

## Installation instructions WIOSUN® Modules

Installation instructions are valid for the following modules:

WIOSUN® AP-Series

WIOSUN® AM-Series

WIOSUN® CP-Series

WIOSUN® CM-Series

WIOSUN® PV-Therm (see additional installation instructions)



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### Symbols used



DANGER! Risk of electrocution!



CAUTION! Risk of damaging the product or harming the environment!



PLEASE NOTE

### Exclusion of Liability

No warranty is given or liability assumed for damage arising from incorrect installation.

## Introduction

Thank you for choosing WIOSUN® photovoltaic modules. This Installation Manual contains essential information for electrical and mechanical installation that you must know **before** installing WIOSUN® photovoltaic modules. Failure to comply may result in personal injury and property damage! Please store this manual safely for the life of the product so that it can be referenced by the end user.

## Instructions

Please make sure both before and during installation that the locally applicable standards, building regulations and health and safety rules are followed.

In addition to any local regulations, the following standards and regulations in particular should be observed:

DIN VDE 0100	High-voltage installations with nominal voltages up to 1,000 volts, all relevant sections, especially T712
VDE 0105 T100	VDE 0105 T100
VDI 6012 Bl. 2	Decentralised energy systems in buildings
VDE 0298 T4	Rubber insulated wiring
DIN 18382	Electrical wiring in buildings
DIN 18334	Carpentry and timber structures
DIN 18338	Roof covering and roof sealing
DIN 18339	Plumbing
DIN 18351	Facades
DIN 18451	Scaffolding
DIN 1055	Load assumptions for supporting structures
VDE 0185	Lightning protection
DIN EN 61724	Photovoltaic system performance monitoring
DIN V VDE V 01261-1	Automatic circuit breaker for PV systems

- German roofing trade regulations
- Technical connection requirements (TAB) for connecting to the energy utilities' low-voltage grid
- VDEW regulations for domestic power generation systems in the low-voltage grid

Accident prevention regulations issued by the Berufsgenossenschaften (employer's liability insurance associations)

BGV A1	General regulations
BGV A2/A3	Electrical systems and equipment
BGV C22	Construction work (personal protective equipment against falls from a height)
BGV D36	Ladders and steps



PLEASE NOTE

The listed standards and regulations are merely a representative selection. The list does not claim to be complete. (Last revised in 08/2011.)

## Safety Information

This installation manual is intended exclusively for qualified tradespeople. Applicable health and safety regulations and procedures must be followed (in Germany, cf. BGV A1, BGV A2, BGV C22). We will not accept any liability for DIY installation and we strongly recommend that you hire a reputable firm.

### DANGER!



#### Electric shock

The connection of several modules in series results in the adding up of voltage and imposes danger.

- Do not insert electrically conducting parts into connectors!
- Do not fit solar modules and wiring with wet connectors!
- Make sure to work with dry tools and under dry working conditions!



#### Work on live parts

When working on wiring, use and wear protective equipment (insulated tools, insulated gloves, etc.)!

### WARNING!



#### Arcing

Modules generate direct current (DC) when exposed to light. When breaking a closed circuit, a dangerous arc may be generated. Do not cut any live wires.



#### Safe installation

Do not carry out installation work in strong winds. Secure yourself and other persons against falling. Secure work materials against dropping. Ensure a safe working environment so as to prevent accidents.



#### Fire protection/explosion protection

Modules must not be installed in the vicinity of highly flammable gases, vapors or dusts (e.g. filling stations, gas tanks, paint spraying equipment). The safety instructions for other system components must also be followed. Make sure to comply with local standards, building regulations and accident prevention regulations during installation. For roof installation, modules must be mounted on a fire-resistant base material.

### ATTENTION!



Do not use damaged modules. Do not dismantle modules Do not remove any parts or nameplates fitted by the manufacturer. Do not apply paint or adhesives on the back side, nor work on it with sharp objects.

## Other notes

### Unpacking and intermediate storage

Do not use the junction box as a handle. Do not place modules roughly on hard floor or on their corners. Do not place modules on top of each other. Do not step or stand on modules. Do not place any objects on modules. Do not work on modules with sharp objects; store modules in a dry place.

### Suitable ambient conditions

The module is intended for use in moderate climatic conditions. The module must not be exposed to focused light. The module must neither be immersed in water nor be exposed to continuous wetting (e.g. by fountains). Exposure to salt or sulfur (sulfur sources, volcanoes) implies a risk of corrosion. The module must not be used for maritime (e.g. boats) or automotive (vehicles) purposes. The module must not be exposed to extraordinary chemical loads (e.g. emissions from manufacturing plants). If the modules are installed on stables, a distance of 3.28 ft (1 m) to ventilation openings shall be ensured; apart from this, the modules shall not be used as a direct roof panel on stables.

### Appropriate installation situation

Make sure that the module meets the technical requirements of the overall system. Other system components should not exert any adverse mechanical or electrical influences on the module. Modules may bend under high loads. For this reason, sharp-edged fixing elements or other sharp objects (e.g. cable ties on mounting sections) must not be mounted near the module back side. For connection in series, only modules of the same amperage rating, for connection in parallel, only modules of the same voltage rating may be used. The modules must not be operated at a higher voltage than the permissible system voltage. The inside opening of the frame corner element is intended for water drainage and must not be closed. For system documentation, please note the serial numbers.

### Electrical connection

The modules are provided with factory-assembled cables and connectors. Do not open the junction box in any case. Connectors may only be connected under dry conditions. Make sure to avoid gaps in a

plugged connection. Only single-core solar cables with an adequate cross-section (4 mm<sup>2</sup> minimum) and appropriate connectors may be used for connecting the modules. Cables should be attached to the installation system by means of UV-resistant cable ties. Exposed cables should be protected against sunlight and damage by suitable precautions (e.g. conduits). In order to limit voltages released by indirect lightning shock, the area of all conductor loops must be reduced to a minimum. Check that wiring is correct (polarity!) prior to starting the generator.

### Cleaning

On principle, the modules do not need any cleaning if the tilt angle is sufficient (> 15°; self-cleaning by rain). In case of heavy contamination, we recommend cleaning the modules with plenty of water (hose) without the addition of cleaning agents but application of a soft cleaning device (sponge). Never scrape or rub off dirt; this may result in micro-scratches.

### Maintenance

We recommend regular inspections of the system to ensure that:

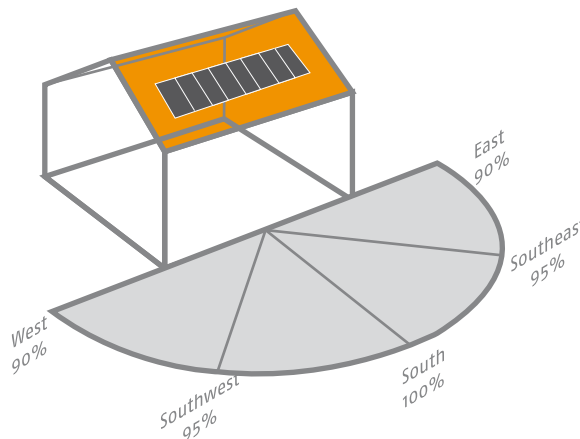
- All fixtures are securely tightened and corrosion-free;
- Wiring is securely connected, properly arranged and free of corrosion;
- Cables are free of damage; Please also observe applicable standards.

### Disclaimer of liability

Solarzentrum Allgäu KG does not guarantee the operational capability and functionality of modules if the instructions contained in the present user information are not complied with. Since compliance with this guide and the conditions and methods of installation, operation, use and maintenance of the modules are not checked or monitored by Solarzentrum Allgäu KG, Solarzentrum Allgäu KG accepts no liability for damage arising through improper use or incorrect installation, operation, use or maintenance. Furthermore, liability for infringements of patent law or of other third party rights arising from the use of the modules is excluded unless we are automatically liable by law.

## Orientation and Tilt

In Europe, the modules should ideally face south. In central Europe the optimal tilt angle for the modules is around 30°. The tilt angle is somewhat steeper in northern Europe and somewhat flatter in southern Europe. Deviating from the optimal orientation and tilt will reduce the system's energy yield. The graphic below serves as a guide:



## Tilt angle

Solar energy can be best utilised when the sun's rays shine on the solar panels at right angles. However, the ideal tilt angle depends on the seasons, since the sun is higher in summer and lower in winter. Since solar installations are used mostly in summer, the ideal tilt angle for roof installations in Germany is between 26 and 32 degrees. The tilt angle of panels should be steeper in the north and flatter in the south.

Recommended angle for fixed tilt panels:

Degree of latitude	Fixed tilt angle
-10°	16° - 20°
-5°	21° - 25°
equivalent to degree of latitude (45°)	26° - 30°
+5°	31° - 35°
+10°	36° - 40°
+15°	41° - 45°

## Absence of Shading

A module is considered to be shadow-free if no shadow is cast across its entire surface all year round – i.e. nothing blocks the sunlight shining on it. Even small areas of partial shading – caused for example by chimneys, roof aerials, buildings, trees (what happens when they grow?) and lamp posts – will result in a reduced yield. Modules should therefore be installed where shading is at a minimum throughout the day, or preferably where there is no shading at all. If necessary, a shading analysis can be performed using a simulation tool or solar altitude analyzer.

## Ventilation from behind

The output of solar modules produced by any manufacturer decreases considerably as the modules heat up. Ventilation from behind prevents a performance-reducing heat build-up. This is especially true for our modules with a black film on the rear and a black frame. For this reason, sufficient space between the modules and the roof surface must be ensured during mounting to provide sufficient cooling of the modules with an air draught.

## Wiring

Please note the following when connecting the system:

### ■ Correct wiring

In order to reduce voltage stress during an indirect lightning strike, keep the surfaces of all conductor loops as small as possible when planning an installation. Check that the system is wired correctly before starting up the generator. If the off-load voltage and short-circuit voltage measured deviate from the set point values, this means there is a faulty connection.

### ■ How to assemble plug-in connectors correctly

A plug-in connector has its own polarity. Ensure the connection is stable and there is no gap between the two parts. A plug-in connection should not be exposed to external influences. Otherwise it will only be used as an electrical connection.

### ■ Use appropriate materials

Always use solar cables and appropriate connectors that are intended specifically for outdoor use. Ensure that electrical and mechanical parts are kept in perfect condition. Only use single core cables. Select the appropriate conductor cross-section in order to minimise voltage drop.

## Grounding of module and frame

We recommend ensuring the functional grounding of the module metal frame. If an exterior lightning protection system is already provided, the PV system has to be integrated into the protection concept against direct lightning stroke. Local standards shall be observed.

## Snow loads and wind loads

The value for the ground snow load  $s_k$  in  $\text{kN/m}^2$  in Germany depends on the respective snow load zone, the building's location and the terrain height above sea level. The wind load can be found for the project location by consulting the wind zone map, which takes site conditions into account along with four wind zones. A simplified method can be used to calculate the wind load for buildings up to 25 m tall. Depending on the building height, the wind load is expressed as a wind speed pressure  $q$  in  $\text{kN/m}^2$ . To keep the specifications practical, the maximum ground snow load  $s_{kzul}$  is read from tables and compared with the assumed ground snow load  $s_k$ . The conditions for approval to install the modules are met if the maximum snow load from the table is greater than the snow load value at the installation site, i.e. if  $s_{kzul} \geq s_k$ . Favourable installation conditions enable modules to be used with greater wind and snow load values per DIN 1055. Calculation results were also based on DIN 1055-100 Actions on structures (March 2001) and DIN 4113 Aluminium structures (September 2002). (<http://www.schneelast.info/>)

## Module Installation

### Required tools

15er box-, flat- or ratchet wrench, 6 mm Allen key



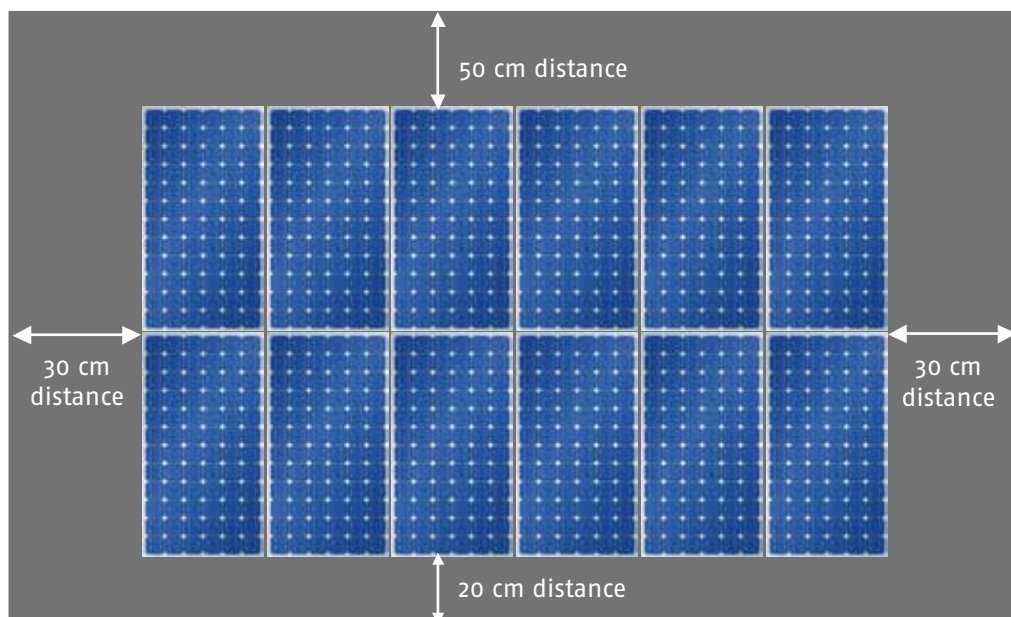
or the new WIOCLICK® mounting system + dismantling pliers



### Positioning panels

When positioning the solar panels, observe the recommended minimum distance to the edge of the roof (see figure below).

- The regulations of VDE and VDS apply to minimum distances when mounting or retrofitting lightning protection systems.
- A 50 cm gap to the ridge is recommended in order to avoid dismantling the ridge tiles unnecessarily.
- A gap of 20 cm to the eaves is recommended in order to avoid snow cornices forming and to allow water to drain properly into the gutter.
- Maximum Incline: 90 °
- Minimum Incline: 10 °
- Maximum Wind Load: Zone 4 = 30 m/sec  
speed pressure 0,56 kN/m<sup>2</sup>
- Maximum Snow Load: SK = 6 kN/m<sup>2</sup> = 600 kg/m<sup>2</sup>  
(depending on the stability of the substructure, we recommend the VARIO mounting system)



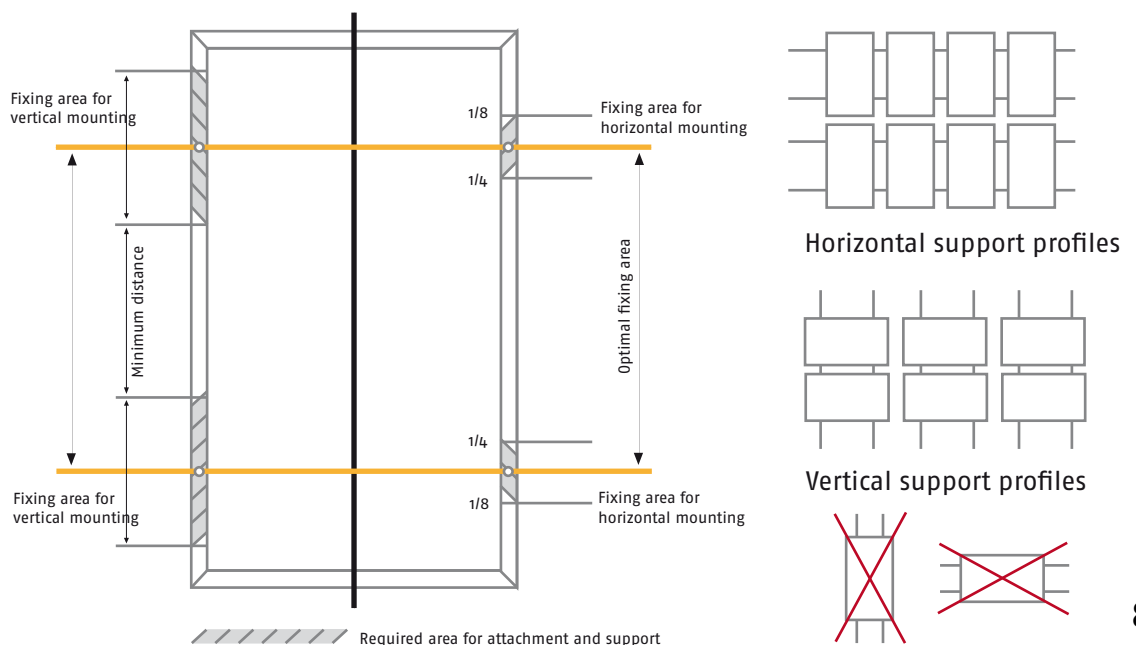
### ! PLEASE NOTE

It is imperative that the roof can withstand the additional static and mechanical loads. If in doubt, always consult a structural engineer.



## Installation instructions

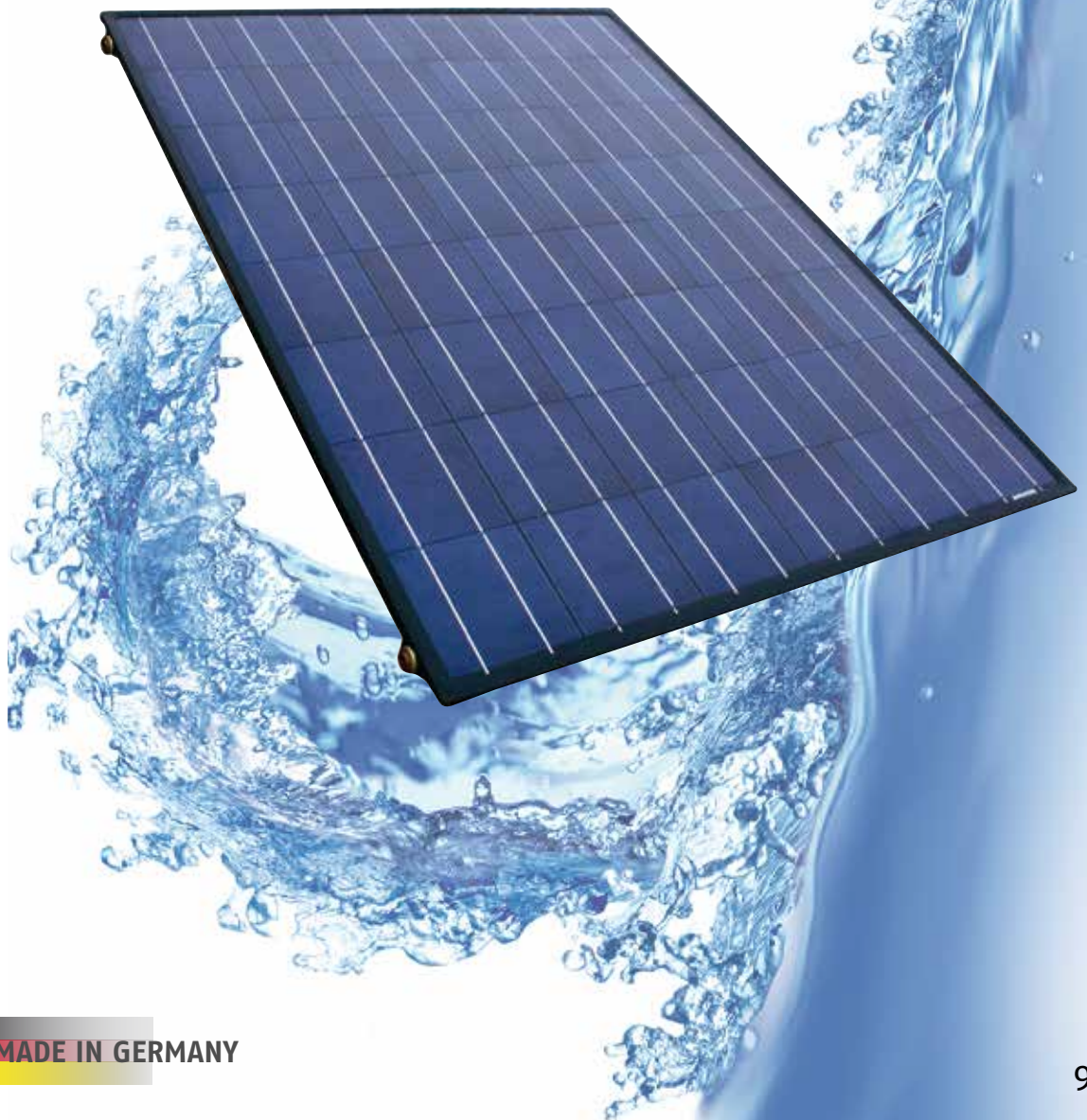
- The electrical output is the same for all panels in a single installation. If connected in series, only panels with the same current rating; if connected in parallel, only panels with the same voltage rating should be used. Check that panels comply with the technical requirements of the whole installation. Panels should not be operated at a higher voltage than the permitted system voltage.
- In order to minimise the risks of an indirect lightning strike, avoid creating conductor loops when planning the installation.
- The panels should not be installed as overhead glazing. Check that the mounting system can withstand expected wind and snow loads.
- Precipitation can run off through small apertures in the rear of the panels. Check that they are not blocked when installing the panels.
- The maximum load on the panel may not exceed 5400 N/m<sup>2</sup>. In order to prevent the maximum load from being exceeded, local factors such as wind and snow loads must be taken into consideration.
- If the panels are connected in series, ensure that all panels have the same orientation and tilt to prevent a loss in output.
- Always comply with the safety instructions for additional components used.
- Avoid the risk of falling objects (e.g. panels or tools) when installing panels at height.
- Ensure that no flammable gases occur near the installation site.
- Do not carry out work on your own.
- The panels must be secured firmly to a minimum of 4 points on the substructure. They may only be attached inside the designated areas. The areas for attaching can be found on the long sides of the panels and are located between 1/8 and 1/4 of the panel length, measured from the corner of the panel. Attaching the panels along the short sides is generally prohibited. If clamping the panels in place from the front, the clamping surface on the panel frame must be at least 135 mm<sup>2</sup> per mounting point. Do not drill the panels. Use corrosion-resistant mounting parts.



# Installation instructions

## PV-Therm (Addition)

Since the combined module PV-Therm is a synergy from photovoltaic module and solar thermal collector, there are special installation instructions for the solar thermal part. The electrical side of the PV-Therm module is equal to the conventional photovoltaic modules.

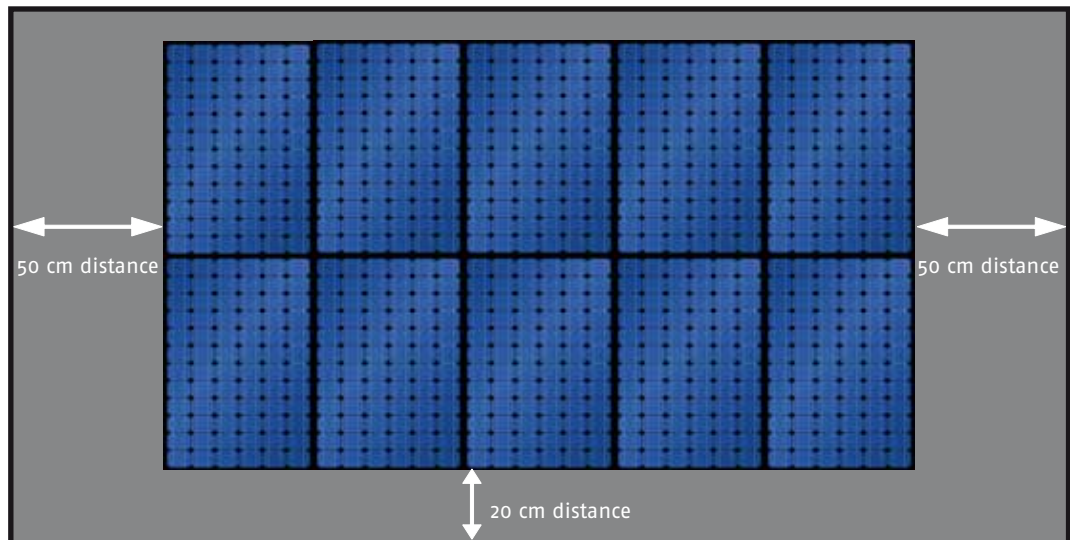


## Arrangement of the PV-Therm Modules

Maximum Incline:	90 °
Minimum Incline:	10 °
Maximum Wind Load:	Zone 4 = 30 m/sec speed pressure 0,56 kN/m <sup>2</sup>
Maximum Snow Load:	SK = 6 kN/m <sup>2</sup> = 600 kg/m <sup>2</sup> (depending on the stability of the substructure, we recommend the VARIO mounting system)

Compared to the conventional PV mounting, the following minimum distances to the respective roof edge are to be adhered to:  
(more lateral distance because of pipe installation)

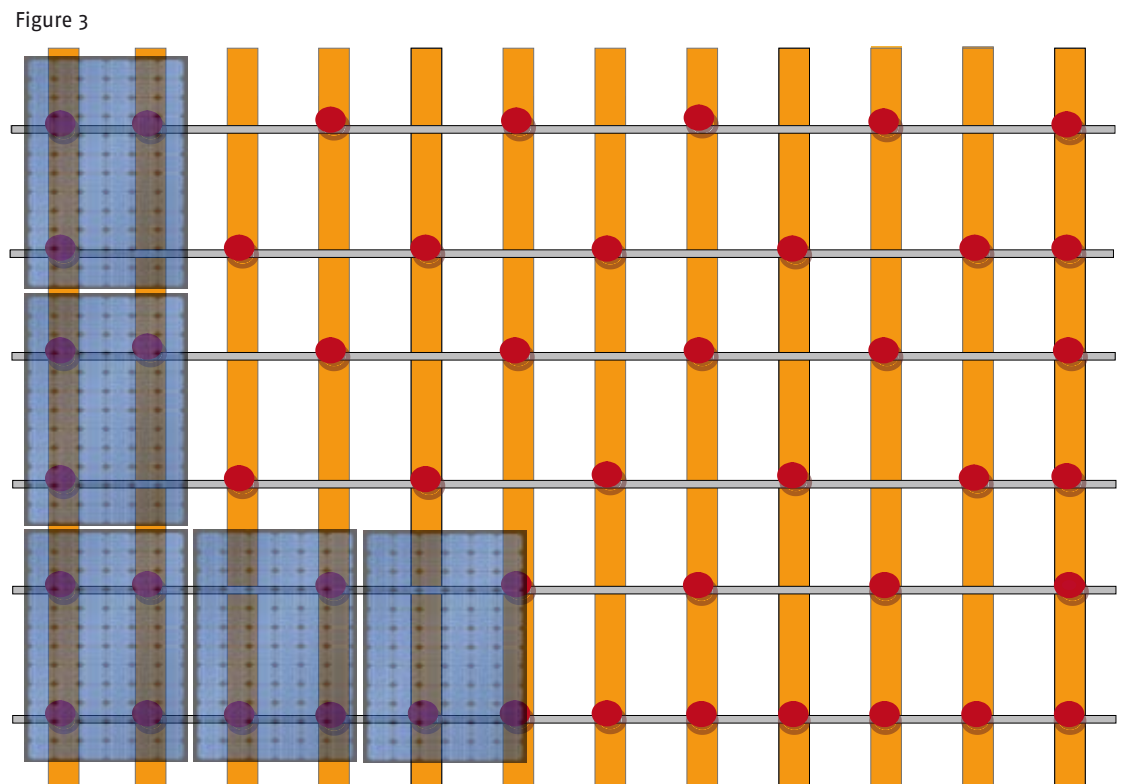
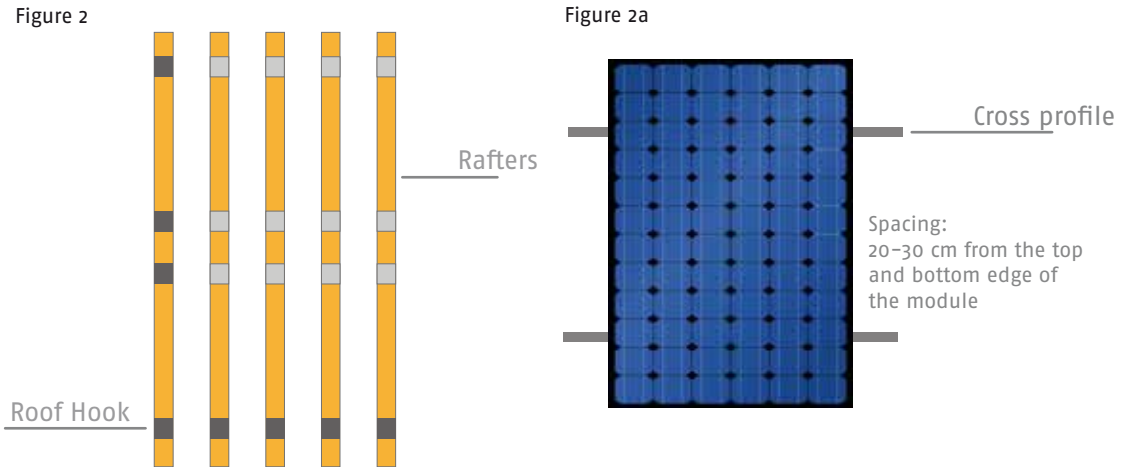
Figure 1



## Positioning of the Roof Hooks

- Measurement of lines and angles of whole module field.
- After the module rows have been defined and the position of the cross profiles has been determined, start to fasten the hooks on top of each other in the uprights, on the left or right rafter. Then, the lowest row is fastened, one next to the other, in the horizontals. (See figure 2)
- Then the remaining hooks are to be completed. (arrangement depends on the spacing between rafters)
- The cross profiles must run approx. 20-30 cm from the bottom and top edges of the module and must not project more than 50 cm to the side over the last hook. Please follow the installation instructions for the specific module types. (See Figure 2a)
- Apply the central clamps at the necessary position

## Positioning of the Roof Hooks



- 10 x 40 mm round-head screws must be used for fastening the rails onto the hooks, so as to be able to install the earth cable and pipe clamps.
- Align the substructure (rails) evenly on one level, in order to prevent strain on the module end-pieces and to make installation easier.
- For the installation of the roof hooks, follow the respective guidelines regarding your snow-load zone.

### Module Installation (please note the order)

1. Make sure that the aluminium rails are correctly aligned.  
(follow instructions provided)
2. Then mount the Vario stop rail (Figure 5) on the substructure by means of the mounting angles and carefully align it. (Only dismantle the stop rail once module installation has been completed)
3. The string cable wires and potential equalisation should be positioned on the roof deck, according to the specific plan.
4. Install flow and return pipes, which are laid under the modules, according to the hydraulic plan.
5. Always take only one module out of the carrier box and fasten on one after the other, start from the bottom and work upwards, row by row. (Figure 3)



**ATTENTION:**

Never put the modules down on the end-pieces!

6. Lay the modules on the substructure.
7. Now (and not before) remove the plastic caps from the module.  
Assemble butterfly control valves according to volume flow.
8. Insert connecting sleeves into the fittings of the module. (top and bottom)
9. Shift central clamp to the module using socket head screw and slide nut.
10. Carefully and evenly, push the next module up against it and carefully insert it in the connector sleeves.
11. Be aware of the insertion depth (if the central clamp is applied on both modules).
12. Tighten central clamps (18 Nm).
13. The first and last module of the row is fastened on the outside with end clamps.
14. A space of 1 cm must be ensured between the individual horizontal rows.

Figure 4

**Relay modules**

- using the mounting angle

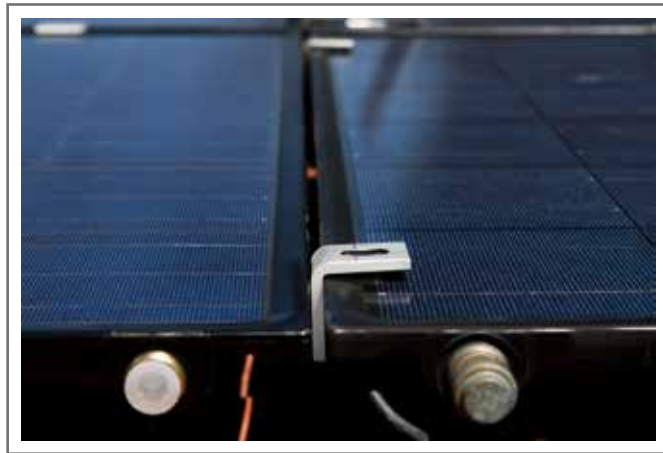


Figure 5

**VARIO Stop Rail**

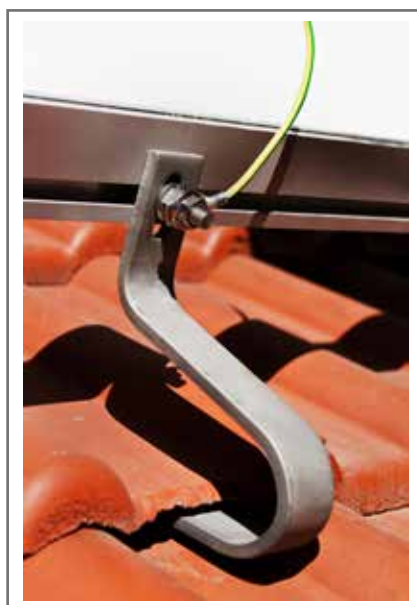
- mount and carefully align, using the mounting angle



Figure 6

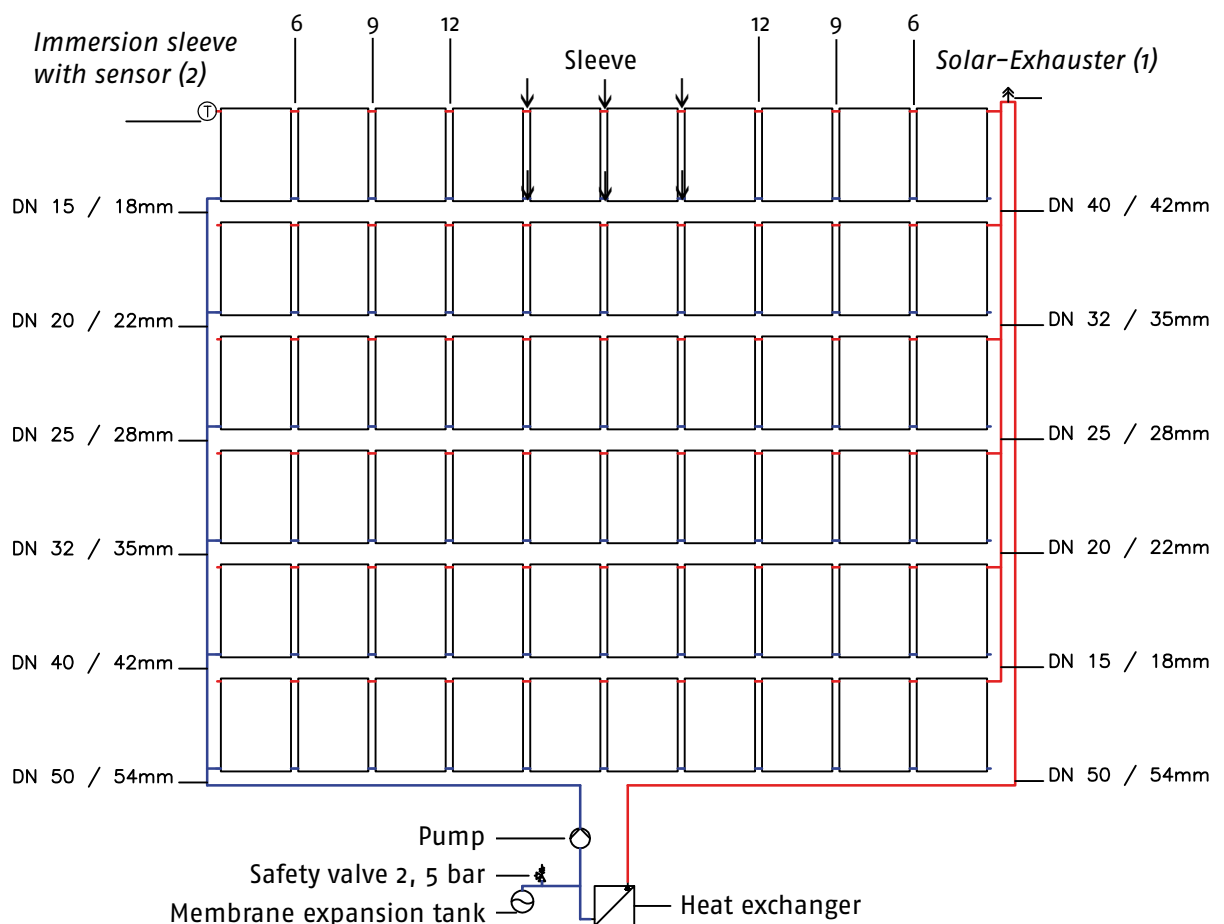
**Potential Equalisation**

- Fasten module potential equalisation cable onto the aluminium rail of the substructure



## Module Conduiting

- The conduiting is to be carried out in accordance with the Tichelmann principle. (*Tichelmann pipe routing, see information box page 15*).
- If this is not possible, hydraulic compensation must be carried out.
- Carry out the conduiting with the Tectite Fittings provided, according to the plan.
- Tube the individual module rows on the side. (see connection diagram)  
→ copper must be used for this
- Tube lines are to be fastened to the substructure with pipe clamps.
- A solar vent must be built into the hot water outlet of the top row.
- The temperature sensor is inserted into the module, on the opposite side, by means of an immersion sleeve. (2)



## Instructions for Hydraulic Conduiting

- Due to the nominal diameters of the tubes, no more than a maximum of 10 modules may be thermally incorporated in the line, or 60 modules per block.
- The materials for rooftop installation are contained in the connecting set. This is a basic package and is for the respective size of system.
- The connecting set consists of:  
solar vents, end caps, semicircular arches, angles, T-pieces, immersion sleeves and roof lead-in tubes with changeovers.
- Additionally required materials such as expansion tank, pump, heat exchanger, buffer storage or service water storage, anti-freezing agent, safety armatures and other incidentals are to be calculated based upon the specific building and are not included in the scope of supply.
- If tanks are used, the following rule of thumb applies: at least 50 litres of storage capacity are recommended for each module installed (depending on the system)
- Example: 10 PV-Therm modules  $\approx$  500 Liter storage capacity
  - With rates of flow  $> 50\text{l/h/Modul}$   
→ higher cooling effect
  - With rates of flow  $< 50\text{l/h/Modul}$   
→ higher heating effect

*Information box:*

### Tichelmann Principle

The Tichelmann system is a special form of pipe laying in heating construction.

The Tichelmann principle consists of making sure that the water, or cold or heat-transferring medium, flowing through the system must pass through the same length of piping. For this, the lengths of the feed and return pipes are considered together and the same pressure losses occur at each consumer, so that the mass flow is divided up evenly.

In this connection, it is also important, of course, that the outputs and/or resistances are approximately equal in all heating areas. The Tichelmann principle is a simple method of hydraulically balancing a system.

Based on the same arrangement of feed and return pipes, it is simple to design. It does not require any additional regulation and has no moving parts that can cause defects or malfunctions. This increases the operating reliability of the system. Solar collectors must also be connected in accordance with this system, so that the flow through all of them is roughly equal.



## Pressure Testing and Filling of a PV-Therm System

### DATA SHEET

- Filling, venting and commissioning must be carried out by an approved, authorized company.
- The whole system is to be checked for correct functioning and the absence of leaks.
- Flush the system for at least 20 minutes to make sure that absolutely all air has left the tubes.
- The system must be pressure tested with water/glycol mixture or air.



#### NOTICE

Do not use only water to fill and check the system, as not all of the water flows out of the system when it is emptied. Frost damage can occur.

- Max. test pressure: 2,5 bar
- Testing time: 30 min
- System operating pressure: 0,5 bar overload pressure at the module on the roof

#### Example:

Family home with a height of construction on 10 m equals an overload pressure of 1,5 bar (1 bar/10m)

- Only fill the centre using suitable filling station or flushing centres
  - Install safety valve with max. 2.5 bar pressure
  - Set membrane expansion tank pressure to system pressure
- Recommended heat transfer fluid: Bilosol L
  - **Maintenance**  
Check system pressure once every year, refill heat transfer fluid if necessary

### Pressure loss table for a PV-Therm module

Fluid	Water/ Glycol Mix approx. 20°C (Bilosol L)					
Mass flow in kg/h		79	189	294	398	501
Pressure loss in mbar	0,9	2,6	4,3	6,4	8,6	

Fluid	Water approx. 20°C					
Mass flow in kg/h		79	185	291	394	501
Pressure loss in mbar	0,2	1,1	2,5	4,3	6,8	

## Dismantling



Figure 7

- After the system has been emptied and the electricity has been switched off, you can start dismantling from the roof.
- Loosen the socket head screw of the module holding clamps and the screw of the module earth cable.
- Pressure is exerted upon the dismantling rings of the fittings with two special dismantling tongs. The modules can then be pulled apart.



Should you have any questions concerning installation or commissioning, please contact your advisor or a technician from WIOSUN® under the following telephone numbers **before** filling the system.

Solarzentrum Allgäu KG, Biessenhofen      +49 (0) 8342 8969-0



The guarantee claim expires in the case of improper installation or implementation.



### Transport and Handling

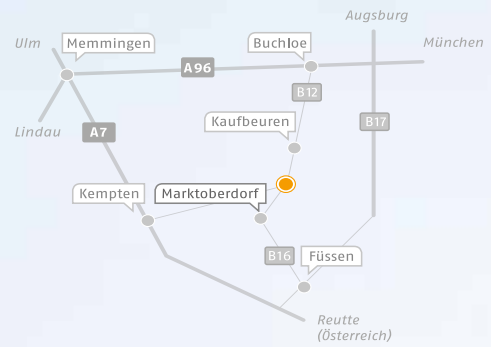
- Do not place the modules on the connections
- Transport modules vertically or with the original edge protector
- Do not place modules on top of each other (risk of breakage)



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