

## Installation guide

Photovoltaic module types:

IBC MonoSol xxx VL4, IBC MonoSol xxx CS4 Smart

IBC MonoSol xxx ZX4, IBC MonoSol xxx ZX4 Black

IBC MonoSol xxx ZX,

IBC PolySol xxx CS4, IBC PolySol xxx VL4,

IBC PolySol xxx ZX4, IBC PolySol xxx ZL4,

IBC PolySol xxx GX/GX4

As of: 12/01/2017

### **Safety, installation and instruction manual**

Corresponds to safety requirements in accordance with IEC 61730; not UL certified

### **ELECTRICAL SYSTEM – PLEASE CONTACT YOUR INSTALLER**

Photovoltaic modules (PV/solar modules) produce direct current under light irradiation. This installation guide contains important information on safety, installation and operation of the modules, which you need to know before using the modules.

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# 1. General information

With IBC SOLAR AG solar modules, you have purchased a high-quality product. To ensure that you can enjoy your new modules in the long term without restriction, please read this installation guide thoroughly and carefully and take note of all instructions before you start installing, wiring, operating, servicing or transporting the modules.

- Before you attempt to install, wire, operate or service the modules, please make sure that you have read and understood all the safety information in this installation guide.
- The solar modules must be installed and operated in accordance with the generally recognised technical regulations. During assembly, the relevant national guidelines on health and safety and accident prevention must be observed and adhered to. This particularly applies to work on the roof.
- Please observe all local, regional, national and international legal provisions, guidelines, standards and regulations, as well as the guidelines on work safety from the employer's liability insurance associations.
- Assembly, installation and initial operation can only be carried out by licensed and qualified professionals.
- Appropriate safety measures (e.g. fall protection devices) must be used for work on solar generators, particularly on roofs.
- The solar module must be checked for mechanical integrity before installation. Damaged solar modules (e.g. modules with broken glass or damage to the insulating foil on the back cannot be installed. Damage to the insulating foil on the back can have serious consequences (e.g. delamination, damage to health and danger of death).
- The modules then also produce voltage when they are not connected to an electric current or load resistor. Even with a light irradiation of only 5% of full sunlight, the modules produce almost full voltage. Current intensity and output increase with light intensity.
- The output power produced by the modules can be above the specified nominal power.
- The industry standard nominal values are calculated at 1000 W/m<sup>2</sup> radiation intensity and a 25 °C solar cell temperature. Colder temperatures can cause a sharp increase in voltage and power.
- Make sure that the modules are only exposed to ambient temperatures of -40° to +85 °C. The current intensity, voltage and resulting power produced by the module can increase as a result of reflection from snow, water or other reflective surfaces.
- Avoid focussing light and directing it onto the module. Even at the lowest level of illumination the full open circuit voltage of the modules is to be expected, i.e. caution must always be exercised during installation with regard to electrical faults e.g. short circuits.
- The modules are intended for operation solely in open air and on solid ground. They are not for operation/use in indoor spaces or on mobile products of any kind.

- They are also not designed for operation or use in hazardous areas. These include, in particular, installations where the modules may come into contact with saltwater or where they could be partially or fully immersed in freshwater or saltwater e.g. on boats or buoys. The distance to the coast must be minimum 500 m. (For distances less than 500m, please contact IBC SOLAR AG)
- Only use devices, connectors, cables and elevated installations which are suitable for use with photovoltaic systems.
- Please observe all safety measures and instructions for other components used.
- For even short-term storage of modules that are not connected together outdoors, modules that are placed with the glass side downwards must be covered. This prevents water collection on the module and protects exposed connectors from damage.
- For further information regarding the IBC MonoSol CS4 Smart module, please refer to the additional mounting instructions.

## 2. Safety instructions

In order to prevent injury or damage to the solar modules in all circumstances, **it is essential that you observe the following safety instructions.**

### 2.1 Important general information and standards

The entire PV system must be mounted according to the generally recognised technical regulations. Please observe the accident prevention regulations that are in force in the country where the solar modules are to be used.

Please observe all regulations and guidelines under public law during planning, erection, operation and maintenance of grid-connected PV plants including the following: national standards, technical connection conditions, accident prevention regulations, the relevant valid guidelines from the

association of property insurers, the trade guidelines of the roofing association (Fachregeln des Deutschen Dachdeckerhandwerks) and all other relevant general guidelines.

Changes that are not permitted and improper use of our components during installation and construction may result in any liability claim lapsing.



The solar modules are certified in accordance with IEC 61215 and IEC 61730 (protection class II)!

### 2.2 Safety guidelines for handling modules

- Always handle your solar modules with care to prevent damage. In particular, do not tread on the module. Do not let it drop and protect it from falling objects.
- Solar modules must not be kept or transported on the connection cable or socket.
- Use a glass suction cup to remove and transport a module or hold the module solely by the module frame. Transport the module vertically over longer distances.
- Take care not to damage or scratch the back of the modules and do not set a module down heavily on a surface. Take particular care when the module is on an edge.
- Do not disassemble, change or adapt the module or remove any IBC SOLAR AG fitted part or label without the consent of IBC SOLAR, otherwise guarantee claims will become invalid.
- Do not weld, drill or insert nails into the module frame. Do not drill holes into the glass surface of the module. If you do, your guarantee claim will expire. Do not apply paint or glue to the module.
- Never leave the module unsecured or without a bracket.

- Modules with a broken glass surface or a rip in the rear side foil are irreparably damaged and must not be used under any circumstances, as any contact with the module surface or elevation can cause an electric shock.

Broken or damaged modules must be handled carefully and disposed of properly. Broken glass can have sharp edges and cause injury if it is not handled using suitable protective equipment.

- Only work in a dry environment using dry tools. Only work with the modules when they are fully dry, unless you have suitable protective equipment.
- Do not stack the modules on top of one another to avoid damage.
- Protect the plug contacts from dirt as much as possible, or use appropriate cleaning measures on the contacts if they come into contact with dirt.
- Always wear gloves when installing modules to guarantee your own safety and to protect the modules from contamination (particularly for modules with ARC glass).

## 2.3 Safety measures during installation

- During installation, ensure that no children or unauthorised persons come near the system or modules. Do not carry out installation work if there are strong winds.
- Before installation, check connection sockets, cables and connectors for damage and dirt. Do not install damaged PV modules or PV modules with dirty connectors.
- If the modules are not installed at ground level, take the appropriate safety precautions and use suitable protective devices to avoid damage from falling modules and other safety risks.
- Photovoltaic modules do not have an on/off switch. They can only be taken out of operation by removing light irradiation. To do this, you should either cover the front surface with a towel, box or other fully opaque material or turn the front surface downwards on a smooth, flat surface.
- Disconnecting from direct current conductors can cause electric arcs. It is therefore essential that you disconnect the inverter from the alternating voltage grid before the start of any work on photovoltaic systems, particularly before disconnecting connectors in direct current circuits.
- If you work with modules that are exposed to light, please observe all legal requirements and regulations for working with electrical systems and live electrical equipment. Please also be aware that through the serial connection of modules the low voltage range (< 120 V DC) can be considerably exceeded. Please be particularly cautious.
- During installation and while the module is exposed to light, avoid touching the electric terminals or cable ends.
- The solar modules, particularly the connectors and tools, must be dry during installation.

- Do not wear any jewellery or accessories made of metal whilst performing mechanical or electrical installation work. Furthermore, do not insert electrically conducting parts into any of the sockets.
- Never interrupt electrical connections or pull out connectors while the circuit is live.
- Touching electrically charged module parts such as terminals can cause burns, sparks and electric shocks and can be fatal. This applies even if the module is not connected.
- Only use insulated tools and wear rubber gloves that are recommended for electrical installation work.
- Avoid loading the module cable mechanically, covering drainage holes or allowing water to run in the direction of the plug connectors.
- If necessary, please take suitable lightning protection measures in accordance with country-specific standards and regulations. If the building has a lightning protection system then the module frame and assembly system must be integrated into the external lightning protection and if necessary, surge protection devices should also be installed. Please get in touch with a lightning protection specialist for this.
- Please find out about fire protection guidelines and requirements for houses and buildings from the local authorities.
- Construction and mounting on roofs can affect the fire safety of a building. Any faults in these areas can be hazardous in case of fire.
- When mounting on the roof, modules should be installed on a fireproof coating (or surface) approved for this purpose.
- In some circumstances, components such as fault current protection switches, cutout switches and circuit breakers may be required.
- Do not use the modules close to devices or areas where gas is produced or can accumulate. Solar modules must not be installed close to highly flammable substances or vapours. Solar modules are not explosion-protected equipment.
- IBC SOLAR AG solar modules are classified as construction products as defined by the DIBt (German institute for building technology). The requirements from the current building regulation list (BRL) must be taken into account.

## 3. Installation

### 3.1 Electrical installation

- Take all necessary precautions during installation, operation and servicing of the modules to avoid electrical hazards.
- Make sure that all electrical connections are securely closed.
- If the direct voltage of the entire system exceeds 100 V, the installation, operation and maintenance must be performed by a licensed electrician, unless the local regulations for handling electrical systems specify otherwise.
- Contact with a direct voltage of 30 V or more is potentially dangerous.
- Do not use modules with different electrical or physical configurations within the same system. Only identical solar modules of the same type and performance class can be connected.
- The maximum open circuit voltage of the system must not exceed the maximum system voltage of the module.
- All IBC SOLAR AG modules are provided with connection cables and connectors ex-works. Thanks to their construction style, they can easily be installed in series.
- During assembly, beware of tensile force relief on the module connection cable.
- IBC SOLAR AG modules are equipped with Multi-Contact® type 4 clickable connectors. The PV module's connector plug can also be protected with the PV-SSH4 connecting safety locking clip available from Multi-Contact®. The factory installed solar connectors and connection cables must not be removed.
- The PV-SSH4 clip is not provided by IBC SOLAR AG and must be purchased separately. If the locking clip is installed, the PV module connector plug can only be unlocked with the PV-MS tool, which is also available from Multi-Contact®.
- During system cabling, please pay attention to the correct cross-sections and connections permitted for the maximum short-circuit current intensity of the module. The cable must have a minimum cross-section of 4mm<sup>2</sup> and the isolation must be permitted for the maximum system voltage.
- Only cables suitable for external assembly should be used for connecting module strings.
- The cables must be protected from damage.
- The socket, cable and connector must not be moistened or cleaned with oily, greasy or alcohol-based substances.
- Please ensure that you match the correct polarity of the cable and terminals when making connections. Otherwise there is a risk that the module will become damaged.



- If modules are connected in reverse polarity to a high voltage current source, e.g. a battery, this can destroy the bypass diodes. This breaks the entire module. Bypass diodes can only be changed and replaced by a specialist approved by IBC SOLAR AG.
- The nominal value of the overcurrent blocking device must not exceed the maximum value of the fuse specified on the back of the module.
- The module is fitted with pre-installed bypass diodes ex-works, which are inside the socket.
- The socket is not suitable for modifications during installation and must not be opened under any circumstances. If the socket is opened, the module guarantee will expire. If you suspect a module has electrical problems you should send it back to IBC SOLAR AG for inspection and, if necessary, repairs, in accordance with the IBC SOLAR AG guarantee conditions.
- In normal operation, it is likely that in certain conditions the current intensity and/or voltage produced by the PV module exceeds the values determined under standard test conditions. Therefore, the values specified on the modules for short-circuit current ( $I_{sc}$ ) and open circuit voltage ( $U_{oc}$ ) should be multiplied by a factor of 1.25 to calculate the components' nominal voltage, conductor capacities, fuse sizes and the size of the controls connected to the module output.
- The IBC SOLAR AG PolySol and MonoSol series modules are certified for application class A.
- Application class A certified modules can be used in systems that are operated with over 50 V direct current or 240 W in areas with general public access.
- Application class A modules that meet the IEC 61730 standard, will also meet the requirements for safety class II.

### 3.1.1 Maximum number of modules in series / parallel strings

- For a series connection of solar modules the individual voltage of each module is added to a total system voltage. The maximum number of PV modules that may be connected in a series string had to be calculated in accordance with applicable regulations in such way that the specified maximum system voltage of the PV module and all other electrical DC components will not be exceeded in open-circuit operation at the lowest temperature expected at the PV system is installed.
- The total system voltage must not under any circumstances exceed the maximum permitted input voltage of the inverter as this will damage it. Due to the negative temperature coefficients of the solar modules, the open circuit voltage of the whole system must also be calculated at the minimum permitted temperature (see data sheet).
- For example, if an inverter with a maximum input voltage of 1000 volts is used, then a maximum of 23 modules can be connected in series (IBC PolySol 250 MS). Make absolutely sure that the voltage range of your inverter is different from this. The specifications we have given in this context must be taken as examples. The total system voltage that results from the series connection of solar modules is calculated from the individual voltage of a solar module ( $V_{oc}$ ) at a temperature of  $-10\text{ }^{\circ}\text{C}$  and an irradiation strength of  $1000\text{ W/m}^2$  multiplied by the number of modules. For the case

the lowest expected temperature leads to a higher number of modules in one string, the user has the burden of proof that the specified system voltage of the PV module and all components will never be exceeded.

- For parallel module connection, always ensure that the same number of modules in the parallel strings to be connected are also connected in series and suitable precautions against over-voltage (e.g. string fuse) are taken.
- Please find the maximum number of parallel strings that can be connected without using overcurrent protection in series on the module-specific data sheet. If properly implemented and certified overcurrent protection is connected in series with each string, further strings can be operated above this maximum number.
- Please ensure that the specified capacity with regard to the reverse current is not exceeded

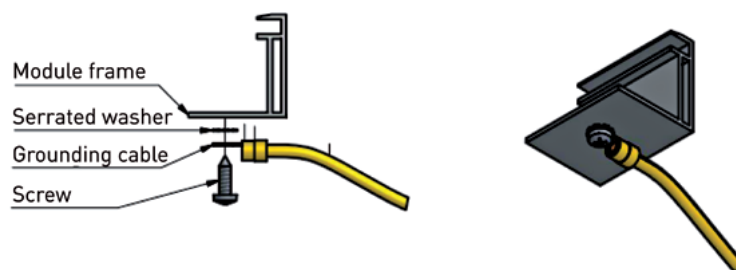


**Warning:**

The reverse current resistance of the modules depends on the type and can be found on the relevant data sheet. If the maximum value of the reverse current stated on the data sheet can be exceeded, each module or module row must be installed with a lawfully registered and certified overcurrent blocking device (fuse or current interruption) in series. The safety value of the modules can also be found on the data sheet!

## 3.2 Grounding

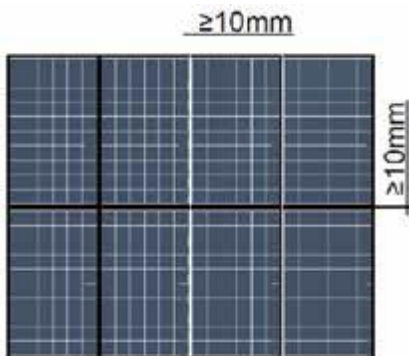
- Regional or national requirements may include an obligation to ground module frames. Grounding module frames may also be necessary for preventing lightning strikes/overvoltage.
- A grounding connection must be installed as per the regulations and standards accordingly. Please enquire about this before installation.
- Use stainless steel self-tapping screws with dimensions 4.8 × 16 for grounding. The anodisation of frame parts must be halted by using stainless steel self-tapping serrated washers.
- Use the grounding holes designed for this purpose. (Grounding holes marked on back of module frame)
- Do not make any further holes in the frame.



## 3.3 Mechanical installation

- The modules should be installed so that they are directly exposed to as much sunlight as possible with absolutely minimal shadows. Even partial shade can damage the solar modules, cause the PV generator to malfunction or lead to loss of power.
- The modules must be securely attached. To do this, use special elevated installations or assembly kits for use with photovoltaic systems.
- The modules must be installed with a minimum inclination angle of 5° in relation to horizontal. You should avoid inclination angles that are too low as dirt can collect on the glass surface and become trapped in the frame. Dirt accumulation on the module surface can cause shadowing on active solar cells, thereby reducing electrical power. Further information on the recommended minimum inclination angles is available from IBC SOLAR AG.

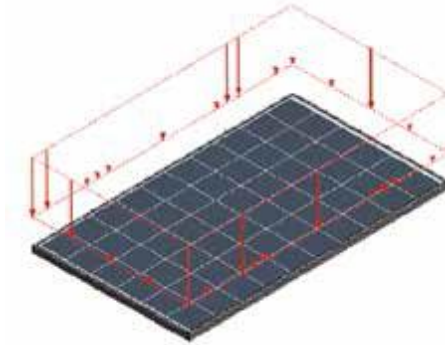
- All the modules in a photovoltaic generator must be adjusted to the same angle (both horizontally and vertically). Separate inverters are provided for angular deviations.
- During roof assembly, please ensure that you leave sufficient ventilation space underneath the modules for cooling of the reverse (minimum distance 70 mm).
- The distance between the individual modules must be at least 10 mm. To account for the thermal linear expansion of the module frame, IBC SOLAR AG recommends increasing the distance between two modules to 20 mm.



- Always ensure that the back of the module does not come into contact with foreign objects or structural elements, particularly if the module is mechanically loaded.
- IBC SOLAR AG permits several different assembly procedures. For detailed information on the permitted assembly procedures with the permitted clamping areas, please refer to the diagrams on page 13!
- When using the assembly holes, please make sure that you use the assembly holes in the clamping areas as standard. Assembly holes outside the clamping areas are for attaching additional items e.g. when there is high snow loads.
- If you want to use assembly procedures that are not described in the diagrams please contact IBC SOLAR AG for approval. Otherwise your guarantee and module certification will become invalid.
- Alongside the instructions in the installation manual, please always follow the installation instructions from the elevated installation manufacturer. In cases where the instructions from this manufacturer are stricter than the ones in this installation manual, they take priority.
- If the maximum permitted load specified by the mounting frame manufacturer is lower than the one in this installation manual, the maximum load given by the mounting frame manufacturer is always obligatory.
- Make sure that the modules are not loaded above the maximum load limit through wind or snow and that they are not exposed to excessive forces due to thermal expansion of the support structure. Secure the solar modules so that they all withstand expected loads and weather-related influences.

- The maximum loads apply to uniformly distributed load from wind or snow. Avoid assembling the modules in areas when there is a risk of sliding snow, icicles or ice formation. Possible snow loads should be calculated separately. If necessary, measures should be taken to prevent damage. Please note the IBC information sheet "Information on increased snow loads" for this.

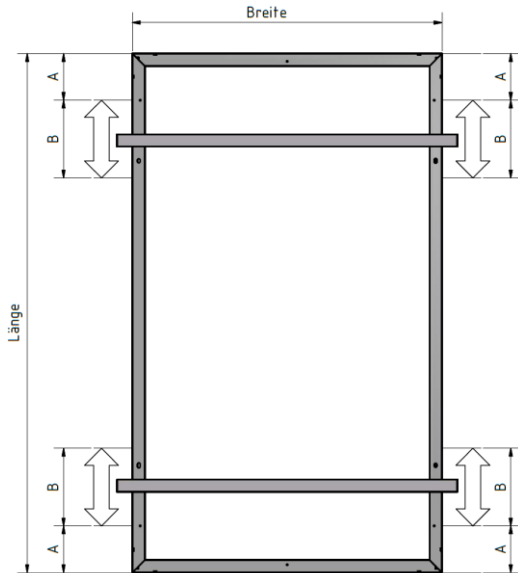
Max. 5,4 kN/m<sup>2</sup>



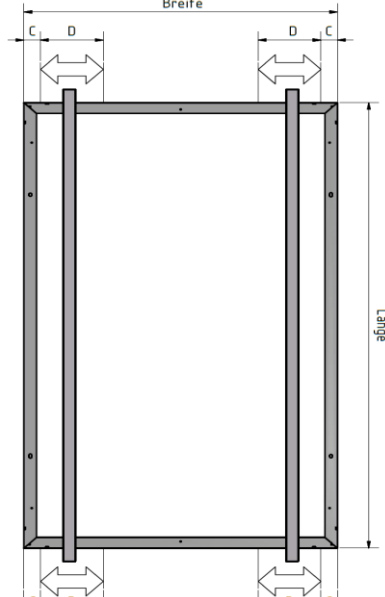
- The solar modules can be attached using clamps or alternatively directly on the assembly holes (position of assembly holes as shown on data sheet). If using assembly clamps, a surface pressure of 8.5–9.5 N/mm<sup>2</sup> must be maintained. We recommend using a clamp with 80 mm × 8 mm contact surface (IBC mounting clamp). The clamp screws (M8 A2-70) should be tightened to approx. 15 Nm. Please do not damage the modules whilst doing this and ensure a proper connection between clamp and module.
- Only use corrosion-free screws, nuts and washers during assembly.
- Sufficient lightning protection is recommended, particularly on exposed sites. Integration into any existing lightning protection must follow the relevant guidelines.
- Only mount solar modules upright with the socket facing upwards or transversely.
- On the elevation, please ensure that rainwater or condensation cannot run in the direction of the cable screw joints on the sockets.
- The solar module must not stand in backwater or condensation.
- The modules must be attached flush to the substructure, without tension, deformation and torsion, within the described clamping ranges.
- The clamping must be done symmetrically and at 4 points.

### 3.4 Assembly variants

**Clamping long side**



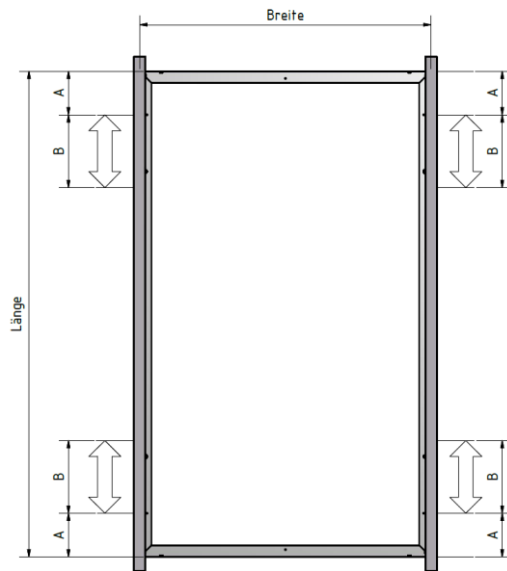
**Clamping short side**



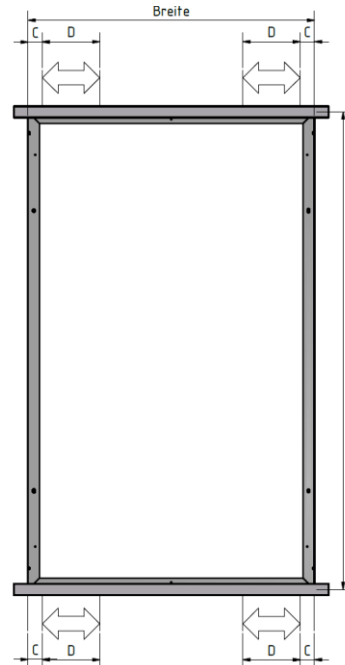
Module type	A	B	C	D
<b>PolySol ZL4/ZX4</b> <b>1640x992x40</b>	125 mm (max 5400Pa)	205 mm (max 5400Pa)	50 mm (max 2400Pa)	150 mm (max 2400Pa)
<b>PolySol GX/GX4</b> <b>1654x989x40</b>	215 mm (max 5400Pa)	200 mm (max 5400Pa)	0 mm (max 2400Pa)	247 mm (max 2400Pa)
	115 mm (max 4200Pa)	350 mm (max 4200Pa)		
	0 mm (max 2400Pa)	465 mm (max 2400Pa)		
<b>PolySol CS4</b> <b>1956x992x40</b>	250 mm (max 5400Pa)	350 mm (max 5400Pa)	50 mm (max 2400Pa)	190 mm (max 2400Pa)
<b>PolySol VL4</b> <b>1650x992x45</b>	150 mm (max 5400Pa)	330 mm (max 5400Pa)	50 mm (max 2400Pa)	190 mm (max 2400Pa)
<b>PolySol CS4</b> <b>1640x992x40</b>	210 mm (max 5400Pa)	330 mm (max 5400Pa)	50 mm (max 2400Pa)	190 mm (max 2400Pa)
<b>MonoSol ZX/ZX4/ZX4 Black</b> <b>1640x992x40</b>	125 mm (max 5400Pa)	205 mm (max 5400Pa)	50 mm (max 2400Pa)	150 mm (max 2400Pa)
<b>MonoSol CS4 Smart</b> <b>1640x992x40</b>	210 mm (max 5400Pa)	330 mm (max 5400Pa)	50 mm (max 2400Pa)	190 mm (max 2400Pa)
<b>MonoSol VL4</b> <b>1640x992x40</b>	150 mm (max 5400Pa)	330 mm (max 5400Pa)	50 mm (max 2400Pa)	190 mm (max 2400Pa)

## Insertion systems and Aerofix

### Long side



### short side



Module type	Long side	Short side	Aerofix
<b>PolySol ZL4/ZX4</b> 1640x992x40	permitted (max 2400Pa)	permitted (max 2400Pa)	permitted (max 2400Pa)
<b>PolySol GX/GX4</b> 1654x989x40	permitted (max 5400Pa)	permitted (max 2400Pa)	permitted (max 2400Pa)
<b>PolySol CS4</b> 1956x992x40	permitted (max 5400Pa)	permitted (max 2400Pa)	permitted (max 2400Pa)
<b>PolySol VL4</b> 1640x992x40	permitted (max 5400Pa)	permitted (max 2400Pa)	permitted (max 2400Pa)
<b>PolySol CS4</b> 1640x992x40	permitted (max 5400Pa)	permitted (max 2400Pa)	permitted (max 2400Pa)
<b>MonoSol ZX/ZX4/ZX4 Black</b> 1640x992x40	permitted (max 2400Pa)	permitted (max 2400Pa)	permitted (max 2400Pa)
<b>MonoSol CS4 Smart</b> 1640x992x40	permitted (max 5400Pa)	permitted (max 2400Pa)	permitted (max 2400Pa)
<b>MonoSol VL4</b> 1640x992x40	permitted (max 5400Pa)	permitted (max 2400Pa)	permitted (max 2400Pa)

## 4. Maintenance

- Regular maintenance of the modules is not necessary. However, it is recommended that you examine the modules regularly for any damage to the glass surface, rear side foil, frame, socket or external electrical connections. The electrical connections should be examined for loose connections and rust formation.
- PV modules operate efficiently even if they have never been washed. Nevertheless, the output power can be increased by removing dirt on the glass surface. Dust, dirt or other residue on the coated glass surface can be regularly washed away with water. Stubborn dirt on the coated glass can be removed with a microfibre cloth and a ph-neutral cleaning agent or with a commercial glass cleaner.
- On no account should the glass surface be treated with aggressive cleaning agents, abrasive cleaners or chemicals. Only use ph-neutral cleaning agents.
- Always wear rubber gloves whilst servicing, washing or cleaning the modules to insulate and protect yourself from electric shock.



## 5. Cleaning the modules

The glass surface of the modules normally cleans itself in rainwater. However, with for example a rather low roof inclination, it may be necessary to clean the modules. In this case, please follow the instructions below.

Do not clean the modules if there is a risk of frost or marked differences between the temperature of the module, air and water. Ideally, clean the solar modules in the early morning or late evening, at low irradiation levels and medium temperatures. Avoid cleaning the modules on hot sunny days, in the middle of the day or when there is high irradiation levels and high temperatures. The module temperature should be between 10° and 30 °C.

Use the following cleaning items:

- Soft cloth
- Cleaning rags or cloths
- Squeegee
- Commercial glass cleaner (with low alcohol concentration)
- Unconcentrated, PH-neutral cleaner
- Water and mild soap

Avoid the following cleaning items:

- Wire brushes, steel wool or sharp-edged tools that could scratch the glass
- High-pressure washers
- Cleaning agents with ammonia or other alkaline products
- Abrasive cleaning agents
- Solvents such as petrol, acetone, highly concentrated alcohol or organic compounds
- Any sort of polishing paste such as polish for metals or cars

## 6. Transport and storage

- Do not set a module down heavily on a surface. Take particular care when the module is on an edge.
- During transport and storage, ensure that each solar module is sufficiently supported.
- Use a glass suction cup to remove and transport a module or hold the module solely by the module frame. Transport the module vertically over longer distances.
- The modules should not be held or transported by a single section of the frame.
- Under no circumstances should you lift or move the module using the connection cables or socket.
- Do not let the module drop.
- Do not place any objects on the modules.
- Do not handle the modules using pointed objects.

When setting down or transporting individual modules directly to the assembly site (e.g. roof), avoid damaging them in any way.

## 7. Disposal

Faulty or old solar modules must be disposed of correctly. They should not be disposed of with household waste but according to the valid disposal regulations for electronic scrap.



## 8. Disclaimer

IBC SOLAR AG does not control the use of this safety, installation and instruction manual or the conditions and procedures for installing, operating, using and maintaining the modules. Therefore, IBC SOLAR AG does not accept any responsibility for loss, damage, injury or costs that may occur during installation, operation, use and maintenance of the modules or in relation to this and expressly rejects any liability for cases of this sort. IBC SOLAR AG does not accept any responsibility for patent infringements or other infringements from third parties that may be caused through the use of the modules. "Use" does not include implicit or other licensing under any patent or Patent Act. The information in this manual is based on the knowledge and experience of IBC SOLAR AG and is considered to be reliable. However, information, product specifications (without restriction) and suggestions have neither the explicit or implicit nature of a guarantee. IBC SOLAR AG reserves the right to make changes to products, specifications or this manual without prior notice.



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