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MOUNTING INSTRUCTIONS FOR PHOTOVOLTAIC MODULES ECO LINE PRIME ECO LINE PRO

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1. INFORMATION ON THESE INSTRUCTIONS

1.1 SUBJECT

This manual contains information on the installation and safe handling of photovoltaic (PV) modules from Luxor Solar GmbH. In the following, these modules are referred to as "module", Luxor Solar GmbH as "Luxor Solar".

1.2 TARGET GROUP

The installation instructions do not replace the specialist knowledge required by law for the installation of photovoltaic systems. This document is intended for trained specialists. These instructions must be read and understood before installation. If you have any questions, please contact Luxor Solar for further clarification. When installing the module, the installer must observe all safety precautions in accordance with these instructions and applicable local regulations. Before installing a photovoltaic system, installers must familiarise themselves with the mechanical and electrical requirements of such a system. Keep these instructions in a safe place for future reference (care and maintenance) and in case the modules are sold or disposed of.

1.3 VALIDITY

Luxor Solar reserves the right to make changes to modules or installation instructions at any time without prior notice. The data contained in the order confirmation is authoritative. If you have any questions about the validity of the documents, please contact Luxor Solar.

1.4 WARRANTY AND USE IN ACCORDANCE WITH INSTRUCTIONS

The current Luxor Solar guarantee declaration for photovoltaic modules applies.

1.5 DISCLAIMER

Failure to observe the installation instructions may invalidate the warranty and liability. Since the use of these instructions and the circumstances or methods of installation, operation, use and maintenance of the photovoltaic product are beyond the control of Luxor Solar, Luxor Solar assumes no responsibility and expressly disclaims all liability for any loss, damage or expense arising out of or in any way connected with the installation, operation, use or maintenance. Luxor Solar accepts no responsibility for any infringement of patents or other rights of third parties resulting from the use of the PV product. No licence is granted by implication or otherwise under any patent or patent rights. The information in these instructions is based on the knowledge and experience of Luxor Solar and is presented to the best of our knowledge. This information, including product specifications (without limitation) and suggestions, constitutes neither an express nor implied warranty. Luxor Solar reserves the right to change the instructions, the PV product, the specifications or product information sheets without prior notice.

1.6 SYMBOLS USED

The following symbols are used in the instructions:

Warning of life-threatening situations
Injuries due to non-compliance

Warning of material damage
in case of non-compliance

Reference to
Useful information

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1.7 REGULATIONS

All technical rules for the planning, installation and operation of PV systems must be observed. Installers must inform themselves in advance about local regulations. The following standards and regulations are only an extract:

+ Erection of power installations with nominal voltage up to 1500 Volt
+ Decentralised energy systems in buildings
+ Load assumptions for supporting structures
+ Lightning protection
+ Safety regulations for roof work in accordance with German employers' liability insurance guidelines
+ Electrical systems and equipment
+ Regulations of the Central Association of the German Roofing Trade – Professional Association for Roof, Wall and Waterproofing Technology (registered association)
+ Regulations of the local supply network operators (VNB)
+ Regional building regulations

1.8 PRODUCT IDENTIFICATION

Each module has labels on the back with the following information:

+ Labelling plate: Contains the article number and describes the product type; rated power, rated current, rated voltage, open circuit voltage, short circuit current according to the standard test conditions and the maximum system voltage. Dimensions, weight and other technical specifications can be found in the supplied data sheets.
+ Barcode: Each individual module has a unique serial number. This is attached to several positions on the module with numbers and a barcode. One of them is also embedded in the laminate, making it permanently fixed and visible from the front of the module.

Attention!
Removal or obliteration of one or more labels is not permitted!
Failure to do so will invalidate any warranty claim!

2. SAFETY INSTRUCTIONS

2.1 HAZARD WARNINGS

Attention! Danger to life!
Warning of life-threatening injuries due to the risk of electric shock if precautions are not taken!

Installation may only be carried out by specialised personnel.

+ Keep children away from the system when transporting and installing the mechanical and electrical components.
+ Installers are liable for all risk of accident and injury during installation, including but not limited to injury from electric shock.
+ Observe the safety instructions for working with direct current.
+ A single module can generate direct current voltages of more than 30 volts when exposed to light. When the modules are connected in series, the total voltage corresponds to the sum of the individual module voltages. If the modules are connected in parallel, the total current corresponds to the sum of the currents of the individual modules. Even contact with a direct current voltage of 30 volts or higher is potentially dangerous.
+ Never disconnect the module under load! Before carrying out any work on the PV system, disconnect the inverter on both the DC and AC sides.
+ Cover the module completely with an opaque material during installation to prevent the generation of electricity.
+ Only use insulated tools that are approved for work on electrical systems. Do not insert any electrically conductive parts into the module connections.
+ Do not carry out work on the PV system in wet weather or strong winds.
+ Use fall protection on the roof in accordance with regulations.

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+ Ensure that all manufacturer specifications for all components on the solar module and all other components used in the system are observed during transport, installation and maintenance.

2.2 FIRE HAZARD

Disregarding the installation instructions can lead to a fire hazard. When installing the modules, comply with the applicable fire protection regulations in your region. The modules must not be installed in the vicinity of flammable gases.

Do not use damaged modules, as these can pose an increased risk of fire.

+ The fire protection class of Luxor Solar's standard modules is rated as fire class C in accordance with IEC 61730-2.
+ The roof for the installation of the modules must have a suitable fire protection class. In Europe, fire class A1, A2, s1, d0 is recommended for the roof in accordance with the fire protection regulations. DIN EN 13501-1.

3. MECHANICAL INSTALLATION

3.1 STORAGE AND HANDLING OF SOLAR MODULES

Attention! Risk of material damage!
Handle the modules with great care when unpacking, transporting and installing them. Avoid twisting or torsion. Do not use the cable or junction box as a handle.

Attention! Risk of material damage!
Do not step on the modules!
During the installation, maintenance access must be planned for.

+ It is recommended that the solar modules are only removed from the packaging at the time of installation.
+ Do not step on the modules!
+ Solar panels can be held from both sides. However, care must be taken not to scratch the surfaces of the panels. Particular care must be taken with solar modules that have a backsheet – the backsheet must not be damaged.
+ Modules should not be stacked during installation work!
+ Opened transport packaging is no longer safe for transport and must not be transported without further measures.
+ Protect the modules from rain and ensure they are not placed down on wet surfaces.
+ Unused modules must be relocated to prevent damage from tipping over. For framed modules, it is recommended to lay the modules flat, glass side up, on a honeycomb cardboard with a thickness of 5 cm. A maximum of 15 modules may be stacked on top with the glass side facing downwards. A layer of cardboard must be placed between each module to protect it from damage.

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3.2 SHADING

Attention! Risk of material damage!
Shading, even temporary shading, especially partial shading, must be avoided.

Shading where only a few per cent of a cell or a substrate is shaded poses a risk of damage to the modules and should be avoided. These shadows are caused by lightning rods, masts or overhead lines, for example, but can also be caused by heavy soiling on the module surface. Slowly moving shadows caused by dormers or chimneys, for example, can also damage the modules in the long term. If the shading is too minimal, the bypass diodes – which are intended to protect the module from damage – will not activate. These areas can become very hot and form hotspots, which can damage the modules. This damage is not covered by the warranty.

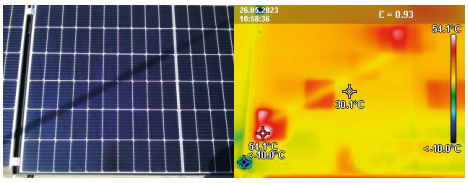

Fig. 1
Shading and hotspots caused by lightning rod 1

Fig. 2
Shading and hotspots caused by lightning rod 2

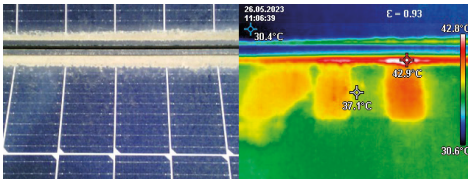

Fig. 3
Shading and hotspots due to soiling 1

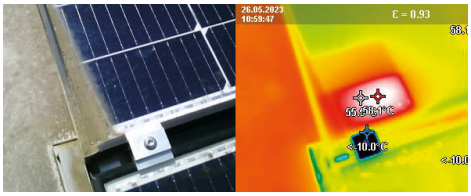

Fig. 4
Shading and hotspots due to soiling 2

3.3 SELECTION OF THE LOCATION

+ Select a suitable location for installing the modules. Modules must be installed on the ground or on roofs using suitable substructures.
+ When installed as a façade or roofing, local building regulations must be observed.
+ Detailed information on the best angle of inclination for installation can be found in the specialist literature.
+ It is advisable to draw up a plan showing the positions of the individual serial numbers of the installed modules.
+ The bifacial yield depends on the albedo, the surface beneath the modules and the installation height.
+ When installing the solar modules in a location with an expected high salt content in the ambient air, it is advisable to take suitable precautions on site to prevent corrosion of the plug connections and other relevant electronic components (e.g. airtight and watertight sealing of the plug connections). Without appropriate precautions, the warranty of the solar modules may not be able to be utilised.
+ The modules have been tested in accordance with the IEC61701 standard. To maximise the service life of the modules, they should not be installed in the immediate vicinity of salt water, as the corrosive effect of the salty air can affect the modules.
+ Suitable modules are required for use on roads where exposure to salt spray is to be expected.
+ Modules may only be installed on building-independent solar systems in publicly inaccessible areas with a height of up to 3 metres.
+ All glass fronts of the Luxor solar modules are equipped with an anti-reflective coating as standard. However, glare cannot be completely ruled out. If a glare effect is critical, it is recommended to have an impairment checked in accordance with the applicable immission control laws.
+ Modules should be secured against unauthorised access. This applies especially to children and animals.
+ To achieve the maximum hail resistance rating for a hailstone diameter of 45 mm, the modules must be installed in accordance with S.11 (a/4 or a/4.4 ± 75 mm).

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Attention!
Danger of inadequate fastening!
For outdoor installation on flat roofs, an edge distance must be maintained.

Free-standing installation
In the case of outdoor installation, especially outdoor installation close to the ground, it must be ensured that the lower module area is not covered with snow for long periods in areas with heavy snowfall. It must also be ensured that the module is not in the shade of plants or trees or damaged by flying sand and stones in strong winds. If there are several rows of modules, mutual shading must be prevented by means of appropriate minimum distances.

When using the modules on tracker systems, the particular load caused by wind must be taken into account. A static report is recommended here. Without such an expert opinion, it may not be possible to claim under the warranty for the solar modules.

Roof-parallel mounting
In the case of roof-parallel installation, sufficient rear ventilation of the modules must be ensured (an air gap of at least 100 mm between the module and the mounting surface is recommended).

Every roof penetration required for the installation of the module must be properly sealed to prevent leaks on the roof.

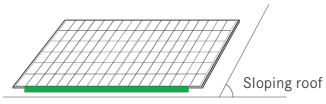
The installation of marten or pigeon defences is possible, but the module must not be technically modified. No holes may be drilled in the module frame. It is possible to attach a marten or pigeon guard by gluing or clamping. The module must not be shaded during installation.

3.4 SELECTION OF A SUITABLE MOUNTING FRAME

+ The mounting frame for the module must be made of durable, corrosion- and UV-resistant material.
+ The mounting frame must be sufficiently dimensioned for the regional snow and wind loads that occur.
+ Observe the instructions and safety precautions of the mounting frame manufacturer.
+ End clamps should be used at the end of module rows; in some cases, manufacturers of the substructure require a safety hook here.
+ The end clamps should be 8-10 cm from the end of the mounting rail.
+ If possible, the modules should be installed at an installation angle of at least 15° to support the self-cleaning effect of the modules.
+ If the modules are mounted <15°, increased maintenance is required. In cases of damage caused by heavy soiling and the resulting shading, the warranty may not be valid.

3.5 MOUNTING THE SOLAR MODULES

+ Depending on the mounting frame and module type, the modules can be attached to the mounting frame using screws or module clamps.
+ Depending on the version, the modules have ventilation and drainage openings in the module frame. Make sure that these openings are not covered during installation.
+ Keep a distance of at least five millimetres between the modules, as the modules can expand when heated.
+ The modules must be securely fastened to the mounting frame. If increased snow and wind loads occur, additional anchoring points must be used. The load calculations are carried out by the system designer or installer.



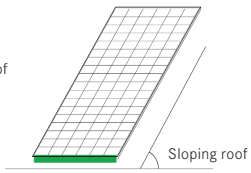


Fig. 5, 6
Clamping area to support the frame against sliding snow

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Screws

Attention! Risk of material damage!
Only use the existing mounting holes in the module frame.

Do not carry out any unauthorised modifications to the module.

The solar module must be securely fastened symmetrically at at least four points on two opposite sides. When installed horizontally at 0°, the modules can withstand a maximum downward test load of up to 6000 Pa (611,83 kg/m2), provided that the following mounting holes are used:

a. four mounting holes in the designated area along the long side (see p. 10 ff).
b. all existing mounting holes in the frame.

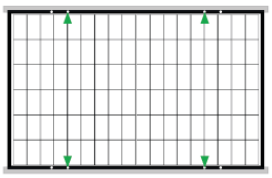

Fig. 7
Utilisation of the four holes, rails parallel to the long side of the frame

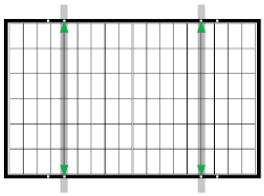

Fig. 8
Utilisation of the four holes, rails perpendicular to the long side of the frame

The tightening torque of the mounting screws must be selected according to the screw type. An exact calculation of the tightening torque must be carried out by the installer. A tightening torque of between 12 and 18 Nm is recommended. The module must rest on the mounting rails as shown in the diagram in order to bear the specified loads. Screws can be replaced by rivets as long as they do not impair the stability or functionality of the connection.

Slide-in system

Solar modules from Luxor Solar can also be used with slide-in systems. The maximum test loads depend on which side of the frame is inserted into the mounting system. The loads are analogous to Table 4, 3.6.3 (slide-in unit with long frame side) and Table 6, 3.6.5 (slide-in unit with short frame side). Ensure that the modules are centred in the holder and secured against slipping. Modules must not protrude more than L/4 of the long frame side beyond the end of the rails of the rack system.

Mounting with module clamps

Attention! Risk of material damage!
Incorrect clamping of the module can lead to serious damage. Module clamps must not touch the glass of the module. Clamps must lie flat on the frame and the frame must not be deformed by the clamps. Module clamps should not have integrated earthing pins or other unevenness.

Framed modules can be fixed to the substructure using commercially available module clamps. The clamps should rest on the frame on the top of the module. At least 500 mm² is recommended for the clamping surface of a terminal. A tightening torque of 10-14 Nm is recommended for the module clamps.
The optimum torque for the respective installation situation must be checked by a specialist.

+ Only use module clamps with integrated earthing pins if this will not cause any damage during installation.
+ The position of the clamps determines the maximum loads that a module can carry.
+ Cells must not be shaded by module clamps.
+ The way in which the modules are supported on the base frame influences the maximum compressive and tensile loads. Details can be found on page 10 ff.
+ With increased snow loads, clamping is required on the lower side of the frame to absorb the forces of the sliding snow (Fig. 5 and 6).

Modules can also be fixed from the rear as long as the fixing to the substructure prevents the frame from slipping, lifting or deforming. Clamps on the back must rest on the inside of the lip of the frame and may be a maximum of 5 mm from the inside edge. The clamping should be comparable to a screw connection.

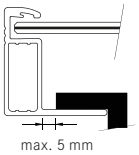

Fig. 9
Clamping the modules from the rear on the long side of the module

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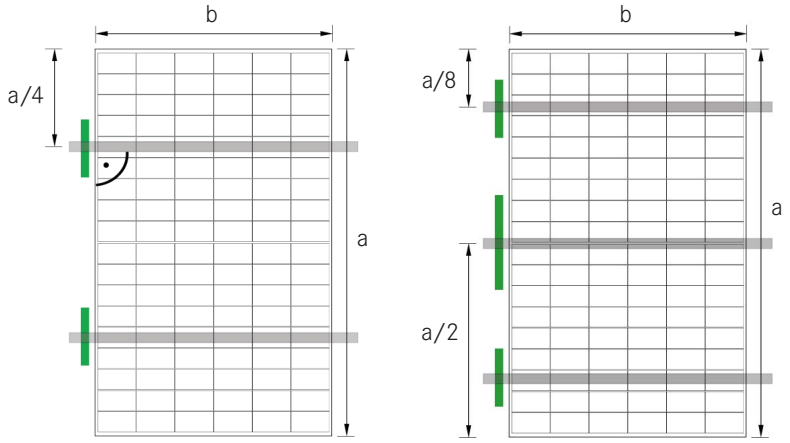
Additions to frameless modules

Attention! Risk of material damage!
Corners and edges of frameless modules are particularly sensitive to impact, despite the use of high-quality glass. Only place modules on a soft surface. Do not remove the edge protection.

Frameless modules must be clamped on the long side of the module at a distance of a/4 ± 50 mm and the center of each clamp must fall within this specified range. The modules may only be mounted on level substructures without tension.

+ When installing frameless modules, suitable laminate clamps offered by the respective manufacturer of the substructure must be used. These usually have an EPDM insert.
+ There must be no shading due to clamps or mounting screws on the module.
+ The lowest point of the module should be protected against buckling under excessive loads.
+ Frameless modules must be secured against slipping by a clamp on the lower edge of the module when mounted on edge.
+ If the frameless module is inserted into rails, these must be fitted with pressure absorption rubbers to prevent contact between the glass and the rail.
+ The laminate clamps should have a length of at least 150 mm.



Category	Test load according to IEC (compression/tension)	Test load according to IEC (compression/tension)
Clamping range x	**a/4 ± 50 mm**	**a/8 ± 50 mm and a/2 ± 100 mm**
A	1200 / 600 Pa	3000 / 1800 Pa
C	1200 / 600 Pa	3000 / 1800 Pa

Table 1

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3.6 CLAMPING AREAS OF FRAMED SOLAR MODULES

3.6.1 Categorisation of solar modules

Module type and module dimensions have an effect on the necessary clamping and maximum test loads.
For a better overview, the solar modules are categorised as follows:

Module name Glass-Glass	Category	Maximum edge length
LX-xxxM/182-64+ GG	A	1721 mm
LX-xxxM/182-108+ GG	B	1754 mm
LXxxxM/166-120+ GG	C	1800 mm
LX-xxxM/182R-96+ GG		
LX-xxxM/182R188-108+ GG		
LXxxxM/182R192-108+ GG		
LX-xxxM/182R-120+ GG	D	1980 mm
LX-xxxM/166-144+ GG	E	2279 mm
LX-xxxM/182-144+ GG		
LX-xxxM/182R192-144+ GG	F	2382 mm
LX-xxxM/182R-132+ GG		
LX-xxxM/210-132+ GG	G	2384 mm

Table 2
Categorisation of the modules

Notes

XXX = Power class of the module
All clamps must be fully secured in the marked areas so that the corresponding load value is valid.
All test loads are determined in accordance with IEC standard IEC 61215-2 and already include the safety factor of 1.5.

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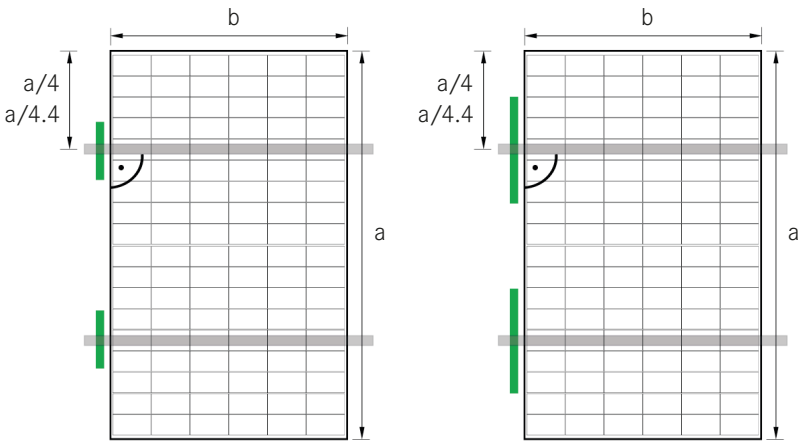
3.6.2 Clamping at 4 points, long frame side, mounting rails perpendicular to the long module side



Category		Test load according to IEC (compression/tension)		Test load according to IEC (compression/tension)	
Clamping range x	**Max. Edge length**	**a/4 ± 75 mm**	**a/4.4 ± 75 mm**	**a/4 ± 150 mm**	**a/4.4 ± 150 mm**
A	1721 mm	6000 / 4000 Pa		3600 / 1800 Pa	
B	1754 mm	6000 / 4000 Pa		3600 / 1800 Pa	
C	1800 mm	6000 / 4000 Pa		3600 / 1800 Pa	
D	1980 mm	5400 / 2400 Pa		3600 / 1800 Pa	
E	2279 mm		5400 / 2400 Pa		3600 / 1800 Pa
F	2382 mm		5400 / 2400 Pa		3600 / 1800 Pa
G	2384 mm		5400 / 2400 Pa		3600 / 1800 Pa

Table 3

+ To achieve the maximum hail resistance rating for a hailstone diameter of 45 mm, the modules must be installed in accordance with a/4 or a/4.4 ± 75 mm.

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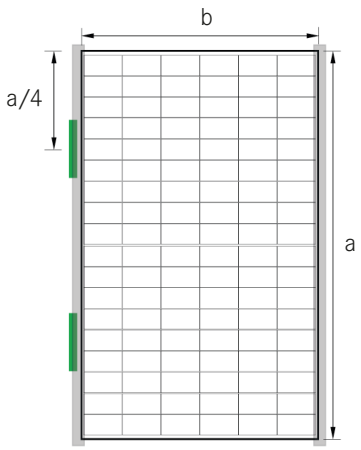
3.6.3 Clamping at 4 points, long frame side, mounting rails parallel to the long module side



Category		Test load according to IEC (compression/tension)
Clamping range x	**Max. Edge length**	**a/4 ± 50 mm**
A	1721 mm	5400 / 2400 Pa
B	1754 mm	4000 / 3200 Pa
C	1800 mm	4000 / 3200 Pa
D	1980 mm	3600 / 2400 Pa
E	2279 mm	3600 / 2400 Pa
F	2382 mm	3600 / 2400 Pa
G	2384 mm	Not permitted

Table 4

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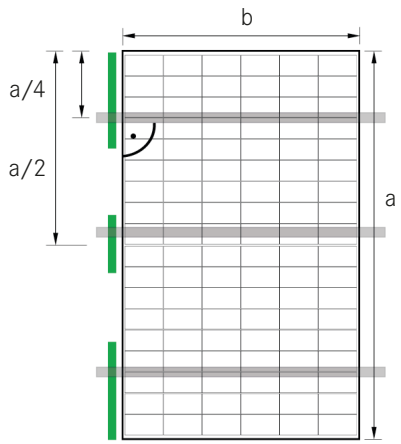
3.6.4 Clamping at 6 points, long frame side, Mounting rails perpendicular to the long module side



Category		Test load according to IEC (compression/tension)
Clamping range x	**Max. Edge length**	**0 to a/4 mm AND a/2 ± 50 mm**
A	1721 mm	5400 / 2400 Pa
B	1754 mm	5400 / 2400 Pa
C	1800 mm	3600 / 3000 Pa
D	1980 mm	2400 / 1800 Pa
E	2279 mm	2100 / 1500 Pa
F	2382 mm	1500 / 900 Pa
G	2384 mm	Not permitted

Table 5

Notes on 3.6.4

It must be ensured that the junction boxes do not touch the centre mounting rail in the event of deflection. The mounting rail must therefore not be located directly under the junction boxes.

If there is only a support point in the centre of the module without clamping, the suction load is reduced to 50 % of the specified value.

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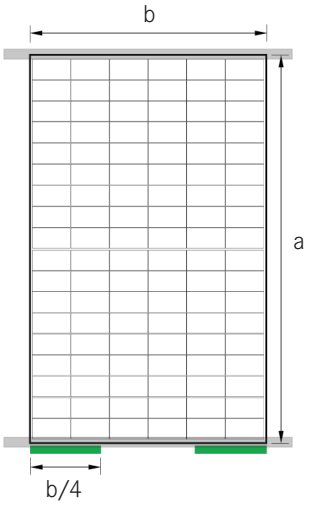
3.6.5 Clamping at 4 points, short frame side, Mounting rails perpendicular to the long module side



Category		Test load according to IEC (compression/tension)
Clamping range x	**Max. Edge length**	**0 mm to b/4**
A	1721 mm	2400 / 1600 Pa
B	1754 mm	1500 / 1200 Pa
C	1800 mm	1500 / 1200 Pa
D	1980 mm	Not permitted
E	2279 mm	Not permitted
F	2382 mm	Not permitted
G	2384 mm	Not permitted

Table 6

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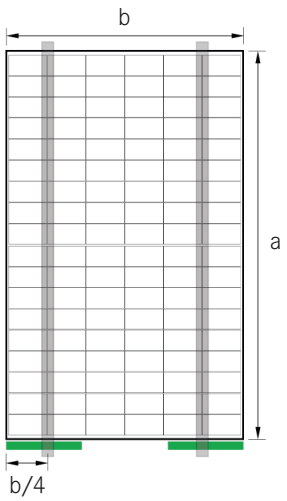
3.6.6 Clamping at 4 points, short frame side, mounting rails parallel to the long module side



Category		Test load according to IEC (compression/tension)
Clamping range x	**Max. Edge length**	**0 mm to b/4**
A	1721 mm	2400 / 1800 Pa
B	1754 mm	2400 / 1800 Pa
C	1800 mm	2400 / 1800 Pa
D	1980 mm	Not permitted
E	2279 mm	Not permitted
F	2382 mm	Not permitted
G	2384 mm	Not permitted

Table 7

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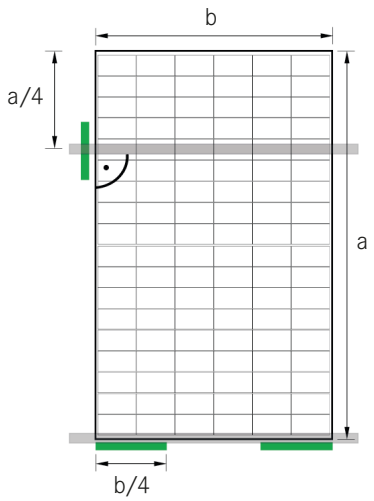
3.6.7 Clamping at 4 points, hybrid, Mounting rails perpendicular to the long module side



Category		Test load according to IEC (compression/tension)
Clamping range x	**Max. Edge length**	**a/4 ± 75 mm AND 0 mm to b/4**
A	1721 mm	2400 / 1800 Pa
B	1754 mm	2400 / 1800 Pa
C	1800 mm	2400 / 1800 Pa
D	1980 mm	Not permitted
E	2279 mm	Not permitted
F	2382 mm	Not permitted
G	2384 mm	Not permitted

Table 8

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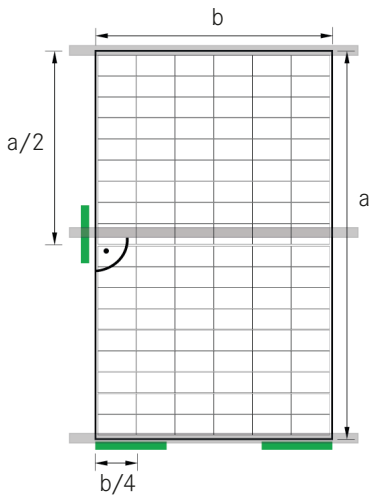
3.6.8 Clamping at 6 points, hybrid, Mounting rails perpendicular to the long module side



Category		Test load according to IEC (compression/tension)
Clamping range x	**Max. Edge length**	**a/2 ± 50 mm AND b/4 ± 50 mm**
A	1721 mm	5400 / 2400 Pa
B	1754 mm	5400 / 2400 Pa
C	1800 mm	3600 / 3000 Pa
D	1980 mm	2400 / 1800 Pa
E	2279 mm	2100 / 1500 Pa
F	2382 mm	2100 / 1500 Pa
G	2384 mm	2100 / 1500 Pa

Table 9

Notes on 3.6.8

It must be ensured that the junction boxes do not touch the centre mounting rail in the event of deflection. The mounting rail must therefore not be located directly under the junction boxes.

If x in the centre of the module is only a support point without clamping, the suction load is reduced to 50 % of the specified value.

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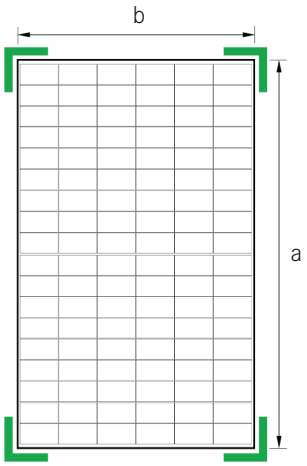
3.6.9 Clamping at 4 points, module corners, independent of the course of the mounting rails



Category		Test load according to IEC (compression/tension)
Clamping range x	**Max. Edge length**	**a = 0 mm to 10 mm AND b = 0 mm to 10 mm**
A	1721 mm	2100 / 1500 Pa
B	1754 mm	2100 / 1500 Pa
C	1800 mm	1200 / 900 Pa
D	1980 mm	Not permitted
E	2279 mm	Not permitted
F	2382 mm	Not permitted
G	2384 mm	Not permitted

Table 10

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4. ELECTRICAL INSTALLATION

4.1 SYSTEM DESIGN

The rated electrical values are determined under standard test conditions (irradiance of 1000 W/m², AM 1.5 spectra and a cell temperature of 25° C).
Under normal outdoor conditions, the current and voltage produced by the module deviate from the values listed on the data sheet.
The data sheet values are the values achieved under standard test conditions. Accordingly, the short-circuit current and open-circuit voltage values should be multiplied by a factor of 1.25 during system design in order to be able to adequately dimension the component voltage, current carrying capacity of the conductors, size of the fuses and the size of the control devices connected to the modules or to the system output.
The open-circuit voltage of the PV system must not exceed the maximum permissible input voltage of the inverter used and the maximum system voltage according to the module data sheet (1000 V or 1500 V). The maximum system voltage of other system components must also be observed.
Do not use modules with different configurations in the same system.

$$\text{Maximum number of modules (N)} = \frac{U_{max}\ \text{system}}{U_{OC}\ @\ \text{temp}_{min}}$$

The cross-sectional area of the cable and the connection capacity must correspond to the maximum short-circuit current of the system, otherwise the cable and the connection will overheat at high currents.
The modules fulfil the requirements of application class A (IEC 61730), protection class II.
The direct current generated by photovoltaic systems can be converted into alternating current and fed into the supply grid. As the supply network operators (DSOs) have different feed-in conditions for the connection of renewable energy systems from location to location, contact should be made with the responsible DSO in good time. As a rule, licences are required for the installation of such a system (application for grid connection). Connection to the supply network may only be carried out by a licenced electrician.

The detailed module data can be found in the valid module data sheet.
The rated electrical data of the modules can also be found on the module type plate.

4.2 EARTHING

Attention! Risk of material damage!
The local regulations and provisions for earthing must be observed.

Attention! Risk of material damage!
Bolts, screws or other earthing connections must not be used to attach the module to the mounting frame.

The modules are tested to protection class II in accordance with IEC 61730, so earthing is not mandatory but is recommended. If available, use the earthing holes on the rear of the modules to fasten the potential equalisation in the module frame. Earthing with so-called earthing clips on the back of the frame is also possible.

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4.3 WIRING

Attention! Danger of electric shock!
Observe the safety instructions for working with direct current!

Attention!
Risk of electric shock and burns!
Do not disconnect the module connectors under load! Otherwise, sustained electric arcs may occur.

Attention! Risk of material damage!
The tensile torque on the cable and connector system must not exceed 50 N (5 kg) at any time. In general, tension on the cable and connector system must be avoided at all costs.

In general, please ensure that only plugs of the same type are connected to each other during installation or when replacing modules. If this necessitates swapping plugs to connect the same types together, it requires professional installation (crimping). Please note that this does not affect any warranty that may still exist, except for the crimping.

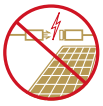
Only use special, UV-resistant solar cables and suitable plugs. Make sure that the cables are laid in such a way that they cannot rub against sharp-edged objects or roof tiles. Cables must be unrolled before commissioning. Plugs must not lie in the water and must be fixed in such a way that they do not hang freely. UV-resistant cable ties, for example, are suitable for fastening. Some mounting systems also have special cable fixings and guides.

Packaging material must be opened and removed using a suitable tool (e.g. open cable ties using cable tie cutting pliers on the cable).
Damage to the product, e.g. the cable or the crimping etc., must be ruled out.

Do not bend the cables sharply and observe the minimum bending radius (at least 8 times the cable's outer diameter, with a minimum distance of 5 cm from the junction box). Ensure that the cables are not installed under tension. Replace damaged cables. If possible, ensure short cable lengths to minimise intrinsic losses. Check the open-circuit voltage and the short-circuit current for each installed string (see also section 4.4).

Attention! Risk of material damage!
Use a rounded tool to cut through the cable ties.

Attention! Risk of material damage!
DO NOT pull on the connector!



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4.4 TEST

Test all electrical and electronic components of the system before use. Follow the instructions in the manuals provided with the components and equipment. Test the open-circuit voltage and the short-circuit current before connecting the system.

Open circuit voltage

Check the open-circuit voltage of each string with a digital multimeter. The measured values should correspond to the sum of the open-circuit voltage for the individual modules. You will find the nominal voltage in the data sheet of the module used*. If the measured value is significantly lower than the expected value, continue as described in the section "Troubleshooting low voltage".

Short-circuit current

Test the short-circuit current of each series circuit. This can be measured directly with a digital multimeter connected to two terminal plates of the series circuit or module or with any load, such as PV lighting, to make an approximate measurement. Ensure that the rated scale of the ammeter or the rated current of the load is at least 1.25 times the rated short-circuit current of the series module. You will find the rated current in the data sheet of the module used. The measured value can vary greatly depending on the weather, time of day and possible shading.

* The electrical values of the supplied individual measurements assigned to the respective serial number are decisive.

5. TROUBLESHOOTING AND MAINTENANCE

5.1 DIODES

Attention! Danger of electric shock!
Observe the safety instructions for working with direct current!

Attention! Risk of electric shock and combustion!
Never disconnect the module under load!
Before working on the PV system, disconnect the inverter on the DC and AC sides. Cover the module completely with an opaque material during installation to avoid the generation of electricity.

In systems with more than two modules connected in series, high reverse current can flow through shaded solar cells if only part of the module is affected by shading while the other part is exposed to solar radiation. This current flow can cause the affected cells to become very hot and damage the module. Bypass diodes are used in the module to protect the module from such a high reverse current. All modules have bypass diodes integrated in the junction boxes.

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5.2 TROUBLESHOOTING FOR LOW VOLTAGE

Attention! Danger of electric shock!
The earthing of the modules must not be interrupted or destroyed by maintenance and repair work.

Attention! Risk of material damage!
Partial shading of the module due to soiling or vegetation in front of the modules must be removed.

Attention! Risk of material damage!
Do not step on the modules under any circumstances.
Avoid scratches and damage to the glass surface.
Do not use any aggressive, abrasive or harsh cleaning agents.

First, identify whether it is a case of normal or excessive low voltage. The usual low voltage is a drop in the open-circuit voltage in the module caused by a rise in temperature of the solar cells or lower irradiance.
Excessive low voltage is usually caused by faulty connections at the terminals or a lack of voltage in some solar cells.
1. First test all cable connections to ensure that there is no open circuit or faulty connection.
2. Test the open-circuit voltage of each module.
3. Cover the modules completely with an opaque material.
4. Disconnect the connection at both module connections.
5. Remove the opaque material from the test module and measure the open-circuit voltage at the connections.
6. If the measured voltage is only 2/3 or 1/3 of the nominal value (depending on the number of substrings and bypass diodes), you can assume a conductive bypass diode. Further information can be found in the section "Block diodes and bypass diodes".
7. If the irradiance is not very low and the voltage between the connection terminals deviates by more than 5 %, this indicates a faulty connection.

5.3 MAINTENANCE

The modules should always be cleaned by hand, as the pressure cannot be properly adjusted to the corresponding soiling by machine. Particular care must be taken with the module edges at the transition between the frame and glass. Lichens or other vegetation may accumulate more heavily in these areas. Early removal is necessary as the plants can develop fine roots right into the waterproofing. Only clean modules when they are cold, preferably in the late evening or in the morning. Sudden cooling of energised, warmed-up modules with cold cleaning water must be strictly avoided. The resulting thermal stresses can destroy the glass and cells. Luxor Solar recommends the following maintenance for optimum module performance:

+ Clean the glass surface of the module as required. Always use water and a soft sponge or cloth for cleaning. A mild, non-abrasive cleaning solution can be used to remove stubborn dirt.
+ Check the electrical and mechanical connections every six months to ensure that they are clean, safe and undamaged.
+ If a problem occurs, consult a specialist. Important: Follow all maintenance instructions for all system components, including racks, charge controllers, inverters, batteries, etc.

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5.4 TAKE-BACK AND DISPOSAL

Sustainability is a high priority for Luxor Solar. Luxor Solar GmbH is therefore registered as a manufacturer with the Stiftung Elektro-Altgeräte Register (ear) under the number DE 27826757.
As part of EU Directive 2012/19/EU WEEE (Waste Electrical and Electronic Equipment), the recycling and disposal of solar modules has been regulated by the authorities. The directive stipulates that the modules are accepted by the local recycling centre and fed into the recycling process. Prior registration is only necessary for larger quantities of solar modules.

If you have any questions despite the precise legal regulations, you can contact Luxor Solar at any time.

5.5 PACKAGING

From 1 July 2022, registrationin the LUCID packaging register will be mandatory for all packaging in Germany. Luxor Solar is listed in the register under registration number DE2186838953861.

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[1] Detailed warranty conditions at: www.luxor.solar/downloads.html