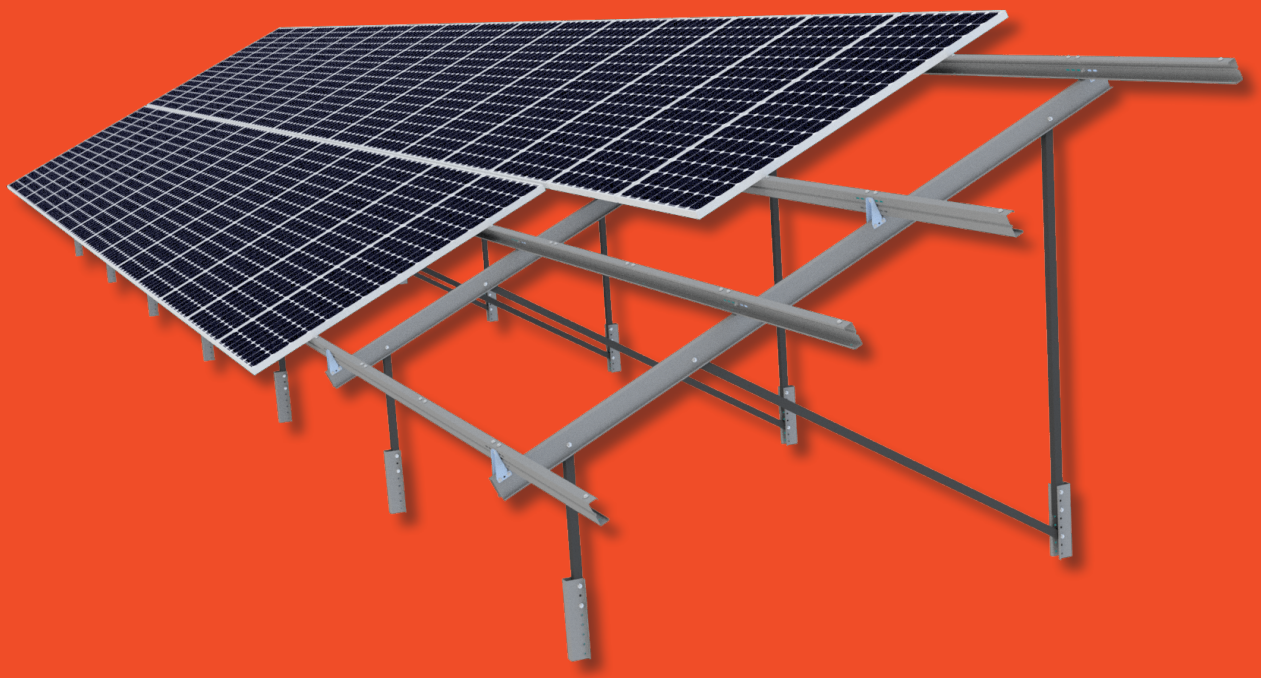
mounting systems

Sigma II C-Module Support Rail Installation Manual



Content

1. Introduction

1.1 Short description

Sigma II is an open field, two post PV ground mount system. It allows a flexible arrangement of modules in portrait or landscape orientation. The Sigma II can be anchored with driven piles or cast in concrete. It consists of a hot-dipped galvanized steel substructure with stainless steel fasteners and aluminum clamps.

1.2 About these instructions

Content
These instructions describe the installation of the Sigma II mounting system and provide necessary information regarding components, system planning and important safety warnings. Sections 1, 2 and 3 provide an overview as well as detailed information about the Sigma II system and components. Section 4 provides basic module layout and planning information. The remaining sections provide detailed system assembly and installation instructions.

Validity of the installation manual
This installation manual is only valid in conjunction with:

- The document "Installation manual for PV mounting systems – general part". This document states the general information on Mounting Systems' products with regard to standards, safety, transport, maintenance, disassembly and disposal.

- The project-specific overview drawing (POD). This document shows the project specific installation details, choice of components and dimensions, as well as any deviations from the standard material/ assembly. **Therefore, the POD takes precedence over the installation manual in case of discrepancies between the two documents.**

- The supplied material for Sigma II according to the bill of materials (BOM).

These documents are an integral part of the product Sigma II and must be observed at every installation.

Please read both this installation manual and the above mentioned documents carefully prior to any installation, maintenance and disassembly work.
You will be provided with all information for safe and complete installation, maintenance and disassembly. However, if you have any questions after having read these documents, please contact Mounting Systems GmbH.

User group
These installation instructions are intended for the following persons (user group):

- Skilled personnel
- Instructed personnel

Skilled personnel
Skilled personnel are persons who, on the basis of their professional training, are able to execute installation, maintenance and disassembly work properly.

Instructed personnel
Instructed personnel are persons who have been instructed and taught appropriately regarding the assigned tasks and the possible risks in the event of improper conduct. An instructed person must have received instructions regarding the required safety devices, precautions, relevant regulations, accident prevention regulations as well as operating conditions and must have demonstrated his/her competence. The implemented work must be inspected and accepted by skilled personnel.

Guidance notes
The following guidance notes enhance the orientation when handling this installation manual:

Pictograms:


This symbol indicates important information and useful tips.


This symbol indicates ways ans means to make the installation process easier.

1.3 Warnings

The following warnings are used in these Installation Instructions to indicate safety-related information. They include:

- Warning symbols (pictograms)
- Signal words which identify the hazard level
- Information about the type and source of the hazard
- Information about the potential consequences if the hazard is disregarded
- Measures for the prevention of hazards and the prevention of injuries or damage to property.

The signal words of the warnings respectively indicate one of the following hazard levels:

 **DANGER**	Indicates a potentially mortal danger, disregard for which may result in death or serious injury.
 **WARNING**	Indicates a potentially dangerous situation which may result in serious injury or damage to property.
 **CAUTION**	Indicates a potentially dangerous situation which may result in injuries or damage to the property if ignored.
 **ATTENTION**	Indicates potential danger which can result in damage to the property.

1.4 Safety

All universally valid safety instructions for products of Mounting Systems GmbH are listed in the document "Installation manual for PV mounting systems – general part". Please read this document carefully and observe the instructions given therein: Do not use the product in a manner other than intended, comply with the obligations of the owner and observe all general and specific safety instructions.

In addition, please observe the specific safety instructions given in this installation manual for all installation work. The specific safety instructions are positioned in each case directly with the respective installation step.

2. Technical description

Upon delivery of the Sigma II system, check to ensure that all parts and components as described in the Bill of Materials and the Project Drawings are present. If an item is missing or damaged, please document the discrepancy and notify Mounting Systems immediately.

2.1 System overview

The major system components of Sigma II are listed below. Some components can vary, especially from portrait to landscape installation. Moreover, variations can be implemented depending on:

- Desired type of foundation
- Type of module
- Number and configurations of modules
- Local conditions

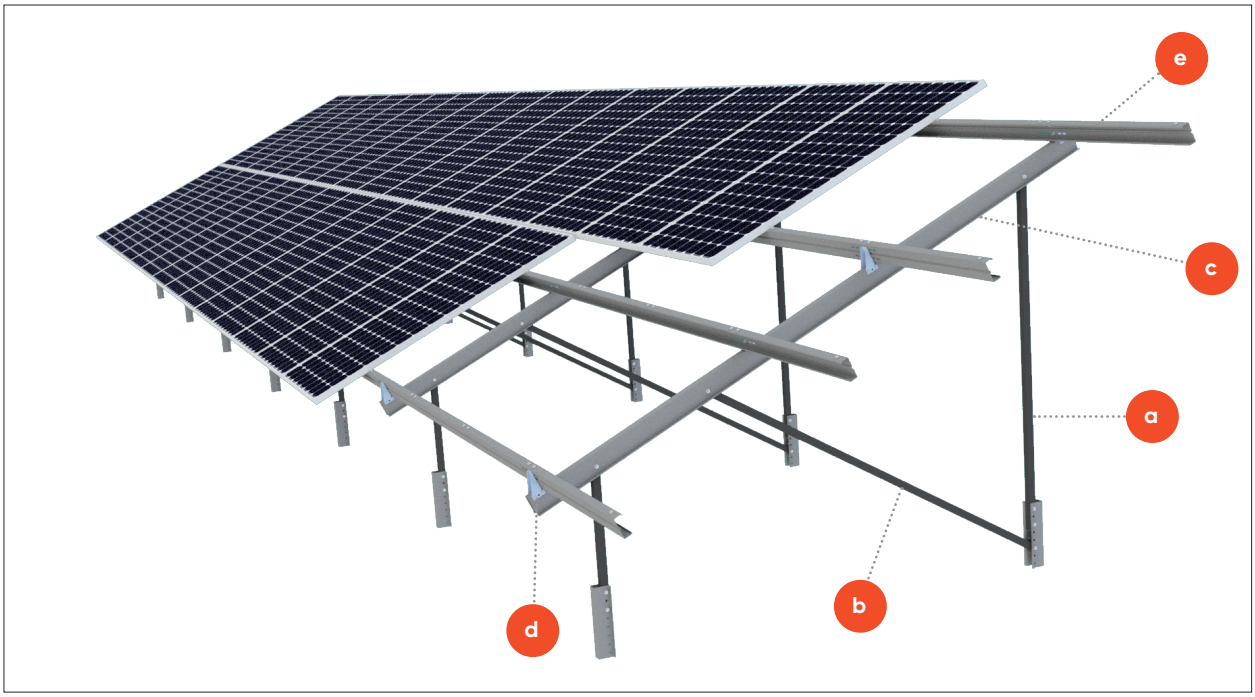


Figure 2.1 - 1 Portrait Configuration

Sigma II Components:

a Legs with driven piles
b Diagonals
c Rafter
d C-rail connector
e Module support C-rail

2.2 Component details

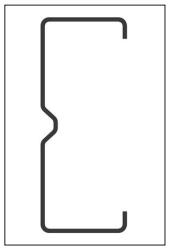


Figure 2.2 - 1 Module rail

Figure 2.2 - 2 Crossbar connector

Figure 2.2 - 3 Module rail connector

Figure 2.2 - 4 Thermal connector

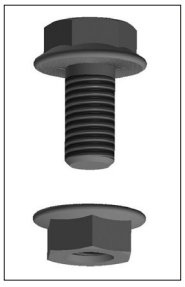


Figure 2.2 - 5 Component details

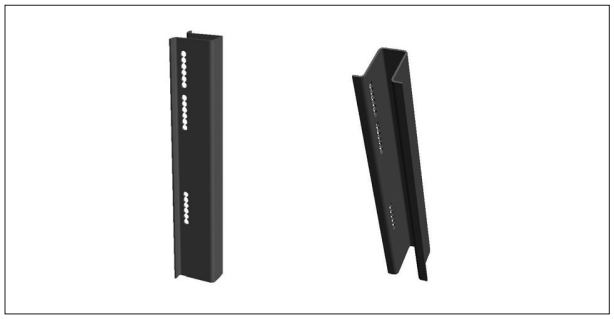


Figure 2.2 - 6 Foundation

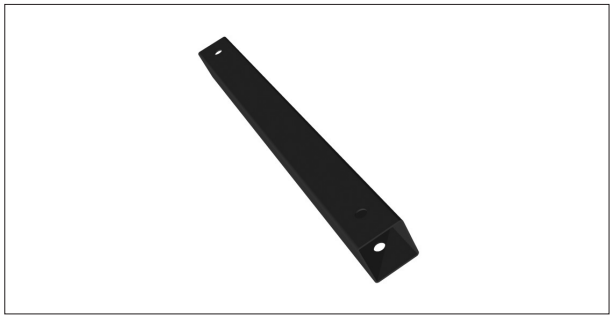


Figure 2.2 - 7 Leg

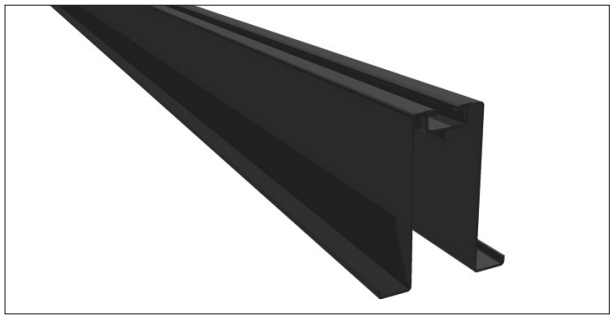


Figure 2.2 - 8 Rafter with channel

3. Project drawings and Bill of Materials

Project-specific documentation is supplied as part of the Sigma II system. It contains all the information necessary to install the system.

The documentation includes:

- Bill of Materials (BOM)

- System overview drawing(s) which show:

  - The exact module configuration for the project
  - Component variations specific to the project
  - Specific foundation information for the project
  - The parts supplied for bolted connections specific to the project
  - Dimension and tolerances

4. Basic installation requirements

4.1 System units

Sigma II is designed in separate system units which can be up to 40 m long. The Bill of Materials and dimensions of the specific system unit are listed in the POD.

4.2 Required tools

In order to mount the Sigma II, the following tools are required:

- Power drill/ electric screwdriver
- Folding rule/ measuring tape
- Angle
- Spirit level or laser level tool
- Allen key 5 mm
- Open end wrenches: 2 x size 17 mm and size 13mm for module support clamp

4.3 Tightening torques

A good quality torque wrench should be used to tighten bolted connections to the torque requirements. These values will be specified in your POD.

5. Foundation

5.1 Installation of ramming posts

Ramming posts should be oriented as shown in Figure 5.1 - 1. Make sure that the posts are positioned and installed within the tolerances. The corresponding tolerances will be specified in your POD. The absence of specific information in the POD shell apply the following guidelines:

Tolerances

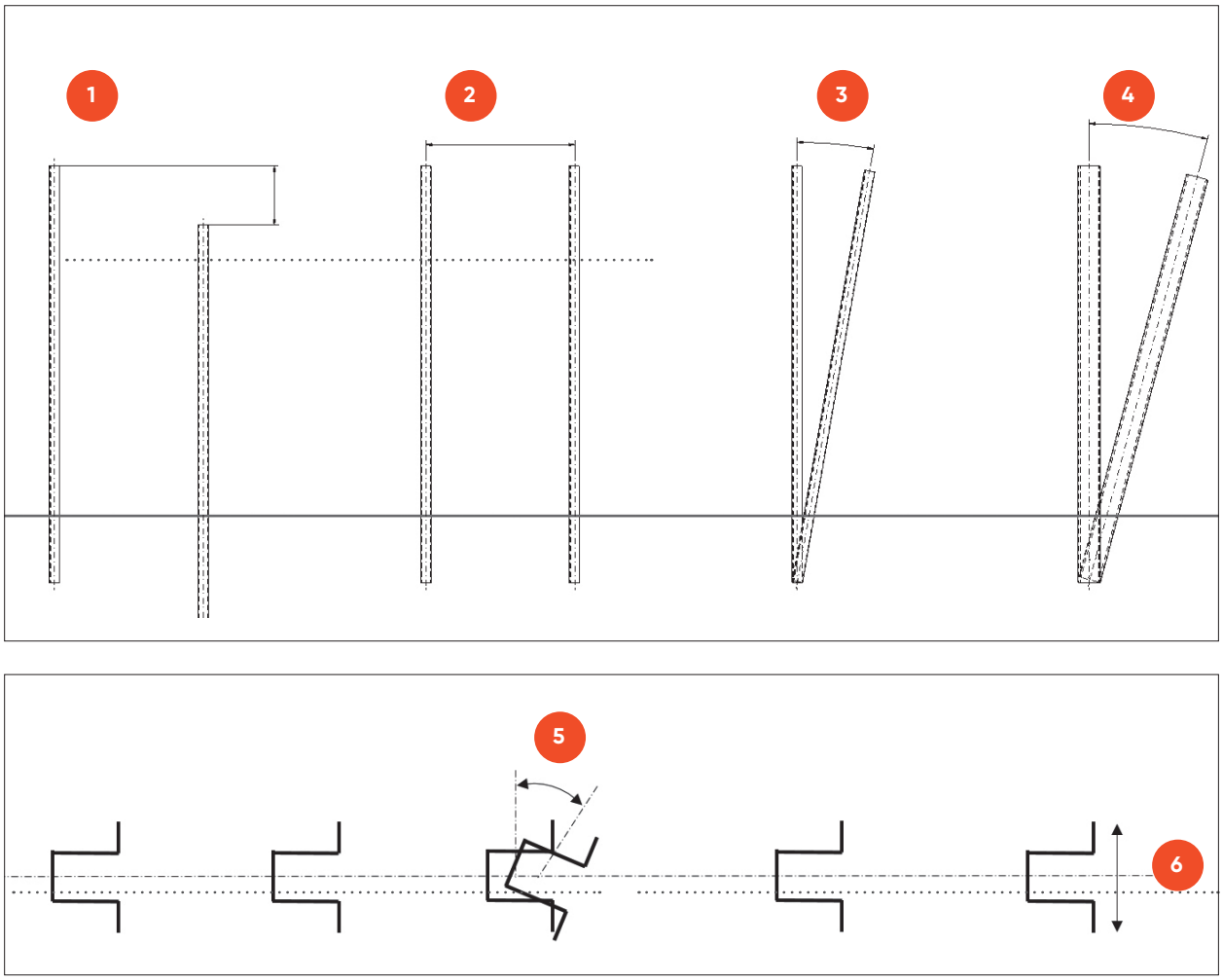


Figure 5.1 - 1 Orientation of ramming posts

1. Post height max. ± 2 cm based on planned height
2. Position E-W max. ± 5 cm
3. Inclination tolerance E-W max. 1° (1° ≈ 2cm/m)
4. Inclination tolerance N-S max. 1°
5. Torsion max. 2°
6. Axis tolerance E-W max. ± 2cm based on the post top

HINT!
After the ramming posts have been set, the pile head (about 3cm) should be treated with zinc dust primer. This prevents premature corrosion and thus support the longevity of the system.

6. Installation of superstructure

6.1. Rafter - legs - diagonal

Position legs and diagonal and fix. Position rafter and fix. Please take the information about the fixation material from the project specific Overview drawing.

Observe the right tightening torques!

Installation steps

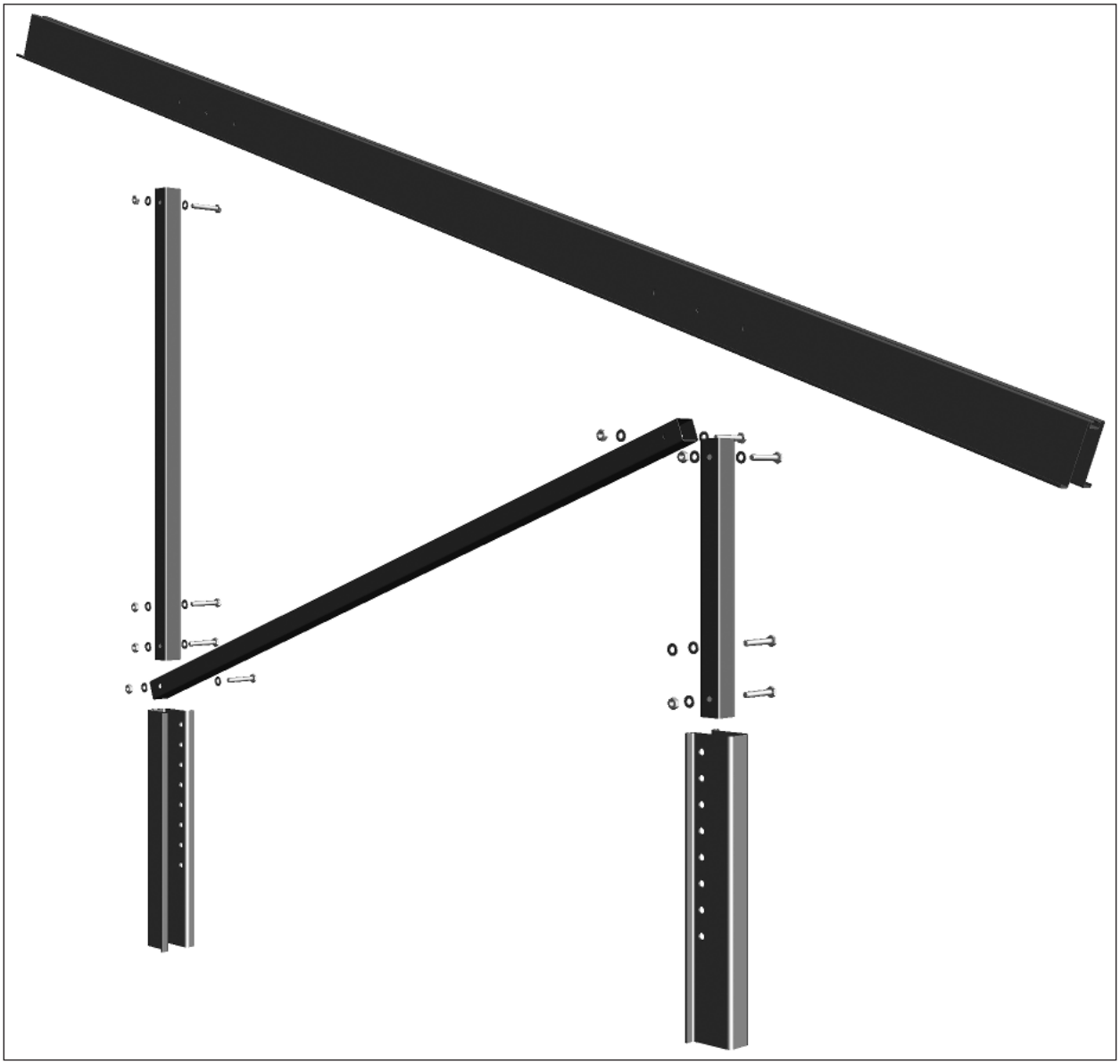


Figure 6.1 - 1 Installation steps

7. Installation of C-module rail

7.1 Installation of module rail
Attach the cross-connectors to the pre-drilled rafters. Depending on the applicable load, use between 4 to 6 screws per cross-connector. Screw the crossconnectors firmly in place with the tightening torque specified. See Figure 7.1 - 1.

Lay the module rail across the cross-connector and tighten it in place. See Figure 7.1 - 2.

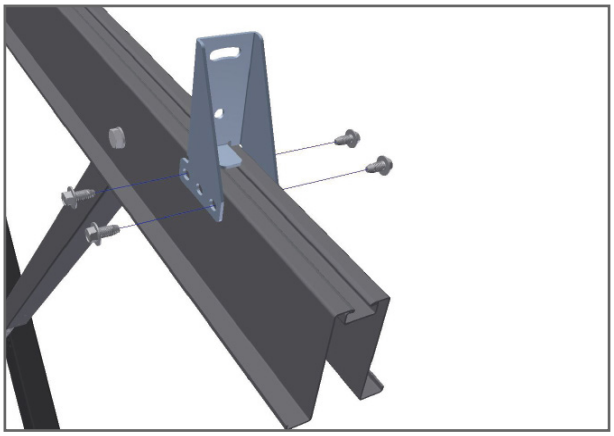


Figure 7.1 - 1 Installed cross-connector

Offsets (+/- 50 mm) and lateral inclinations (east-west direction) of up to 10° can be realized via the slottedholes in the cross-connector and the module rail.

See Figure 7.1 - 3.

ATTENTION

NOTE!
The tightening torques must be complied according to the project drawing.

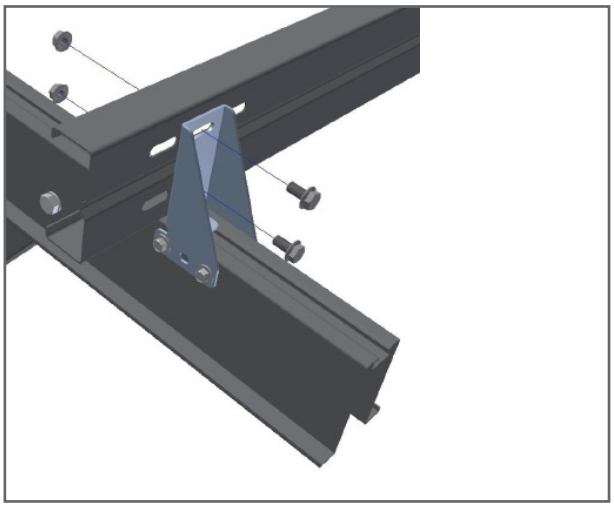


Figure 7.1 - 2 C Module - rail connection

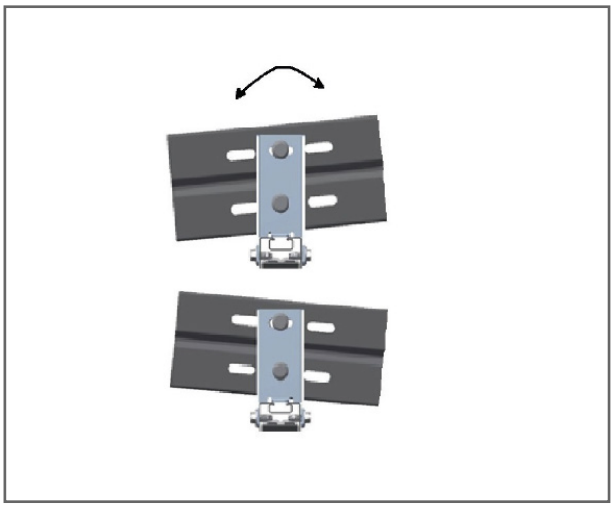
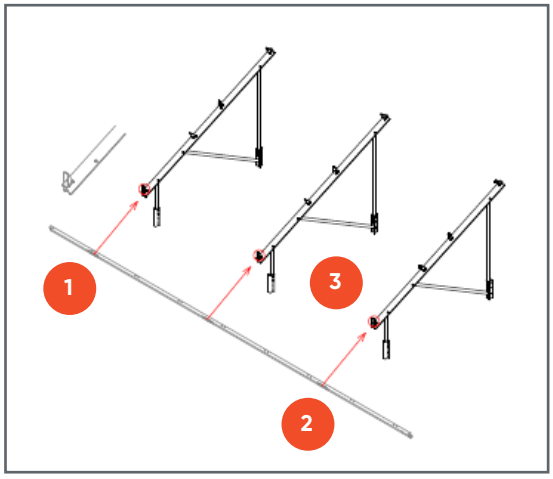
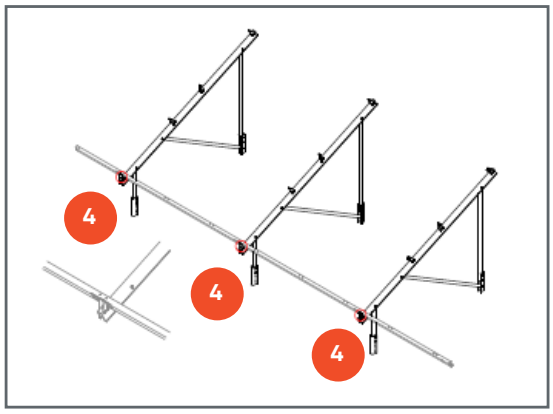
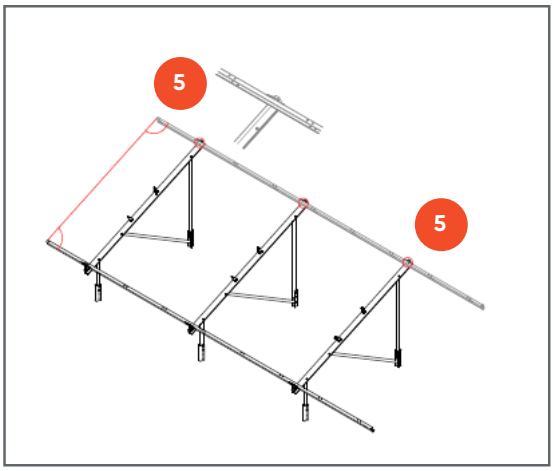
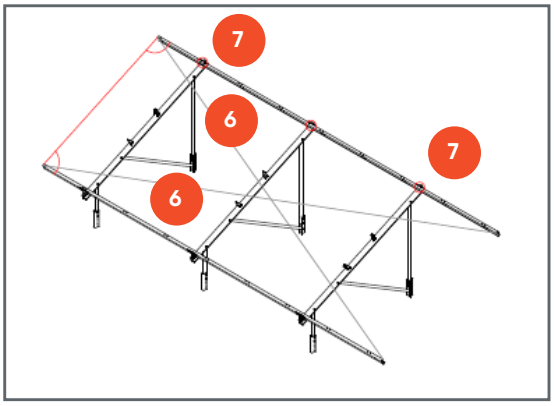


Figure 7.1 - 3 Lateral inclination of module rail





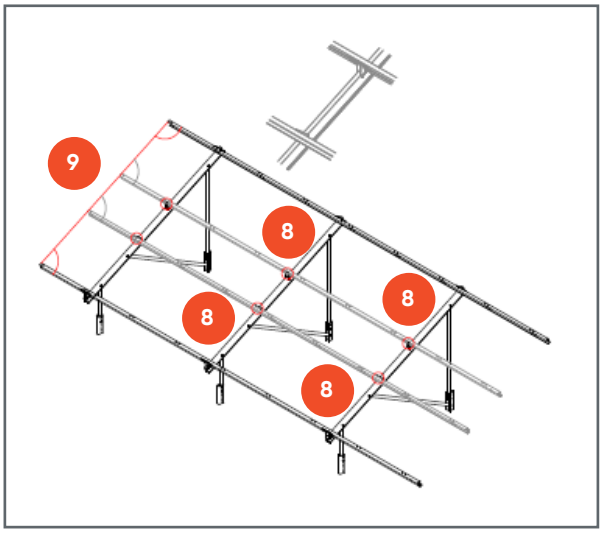




7.2 Alignment of C-module rail

Suggestions for installation steps

1. Mark cantilever arm length of the lower module support rail
2. Mark field length of module support rail
3. Lay lower module support rail on cross connectors
4. Tighten the screws to fix the module rail, see Fig. 7.1
5. Lay upper module rail on cross connectors
6. Align the two module rails by measuring the diagonals. Both diagonals must have the same length
7. Tighten the upper module rail
8. Mount the other (middle) module support rails at the cross adapter
9. Align the other module support rails with the upper and lower module rail using a cord (red)



The module support rails are spliced together with a connector as shown in Figures 7.3 - 1 through 7.3 - 2.

7.3. Connector

Connector for the module rail:

- In order to connect two module rails, align them on the rafters as shown in Figure 7.3 - 1.
- Place the connector against the rear of the module rails facing in the opposite direction, and fix the connector in place using the screws and nuts provided.

Please refer to the project drawing for the points at which a thermal separation is necessary in the system. For thermal separation, there is a variable module rail connector:

- Various module rail distance can be realized using the slotted holes. See Figure 7.3 - 2.
- Place the connector against the rear of the module rails facing in the opposite direction.
- Screw one side of the connector (the side with the screw holes) to the module rail with the same screws and nuts as with the fixed module rail connector.
- Screw the other side of the connector (with slotted holes) to the other module rail with the screws and cap nuts provided.

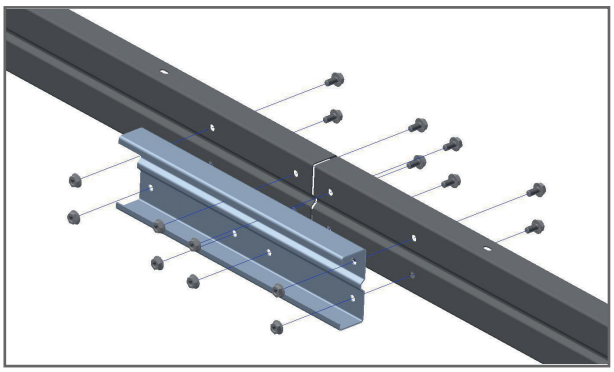


Figure 7.3 - 1 Installed cross-connector

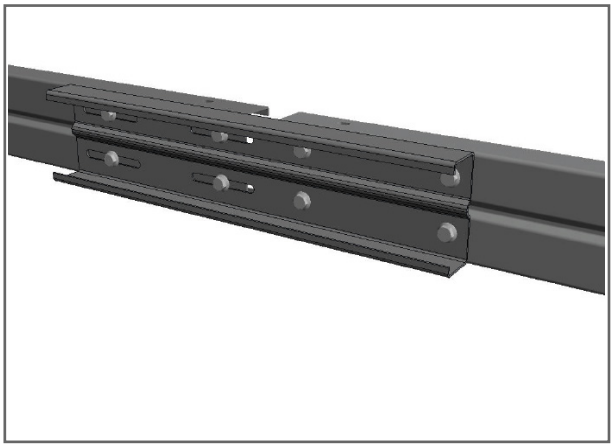


Figure 7.3 - 2 Variable module thermal connector

8. Installation of modules

The following steps describe installation of modules in a row. This procedure begins on the left edge (west) of the module system and proceeds to the right (east). However, the modules can also be installed in the opposite direction.

Variant 1 - screw and nut connection

The following installation steps apply if the modules already have holes drilled into the module frames and the modules are to be screwed directly onto the module rails:

- Place the module onto the module rails and slide it over the pre-drilled holes in the module rail.
- Hold the module tight and use the screws and nuts provided to screw the module onto the module rail. See Figure 8.1 - 2.
- Repeat these steps until modules cover the entire module substructures.

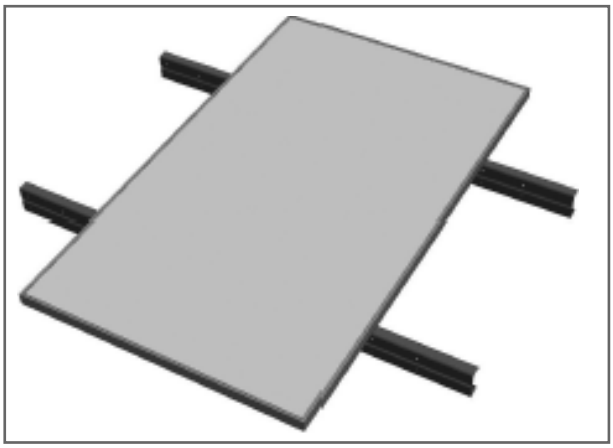


Figure 8.1 - 1 Portrait installation

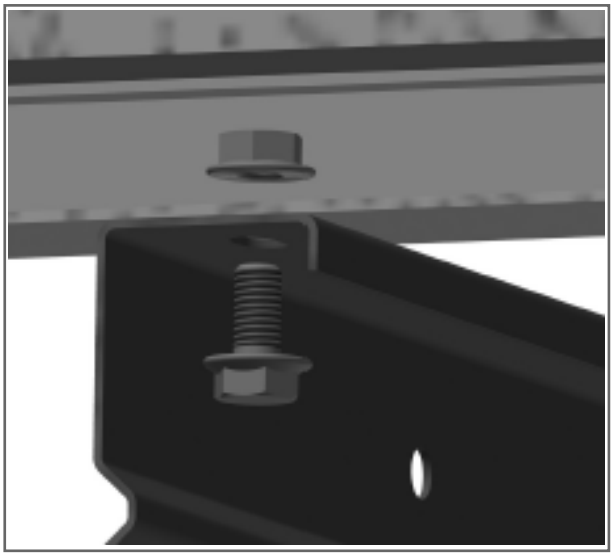


Figure 8.1 - 2 Screw-and-nut module connection

Variant 2 - Module clamp installation

The procedure below describes the installation of modules on a single row. This procedure begins on the west end of the array and moves east. Modules can also be installed from east to west if desired.

- Attach an end clamp onto each module support rail to the long hole.
- Place the first PV module on the rails and slide the module frame against the end clamp. With the module's clamping points correctly positioned under the end clamps, tighten the end clamps onto the module frame.
- Attach a mid clamp onto each module support rail to the long hole. Push it flush against the module, ensuring the clamp body rests on top of the previously installed module frame.
- Place the next module on the module support rail and slide it against the mid clamps.
- Repeat the above steps for the rest of the row of modules. At the end of a row, install an end clamp on the outside of the last module to complete the row.

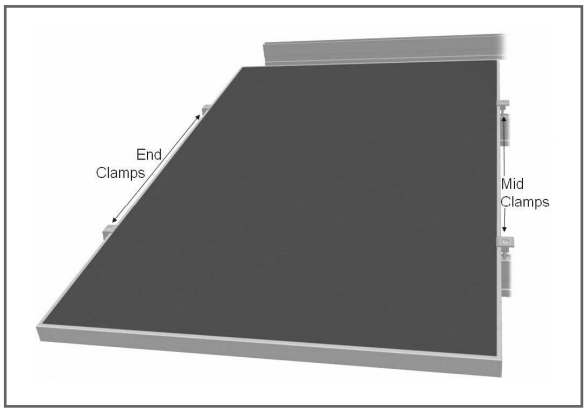


Figure 8.1 - 3 Installing locations clamps

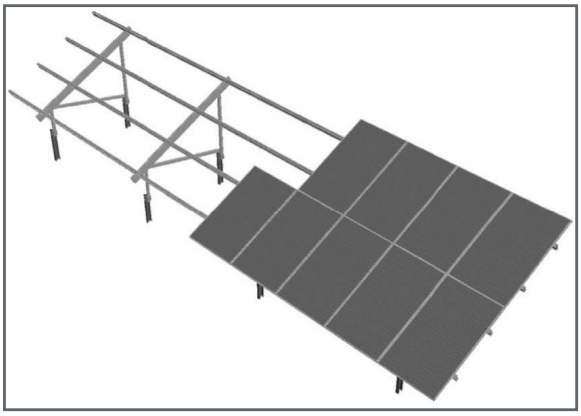


Figure 8.1 - 4 Portrait installation

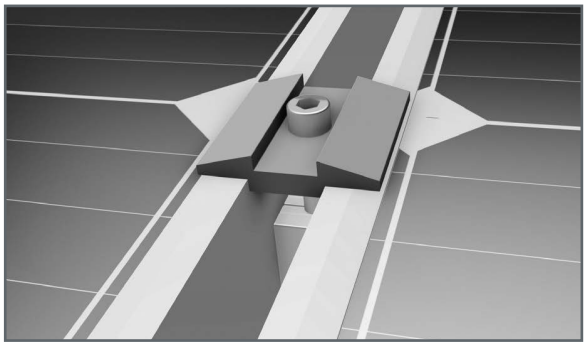


Figure 8.1 - 5 Module mid clamp

CAUTION

Material damage due to incorrect mounting

Incorrectly fastened modules can fall and become damaged.

- Ensure the modules are flush against both sides of the clamp.
- Observe and adhere to the recom-mended torque specifications.

ATTENTION

NOTE!
The tightening torques must be complied according to the project drawing.

9. Installation of wind bracings

If specified in your project overview drawing, wind bracings can be installed on the right and left side or in the middle of each system unit between the two rear legs.

Wind bracings are for additional stiffness of the structure and the number and the direction depends on the specific position of the table on the project site. Commonly, a distinction is made between the tables of edge areas and the field.

Please refer to your project layout and the POD for the correct positioning and small parts used in the connection.

9.1. Installation of wind bracings

The wind bracings can be designed as a single diagonal bracing or as an across-the-table variant, as described in the POD.

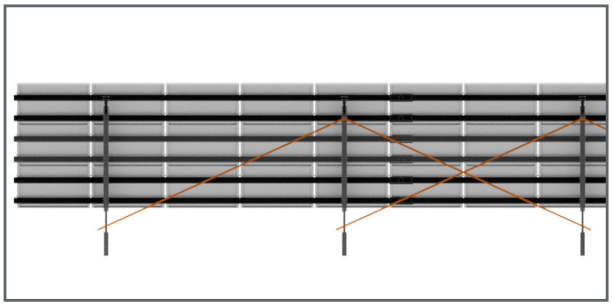


Figure 9.1 - 1 Installed wind bracings

The rear leg has pre-drilled holes for the mount of the bracings. Insert screws through the hole to fix the bracing.

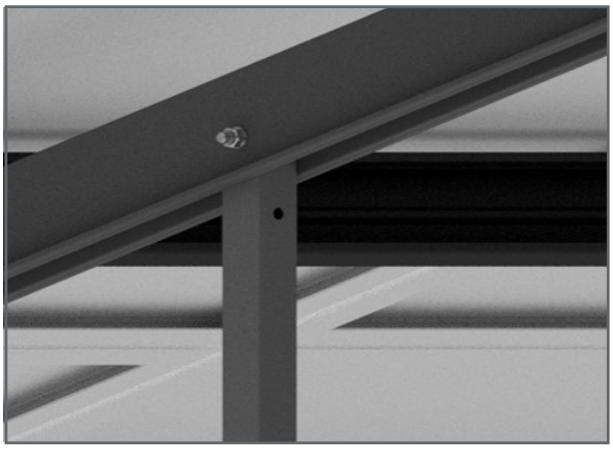


Figure 9.1 - 2 Pre-drilled hole in post for bracings

ATTENTION

NOTE!
The tightening torques must be complied according to the project drawing.

Figure 9.1 - 3 Installed wind bracings to post

Generally, both the post and the bracing have pre-drilled installation holes. If not readily available, please drill missing holes to the bracings by using a power drill. Tighten the bracings with screws.

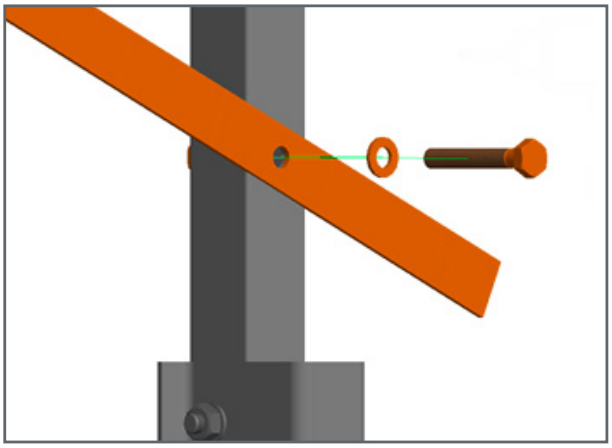


Figure 9.1 - 4 Screw connection post - bracing

The overhang bracing at the drilled end needs to be at least 35 mm long. Cut the remaining part of the bracing to avoid possible injury caused by sharp edges.

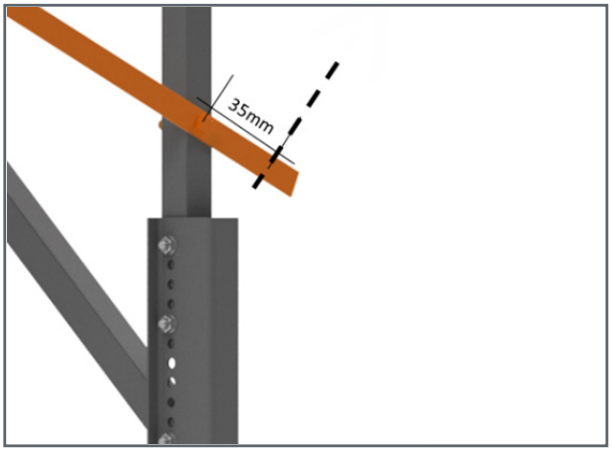


Figure 9.1 - 5 Installed wind bracings to post

10. Maintenance

When properly assembled, the ground mounting system is a reliable and troublefree system and should require little in the way of ongoing repair. Nevertheless, Mounting Systems recommends maintaining a regular inspection and maintenance schedule. Such a program can detect and address potential problems before they become serious and help ensure the system's excellent long-term durability and reliability.

The following procedure pertains only to the Sigma II mounting system structure. Maintenance and repair of other PV system components should be carried out in accordance with the respective manufacturers' recommendations.

10.1 Inspection

At least annually the system should be visually inspected for obvious loose connections, missing components, modules which appear to have shifted, vegetation overgrowth, wind-blown debris and other indications of abnormality. Any problems detected at this time should be addressed and repaired as necessary.

10.2 Testing

After one year in service, it is a good practice to check the torque settings of a representative sample of system connections including module clamps and rail clamps. Do not exceed the recommended torque settings. If a disproportionate number of loose connections (more than 10% of connections) are found, it may be an indication of improper assembly and it may be necessary to take comprehensive corrective action.

A smaller sampling of connections can be tested annually thereafter. Mounting Systems recommends keeping records of the connections sampled each year and testing and, if necessary, adjusting previously untested connections in succeeding years. After all connections have been tested, sample sizes and test frequency can be reduced.

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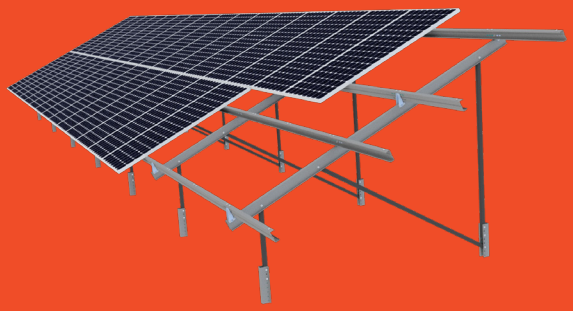

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