

OPTIMUM GS Modules Installation Manual



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Note: The contents and specifications hereof may vary with the product design. Atersa reserves the right to make change to the installation guide without prior notice.

1 Introduction

Thank you for choosing Atersa photovoltaic (PV) module. It is a great honor to provide you our PV modules. This manual contains information regarding the installation and safe handling of Atersa. The word "module" or "PV module" used in this manual refers to one or more GS-Series solar modules.

Installers must read and understand the guide before installation. Any questions, please contact with our sales department for further explanations. The installer should conform all safety precautions in the guide and local codes when a module be installed.

Before installing a solar photovoltaic system, installers should become familiar with the mechanical and electrical requirements of the system. This guide must be kept in a safe place for future references (care and maintenance), and also in case of sale or disposal of the modules.

Module model	Specific construction	Marking
36 cells 6"	<ul style="list-style-type: none"> • Superstrate glass: 3,2 mm thick. AR COATING. 	<ul style="list-style-type: none"> • Fire Resistance Rating: Class C (IEC 61730).
60 cells 6"	<ul style="list-style-type: none"> • EVA: 0,45 mm thick • Substrate: 0,3 mm thick. 	<ul style="list-style-type: none"> • Safety class: II (IEC 61730).
72 cells 6"	<ul style="list-style-type: none"> • Frame Types: 35 – 40 mm. 	<ul style="list-style-type: none"> • Application Class: A (IEC 61730).

2 Disclaimer of Liability

Because the use of this manual and the conditions or methods of installation, operation, use and maintenance of photovoltaic (PV) product are beyond Atersa's control, Atersa does not accept responsibility and expressly disclaims liability for losses, damages, or expense arising out of or in any way connected with such installation, operation, use or maintenance.

No responsibility is assumed by Atersa for any infringement of patents or other rights of third parties, which may result from use of the PV product. No license is granted by implication or otherwise under any patent or patent rights.

The information in this manual is based on Atersa's knowledge and experience and is believed to be reliable; but such information including product specification (without limitations) and suggestions do not constitute a warranty, expresses or implied.

Atersa reserve the right to change the manual, the PV produce, the specifications, or product information sheets without prior notice.

Warning: Read this instruction sheet in its entirety before installing, wiring, or using this product in any way. Failure to comply with these instructions will invalidate the Atersa Warranty for PV Modules.

In summary, the Atersa Limited Warranties does not apply to any of the following cases:

- PV modules which in Atersa's absolute judgment have been subjected to: misuse, abuse, neglect or accident; alteration, improper installation or alteration of any kind.
- Non-observance of Atersa's installation, users and/or maintenance instructions.
- Repair or modifications by someone other than an approved service technician of Atersa.
- Power failure surges, lightning, flood, fire, accidental breakage or other events outside Atersa's control.

3 General Safety

- Follow all permission, installation and inspection requirements.
- Before installing modules, contact the appropriate authorities to determine permissions, installation, and inspection requirements which should be followed.
- Electrically ground modules for all systems of any voltage.
- If not otherwise specified, it is recommended that requirements of the latest national or international electrical standards be used.
- Be sure that the construction or structure (roof, facade, etc.) where the modules are being installed has enough strength. For modules mounted on roofs, special construction or structures may be required to help provide proper installation. Both roof construction and module installation design have an effect on the fire resistance of a building. Improper installation may contribute to fire hazards. Additional devices such as ground fault, fuses, and disconnects may be required.
- Follow all safety precautions of other system components used.
- Wiring and grounding method of the frame of arrays shall comply with national, regional and local codes, laws and standards.
- PV modules should be installed and maintained by qualified personnel. Only installation/service personnel should have access to the PV module installation site.
- Keep children and animals away from PV modules.
- Prior to installation, do not store modules outdoors or in a damp environment.
- When PV modules are installed on roofs or any other structures above ground, appropriate safety practices should be followed and appropriate safety equipment should be used in order to avoid possible safety hazards. Note that the installation of PV modules on some roof types may require the addition of fireproofing, as required by local building/fire codes.
- In order to avoid risk of injury or electrical shock, do not allow anyone (unqualified or having limited knowledge of PV modules) to handle damaged PV modules.
- Avoid uneven shade on the PV module surface. Shaded cells may become hot ("hot spot" phenomenon) which may result in permanent damage to the module.
- Do not expose PV modules to sunlight concentrated with mirrors, lenses or other means.
- The maximum open circuit voltage must not be greater than the specified maximum system voltage. Voltage is proportional to the number of PV modules in series and is affected by weather conditions.

4 Precaution for unpacking, handling and storage

The handling of modules requires great diligence. Therefore, caution is required while unpacking, transporting and temporarily storing these modules.

- Modules are delivered in specially designed boxes so that they are properly protected during transport. Please do not take them out of the boxes until being the installation.
- Unpack module pallet with extreme care. Be careful while unpacking, transporting and storing the modules. Avoid module mishandling during unloading.
- When carrying a bigger module, two or more people should carry it by its frame and wear non-slip gloves (to avoid injury by a slipping module, cuts by the edge of a frame etc.) do not take them out of the boxes. Do not leave the module unsupported or unsecured prior to installation. For example, wind can cause a module which is leaning against a fence to fall and break. Avoid application of excessive bending or twisting forces to the module, it may cause severe micro-cracks at the cell level, which in turn may compromise module reliability.
- A module with broken glass or torn back sheet cannot be repaired and must not be used since contact with any module surface or the frame can produce electrical shock.
- Broken or damaged modules must be handled carefully and disposed of properly. Broken glass can be sharp and can cause injury if not handled with appropriate protective equipment.
- Store modules in a dry and ventilated room. Do not place modules on an uneven surface. Do not place excessive loads on the module or twist the module frame, it may cause severe micro-cracks at the cell level, which in turn may compromise module reliability.
- Do not stand, step, walk and/or jump on the module. Do not drop or place objects on the modules (such as tools.)
- Do not mark the modules with sharp instrument. Particularly attention should be taken to avoid module back sheet to come in contact with sharp objects, as scratches may directly affect product safety.

5 Warning



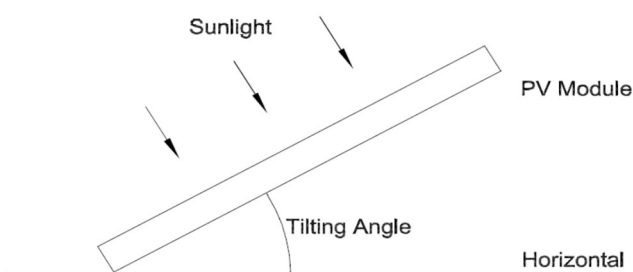
- A system formed by photovoltaic modules may produce high voltages and currents, which implies an added hazard. Module installation and operation should be performed by qualified personnel only.
- Children and unauthorized persons should not be allowed near the installation of PV modules.
- Use module for its intended function only.
- Be sure that all other system components are compatible, and they do not subject the module to mechanical or electrical hazards.
- Be sure to completely ground all modules.
- Work only under dry conditions, with dry modules and Insulated tools.
- Cover the entire front surface of the PV module with a dense, opaque material such as cardboard box, during installation and handling of the modules.
- Do not expose Back sheet directly to sunlight.
- Since sparks may occur, do not install the module where flammable gases or vapors are present.
- Do not touch terminals while module is exposed to light or during installation. As a Precaution use properly insulated tools only.
- Do not damage or scratch the back sheet of the module.
- Do not use the junction box to hold or transport the module.
- Do not drop module or allow objects to fall on module.
- Do not stand or step on the module.
- Do not disassemble, modify or adapt the module or remove any part or labeling installed/pasted by the manufacturer.
- Do not drill holes in the frame or glass of the module.
- Do not treat back sheet and front surface of the module with paint and adhesives.
- Do not artificially concentrate light on the module.
- Do not wear jewelry or metal accessories during installation or maintenance.
- Do not change the wiring of bypass diodes.

6 Installation

The photovoltaic modules of ATERSA, use high efficiency, poly-crystalline silicon cells (or mono-crystalline silicon cells) to turn solar radiation energy into direct current electric power.

Output electricity from PV module may vary according to season, climate and location. It is vital to install PV module in its proper direction and tilting angle to receive the most direct sun exposure.

- Please read this guide completely before installation or use of the modules.
- Facing south is the most suitable direction to receive the maximum sun light in the northern hemisphere, and conversely, facing north is the correct orientation for PV module in the southern hemisphere. Selecting the proper support frame.
- The assembly is to be mounted over a fire-resistant roof covering rated for the application, the roof slope should be less than 22.62° (less than 5 in/ft) to maintain fire class ratings. The modules are not designed for integral mounting as part of a roof or wall. The mounting design may have an impact on the fire resistance.
- Tilting angle of PV module should almost be the same degree of latitude where the installation locates in most situations. In order to set the best tilting angle, 10 degrees of tilting angle or more is recommended if natural effect of cleaning PV module such as raining is intended and expected. High latitude areas require an additional 10-degree tilting angle to the degree of latitude to reach the optimal tilting angle of PV module in the winter. The module tilting angle recommended varies according to the location of installation. Please refer to the table below for more information.



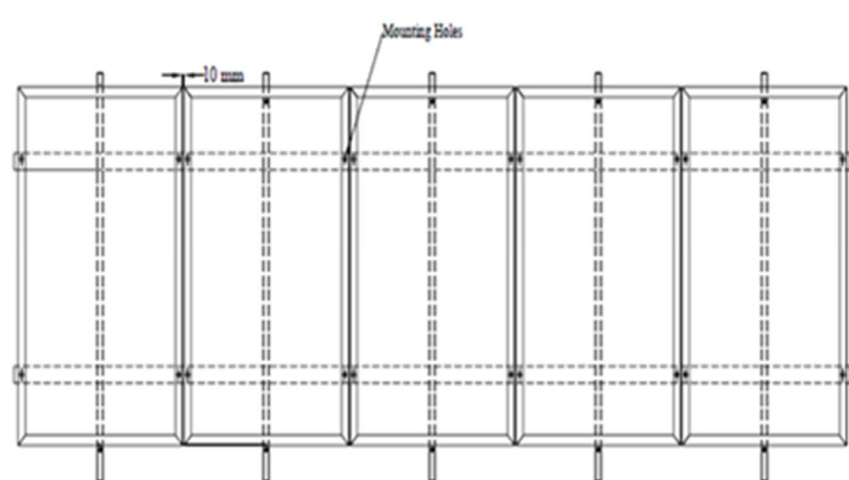
Tilting angle of PV module

Degrees of Latitude	Tilting Angle
0° ~ 15°	15°
15° ~ 25°	Same as Latitude
25° ~ 30°	Latitude + 5°
30° ~ 35°	Latitude + 10°
35° ~ 40°	Latitude + 15°
40° +	Latitude + 20°

Recommended tilting angles

Shading PV module by trees, building or any obstructions to sunlight should be avoided. Trim branches and remove unnecessary items that may block the path of sunlight during the daytime. Otherwise, the power output will undoubtedly decline.

- If several modules are mounted, ensure they do not throw shadows on each other.
- Do not use modules of different specifications in the same system. Only PV modules with the same cell size should be connected in series.
- Grounding should be completed through an attachment of the frame of PV module and mounting racks in compliance with the national regulations to avoid risks of electrical shocks or fire.
- Wiring should be protected and used in location not accessible to children or small animals to ensure personal safety and to prevent PV module from damage.
- The junction box shall be in the uppermost position to minimize the ingress of water.
- Modules installed in parallel to the surface of the building wall or roof. Clearance between the module frame and the mounting surface (wall or roof) is required to prevent wiring damage and to allow cooling air to circulate around the back of the module. This also allows any condensation or moisture to dissipate. The module should never be sealed to the mounting surface with sealant that prevents air from circulating under the module.
- The recommended stand-off height is about 115 mm (between the roof and the module frame), If other mounting means are employed, this may affect the Listing for Fire Class Ratings. Clearance of 10 mm. (0.39 inch) or more between modules is required to allow for thermal expansion of the frames.
- Recommended maximum number of 60 cells module is 24 in series and 2 in parallel, 72 cells module is 21 in series and 2 in parallel.



PV modules array

6.1 Bolding method

The frame of each module has mounting holes to secure the modules to the supporting structure. Each module needs to be securely fastened at 4 points.

The frame of each module has 8 mounting holes (length x width = 14 mm. x 9 mm.) that are used for assembly modules to the supporting structure. Use minimum four holes to secure the modules.

Depending on the number of holes used, the maximum mechanical load that the module can withstand varies (refer table).

The module frame must be attached to a mounting rail using M8 corrosion-proof bolts together with spring washers and flat washers in four symmetrical locations on the PV module. Use the existing holes for securing the module and do not drill additional holes (doing so would void the warranty). Use appropriate corrosion-proof fastening materials. The applied torque value should be big enough to fix the modules steadily. The torque value for a M8 bolt is 16~20 N*m. For special racking systems or special installation requirements, please reconfirm with the supplier for the appropriate torque value. Please find detailed mounting information in figure 2.

USED HOLES	MAX. PRESSURE (*)
8 mounting holes	5400 Pa
4 inside mounting holes	2400 Pa

(*) Maximum pressure

*5400 Pa, with a frame of 45 mm thickness for all the modules type, using 4 holes is enough.

*2400 Pa, with a frame of 35 mm thickness for all the modules type.

The hardware required to mount the module is given below:

1. Aluminum Frame
2. M8 Stainless Bolts
3. Flat Stainless Washer
4. Spring Stainless Washer
5. M8 Hex nut stainless

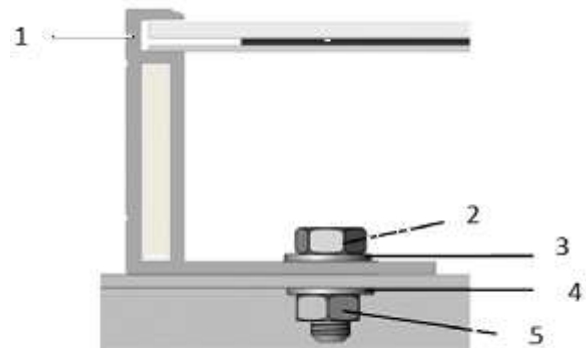
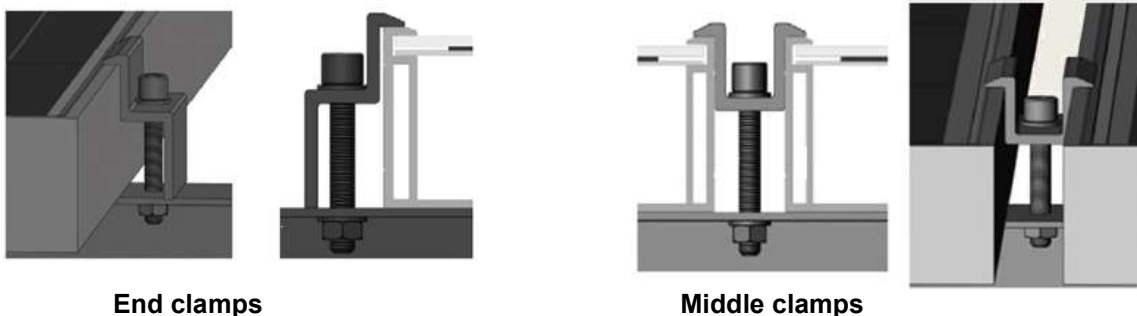


Figure 2. Installed module

6.2 Clamping Method

Each Module must be securely fixed to the mounting structure at a minimum of four points. The Module clamps shall not come into contact with the front glass and must not deform the frame. Be sure to avoid shadowing effects from the Module clamps. The Module frame is not to be modified under any circumstances.

When choosing this type of clamp-mounting method, please be sure to use at least four clamps on each Module, two clamps should be attached on each long side or two clamps on each short side of the Module. Depending on the local wind and snow loads, if excessive pressure load is expected, additional clamps or support would be required to ensure that the Module can bear the load. The applied torque shall be big enough to fix it steadily. For safety, it is better to follow the clamp manufacturer's recommendations.



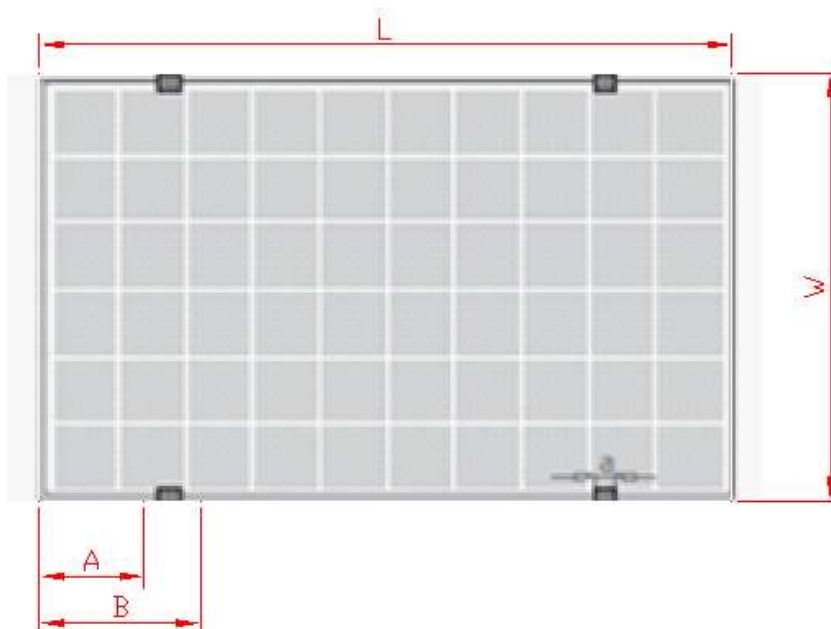
End clamps

Middle clamps

→ **Clamp mounting on Long sides of the frames:**

The mounting zone is greater than A and less than B. The clamp size will be greater than or equal to 60 mm.

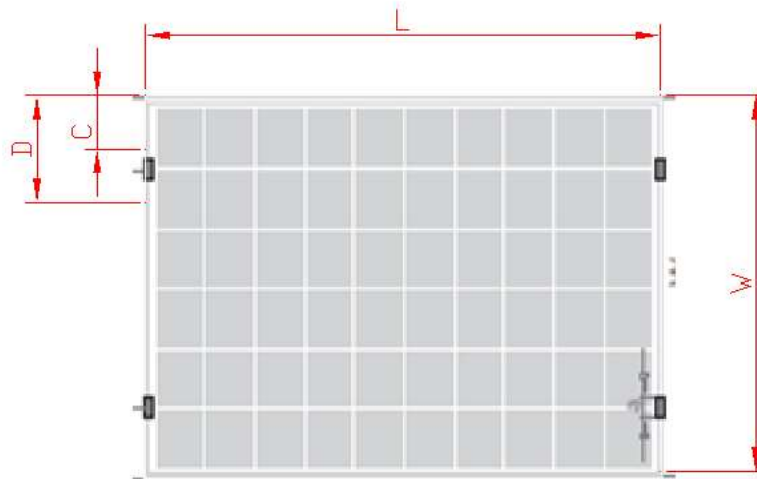
Module type	Length (mm)	Width (mm)	Thickness (mm)	A (mm)	B (mm)	Max. static load (Pa)
36 Cells 6"	1482	676	35	240	260	2400
60 Cells 6"	1640	992	35	380	400	2400
72 Cells 6"	1956	992	40	380	400	2400
72 Cells 6" BC	1979	1002	40	390	410	2400
36 Cells 6"	1482	676	45	240	260	5400
60 Cells 6"	1640	992	45	380	400	5400
72 Cells 6"	1956	992	45	380	400	5400
72 Cells 6" BC	1979	1002	45	390	410	5400



→ **Clamp mounting on short sides of the frames:**

The mounting zone is greater than C and less than D. The clamp size will be greater than or equal to 60 mm.

Module type	Length (mm)	Width (mm)	Thickness (mm)	A (mm)	B (mm)	Max. static load (Pa)
36 Cells 6"	1482	676	35/45	50	240	1600
60 Cells 6"	1640	992	35/45	50	240	1600
72 Cells 6"	1956	992	40/45	50	240	1600
72 Cells 6" BC	1979	1002	45	390	410	1600



7 Electrical Connections and Wiring

- These modules contain factory installed bypass diodes. If these modules are incorrectly connected to each other, the bypass diodes, cables, or junction box may be damaged.
- Modules can be wired in series to increase voltage. Connect wires from positive terminal of one module to the negative terminal of the next module. All modules connected in series should be of the same model number and/or type.
- Use wiring and connection techniques consistent with outdoor installations. Wiring should be placed in conduit that is sunlight-resistant or, if exposed, should be sunlight-resistant type cable.
- The maximum open circuit voltage of the system must not be greater than the specified maximum system voltage for the module.
- When reverse currents can exceed the value of the maximum protective fuse marked on the back of the module, a properly rated and certified over current device (fuse or circuit breaker) must be connected in series with each module or string of modules.
- Match the polarities of cables and terminals when making the connections; failure to do so may result in damage to the module.
- Connecting modules in reverse polarity to a high current source, such as a battery, will destroy the bypass diodes and render the module inoperative. Bypass diodes are not user replaceable.
- The junction box is under no circumstances being opened. Opening the junction box may void the warranty.
- Modules with a suspected electrical problem should be returned to Atersa for inspection and possible repair or replacement as per the warranty conditions provided by Atersa.
- Under normal conditions, a photovoltaic module is likely to produce more current and/or voltage than that specified under standard conditions. In these cases, the values of I_{sc} and V_{oc} should be multiplied by a factor of 1.25, and components such as fuses, conductors and controllers must be adapted to the photovoltaic generator's output.
- When disconnecting wires under load, an electric arc may result. Such arcs may start fires and may otherwise create problems. To disconnect the PV system while under load, turn off the inverter first and then switch on the DC-circuit breaker.

The ensure proper system operation and maintain the warranty, be careful to observe the correct cable connection polarity when connection the module to a battery or to another module.

Series method

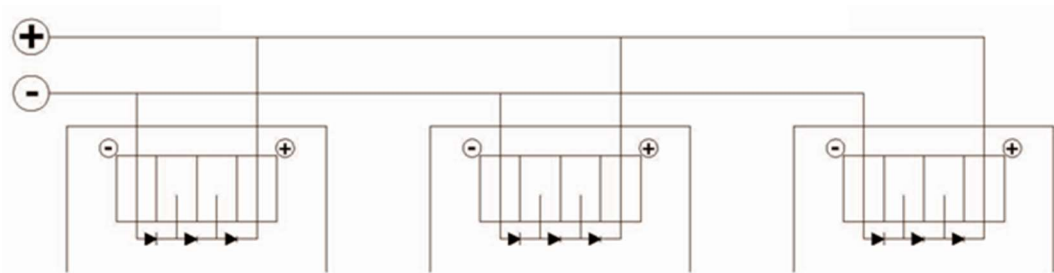
Photovoltaic modules are manufactured to support high voltages. The maximum voltage of the system is indicated on the label of the module’s characteristics. Therefore, modules can be connected in series until that voltage is reached.

Parallel method

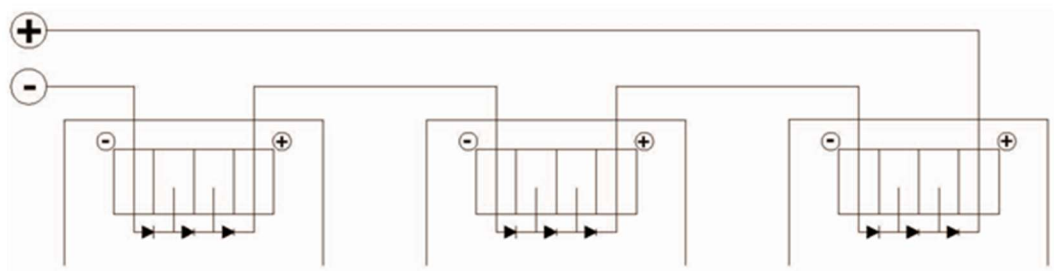
When modules are parallel connected, the current is added together. The number of modules in parallel to used can be as allowed as by charge controller, frequency variator, or the corresponding equipment to which the module is connected. A cable with an adequate section for the conduction of the total current generated by the modules should be used.

Modules are supplied with cables (4 mm² of section) or without cables, it is recommended that cables with cross sections between 4 mm² and 10 mm² be used.

In all case, the conductor should never use any section less than 4mm². Should a larger section be needed to transport the energy to the corresponding equipment junction boxes should be used which will allow for bigger cable sections for longer distance.



Typical wiring connections in serie

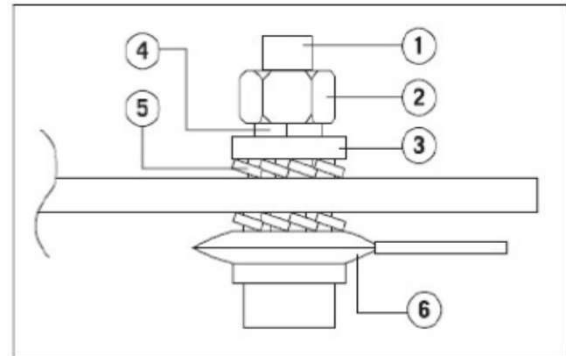


Typical wiring connections in parallel

7.1 Grounding equipment

To avoid the risk of electrical shock or fire, the module frame should be grounded before the electrical connection of the modules is operated. The mounting part of the ground mounting hole:

1. Stainless steel bolt M4
2. Stainless steel nut M4
3. Stainless steel flat washer M4
4. Stainless steel spring washer M4
5. Stainless steel toothed washer M4
6. Stainless slotted washer M4



Attach a ground conductor at one of the ground holes on the module frame using a self-tapping screw (indicated with the symbol \perp on the frame).

A good connection between the grounding hardware is essential for an effective ground. Anodizing the frame provides a coating against corrosion, but reduces the effectiveness of the ground connection. The ground wire should be a naked copper wire with surface coating only and must not have an insulation jacket. This may be required by your local codes.

Note: - "Please avoid negative bias of the cells with respect to the grounded frames".

7.2 Bypass Diodes

When the modules are shaded partially, it may cause reverse voltage across cells or modules, because the current from other cells in the same series is forced to flow through the shaded area. This may cause undesirable heating to occur. When a bypass diode is wired in parallel with the series string, the forced current will flow through the diode and bypass the shaded module, thereby minimizing module heating and array current losses. The use of a diode to bypass the shaded area can minimize both heating and array current reduction.

Modules are equipped with factory installed bypass diodes. The factory installed diodes provide proper circuit protection for the systems within the specified system voltage, so that you do not need any other additional bypass diodes. If your system specifications require you to add or change diodes, please contact authorized Atersa representative for recommendations for the proper diode type.

Blocking diodes are typically placed between the battery and the PV module output to prevent battery discharge at night. Atersa modules do not contain a blocking diode when shipped from the factory. It is recommended that a charge controller be used to prevent the batteries from being overcharged and discharged at night.

7.3 Junction boxes

The modules' connection boxes are located at the rear thereof. As stated earlier, they are outdoor prepared, leak-tight boxes with an IP-67, provided sealing is respected in the cable bushes or stuffing glands when passing cables through. To this effect, will not be held responsible for bad installation of these cables (in the case of modules supplied without cables).

Each module has either a single connection box for both terminals. The polarity in the connections must be respected for the module's correct operation.

The connection box covers are marked with a drawing. They are opened by inserting a flat screwdriver into the pertinent flange in the direction shown by the arrow and pressing lightly thereon to open. To close, it suffices to press down on the cover until it closes

Connection boxes must not undergo any type of pressure when installing the module in a support structure. No item thereof must touch the connection box.

Connection boxes are similar in modules of the same nominal voltage.

8 Cleaning and maintenance

8.1 Cleaning

It is common for dust and dirt particles to accumulate on the surface of the module. This can reduce the optimal output performance of the solar modules. Normally, the accumulated dust can be washed with water, but in some instances some maintenance is recommended to clean the surface of the glass with water and a soft cloth or sponge to remove layer of dirt. A mild non-abrasive detergent may be applied for persistent dirt.

- PV Module Cleaning should be done only by properly trained personnel who understand the risks of applying water to electrical components.
- It is advisable to perform periodic inspection of the modules for damage to glass, back sheet, frame, junction box or external electrical / loose connections and corrosion by the authorized professional.
- No aggressive and abrasive cleansers or chemicals should ever be used on the coated front glass.
- No alkali-based chemicals should be used, including ammonia-based solutions.
- Always wear rubber gloves for electrical insulation while maintaining, washing or cleaning modules. Appropriate electrically insulating Personal Protective Equipment (PPE) must be worn during any cleaning or inspection operations.
- Acceptable module cleaning methods are to spray the modules with low-pressure water closely matched in temperature to the module. Do not apply water that is more than 20°C warmer or colder than module surface temperature.
- For cleaning of Modules Fresh water (TDS < 1500 mg/l) may be used. If needed, a mild, non-abrasive, non-caustic detergent with a final fresh water and detergent solution mix between $6.5 < \text{pH} < 8.5$ at 25°C may be used.
- When using water, RO water provides the best results. In absence of RO water, tap water with low mineral content (total hardness <75 mg/l) or deionized water may be used. Calcium should not exceed: 75 mg/ml. Do not use solutions containing hydrochloric acid, D-Limonene, ammonia or sodium hydroxide.
- Clean the module either with soft sponge or a soft rubber wiper, do not use abrasive cleaners or de-greasers on the module. Do not scrub with abrasive brushes. The brush fibers will scratch, reducing the power output of the panel.
- In case if water is not available or soft water (with low mineral content) is not available, Module can be dry cleaned with the help of a soft cloth or with soft sponge to remove dirt, dust. One can also use wet cloth, sponge to clean dirt which is not

- easily removed by dry cleaning.
- Always make sure that Cleaning should not be done during Generation time, as during the generation time the temperature of module is higher and washing may cause thermal stress in module.
 - Do not clean or spray water at the Junction Box or any area on the backside of the module.
 - Frequency of Cleaning will vary depending upon any special conditions in area where the modules are installed. Modules installed in high windy or dusty areas should be inspected more frequently.
 - If excessive soiling is present, a non-conductive soft brush, sponge, or other mild agitating method may be used before using water. Ensure brushes or agitating tools are not abrasive to glass.
 - Module damage that arises as a result of improper cleaning will not be warranted by Atersa.
 - Do not clean the glass surface with chemicals. Do not let water stay on the glass surfaces of PV modules for a long time. This creates a risk of permanent damage to the glass, such as white efflorescence, otherwise known as "glass disease," which may cause reduced power output.
 - To avoid dirt accumulation or white efflorescence due to water accumulation, do not install PV modules horizontally (flat).

8.2 Precauciones de mantenimiento

Safety instructions must be followed during maintenance of PV modules. Any Maintenance work must be performed by a certified installer/servicer to ensure system integrity and safety.

- Do not pull the PV cables. Do not place/drop objects onto the PV modules.
- Not to damage, pull, bend, or place heavy material on Junction box, cables & connectors.
- Upon completion of any service or repairs, ask the installer/servicer to perform routine checks to determine that the PV modules are in safe and proper operating condition.
- Do not stand or step on the module.
- Do not disassemble, modify or adapt the module or remove any part or labeling installed/ pasted by the manufacturer.
- Do not drill holes in the frame; Do not treat back sheet and front surface of the module with paint and adhesives.

- Do not artificially concentrate light on the module.

8.3 Comprobaciones:

Check the items below periodically:

- Visual inspection of the module.
- All fastenings are tight and secure and free of corrosion.
- All cable connections are secure, tight, clean and free of corrosion.
- Cables are not damaged in any way.
- The tightness and condition of the module connection cable terminals.
- The junction box sealing. To monitor the junction box sealing, using new seals or a silicon sealing according to the case.
- The earthing resistivity of metals.
- The tightness and condition of the module connection cable terminals.

9 ANNEX : Mechanical and Electrical Ratings

9.1 Mechanical ratings

Module type	Dimensions			Weight (Kg)
	Lenght (mm)	Width (mm)	Thickness (mm)	
36 Cells 6"	1482 ± 2	676 ± 2	35± 0,02	11,1 ± 0,5
60 Cells 6"	1640 ± 2	992 ± 2	35± 0,02	17,75 ± 0,5
72 Cells 6"	1956 ± 2	992 ± 2	40± 0,02	20,9 ± 0,5
72 Cells 6" BC	1979 ± 2	1002 ± 2	40± 0,02	22,5 ± 0,5

The modules are qualified for application class A: Hazardous voltage (IEC 61730: higher than 50V DC; EN 61730: higher than 120V), hazardous power applications (higher than 240W) where general contact access is anticipated (Modules qualified for safety through EN IEC 61730-1 and EN IEC 61730-2 within this application class are considered to meet the requirements for Safety Class II).

During the stabilization process that occurs during the first few months of deployment, module power may decrease by up to 3% from typical Pmax.

All electrical data under STC (see datasheet of the modules)

Electrical characteristics tested at Standard Test Conditions (STC), defined as: Irradiance of 1000 w/m², spectrum AM 1.5 and temperature of 25 °C.

Tolerance measures STC: ±3% (Pmp); ±10% (Isc, Voc, Imp, Vmp).

9.2 Electrical Ratings

9.2.1 Poly-cristalline Modules

→ PV Module 36 Cells 6”:

ELECTRICAL CHARACTERISTICS	A-150P GS	A-155P GS	A-160P GS	A-165P GS I
Maximum Power (Pmax)	150 W	155 W	160 W	165 W
Maximum Power Voltage (Vmp)	18,3 V	18,6 V	18,85 V	19 V
Maximum Power Current (Imp)	8,2 A	8,35 A	8,5 A	8,7 A
Open Current Voltage (Voc)	22,7 V	22,85 V	23 V	23,15 V
Short Circuit Current (Isc)	8,75 A	8,9 A	9,05 A	9,2 A
Module Efficiency (%)	14,97	15,47	15,97	16,47

→ PV Module 60 Cells 6”:

ELECTRICAL CHARACTERISTICS	A-270P GS	A-275P GS	A-280P GS	A-285P GS
Maximum Power (Pmax)	270 W	275 W	280 W	285 W
Maximum Power Voltage (Vmp)	31,8 V	32 V	32,2 V	32,4 V
Maximum Power Current (Imp)	8,5 A	8,6 A	8,7 A	8,8 A
Open Current Voltage (Voc)	37,4 V	37,6 V	37,8 V	38 V
Short Circuit Current (Isc)	9,14 A	9,25 A	9,36 A	9,47 A
Module Efficiency (%)	16,6	16,9	17,21	17,52

→ PV Modules 72 Cells 6”:

ELECTRICAL CHARACTERISTICS	A-325P GS	A-330P GS	A-335P GS	A-340P GS
Maximum Power (Pmax)	325 W	330 W	335 W	340 W
Maximum Power Voltage (Vmp)	37,8 V	37,95 V	38,2 V	38,5 V
Maximum Power Current (Imp)	8,6 A	8,7 A	8,77 A	8,84 A
Open Current Voltage (Voc)	45,45 V	45,55 V	46,1 V	46,4 V
Short Circuit Current (Isc)	9,2 A	9,3 A	9,38 A	9,45 A
Module Efficiency (%)	16,75	17,01	17,26	17,5

***Notes:**

- Nominal Operating Cell Temp (NOCT).....45±2°C
- Temperature Cycling Range.....-40 °C to +85 °C
- Maximum series fuse15 A.

9.2.2 Mono-crystalline Modules
→ PV Modules 60 Cells 6”:

ELECTRICAL CHARACTERISTICS	A-295M GS	A-300M GS	A-305M GS	A-310M GS
Maximum Power (Pmax)	295 W	300 W	305 W	310 W
Maximum Power Voltage (Vmp)	32,80 V	33,00 V	33,25 V	33,50 V
Maximum Power Current (Imp)	9,00 A	9,10 A	9,18 A	9,25 A
Open Current Voltage (Voc)	38,50 V	38,70 V	38,95 V	39,20 V
Short Circuit Current (Isc)	9,70 A	9,80 A	9,87 A	9,95 A
Module Efficiency (%)	18,13	18,44	18,74	19,05

→ PV Modules 72 Cells 6”:

ELECTRICAL CHARACTERISTICS	A-360M GS	A-365M GS	A-370M GS	A-375M GS
Maximum Power (Pmax)	360 W	365 W	370 W	375 W
Maximum Power Voltage (Vmp)	39,60 V	39,85 V	40,10 V	40,50 V
Maximum Power Current (Imp)	9,10 A	9,16 A	9,23 A	9,27 A
Open Current Voltage (Voc)	47,70 V	47,95 V	48,20 V	48,45 V
Short Circuit Current (Isc)	9,80 A	9,85 A	9,90 A	9,95 A
Module Efficiency (%)	18,55	18,81	19,07	19,33

→ PV Modules 72 Cells 6” BC:

ELECTRICAL CHARACTERISTICS	A-385M GS	A-390M GS	A-395M GS	A-400M GS
Maximum Power (Pmax)	385 W	390 W	395 W	400 W
Maximum Power Voltage (Vmp)	40,80 V	41,10 V	41,40 V	41,70 V
Maximum Power Current (Imp)	9,44 A	9,49 A	9,55 A	9,60 A
Open Current Voltage (Voc)	49,10 V	49,30 V	49,50 V	49,80 V
Short Circuit Current (Isc)	9,92 A	10,12 A	10,23 A	10,36 A
Module Efficiency (%)	19,42	19,67	19,92	20,17

***Notes:**

- Nominal Operating Cell Temp (NOCT).....45±2°C
- Temperature Cycling Range.....-40 °C to +85 °C
- Maximum series fuse15 A.