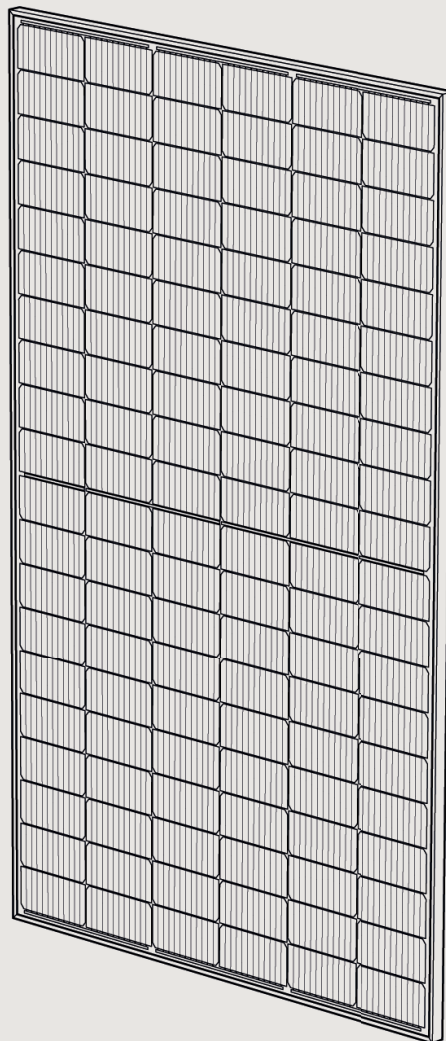


Solar PV Modules

Installation and
Operation Manual



This manual is an integral part of the unit. Please read the manual carefully before installation, operation or maintenance. Keep this manual for future reference.

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This manual contains important information for use during installation and maintenance of Autarco Solar PV Modules. Please read all instructions, both electrical and mechanical, carefully before installation.

To reduce the risk of electrical shock, and to ensure the safe installation and operation of the Autarco Solar PV Modules the following safety symbols will appear throughout this document to indicate dangerous conditions and important safety instructions.



WARNING! Indicates safety instruction, which if not correctly followed, can result in injury or property damages.



RISK OF ELECTRIC SHOCK! Indicates safety instructions, which if not correctly followed, could result in electric shock.

1.1

Purpose

This document provides detailed instructions and safety precautions regarding the installation, electrical connection, and maintenance of Autarco' Solar PV modules.

This manual is for authorized solar installers using Autarco Solar PV Modules. Before any further action, operators must read all safety regulations and be aware of the potential danger in operating high-voltage devices. Operators must also have a complete understanding of this device's features and functions. All safety precautions mentioned in this manual shall be strictly observed during installation, and the manual should be kept for future reference.

The main purpose of this user manual is to provide instructions and detailed procedures for installing, operating, maintaining, and troubleshooting the following series Autarco solar PV modules:

| Modules series | Module type | No. of cells | Wafer size | Module dimensions (mm) |
|----------------|----------------------|--------------|------------|------------------------|
| I series | MHI | 60 | 166 (M6) | 1762 x 1039 |
| H series | MHH | 72 | 166 (M6) | 2094 x 1038 |
| J series | MHJ / TBJ / TGJ / TJ | 54 | 182 (M10) | 1722 x 1134 |
| L series | MHL / TBL / TGL / TL | 60 | 182 (M10) | 1903 x 1134 |
| M series | MHM | 66 | 182 (M10) | 2073 x 1134 |
| N series | MHN / MGN / TBN / TN | 72 | 182 (M10) | 2278 x 1134 |
| Q series | MGQ / TNQ | 78 | 182 (M10) | 2465 x 1134 |
| O series | MHO / TO | 78 | 210 (M12) | 2172 x 1303 |

The product code will be S1.XXX450(B), where:

- S1 = Autarco Solar PV Module
- XXX = Module series
- 450 = Power class / Wp output
- B = Full black

Please keep this user manual available at all times during installation, or in case of emergency.

2.1 Safety instructions

Solar modules generate electricity as soon as they are exposed to light. The voltage of a single module is less than 50VDC. When several modules are connected in series, the combined voltage can be dangerously high. When the modules are connected in parallel the currents are summed together.

Although touch protection is provided in the form of the fully insulated plug contacts, the following points must be observed when handling solar modules to avoid the risk of fire, arcing and fatal electric shock:



NOTICE! The installation of solar PV voltage should be done by qualified professionals.



DANGER! Do not insert electrically conducting parts into the plugs or sockets.



DANGER! Do not wear metallic jewelry while performing mechanical or electrical installation.



DANGER! Do not fit solar modules and wiring with wet plugs and sockets. Tools and working conditions must be dry.



ATTENTION! Exercise extreme caution when carrying out work on wiring and use appropriate safety equipment (insulated tools, insulated gloves, etc.).



ATTENTION! Do not use damaged modules, dismantle modules or remove any part or label fitted by the manufacturer.



ATTENTION! Do not treat the rear of the laminate with paint or adhesives or mark it using sharp objects.

2.2 Unpacking the modules and storage

The utmost care is required when handling the modules. Take care when unpacking, transporting, and storing them.

- Leave modules in packaging until they are to be installed.
- Carry modules with both hands.
- Do not use the connection socket as a handle.
- Do not place the modules on hard or rough ground.
- Do not put the modules on their corners.
- Ensure modules do not bend.
- Do not subject modules to a load over 5400 N.
- Do not stand, and do not drop the modules.
- Do not mark or work on them with sharp objects.
- Keep all electrical contacts clean and dry.
- If it is necessary to store the modules temporarily, a dry, ventilated room should be used.

Ensure that the module is used for its intended purpose only. Pay attention to the local ordinances, building standards and accident prevention regulations during installation. The safety information for other system components must also be followed.



ATTENTION! Do not carry out installation work when there are strong winds. Secure yourself and other workers to avoid falling. Secure work materials to prevent articles from falling. Create a work zone to avoid accidents.



WARNING! The following paragraphs are very important. Failure to comply with these instructions can lead to system underperformance and will void the Autarco kWh guarantee.

3.1 Keeping within the maximum permitted load

Make sure the support structure adheres to maximum permissible load requirements as prescribed by local ordinances, particularly in regions of high snow accumulations and high wind velocities. Take notice of possible bending of the modules under high loads. If possible, avoid installing fasteners, cable ties, etc. between the module backside and support structure (i.e. on mounting rails) as any sharp edges can damage the module.

3.2 Grounding

The company installing the PV module frame is also responsible for proper grounding. If the building is already equipped with an exterior lightning protection system, the PV-installation must be integrated in this protection system against direct effects of lightning. Country specific standards must be adhered to. A grounding method authorized by UL is mandatory in the US and Canada.

3.3 Fire safety

The roof construction and installation may affect the fire safety of a building; improper installation may contribute to hazards in the event of a fire. For roof application, the modules should be mounted over a fire-resistant covering rated for the application. The module is not Ex-proof that is, “non-explosion-protected equipment”. Hence it must not be installed in the proximity of highly flammable gasses and vapors (e.g. filling stations, gas containers, paint spraying equipment & other explosive environments). The module must not be installed near open flames or flammable materials.

3.4 Suitable environmental conditions

The roof construction and installation may affect the fire safety of a building; improper installation may contribute to hazards in the event of a fire. For roof application, the modules should be mounted over a fire-resistant covering rated for the application. The module is not Ex-proof that is, “non-explosion-protected equipment”. Hence it must not be installed in the proximity of highly flammable gasses and vapors (e.g. filling stations, gas containers,

paint spraying equipment & other explosive environments). The module must not be installed near open flames or flammable materials.

Solar panels

3.5 Suitable installation

Make sure the module meets the technical requirements of the system as a whole. Ensure that other system components do not exert damaging mechanical or electrical influences on the modules. When connected in series, all modules must have the same amperage. When connected in parallel, all modules must have the same voltage. The modules must not be connected to create a voltage higher than the permitted system voltage. Modules must not be fitted as overhead glazing or vertical glazing (façade). Ensure that the mounting system can also withstand the anticipated wind and snow loads. There are openings at the base of the module frame to allow water from precipitation to drain. Ensure that these openings are not blocked nor partially blocked by the module installation method. Ventilation of the module backside is necessary to avoid the build-up of heat that can reduce performance.

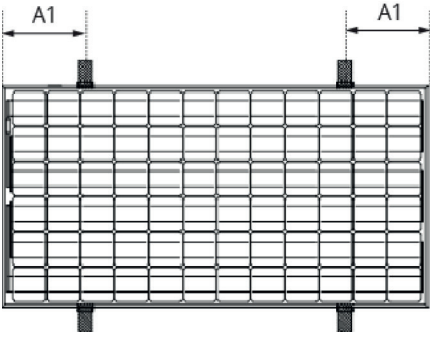
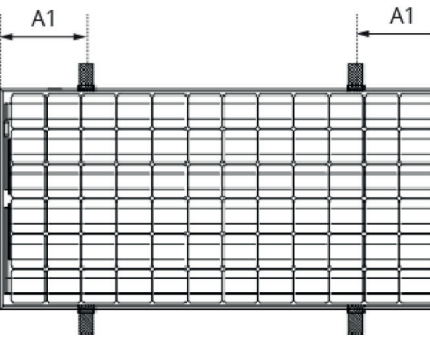
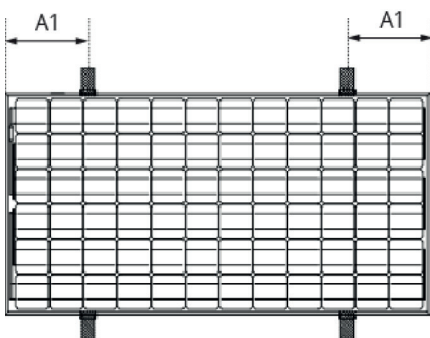
3.6 Optimal orientation and tilt

To obtain maximum yield from the system, we recommend that you determine the best direction and tilt angle for the modules. Conditions for generating electricity are considered ideal when the sun's rays strike the module perpendicular to its surface. To avoid performance drops in series circuits, ensure that all modules have the same orientation and tilt. Failing to do so will void the Autarco AC power output guarantee.

4.1 Clamping on the frame

Each module must be securely fastened at a minimum of four (4) points on two (2) opposite sides. The following clamping positions should be adhered to:

Clamping on long sides (Autarco Apex & Flow Mounting Systems)

| | | | | | | | | | | | | | | | | | |
|---|--|----------------|--------------|-----|--------------|-----|--------------|----------------------|--------------|-----|--------------|-----------|--------------|----------|--------------|----------|--------------|
|  | <p>Clamp positions when clamping on the long sides with load 5400 Pa (front)</p> <table border="0"> <tbody> <tr> <td>MHJ / TBJ / TJ</td> <td>266 – 466 mm</td> </tr> <tr> <td>MHI</td> <td>350 – 450 mm</td> </tr> <tr> <td>MHH</td> <td>350 – 450 mm</td> </tr> <tr> <td>MHL / TBL / TGL / TL</td> <td>320 – 520 mm</td> </tr> <tr> <td>MHM</td> <td>450 – 550 mm</td> </tr> <tr> <td>MHN / MGN</td> <td>430 – 530 mm</td> </tr> <tr> <td>TBN / TN</td> <td>430 – 530 mm</td> </tr> <tr> <td>MHO / TO</td> <td>375 – 425 mm</td> </tr> </tbody> </table> | MHJ / TBJ / TJ | 266 – 466 mm | MHI | 350 – 450 mm | MHH | 350 – 450 mm | MHL / TBL / TGL / TL | 320 – 520 mm | MHM | 450 – 550 mm | MHN / MGN | 430 – 530 mm | TBN / TN | 430 – 530 mm | MHO / TO | 375 – 425 mm |
| MHJ / TBJ / TJ | 266 – 466 mm | | | | | | | | | | | | | | | | |
| MHI | 350 – 450 mm | | | | | | | | | | | | | | | | |
| MHH | 350 – 450 mm | | | | | | | | | | | | | | | | |
| MHL / TBL / TGL / TL | 320 – 520 mm | | | | | | | | | | | | | | | | |
| MHM | 450 – 550 mm | | | | | | | | | | | | | | | | |
| MHN / MGN | 430 – 530 mm | | | | | | | | | | | | | | | | |
| TBN / TN | 430 – 530 mm | | | | | | | | | | | | | | | | |
| MHO / TO | 375 – 425 mm | | | | | | | | | | | | | | | | |
|  | <p>Clamp positions when clamping on the long sides with load 2400 Pa (front)</p> <table border="0"> <tbody> <tr> <td>MHJ / TBJ / TJ</td> <td>266 – 466 mm</td> </tr> <tr> <td>MHI</td> <td>350 – 450 mm</td> </tr> <tr> <td>MHH</td> <td>350 – 450 mm</td> </tr> <tr> <td>MHL / TBL / TGL / TL</td> <td>320 – 520 mm</td> </tr> <tr> <td>MHM</td> <td>450 – 550 mm</td> </tr> <tr> <td>MHN / MGN</td> <td>430 – 530 mm</td> </tr> <tr> <td>TBN / TN</td> <td>430 – 530 mm</td> </tr> <tr> <td>MHO / TO</td> <td>375 – 425 mm</td> </tr> </tbody> </table> | MHJ / TBJ / TJ | 266 – 466 mm | MHI | 350 – 450 mm | MHH | 350 – 450 mm | MHL / TBL / TGL / TL | 320 – 520 mm | MHM | 450 – 550 mm | MHN / MGN | 430 – 530 mm | TBN / TN | 430 – 530 mm | MHO / TO | 375 – 425 mm |
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| MHN / MGN | 430 – 530 mm | | | | | | | | | | | | | | | | |
| TBN / TN | 430 – 530 mm | | | | | | | | | | | | | | | | |
| MHO / TO | 375 – 425 mm | | | | | | | | | | | | | | | | |
|  | <p>Clamp positions when clamping on the long sides with load 1800 Pa (front)</p> <table border="0"> <tbody> <tr> <td>MHJ / TBJ / TJ</td> <td>150 – 250 mm</td> </tr> <tr> <td>MHI</td> <td>0 – 450 mm</td> </tr> <tr> <td>MHH</td> <td>0 – 450 mm</td> </tr> <tr> <td>MHL / TBL / TGL / TL</td> <td>150 – 250 mm</td> </tr> <tr> <td>MHM</td> <td>0 – 400 mm</td> </tr> <tr> <td>MHN / MGN</td> <td>0 – 400 mm</td> </tr> <tr> <td>TBN / TN</td> <td>0 – 400 mm</td> </tr> <tr> <td>MHO / TO</td> <td>0 – 400 mm</td> </tr> </tbody> </table> | MHJ / TBJ / TJ | 150 – 250 mm | MHI | 0 – 450 mm | MHH | 0 – 450 mm | MHL / TBL / TGL / TL | 150 – 250 mm | MHM | 0 – 400 mm | MHN / MGN | 0 – 400 mm | TBN / TN | 0 – 400 mm | MHO / TO | 0 – 400 mm |
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| MHL / TBL / TGL / TL | 150 – 250 mm | | | | | | | | | | | | | | | | |
| MHM | 0 – 400 mm | | | | | | | | | | | | | | | | |
| MHN / MGN | 0 – 400 mm | | | | | | | | | | | | | | | | |
| TBN / TN | 0 – 400 mm | | | | | | | | | | | | | | | | |
| MHO / TO | 0 – 400 mm | | | | | | | | | | | | | | | | |

Clamping on long sides (Autarco Matrix Mounting Systems)

Solar panels

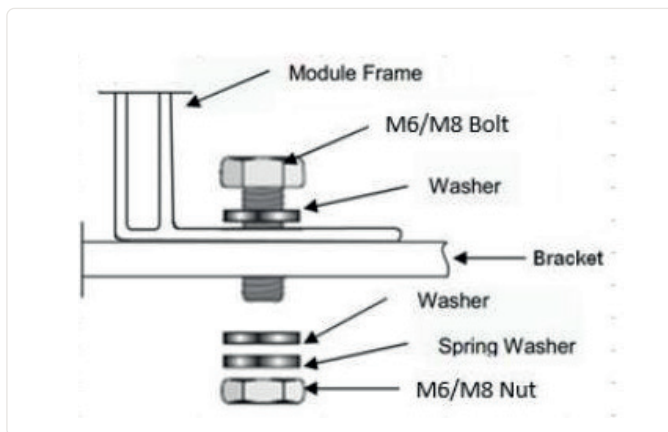


ATTENTION! Clamping on short side position is not possible with loads of 5400 or 2400 Pa.

| | | | | | | | |
|----------------------|---|----------------|--------------|-----|--------------|----------------------|--------------|
| | <p>Clamp positions in mm when rails overlapping the short sides with load 1800 Pa (front)</p> <table border="0"> <tr> <td>MHJ / TBJ / TJ</td> <td>150 – 250 mm</td> </tr> <tr> <td>MHI</td> <td>150 – 250 mm</td> </tr> <tr> <td>MHL / TBL / TGL / TL</td> <td>150 – 250 mm</td> </tr> </table> | MHJ / TBJ / TJ | 150 – 250 mm | MHI | 150 – 250 mm | MHL / TBL / TGL / TL | 150 – 250 mm |
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| MHI | 150 – 250 mm | | | | | | |
| MHL / TBL / TGL / TL | 150 – 250 mm | | | | | | |
| | <p>Clamp positions in mm when rails overlapping the short sides with load 1600 Pa (front)</p> <table border="0"> <tr> <td>MHJ / TBJ / TJ</td> <td>150 – 250 mm</td> </tr> <tr> <td>MHI</td> <td>150 – 250 mm</td> </tr> <tr> <td>MHL / TBL / TGL / TL</td> <td>150 – 250 mm</td> </tr> </table> | MHJ / TBJ / TJ | 150 – 250 mm | MHI | 150 – 250 mm | MHL / TBL / TGL / TL | 150 – 250 mm |
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| MHJ | 0 – 250 mm | | | | | | |

4.2 Bolting through mounting holes

PV modules can be mounted to a substructure by clamping at the front side of the module frame or by screwing at the back side of the frame. All modules must be securely fastened with at least 4 stainless steel bolts (M6 or M8)



- The tightening torque must be 9-12 Nm for M6 bolts and 17-23 Nm for M8 bolts. If bolts are purchased separately, recommendations from specific clamping hardware suppliers for torque values should prevail.
- Do not drill any additional holes into the module. The available mounting holes should be used.
- Secure each bolt to the frame with stainless-steel washers, one for each side of the mounting structure, and screw on either a stainless-steel spring washer or a toothed lock washer. Finally, secure with a stainless-steel nut.
- Use appropriate corrosion-proof fastening materials.



WARNING! Product warranty may be void in cases where above clamping positions, improper clamps or unsuitable installation methods are found.



WARNING! The module is provided from the factory with pre-connected cables. Under no circumstances should the junction box be opened.



ATTENTION! Check that the module wiring is correct before commissioning. All DC cables should be as short as possible.



ATTENTION! If measured open circuit voltage differs from the specifications, there is a wiring fault.



WARNING! Make sure all connections are secure and tight and made in dry conditions.



WARNING! Modules should be strung in a way that the resulting voltages and currents do not violate the max. voltage and max. current of the inverter and module which are stated on the product datasheets.

When Autarco modules are supplied as part of an integrally designed, complete Autarco Solar PV system, the supplied wiring diagram should be followed.

Use Autarco supplied solar cable and connectors only. Ensure that they are in perfect electrical and mechanical condition. Use only single wire DC cables.

5.1 Cable protection

We recommend securing the cables to the mounting system using UV-resistant cable ties. Protect exposed cables from damage using suitable precautions (e.g. laying them in plastic pipes). Avoid direct exposure to sunlight.

While modules typically have low maintenance requirements, they are not maintenance free.

6.1 Soiling

Regularly carry out a visual inspection for dirt, dust, bird dropping, leaves, and other detritus covering the modules. The frequency of cleaning is dependent on the local environment and rain levels. When the system is sold with an Autarco performance guarantee or O&M contract, our performance monitoring will indicate when cleaning is necessary.

- Use clean water and a soft cleaning tool (such as a sponge) to clean the module array during a cooler time of the day.
- Do not scratch the dust on the surface of the modules in a dry condition, otherwise it will cause
- Do not use abrasive powder, abrasive cleaners, scrubber cleaners, polishers, sodium hydroxide, benzene, nitro-thinners, acid or alkali and other chemical substances.
- Do not clean broken glass or modules with broken lines or exposed wires, as it may cause an electric shock.

6.2 Snow

If snow is present, a soft-bristled brush may be used to clean the surface of the modules. Try to clear out snow as soon as possible from over your solar panels to avoid any damage.

6.3 Electrical Inspections

It is required to perform regular inspection and maintenance of the modules, especially within warranty scope. It is the user's responsibility to report to the supplier regarding the damages found in time. Regular electrical and mechanical inspection by a licensed professional will keep the system safe and operating at maximum efficiency.

Our commitment to sustainability extends to the end of the solar module's life. Autarco is a member of the Stichting OPEN foundation. As a producer of electronic devices, we are responsible for facilitating the recycling and collection processes of our solar panels. For every solar panel we produce, we pay a fixed fee to Stichting OPEN. This fee ensures that the solar panels can be recycled after their economic lifetime.

There are three different ways our solar panels can be collected before they are recycled.

- Through a local recycling centre: You can dispose off your unwanted solar panels at a local recycling center.
- Stichting OPEN. Due to Autarco contributing to stichting OPEN you can send end of life modules to Stichting Open. You can make an appointment by calling this number: 079 760 06 85.
- Collection Points: There are local businesses who can collect electronic devices free of charge. You can find collection points in your neighborhood at <https://inleverpunten.stichting-open.org/>

What are the benefits of this centralized approach? The solar panels directly go from collection location to the recycling plant, ensuring CO2 is kept to a minimum since unnecessary transport is avoided as much as possible. The recycling plants of our solar panels are located in Belgium and Germany.

Since compliance with this guide and the conditions and methods of installation, operation, use and maintenance of the modules are not checked or monitored by Autarco; Autarco accepts no liability for damage arising through improper use or incorrect installation, operation, use or maintenance.