

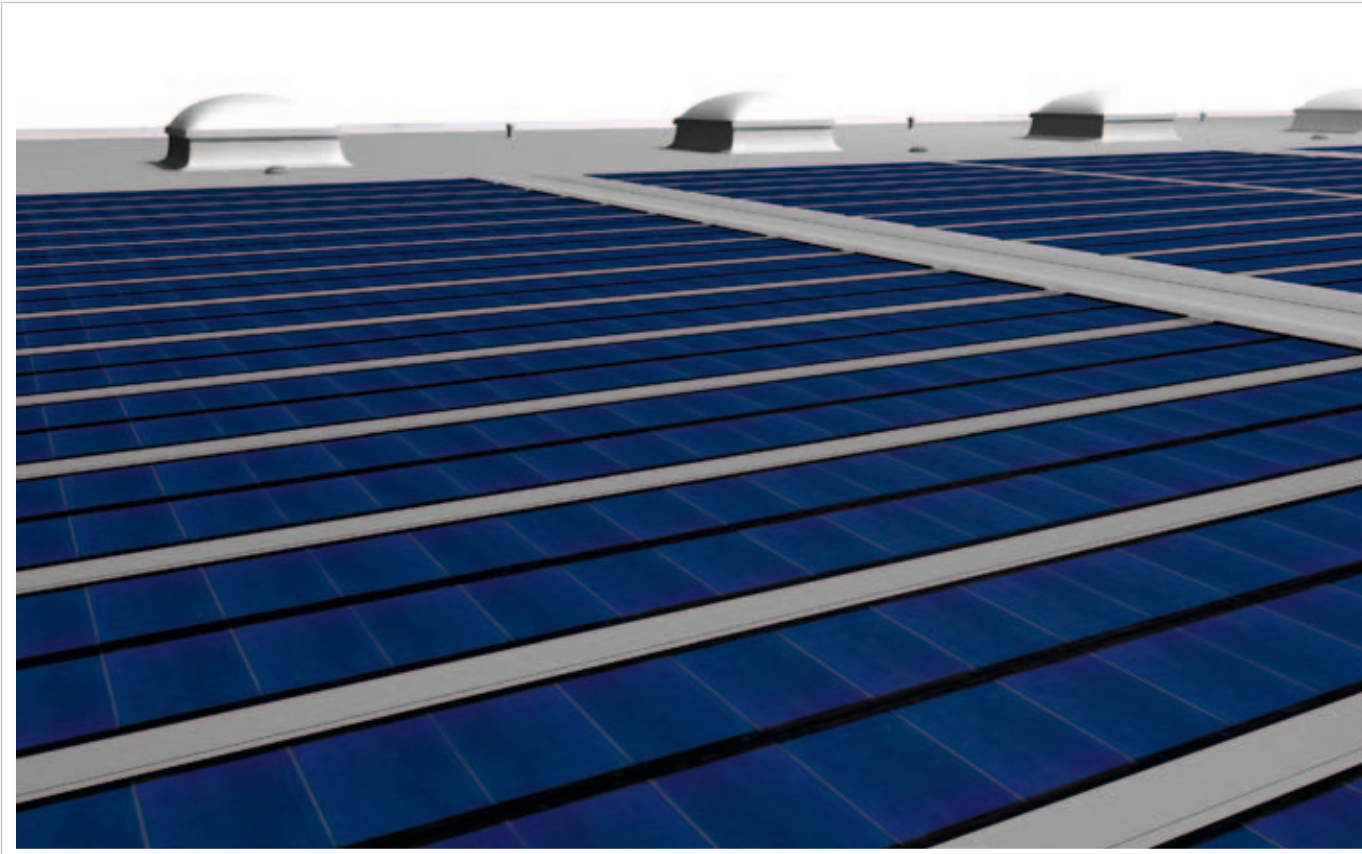


Installation Guide



# TF Membrane Professional

Installation Guide



TFM 288FB Professional  
TFM 288RG Professional



## Installation Guide

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## 1 About this guide

Thank you for choosing Centrosolar TF Membrane Professional. If you have questions about the installation or components of the system, please contact our technical support: +49 (0) 5251 500 500.

The maintenance and operation of a PV system requires a sound technical knowledge. Therefore, any work on the system may only be carried out by qualified and authorized personnel. Make sure to read these assembly instructions carefully before installing, commissioning or servicing the system, and store these instructions in a well accessible location. The guide is part of the product. It only applies to the solar modules TF Membrane Professional by Centrosolar AG. Pay special attention to the information regarding safe usage. Centrosolar is not liable for damage resulting from disregarding this guide.

### Target groups

The target group of this guide, especially chapter 4 (Safe Installation) and 5 (Commissioning the System), are skilled **craftsmen**. Information relevant for the **operator** can be found in chapter 6 (Maintenance and Cleaning).



**Information concerning your safety or that of the device are highlighted.**

### Please note:

Disregarding the instructions of this installation guide may void any warranties, guaranties and product liabilities.

## 2 Site preparation

The TF Membrane Professional modules are sensitive technical components, which must be handled with utmost care. Pay special attention during transport or when putting into interim storage on site and ensure a safe working environment.



**Danger!**  
**Enter TF Membrane Professional only with adequate protection!**

Mechanical strain of the TF Membrane Professional can lead to damage of the photovoltaic cells. Therefore, stepping onto the photovoltaic laminate is forbidden. If stepping onto the laminate can not be avoided, use special over-shoes and protective mats or similar protective equipment, to avoid scratching or damaging the laminate surface.



*Fig. 1: Stepping onto the TF Membrane Professional can result in damage.*



**Danger!**  
**Transport pallets may only be placed on sufficiently stable roofs!**

TF Membrane Professional is delivered on transport pallets with considerable weight (approx. 1400 kg). A truck crane should be used on site to hoist the pallets onto the roof. Unpacking of TF Membrane Professional will take place on the roof. Prior to hoisting, check if the load capacity of the roof meets the weight of the fully loaded pallets in the load area. If in doubt consult a structural engineer.

## Installation Guide



Fig. 2: On the roof, place pallet in a location that can withstand high loads.



**Danger!**  
**Protect modules on the roof against wind suction!**

After releasing the transport locks on the pallets, the modules on the roof must be protected against wind suction. Keep suitable weight elements or belts handy on site.



**Danger!**  
**Do not roll TF Membrane Professional!**

An unduly small bending radius will cause mechanical strains in the laminate and can damage the module. Make absolutely sure that the TF Membrane Professional is not rolled during installation.



Fig. 3: TF Membrane Professional must not be rolled during installation!



**Installation temperature must exceed 10 °C to limit material expansion due to temperature changes to a permissible degree.**

### 3 Installation prerequisites

The structural prerequisites of the system are met for buildings up to a height of 10 m. Hence, installation on buildings higher than 10 m is not permitted.

Neither the TPO/FPA SINTOFOIL sealing membrane nor the TF Membrane Professional may be installed under arbitrary conditions or on arbitrary surfaces. The guidelines of the roofing system manufacturer Rubberfuse must be adhered to, especially the stipulation to only use fastening components for installation, which are authorized by Rubberfuse. **Failure to observe the guidelines will result in guarantee exclusion.**

All necessary accessories and authorized fastening components can be ordered from Co. DaKo System GmbH, Phone +49 (0)5251 5405348, Fax +49 (0)5251 5405349, indicating the roof sealing Sintofoil RG/FB.



**Please note:**  
**The installation must be executed by certified roofers.**

#### Check the roof inclination

To facilitate proper installation and sufficient drainage from the modules, the roof inclination must be at least 3°. The maximum roof inclination is 20°, if fire protection regulation according to ENV 1187 must be adhered to resp. proof of rigid roofing according to DIN 4102 must be furnished. In all other cases the maximum roof inclination is 60°.

#### Provide sufficient drainage

Irrespective of the roof inclination, a sufficient drainage in the area of the PV modules must be ensured. Never expose the modules to standing water. Any unevenness of the surface must be evened out prior to installation.

## Information about laying and fastening of the TF membrane

The TF Membrane Professional must be laid onto an even surface. The following fastening methods can be distinguished:

- Mechanical fixing to trapezoidal steel sheets with additional Insulation (the insulation layer is fixed onto the steel profile and provides an even surface to the membrane).
- Bonding on uncovered surfaces with PU-adhesive. In this case the SINTOFOIL FB foil must be used as a laminate substrate.
- When using a two-layer laying method, the TF Membrane Professional can be welded onto the existing TPO roof cladding. In advance, authorization regarding the material compatibility should be obtained from the manufacturer of the roofing membrane. Welding onto PVC roofing membranes is generally not possible.

## Ensure correct orientation of the modules.

The orientation of the modules must be in such a way that starting from the electrical connection, each module is installed in the water flow direction. The maximum permissible orientation is horizontal to the roof inclination (see figures).

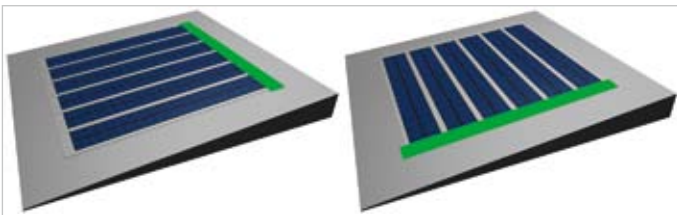


Fig. 4: Correct installation of the cable protection: top or side (green).

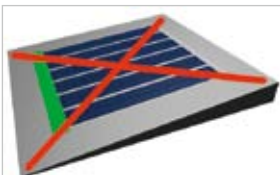


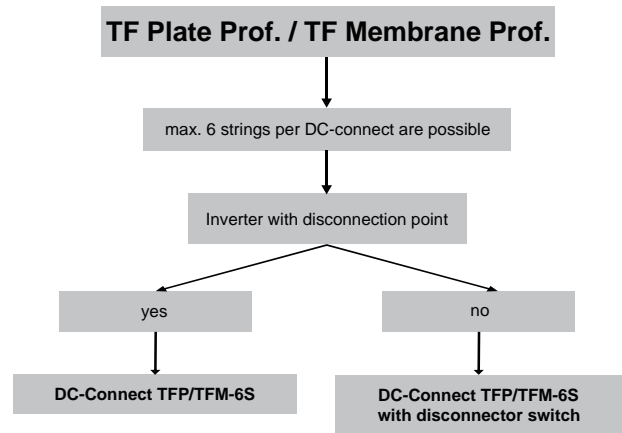
Fig. 5: The cable protection must not be installed at the bottom of the inclination (green).

## Please note:

It is strictly forbidden to direct artificially concentrated sunlight onto the module or panel, as this will damage the module.

## How to use the DC-Connect junction box:

The wiring of the modules with each other, with the corresponding DC-Connect junction box, and/or with the inverter may only be accomplished using connection cables with a diameter of at least 4 mm<sup>2</sup>. With cable lengths of more than 20 m, a cable diameter of at least 6 mm<sup>2</sup> is recommended.



- For electrical connection with the modules, only use original Multi-Contact MC3 plugs or Lumberg LC3 plugs.
- If more than three strings are to be connected to the inverter in parallel, use a DC-Connect junction box to eliminate excessive reverse electrical loads in case of a failure.
- Thin-layer modules are generally used for large surfaces. Due to the increasing probability of an indirect lightning effect, we recommend the use of a surge protector.

## Grounding

Grounding of the photovoltaic generator to protect the solar cells from corrosion is generally not necessary, because the solar laminates are made of a substrate assembly. Corrosion of the cell material due to a negative field can therefore be ruled out.

## Installation Guide

### 4 Safe Installation

#### Installation of TF Membrane Professional

If necessary, install an insulation layer first. TF Membrane Professional is mounted to the trapezoidal sheet metal above the insulation by means of screws and retaining plates. The following figures depict the installation process.



Fig. 6: Overall view of trapezoidal sheet metal, insulation and TF Membrane Professional

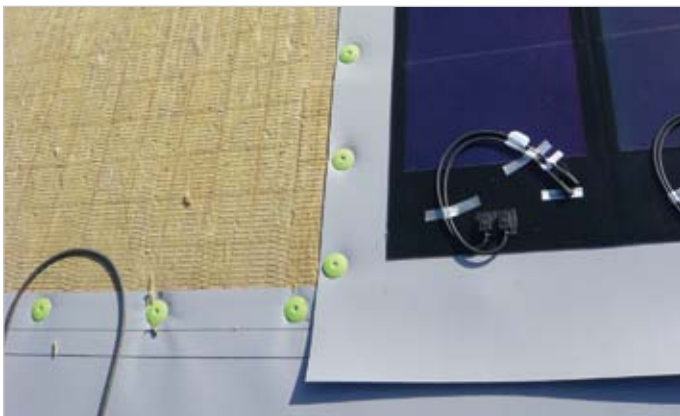


Fig. 7: TF Membrane Professional is mounted through the insulation.

Determine the distances between the fastening points according to the project-specific wind load calculation and take note of the subsequent position of the foil composite sheets for cable protection while positioning the retaining plates. This is particularly important on hard surfaces. It is possible to leave out one fastening point if it would obstruct the installation of the foil composite sheet.

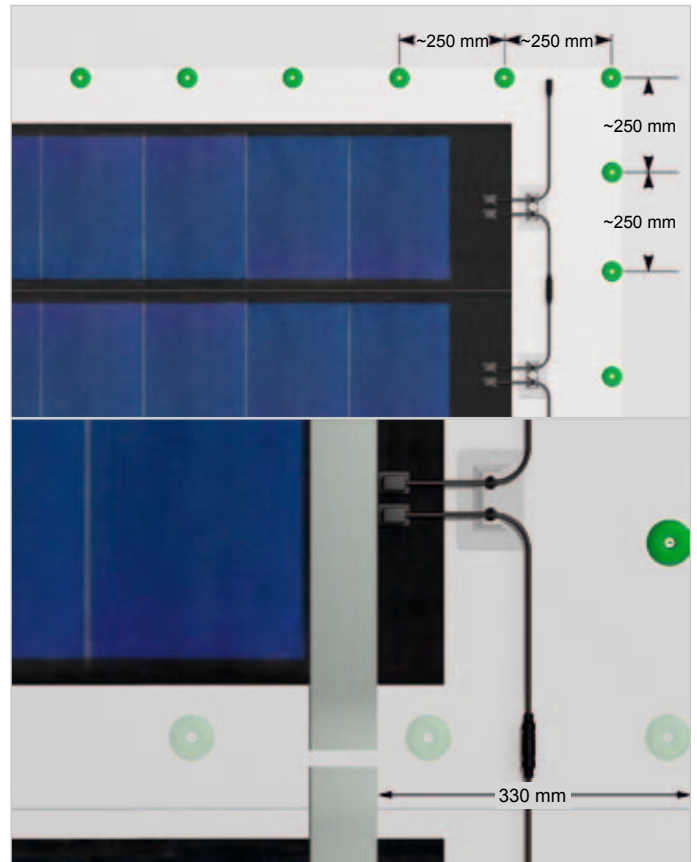


Fig. 8: The individual distances in detail

#### Overlapping of fastenings

The laying of TF Membrane Professional is similar to laying common roofing membranes without photovoltaic modules: To guarantee an optimum tightness of all fastenings, the fastening points of the TF Membrane Professional are only located on one of the long sides of the membranes and are overlapped by the following TF Membrane Professional. The overlap welding serves as a sealing of the fastening points.



Fig. 9: Overlapping alignment of the membranes

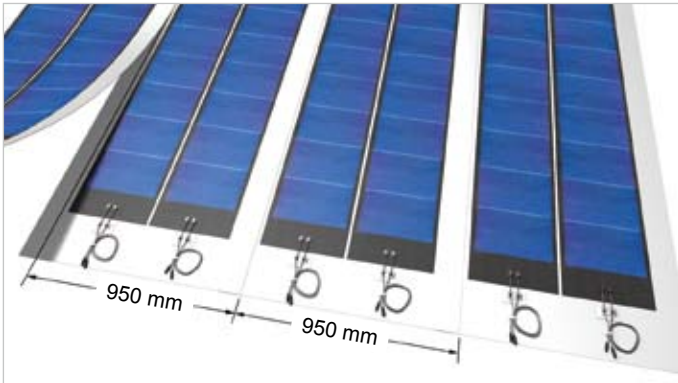


Fig. 10: Laying pattern and overlapping of TF Membrane Professional

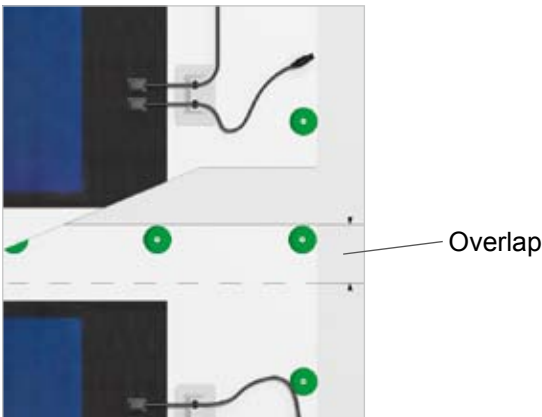


Fig. 11: Overlapping in detail

### Welding of TF Membrane Professional

The membranes must be joined with each other by means of welding according to the technical guidelines of the roofing system manufacturer Rubberfuse. Machine welding is permissible, if possible under the prevailing roof conditions. In hard to reach areas, the joints should be made manually with a hand welding torch.



Fig. 12: Machine Welding of TF Membrane Professional

Damage of the PV laminate surface due to the own weight of the welding apparatus is possible. Ensure that the rollers of the device are clean at all times. When welding manually it is imperative to use a protection mat to protect the TF Membrane Professional (see figure 13).



Fig. 13: Manual welding with a protection mat.



Fig. 14: The hand welding torch is used for the roof edges, which are difficult to reach.

### Wiring Information: TF Membrane Professional

When wiring the TF Plate Professional module, please note that there are two electrically independent laminates applied to the carrier sheet metal. Structurally, it is one inseparable unit. Electrically, however, the two laminates are independent. Therefore, laminate A can be connected to a different string or inverter than laminate B. Likewise, both laminates can be connected in series to one string or one inverter.

Please note that all design programs for inverters refer to a laminate with a power of 144 W. For an electrical view it is therefore necessary to consider the number of the laminates (twice the number of modules) and not the number of modules.

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### Mounting of the Cable Protection

To protect the cable connections of the modules and the string wiring from weather influences such as wind, snow, rain, or UV radiation, a cable protection must be mounted. It consists of three parts:

- pre-canted foil composite sheet (FCS, see figure 15)
- overlap welding stripes for fastening the FCS
- overlap welding membrane as cover

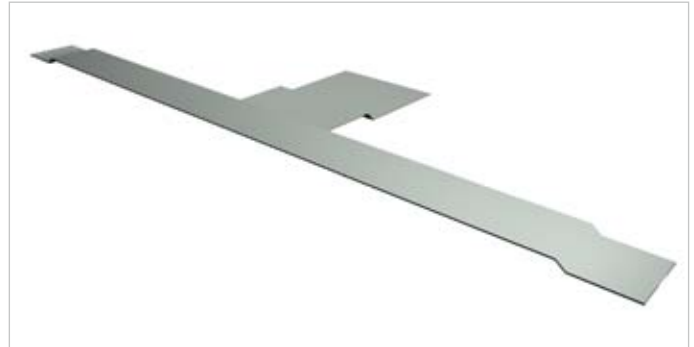


Fig. 15: Pre-canted foil composite sheet, top view

### Installation of the Cable Protection:

#### Step 1:

Lay down the foil composite sheets as shown in figure 16. The cable outlet box on the photovoltaic laminate must not contact the foil composite sheet in order to avoid the transfer of mechanical stress (see figure 16a).

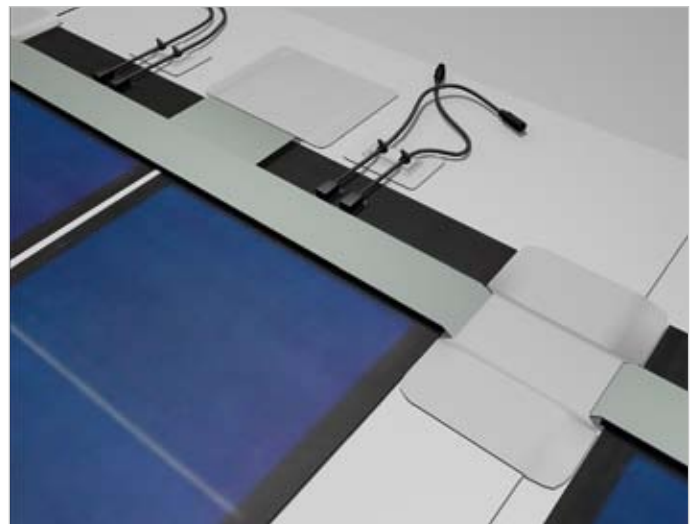


Fig. 16: Positioning the foil composite sheet

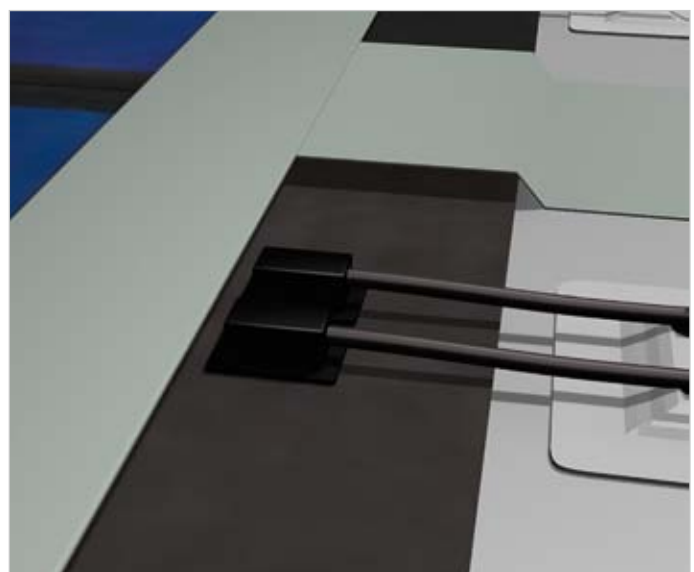


Fig. 16a: Detail

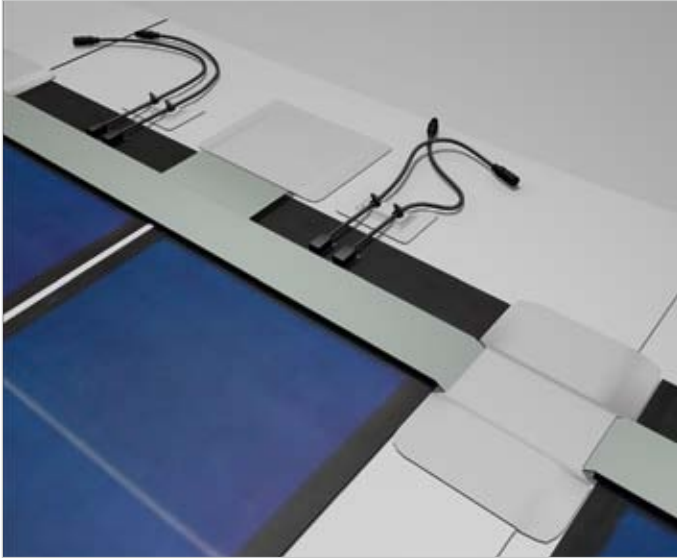


Fig. 17: Fastening the FCS with overlap welding flap



Fig. 18: Cross-section of the cable protection

### Numeric Key:

- 1 TF membrane
- 2 TF PV cells
- 3 Roofing membrane
- 4 FCS (foil composite sheet)
- 5 Cable outlets
- 6 Strain reliefs
- 7 FCS buttstraps
- 8 Cable cover foil

### Step 2:

Fasten the foil composite sheet by means of overlap welding with overlap welding strips. This guarantees a quick and simple installation.

### Step 3:

Carry out the correct wiring of the module. The wiring must be checked and separately authorized by a qualified electrician. Only then proceed with step 4.

### Step 4:

Mount the overlap welding membrane as a cover. Weld the strip continuously to the foil composite sheets on one side and to the roofing membrane on the other. It is advisable to leave small gaps in the water flow direction to facilitate good ventilation of the covered area.



### Danger!

The protection cover must not be closed before authorization by a qualified electrician! The covered area must be thoroughly cleaned from material residues before closing.

### Cross-section of the cable protection:

For a better understanding, we have numbered the individual areas in the figure. The corresponding remarks can be found below the figure.

## Installation Guide

### Cable routing

Ensure that the routed cables do not cast a shadow onto the TF Membrane Professional as this would reduce the output of the system. Additionally, avoid the collection of water at cables or cable bundles routed over the roof.

### Cable outputs on the roof

To ensure a proper operation of the system, the cables are usually routed via the roof to the inverter and into the building. There are different methods to achieve this, which depend on the local conditions and therefore have to be planned and executed on site.

There are no standard products available for routing the cables into the building. To protect the exposed cables on the roof from weather influences, they must be covered with overlap welding strips.

## 5 Commissioning of the System

The commissioning of a photovoltaic system is part of the proper and professional implementation and installation. It must only be performed following a careful visual examination and a professional electrical inspection. Furthermore, a report of the commissioning must be prepared.

Follow the below checklist during commissioning of the system.

### Visual examination:

- Anchoring of the components to the roof structure
- Fastening of the module according to the laying guidelines of the roofing system manufacturer
- Cable installation on modules, generator connection boxes, DC-sectioning points and inverters
- Potential equalization (if applicable)

### Electrical inspection

- String open circuit voltages
- String open circuit currents (use load break switch)
- PV generator open circuit voltage
- Voltage drop on fuses (for PV systems with string fuses)
- Insulation resistance of the PV generator
- Insulation resistance of the DC main lead
- Insulation resistance of the AC lead
- Loop resistance of the AC circuit

### Report:

- Name of the system operator
- Location of the system
- Specifications of the photovoltaic system
- Results of the visual examination
- Results of the electrical inspection
- Confirmation of completion by signature of the installer

### Please note:

This list is only for your information. It does not raise a claim on completeness.

### 6 Maintenance and cleaning

This photovoltaic system requires extremely little maintenance and servicing.

**However, do inspect the system regularly and perform a check every 6 months following this scheme:**

- Checking of the solar modules for scratches, optical changes or contamination
- Checking of the module fastening (tightness of the welding seams, strength of the butyl bondings, loosening of screws)
- Checking of the wiring as far as accessible (connecting lead, fastenings, mechanical damage)
- Checking of the roof tightness
- Checking of the electrical functions of all components
- Monitoring of the operational safety of the electrical components

This list is only for your information. It does not raise a claim on completeness.



**Danger!**  
**No high pressure cleaning!**

Usually, the modules are automatically cleaned by rain. With an inclination of more than 15° the modules generally need no additional cleaning. In case the module surface is contaminated by leaves, bird feces, pollen etc. we recommend cleaning with sufficient water without detergents. The modules are best cleaned using a water hose and soft, gentle cleaning equipment, e.g. a sponge or a car cleaning brush. To avoid micro-scratches, which may affect the yield of the system or could lead to module damage in the long run, the dirt must never be rubbed or scraped off the surface in a dry state.

# Installation Guide

## 7 Technical Specifications

### Electrical Parameters

Module type	TFM 288FB Professional	TFM 288RG Professional	
Rated Power ( $P_{MPP}$ )	144	144	Wp
Voltage ( $U_{MPP}$ )	33	33	V
Current ( $I_{MPP}$ )	4.36	4.36	A
Open Circuit Voltage ( $U_{OC}$ )	46.2	46.2	V
Short Circuit Current ( $I_{SC}$ )	5.3	5.3	A
Coefficient of Performance ( $\Delta P_{MPP}$ )	-0.3	-0.3	W/K
Coefficient of Voltage ( $\Delta U_{MPP}$ )	-102	-102	mV/K
Coefficient of Current ( $\Delta I_{MPP}$ )	4.36	4.36	mA/K
Coefficient of Voltage ( $\Delta U_{OC}$ )	-176	-176	mV/K
Coefficient of Current ( $\Delta I_{SC}$ )	5.3	5.3	mA/K
NOCT	46	46	°C

According to standard test conditions STC (1,000 W/m<sup>2</sup>, spectrum AM 1.5, cell temperature 25 °C). The following max. deviations occur during the first 8 to 10 weeks. Power PMPP +15%, Voltage Uoc +11%, Current Isc +4%.

\* Electrical specific values refer one sub module. The product consists of two separately connectible sub modules.

### Weights and Dimensions

Length	5900	5900	mm
Width	1050	1050	mm
Weight	35	32	kg
Laying pattern	5750 (min.) x 950	5750 (min.) x 950	mm

### Quality Features

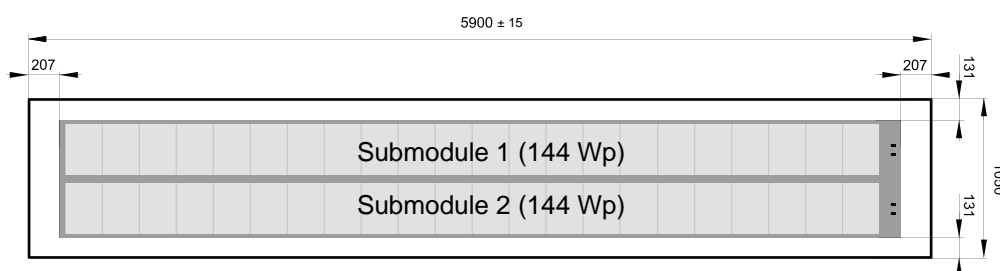
Performance tolerance	±5%
Performance guarantee**	20 years performance guarantee for 80% of rated power
Product Guarantee**	5 years
Max. system voltage	1000 V

\*\* According to stipulation of Centrosolar AG Warranty conditions (incl. product and performance warranty)

### Design features

Cells	Amorphous Silicon Triple Junction Cells
Construction	Foil laminate on roofing membrane
Front side	Highly transparent ETFE fluoropolymer
Junction box	Protection class IP 65
Bypass diodes	Integrated bypass diodes
Connecting lead	2 x 0.5 m, connector system
System application	Flat roof, roof inclination 3° min.

Technical changes and errors reserved - as of 03/2010



### 8 Warranty and guarantee

Warranties and guarantees can only be claimed if the installation and commissioning of the photovoltaic system was done by professional personnel, as can be proved.

Warranty and guarantee claims are not covered in case of

- unprofessional installation of the PV system
- improper use or inadmissible changes of delivered components
- improper use of individual components in a system
- use of structurally untested and therefore unsuitable substructure for the module installation
- deviations of the installation from the installation guide
- disregard of structural requirements concerning snow and wind loads
- installation of defective components

For more information about warranty and guarantee see the warranty statement of CENTROSOLAR AG under [www.centrosolar.com](http://www.centrosolar.com).

### 9 Disclaimer

Photovoltaic systems consists of electrical and mechanical components, which are assembled to a complete system on site. CENTROSOLAR AG is not in a position to monitor the adherence to the information and instructions of this installation guide. Therefore CENTROSOLAR AG is not responsible or liable for any damage due to unprofessional installation, improper operation, operation in dirty environments (e. g. on a stable) or improper use of the photovoltaic system resp. its individual components.

**We explicitly point out that disregarding the instructions in this installation guide, even for individual components, will result in an exclusion of all warranty, guarantee and product liability claims with regard to the complete system.**





## Sunshine is our business.

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