Installation and Operation Guide

Crystalline Solar Modules

Bosch Solar Module c-Si M 60 IN30125

BOSCH

en Operating instructions

Issue 01/2013

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1 Introduction

This manual contains information regarding installation, operation, maintenance and safety handling of Bosch Solar Energy AG photovoltaic modules. Before installation or using the PV modules, it is important to read this manual and understand the instructions carefully.

2 Disclaimer of liability

Since the use of this Installation, Operation and Maintenance Manual and the conditions of installation, operation, use and maintenance of the module are beyond Bosch Solar Energy AG control, Bosch Solar Energy AG does not assume responsibility and expressly disclaims liability for loss, damage, injury or expense arising out of or in anyway connected with such installation, operation, use or maintenance of the module.

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The information in this Manual is based on Bosch Solar Energy AG knowledge and experience and is believed to be reliable; but such information including product specifications (without limitations) and suggestions do not constitute a warranty, expressed or implied. Bosch Solar Energy AG reserves the right to make changes to the product, specifications or this manual without prior notice.

3 General information

The installation of solar PV modules requires a great degree of skill and DC voltage exceeds 100 V, it only be performed by a qualified licensed professional, including, without limitation, licensed contractors and licensed electricians. The installer assumes the risk of all injury that might occur during installation, including without limitation, the risk of electric shock.

Important Notice!

For your safety and the safety of others, please read the entire Installation, Operation and Maintenance Manual carefully prior to installing, wiring, operating and performing maintenance of PV modules. Also, carefully read the Module Data Sheet provided with this product. Determine local permits, installation and inspection requirements before installing module(s). If not otherwise specified, it is recommended that the requirements of the U.S. National Electric Code (NEC) be followed.

This photovoltaic module produces electricity when exposed to the sunlight, even at low light levels or when other sources illuminate the front face. The electrical hazard from the voltage and current of a single module is low. However, the voltage increases as modules are connected in series and the available current increases as the modules are connected in parallel. Thus, for a module connected within a system, contact with electrically active parts of the module such as terminals can result in lethal shock, sparks, and burns. The only way to eliminate this hazard is to prevent exposure of the module(s) to light.

Important Notice!

To avoid the hazard of electric shock and injury when installing, wiring, operating and maintaining the PV modules

- Cover the entire front surface of the PV modules with a dense, opaque material such as the cardboard box, during installation and handling of the modules.
- Do not expose Back sheet foil directly to sunlight
- Work only under dry conditions, with dry modules and tools.
- Be sure to completely ground all modules.
- Since sparks may occur, do not install the module where flammable gases or vapors are present.
- Module installation and operation should be performed by qualified personnel only.
  Children and unauthorized persons should not be allowed near the installation of PV modules.
- Use module for its intended function only.
- Be sure that all other system components are compatible, and they do not subject the module to mechanical or electrical hazards.
- Do not touch terminals while module is exposed to light or during installation.

Provide suitable guards to prevent contact with 30 VDC or greater. As a Precaution use properly insulated tools only.

- Do not damage or scratch the back sheet of the module.
- Do not use the junction box to hold or transport the module.
- Do not drop module or allow objects to fall on module.
- Do not stand or step on the module.
- Do not disassemble, modify or adapt the module or remove any part or labeling installed by the manufacturer.
- Do not drill holes in the frame or glass of the module.
- Do not treat back sheet and front surface of the module with paint and adhesives.
- Do not artificially concentrate light on the module.
- Do not wear metallic jewelry while installing or trouble shooting the module.
- Do not change the wiring of bypass diodes.
- Do not disconnect modules under load

To help avoid breakage problems

- Always transport and store the module in the shipping container provided.
- When carrying a module two or more people should carry it by its frame and wear non-slip gloves (to avoid injury by a slipping module, to a foot, or cuts by the edge of a frame, and so on).
- Do not leave the module unsupported or unsecured prior to installation. For example, wind can cause a module which is leaning against a fence to fall and break. Avoid application of excessive bending or twisting forces to the module.
- A module with broken glass or torn back-skin cannot be repaired and must not be used since contact with any module surface or the frame can produce electrical shock.
- Broken or damaged modules must be handled carefully and disposed of properly.
  Broken glass can be sharp and can cause injury if not handled with the appropriate protective equipment.

4 Genaral safety

Follow all permission, installation and inspection requirements.

- Before installing modules, contact the appropriate authorities to determine permissions, installation, and inspection requirements which should be followed.
- Electrically ground modules for all systems of any voltage.
- If not otherwise specified, it is recommended that requirements of the latest National Electrical Code (USA) or other national or international electrical standards be used.
- Be sure that the construction or structure (roof, facade, etc.) where the modules are being installed has enough strength. For modules mounted on roofs, special construction or structures may be required to help provide proper installation. Both roof construction and module installation design have an effect on the fire resistance of a building. Improper installation may contribute to fire hazards. Additional devices such as ground fault, fuses, and disconnects may be required.
- Do not use modules of different specifications in the same system.
- Follow all safety precautions of other system components used.

To satisfy regulatory requirements, when installing the modules, be sure to:

1. Use only stranded or solid copper single-conductor type UF cable or USE cable rated sunlight resistant, for modules and modules interconnect wiring that is exposed to weather.
2. Observe the requirements described in sections labeled INSTALLATION and SPECIFICATIONS of this manual.
3. Grounding of the module frame is required. When ground wires greater than 6 mm^2 (No.10 AWG) are required, the installer will need to provide suitable terminal connectors.

4. 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 Isc and Voc marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor capacities, fuse sizes, and size of controls connected to the PV output.
5. Refer to section 690-8 of the National Electric Code (NEC) for an additional multiplying factor of 125 % (80 % de-rating) which may be applicable.
6. Conductor recommendations: single conductor cable, type USE-2 12 AWG, rated 600 V/1000 V minimum, 90° C minimum, marked sunlight resistant.

5 Installation

Important Notice!

General

- Please read this guide completely before installation or use of the modules. This section contains electrical and mechanical specifications needed before using your Bosch Solar Energy AG PV modules.
- Modules should be firmly fixed in place in a manner suitable to withstand all expected loads, including wind and snow loads. Module mounting holes are provided for easy installation and proper mechanical loading.
- Modules should be mounted with the orientation and tilt angle required for consistent performance (seasonally, yearly). The location should be selected to have direct access to sunlight from 9:00a.m. to 3.00p.m. on the shortest day of the year. Calculate the tilt angle by using the site latitude plus 20 degrees, with modules facing south in the northern latitudes and north in the southern latitudes. This will result in consistent energy output throughout the year.
- The appropriate material should be used for mounting hardware to prevent the module frame, mounting structure, and hardware itself from corrosion.
- Install modules where they are not shaded by obstacles like buildings and trees.
  Especially pay attention to avoid partially shading the modules by objects during the daytime.
- For roof mounted systems, provide adequate rear ventilation under a module for cooling (100 mm: 4in gap minimum)
- Clearance of 7mm: 0.25” or more between modules is required to allow for thermal expansion of the frames.
- Observe the specifications for mounting areas according to Illustrations 1 and 2.
- Attachment with clamps on the narrow sides of the solar module may not be performed.
- The attachment of the solar module can be performed with clamps (or as an alternative, directly on the installation holes). When clamping systems are used, the clamp surface per attachment point on the module must amount to at least 400 mm^2.
- Position of the installation drill holes in accordance with Illustrations 3

Please contact your Bosch Solar Energy AG authorized representative with questions regarding mounting profiles for modules.

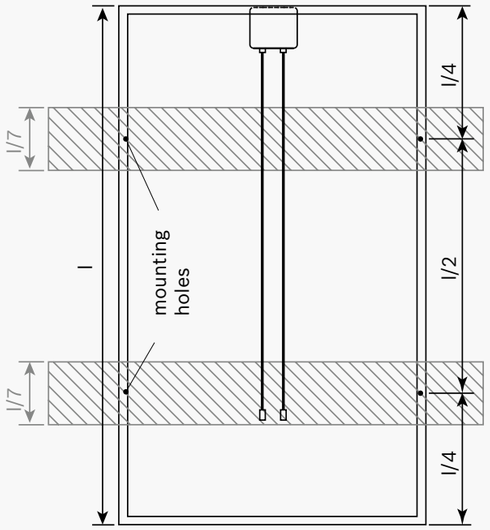


Figure 1: Mounting area, vertical

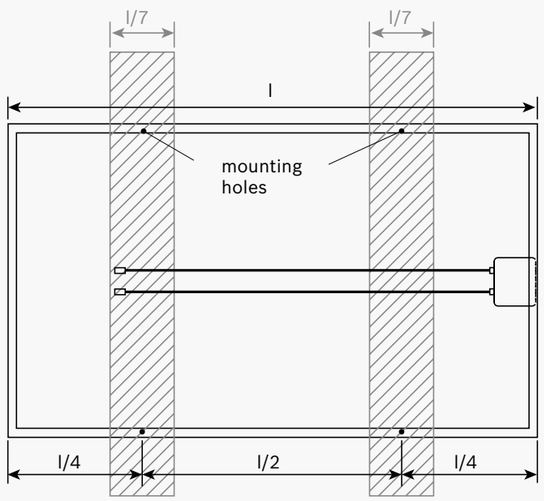


Figure 2: Mounting area, horizontal

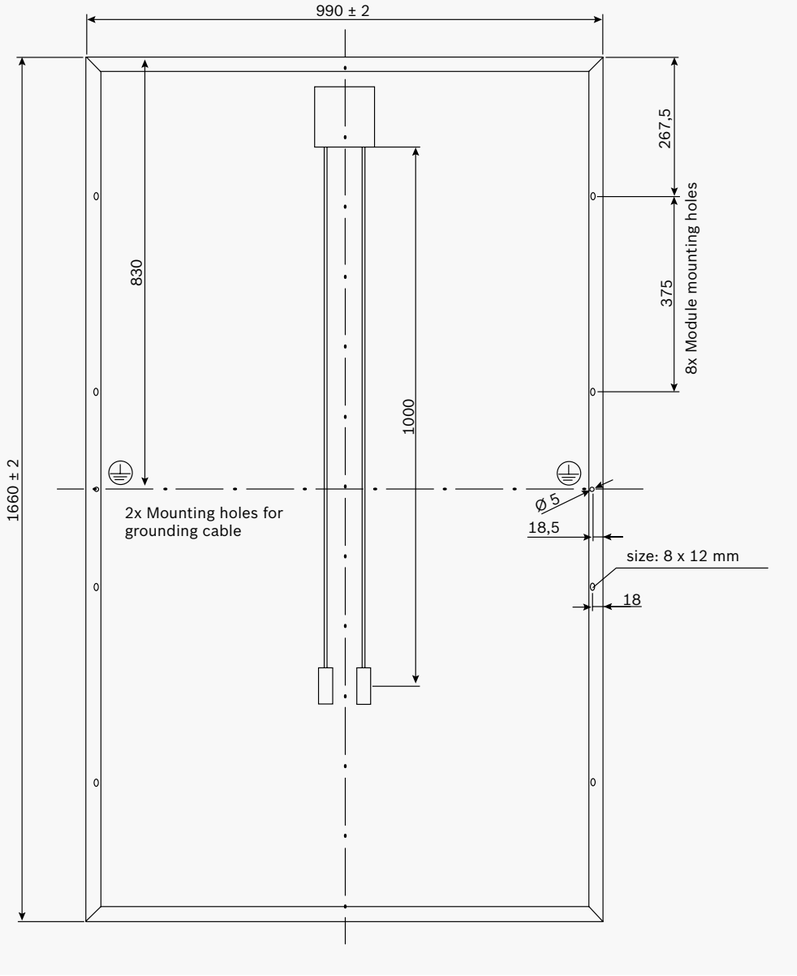


Figure 3: reverse side Bosch Solar Module c-Si M 60 IN30125

Notes on Installation

- 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. The module should never be sealed to the mounting surface with sealant that prevents air from circulating under the module.
- Leave 4 inches of clearance between the roof and the module frame.
- Refer to your local authority for guidelines and requirements for building or structural fire safety.
- For roof application, the modules should be mounted over a fire resistant covering rated for the application

Standard Operating Condition

Bosch Solar Energy AG recommends that modules be operated under Standard Operating Conditions (SOC). An installation location with conditions exceeding SOC or with other Special Conditions (see below) should be avoided. SOC of Bosch Solar Energy AG modules is as follows:

1. Standard Operating Conditions (SOC)

- The modules should be operated only in terrestrial applications. No space or other Special Conditions (see below).
- The measured ambient temperature of the installation location should be within –20°C (-4°F) to 40°C (104°F).
- The lower and upper temperature limit is defined as the monthly average low or high of the installation location.
- The relative humidity should be within 45% to 95%.
- The installation place should be less than 1,000 m (3,280ft) above sea level.
- Installations more than 1,000 m (3,280 ft) are allowed only if the wind pressure load for a module is less than 2,400N/m² (50PSF).

2. Special Conditions

- The ambient temperature of the installation place exceeds SOC.
- The salt damage is heavy at the installation place.
- The hail and snow damage is heavy at the installation place.
- The sand and dust damage is heavy at the installation place.
- The air pollution, chemically active vapors, acid rain, and/or soot, etc. are heavy at the installation place

3. Application Class & Safety Class

The modules are qualified for application class A: Hazardous voltage (IEC 61730:Higher than 50VDC; EN 61730: Higher than 120 V), hazardous power applications (Higher than 240 W) where general contact access is anticipated (modules qualified for safety through EN 61730-1 and 61730-2 within this application class are considered to meet the requirement for Safety Class II).

6 Specification

60 Cell Module Series

Model Number	IN30125 – 225
Peak / Rated Power (Pmax, Wp)	225
Max Power Voltage (Vmp, V)	29.40
Max Power Current (Imp, A)	7.80
Open Circuit Voltage (Voc, V)	36.90
Short Circuit Current (Isc, A)	8.30
Power Tolerance (%)	± 3
Factory Installed Bypass Diode (Qty)	3
Bypass Diode Rating (A)	15
Max. Series Fuse Rating (Amps)	15
Maximum System Voltage (VDC)	1000
Fire Resistance Rating	Class C
Temp. coefficient of Voc (%/°C)	-0.32
Temp. coefficient of Isc (%/°C)	0.032
Temp. coefficient of Pmax (%/°C)	-0.46
Cable (1Mtr Length-2Nos)	4Sq.mm, 12AWG
Length, mm (Inches)	1660(65.35)
Width, mm (Inches)	990(43.92)
Frame Depth(Thk), mm (Inches)	42 (1.65)
Weight, Kg (Pounds)	20(44.09)
Mounting Hole, mm (inches)	8x12 (0.315x0.472), Qty- 8
Ground Hole dia., mm (Inches)	Ground back – 5mm (0.196) dia., Qty-2

Note: Modules in parallel can be done as applicable

Notes:

1. Rated electrical characteristics are within 10% of the values measured at Standard Test Conditions (STC) of: 1000W/m², 25°C cell temperature and solar special irradiance per IEC 60904-3.

7 Wiring

Important Notice!

General

All wiring should be done in accordance with applicable electrical codes.

- All wiring should be done by a qualified, licensed professional. Wiring should be protected to help ensure personal safety and to prevent its damage.
- All Bosch Solar Energy AG modules are equipped with wires and quick connectors. Modules have been designed to be easily interconnected in series.
- Modules can be wired in series to increase voltage. Connect wires from positive terminal of one module to the negative terminal of the next module. All modules connected in series should be of the same model number and/or type. Make sure the number of modules connected in series does not exceed: ((Maximum system voltage / Open circuit voltage of the module) – 1) at standard condition, AM1.5G, 25 degrees temperature, 1,000 W/m².
- Connect modules in parallel to increase current. Connect wires from the positive terminal of the one module to the positive terminal of the next module. Do not connect modules in parallel without using a connection box. The number of parallel strings depends on the system integrator's requirements and the inverter ratings.
- These modules contain factory installed bypass diodes. If these modules are incorrectly connected to each other, the bypass diodes, cables, or junction box may be damaged.

Module Version	Positive Pole	Negative Pole
IN xx125	Tyco, Neutral 6-1394461-2	Tyco, Minus 0-1394462-4

Coding for connector plug[1]

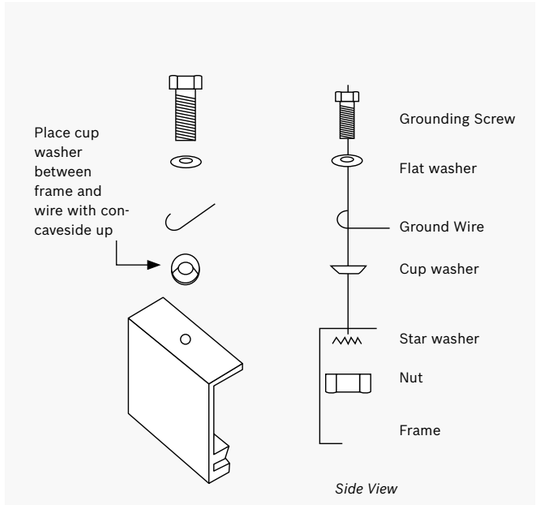
[1] *IN xxxxx: Internal technology code*

- The term “array” is used to describe the assembly of several modules on a support structure with associated wiring. Use copper wire that is sunlight resistant and is insulated to withstand the maximum possible system open circuit voltage. Check your local codes for requirements.
- Use system wiring with suitable cross-sectional areas and connectors that are approved for use at the maximum short-circuit current of the module.
- The maximum open circuit voltage of the system must not be greater than the specified maximum system voltage for the module.
- When reverse currents can exceed the value of the maximum protective fuse marked on the back of the module, a properly rated and certified over current device (fuse or circuit breaker) must be connected in series with each module or string of modules.
- The fuse used is a glass / HRC type of rating 15 Amps. The fuse rating has to begreater than or equal to 135 % of the module’s short circuit current.
- The rating of the over-current device shall not exceed the value of the maximum protective fuse marked on the back of the module.
- Match the polarities of cables and terminals when making the connections; failure todo so may result in damage to the module.
- Connecting modules in reverse polarity to a high current source, such as a battery, will destroy the bypass diodes and render the module inoperative. Bypass diodes are not user replaceable.
- The junction box is under no circumstances being opened. Opening the junction box may void the warranty.
- Modules with a suspected electrical problem should be returned to Bosch Solar Energy AG for inspection and possible repair or replacement as per the warranty conditions provided by Bosch Solar Energy AG.

8 Grounding

Important Notice!

Bonding connection
Module frames should be connected to an earth ground for safety and protection from lightning. A good connection between the grounding hardware is essential for an effective ground. The anodization on a module frame provides a coating to minimize the corrosion due to weather and it acts as a barrier that reduces the effectiveness of the grounding connection. For an adequate ground, the grounding hardware should pierce the anodization layer.



The above figure is for hardware mounting reference.

9 Diodes

Bypass Diodes
When the modules are shaded partially, it may cause reverse voltage across cells or modules, because the current from other cells in the same series is forced to flow through the shaded area. This may cause undesirable heating to occur. When a bypass diode is wired in parallel with the series string, the forced current will flow through the diode and bypass the shaded module, thereby minimizing module heating and array current losses.

The use of a diode to bypass the shaded area can minimize both heating and array current reduction.

All Bosch Solar Energy AG modules are equipped with factory installed bypass diodes. The factory installed diodes provide proper circuit protection for the systems within the specified system voltage, so that you do not need any other additional bypass diodes. If your system specifications require you to add or change diodes, please contact authorized Bosch Solar Energy AG representative for recommendations for the proper diode type.

Blocking Diodes
Blocking diodes are typically placed between the battery and the PV module output to prevent battery discharge at night. Bosch Solar Energy AG modules do not contain a blocking diode when shipped from the factory. It is recommended that a charge controller be used to prevent the batteries from being overcharged and discharged at night.

10 Maintenance

Important Notice!

- It is common for dust and dirt particles to accumulate on the surface of the module. This can reduce the optimal output performance of the solar modules. Normally, the accumulated dust will be washed away by periodic rainfall, but in some instances some maintenance is recommended to clean the surface of the glass with water and a soft cloth or sponge. A mild non-abrasive detergent may be applied for persistent dirt.
- However it is advisable to perform periodic inspection of the modules for damage to glass, back-skin, frame, junction box or external electrical / loose connections and corrosion by the authorized professional.
- No aggressive and abrasive cleansers or chemicals should ever be used on the coated front glass. No alkali based chemicals should be used, including ammonia based solutions.
- Always wear rubber gloves for electrical insulation while maintaining, washing or cleaning modules.
- Once a year, check that growing foliage has not caused module shading. Correct if this condition has occurred.
- As required, check that the system voltage and current output (or power output) is consistent with the expected output. Such a check will help to determine if array cleaning is needed, if there are loose or corroded connections, or if there is a component problem.
- Warning: Do not attempt to clean a module with a broken glass over or a perforated backsheet. Such a module can present a serious shock hazard.

11 Disposal

Important Notice!

Defective or old solar modules must be appropriately disposed of. These may not be disposed of in household waste.

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