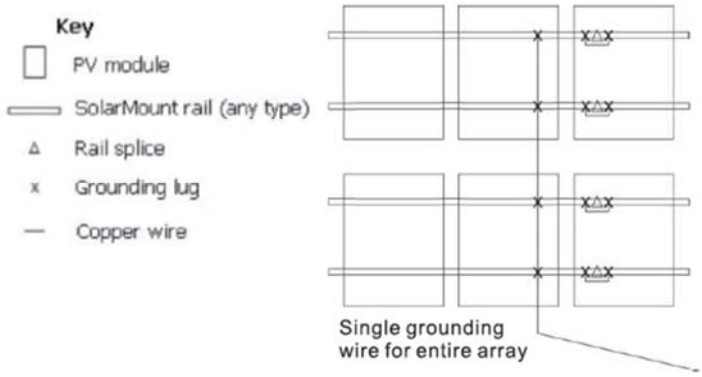
UGC-1 grounding clips are used to create grounding path between the module frame and the UNIRAC rail. WEEBlug 6.7 assemblies are designed for use with size 6-12 AWG copper conductor wire, and allow connecting the system to equipment ground connector

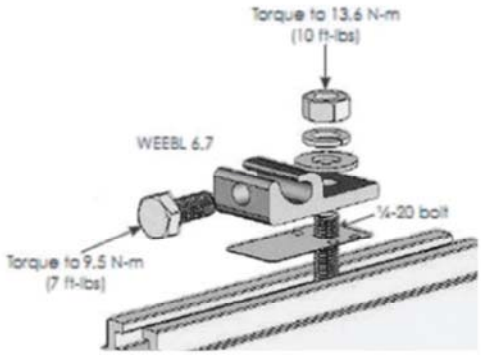
UGC-1 grounding clips should be preassembled with top mounting clamps in order to reduce the possibility of losing parts during installation. When installing the modules, slide the assemblies into the mounting slot of rails (UGC nibs should be aligned under the edge of the module for proper installation and torque the modules in place on top clip upright. Nibs will penetrate rail anodization and create a grounding path through rail.

The layout for the UGC-1 grounding clips depends on the number of modules by row. For an even number, two clips are used between each pair of modules. For an odd number, refer to the following picture where “X” denotes places to install the clips:



At least one WEEBlug assembly should be installed on each rail (more if rail splices are used). Slide a bolt in the mounting slot of rail to the desired position, and then place the special steel flat washer on the bolt, orient so the dimples will contact the aluminum rail. Slip the lug portion on top of the washer and install standard flat washer, lock washer and nut. Tighten the nut until the dimples are completely embedded into the rail and lug.





Even with splice rails, one single wire grounding is enough. Lay the equipment conductor in the lug and torque bolt to 10 Nm. Then repeat the operation for the other WEEBlug assemblies. Once grounded to an appropriate grounding electrode, the installation should look as above.

MOUNTING INSTRUCTIONS

Modules should only be bolted to support structures through mounting holes located in the frame's back flanges. 6T and 7T2 must be securely fastened at a minimum of 4 points, 9T6 must be securely fastened at a minimum of 6 points.

NOTE: Do not drill any additional holes in the module's frame. Doing so will void its warranty.

Comply with all local building codes.

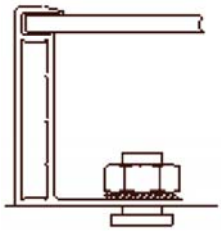
Helios Solar Works modules can be mounted on a roof: freestanding modules turn a class B rooftop into a class C rooftop.

Use appropriate corrosion-proof fastening materials.

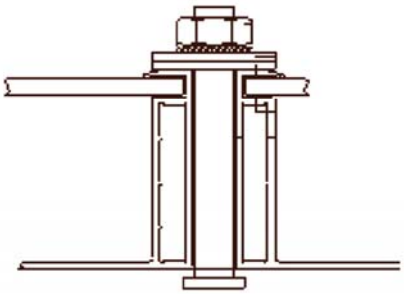
Top or bottom clamping methods will vary and are dependent on the mounting structures. Follow mounting guidelines recommended by the PV RACKING supplier.

The mounting design must be certified by a registered professional engineer. The mounting design and procedures shall comply with local codes and all authorities having jurisdiction.

Use a torque wrench for installation (torque to amount specified by professional engineer). The figure below shows methods of fastening a module to a support structure.



Bolt-on



Clamp-on

MAINTENANCE

• Cleaning the modules improves their optimal performance. The cleaning should always be done using clean water with low calcium concentration and without detergents or abrasives. The water should not be applied at high pressure and scrapers or other cleaning tools should not be used as they may cause scratches on the glass. Avoid producing a thermal shock using cold water when glass could be at a very high temperature (e.g. at noon).

• A thorough visual inspection of the modules should be conducted once or twice a year, noting possible effects of aging or corrosion. In this inspection special attention should be given to the integrity of the glass, the aluminum frame, the silicone seals, the waterproof of the junction box, oxidation of the contacts between cells and condensation in the interior of the laminate.

• Testing of all wiring and connections should be done at least once a year. The integrity and waterproof of all the parts that make up the wiring and connections of the solar installation should be tested: junction boxes, isolation of outdoor cables, protective tubing, connection links of connectors, support cables, fuse boxes, etc. Only qualified personnel duly trained and equipped for the job should do this work along with the measuring of isolation distances and resistance of the installation to the ground.

DIAGNOSTICS AND TROUBLESHOOTING

The strict quality controls in the factory ensure that Helios Solar Works modules are sold free of defects, breakages and/or other problems. However, in its operation some problems may arise that can alter the correct operation of the modules. They are detailed as follows:

Breaking of the glass. The tempered glass is resistant to impact; however poor handling during transport or installation as well as excessive mechanical tension in the racking structure, or impact can break the glass. Chipping of the surface might reduce the transparency of the module. Accumulation of dirt and humidity between the spots might lead to freezing, increasing the separation of the frames. Regardless, the module may continue producing power between 50 and 70 % of its capability – weather resistance will be compromised though.

On occasion the seal of the junction box is compromised due to external conditions such as weathering.

Short-circuit of the module: An excess of intensity due to meteorological phenomena or mistakes in the connection can cause damage, short-circuiting some of the bypass diodes contained in the module. As a result, the voltage of the module will decline in proportion to the damaged diodes to 2/3, 1/3, or 0 V. Only Helios Solar Works personnel are authorized to replace the bypass diodes.

Helios Solar Works guarantees the workmanship of its modules for ten years. In the event of accelerated deterioration of the module, Helios Solar Works should be notified immediately to make the necessary replacement.

Notice:

It is the owner's and operator's responsibility to determine and follow all national and local codes and regulations related to the use and installation of photovoltaic modules

CERTIFICATES

Technical File with Certification of the CE trademark, tests in Leitat Technical Center and AT4 Wireless with certification ENAC, in accordance with the IEC. UL and CEC through Intertek.

Certificates:

Certificate Helios-USA CE

Certificate of Helios Solar Works Guarantee

Factory Certificate TÜV

Integrated Modules Certificate TÜV

Monocrystalline Modules Certificate TÜV

Multicrystalline Modules Certificate TÜV

Test Certificate AT4 - HEE215M, IEC 61215 y IEC 61730, UL 1703

Test Certificate AT4 - HEE210U, IEC 61215 y IEC 61730, UL 1703

Certificate ULC/ORD-C1703-01

$_{C}ETL_{US}$ mark with listed number 4001272

CEC listed

FSEC Listed