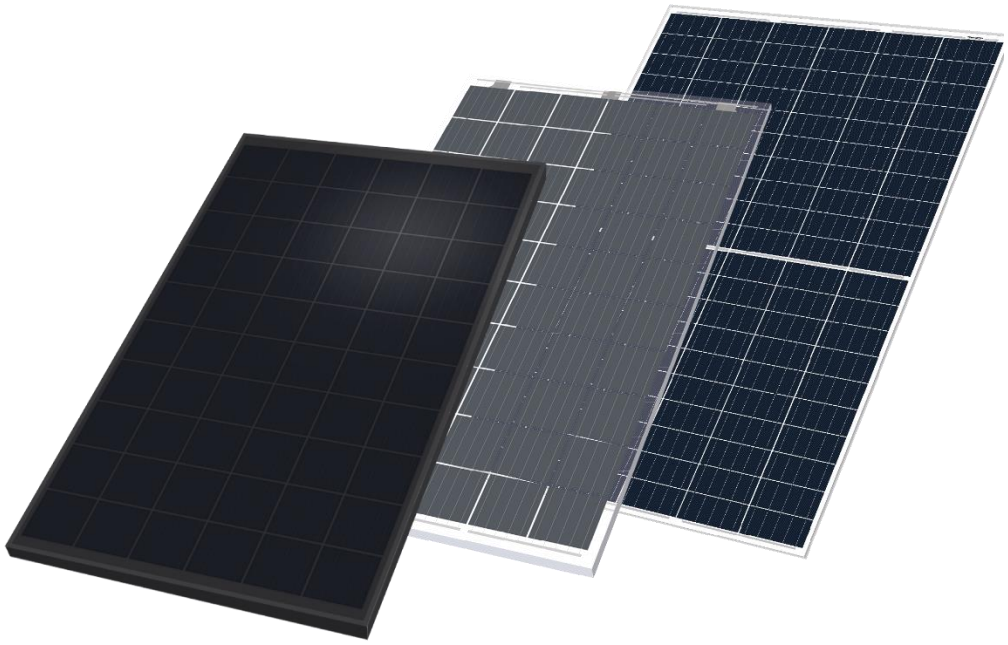
KIOTO SOLAR

Eine Marke von SONNENKRAFT

PHOTOVOLTAIC MODULES

Installation manual



Power-60 (-Standard, -MAXIM, -ALPIN); Glas-60 (with/without frame); Project-60 halfcut

Contents

Please read these installation instructions carefully before installing the photovoltaic modules. The non – observance could lead to damage to persons and / or goods. Further the guarantee and the product warranty could expire. The installation of photovoltaic modules requires technical knowledge; therefore, this must be done by skilled and qualified persons!

The general handling of the product, the using and the exact installation are beyond the control area of KIOTO Photovoltaics GmbH. Therefore, KIOTO cannot take responsibility for any damage, loss or cost which is caused by inappropriate installation, inappropriate handling of the product or wrong use!

General module handling

- Do not open or demount the module.
- Do not remove any parts from the module.
- Do not remove or damage any product markings.
- Do not stand or step on a module to prevent the risk of injury and damage to the module.
- Do not drop the module.
- Avoid any form of external force exposure.
- Do not expose the module, especially the module backside to any lacquer, paint, glue, chemicals or other abrasive liquids.
- Do not handle the module at the junction box.
- Do not pull the module connection cables by forces.
- Do not drill any holes in the framework or other components of the module.
- Do not interfere with the internal electrical connection of the module. Contact your photovoltaic retailer if problems occur.
- Please consider the maximum system voltage.
- Never align simulated sunlight on the module or parts of the module.
- Observe the mounting and installation instructions of other used components.
- Prior to the installation of the modules, please contact the appropriate authorities to determine the necessary requirements regarding installation, approval and inspection.

Product marking, product label

- The product label is placed on the backside of the module and contains all required important electrical and product specific values. The information on the label relates to EN 50380:2003 and Standard Test Conditions (1000W/m² - 25°C – AM 1,5).
- Electrical and mechanical characteristics can be taken from the current data sheets. These are available in the download area at www.kiotosolar.com.

The product label must not be damaged or removed – otherwise the guarantee and product warranty will be invalidated!

Technical data

Module series: KPV ME NEC – 320/325/330/340/380Wp
KPV GME/GML (framed/unframed) NEC – 310/360Wp

- These modules are configured for use in DC systems.

- The use of the modules relates to class A: dangerous voltage (IEC 61730: higher than 50V DC, EN 61730: higher than 120V), dangerous power applications (higher than 240W) which are general accessible, according to EN IEC 61730 -1 and -2. Protection class II regulations are also fulfilled.
- Maximum reverse over current verified according to IEC 61730 -2, MST 26 of the module: 15A.
- The Current rating of the diodes is 16A according to the manufacturer's specifications. Under open field conditions, photovoltaic modules can produce voltages and/or currents that are higher than specified on the nameplate. To consider this in the rating dimensioning of other system components (e.g. electrical lines, electrical fuse, …) that are directly connected to the PV generator, the Isc and Uoc values should be multiplied by the safety factor 1.25 or designed by a specialist.
- The permissible ambient temperature range for operation and storage is -40 ° C to + 85 ° C.

Safety and installation instructions for mounting

Consider general health and safety regulations relating to mounting equipment on roofs and/or buildings. Secure the modules, so that they cannot fall down during mounting and in further operation. Take care and consider the wind and snow load figures for the affected area. In addition, observe the following:

Electrically

The following should provide a basis to avoid fire, formation of sparks and deadly electrical shock; Therefore, they have to be followed stringently. Remember, in de – energized state, high contact voltage could occur and / or deadly electric arc can be generated. Cover the single module with a lightproof material during the mounting process.

Modules generate electricity as soon as they are exposed to any kind of light. This is unrelated to whether the module has already been connected or not. So voltage may occur which can be fatal in some circumstances!

- Never install damaged photovoltaic modules.
- Never touch cable heads (especially exposed ones) during the mounting, especially when the module is exposed to light or sunlight.
- The tools used for mounting should be approved, isolated and voltage proofed (according to system voltage).
- Do not bring electrically conducting parts (not isolated tools, jewellery or others) in contact with the photovoltaic module, the cable heads or the electrical plugs during the mounting. Conductive objects include uninsulated tools, jewelry or other conductive materials.
- In case of a roof mounting, additional installations like fuses, DC disconnectors, earth fault detection etc. may be necessary. In this case, please contact the appropriate specialists before installation.
- Never use the photovoltaic modules near or in rooms, where flammable liquids or gases are stored or where theses liquids or gases could escape.
- When modules are connected in serial, only modules with the same current should be used. When you are using a parallel connection, only modules with the same voltage should be used. Never operate the modules with a higher voltage than the maximum system voltage.
- The maximum allowed number of modules used in a serial connection is an outcome of the maximum input voltage / maximum input current of the used inverters / charge regulators, the

used module type and the local temperature conditions. The maximum system voltage must not be exceeded!
- The maximum reverse over current is 15A. When connecting more than two strings in parallel this value could be exceeded. Therefore, string fuses with a rating of maximum 15A have to be installed.
- Only modules with the same configuration may be used within a system.

Mechanically

- Mounting works must be done when the environment and tools are dry.
- Clean gloves must be worn while any transport and installation work to avoid soiling of the solar glass, which is equipped with a special anti-reflection coating.
- Make sure that the module meets the system compatibility and the requirements of the mounting system and that the system compatibility is given.
- No sharp objects may be mounted under the module, as the module could bend under load.
- The first row of modules must be secured against slipping with safety hooks.
- Do not use the junction box as a handle.
- Consider local factors for example wind force, wind speed and snow load. Calculate these values with a security factor, before mounting the modules. In special cases, a static calculation must be undertaken. KIOTO modules are designed and tested to resist a suction force (e.g. wind) of maximum 2400 Pa and a static pressure force/load (e.g. snow) of maximum 5400 Pa, provided that they are mounted according to the specified points of application.
- Ensure that there is adequate ventilation behind the modules.
- To generate optimal output of the photovoltaic generator, consider the perfect alignment and mounting angle of the photovoltaic modules.
- Shadowing of the modules leads to loss of output. Therefore, take care that there is no shadowing on the photovoltaic array over the whole year.
- Never mount KIOTO modules in areas where abnormal (aggressive) conditions can occur.
- If modules are installed on farm buildings, the products shall not be used as a roof replacement. A minimum distance of 1,5 m to roof and ventilations openings has to be observed.
- When the modules are mounted on-roof, ensure that the roofs are fire resistant or that an appropriate fire protection layer, designed for this use, is installed. In case of fire, never extinguish with water! Inappropriate installation could also lead to hazard in case of fire.
- Incorrect installation can lead to a fire hazard.
- The PV – module is an equipment which is not protected against explosion. Therefore, the modules must not be installed near flammable gases and liquids (e.g. gasoline stations, gas tanks, colour spraying plants etc.).
- The PV module must not be installed next to naked flames and flammable materials.
- Unless explicitly marked, the PV module is not a laminated safety glass (LSG) component.
- Please also observe all safety instructions of the other components used.
- Make sure that other mechanical system components cannot have a harmful effect on the modules.

Advices double glass modules without frame

- KIOTO double glass modules are containing bifacial cells that allow a higher yield through reflection on the bottom side. If possible, make sure to minimize shading on the backside.

- Any technical advice in verbal or written form or in any other way, is given on the basis of the actual knowledge, but without any warranty and / or liability.
- A project-related, static dimensioning and the glass-technically correct use of the glasses is not carried out or checked by us. This is the responsibility of the system installer.
- Special technical designs or special constructions may be subject to official approval. It is the responsibility of the customer or the building owner to obtain such approval. Resulting changes in design or additional services, in particular tests and calculation proofs, are at the expense of the customer.

Fixing points of the KIOTO modules

Detailed information about the mounting (clamping range) and the load limits can be found in the following file: "KIOTO_Mounting_matrix_2021".

To resist the named snow and wind loads, the marked distances must be followed when mounting. In case of a longitudinal mounting, the specified mounting points must also be adhered to. If this is not possible because of the substructure, a crossbar system must be used!

For standard mounting of **modules with frame**, the modules must be securely fastened with continuous support profiles at least 4 points.
The PV modules can only be attached to the substructure by clamping from the front. The clamping area must be at least 400 mm² per fastening point. Use a torque wrench for assembly. The tightening torque for an M8 screw made of V2A is 20Nm. Use suitable, corrosion-proof fastening material.

When assembling **modules without frame**, they must be clamped with laminate clamps. The minimum length for these laminate clamps is 100mm. We generally recommend vertically mounted laminate modules to be secured against sliding out of the laminate clamps with a slip protection when clamping on the long module side. The tightening torque of the laminate clamps can be found in the data sheet of the clamp manufacturer.

Electrical connection of the photovoltaic generator

- At high direct current voltages, as can occur in serial connections, the risk of short circuits and electric arcs is higher. To avoid this, always use an adequate cross section for cables and connectors, which are approved for the maximum specified value of open circuit voltage.
- KIOTO modules are equipped with the following junction boxes and plugs:

Modul series	**Plug system**
Power-60 Power-60-ALPIN Power-60-MAXIM Glas-60 framed Glas-60 unframed	Stäubli MC4
Project-60 340Wp halfcut	MC4 — compatible connecting system 4 mm²
Project-60 380Wp halfcut	Stäubli MC4 EVO2

- The used solar cable is a 4mm² insulated, weatherproof and UV-resistant product.

- KIOTO modules are equipped with the following cable lengths:

Modul series	Cable length
Power-60 Power-60-ALPIN Power-60-MAXIM Glas-60 framed Project-60 340Wp halfcut	2x 1000mm
Project-60 380Wp halfcut	2x 1150mm
Glas-60 unframed	2x 350mm

- At strong currents, as can occur in parallel connections, the risk of warming of the connections is higher. To avoid this risk, use an adequate sizing of the cross section.
- The solar cables must be approved for the possible maximum short circuit current.
- Make sure that other electrical system components may have no adverse effect on the modules.

Detailed information about the connection technique, solar cable and connectors/plugs

- Only use cables and connectors/plugs which are approved and tested for photovoltaic applications.
- The choice of cables for the use in the photovoltaic generator must be based on sizing by a skilled person. Cables with a cross section from 4mm² to 6mm² are recommended. The optimum cross section should be determined by the maximum short circuit voltage and the complete length of the wiring (line voltage drop).
- Only use high quality cables to assure a failure – free operating. Ensure good isolation and whether/UV-durability of the cables.
- The rated voltage of the solar cable must be 1000V minimum.
- If possible, use flexible cables to ensure consistency against movements, wind etc. This will make the laying of the cables easier (please find detailed information in the next clause).
- Only use tools which are approved for cutting, isolating etc. of the cables or employ qualified persons/staff.
- Only use connectors / plugs which are approved and tested for photovoltaic applications.
- Only plug in the connectors when dry and clean. Make sure that they are properly connected.
- The connector system is fully latched only when the snap arm is fully obvious in the inspection window. Take care of the clearance.
- When disconnecting the connector, open the lock with the opening tool and pull the connector apart.
- For information about the compatible cables, please refer to the respective connector system manufacturer.
- Further information about the plugs/connectors can be found in the manufacturer's documents:
  - Stäubli Electrical Connectors MC4: MA231
  - Stäubli Electrical Connectors MC4 EVO2: MA273

Safety note: DO NOT disconnect the plugs/connectors under load! NEVER disconnect when the system is in operation! Non-compliance is FATAL. You will find the safety note also printed on the photovoltaic module product label and on the system plugs.

Laying of the solar cables

- Keep the length of cable connections as short as possible, to optimize the energy yield and minimize sources of errors. Consider this point while planning and sizing the generator.
- Fix loose solar cables after mounting to avoid damaging. Use only adequate fixing material (conduits in the mounting profiles or UV–resistant plastic tubes).
- Take care while handling the cables to avoid damaging, especially at low temperatures.
- The cables should not be bent or folded in an extreme way. Where possible use flexible cables. Please follow supplier instructions.
- Use conduits for laying and fixing of the cables.
- To avoid voltages from indirect lightning strikes, lay the feed line and return line very close to each other.
- Always consider the polarity.
- The cables must not lie between the mounting profiles and module backside to avoid damaging the module, especially under heavy mechanical load.

Electrical connection

- The modules must be covered with a light resistant material during the complete mounting process.
- Avoid damaging the module and those cables.
- Execute the system grounding according to national and international standards.
- Sizing of inverters should be done upfront. The installation has to be done by qualified persons to ensure an optimized energy yield.
- For safety reasons and to minimize maintenance works, a DC disconnector should be installed between the generator and the inverter. This could also be obligatory by law.

Connection of the module to a grounding system

- The photovoltaic modules can be grounded as follows:

Modul series	**Possibility to connect the grounding to the frame**
Power-60 Power-MAXIM	On the bottom side of the module frame, in the area of the plastic corner connector - Earthing sign on the corner connector
Power-ALPIN Glas-60 framed Project-60 Project-60 halfcut	On the bottom side of the module frame - Earthing sign on the frame

- The adequately sized grounding cable must be connected with a stainless steel (A2) ISO 7981 screw (3,9x 6,5mm) with a form C rounded head with two fan shaped washers (on the outside and inside of the eyelet). The assembly from the outside to the inside should be: screw head – fan shaped washer – eyelet – fan shaped washer – frame.
- For the professional grounding of the complete photovoltaic system the installer is responsible. If a grounding system is already in use at the affected building, the photovoltaic generator has to be integrated in this protection system against direct lightning strikes. National standards have to be considered and executed.
- The modules must be earthed through the provided holes on the frame of the module or in a proper manner through other electrically conductive materials, such as the supporting structure. This may only be performed by a qualified specialist.

Commissioning of the photovoltaic power plant

Before initiation of the generator, please check all components (observe the installation instructions of other components), the electrical connection and all plugs, that they are connected correctly and ensure that the connection is tight.

Solar generators with a direct current voltage from more than 50V must be installed/initiated by qualified persons!

The open circuit voltage of every serial connection should be checked after initiation. Follow the rule: Result of the measurement = sum of the open circuit voltages of the single modules. Consider the actual time, sun irradiation, shadowing and other factors while measuring the open circuit voltage, otherwise the result of the sum and the single results could deviate considerably.

Maintenance

- Soiling on the module surface can lead to a reduction in performance.
- Clean the modules as required and soiled with plenty of water and a soft cloth or sponge without any detergent. Do not use high pressure cleaners!
- If other additives or devices like aggressive chemicals, scrubbing agents, sharp blades or steel wool are used the guarantee and product warranty will be invalid! Never wipe off or scrape off pollution in a dry state of the module surface.
- An additional application of water / dirt resistant coatings can affect the efficiency of the modules and also the yield, in a negative way.
- Check the module wiring and the single module plugs to ensure they are clean, corrosion free, mechanically ok and tight in regular intervals.

ATTENTION: Never disconnect the plugs under load!

- Free the modules, if necessary, from high snow loads.
- Check the substructure in regular intervals for their tightness.
- Never try to open or repair parts of the module or of the junction box on your own.
- All other trouble shootings, repairing and maintenance works must be done by qualified, skilled staff/persons.

For further information relating to warranties etc. please read through the GENERAL TERMS AND CONDITIONS of KIOTO Photovoltaics GmbH.

Eine Marke von

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