

KORAX SOLAR

General installation guide for Korax Solar photovoltaic modules



INTRODUCTION

This guide contains application and safety information with which you should be familiar before using your Korax Solar photovoltaic module. Your authorized Korax Solar distributor or dealer can provide additional sizing and system design information if necessary.

The information in this guide is based on Korax solar knowledge and experience and is believed to be reliable, but such information including product specifications and suggestions do not constitute a warranty, expressed or implied. Korax solar reserves the right to make changes to the product specifications, or guide without prior notice.

GENERAL INFORMATION

The installation of modules requires a great degree of skills and should (if DC voltage exceeds 100 V then must) only be performed by qualified licensed professional, including licensed contractors and licensed electricians. The installer assumes the risk of all injury that might occur during installation, including the risk of electrical shock.

Korax Solar photovoltaic modules do not require the use of special cable assemblies. All modules come with a permanently attached junction box that will accept a variety of wiring applications or with a special cable assembly for ease of installation.

It is recommended to utilize qualified installer or reseller for service.

WARNING

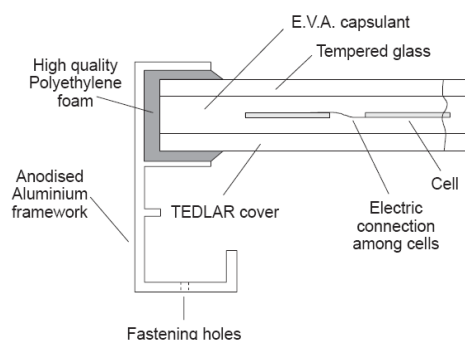
All instructions should be read and understood before attempting to install, wire, operate, and maintain the module. Contact with electrically active parts of the module such as terminals can result in burns, sparks, and lethal shock whether the module is connected or disconnected.

Modules produce electricity when sunlight or other sources illuminate the module is not considered a shock hazard. When modules are connected in series, voltages are additive. When modules are connected in parallel, current is additive. Consequently, a multi module system can produce high voltages and current, which constitute an increased hazard and could cause serious injury or death.

TECHNICAL INFORMATION

The Korax Solar photovoltaic modules use high efficiency pseudo-square monocrystalline (or square polycrystalline) silicon cells to turn solar radiation energy into direct current electric current. The cell circuit is laminated using ethylene-vinyl acetate (EVA) as a capsulant, in an assembly formed by a tempered glass at its front and plastic polymer (Tedlar) at the rear, which provides resistance against environmental agents and electric insulation.

The laminate fits into an anodised aluminium structure. The IP-65 protected terminal boxes are made from temperature resistant plastic and contains terminals, connection terminals and protection diodes (by-pass diodes). The frame has several fastening holes for securing the module to the support structure and its earthing, if necessary.



Section of a photovoltaic module.

The electrical values are obtained under standard testing conditions (STC) which correspond to a 1000 W/m² irradiance, 1,5 AM (air-mass) spectrum and 25 °C cell temperature. However, the actual working conditions of the modules, once they are installed may be different from the laboratory conditions. Therefore it is advisable to check out the actual local conditions in order to carry out the pertinent corrections in calculation.

Under actual conditions, a photovoltaic module may experience higher than standard illumination and produce more current and voltage than reported at STC conditions. Accordingly the values of I_{sc} and V_{oc} should be multiplied by a factor of 1.25 when determining the voltage ratings, conductor capacities, fuse sizes, and sizes of controls connected to the module output.

Protection diodes

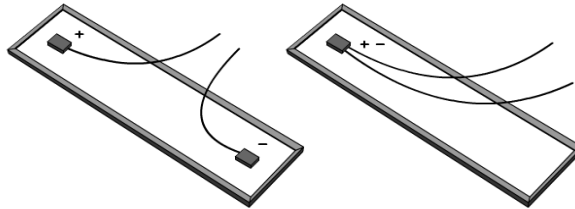
The shading of a cell may give rise to a reverse voltage in the cell. This cell would, therefore consume power generated by the other cells in series and an unwanted heating of the shaded cell may occur. This effect, called hot point effect, will be highest at highest incident radiation on the rest of the cells, and in an extreme case the cell could break up due to over-heating.

The use of protection or by-pass diodes reduces the risk of the shaded cells heating up by limiting the current, which can run through them and in this way preventing their breakage.

In general, modules made by Korax Solar with 24 or more cells in series are supplied with protection diodes, which are located in the connection boxes.

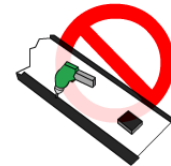
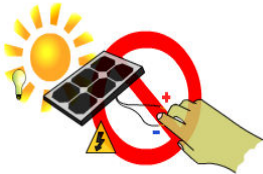
Connection Boxes

The connection boxes of the modules are located at the rear side of the modules. As specified earlier, they are made of a durable (polycarbonate) plastic, having a leak tight cover, providing IP-65 safety. The polarity of cable connection marked on the top of the boxes. Normally the modules come without cabling. The standard Korax Solars cabling system (on request) includes a 400 mm long positive and a 700 mm (for KS-75 family) or 1000 mm (for KS-150 family) negative cable. The Korax Solar standard cable is double insulated, flexible, the upper layer is UV resistant. The standard cross section of the cables are 4 mm². The sealing in the cable glands can host of maximum 6.5 mm OD cable. The polarity of connections must be respected during the assembly.



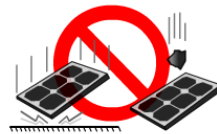
CAUTIONS

- Avoid electrical hazards when installing, wiring, operating and maintaining the module.
- A module generates DC electricity when exposed to sunlight or other light sources.
- It is recommended that the module remains packed in the box until time of installation.
- Do not touch the terminals while module is exposed to light or during installation. Provide suitable guards to prevent contact with 30 VDC or greater. Use properly insulated tools only.
- Do not stand or step on the module.
- Do not drill holes into module frame as it will void warranty.



- When installing or working with module or wiring, cover module face completely with opaque material to halt production of electricity.

- Do not drop the module or allow objects to fall on module.



- Avoid sharp edges.



- Work only under dry conditions, with a dry module and tools.

- Never leave a module unsupported or unsecured. If a module should fall, the glass can break. A module with broken glass cannot be repaired and must not be used.

- Do not artificially concentrate sunlight on the module.

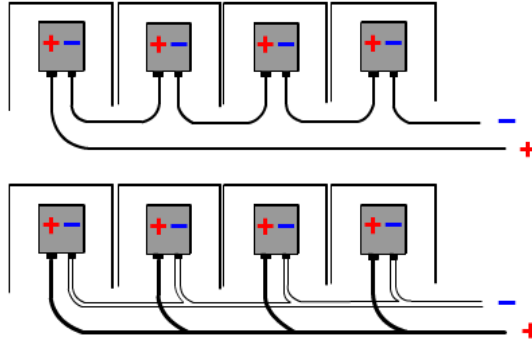


- Module installation and operation should be performed by qualified personnel only. Children should not be allowed near the solar electric installation.
- If not otherwise specified, it is recommended that requirements of the local, national or regional electrical codes be followed.
- Use module for its intended function only.
- Do not disassemble the module, or remove any part or label installed by manufacturer.

INSTALLATION

Series and parallel wiring

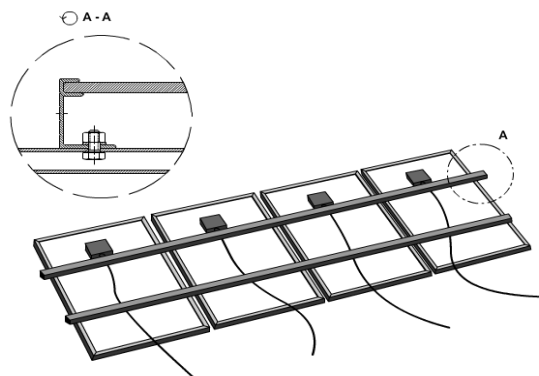
Modules can be wired in series to increase voltage. Connect wire from the positive terminal of one module to the negative terminal of the next module. The first illustration shows four modules connected in series. Installer should consider the maximum allowed system voltage in case of connecting modules in series. Take also care of connecting in series strictly only modules of the same type (the current at the maximum power point must be the same).



Connect modules in parallel to increase current. Connect wires from the positive terminal of one module to the positive terminal of the next module. The second illustration shows four modules connected in parallel.

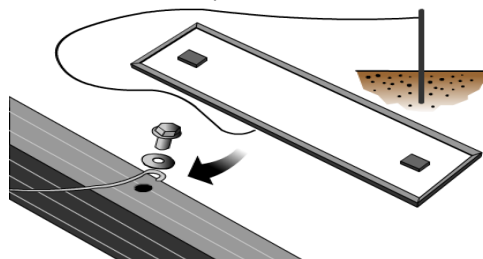
It is recommended that paralleling modules be performed using an external junction box. Installer should also keep in its mind that the current values are additive in parallel connection and the common wire cross section must be chosen according to local regulations and standards. When cabling a system of several modules installer should ensure that the voltage drop on the main conductor does not exceed 2 % of the nominal voltage.

There are many types of mounting system used to install Korax Solar modules. The mounting structure must withstand all snow and wind forces. Module mounting holes are provided for easy installation and proper mechanical loading. Contact your local dealer for information regarding mounting structures and special mounting profiles for modules. This illustration shows one possibility to mounting some modules.



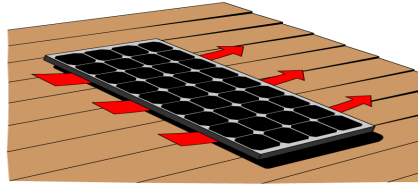
Grounding

Module frames should be connected to an earth for safety and protection from lightning. Korax Solar modules have a hole on the frame marked with symbol □ for connecting the earthing cable. If the support structure is a conductor, the metallic contact between the frame and the structure must be ensured during the assembly of the modules. In that case the supporting structure must be earthed according to the local regulations. Should the support structure be made of non-conducting material it is recommended that the earth conductors from the individual modules be connected to a common earthing terminal (bus conductor) so that removal of any module does not interrupt the earth connection of the remaining modules.



Air Circulation

Sufficient clearance between the module frame and the mounting surface is required to allow cooling air to circulate around the back of the module. This also allows any condensation or moisture to dissipate.



MAINTENANCE OF THE PHOTOVOLTAIC MODULES

Photovoltaic modules requiring very little maintenance due to their own design, with no moving parts and with an interior cell circuit soldering isolated from the environment by protecting materials. At the same time the quality control performed by Korax Solar is very strict.

Maintenance may include one or several of the following steps:

- Regular cleaning of the module
- Visual inspection of possible internal degradation of the module sealing
- Check out of the condition of electric connectors and wiring
- Occasionally, checking out the electrical characteristics of the module

Regular cleaning of the modules

Dirt piled up on the transparent surface of the module reduces its performance and may cause reversal effects similar to those caused by shadows. The layers of dust that reduce evenly the sun intensity are not dangerous and power reduction is not usually significant. In many cases the rainfall can reduce or remove the dirt to an acceptable level.

The spot dirt is advisable to remove by occasional cleaning by washing the modules with water or some nonabrasive detergent.

Visual inspection of the module

The aim of the visual inspection of the modules is to detect the possible faults, like broken glass and/or corrosion of the circuits elements, mostly due to humidity leakage at the damaged insulation spots or glass breakage. Consult your area dealer or Korax Solar in case of serious damage.

Check out the connections and cabling

The regular check-out of connections tightness and cable conditions considered as a preventive maintenance step.

SPECIFICATIONS/PRODUCT OVERVIEW

| PHYSICAL AND ELECTRICAL CHARACTERISTICS | | | | |
|---|--|-----------------------|----------------------|----------------------|
| | KS-90 | KS-180 | KS-180L | KS-240 |
| PHYSICAL | | | | |
| Dimensions | 1224 x 545 x 39.5 mm | 1224 x 1047 x 39.5 mm | 1600 x 800 x 39.5 mm | 1657 x 977 x 39.5 mm |
| Weight | 9 kg | 15 kg | 15 kg | 19 kg |
| Number of cells | 36 | 72 | 72 | 60 |
| Size of cells | 5" | 5" | 5" | 6" |
| ELECTRICAL (1000 W/m², 25°C cell, AM 1.5) | | | | |
| Nominal voltage (V _n) | 12 V | 24 V | 24 V | 24 V |
| Maximum power (P _{max}) | 90 Wp | 180 Wp | 180 Wp | 240 Wp |
| Short-circuit current (I _{sc}) | 5,23 A | 5,23 A | 5,23 A | 8,39 A |
| Open circuit voltage (V _{oc}) | 21,7 V | 43,42 V | 43,42 V | 37,44 V |
| Maximum power current (I _{max}) | 4,90 A | 4,90 A | 4,90 A | 7,88 A |
| Maximum power voltage (V _{max}) | 18,61 V | 37,25 V | 37,25 V | 31,2 V |
| DESIGN | | | | |
| Cells | Monocrystalline Si, textured and covered with antireflection layer | | | |
| Contacts | Redundant contacts on each cell for circuit reliability | | | |
| Laminate | EVA (Ethylene-vinyl acetate) | | | |
| Front face | Tempered glass with improved light transmission | | | |
| Rear face | Tough multilayered backsheets Tedlar | | | |
| Frame | Anodised aluminium | | | |
| Connection boxes | IP 65 with built-in bypass diode | | | |
| Cable cross section | 4 mm ² | | | |
| Connection box | Pression screw with possibility of soldering, MC optional | | | |

PHYSICAL AND ELECTRICAL CHARACTERISTICS