

Mounting instructions

for BAUER thin-film photovoltaic modules



1. Introduction

These instructions for assembly must be read carefully and clearly understood prior to the mounting, wiring and initial operation of the modules. They contain basic information on both mechanical and electrical assembly. They also contain various safety instructions which you should familiarise yourself with.

2. Safety instructions

It is essential that the accident prevention regulations pertaining to safe work on roofs be observed.

If necessary, erect barriers to prevent injury from falling components.

When working on roofs the relevant safety precautions must be observed according to such regulations (use of safety harnesses, scaffolding, etc.).

When installing solar modules, locally applicable building regulations and all generally recognised rules of technology must be adhered to.

The following rules and regulations – among others – must be observed during mounting and wiring:

General accident prevention regulations (more detailed information is available from the Berufsgenossenschaften, the German trade association liable for industrial safety and insurance)

- DIN 18451: scaffolding works
- DIN 18338: roofing and roof sealing works
- DIN 1055: calculation of wind and snow loads
- VDE 0100: installation of high voltage systems up to 1000 V
- VDE 0190: main potential equalisation of electrical systems
- VDE 0185: lightning conductor systems
- DIN 18015: electrical installations in residential buildings
- DIN 18382: cables and lines in buildings.

These regulations apply to all systems assembled in the Federal Republic of Germany.

If the photovoltaic system is to be installed outside Germany, the rules and regulations for that country then apply.

The structure calculations of the roof and building must be analysed prior to assembly.

When working on uncovered solar modules, you are working on live panels.

As soon as light hits the panels, full open-circuit voltage can be expected on the ends of the module cables and/or the cable ends of strings already connected. The more modules there are connected in series, the greater the corresponding open-circuit string voltage.

The number of modules multiplied by the module's open-circuit voltage (see datasheet) equals the total voltage.

The maximum permissible system voltage of the solar generator and the maximum permissible DC voltage of the power inverter must not be exceeded!

Please note:

The protective low voltage range of 120 V is usually exceeded here.

The modules may be mounted by untrained personnel; the panels may only be wired, contacted and put into operation by electrical experts.

AC connections may only be hooked up to the mains (wiring between the inverter and domestic connection and installation of the electricity meter in a DIN-approved meter cupboard) by electricians who have been licensed by the appropriate electricity supplier / network operator.

3. Guarantee and liability

The current General Terms and Conditions of Business and guarantees issued by Bauer Solartechnik GmbH and Bauer Solarenergie GmbH generally apply.

Any guarantee and liability claims are excluded if they result from one or more of the following causes:

- Improper mounting or handling of the modules
- Failure to observe the regulations currently in force and generally recognised rules of technology
- Assembly with improperly mounted or inoperable safeguards and protection facilities
- Non-compliance with the information contained in these instructions for assembly
- Failure to use any original materials included in delivery.

4. Planning notes

4.1. Site of installation

Environmental influences at the site of installation can have a detrimental effect on system performance or even damage the modules themselves.

These include aggressive vapours found near chemical plants, for example, and also those present in agricultural environments such as pigsties, chicken coops and near uncovered liquid manure. The modules should also not be used in areas where there is considerable dust (such as near grain stores, cement works, etc.)

The modules may **NOT** be assembled on the coast (no contact with saltwater or sea air / spray) as this may cause the glass to become cloudy or dull. For reasons of safety the modules may also **NOT** be operated in the vicinity of highly inflammable gases.

4.2 Mains supply

The inverter may only be hooked up to the mains by a licensed expert. The conditions governing technical connections issued by the appropriate public utilities company must be observed.

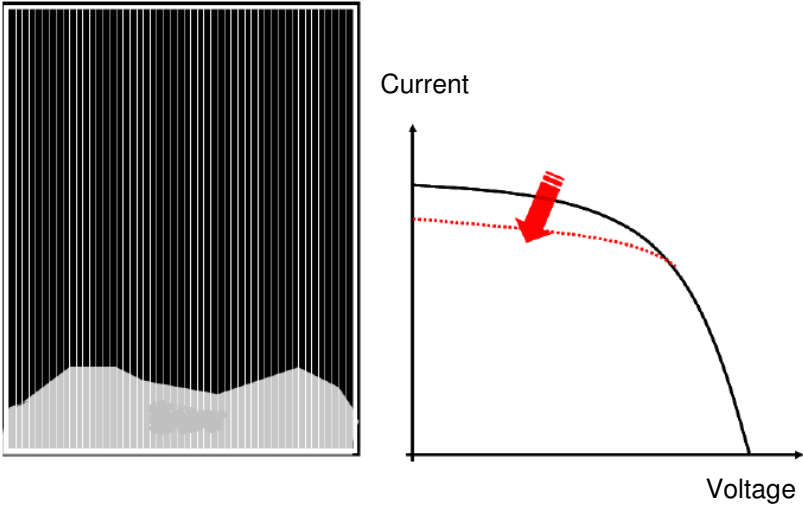
4.3. Solar generator

As the modules have a very high life expectancy, the condition of the roof must be carefully assessed.

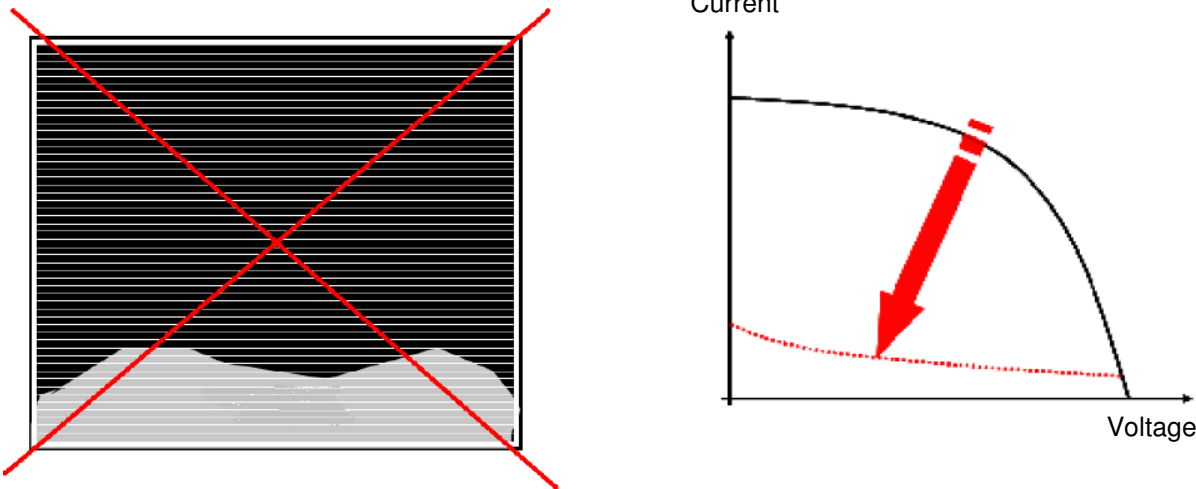
All modules connected to one inverter should face the same way and have the same slant; a decrease in power can otherwise be expected.

The entire generator field must be free of shade; here, the low position of the sun in winter must be taken into account. Even partial shade caused by chimneys, gables, pylons, radio masts, trees or neighbouring buildings, etc., can result in a considerable reduction in power.

Modules should only be mounted vertically (on end) as shade on the lower part of the panels can lead to considerable reductions in power.



Change in the I/V characteristic curve due to shading caused by snow.



4.4 Mounting / mounting system

Only use rustproof materials such as aluminium or stainless steel.

The planning and assembly guidelines issued by the manufacturer of the mounting must be heeded.

4.5 Inverter

Inverters without a transformer are NOT permissible for use with for Bauer thin-film modules.

Please heed the planning notes included in the inverter manual.

When selecting an inverter, ensure that the initial values of the modules (and especially the open-circuit voltage) are approximately 2 V higher than the nominal (stabilised) values on the datasheet.

4.6 Wiring

Plan the wiring very carefully. Insufficient cable cross-sections result in wiring loss which directly affects system performance.

On no account must the permissible wiring ampacity be exceeded as this can cause the cable to heat up or even burn.

Please observe the guidelines and regulations currently in effect.

In the wiring for the solar generator only weatherproof and UV-resistant solar leads and cables should be used.

4.7 Isolators

In Germany, **approved isolators** must always be installed between DC strings and inverters. Should the selected inverters not have such isolators, the strings must be hooked up using external, approved isolators.

4.8. Lightning conductors

When installing a PV system it is not absolutely necessary to install a lightning conductor or arrester for the building. You should, however, seek information and advice to this end from a professional experienced in lightning protection.

The following principle normally applies. Should the building already have a lightning protector, this usually also covers the PV system.

If the PV system is not protected by an existing lightning conductor or arrester, all metallic parts of the PV system and the mounting must be integrated in the building's main potential equalisation.

5. Handling the modules

Bauer thin-film modules are glass-glass modules (i.e. the front and back are made of glass) and must be handled accordingly.

Please heed the following information:

- Keep the PV module in its original box until you assemble it
- Do not exert any great pressure on the module surface and avoid bending it as the glass may crack
- Do not stand on the module
- Do not subject the module to permanent vibration or oscillation
- Concentrations of sunlight should not be allowed to collect on the module surface as these can raise the module temperature to impermissible levels
- The junction box on the reverse of the module must not be opened
- Damaged solar modules must not be assembled
- Ensure that no inflammable gases develop close to the site of assembly
- Avoid hitting or knocking the glass
- Do not pull at the connecting cables
- Make sure that the solar plugs do not come into contact with water or moisture during the storage and mounting of the modules. This can cause the contacts to oxidize, resulting in contact resistance and subsequent drops in performance, or scorch the solar plug
- The frames of framed modules must not be damaged or removed
 - Do not damage the connecting cables by cutting them, catching them in the mount or bending them as this can lead to a loss of power and/or an electric shock
- Do not damage or remove the ID plate bearing the serial number.
- The modules must be assembled so that they are not standing in water.

6. Mounting / mounting systems

Bauer thin-film modules are suitable for roof, façade and stand-alone systems.

Our thin-film modules are available as simple modules or as complete systems which come with a mounting system and inverter. The necessary mounting racks can be purchased from Bauer Solartechnik GmbH.

Mounting equipment produced by other manufacturers can also be used. It is essential, however, that these be suitable for the mounting of glass-glass modules.

Only use rustproof materials such as aluminium or stainless steel for mounts and/or supports. You should preferably only use mounting racks from manufacturers who can certify the static load capabilities of their mounting racks and provide you with satisfactory instructions for assembly.

The manufacturer's mounting instructions for the mounting system must be adhered to. Bauer Solartechnik GmbH shall not be held liable for any damage caused by the use of unsuitable or inadequate mounting systems.

Prior to mounting, the generator field on the roof must be measured to ensure the optimum position for the setup.

Frameless modules may not be directly fastened with metal clamps; the clamps used must buffer the module with weatherproof rubber on both sides. (Laminate clamps)

When choosing clamps it is imperative that the thickness of the module/glass be taken into account.

If the frameless glass-glass module is pressed into the clamps too hard, the glass may crack.

The rail system must be evenly aligned; the modules may otherwise be subjected to strain and break.

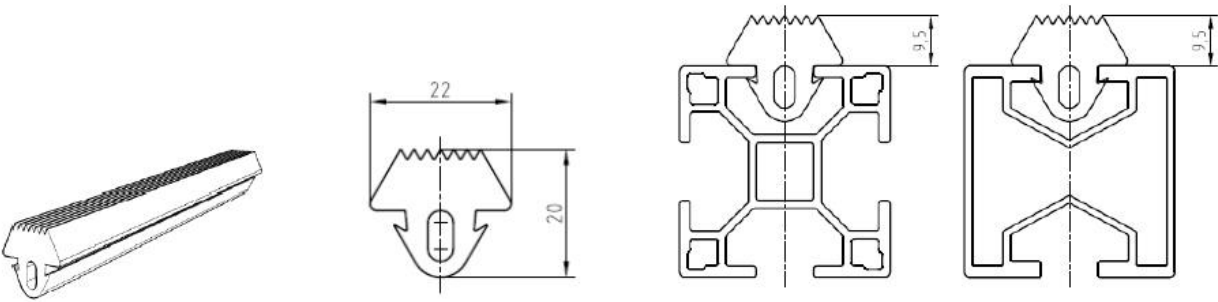
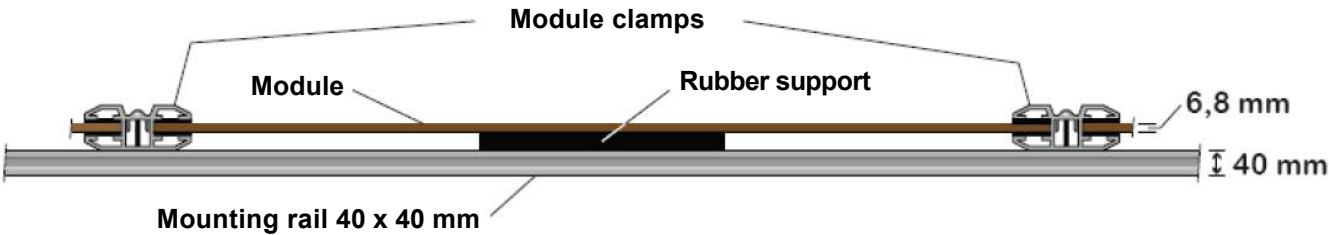
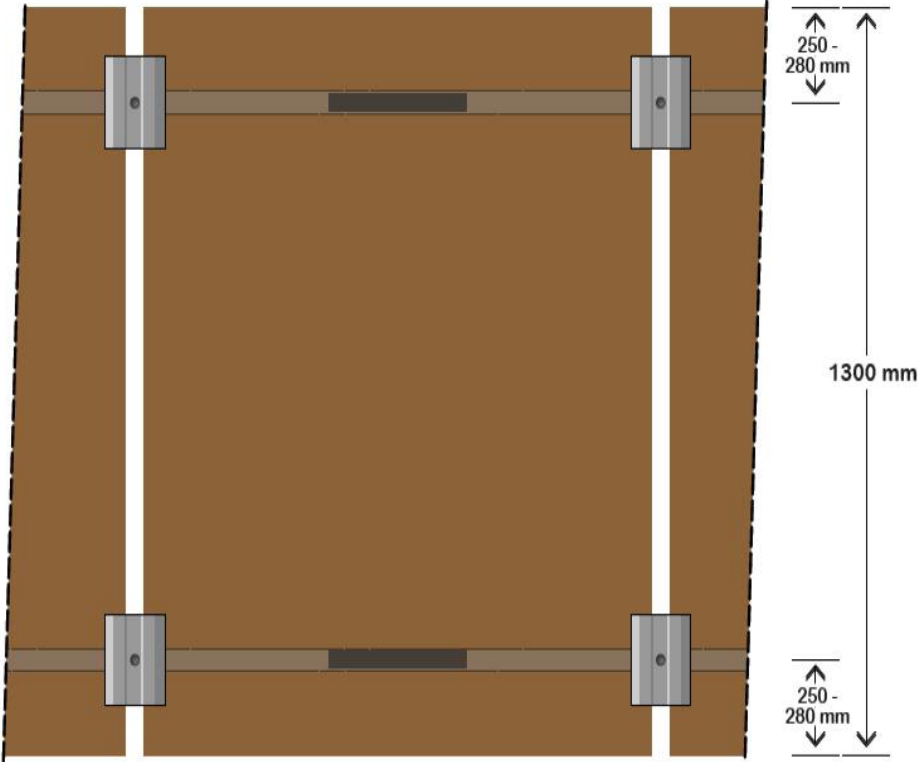
Each module must be fastened with four clamps.

The clamps may only be attached to the long side of the module and there must be a distance of approx. 250–280 mm from the centre of the clamp to the outer edge of the module.

Example clamps for frameless modules

Warning! Module clamps must not protrude into the cell area of the module. The trim on frameless modules is 15 mm.

It is also imperative that an additional weatherproof rubber support (rubber contact) be inserted in each rail in the middle of the module. This rubber support must be at least 20 cm long.



As vibrations and shock can loosen clamps in time, the modules must be permanently secured against sliding or falling. For this purpose manufacturers of mounting racks offer a number of suitable slide guards.

Example slide guard



Framed thin-film modules can be fixed to the rails using metal clamps without rubber inserts.

Example clamps for framed modules



Earthing the mounting system

All metal parts of the generator and the mounting system must be included in the building's main potential equalisation. To this end, all electrically conductive metal parts are interconnected and attached to the building's equipotential busbar using earth wires of at least 16 mm².

If the system is to be installed outside Germany, the regulations for that country must be observed.

7. Wiring

In the wiring of the string only weatherproof and UV-resistant solar leads and cables with a cross-section of at least 4 mm² should be used. Larger cross-sections of wire may be needed for longer leads. Wiring sizes must be calculated exactly to avoid a decrease in output due to loss of conduction.

All Bauer thin-film modules are equipped with MC 4 solar connectors.



The polarity is shown on the connectors.

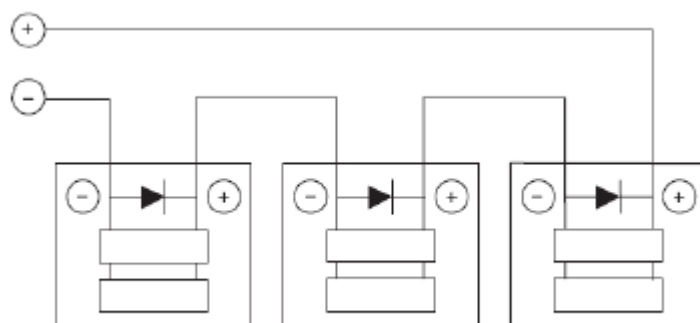
When attaching solar connectors and couplings to the string, only original crimping tools may be used.

It is imperative that you check the polarity of the strings before connecting these up to the inverter. You must also check the plausibility of the string voltages before the system is put into operation.

Only modules of the same type may be connected in one circuit.

Connection in series

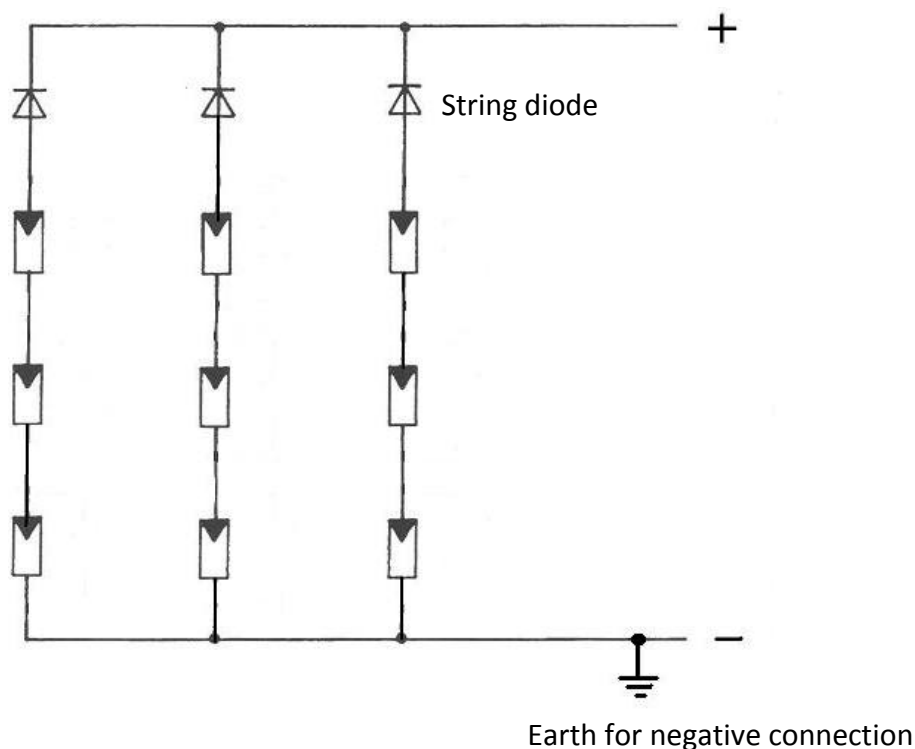
In order to increase the voltage, several modules can be connected in series to form a string. In this case, the maximum DC voltage of the inverter and the maximum system voltage of the modules must not be exceeded. Connect the plus plug of the wire of one module to the minus plug of the other module. The string wires leading to the inverter are then connected to the first and last modules.



Parallel connection

So that the inverter functions at maximum load, it may be necessary to connect several strings in parallel.

If more than two strings are connected in parallel, string diodes (blocking diodes) protecting the modules against extreme reverse currents must be hooked up to the individual strings.



The necessary diode boxes can be ordered from Bauer Solartechnik GmbH.



All negative string connections must be earthed. These are earthed in the diode box. Normally, inverters interpret an earthed negative pole as a short to ground and indicate this as an error. Only inverters suitable for the grounding of strings can thus be used. **(Please clarify this with the relevant inverter manufacturer!)**

SMA transformer inverters are suitable here. However, a negative grounding set must be additionally ordered for each inverter and subsequently integrated into the inverters.

8. Maintenance

Generally speaking, the PV system is maintenance free.

However, we recommend that the system be regularly checked to see if it is functioning properly and for signs of damage or cracks in the glass in order to quickly detect and rectify any disruptions in service.

The PV generator is usually kept clean by rainwater run-off (the flatter the roof, the less efficient this self-cleaning effect).

The angle of slope should thus be at least 10°.

Dust and dirt (such as bird excrement) can lead to a drop in performance.

The modules can be washed with water and, if necessary, a soft cloth; on no account must aggressive or abrasive cleaning agents be used.

The glass of the module must not be scratched!

If possible, use softened water for cleaning and make sure that no chalk residue is left on the surface of the glass.

9. Dimensional drawings

All measurements are for frameless modules.

