

Installation Instructions
alfasolar Solarmodules

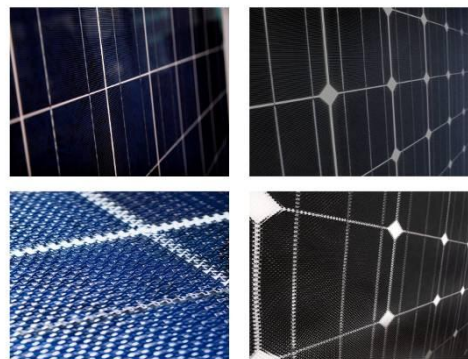


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Congratulations!

We congratulate you on the purchase of your alfasolar solar modules, characterized by the following outstanding features:

- Long service life thanks to the use of only high-quality materials
- Environmentally friendly production with electricity from the sun and water
- Easy-to-maintain-components as well as the recycling possibility via PV Cycle
- Very high efficiency for optimum area utilisation
- High energy yield thanks to anti-reflex-glass and optimum low-light behaviour

The solar modules as innovative, high-quality products generate the electrical energy in your photovoltaic system. We would like to give you some important information at this point to help you make optimum, trouble-free use of your solar modules. Please read this information carefully. Keep this document in a safe place, preferably together with the documentation on your photovoltaic system, so you have it close at hand at all times.

1 General Informationen

The installation of our alfasolar solar modules and our alfasolar A2 system needs high competence and should only be done by qualified persons (including contractual partners or electricians). During the installation please consider the safety indications given in chapter 2.6 – 2.7 and in other parts.

2 Brands and types

2.1 alfasolar solarmodules

alfasolar P6L36, alfasolar M6L36 & alfasolar Pyramid 36			
	Dimensions (mm)	1465 x 670 x 35	
	Weight (kg)	13,4	
	Number of cells	36	
Power classes (Wp)*			
	Pyr36 poly	130 – 160	Pyr36 mono 135 – 165
	P6L36 poly	130 – 150	M6L36 mono 135 – 165
alfasolar P6L48, alfasolar M6L48 & alfasolar Pyramid 48			
	Dimensions (mm)	1306 x 986 x 35	
	Weight (kg)	16,5	
	Number of cells	48	
Power classes (Wp)*			
	Pyr48 poly	170 – 210	Pyr48 mono 180 – 220
	P6L48 poly	170 – 200	M6L48 mono 180 – 220
alfasolar P6L54, alfasolar M6L54 & alfasolar Pyramid 54			
	Dimensions (mm)	1465 x 986 x 35	
	Weight (kg)	18,2	
	Number of cells	54	
Power classes (Wp)*			
	Pyr54 poly	195 – 235	Pyr54 mono 200 – 245
	P6L54 poly	195 – 225	M6L54 mono 200 – 245
alfasolar P6L60, alfasolar M6L60 & Pyramid 60			
	Dimensions (mm)	1623 x 986 x 35	
	Weight(kg)	20,4	
	Number of cells	60	
Power classes (Wp)*			
	Pyr60 poly	215 – 265	Pyr60 mono 225 – 275
	P6L60 poly	210 – 250	M6L60 mono 225 – 275
alfasolar Pyramid 72			
	Dimensions (mm)	1465 x 1303 x 35	
	Weight (kg)	24,5	
	Number of cells	72	
Power classes (Wp)*			
	Pyr72 poly	260 – 305	
alfasolar Pyramid 80			
	Dimensions (mm)	1623 x 1303 x 35	
	Weight (kg)	26	
	Number of cells	80	
Power classes (Wp)*			
	Pyr80 poly	290 – 350	



Furtheron alfasolar modules have passed the ammonia resistance testing at TÜV Rheinland and the salt mist corrosion test sev.6 at Kiwa.



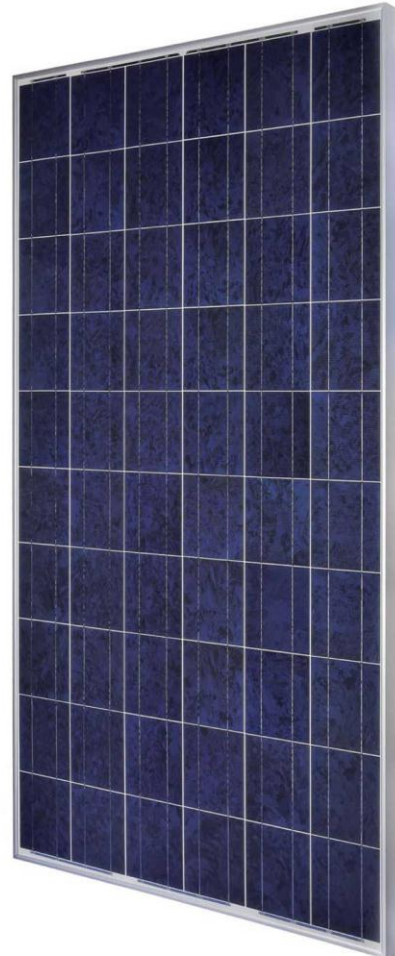
2.2 Datasheets (examples)



Solar module alfasolar P6L60

Equipped with the advantage of the + :

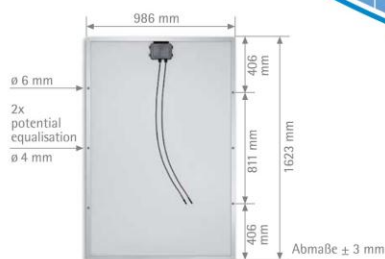
- + plus in energy yield at the same power class
- + plus in durability and quality control
- + plus in economic efficiency
- + plus in security due to high-quality guarantee conditions
- + plus in availability
- + plus in service standards



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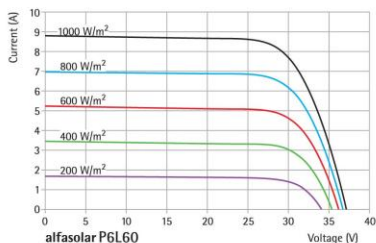


Very strong and reliable polycrystalline high-performance cells AR glas



High-quality, service-friendly connector box

V-I curve at different irradiation



Environmental management system to DIN-EN-ISO 14001:2009



Quality management system to DIN-EN-ISO 9001:2008



Physical data	
Dimensions/weight	1623 x 986 x 35 mm / 20,4 kg
Cell type	60 polycrystalline solar cells 156 x 156 mm
Connector box	IP 65 with H+S-Twistlock-connectors 2 x 1,0 m Radox cable 1 x 4 mm ² W x H x D = 141 x 101 x 28 mm
Bypass diodes	3 x 12 A / 1000 V
Vertical hole spacing	811 mm / hole size: M6

Limiting values /Qualifications	
Permissible module temperature range	-40 to +85 °C
Maximum permissible system voltage	1000 V
Snow load / Wind load	5400 / 2400 N/m ² *
Maximum reverse current	18 A
Humidity at 85 °C	85 % relative
Positive sorting P _{Flash} ≥ P _{max}	-0/+5 Wp
Application category/fire class (according to IEC 61730)	A/C

* see alfasolar installation instructions

Thermal data			
α [I _{mpp}]	+2,3 mA/°C	γ [P _{mpp}]	-0.4 %/°C
β [V _{mpp}]	-116,0 mV/°C	NOCT	45 ± 2 °C

Electrical data	alfasolar P6L60				
	230	235	240	245	250
Power output P _{max} at STC (W _p)	230	235	240	245	250
Short-circuit current I _{sc} (A)	8,51	8,57	8,63	8,69	8,75
Open-circuit voltage U _{oc} (V)	36,81	37,04	37,27	37,50	37,73
Current in MPP I _{mpp} (A)	7,81	7,92	8,02	8,12	8,22
Voltage in MPP U _{mpp} (V)	29,45	29,70	29,95	30,20	30,45
Bulk factor (%)	73,42	74,10	74,70	75,25	75,82
Power output (W/m ²)	143,73	146,85	149,97	153,10	156,22

Electrical data (800 W/m ² , NOCT, AM 1.5)	alfasolar P6L60				
	230	235	240	245	250
Maximal power output P _{max} (W _p)	175,09	179,12	182,99	186,89	190,76
Short-circuit current I _{sc} (A)	6,83	6,88	6,93	6,98	7,03
Open-circuit voltage U _{oc} (V)	34,83	35,06	35,29	35,52	35,75
Current in MPP I _{mpp} (A)	6,28	6,37	6,45	6,53	6,61
Voltage in MPP U _{mpp} (V)	27,88	28,12	28,37	28,62	28,86

Information valid as of 12/2012 - This data sheet complies with the regulations of European standard 50380. alfasolar reserves the right to change specifications. Doc.-No. DBE-29.

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See chapter 7 for all electrical ratings of alfasolar P6L- and alfasolar M6L-modules. The electrical ratings for alfasolar Pyramid modules are specified on the datasheets.

2.3 Modifications

alfasolar solar modules should not be modified by the user. A modified module loses it's all its guarantee conditions (product guarantee and performance guarantee).

If the final user still wishes some modifications they should be addressed to the installer before it's installation. The installer is able to do the modifications in an appropriate, long-lasting and efficient way.

It is not allowed to modify the frame of the solar module.

2.4 Indications for the qualified person

2.5 Terms & symbols

This installation manual contains terms and symbols which are recurrently used to warn the user/installer against dangers and give reference to prevent these dangers.



This symbol is used where there is a risk of injury if instructions are not followed



This symbol is used where there is a risk of injury due to slipping or falling



This symbol is used where there is a risk of contact with live parts



This symbol is used where electric components have to be isolated to avoid contact with live parts



This symbol is used where danger areas have to be cordoned off and unauthorised persons must be prevented from entering



This symbol is used where there is a risk of injury due to falling objects



Handle solar modules only on their short sides



Do not lift solar modules on their long sides



This symbol is used where there is a risk of injury due to falling from heights



Do not walk on solar modules

2.6 General safety indications

The planning of the installation, the installation and commissioning of the solar modules may only be carried out by persons who, due to their professional qualification, are familiar with the installation and the proper and safe configuration. For your safety please wear a helmet, isolating gloves and slip resistant safety shoes

Don't do any installation or maintenance work when there are rain, snow or windy conditions.

The installation should be done on an underground with verifiable static conditions.

The assembly is to be mounted over a fire resistant roof covering rated for the fire application of alfasolar modules.

Be aware that you don't through anything on the solar module! Prevent your solar module of any mechanical influence on the front- and backside. Do not install solar modules which are damaged!

Touching live parts of the solar module such as terminals can cause burns, sparks or a fatal death both at connected and at disconnected modules.

Solar modules generate electricity as soon as sufficient direct or indirect sunlight reaches the surface of the module. Aeries connection of solar modules (addition of voltages) can cause voltages above the low voltage of 120 Vdc. (see Chapter 3.4.11 "Tab.1 – Date and limit values of the circuit") specifies the maximum number of series connected solar module which shall not be exceeded, even not under low ambient temperatures.

Do not cover the water outlet holes in the module frame. If water remains in the frame there is a risk of frost damage. Please do not drill holes into the module frame. This could affect the stability of the frame and cause corrosion. Don't touch the module with bare hands. The edges could cause injuries to your hands.

Protect the cables during transportation and installation to any mechanical shock.

Please make sure that the environment of the installations site does not cause a negative impact. In the following areas precautionary measures should be taken in order to ensure a high degree of reliability and safety: snowy regions, cold regions, windy areas, coastal or offshore, areas with increased risk due to salt water or ammonia, islands or desert areas.

In areas with high amounts of snow preventive measures against bending under load shall be taken.

2.7 Special safety indications



The solar modules must be installed and operated according to the approved rules of engineering. During installation, the applicable national regulations on safety at work and accident prevention must be observed and complied with at all times. This applies in particular to work carried out on the roof.



During the installation and maintenance of the solar modules, the applicable regulations and safety instructions for the installation of electrical equipment and systems and any regulations of the responsible public utility for grid parallel operation of photovoltaic systems must be observed.

The solar modules are electric voltage sources with the corresponding potential hazards. The full open circuit voltage must be expected even under poor light conditions. The electrical commissioning of the solar modules may only be carried out by an approved electrician.

If the solar modules are integrated into a lightning conductor system, the applicable national regulations must be observed and complied with.



There is a risk of falling when working on the roof and when climbing on to and down from the roof. Be sure to observe the accident prevention regulations and to use appropriate fall arrest harnesses.



When working on the roof, there is a risk of tools, installation material or solar modules falling from the roof and injuring persons on the ground.



Therefore cordon off the danger area on the ground before starting the installation work.

Warn persons in the vicinity of the danger area or inside the house of the imminent danger.



Keep children well clear of the danger area. Unauthorised persons must not be allowed to climb onto the roof.



Before starting work on the solar modules, they must be isolated from the power supply by means of an isolating switch as arcs can occur when working on lines conducting direct current.



Handle solar modules only on their short sides



Do not lift solar modules on their long sides



Do not walk on solar modules Walking on the modules will provoke micro cracks in the solarcells which can lead to a significant loss of efficiency.

2.8 What must I watch for during day-to-day operation?

During day-to-day operation, the solar modules function completely independently. They convert the solar energy silently and unnoticed into electrical energy without you have to do anything. During daylight, direct current flows through the solar modules to the inverter during the energy transformation. That is the normal operating mode.

If work has to be carried out on your roof, for example by roofers, chimney sweep or aerial installers, draw the attention of these persons to the following points before they go up or out onto the roof:



- Do not walk on the solar modules
- Do not touch the solar modules, substructures, PV cables or plug connectors
- Do not drop anything on the solar modules
- Do not mechanically load cables and plug connectors
- On no account disconnect plug connectors
- On no account cut any cables

2.9 Mounting instructions

In order to ensure sufficient self-cleaning, the angle of inclination should be at least 15 degrees. Take account of local conditions (rainfall, dust development, etc.) when determining the angle.

The solar modules should be set up so that shadowing (even partial) is avoided. The optimum installation position is one where there is no shadowing at any time of the day or any time of the year.

If shadowing nevertheless has to be accepted or is unavoidable, Figure 1 opposite helps to illustrate the effects of this shadowing:

TYPE A:

Shadowing type A results in the decrease of the power of one double-string (e.g. 60-cell-module has 3 double-strings).

TYPE B:

Shadowing type B results in noticeably decreased power losses of the module affected!

ATTENTION:

Be aware the modules need a standoff of at least 5 cm. Each additional temperature degree will cause a power loss of about 0.28% (monocrystalline type) to 0.30% (polycrystalline type).

Artificially concentrated sunlight shall not be directed on the module.

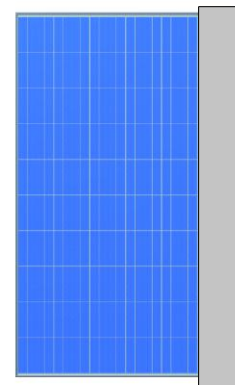


Fig. 1 Type A

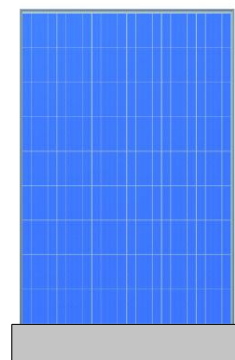


Fig. 2 Type B

3 Installation of alfasolar modules

3.1 General instructions

The fire rating of the modules is valid only when mounted in the manner specified in these installation instructions.

Local circumstances such as local climate, wind loads, snow loads or special static requirements have to be considered by the installer. Local circumstances are not known by alfasolar GmbH.

3.2 Exclusion of liability

Die Installation instructions are only valid for the standard modules of alfasolar solar module series and the alfasolar A2 fastening system. Special constructions at the request of customers concerning the solar modules or the fastening system cannot be considered. To facilitate your installation alfasolar GmbH gives special data for static calculations in the data sheets.

This introduction provides useful information on installing the A2 fastening system from alfasolar GmbH. In addition to this information, the specialized company installing the system is to observe the rules and regulations applicable for this technology. The information on dimensions and spacing contained in this introduction are only guidelines based on practical experience that must be validated only through static testing on a case-by-case basis. Alfasolar GmbH is not responsible for dimensioning information contained in sales materials since generally not all technical requirements are verified in sales information. The installing company is responsible for the mechanical durability of the installed interface connections on the shell of the building and, in particular, for their tightness as well. The components supplied by alfasolar GmbH are state of the art and designed to withstand the expected stress and loads. Alfasolar GmbH shall not be held liable if the installed parts have been improperly handled.

The exclusion of liability does not apply to damages arising from injury to life, limb or health based on a negligent breach of duty of alfasolar GmbH or an intentional or negligent breach of duty by a legal representative or vicarious agent of alfasolar GmbH. Please also refer to the general terms and conditions as well as the publications of guarantee and performance of alfasolar GmbH.

3.3 Product warranty

Alfasolar GmbH guarantees the lifespan and durability of the frame system for a period of ten years provided the components have been handled properly and arranged according to the static basic requirements and normal environmental and local conditions (Federal Republic of Germany). This applies within the framework of environmental conditions, e.g., those factored into DIN 1055. The expected lifespan of the product, however, extends significantly beyond the lifespan stated in the warranty. Because the static dimensions stated for the system cannot apply for all possible environmental conditions, but are instead based on the stipulations of the applicable standards, we recommend always purchasing appropriate natural hazard insurance.

3.4 Installation of alfasolar solar modules with alfasolar A2 fastening system

3.4.1 Pre-installation planning

For a pitched roof, two rows of roof hooks or roof fasteners are secured to the load-bearing roof substructure. The mounting rail is then secured to these elements. Each module row is supported by two mounting rails. The module rows are arranged on and secured to the mounting rails by means of end and center fastening clamps. The modules are normally installed with their long sides orientated vertically.

Ultra-stable roof hooks are used for interlocking-tile and pantiled roofs. Special roof hooks are also available for special kinds of tiles. For corrugated Eternit roofs or profiled sheet metal roofs, a set of fasteners with a special hanger bolt and rubber seal is available. On standing seam or Kalzip roofs, the rails are secured to the sheet metal seams with sheet metal seam or Kalzip clamps.

We recommend you to make a sketch for the arrangement of the modules first.

Regarding the interconnection of the solar modules you should consider the position of the junction boxes and the input voltage of the inverter. It might be necessary to work with cable extensions.

3.4.2 Recommended tools

Handheld FLEX grinder with small diamond blade and replacement blade, no. 15 ratchet box wrench, battery-driven screwdriver or drill with Torx TX25 and 5 mm hex drill bit set, 5 mm hex key, string, tape (for labeling and for securing the string), tape measurer, measuring stick, vial level, pencil for marking, pen and paper for sketching, hand-held gas stove for heat-shrink sleeve, crimping pliers for crimp connectors, optional connector-fitting tool with connectors. Wood shims to place for under the roof hooks and to even out height differences.

3.4.3 Checking completeness of parts

Prior to installation, make sure that all parts listed in the packing list are present. The parts list and packing lists can be found in the packets. The parts list indicates which parts belong to each individual module row.

ATTENTION:

Please consider the corrosion resistance of stainless steel V2A. For the installation in a high corrosive surrounding (such as coastal regions, ammonia or acids) specially coated materials should be used.

3.4.4 A2 fastening system



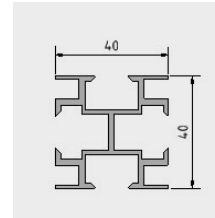
Roof hook, doubly adjustable



Fastener set, roof hook to rafter



Mounting rail



Mounting rail profile
dimension 40 x 40 mm
Material: ALMgSi 6060 / T66



Mounting rail with lateral cable channel



Fastener set roof hook to mounting rail



Linking plate, rail to rail



Mounted fastener set, rail to rail



Mid Clamp (module to module)

Mid Clamp assembly:

- a) screw M8 x 50 mm, stainless steel.
- b) washer M8, min. OD 23.5 mm, min. 2 mm thickness, stainless steel.
- c) rail nut for M8, stainless steel.
- d) torque value for grounding is 15 Nm .



End Clasp set, module to rail

End Clamp assembly:

- a) screw M8 x 16 mm, stainless steel
- b) rail nut for M8, stainless steel
- c) aluminum clamp, 40 mm by 38 mm by 30 mm, min. 2 mm thick
- d) torque value for grounding is 15 Nm

3.4.5 Position of the mounting rails

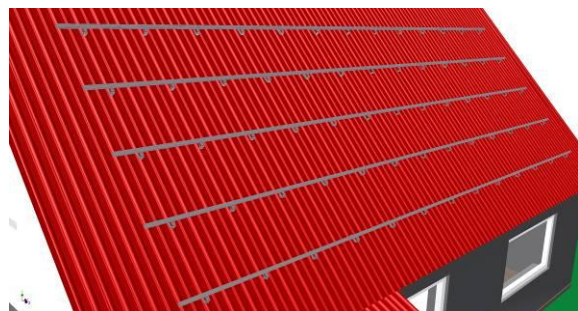


Fig. 3: laying of mounting rails

The mounting rails should be attached approximately 32 – 40 cm from the upper and lower edge of the module. Pay attention to the location of the electrical outlets! The location of the mounting rails for the module rows arranged one on top the other must be adapted to fit the roof tile rows. Depending on the roof tiles, it has proven to be effective to space the module rows two roof tile rows apart from one another and the rails three roof tiles rows from one another. Please first check to see if this arrangement is applicable for the current project.

3.4.6 Placement of roof hooks

The roof hooks are arranged vertically in relation to the desired mounting rail position. On the horizontal axis, a roof hook is placed on every second rafter. In areas with heavy snow or high winds, a roof hook should be placed on each rafter (please order sufficient additional roof hooks!).

Please take static load into consideration. At the roof edges, the mounting rail should not extend past the outermost roof hook by more than 0,4 m. Maximum spacing between roof hooks is 1,8 m.

Between the lower side of the roof hook and roof tile the standoff should be at least 5 mm to avoid that the tile gets damaged in case of deformation under load (e.g. due to snow loads) .

3.4.7 Fastening the roof hooks

Doubly adjustable roofhooks

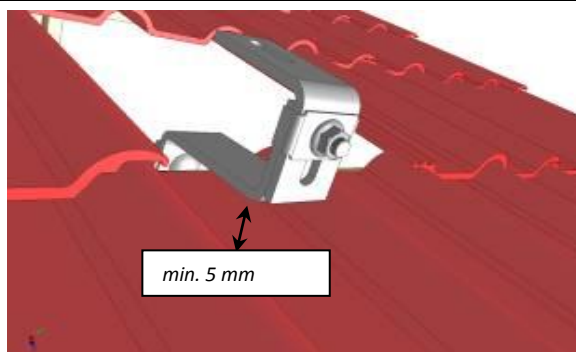


Fig. 4: Adaptability to roof tiles

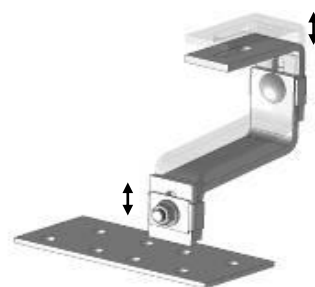


Fig. 5: Adaptability of roof hook

The doubly adjustable roof hook can be adjusted in the upper part (for fixing the mounting rails) and in the lower part. This enables the equalization of different profiles of the roof laths resulting in a big flexibility for different kinds of roofs.

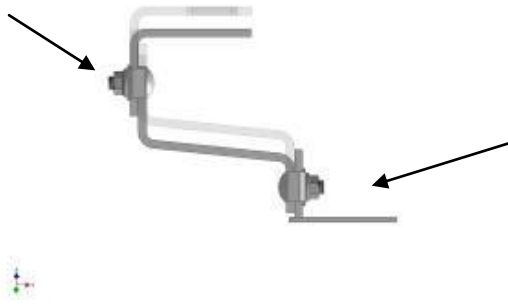


Fig.6: Hints for adaptations

Please watch fig. 6 for adaptation options. The screws are constructed of stainless steel resulting in max. torque of 32 Nm. The adaption should always be part of the installation to get a safe construction.

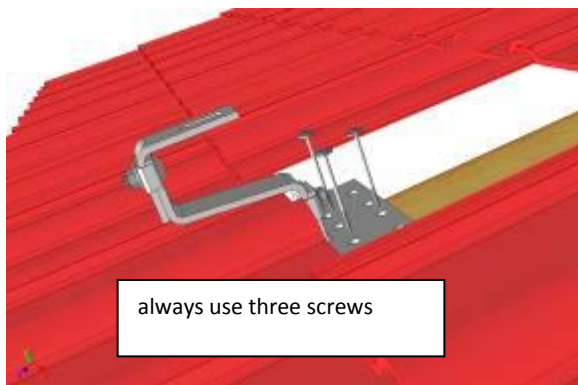


Fig. 7: information for the screw connection

Lift up the roof tile. Place the hook portion of the roof hook in the trough or in the flat surface of the roofing tile. There should be at least 5 mm of space between the tile and the hook portion. If necessary, place wooden shims at the base plate of the roof hook accordingly. For clay tile especially, we recommend placing a sheet metal pantile that fits the shape of the roof tile below the roof hook. Using a battery-powered screwdriver, secure the roof hook to the rafter (not the laths!!) with the supplied three self-tapping anchoring plate screws and washers. Other suitable screws can also be used. Please adjust the battery-powered screwdriver so that excessive stress is not placed on the screws while they are being screwed in. Select the correct friction clutch to prevent screw heads from being broken off. If counter lathing is present, use longer screws to achieve sufficient fastening depth in the rafter (at least 55 – 60 mm). The roof hooks must be fastened at the same height in the horizontal and vertical axes.

If counter lathing is present, use longer screws to achieve sufficient fastening depth in the rafter (at least 55 – 60 mm). The roof hooks must be fastened at the same height regarding the horizontal and vertical axes.

Use the string and vial level for this purpose. For best results, fasten the roof hooks along the vertical axis on one side and then on the other side. Then attach the string, which will show the proper height for the roof hooks lying along its span.

3.4.8 Arrangement of mounting rails on the fastening points and screwing them down

Start with the alignment of the lowermost rail and the right or left edge. Then arrange the additional rails. Important! The side ends (left or right) must be arranged so that they form a vertical line running at an exact 90° angle to the lowermost rail. Otherwise the seams in the module array cannot be properly aligned within these lines. The rails are then placed on the roof hooks.

Please make sure that the center bar of the rail is vertical for optimal stability of the system and the large grooves face the bottom (for connecting the roof hooks) and top (for fastening the module).

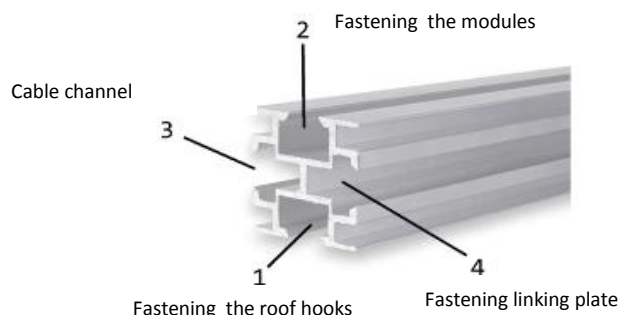


Fig. 8: A2-Mounting rail with channels



Fig. 9: introduce the A2 profile into the clamping screw

The bolts for fastening the roof hooks are inserted into the bottom groove of the rail, positioned and then screwed to the roof hook using a serrated lock nut. The rails can be extended with the rail connector if necessary. In this case, insert the connecting plate into the lateral groove and secure it with 2 round-head screws M8x16 and washers using the 5 mm hex key. For rails longer than 2 m the variant listed in the parts list can be used, since it ensures greater stability.

3.4.9 Tightening and checking all screws of the substructure

To avoid damaging the threads, retighten each screw approximately a quarter turn upon encountering firm resistance. Important: Screws with damaged threads are difficult to loosen and make the installation process more difficult. Please refer to Item "Grounding". This step is easier to perform before the module is installed.

WARNING:

Due to thermal extension of the mounting rails stress is caused to the modules. To avoid this you should install an expansion gap of 20 mm after two rails length (12 m).

Preparation for the installation of the module rows

Prepare the cabling including feed and return lines up to the module rows. For modules with connector plugs, route cables with connector plugs (e.g., MC4-adapter set with heat-shrink sleeve and crimping connectors for crimping) lead to the individual end modules of the strings. It is necessary to first plan how the modules can be wired over multiple rows (this allows the location of the outlets and the + and – terminals of the individual modules to be) and order any necessary additional materials.

When laying the module string cables, make sure that the + line and the – line of the string are laid together tightly to prevent electrical surges through the surface of the string conductor loop in the event of a nearby lightning strike.

The return line should take the same path as the passage of the current through the module so that the feed and return line can be routed off the roof to the same site. The return line can now be fastened in the lateral cable channel of the mounting.



Fig. 10: Fixing the cable at A2 mounting rail with PV-clamp

Together with our rail we deliver a PV-clamp (see figure 10). The fixing of the clamp is to be done by clicking it into the profile of the rail so it can be moved and removed at any time. We recommend the application of one clamp per meter.

Pay particular attention to the polarity of the solar modules. Reversing the polarity will destroy the bypass diodes.

Our modules are mainly sold with junction box type PV 1410-2 (4 or 6 poles) which contain diodes type Diotec SB 1240. The diodes have the following electrical characteristics:

- Max. peak reverse voltage: 40V
- Forward rectified current: 12A
- Max. Junction temperature: 200°C

Replacement diodes can be ordered at alfasolar GmbH.

If you have bought a monocrystalline module with ISBT junction box the overcurrent protection is provided by an electronic chip, Type Microsemi with the following ratings:

- Max. peak reverse voltage 24V
- Forward Rectified current 25 A
- Max junction temperature 225°C

The junction box with cables connected at the factory does not have to be opened for the electric wiring of the solar modules.

Lay cables with strain relief, lay them mechanically stress-free and with sufficient large bending radii. If necessary, secure lines using cable ties.

The cross section of the connecting cable must not be smaller than 4 mm².

3.4.10 Wiring instructions

Take care that the dimension of the cables is adequate, especially regarding the input cable for the inverter. If necessary you have to use bigger cable dimensions.

For **additionally required cable** (e.g. string cables), use only cables specified for the application or special solar cables. Observe recognised good engineering practice when dimensioning the cables: Take into consideration the connected power (and the resulting voltages and currents), temperature influences, cable lengths and the laying situation for safety reasons and to prevent unnecessary power losses in the cables.



Caution:
Do not insert or remove the plugs under load.



Abb. 1: Modulrückseite

The solar cables on the modules are fitted with Radox Twist Lock connectors 4mm² with temperature range from -40°C to 85°C. The plugs have been specially developed for use in photovoltaics. The plugs are marked with their respective polarity.



Fig. 2: H&S Radox Twist Lock connector system



Connect only solar modules of the same type and same power class in series!

Module type alfasolar	Maximum current I_{sc}	Maximum admissible system voltage	Maximum permis- sible number of modules in se- ries*	Maximum admis- sible number of strings in parallel**
PYR36/P6L36/M6L36	9,10 A	1000V	37	3
PYR48/P6L48/M6L48	9,10 A	1000V	28	3
PYR54/P6L54/M6L54	9,10 A	1000V	25	3
PYR60/P6L60/M6L60	9,10 A	1000V	22	3
Pyr72	9,10 A	1000V	18	3
PYR80	9,10 A	1000V	17	3

Tab. 1 – Date and limit values of the circuit

***Values refer to the module with the highest efficiency**

** If more than three strings are to be connected in parallel they must be protected by using surge voltage protectors

Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly the values of I_{sc} and V_{oc} marked on the module should be multiplied by a factor of 1,25 when determining component voltage ratings, conductor current ratings, fuse sizes and size of controls connected to the PV output.

The modules are dimensioned for use in application class A to EN 61730 / IEC 61730 (general access, hazardous voltage >120 V DC EN 61730 / > 50 V DC IEC 61730).

3.4.11 Installing module rows

GENERAL INDICATIONS:

- The modules are normally installed with their long sides orientated vertically. Besides that the modules can also be installed with their long sides horizontally.
- Regarding the permissible loads you have to attend to the fixing specifications indicated below.
- Solar modules have to bear on the mounting system with at least four points on two opposite sides.
- The fixing of the module can be done using the boreholes (tolerances: ± 90 mm, see Chapter 3.5 "Fixing specifications") or integration systems.

Optimal adjustment and inclination

- For maximum power you should determine the optimal adjustment and orientation of your solar modules. The highest solar power is created when sunlight shines in an angle of 90° .

CAUTION: Avoid shading!

- Power losses can be indicated by half shadowing (e.g. caused by dirt). Take care that dirt does not remain on your module for longer time. Alfasolar modules have been tested against hotspot but still - if dirt remains too long a hotspot could occur damaging single cells, double strings or the whole module.
- A solar panel is called "shadow-free", when the entire surface is freely accessible over the whole year. A shadow-free module is reached by solar radiation even on the shortest day of the year.

Ventilation

- To avoid high temperatures the stand-off between your solar modules and the mounting ground is min. 5 mm. Additionally you can avoid high moisture by keeping a sufficient stand-off.

Thermal extensions

- Regard the thermal extension of the module frames
- Solar modules are not to be mounted together too tightly.
- The min. distance between solar modules has to be 8 – 10 mm.
- We recommend a distance of 20 mm between the rows.
- The PV generator has to be fixed on a fire-resistant roof with a determined static load.

If you use other mounting material than alfasolar components please regard the electrochemical series to avoid contact corrosion between different metal types.

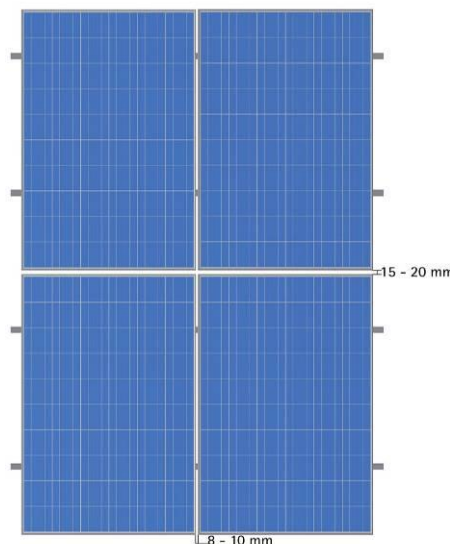


Fig.13: Mounting distances

MOUNTING OF SOLAR MODULES

For mounting points that deviate from the specified dimensions and tolerances, the manufacturer is not liable. The end clamps are using Allen screw M8x16 (torque 15 Nm) and square nut on the edge of the rail loosely attached and each stuck a module. With the tensioning cord which is attached to the upper edge of the module, can now take place, the alignment of the module row. Clamp on additional modules using a nut-washer combination (hexagon socket screw, large washer and square nut in the upper groove) before releasing the last edge module again and placing it on the row. The square nut can simply be placed where required from above.

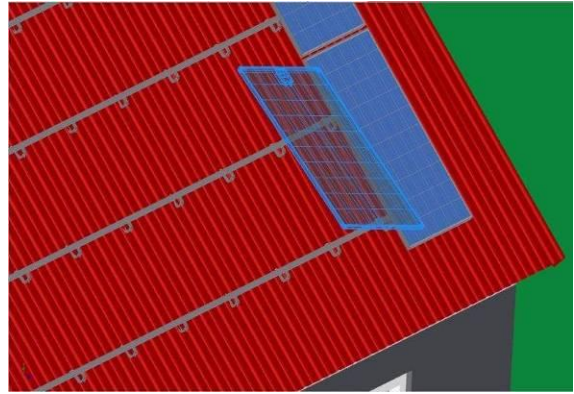


Fig. 14: installation of solar modules

The special profile of the mounting rail ensures a highly secure module-rail connection. The modules are electrically connected to the previous module (connector or cable bridge) prior to being secured.

WARNING!

The fixing clamps shall not get into contact with the front glass and shall not deform the frame. Furthermore they shall not cause any shade on the solar cells. Regard the described torque values! Don't use a cordless screwdriver!

3.4.12 Fuse protection of strings

Depending on the manufacturer, the fuses can be installed in the inverter or in separate housings (together with modular terminal blocks and/or surge voltage protectors).

Our staff will be pleased to advise you on the correct dimensioning of the fuse links.

Fuse links should generally be dimensioned according to the system they are installed to protect; reliable rules of thumb for the commercially available fuse links developed for PV applications are:

$$\text{Rated voltage:} \quad U_N \geq U_{OC-String} \cdot 1,18$$

(at lowest temperature -25 °C)

$$\text{Rated current:} \quad I_N \geq I_{SC-Modul} \cdot 1,3$$

(at 60°C in junction box, alternating load factor 0.9 and irradiance 1000 W/m²)

Source: SIBA GmbH & Co. KG

If other commercially available plug systems are employed on the inverter side and the tools required for crimping are not available, adapter sets can be obtained from us (short pieces of Radox 4 mm² & 6 mm² with connectors and shrink sheaths).

Overshooting the power output



Under certain conditions*, a solar module can output higher currents and/or voltages than the electrical characteristics measured under standardized test conditions (see Chapter "3.4.11 Tab.1 – Date and limit values of the circuit").

This has to be taken into consideration by means of corresponding factors when determining the current and voltage ratings of components (e.g. controllers) connected to the output of PV modules.

**The highest irradiances occur on sunny days with light cloud. Reflections of the solar radiation on passing clouds can result in brief irradiance peaks*

3.4.13 Lightning and surge voltage protection

The requirements for lightning and surge voltage protection must be determined according to the specific local conditions (building with or without external lightning conductor), to the technology employed (in particular inverter or solar module) and on the local and national regulations and directives. The legal regulations must be observed in all respects. Otherwise it is assumed that the installation complies with the state-of-the-art.

Equipotential bonding

All metallic parts of the photovoltaic system must be connected electrically and, depending on whether the building has a lightning conductor system, connected to the equipotential bonding conductor. If the building has a lightning conductor system and the minimum distances to this system are not observed, the photovoltaic system must be integrated into the system in a manner appropriate to the building and using the normal methods using a grounding conductor.

Where common grounding hardware (nuts, bolts, star washers, split-ring lock washers, flat washers) and the like is used, the attachment must be made in conformance with the grounding device manufacturer's instructions.

3.4.14 Grounding of alfasolar solar modules

Generally you can make the grounding for the whole PV-generator or for each single module. To install your PV-system in safe manner you have to follow the national electrical standards of the country where the system is to be installed.

Grounding of an alfasolar PV- generator alfasolar A2 rail system

As the module frames are connected as electrical conductors to the rail when using the alfasolar installation system, you have the possibility to connect the individual module rows together and to lay a cable from there to the equipotential bonding conductor. **WARNING:** make sure that you use the centre clamps and the flat washer with its sharp edge towards the frame, so that the coating is penetrated! This can be carried out, for example, using cable shoes and M10 nuts/screws in the lateral grooves (see figure). When selecting the connection materials, pay attention to the electrochemical displacement series (contact corrosion). If the normal aluminium materials used in lightning conductor systems are employed, no particular precautions are necessary.

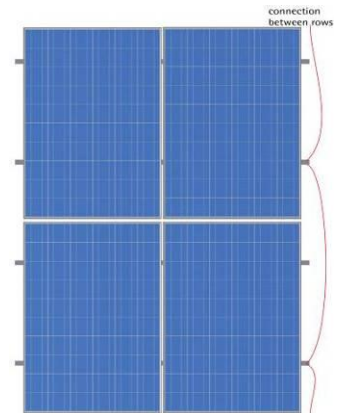


Fig.15: grounding system of the A2

Grounding of single alfasolar solar modules without alfasolar A2 rail system



Fig. 16: grounding advice

If some other method of installation is employed, the modules can be integrated into the equipotential binding system via the M4 grounding bores in the middle of the module frames as described above using corresponding cable shoes and screws. For appropriate sizes and materials on the rail system-side please ask the deliverer of your mounting system.

WARNING! The grounding connection must not be interrupted or destroyed during routine maintenance of a module. Bolts, screws or other grounding connections must not be used for mechanically securing the complete installation to supporting surfaces or frameworks.

Grounding of single solar modules with alfasolar A2 rail system

Beyond the grounding of the PV-generator via A2 rail system it is recommended to do the **grounding for each single module and connect it with the A2 rail system**. In the following you find the detailed description of the grounding means and the way they have to be assembled:

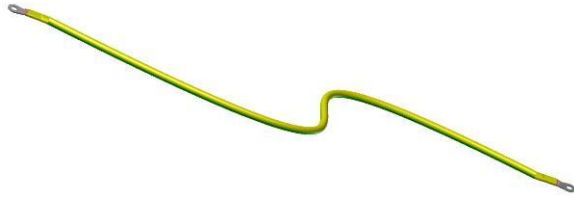


Fig.17:grounding cable

The wire 4 – 6 mm² has to be assembled with two cable shoes and a length of 60 cm:

For the frame contact you use a cable shoe RC 6 – 4 - 6 mm²

For the rail contact you use a cable shoe M8 – 4 – 6 mm²



Fig.18:grounding set for the frame

Grounding set for contact to module frame (from left to right):

1. selftapping screw M5,0x16,type BN 20191, galvanized steel which allows two full screw threads
2. Spring washer M6, galvanized steel
3. Flat washer M6, galvanized steel
4. Cable shoe M6 with cable (see above), galvanized copper
5. Lock washer M6, galvanized steel

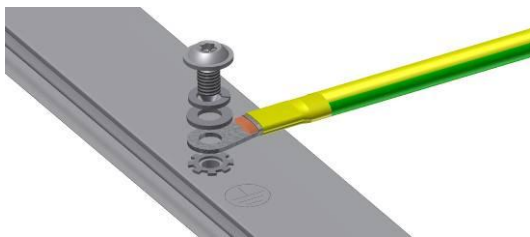


Fig. 19:connecting grounding set to the frame

The grounding set has to be assembled in the specified way and attached to the M4-grounding hole in the middle of the frame.

The torque value for the screw is 2,3 Nm.

WARNING!

Due to the material sizes you have to do the grounding in the hole with the grounding symbol!



Fig. 20: grounding set for A2 rail system

Grounding set for A2-rails (from left to right):

1. Lens head screw, M8x16, stainless steel
2. Spring washer M8, galvanized steel
3. Flat washer M8, galvanized steel
4. Cable shoe RC 8 with cable (see above), galvanized copper
- 5.Lock washer M8, galvanized steel
6. Insertion nut, M8, stainless steel

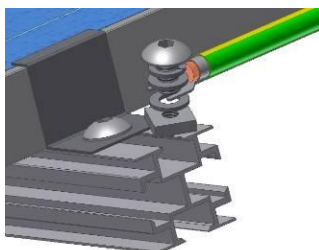


Fig. 21: connecting grounding set to A2 rail system

The grounding set has to be assembled into the groove of the A2 rail.

The torque value is 15 Nm.

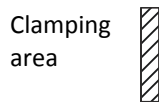
WARNING!

Please pay attention that two tips of the lock washer are contacted to the A2 rail on each side of the groove.

3.5 Fixing specifications

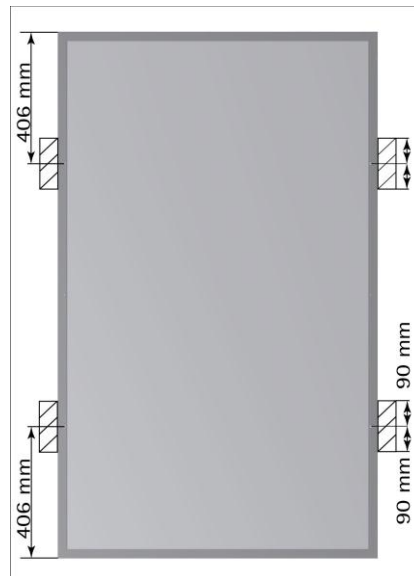
The permissible design loads depend on the mounting method as indicated below:

3.5.1 Permissible fixing for vertical instruction

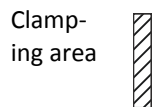


Snow load up to 5400 N/m^2
Wind load up to 2400 N/m^2

Fixing of long side

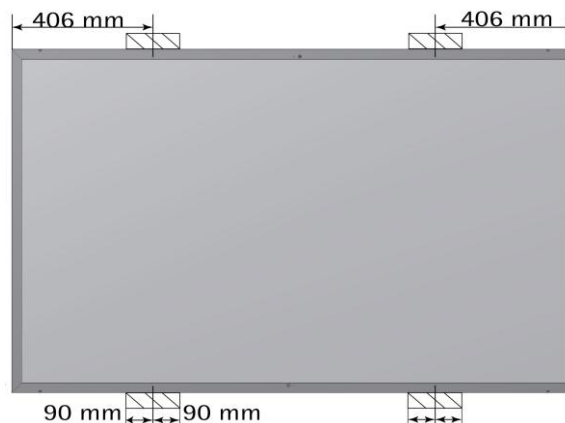


3.5.2 Permissible fixing for horizontal installation



Snow load up to 5400 N/m^2
Wind load up to 2400 N/m^2

Fixing on long side



3.5.3 Remarks for the fixing

Other mounting system than alfasolar A2 rail system can cause variations to the fixing specifications which cannot be predicted by alfasolar GmbH. If there occur any questions please contact your contractual partner directly or apply to a certified structural engineer.



This is in subject to technical modifications. The installation instructions are only valid in combination with datasheets, general terms and conditions and the current guarantees of alfasolar GmbH for the time being.

4 Cleaning and maintenance

4.1 Cleaning of solar modules

Installing the modules with a sufficient gradient (min. 15°) will enable the self-cleaning process supported by rain. Please notice that the self-cleaning effect has natural limitations.

Dirt on the front side of the modules reduces the incidence of light on the solar cell and it reduces the solar power of the modules. Therefore we recommend the cleaning of the modules if they are exposed to dirty conditions such as bird droppings, leaves or if the surrounding is too dirty (e.g. lichens on a roof).

If it is necessary to clean the module please consider the following advices:

1. Use only soft brushes, otherwise the glass structure will be destroyed
2. Avoid normal water, better use water without minerals, at least without calcium carbonate.
3. Don't use rain water because it can contain dirty particles.
4. Persistent stains can be removed with a large-pore non-abrasive sponge from the automotive sector, additionally you can use a commercial window cleaner. Use neither abrasive or chemically aggressive cleaning detergents nor hard objects.
5. Big temperature differences such as cold water on heated modules may damage materials or cause a loss of power.
6. Walking on the solar modules or other strong mechanical impact shall be avoided.
7. Cleaning with high-pressure-cleaners (e.g. Kärcher) is not allowed.
8. If you consider the above named advices the performance of your alfasolar modules will not be affected by dirt pollution.

4.2 Maintenance of the photovoltaic system

We recommend an inspection of technical functions and performance by a qualified person every two years. Via an open circuit withstand test you can detect defect bypass diodes (e.g. caused by overvoltage) and subsequently prevent overheating of the junction box and loss of energy yield.

The electric wires should be checked occasionally by a qualified person for damages, corrosion and tightness of the connectors.

Some aspects about the conditions of your PV-plant can be collected by yourself:

Ideally a data logger with internet connection should be installed to display the relevant data and provide default reports. A data logger can be purchased at alfasolar GmbH and it can be installed later.

To determine if your PV-plant is working well you should check the energy yield regularly and compare it with an appropriate data base given in the internet. Be aware that only comparable locations and situations enable an objective evaluation.

If your PV-plant has been working for several years the previous year's data can be used as a comparison. If the current yield is significantly lower you should ask a qualified person to check your PV-plant (please ask your installer).

We recommend the operator to close a maintenance contract. Professional maintenance absolves the operator of the PV-plant of work which is potentially dangerous or difficult to be done due to the absence of technical equipment.

5 Behavior in the event of malfunctioning

If you have the impression that your PV-plant does not work properly we recommend that you inform your installer immediately. Repairs shall only be done by qualified persons.



- Danger to life! Do not walk on the roof for inspections purposes if your modules are damaged. You could fall down from the roof.
- Do not do any kind of work at the solar system as this is associated with significant risks. You could injure yourself, get an electrical shock or damage the solar system.

5.1 Who can I contact if I have questions or malfunctions?

When they ask malfunctions or contact the professional company who installed their solar system.

Stamp Installation Company

6 Parts catalog

The following parts can be ordered directly from alfasolar GmbH and are available from stock.

product name	product code (alfasolar)
JUNCTION BOX INCL. CABEL Type PV 1410-2 / 4 and 6 pole with diode	54/60 Zeller / 50020003-set 80 Zeller / 50020002-set
DIOTEC SB 1240 (bypass diode junction box for the standard-Pos.1)	1150110
JUNCTION BOX INCL. CABEL Type ISBT / 4 pole with an electronic chip	54/60 Zeller / 50020004-Satz
H+S MALE CONNECTOR / H+S FEMALE CONNECTOR TWIST LOCK (4MM² OR 6MM²) (severally or as adapter set)	adapter set (4mm ²) per string / 1031103 adapter set (6mm ²) per string / 1031121
MC 3 MALE CONNECTOR / MC 3 FEMALE CONNECTOR (severally or as adapter set)	adapter set (4 mm ²) per string / 1050317
MC 4 MALE CONNECTOR / MC 4 FEMALE CONNECTOR (severally or as adapter set)	adapter set (4 mm ²) per string / 1050317B
SOLAR CABLE BLACK Radox – various diameter & lengths (mm ²)	4 mm ² / 1030502 6 mm ² / 1030503
MOUNTING KIT ROOF HOOK/RAFTER (3 x fixing plate screw TX25 6x90/60 A2 and 3 x washer 8,4 A2 DIN 9021)	fixing plate screw/1022016a washer / 1022014
PV-CLAMP (cable routing for the mounting rail)	1022097
MOUNTING KIT MODULE/RAIL (1 x end clamp from 1.38 Inch to 1.96 Inch Height, 1 x rounded head screw M8x16, and 1 x hexagon head screw M8)	end clamp (35 mm)/1022006a rounded head screw / 1022010 hexagon head screw / 1022017
MOUNTING KIT RAIL/RAIL (1 x rail connector A2, 2 x rounded head screw M8x16 and 2 x washer 8,4 A2 DIN 9021)	rail connector / 1022008 rounded head screw / 1022010 washer / 1022014
MOUNTING KIT ROOF HOOK/RAIL (1 x hexagon head screw M10x20 and 1 x hexagonal flange nut with serration M10)	hexagon head screw / 1022011a hexagonal flange nut with serration / 1022015
MOUNTING KIT MID CLAMP MODULE/MODULE (1 x rounded head screw M8x50 mm, 1 x washer 8,4 A2 DIN 9021 and. 1 x hexagon head screw M8)	rounded head screw / 1022010 washer / 1022014 hexagon head screw / 1022017

7 Electrical ratings

alfasolar M6L-modules

Model	Open Circuit Voltage at STC, (V dc)	Rated Voltage at STC, (V dc)	Maximum System Voltage, (V dc)	Rated Current at STC, (A dc)	Short Circuit Current at STC, (A dc)	Rated Max. Power at STC, (Watts)	Max. Series Fuse, (A)
alfasolar M6L36-135	22.14	18.05	1000	7.48	8.46	135	20
alfasolar M6L36-140	22.31	18.17	1000	7.71	8.54	140	20
alfasolar M6L36-145	22.48	18.29	1000	7.93	8.62	145	20
alfasolar M6L36-150	22.65	18.41	1000	8.15	8.70	150	20
alfasolar M6L36-155	22.82	18.53	1000	8.37	8.78	155	20
alfasolar M6L36-160	22.99	18.65	1000	8.58	8.87	160	20
alfasolar M6L36-165	23.16	18.77	1000	8.80	8.96	165	20
alfasolar M6L48-180	29.52	24.06	1000	7.49	8.46	180	20
alfasolar M6L48-185	29.69	24.18	1000	7.66	8.52	185	20
alfasolar M6L48-190	29.86	24.30	1000	7.83	8.58	190	20
alfasolar M6L48-195	30.03	24.42	1000	7.99	8.64	195	20
alfasolar M6L48-200	30.20	24.54	1000	8.16	8.70	200	20
alfasolar M6L48-205	30.37	24.66	1000	8.32	8.76	205	20
alfasolar M6L48-210	30.54	24.78	1000	8.48	8.83	210	20
alfasolar M6L48-215	30.71	24.90	1000	8.64	8.90	215	20
alfasolar M6L48-220	30.88	25.02	1000	8.80	8.96	220	20
alfasolar M6L54-200	33.21	27.16	1000	7.37	8.46	200	20
alfasolar M6L54-205	33.36	27.25	1000	7.53	8.51	205	20
alfasolar M6L54-210	33.52	27.34	1000	7.69	8.56	210	20
alfasolar M6L54-215	33.67	27.43	1000	7.85	8.61	215	20
alfasolar M6L54-220	33.82	27.52	1000	8.01	8.66	220	20
alfasolar M6L54-225	33.98	27.61	1000	8.16	8.72	225	20
alfasolar M6L54-230	34.13	27.70	1000	8.31	8.78	230	20
alfasolar M6L54-235	34.28	27.79	1000	8.46	8.84	235	20
alfasolar M6L54-240	34.34	27.88	1000	8.61	8.90	240	20
alfasolar M6L54-245	34.59	27.97	1000	8.76	8.96	245	20
alfasolar M6L60-225	36.90	30.07	1000	7.51	8.46	225	20
alfasolar M6L60-230	37.07	30.19	1000	7.64	8.51	230	20
alfasolar M6L60-235	37.24	30.31	1000	7.77	8.56	235	20
alfasolar M6L60-240	37.41	30.43	1000	7.90	8.61	240	20
alfasolar M6L60-245	37.58	30.55	1000	8.03	8.66	245	20
alfasolar M6L60-250	37.75	30.67	1000	8.16	8.71	250	20
alfasolar M6L60-255	37.92	30.79	1000	8.29	8.76	255	20
alfasolar M6L60-260	38.09	30.91	1000	8.42	8.81	260	20
alfasolar M6L60-265	38.26	31.03	1000	8.55	8.86	265	20
alfasolar M6L60-270	38.43	31.15	1000	8.68	8.91	270	20
alfasolar M6L60-275	38.60	31.27	1000	8.81	8.96	275	20

alfasolar P6L-modules

Model	Open Circuit Voltage at STC, (V dc)	Rated Voltage at STC, (V dc)	Maximum System Voltage, (V dc)	Rated Current at STC, (A dc)	Short Circuit Current at STC, (A dc)	Rated Max. Power at STC, (Watts)	Max. Series Fuse, (A)
alfasolar P6L36-130	21.67	17.23	1000	7.55	8.35	130	20
alfasolar P6L36-135	21.90	17.48	1000	7.73	8.46	135	20
alfasolar P6L36-140	22.13	17.73	1000	7.90	8.57	140	20
alfasolar P6L36-145	22.36	17.98	1000	8.07	8.68	145	20
alfasolar P6L36-150	22.59	18.23	1000	8.23	8.78	150	20
alfasolar P6L48-170	28.80	22.87	1000	7.44	8.30	170	20
alfasolar P6L48-175	29.03	23.12	1000	7.57	8.37	175	20
alfasolar P6L48-180	29.26	23.37	1000	7.71	8.44	180	20
alfasolar P6L48-185	29.49	23.62	1000	7.84	8.51	185	20
alfasolar P6L48-190	29.72	23.87	1000	7.96	8.58	190	20
alfasolar P6L48-195	29.95	24.12	1000	8.09	8.66	195	20
alfasolar P6L48-200	30.18	24.37	1000	8.21	8.74	200	20
alfasolar P6L54-190	32.28	25.59	1000	7.43	8.28	190	20
alfasolar P6L54-195	32.51	25.84	1000	7.55	8.35	195	20
alfasolar P6L54-200	32.74	26.09	1000	7.67	8.42	200	20
alfasolar P6L54-205	32.97	26.34	1000	7.79	8.49	205	20
alfasolar P6L54-210	33.20	26.59	1000	7.90	8.56	210	20
alfasolar P6L54-215	33.43	26.84	1000	8.02	8.63	215	20
alfasolar P6L54-220	33.66	27.09	1000	8.13	8.70	220	20
alfasolar P6L54-225	33.89	27.34	1000	8.23	8.77	225	20
alfasolar P6L60-210	35.89	28.45	1000	7.41	8.27	210	20
alfasolar P6L60-215	36.12	28.70	1000	7.51	8.33	215	20
alfasolar P6L60-220	36.35	28.95	1000	7.61	8.39	220	20
alfasolar P6L60-225	36.58	29.20	1000	7.71	8.45	225	20
alfasolar P6L60-230	36.81	29.45	1000	7.81	8.51	230	20
alfasolar P6L60-235	37.04	29.70	1000	7.92	8.57	235	20
alfasolar P6L60-240	37.27	29.95	1000	8.02	8.63	240	20
alfasolar P6L60-245	37.50	30.20	1000	8.12	8.69	245	20
alfasolar P6L60-250	37.73	30.45	1000	8.22	8.75	250	20