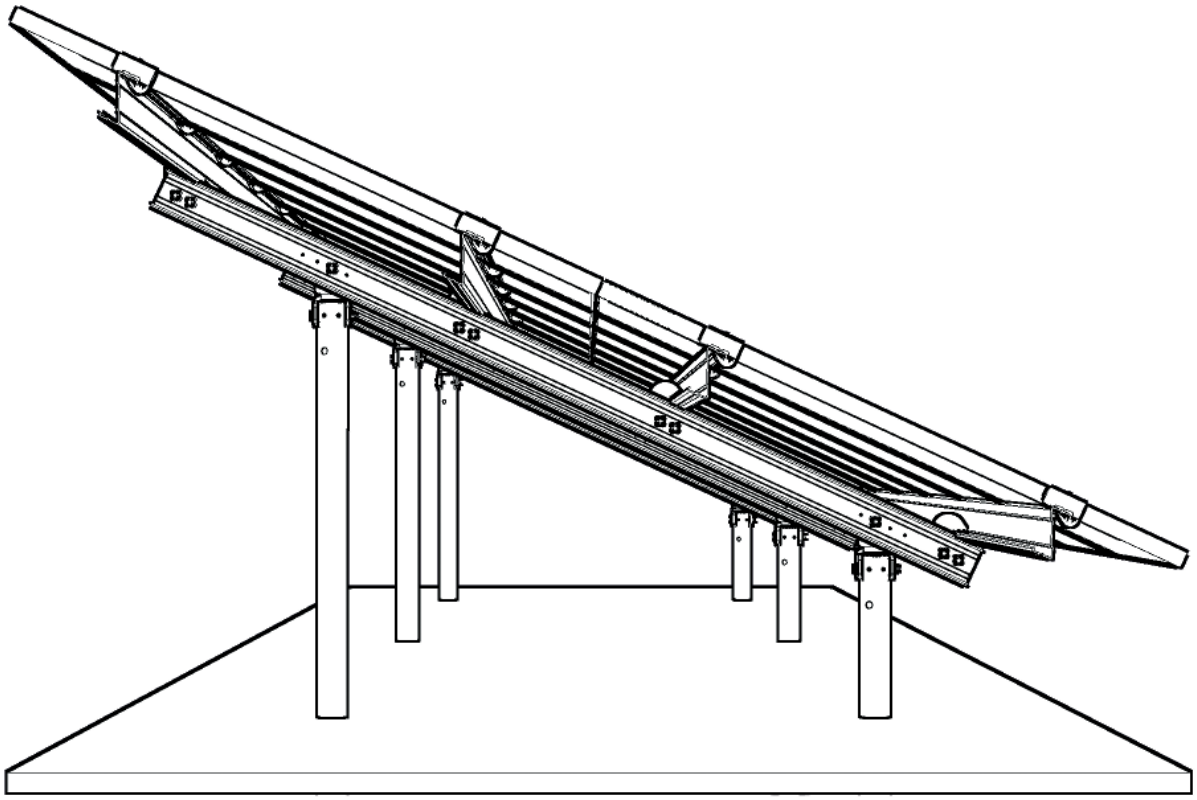
TerraGrid Steel

Mounting Instructions



CONTENTS **Page**

1 General

1.1. 1.1 Information

The TerraGrid steel system is customized for the respective installation site. A corresponding detailed structural analysis must be created to determine the required cross sections of the rails, as well as a geo-technical report to determine the required anchoring depth.
It is compulsory to create well-arranged and detailed documentation (site journal) where all daily work steps, employment of staff and assembled material are exactly specified.
Please remember that wrong deliveries or damaged components must be reported to Schletter immediately.
If the mounting instructions are not adhered to or components made by other manufacturers are used, Schletter GmbH will not assume any liability for resulting damage or defects.

Only qualified personnel and accordingly trained staff is allowed to carry out mounting operations, drive building site vehicles and operate building machines!

Securing of the working area
Before the start of construction, the building site must be inspected by a supervising person by sight check or using plans showing all supply lines (water, electricity, gas) in the relevant area. For this purpose, the position of all supply lines (water, gas electricity, etc.) must be marked using marking paint and unstable ground and areas that are landslide-prone must be sealed off with stable barriers or warning signs.

When mounting the solar modules, the safety regulations and mounting instructions of the respective module manufacturer must be observed!

Due to production tolerances, there may be deviations from the dimensions specified in the overview drawing. The specialist company that carries out the mounting operations is responsible for the adaptation of these deviations within the admissible tolerances!

It is compulsory to wear safety vests and safety shoes all the time

Always wear ear protection when carrying out noisy work

Always wear a hard hat when there might be falling objects or if you could hurt your head in some other way

Wear protective gloves when working with sharp-edged components

Wear respiratory protection when carrying out dusty work

Wear safety glasses when carrying out grinding and abrasive cutting operations in order to avoid any danger to your eyes caused by flying liquids or parts (sparks, splinters)

1.2. Planning

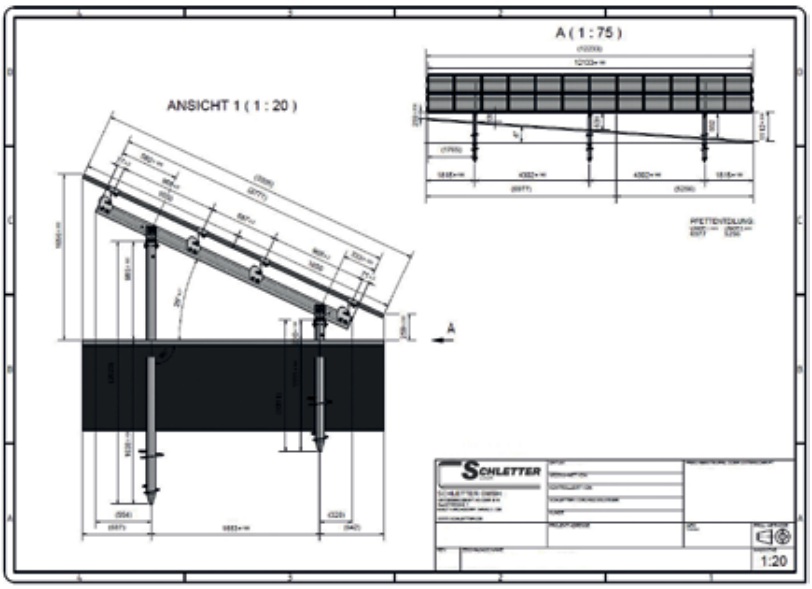
An accordant overview drawing is drawn up for each system before delivery. All defined measurements and the positions of the individual components and fasteners are displayed on these drawings. The respective torques are also listed in this instruction.

In the general layout drawing, the components are shown from various perspectives and defined by name. Thus, items, quantities and article numbers on the delivery note can be looked up.

Possible tolerance values that are to be considered for the mounting of the rack and the modules by the expert staff are also specified here!

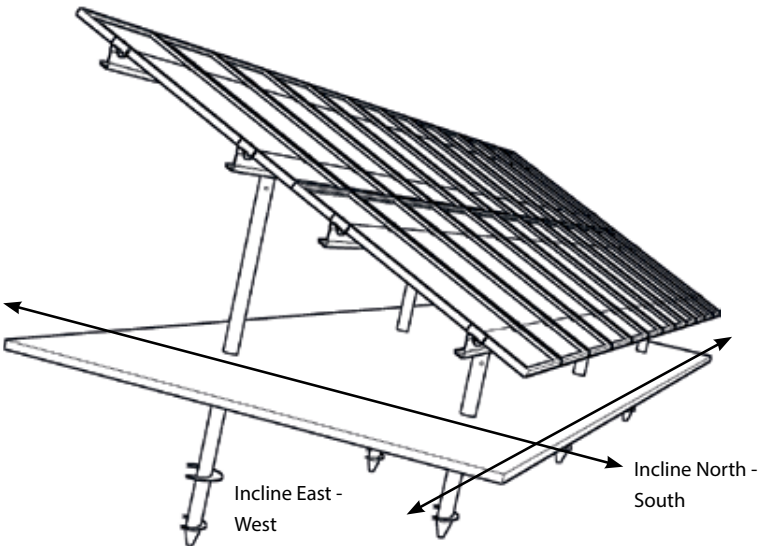
⚠ The tolerances specified here must not be exceeded!

Example general layout drawing



1.3. Terrain

When planning the ground-mounted system, make sure that the ground slope is within the tolerances. In the following, the guiding values for a structurally safe solar plant are specified.



Maximum admissible incline/slope East - West: **15°**
Regarding the structural calculations, additional measures may be required (for example reinforcements)

Maximum admissible incline/slope North - South: **35°**
Depending on the condition of the slope (soil composition, rocks, etc.)

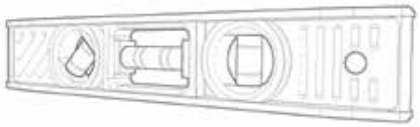
⚠ Pay regard to item 8 "Tolerances regarding terrain topography"!

1.4. Tools list

In the following, the tools that are usually required for the mounting of the FS system are listed. Additional tools that are required for special cases (for example encasing the foundation piles in concrete) are not listed here.

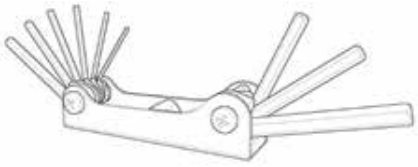
1.4.1. Defining the positions of the earth screw foundations and marking these positions

- Measuring tapes (100 m)
- Line pins (about 20 pieces)
- Mason´s lacing cord
- Club hammer
- Wooden stakes
- Color spray (for ground marking etc.)
- Permanent marker
- Zinc dust primer
- Brush



1.4.2. Screwing-in of the foundations

- Hydraulic rotating motor with insertion adapter
- Water level

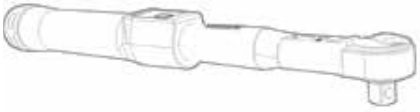


1.4.3. Rack mounting

- Torque wrench (30 Nm to 60 Nm)
- Wrench socket size 13
- Wrench socket size 16
- Wrench socket size 17
- Wrench socket size 18
- Wrench socket size 19
- Hammer
- Club hammer (to hold against the holding plates)
- Plastic tip hammer
- Angle meter - spirit level
- Measuring tape
- Mason´s lacing cord
- Cordless screw driver

1.4.4. Module mounting

- Mason´s lacing cord
- Measuring tape
- Possibly distance template for distances between the modules
- Cordless screw driver
- Wrench socket size 8 for cordless screwdriver
- Allen key size 6 / 40TX key
- Torque wrench (< 8 Nm)
- Allen key socket size 6 / 40TX bit for torque wrench
- Plastic tip hammer (for driving in the nails of the lay-in system)



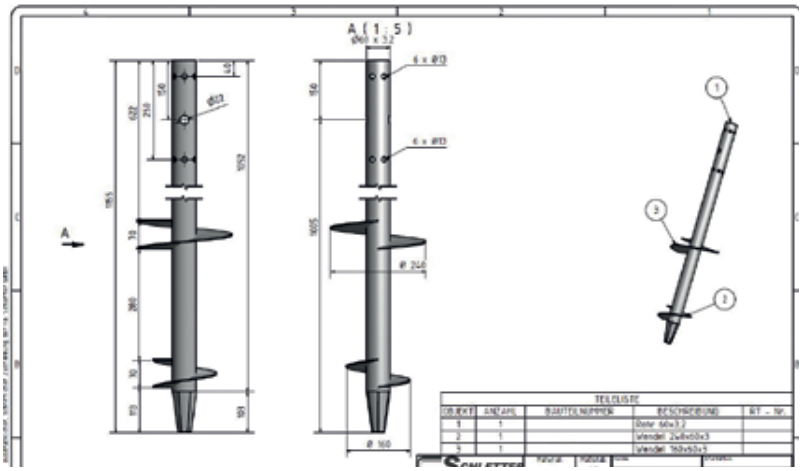
⚠ We recommend to use torque wrenches for all bolted connections.
With quick rotation, there is an increased danger of "bolt blocking"!

2 Insertion of the earth screw foundations

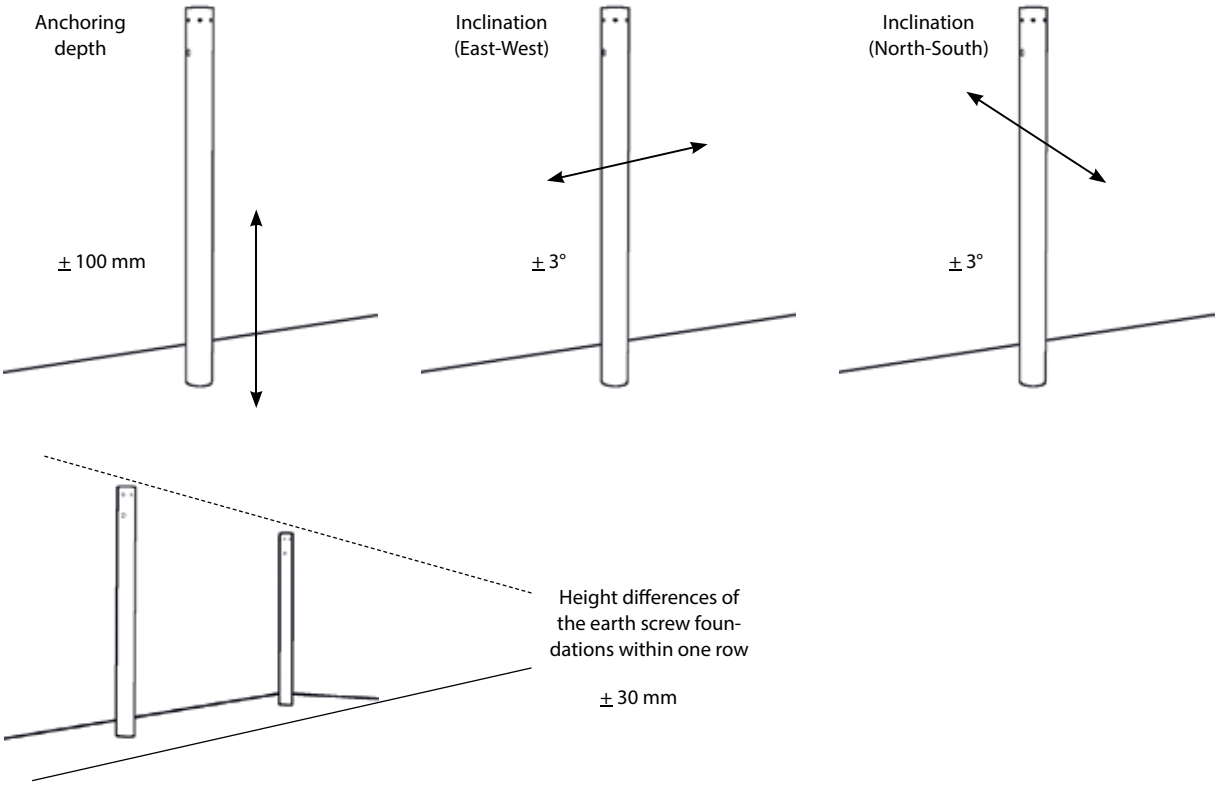
2.1. Positioning

An overview drawing of the screw foundation and a foundation plan are required for the insertion of the foundations. Using a digital terrain model, a foundation plan is created specifying contour lines. Apart from that, the position and the dimensions of the piles are specified. The screwing in of the piles must be carried out by an expert company on the basis of the documents.
The respective position of the first and last pile of each row must be marked on the terrain with a wooden stake. If a row length exceeds 50 meters, additional markings (wooden stakes) must be used within the row.

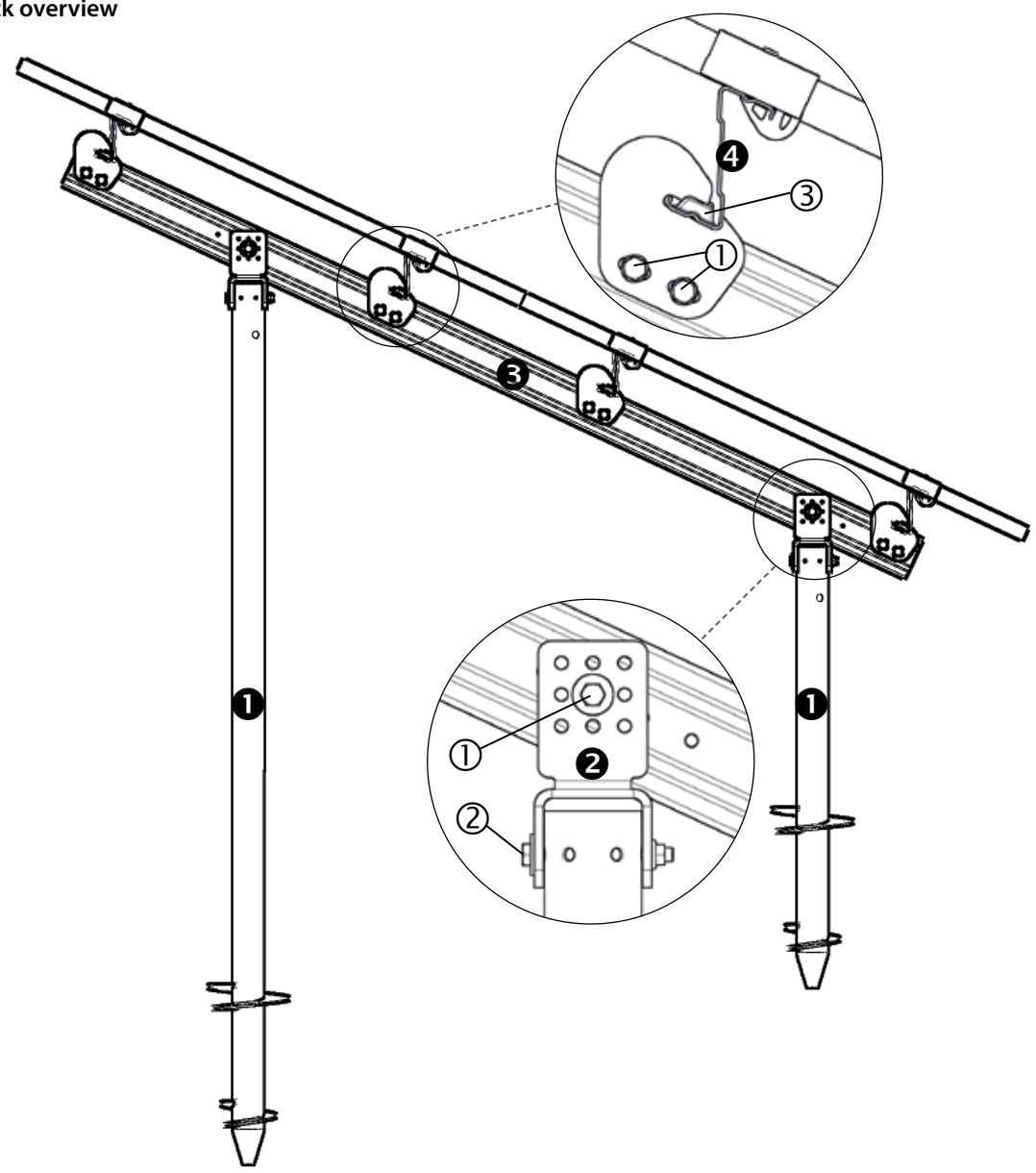
Example of a technical drawing with dimensioning of a screw foundation



2.2. Mounting tolerances



3 Rack overview



Components

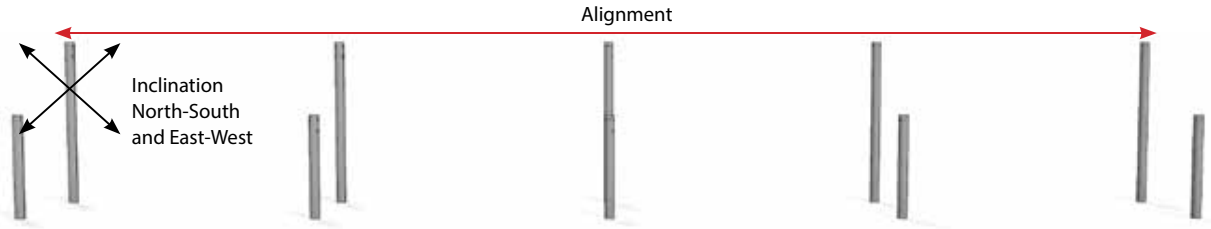
- ❶ Earth screw foundation
- ❷ Head assembly group
- ❸ Girder assembly group
- ❹ Module-bearing rail

Fasteners

- ① Hexagon bolt M12x30, washer DIN9021 and Flange nut M12 DIN6923
- ② Hexagon bolt M12x120, washer DIN9021 and Flange nut M12 DIN6923
- ③ Fastening device

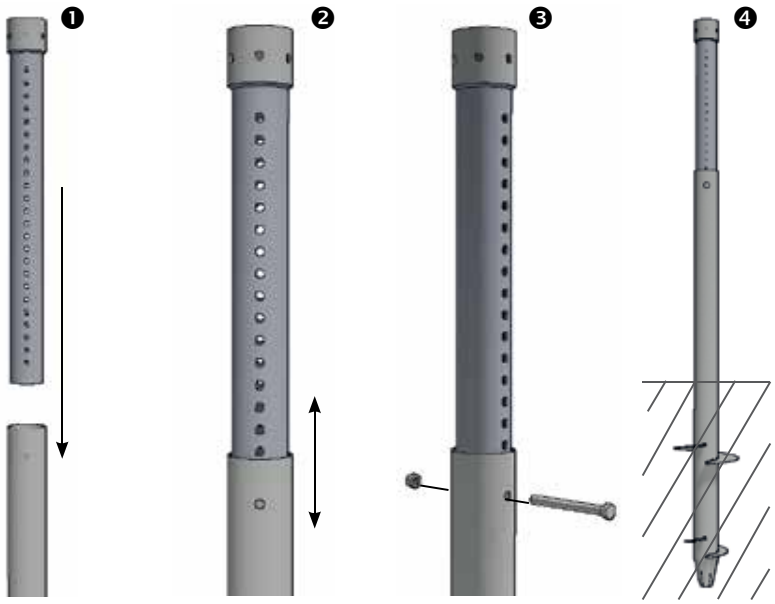
4 Mounting of the individual assembly group

4.1. Screwing-in of the foundations



Insert the screw foundations into the ground using an accordingly aligned cord. After that, check the inclination of the foundations!

⚠ In order to mount the racks at the same height, extensions can be fastened to the earth screws to even out ground height differences.



❶ Insert the extension into the earth screw foundation

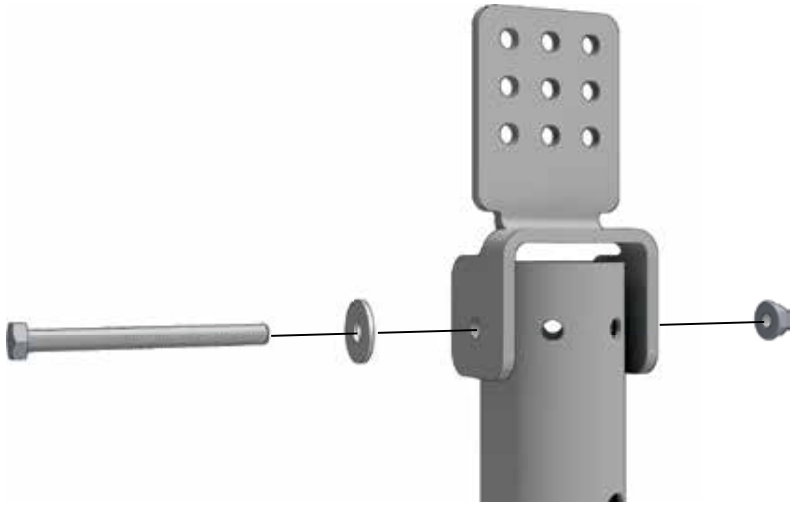
❷ Adjust the height of the extension as required.

❸ Fasten the extension to the earth screw foundation using a M12 bolt and a M12 nut.

❹ Completely assembled earth screw foundation

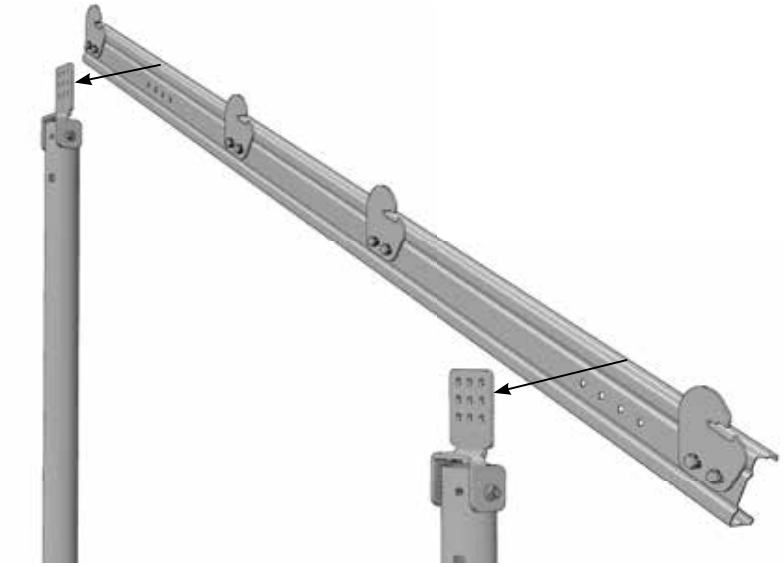
4.2. Mounting of the head assembly group on the screw foundation

⚠ When mounting, always consider the tightening torque specifications



Tighten the head assembly group loosely with a M12x120 DIN933 hexagon head screw, a washer DIN125 and a flange nut M12 DIN6923 (the head assembly group on the foundation must still be moveable)

4.3. Mounting of the girder assembly group

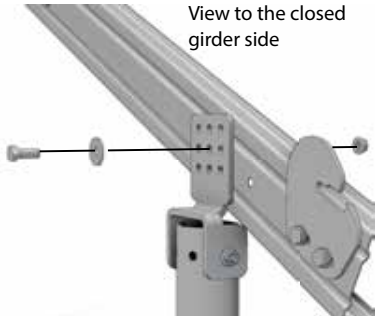


Join the girder assembly group to the head assembly groups

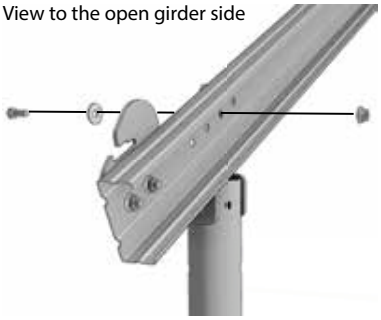
⚠ Always fasten the bolted connection by turning the bolt head! Do not turn the nut, just hold it!

⚠ Check the torques of all screws!

View to the closed girder side

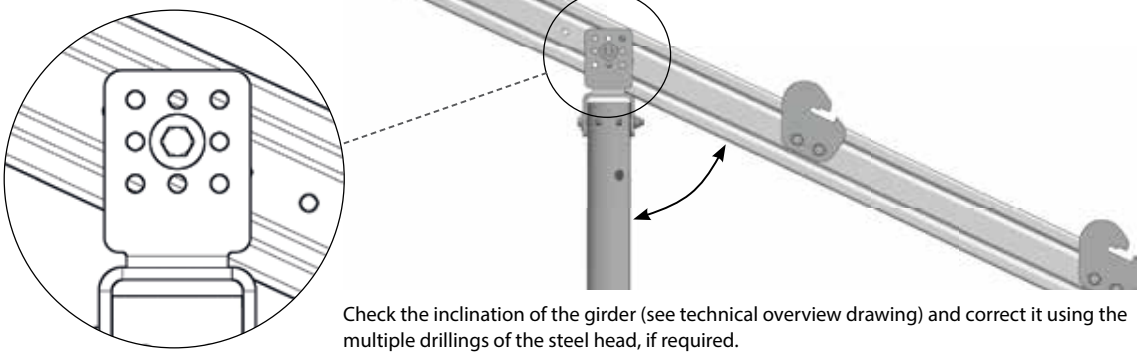


View to the open girder side



Fasten the girder assembly group with a hexagon bolt M12x30 DIN933, a washer DIN9021 and a flange nut M12 DIN6923 through the middle pre-drilling of the steel head.

⚠ For the equalization of the height level or soil unevenness, the multiple drillings in the steel head can be used!

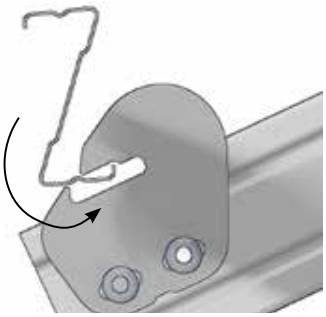


Check the inclination of the girder (see technical overview drawing) and correct it using the multiple drillings of the steel head, if required.

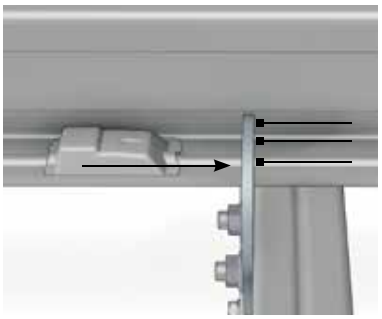
4.4. Mounting of the module-bearing profiles (rails)

⚠ Please note that the purlin must be at a 90° angle to the girder!
The distances between purlins must be observed as specified in the drawing!

⚠ In order to avoid deformations caused by tension, it has to be made sure that the purlins rests completely on the girder when they are mounted!



Insert the purlin into the pre-assembled fastening plates



Fasten the fastening device by holding one hammer against the fastening plate and knocking in the wedge (fastening device) with a second hammer (plastic tip hammer).

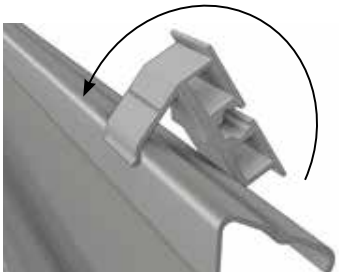
4.5. Mounting of the connectors (optional)

⚠ Use the pre-drilled holes to screw the connectors to the purlins!

Fasten the connector to the purlins, using four M12x30 bolts, DIN 9021 washers and four M12 flange nuts

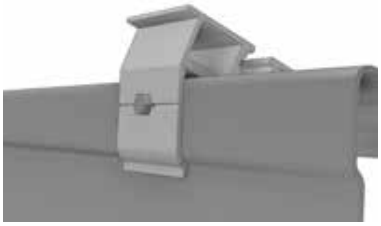
Side view

4.6. With horizontal module arrangement or vertical and horizontal module arrangement at the same time, mount a module clamp adapter (optionally also with vertical arrangement of the modules)



Clip the module clamp adapter onto the Z-purlin at the indicated points

Side view

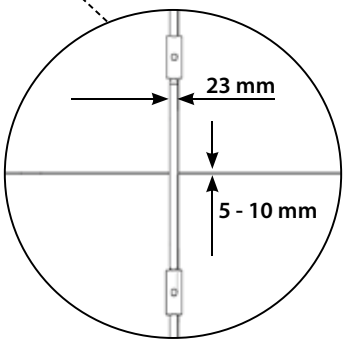


Fasten the module clamp adapter to the Z-purlin using a drilling screw

5 Module mounting and module clamping

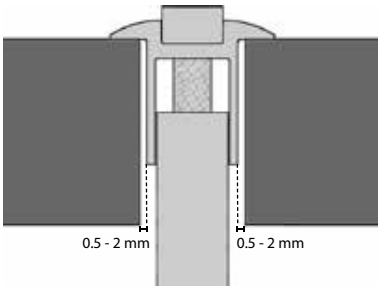
The modules are mounted according to the drawing using the module clamps that are part of the delivery and are fastened to the module-bearing rails using end clamps and middle clamps. For this purpose, the clamps are attached onto the rail or the module clamp adapter and are fastened with screws.

The distance between modules can deviate from the standard value. The standard distance is **23 mm** on the clamped side and **5 - 10 mm** (on the unclamped side (according to the specifications in the technical drawing; specifications by the module manufacturer are considered)

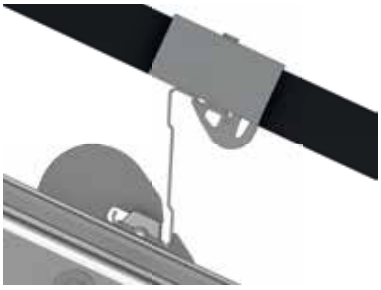


⚠ **When mounting the modules, observe the clamping points specified by the module manufacturer!**

⚠ **Make sure that the distance from the module to the clamp is at least 0.5 mm and not more than 2 mm!**
(= distance between module and module clamp, see picture on the right)



5.1. Module clamping with vertical module arrangement



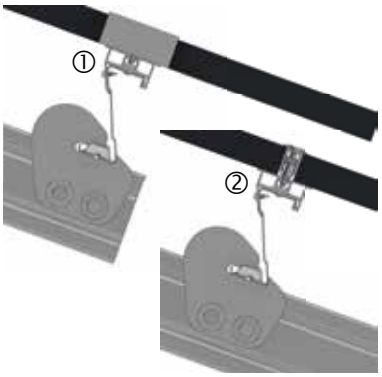
When mounting the modules, the module clamp screws must be tightened with a torque of 8 Nm!

Optionally, the vertical module mounting can also be carried out in combination with the module clamp adapter and Rapid 2+ or Standard clamps.

5.2. Module clamping with horizontal module arrangement

Attach the Rapid 2+ or Standard clamp on the module clamp adapter and fasten it with a tightening torque of 14 Nm.

5.3. Module clamping with horizontal and vertical module arrangement at the same time



Attach the Rapid 2+ or Standard clamp on the module clamp adapter and fasten it with a tightening torque of 14 Nm.

① Clamping at the long side of the module to the uppermost and to the lowermost purlin.

② Clamping to the middle purlins at the short module sides (comparable to clamping with horizontal module arrangement)

Module clamps for vertical module mounting

	Steel clamp			Rapid clamp*		Standard clamp*	
Module height	**End clamp left**	**Middle clamp**	**End clamp right**	**End clamp**	**Middle clamp**	**End clamp**	**Middle clamp**
20 mm	---	---	---	---	---	130001-020	130002-000
24 mm	---	---	---	---	---	130001-024	130002-000
28 mm	---	---	---	---	---	130001-028	130002-000
30 mm	144912-030	144910-001	144911-030	131001-030	131002-000	130001-030	130002-000
31 mm	144912-031	144910-001	144911-031	131001-031	131002-000	130001-031	130002-001
32 mm	144912-032	144910-001	144911-032	131001-032	131002-000	130001-032	130002-001
33 mm	144912-033	144910-002	144911-033	131001-033	131002-000	---	---
34 mm	144912-034	144910-002	144911-034	131001-034	131002-000	130001-034	130002-001
35 mm	144912-035	144910-002	144911-035	131001-035	131002-000	130001-035	130002-001
36 mm	144912-036	144910-002	144911-036	131001-036	131002-000	130001-036	130002-001
37 mm	144912-037	144910-002	144911-037	131001-037	131002-000	---	---
38 mm	144912-038	144910-003	144911-038	131001-038	131002-000	130001-038	130002-001
39 mm	144912-039	144910-003	144911-039	131001-039	131002-000	---	---
40 mm	144912-040	144910-003	144911-040	131001-040	131002-001	130001-040	130002-001

41 mm	144912-041	144910-003	144911-041	131001-041	131002-001	130001-041	130002-001
42 mm	144912-042	144910-003	144911-042	131001-042	131002-001	130001-042	130002-001
43 mm	144912-043	144910-004	144911-043	131001-043	131002-001	130001-043	130002-001
44 mm	144912-044	144910-004	144911-044	131001-044	131002-001	130001-044	130002-001
45 mm	144912-045	144910-004	144911-045	131001-045	131002-001	130001-045	130002-001
46 mm	144912-046	144910-004	144911-046	131001-046	131002-001	130001-046	130002-001
47 mm	144912-047	144910-004	144911-047	131001-047	131002-001	---	---
48 mm	144912-048	144910-005	144911-048	131001-048	131002-001	130001-048	130002-001
49 mm	144913-049	144910-005	144913-049	131001-049	131002-001	---	---
50 mm	144913-050	144910-005	144913-050	131001-050	131002-001	130001-050	130002-001
51 mm	---	---	---	---	---	130001-051	130002-001

*** in combination with module clamp adapter**

Module clamps for horizontal module mounting

	Rapid clamp*		Standard clamp*	
Module height	**End clamp**	**Middle clamp**	**End clamp**	**Middle clamp**
20 mm	---	---	130001-020	130002-000
24 mm	---	---	130001-024	130002-000
28 mm	---	---	130001-028	130002-000
30 mm	131010-030	131012-000	130001-030	130002-000
31 mm	131010-031	131012-000	130001-031	130002-001
32 mm	131010-032	131012-000	130001-032	130002-001
33 mm	131010-033	131012-000	---	---
34 mm	131010-034	131012-000	130001-034	130002-001
35 mm	131010-035	131012-000	130001-035	130002-001
36 mm	131010-036	131012-000	130001-036	130002-001
37 mm	131010-037	131012-000	---	---
38 mm	131010-038	131012-000	130001-038	130002-001
39 mm	131010-039	131012-000	---	---
40 mm	131010-040	131012-001	130001-040	130002-001
41 mm	131010-041	131012-001	130001-041	130002-001
42 mm	131010-042	131012-001	130001-042	130002-001
43 mm	131010-043	131012-001	130001-043	130002-001
44 mm	131010-044	131012-001	130001-044	130002-001
45 mm	131010-045	131012-001	130001-045	130002-001
46 mm	131010-046	131012-001	130001-046	130002-001
47 mm	131010-047	131012-001	---	---
48 mm	131010-048	131012-001	130001-048	130002-001
49 mm	131010-049	131012-001	---	---
50 mm	131010-050	131012-001	130001-050	130002-001
51 mm	---	---	130001-051	130002-001

*** in combination with module clamp adapter**

Steel module clamps (V arrangement)

Rapid module clamps

Standard module clamps

The nuts and bolts of the standard clamps are not included in the scope of delivery and are delivered separately.

With big order quantities, clamps for other module thicknesses can be manufactured on request!

The Standard clamps are not pre-assembled when they are delivered. These clamps are combined with a socket head screw, a KlickIn click component and a square nut. The screws listed below can be used for that purpose:

Frame height	Suitable socket head screw mm	Item number	Module name
20	25	943308-125	M8x25 socket head screw with serrated flange
24	30	943308-130	M8x30 socket head screw with serrated flange
28-30	35	943308-135	M8x35 socket head screw with serrated flange
31-35	20	943308-120	M8x20 socket head screw with serrated flange
36-40	25	943308-125	M8x25 socket head screw with serrated flange
41-45	30	943308-130	M8x30 socket head screw with serrated flange
46-51	35	943308-135	M8x35 socket head screw with serrated flange
129010-008		KlickIn click component	
943914-008		Square nut M8, V4A	

6 Components list

❶ Earth screw foundation

143009-xxx Earth screw foundation (xxx according to the length of the foundation)

Extension of the earth screw foundation

according to structural specifications

❷ Steel head

142500-017	TerraGrid galvanized steel head

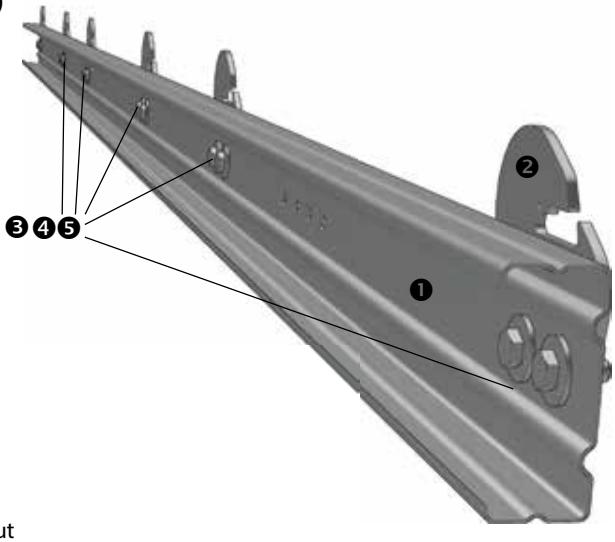
❸ Girder assembly group (optionally pre-assembled)

consisting of:

*144YXX-ZZZ** ❶ 1x girder custom cut

* varying depending on girder assembly:

XX: Number of installed modules
Y: System type
ZZZ: H or V arrangement



144999-006	❷ *x FS Uno/Duo fastening plate
943612-030	❸ *x Bolt M12x30 DIN 933 A2
943912-012	❹ *x Flange nut M12 DIN 6923 A4
943922-012	❺ *x Washer large M12 DIN 9021 A2

* variable depending on girder assembly

Girder assembly groups for vertical module arrangement

144301-000	FS Duo girder assembly 1V custom cut
144302-200	FS Duo girder assembly 2V custom cut
144303-200	FS Duo girder assembly 3V custom cut
144304-200	FS Duo girder assembly 4V custom cut

Girder assembly groups for horizontal module arrangement

144301-000	FS Duo girder assembly 1H custom cut
144302-100	FS Duo girder assembly 2H custom cut
144303-100	FS Duo girder assembly 3H custom cut
144304-100	FS Duo girder assembly 4H custom cut
144305-100	FS Duo girder assembly 5H custom cut
144306-100	FS Duo girder assembly 6H custom cut

❹ Module-bearing rail (custom cut)

144901-001	FS Uno/Duo purlin
144999-003	FS Uno/Duo fastening device

Fastening device

Module clamp adapter

144919-050 FS steel module clamp adapter kit (incl. drill screw)

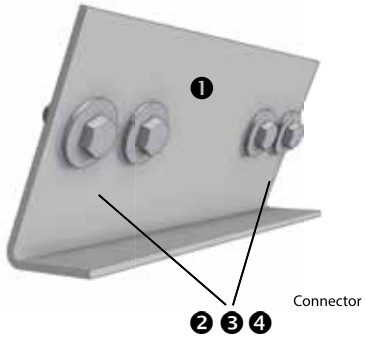
Module clamp adapter

Module-bearing rail - connector (optional)

144999-008 FS Uno/Duo purlin connector Gen2 kit

consisting of:

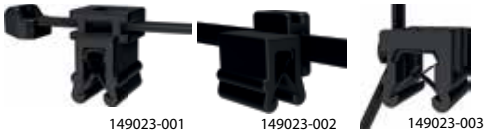
000014-577	❶	1x FS Uno/FS Duo purlin connector Gen2
943922-012	❷	4x washer large M12 DIN9021 A2
943612-030	❸	4x hexagon head bolt M12x30 DIN933 A2
943912-012	❹	4x flange nut M12 serrated DIN6923 A4



Connector

Auxiliary equipment / accessories

964000-176 Zinc dust silver-grey satin-finished



149023-001 149023-002 149023-003

149023-001	Cable fastener 1.0 - 3.0 mm, guidance at the top
149023-002	Cable fastener 1.0 - 3.0 mm, guidance at the side
149023-003	Cable fastener 3.0 - 6.0 mm

144999-009	FS Uno/FS Duo cable fastener for purlin
144999-010	Cable conduit

Purlin cable fastener for the fastening of cable conduits

7 Torque specifications

7.1. Bolted connections in the substructure

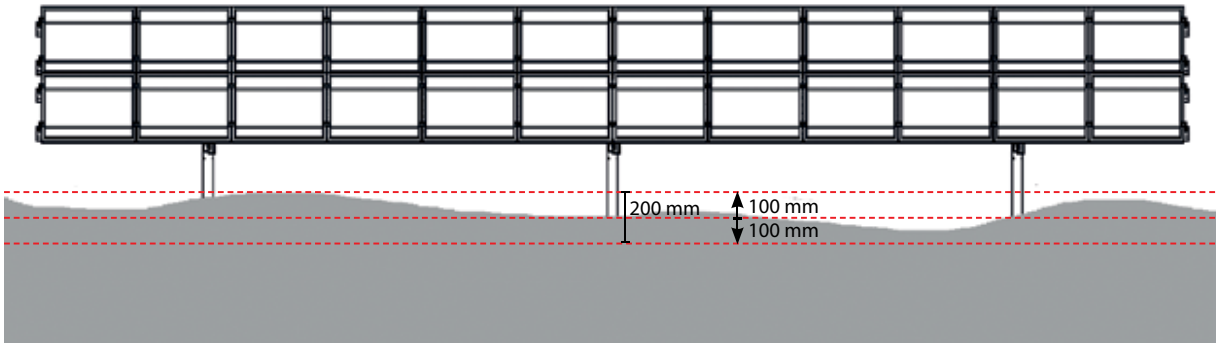
Picture	Name	Tightening torque (MA-Nm)
	Hexagon head bolt DIN933 - M12x30 A2 GMB Flange nut DIN6923 - M12 A4 Washer, large DIN9021 - M12 A2	56 Nm
	Hexagon head bolt DIN931-1 - M12x120 A2 GMB Flange nut DIN6923 - M12 A4 Washer, large DIN9021 - M12 A2	56 Nm

7.2. Fastening of the module clamps

Picture	Name	Tightening torque (MA-Nm)	Type of module arrangement
Standard module clamps 	Socket head screw DIN4762 - M8 (20 - 35 mm) KlickIn click component for nut M8 Square nut DIN557 A4 - M8	14 Nm	H and V in combination with module clamp adapter
Steel module clamps 	Socket head screw DIN912 A2 - M8 (25 - 45 mm)	8 Nm	V
Rapid 2+ module clamps 	TX-drive stud screw A2 GMB - M8 (42.5 - 55 mm)	14 Nm	H and V in combination with module clamp adapter

Always fasten the bolted connection by turning the bolt head! When checking the prestress of the bolts, it has to be considered that constraints and frictional forces can lead to a loss of clamping force. This was taken into consideration when the tightening torques were determined. When a bolted connection is checked, it must not loosen when 50% of the specified tightening torque is applied.

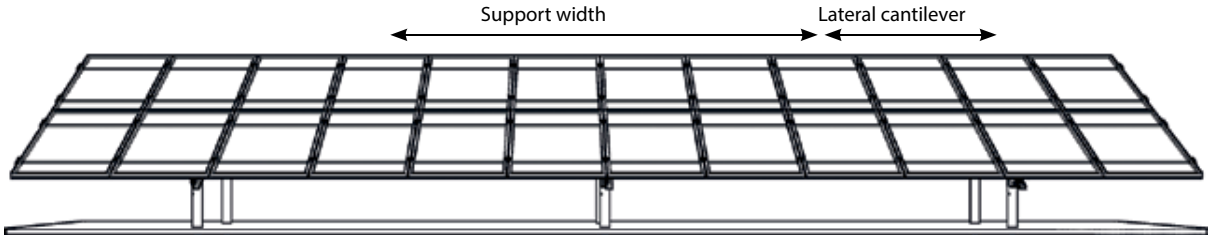
8 Tolerances regarding terrain topography



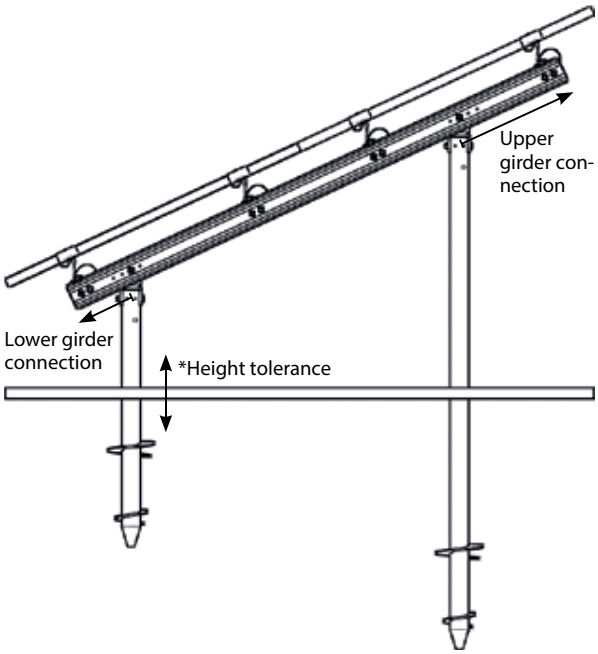
Individual Schletter racks are not parallel to the subsoil below them. Height differences of the subsoil under a rack can be equalized with the earth screw foundations and extensions of the earth screw foundations. Please already align the earth screw foundation with a cord in the course of screwing it into the ground. The tolerance of the anchoring depth is ±100 mm (see picture).

9 Tolerances regarding rack mounting

Schletter mounting racks for ground-mounted solar plants are always custom-dimensioned to withstand the wind and snow loads at the respective location. In the interest of economic efficiency, usually the maximum load-bearing capacity of the individual components is exploited. To achieve this, however, the racks must be mounted with the utmost precision. If there are significant deviations from the mounting plans, this can lead to structural overstress which in turn can lead to damage cases. Schletter will not assume any liability for such damage cases. Adherence to the specified tolerances is therefore essential to the structural safety of the rack.



Support width	± 150 mm
Lateral cantilever of purlins	± 100 mm
Lower girder connection	± 100 mm
Upper girder connection	± 100 mm
Clearance between module and clamp	0.5 to 2 mm



***Please consider that the height tolerances of the earth screw foundations on subsoils with integrated geo-membranes (for example on landfill sites) depend on the depth the membrane is placed at. Any damage to the membrane must be avoided.**

In the event of deviation, this must be communicated to Schletter immediately!

TerraGrid

Mounting instructions

CONTENTS Page

1 General

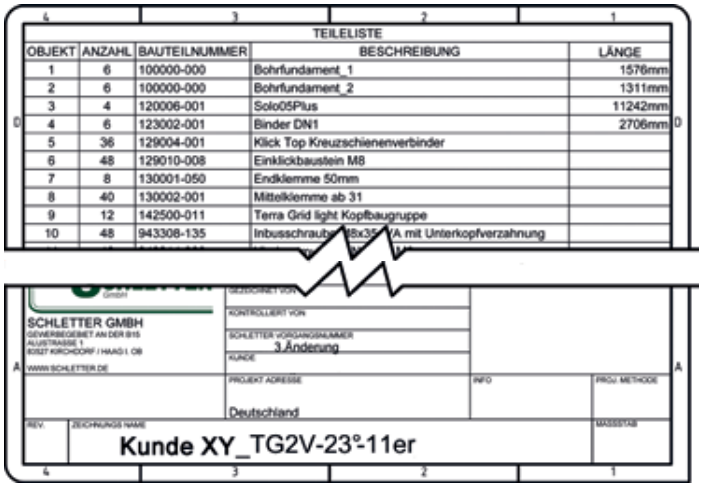
1.1 Information

For the project planning of a ground-mounted solar plant, it is absolutely required to create a geological survey and to examine the building ground regarding the cohesion of the soil. On landfill sites, there often is a sealing membrane in the ground and the exact depth of this membrane has to be specified. It is also highly recommended to carry out load tests regarding the deformation and the load-bearing capacity of the earth screw foundations!

1.2 Planning

Using data from the structural analysis documentation, an overview diagram and a parts list is created for each system prior to delivery. These drawings show the respective measurements and positions of the individual components and fasteners.

Example parts list

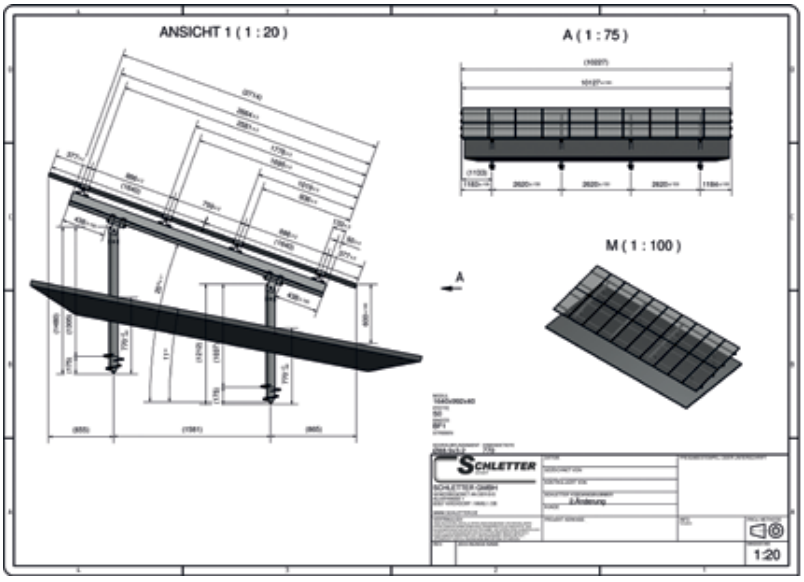


TEILELISTE

OBJEKT	ANZAHL	BAUTEILNUMMER	BESCHREIBUNG	LÄNGE
1	6	100000-000	Bohrfundament_1	1576mm
2	6	100000-000	Bohrfundament_2	1311mm
3	4	120006-001	Solo05Plus	11242mm
4	6	123002-001	Binder DN1	2706mm
5	36	129004-001	Klick Top Kreuzschienenverbinder	
6	48	129010-008	Einklickbaustein M8	
7	8	130001-050	Endklemme 50mm	
8	40	130002-001	Mittelklemme ab 31	
9	12	142500-011	Terra Grid light Kopfbaugruppe	
10	48	943308-135	Inbusschraube 8x35 VA mit Unterkopfverzahnung	

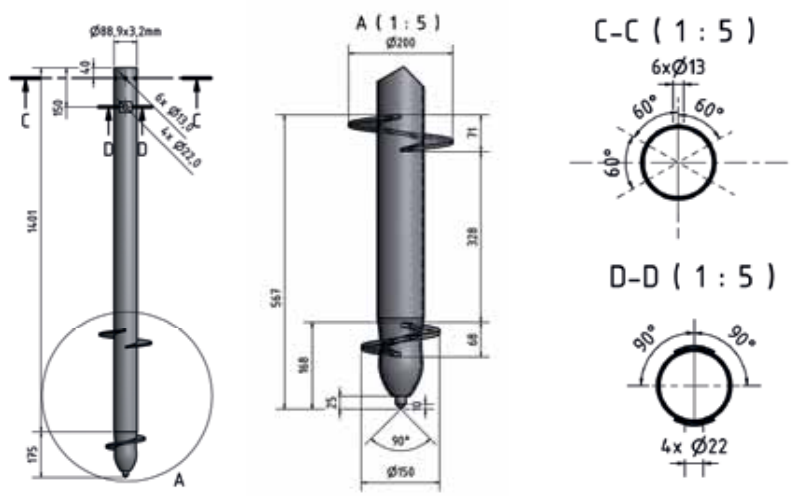
Items, quantities and article numbers can therefore be referenced both on the delivery note and on the detail drawing.

Example general layout drawing



In the overview drawing, the components are presented from various perspectives and with all important dimensions.

Example drawing of an earth screw foundation



In the overview drawing of the earth screw foundation, all important dimensions are shown.

2 Insertion of the earth screw foundations

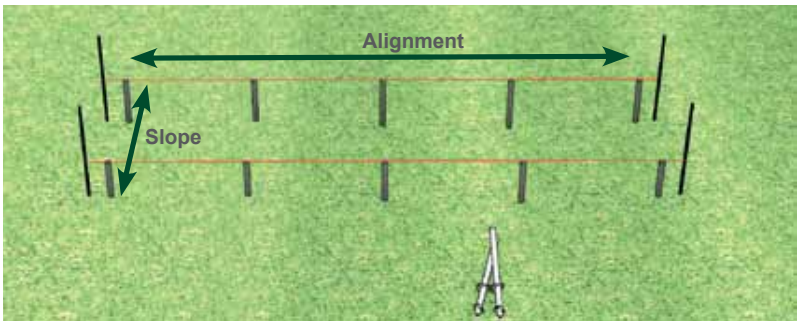
The earth screw foundations are inserted by specialized companies using special screw-in machines. In order to ensure a smooth workflow, foundation plans must be generated by the client based on our rack drawings. These plans must include the positions of the foundations and the corresponding dimensions. The position of the first and the last pile (earth screw foundation) in each row must be marked on the terrain with a wooden stake. If a row length exceeds 50 meters, additional stakes must be used within the row.

3 Mounting the individual assemby groups

1. Screwing-in of the foundations

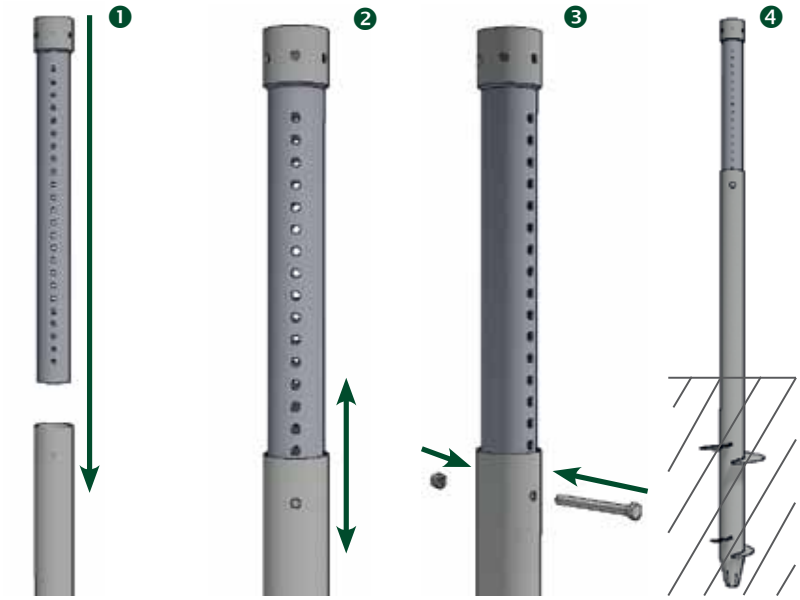
⚠ Verify the stability of the piles (earth screw foundations) in the ground prior to mounting the racks!

⚠ If required, a zinc dust primer has to be put on the upper edge of the pile (earth screw foundation)!



Insert the earth screw foundations in the ground and align them using a cord. Check the slope!

⚠ In order to mount the racks at the same height, extensions can be fastened to the earth screws to even out ground heigth differences.



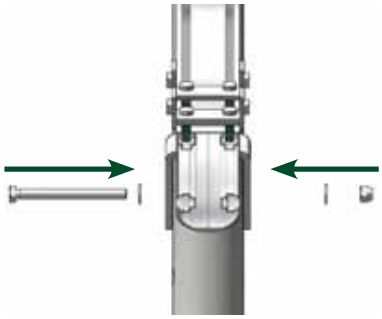
1. Insert the extension into the earth screw foundation
2. Adjust the height of the extension as required.
3. Fasten the extension to the earth screw foundation using a M12 bolt and a M12 nut.
4. Completely assembled earth screw foundation

a. TerraGrid

2. Mount and adjust the girder assembly group

⚠ Components must be accurately adjusted to avoid tensions in the module.
Once the head assembly has been aligned, please verify the torque of the bolts!

Put the pre-assembled girder assembly group on the earth screw foundation.

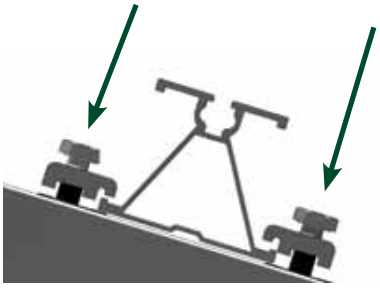


Fasten each girder assembly group to the earth screw foundation using a M12x140 bolt, a M 12 washer and a M12 nut.

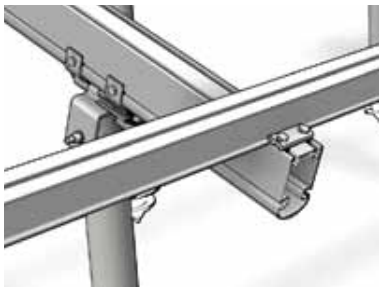
3. Mount the module beam

⚠ Please note that the purlin must be mounted at a 90°-angle to the girder!
The distances between purlins must be observed as specified in the drawing!

⚠ In order to avoid deformations caused by tension, it has to be made sure that the purlin rests completely on the girder when mounting!



Losen the mounting claws, then put the module-bearing profiles on the girder assembly group and fasten the mounting claws.

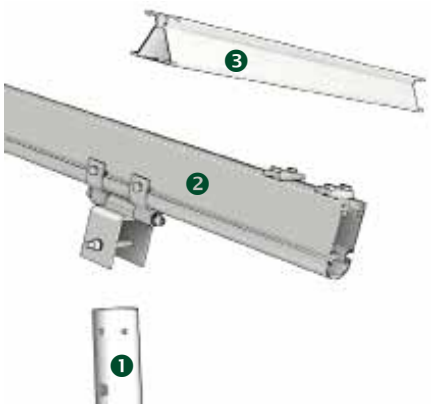


Assembled purlin

4. Exploded view of an assembly group

❶ Earth screw foundation
❷ Girder assembly group
❸ Module-bearing rail

Detail view:

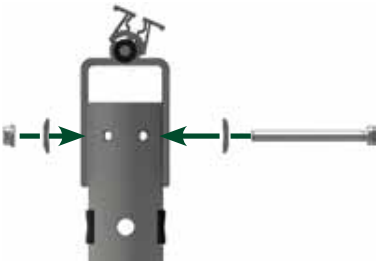


b. TerraGrid Light

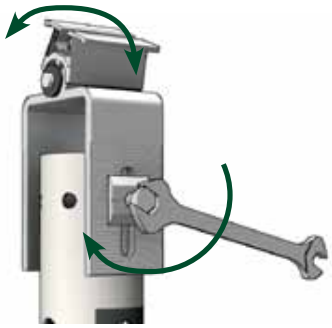
2. Mount and adjust the head

⚠ The utilization of TerraGrid Light in only recommendable on even terrain!

⚠ The components must be accurately adjusted to avoid tensions in the module.
Once the head assembly has been aligned, please check the torque of the bolts!

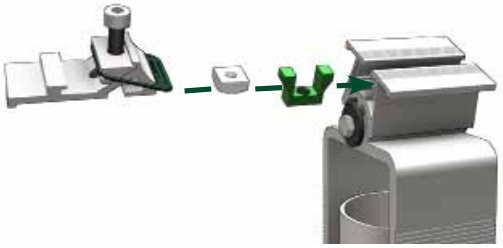


Put the head assembly group on the earth screw foundation and fasten it with a M12x140 bolt, 2 base claws and a M12 nut



The head assembly group can be height adjusted by means of the slotted holes, the girder shoe of the head assembly group can be variably adjusted.

Insert the KlickTop connector into the duct of the girder shoe profile



3. Put on the girder and hook it in

Put the pre-assembled girder assembly group on the KlickTop connectors.

Put the girder profile into the connector and fasten the bolt tightly

4. Mount the module beam

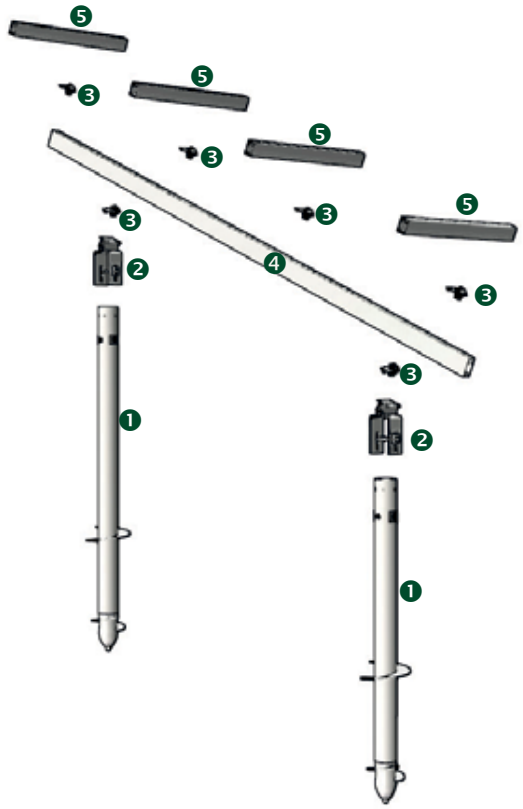
⚠ Make sure that the 90° angle is maintained at the crossing points of the module-bearing rail and the girder!

⚠ In order to avoid deformations caused by tensions it has to be made sure that the purlin rests completely on the girder when mounting.

Put the purlin into the connector and fasten the bolt tightly

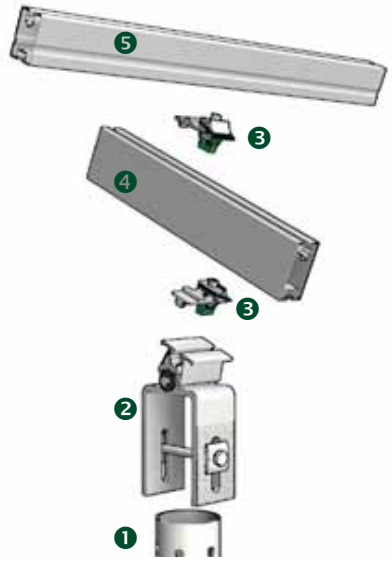
The bolt has to be fastened so tightly that the KlickTop (here shown in red) clamps the purlin completely.

5. Exploded view of an assembly group



1. Earth screw foundation
2. TerraGrid Light head assembly group
3. KlickTop cross connector
4. Girder
5. Module-bearing rail

Detail view:



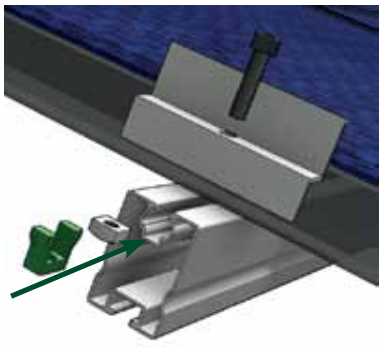
4 Module mounting

Modules are fastened to the module-bearing rail using end clamps and middle clamps. Arrange the M8 KlickIn click components and the square nuts in the click channel of the module-bearing rail, position the module clamps at the clamping points and fasten them with M8 socket head screws.

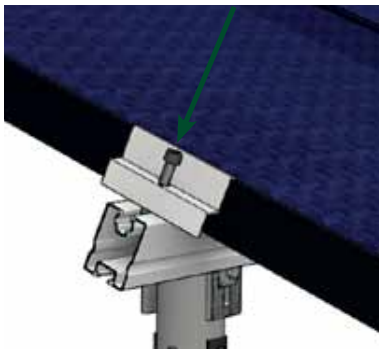
⚠ **The M8 bolts for the module clamps must be tightened with a torque of not more than 14 Nm unless specified otherwise by the manufacturer!**

⚠ **When mounting the modules, please observe the clamping points specified by the module manufacturer!**

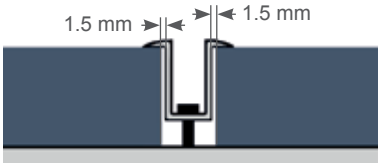
⚠ **Make sure that there is an expansion joint of 1.5 mm between the clamp and the module!**

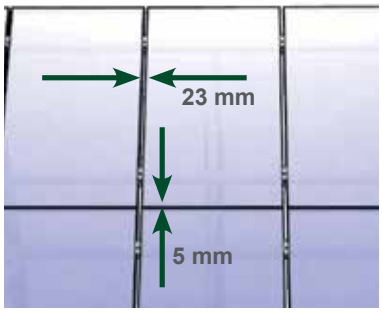


Insert the green click component and the M8 nut (with the rounded side of the nut facing downwards) into the click channel of the purlin.



Afterwards, fasten the module clamp with a M8 socket head screw.





The distance between modules can deviate from the standard value. Tolerated variance is 23 mm on the clamped side and 5 mm on the unclamped side.

The variance is outlined with a detail drawing in the overview plan. (see example gen. layout drawing, Page 2)

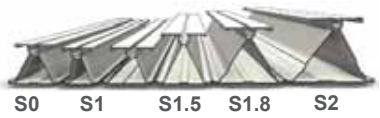
5 Components list

Earth screw foundation

143009-xxx	Earth screw foundation xxx according to the length of the foundation

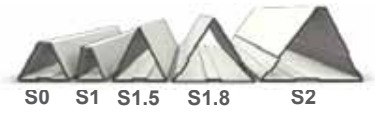
5.1 TerraGrid

Module-bearing rail (customized cuts)



124300-001	Module-bearing rail S0
124301-001	Module-bearing rail S1 exterior
124302-001	Module-bearing rail S1 interior
124303-001	Module-bearing rail S1.5
124307-001	Module-bearing rail S1.8
124304-001	Module-bearing rail S2

Module-bearing rail - connector (optional)

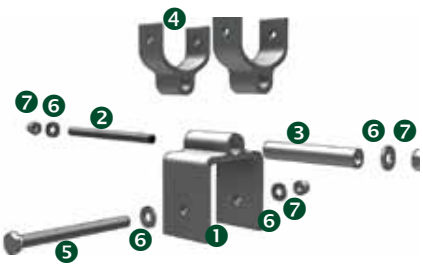


129300-000	Connector for module-bearing rail S0
129301-000	Connector for module-bearing rail S1
129303-000	Connector for module-bearing rail S1.5
129306-000	Connector for module-bearing rail S1.8
129304-000	Connector for module-bearing rail S2

Head assembly group (pre-assembled)

142500-008 TerraGrid head assembly group

consisting of:



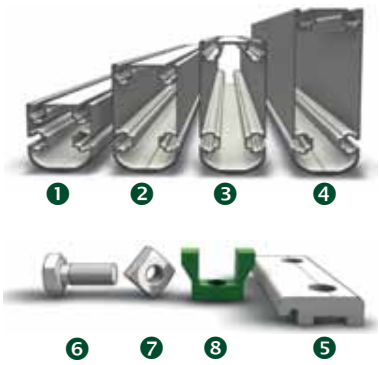
000007-632	❶ 1x foundation shoe
000007-601	❷ 1x threaded rod
000007-805	❸ 1x spacer tube
000007-631	❹ 2x girder shoe
943612-140	❺ 1x bolt M12x140 hex. self-locking DIN985
943912-012	❻ 4x washer 12 DIN125
943911-012	❼ 3x nut M12 hexagon self-lock. DIN985

Girder assembly groups (pre-assembled)

consisting of:

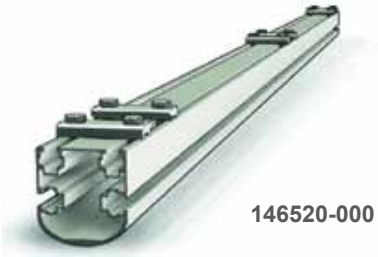
124500-001	❶	1x girder BF0
or *124501-001*	❷	1x girder BF1
or *124502-001*	❸	1x girder BF2
or *124503-001*	❹	1x girder BF3
146001-000	❺	*x mounting claw
943610-025	❻	*x M10 hexagon bolt DIN933
943914-010	❼	*x M10 square nut DIN557
129010-001	❽	*x KlickIn click component for M10 nut

* variable depending on girder assembly

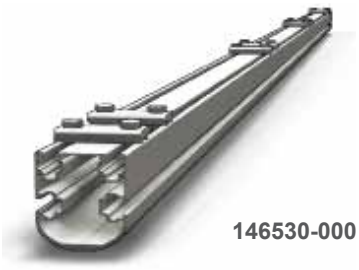


146510-000	Girder assembly 1H-BF0
146511-000	Girder assembly 1H-BF1
146512-000	Girder assembly 1H-BF2
146513-000	Girder assembly 1H-BF3
146110-000	Girder assembly 1V-BF0
146111-000	Girder assembly 1V-BF1
146112-000	Girder assembly 1V-BF2
146113-000	Girder assembly 1V-BF3
146520-000	Girder assembly 2H-BF0
146521-000	Girder assembly 2H-BF1
146522-000	Girder assembly 2H-BF2
146523-000	Girder assembly 2H-BF3
146524-000	Girder assembly 2H-BF4
146120-000	Girder assembly 2V-BF0
146121-000	Girder assembly 2V-BF1
146122-000	Girder assembly 2V-BF2
146123-000	Girder assembly 2V-BF3
146530-000	Girder assembly 3H-BF0
146531-000	Girder assembly 3H-BF1
146532-000	Girder assembly 3H-BF2
146533-000	Girder assembly 3H-BF3
146130-000	Girder assembly 3V-BF0
146131-000	Girder assembly 3V-BF1
146132-000	Girder assembly 3V-BF2
146133-000	Girder assembly 3V-BF3

146510-000



146520-000

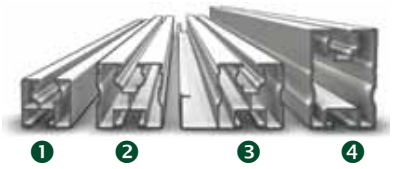


146530-000

5.2 TerraGrid Light

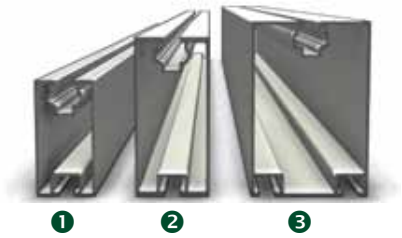
Module-bearing rail (customized cuts)

120001-001	❶	Module-bearing rail Eco05
120002-001	❷	Module-bearing rail Solo05
120003-001	❸	Module-bearing rail Profi05
120004-001	❹	Module-bearing rail ProfiPlus05



Girder profile (customized cuts)

123002-001	❶	Mounting beam DN1
123004-001	❷	Mounting beam DN2.5
123005-001	❸	Mounting beam DN3

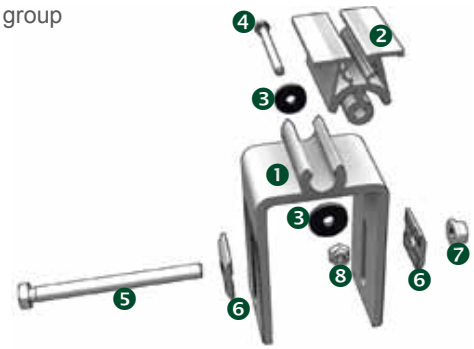


Head assembly group (pre-assembled)

142500-011 TerraGrid Light head assembly group

consisting of:

000009-902	❶	1x foundation shoe
000009-903	❷	1x girder shoe
943922-008	❸	2 x washer
943608-100	❹	1x bolt M8x100 hexagon DIN933
943612-140	❺	1x bolt M12x140 hexagon DIN933
147005-000	❻	2 x base claw
943912-012	❼	1x flange nut M12 serrated DIN6923
943911-008	❽	1x nut M8 hexagon self-lock. DIN985



Auxiliary equipment

964000-176	Coating: Zinc Dust Silver-Grey Silky Luster
119015-000	Punched mounting tape: Width 12mm; Thickness: 0.8mm; Hole diameter: 5.2 mm; Length: 50 m
135005-000	Grounding connector kit
149100-900	Grounding pin kit variable
149100-000	Grounding pin kit
129065-008	Multiklip-8 for size 8 screw channel
129065-010	Multiklip-10 for size 10 screw channel
143010-003	Extension for earth screw foundation 861mm
143010-004	Extension for earth screw foundation 861mm
143010-005	Extension for earth screw foundation 1281mm

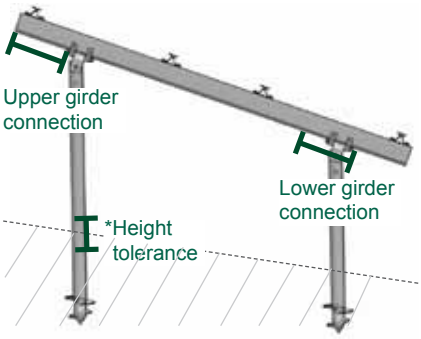
6 Torque specifications

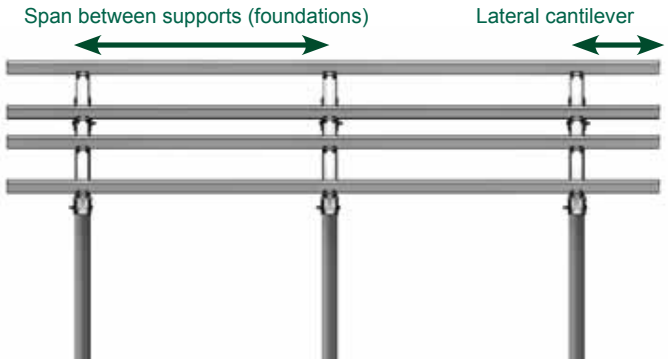
Image	Name	Tightening torque (MA-Nm)
	Hexagon head bolt DIN933 M10x25 Square nut DIN557 M10 KlickIn click component M10	30 Nm
	Hexagon head bolt DIN933 A2 M8x100 Flange nut DIN933 A2 M8	14.5 Nm
	Hexagon head bolt DIN933 A2 M12x140 Flange nut DIN6923 A4 M12	50 Nm

When checking the preload of the bolts, it must be considered that constraints and frictional forces can lead to a loss of clamping force. This was considered when the tightening torques were determined. When tested, the nut must not loosen when 50% of the torque specified above is applied.

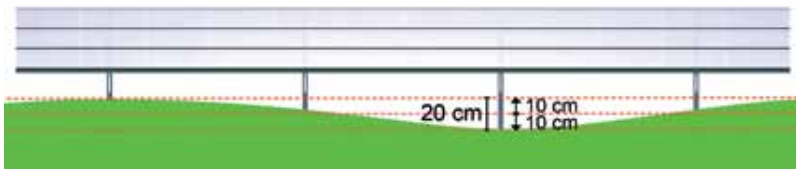
7 Tolerances

Schletter mounting racks for ground-mounted solar plants are always explicitly dimensioned for the wind and snow loads at the respective location. In the interest of economic efficiency, the maximum capacity potential of individual components is generally exploited. To achieve this, however, the racks must be mounted with the utmost precision. Significant deviation from the mounting plans can lead to structural overstress. Adherence to the specified tolerances is therefore essential to the structural safety.





Span between supports (foundations)	± 150 mm
Lateral cantilever	± 100 mm
Lower girder connection	± 100 mm
Upper girder connection	± 100 mm
Height tolerance of the earth screw foundation*	± 100 mm



Ground-mounted solar plants by Schletter are adapted to the shape of the terrain. Height differences of the ground under a rack can be equalized with the earth screw foundation, the height tolerance is ±100 mm

***Please consider that the height tolerances of the earth screw foundations on subsoils with integrated membranes (landfill sites) depend on the depth the membrane is placed at. Any damage to the membrane must be avoided.**

In the event of deviation, Schletter must be consulted immediately!

MOUNTING

PvMax3

Mounting Instructions

Schletter GmbH
Gewerbegebiet an der B15
Alustrasse 1
83527 Kirchdorf / Haag in OB
GERMANY

Phone: +49 8072 9191 - 0
E-mail: info@schletter.eu

Your contact:

Technical advice for ground-mounted solar plants
Phone: +49 8072 9191 - 203
E-mail: tb-freiflaeche@schletter.de

SCHLETTER

Table of Contents

1. General Information

1.1. Short Description

PvMax3 is a modular unit assembly system for the installation of ground-mount substructures in high-quality and efficient aluminum design. As the individual components have been optimized and structurally synchronized, a minimum system price is achieved. PvMax3 allows to use framed as well as unframed modules that can be mounted either in portrait or in landscape, or with the Schletter combined clamping system. It is also possible to mount additional accessories for the cable management or components for the internal potential equalization.

1.2. Intended Use

PvMax3 is a substructure for the mounting of photovoltaic modules. Any kind of different use that is not mentioned in these Mounting Instructions or an incorrect mounting (e.g. the utilization of components made by other producers or non-observance of tolerances specified here and/or exceeding the indicated loads) are considered as non-intended use and, thus, exclude any liability of the manufacturer.
The manufacturer accepts no liability for damage caused by failure to observe these Mounting Instructions.

1.3. Copyright and Intellectual Property Rights

These Mounting Instructions are subject to change without notice.

All names of products stated in these Mounting Instructions are trademarks of Schletter GmbH and are herewith recognized and acknowledged.
Schletter GmbH is not liable for any damage of a product or consequential damage caused by the product that are due to improper handling.
First and foremost, Schletter GmbH is not responsible or liable for failures and faults that are caused by modifications made by the customer or other persons.
There is no claim for availability of previous designs and for the ability to retrofit delivered components to the respective latest state of the series.

Schletter GmbH has made considerable efforts to make sure that these Mounting Instructions are free of errors and omissions.
Schletter GmbH takes no responsibility respectively liability for faults that may be part of these Mounting Instructions for example for direct or consequential damage that arise from placing these Mounting Instructions at your disposal.

1.4. Safety Information

Please read these Mounting Instructions carefully before starting the assembly and keep it in a safe place for further reference. Please observe and abide by the regional and national applicable standards, building regulations and accident prevention regulations.

Read and make sure you understand the safety and warning notes in these Mounting Instructions and always apply them according to the relevant conditions and type of operation!

This instruction manual contains guidelines and notices you have to observe in order to ensure your personal safety and to prevent physical injuries or damage to property. Such safety and warning notes are marked with a warning triangle. Depending on the kind and degree of danger, **warning notices** are displayed as follows:

DANGER
*indicates that death or serious personal injury **will** result, if proper safety precautions are not taken.*

WARNING
*indicates that death or serious personal injury **can** result, if proper safety precautions are not taken.*

CAUTION
indicates that minor personal injury may result, if proper safety precautions are not taken.

DANGER
due to operations with electricity. Electric power can lead to serious accidents and can cause serious injuries. Appropriate safety precautions are to be taken by all means.

Securing the working area
Before the start of construction, the building site must be inspected by a supervising person by sight check or using plans showing all supply lines (water, electricity, gas) in the relevant area. For this purpose, the position of all supply lines (water, gas, electricity, etc.) must be marked using marking paint and unstable ground and areas that are landslide-prone must be sealed off with stable barriers or warning signs.

Important information and notices
regarding the product and its handling and/or mounting of the product are characterized by the following symbol.

NOTICE
warns about situations that can lead to material damage and disturbances during the operating procedure, if the instructions are not observed.

REFERENCES
All documents relevant for the mounting that are not included in these Mounting Instructions, are marked with this symbol.

We absolutely recommend to observe the following protective measures when mounting PvMax3:

Remember to wear high-visibility vests and safety shoes *all the time*

Always wear ear protection *when carrying out noisy work*

Always wear a hard hat *when there might be falling objects or if you could hurt your head in some other way*

Wear protective gloves *when working with sharp-edged components*

Wear respiratory protection *when carrying out dusty work*

Wear safety glasses *when carrying out grinding and cutting operations in order to avoid any danger to your eyes caused by flying liquids or parts (sparks, splinters)*

Apart from that, please consider the applicable rules and regulations on accident prevention and environmental protection that apply at the respective installation site as well as the work instructions and directives by the plant owner/operating company or at the place of operation.

1.5. Obligation of the Plant Owner / Operating Company

The plant owner ensures that all parts of these Mounting Instructions are readily available and handy at the plant.

The plant owner/operating company undertakes to only let people work at and in the striking distance of the plant who
- have read and understood the parts of the mounting instruction that are relevant for the respective operations,
- are familiar with the fundamental regulations on work safety, accident prevention and protection of the environment
- and have been instructed in the safe handling of the plant (training course).

Before starting any mounting works, the plant owner/operating company designates
- a supervising person and ensures that
- the construction site is inspected using plans showing all supply lines (water, electricity, gas) and thus
- the position of all underground supply lines and unstable ground without sufficient load-bearing capacities are marked properly or sealed off with barriers.

1.6. Commitment of the Personnel

Only people who give reason to expect that they will reliably do their job are allowed. Persons whose ability to react is affected, for example by drugs, alcohol or medication, are NOT allowed.
- Every person that is involved in the mounting of PvMax3 must have read and understood these Mounting Instructions, especially chapter "1.4. Safety Information", as well as all relevant chapters regarding the corresponding operations.
- These Mounting Instructions should always be kept available and easily accessible for all persons involved.
- Only trained and instructed qualified and certified personnel are allowed to execute the operations mentioned in this instruction manual.
- Personnel that still is to be trained may only mount the PvMax3 system under the supervision of an experienced person.

We recommend the operator to insist on a confirmation in writing in each case.

1.7. Training of the Personnel

These Mounting Instructions are addressed to certified personnel qualified in the areas of transportation and loading, mounting, disassembly and disposal, having the following qualifications:
- The certified professionals must be capable of fulfilling the tasks they have been assigned with and must be able to realize and avoid dangers on the basis of their professional formation, experience, expertise and their specific knowledge of the relevant regulations.
- The certified staff members must have the required knowledge of the guidelines regarding safety, accident prevention and environmental protection, as well as of loading and unloading regulations that apply at the respective construction site.
- The certified professionals have the driving licenses required at the specific construction site to be able to drive site vehicles and operate construction machines.

1.8. Additional Documents Relevant for the Mounting

In addition to these Mounting Instructions, the following documents are required for the mounting of PvMax3:

- *Reinforcement plan (optional)*
- *Blueprint drawing / general layout drawing*
- *Bill of materials / parts list*
- *Delivery note*
- *DIS unloading guidelines for transport in maritime containers*
- *General Terms and Conditions of Sale and Supply of Schletter GmbH*
- *Data sheet and instructions of the module manufacturer*

2. Transportation, Loading and Unloading

WARNING

- *Always wear protective equipment (safety shoes, hard hat, safety glasses, protective gloves and high-visibility vest) when unloading the components of the PvMax3 system.*
- *Besides also wear the personal protective equipment that is specified in your intra-company regulations for the respective activity.*
- *It is compulsory to monitor and supervise the complete unloading process.*
- *Do not step under suspended loads!*
- *Please make sure that there are no unauthorized persons in the danger area.*

Please observe all country-specific regulations and standards of the country of destination and its work instructions!

2.1. Delivery of the components

The delivery of the components for PvMax3 is carried out with an appropriate vehicle, for example

- truck/lorry or
- overseas container.

2.2. Preparing the delivery

- Provide a stable and drivable surface for the delivery.
- Please make sure that all access roads, manoeuvring and unloading areas are suitable for trucks (up to 40 tons) and can be used by forklift trucks and hoisting equipments.
- Ensure that loading/unloading and transport activities are carried out by trained and certified personnel only.

2.3. Provide forklift trucks and hoisting equipment

- Organize suitable forklift trucks and hoisting equipment to be available at the moment of delivery.
- Choose the suitable forklift trucks and hoisting equipment in cooperation with the site manager in charge.
- Make sure that the components, pallets and long items can properly be unloaded.
- Provide forklifts and hoisting equipment with different fork intervals or with adjustable forks.

2.4. Check the scope of delivery

The following shipping documents need to be verified on delivery:
- *Delivery note*
- *Packing lists*

We recommend to observe the following points when receiving the goods:
- Visual inspection of the delivered goods
- Check whether the supplied goods correspond to the delivery order
- Delivered quantity / comparison with packing lists and delivery note
- General condition of the goods
- Damages of the delivery
- Delivery documents

Claims as to defects by the customer shall require that he has complied with his duties of examination and notification of complaint contained in Sections 377, 381 of the German Commercial Code [HGB]. Defects discovered during incoming goods inspection or later shall be notified to Schletter GmbH in writing without undue delay. A notification shall not be unduly delayed if it has been made within two weeks; the timely dispatch of this notification shall be deemed sufficient to meet the deadline. Regardless of the obligation to inspect and notify, the customer shall notify Schletter of obvious defects (including delivery of the wrong product or in not enough quantity) within two weeks of delivery in writing; the timely dispatch of this notification shall also be deemed sufficient in this case to meet the deadline. A general right to return purchased goods is not granted.

Extract from the General Terms and Conditions of Sale and Supply of Schletter GmbH - download available at www.schletter.de/AGB_en

2.5. Storage of the components

The components will also be delivered in cardboard boxes on pallets. And there also are fragile and sensitive items among those components.
- Unload the items on firm and stable ground only.
- Protect all components against rain, snow, moisture and other weather conditions.
- Store the items in dry and well-ventilated storage buildings or tents.
- Never store components outdoors or covered by a plastic sheet only.

If you adhere to the hints above, you can prevent the goods from being damaged already before mounting.

3. Technical data

3.1. System description and properties

System description	PvMax3 - unit assembly system for ground-mounted solar plants
Material	• Module bearing rails: Aluminium, special rails of the S series • Girders: Aluminium, special rails of the BF series • Supports: Aluminium, RHP profiles • Bolts, nuts: A2-70, A4-80
Structural dimensioning	• According to the current national standards (in Germany: DIN 1055, EC 1). • System structural analysis with data on foundation dimensioning and screw anchor recommendation based on the wind and snow loads that have to be considered
Characteristics of the structure	• Quick and easy assembly • Pre-assembled support structure • Wide spans, which reduce the number of required supports and foundations
Foundation	• Concrete (The structural analysis of the system features specifications on reinforcement and dimensioning)
Module clamping	• Framed and unframed modules • Combined module clamping possible • with standard clamps or Rapid^{2+} clamps • Grounding clamps

3.2. Rack tolerances

PvMax3 is always configured specifically for the wind and snow loads at the respective installation site. In the interest of economic efficiency, usually the maximum load-bearing capacity of the individual component is exploited. To achieve this, however, the racks must be mounted with the utmost precision. If there are significant deviations from the mounting plans, this can lead to structural overstress which in turn can lead to damage cases. Schletter GmbH will not assume any liability for such damages nor for any consequences thereof. Adherence to the specified tolerances is therefore essential to the structural safety of the rack.

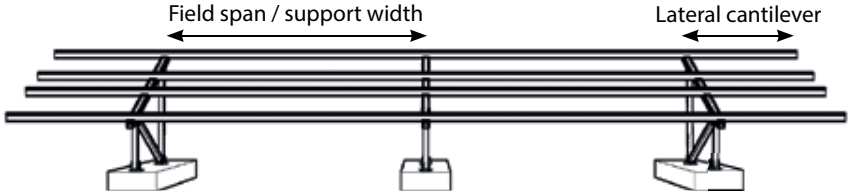


Fig. 3.2.-1 (field span / support width)

Support width	± 150 mm
Lateral cantilever of purlins	± 100 mm
Lower girder connection	± 100 mm
Upper girder connection	± 100 mm
Clearance between module and clamp	0.5 to 2 mm

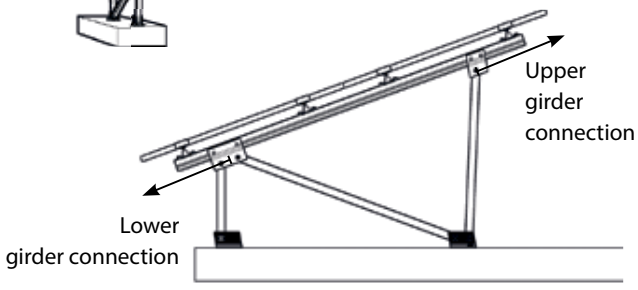


Fig. 3.2.-2 (girder connections)

3.3. Systems overview

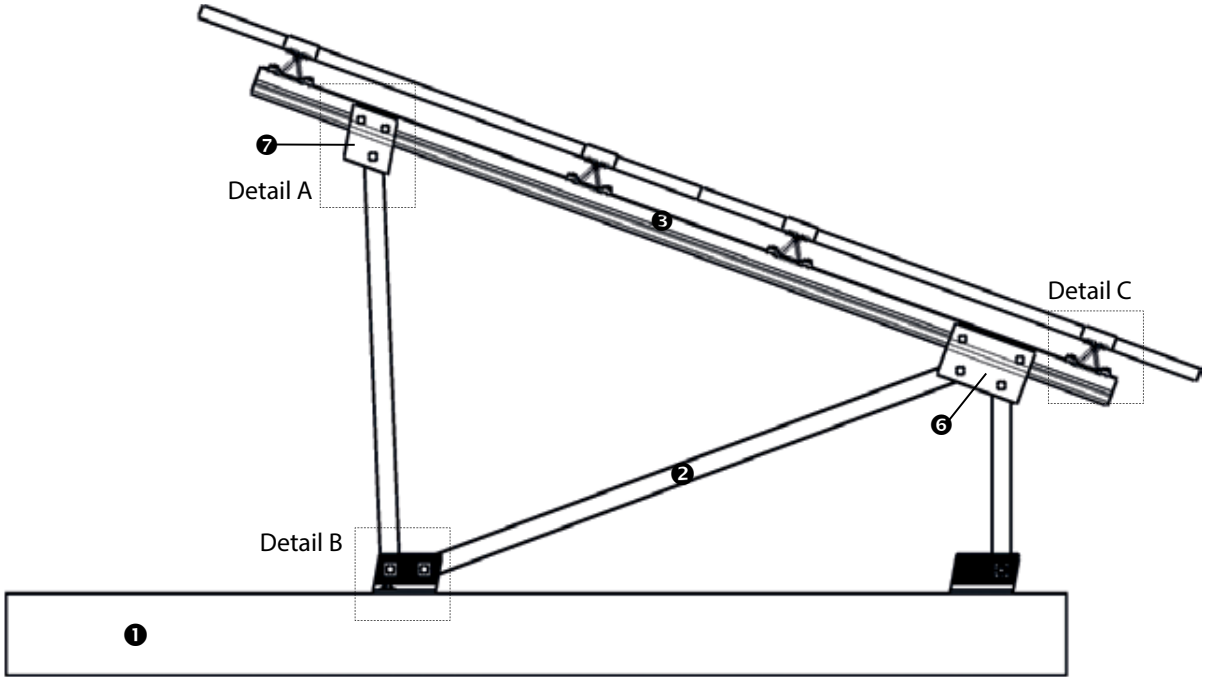


Fig. 3.3-1 (system visualisation)

Components

❶	Concrete foundation
❷	Strut assembly
❸	Girder assembly
❹	Module-bearing rail
❺	PvMax3 base bracket
❻	Girder to strut connector front
❼	Girder to strut connector rear

Connection elements / fasteners

①	Hexagon head screw M10x25 DIN933, square nut M10, KlickIn click component for square nut M10
②	Hexagon head screw M12x80 DIN931 and flange nut M12
③	Hexagon head screw M12x100 DIN931, flange nut M12 and base clamp
④	Mounting clamp

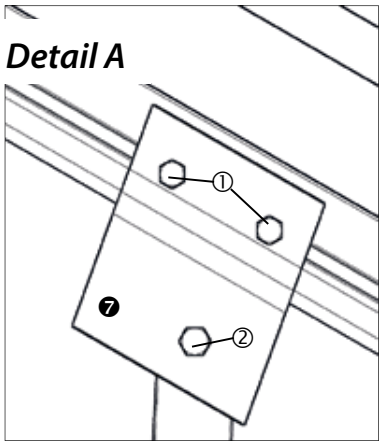


Fig. 3.3.-2. (detail A)

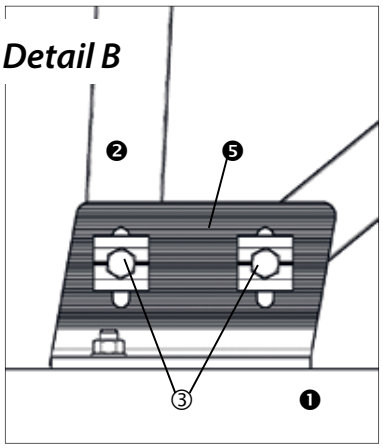


Fig. 3.3.-3. (detail B)

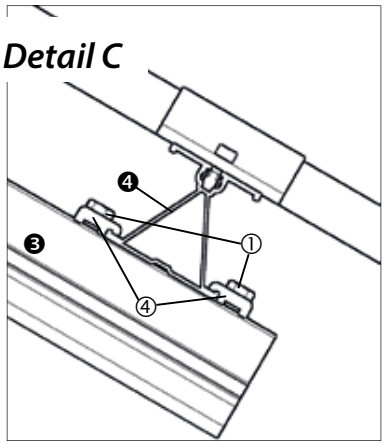


Fig. 3.3.-4. (detail C)

3.4. Components

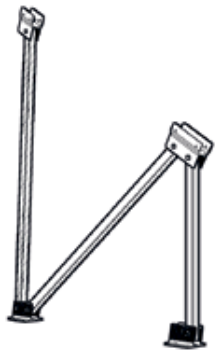


Fig. 3.4.1.-1 (147007-002)

3.4.1. Strut assembly

147007-001	PvMax3 strut assembly V55-D55-H55
147007-002	PvMax3 strut assembly V75-D75-H75
147007-003	PvMax3 strut assembly V55-D75-H75
147007-004	PvMax3 strut assembly V55-D75-H55 / V55-D55-H75

Fig. 3.4.2.-1 (147004-001)

Fig. 3.4.2.-2 (147004-002)

3.4.2. Components of the strut assembly

000011-126	PvMax3 Strut 55x55 front custom cut
000011-127	PvMax3 Strut 55x55 diag. custom cut
000011-128	PvMax3 Strut 55x55 rear custom cut
000011-129	PvMax3 Strut 75x55 front custom cut
000011-130	PvMax3 Strut 75x55 diag. custom cut
000011-131	PvMax3 Strut 75x55 rear custom cut
147004-001	PvMax3 front base bracket
147004-002	PvMax3 rear base bracket
147004-001	PvMax3 girder to strut connector front
147004-002	PvMax3 girder to strut connector rear
147005-000	PvMax3 base clamp

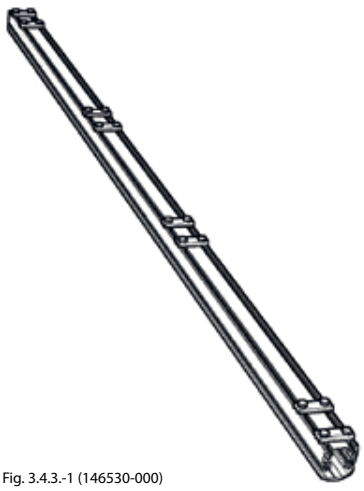


Fig. 3.4.3.-1 (146530-000)

3.4.3. Girder assemblies

146510-000	Girder assembly FS1H-BF0
146511-000	Girder assembly FS1H-BF1
146512-000	Girder assembly FS1H-BF2
146513-000	Girder assembly FS1H-BF3
146520-000	Girder assembly FS2H-BF0
146521-000	Girder assembly FS2H-BF1
146522-000	Girder assembly FS2H-BF2
146523-000	Girder assembly FS2H-BF3

3.4.3. Girder assemblies

146530-000	Girder assembly FS3H-BF0
146531-000	Girder assembly FS3H-BF1
146532-000	Girder assembly FS3H-BF2
146533-000	Girder assembly FS3H-BF3
146540-000	Girder assembly FS4H-BF0
146541-000	Girder assembly FS4H-BF1
146542-000	Girder assembly FS4H-BF2
146543-000	Girder assembly FS4H-BF3
146550-000	Girder assembly FS5H-BF0
146551-000	Girder assembly FS5H-BF1
146552-000	Girder assembly FS5H-BF2
146553-000	Girder assembly FS5H-BF3
146560-000	Girder assembly FS6H-BF0
145561-000	Girder assembly FS6H-BF1
145562-000	Girder assembly FS6H-BF2
146563-000	Girder assembly FS6H-BF3
146110-000	Girder assembly FS1V-BF0
146111-000	Girder assembly FS1V-BF1
146112-000	Girder assembly FS1V-BF2
146113-000	Girder assembly FS1V-BF3
146120-000	Girder assembly FS2V-BF0
146121-000	Girder assembly FS2V-BF1
146122-000	Girder assembly FS2V-BF2
146123-000	Girder assembly FS2V-BF3
146130-000	Girder assembly FS3V-BF0
146131-000	Girder assembly FS3V-BF1
146132-000	Girder assembly FS3V-BF2
146133-000	Girder assembly FS3V-BF3
146140-000	Girder assembly FS4V-BF0

3.4.3. Girder assemblies

146133-000	Girder assembly FS3V-BF3
146140-000	Girder assembly FS4V-BF0
146141-000	Girder assembly FS4V-BF1
146142-000	Girder assembly FS4V-BF2
146143-000	Girder assembly FS4V-BF3
146150-000	Girder assembly FS5V-BF0
146151-000	Girder assembly FS5V-BF1
146152-000	Girder assembly FS5V-BF2
146153-000	Girder assembly FS5V-BF3
146160-000	Girder assembly FS6V-BF0
146161-000	Girder assembly FS6V-BF1
146162-000	Girder assembly FS6V-BF2
146163-000	Girder assembly FS6V-BF3

3.4.4. Module-bearing rails

Fig. 3.4.4.-1 (124300-001)

124300-001	Module-bearing rail S0 - custom cut
124301-001	Module-bearing rail S1 ext. - custom cut
124302-001	Module-bearing rail S1 int. - custom cut
124303-001	Module-bearing rail S1.5 - custom cut
124307-001	Module-bearing rail S1.8 - custom cut
124304-001	Module-bearing rail S2 - custom cut
124305-001	Module-bearing rail S3 - custom cut
124306-001	Module-bearing rail S4 - custom cut

3.4.5. Purlin connector

Fig. 3.4.5.-1 (129300-000)

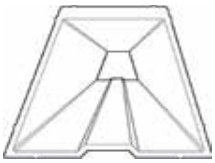


Fig. 3.4.5.-2 (129600-000)

129300-000	Connector for module-bearing rail S0 kit
129301-000	Connector for module-bearing rail S1 kit
129303-000	Connector for module-bearing rail S1.5 kit
129306-000	Connector for module-bearing rail S1.8 kit
129304-000	Connector for module-bearing rail S2 kit
129305-000	Connector for module-bearing rail S3 kit
129307-000	Connector for module-bearing rail S4 kit

3.4.6. Auxiliary equipment / accessories

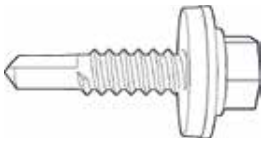


Fig. 3.4.6.-1 (943755-925)

Fig. 3.4.6.-2 (129012-010)

Fig. 3.4.6.-3 (129065-008)

Fig. 3.4.6.-4 (129012-001)

964000-176	Paint zinc dust silver gray satin-gloss
943755-925	Screw 5.5x25 self-tapping JT3-6 A2
119015-000	Punched mounting tape 12x0.8 hole 5.2mm - 50m
135005-000	Grounding connector kit
149100-900	Grounding pin kit variable
149100-000	Grounding pin kit
128014-000	Interior cable duct pre-assembled custom cut
128014-001	Exterior cable duct left, pre-assembled custom cut
128014-002	Exterior cable duct right, pre-assembled custom cut
129012-010	Proklip2000-B cable clip round duct M10
129012-002	Proklip2000-P round cable clip for the S design
129065-008	Proklip-Multi8
129065-010	Proklip-Multi10
129042-001	Proklip-F
129012-008	Proklip-S rectangular cable clip for M8 channel
129012-001	Proklip-Q

3.4.7. Module clamping

	Rapid clamp		Standard clamp	
Module height	***End clamp***	***Middle clamp***	***End clamp***	***Middle clamp***
20 mm	---	---	130001-020	130002-000
24 mm	---	---	130001-024	130002-000
28 mm	---	---	130001-028	130002-000
30 mm	131001-030	131002-000	130001-030	130002-000
31 mm	131001-031	131002-000	130001-031	130002-001
32 mm	131001-032	131002-000	130001-032	130002-001
33 mm	131001-033	131002-000	---	---
34 mm	131001-034	131002-000	130001-034	130002-001
35 mm	131001-035	131002-000	130001-035	130002-001
36 mm	131001-036	131002-000	130001-036	130002-001
37 mm	131001-037	131002-000	---	---
38 mm	131001-038	131002-000	130001-038	130002-001
39 mm	131001-039	131002-000	---	---
40 mm	131001-040	131002-001	300001-040	130002-001
41 mm	131001-041	131002-001	130001-041	130002-001
42 mm	131001-042	131002-001	130001-042	130002-001
43 mm	131001-043	131002-001	130001-043	130002-001
44 mm	131001-044	131002-001	130001-044	130002-001
45 mm	131004-045	131002-001	130001-045	130002-001
46 mm	131001-046	131002-001	130001-046	130002-001
47 mm	131001-047	131002-001	---	---
48 mm	131001-048	131002-001	130001-048	130002-001
49 mm	131001-049	131002-001	---	---
50 mm	131001-050	131002-001	130001-050	130002-001
51 mm	---	---	130001-051	130002-001

The nuts and bolts of the Standard clamps are not included in the scope of delivery and must be ordered separately.

With big order quantities, clamps for other module thicknesses can be manufactured on request!

The Standard clamps are not pre-assembled when they are delivered. These clamps are combined with a hexagon socket head screw, a KlickIn click component and a square nut. The screws listed below can be used for that purpose:

3.4.8. Screws for Standard module clamps

	Frame height in mm	*Hexagon socket screw in mm*	*Name*
943308-125	20	25	Hexagon socket screw M8x25 serrated DIN912 A3
943308-130	24	30	Hexagon socket screw M8x30 serrated DIN912 A3
943308-135	28 - 30	35	Hexagon socket screw M8x35 serrated DIN912 A3
943308-120	31 - 35	20	Hexagon socket screw M8x20 serrated DIN912 A3
943308-125	36 - 40	25	Hexagon socket screw M8x25 serrated DIN912 A3
943308-130	41 - 45	30	Hexagon socket screw M8x30 serrated DIN912 A3
943308-135	46 - 51	35	Hexagon socket screw M8x35 serrated DIN912 A3

4. Mounting information

The PvMax3 system is customized for the respective installation site. The following indications are already needed during the planning process:

- Site boundaries
- Rights of way / easements (the building site must be accessible for vehicles at any time)
- Obstacles in the subsoil (pipes, subterranean cables, etc.)
- Weather conditions (wind, rain, snow, etc.)
- Conditions that may influence the building ground (seismic activities, erosion, etc.)
- Geotechnical reports about the topology of the site and the composition of the soil

When mounting the ground-mount system, we recommend:

- Keeping a clearly laid out and detailed daily construction report (site journal), where all daily work steps, employment of personnel and assembled components are exactly specified.
- Accurately checking and comparing the delivery notes with the delivered goods on the site.

4.1. Terrain

When planning the ground-mounted system, make sure that the ground slope is within the tolerances. In the following, the guiding values for a structurally safe solar plant are specified.

Maximum admissible ground slope
East-West: **10°**

Regarding the structural calculations, additional measures may be required (for example reinforcements)

Maximum admissible ground slope
North-South: **10°**

(depending on the condition of the slope, soil composition, rocks, etc.)

Installations on steeper slopes are only possible if special measures such as anchoring or excavations of the terrain are taken!

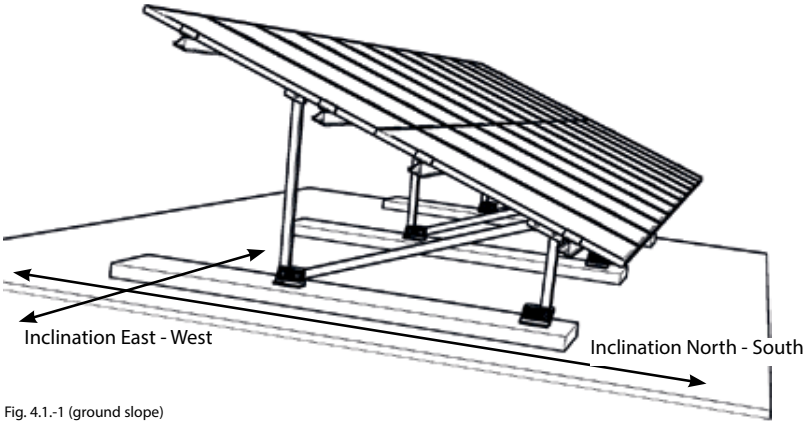


Fig. 4.1.-1 (ground slope)

4.2. Foundation

PvMax3 can basically be combined with all kinds of concrete foundations!
Ground-mounted solar plants are often built on re-vegetated landfill sites or agricultural terrains of low quality with bad subsoil conditions. In such cases a foundation using posts at frost penetration depth mostly is not possible or not reasonable. Thus, a foundation on concrete blocks made of pre-cast concrete or cast-in-place concrete is recommended as a standard option. This kind of foundation is virtually always possible and very easy to carry out.

Other types of foundation on request!

Whether or not the subsoil is suitable for a certain type of foundation generally has to be determined on site in each case.

4.2.1. Pre-cast strip foundations

As a standard, strip foundations are put under the supports (continuous strips parallel to the module rows are also possible). The weight of the foundations has to be dimensioned in such a manner that the wind loads are compensated by the foundation weight only (see structural analysis).

4.2.2. Dimensioning and reinforcement

The dimensioning of the foundations is carried out according to the structural analysis (by all means do specify the load parameters - especially the wind loads!)
The foundations have to be reinforced by the concrete builder according to the loads that have to be considered.

4.2.3. Preparation of the soil and positioning of the foundations

Before setting up the PvMax3 system, the terrain must be prepared for the positioning of the concrete foundations. Please consider that individual sub-racks that are part of one rack are not parallel to the subsoil beneath them. Thus, the foundations have to aligned correctly. This alignment must be maintained for all the racks in order to avoid "terracing" that would lead to shades on individual racks.

WARNING

- *Only use construction machines and site vehicles that comply with local safety requirements and which ensure protection of health and safety when used as intended.*
- *Secure the work area by taking appropriate measures and make sure that there are no unauthorized persons in the work area of the construction machines.*
- *See to it that persons who are performing earthworks are protected by personal protective equipment (PPE), such as high-visibility vest, safety shoes and hard hat).*

NOTICE
If the terrain structure is too uneven, soil has to be removed and the terrain has to be graded, if necessary.

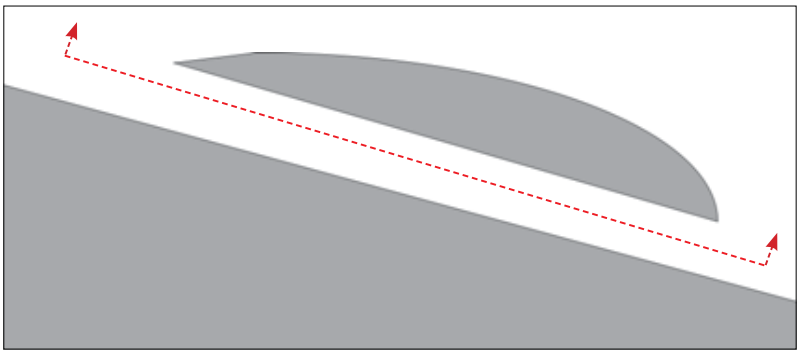


Fig. 4.2.3.-1 (removing soil and grading the terrain structure)

NOTICE
The concrete foundations must be aligned flush on a gravel bed. The rack can only be installed properly, if all foundations are correctly aligned and at the same level.
Maximum height tolerance within the foundations: ± 30 mm.

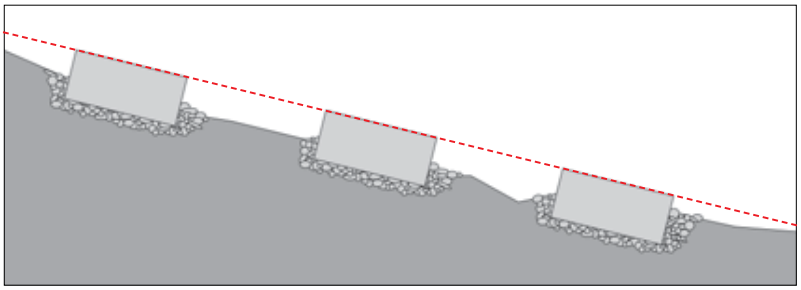


Fig. 4.2.3.-2 (aligning the concrete foundations on a gravel bed)

NOTICE
Also when using a cast-in-place foundation, make sure that the foundations are cast up to the same height.

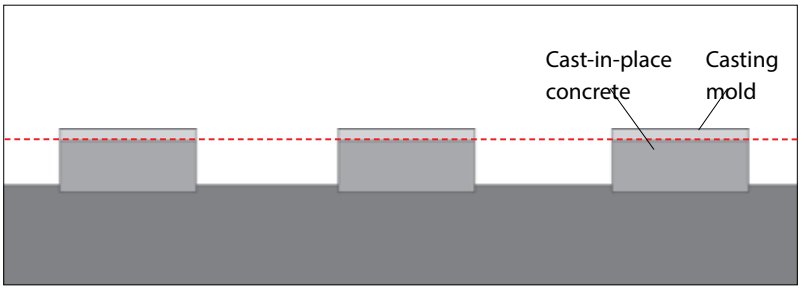


Fig. 4.2.3.-3 (flush height cast-in-place foundation)

4.3. Tolerances regarding inclination and distortion (twist)

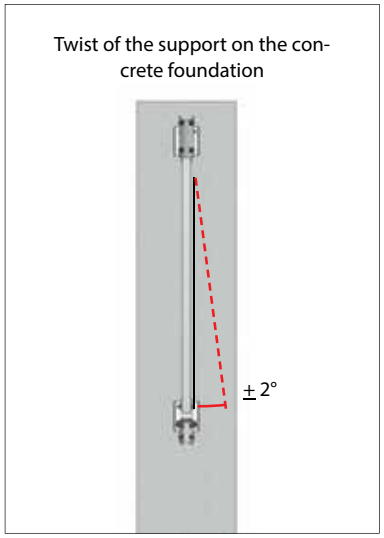


Fig. 4.3.-1 (twisting of the support)

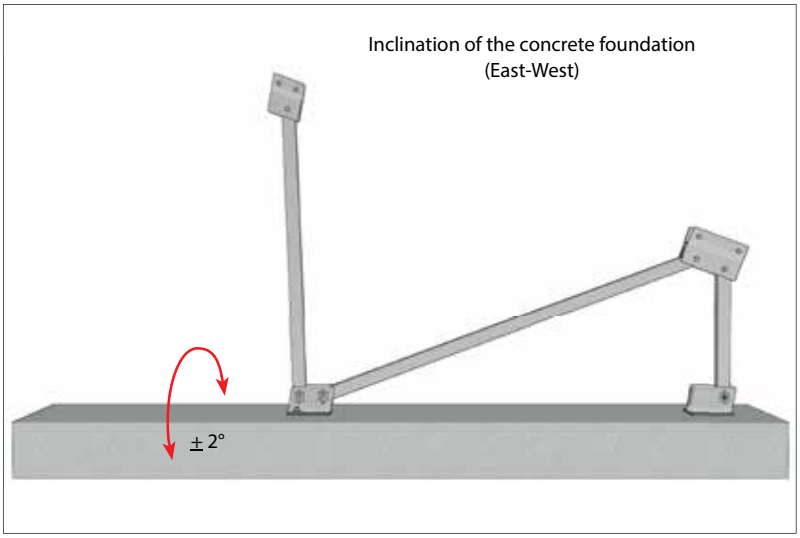


Fig. 4.3.-2 (east-west tilt of the concrete foundation)

4.4. Tools

In the following, the tools that are usually required for mounting the PvMax3 system are listed. Additional tools that are required for special cases (for example encasing the foundations in concrete) are not listed here.

NOTICE
For the assembly of the PvMax3 system, please exclusively use the tools recommended.
If you use tools that are not intended for this purpose, the rack can be damaged and the structural safety of the plant could thus be endangered!

We recommend using torque wrenches for all bolted connections. With fast rotary motions, there is an increased danger of "jamming / bolt blocking"!

4.4.1. Surveying, staking and aligning the foundations

- Measuring tapes (100 m)
- Line pins (about 20 pieces)
- Mason's lacing cord
- Club hammer
- Wooden stakes
- Color spray (for ground marking etc.)
- Permanent marker
- Spirit level
- Shovel
- Chains / straps to lift the foundations

The selected fasteners (for example screw anchors/dowels) must be appropriate for the fastening forces that are specified in the structural analysis! The customer has to add an accordant structural verification to the documents.
The fasteners are NOT included in the scope of delivery!

4.4.2. Rack mounting

- Torque wrench (30 Nm to 60 Nm)
- Wrench socket size 17
- Wrench socket size 19
- Hammer
- Angle meter (goniometer) - spirit level
- Measuring tape
- Mason's lacing cord
- Cordless screw driver
- Drill hammer with drill
- Air pump for blowing out the drill holes

4.4.4. Module mounting

- Mason's lacing cord
- Measuring tape
- Possibly distance template for clearance between the modules
- Cordless screw driver
- Size 8 socket for cordless screwdriver
- Size 6 hexagon socket wrench / 40TX key
- Torque wrench (< 8 Nm)
- Size 6 hexagon socket wrench / 40TX bit for torque wrench

4.5. Torque specifications

Fig. 4.5.1.-1 (concrete anchor, example)

Fig. 4.5.1.-2 (screw connection M12x120)

Fig. 4.5.1.-3 (screw connection M12x80)

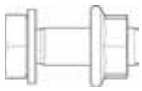


Fig. 4.5.1.-4 (screw connection M10x30)

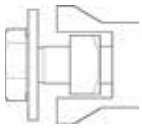


Fig. 4.5.1.-5 (screw connection M10x25)

4.5.1. Bolted connections in the substructure	
Name	***Tightening torque (MA-Nm)***
Screw anchor (dowel) acc. to structural analysis Washer	**Pay regard to manufacturer specifications!**
Hexagon head screw M12x120 DIN931 A2 Flange nut M12 serrated DIN6923 A4	**56 Nm**
Hexagon head screw M10x80 DIN933 A2 GMC Flange nut M10 serrated DIN6923 A4	**56 Nm**
Hexagon head screw M10x30 DIN933 A2 GMC Flange nut M10 serrated DIN6923 A4 Washer 10.5 DIN7349 A2	**33 Nm**
Hexagon head screw M10x25 DIN933 A2 GMC Square nut M10 DIN557 A4 KlickIn click component for nut M10	**33 Nm**

Fig. 4.5.2.-1 (Standard module clamp)

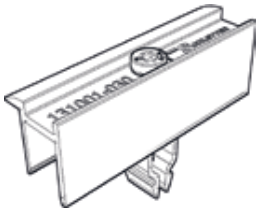


Fig. 4.5.2.-2 (Rapid^{2+} module clamp)

4.5.2. Fastening of the module clamps

Name	*Tightening torque (MA-Nm)*	*Module arrangement*
Hexagon socket screw DIN4762 M8 (20 - 35 mm) KlickIn click component for nut M8 Square nut DIN557 M8 A4	**14 Nm**	H, V and Kombi
TX stud screw M8 A2 GMC (42.5 - 55 mm)	**14 Nm**	H, V and Kombi

Always fasten the bolted connection by turning the bolt head! When checking the pre-stress of the bolts, it has to be considered that constraints and frictional forces can lead to a loss of clamping force. This was taken into consideration when the tightening torques were determined. When a bolted connection is checked, it must not loosen when 50% of the specified tightening torque is applied.

5. Assembly steps

5.1. Providing the concrete foundations and mounting the strut assembly

The concrete foundations are provided according to project-specific requirements either in pre-cast concrete blocks or cast-in-place concrete. Please observe all the information provided by the manufacturer as to the handling of the material or the pre-cast elements and abide by the safety regulations!

CAUTION when handling drilling equipment

- *Always wear appropriate protective equipment (PPE), above all respiratory protection, ear protection and safety glasses, when performing drilling operations.*
- *Do not wear clothes that could get caught in the drill chuck and abide by all further safety guidelines provided by the manufacturer as to handling the drilling equipment.*
- *In case of special ambient conditions, appropriate additional measures must be taken, or the operations must be stopped. Such special ambient conditions are, for example, moisture or conductive dust. And additional measures are, for example, weather protection, coverings and protective hood or cap.*

CAUTION when handling concrete

- *Irritant - Avoid contact with skin and eyes! Wear adequate protective equipment (PPE), such as protective gloves and eye and face protection.*
- *In case of spray applications, a suitable respirator mask (half mask respirator) is to be used!*

WARNING when handling precast foundations

- *Use appropriate auxiliary devices to move heavy loads.*
- *Never walk under suspended loads and do not stay in the turning radius of the lifting vehicle!*
- *Ensure that the loads are properly and professionally fastened to guarantee a safe transport.*
- *Only move the lifting vehicle on sufficiently compacted terrain and in adequate distance from overhead power lines or other obstacles.*

NOTICE

The selected fasteners (e.g. screw anchors/dowels) must be appropriate for the fastening forces that are specified in the structural analysis! For this purpose, a corresponding data sheet has to be added to the documents.

The required fasteners are NOT included in the scope of delivery!

1. Please refer to the rack drawings to determine the positions of the base brackets and pre-drill as indicated there.

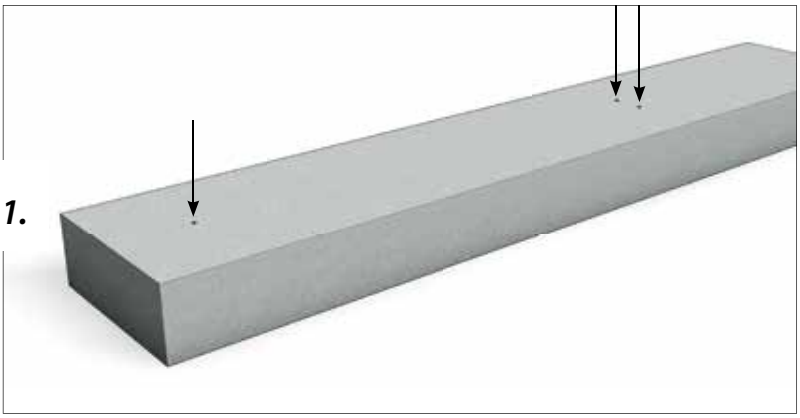


Fig. 5.1.-1 (pre-drilling the concrete foundation)

2. Insert the fasteners into the pre-drilled holes as specified in the manufacturer information.

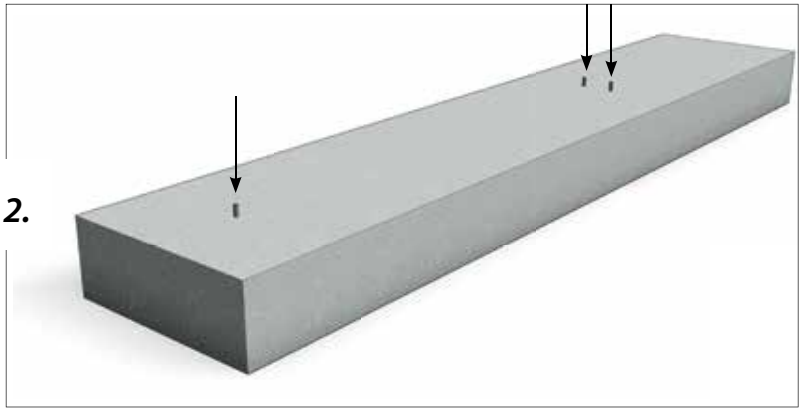


Fig. 5.1.-2 (inserting the fasteners)

3. Position the strut assembly onto the fasteners and fasten using nuts.

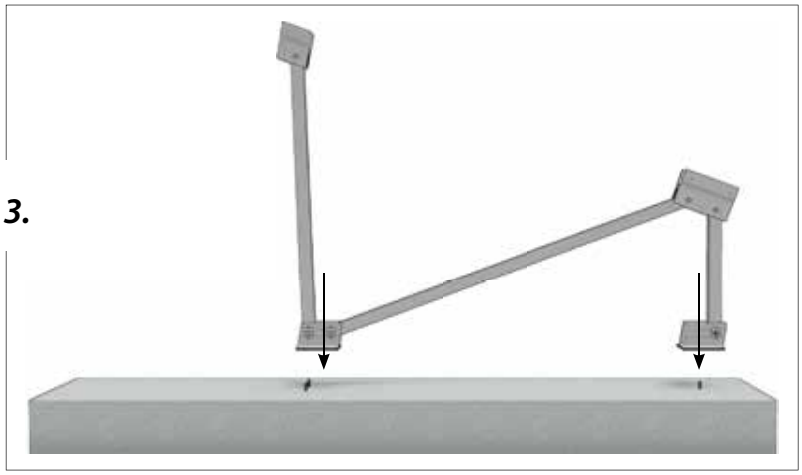


Fig. 5.1.-3 (positioning and fastening the strut assembly)

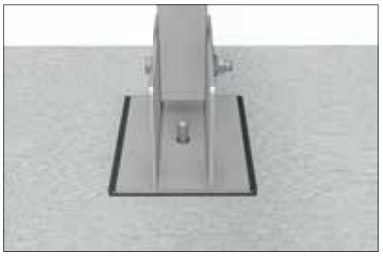


Fig. 5.1.-4 (PvMax3 front base bracket)

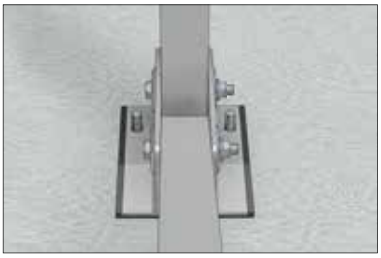


Fig. 5.1.-5 (PvMax3 rear base bracket)

5.2. Mounting the girder assembly

CAUTION

- *Wear adequate protective equipment, especially a hard hat, when mounting the girder assembly!*
- *Secure all parts that need to be fastened against slipping!*
- *Use appropriate auxiliary devices to handle heavy loads and ask your co-workers for help!*
- *Keep the work area clean to avoid falls!*
- *Never walk under suspended loads and secure objects and tools against falling down.*

1. Insert the KlickIn click component and square nut into the screw duct of the girder where the strut joints are to be attached.
For each side of the girder:

- 4 KlickIn click components
- 4 square nuts

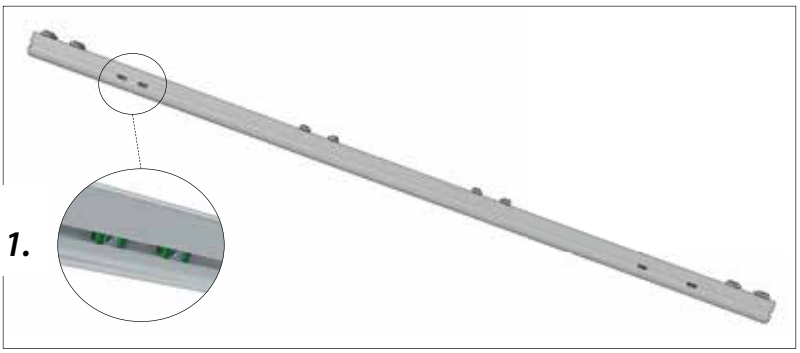


Fig. 5.2.-1 (inserting the KlickIn click components and square nuts)

2. Place the girder assembly onto the girder to strut connector.

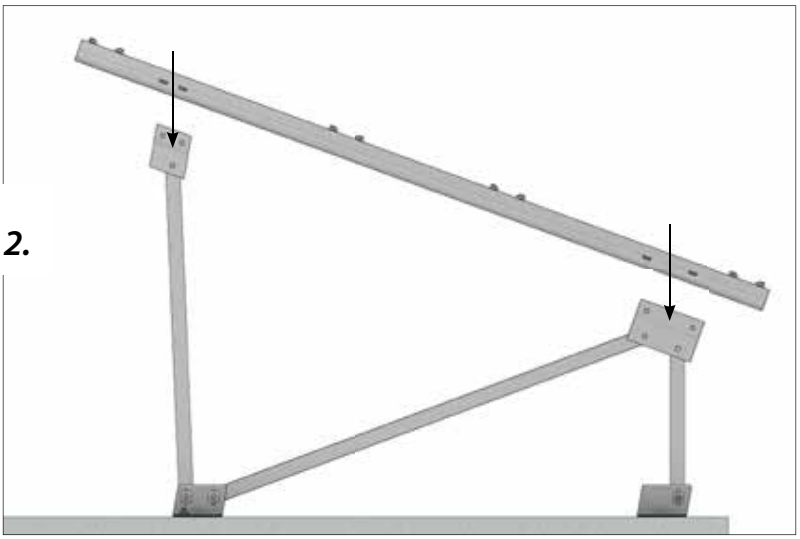


Fig. 5.2.-2 (placing the girder assembly)

3. Feed the hexagon head bolts through the pre-drilled holes of the girder to strut connector into the KlickIn click components and square nuts and fasten.
For each side of the girder:

- 4 hexagon head bolts M10x25 DIN933

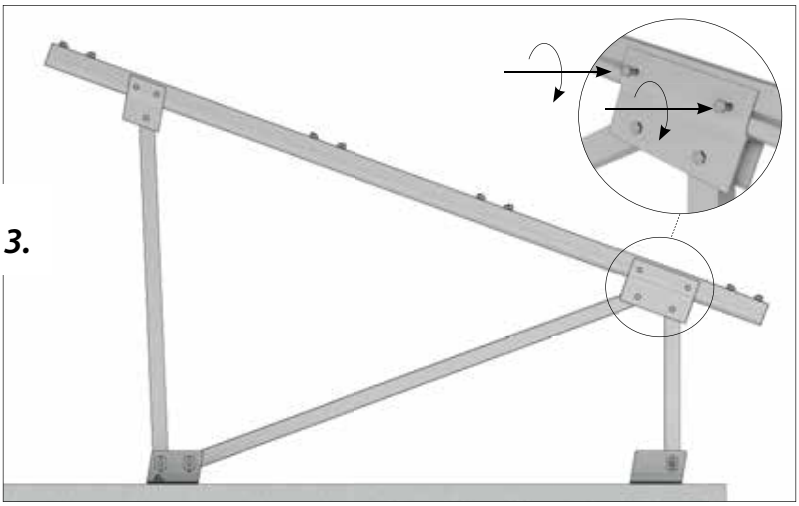
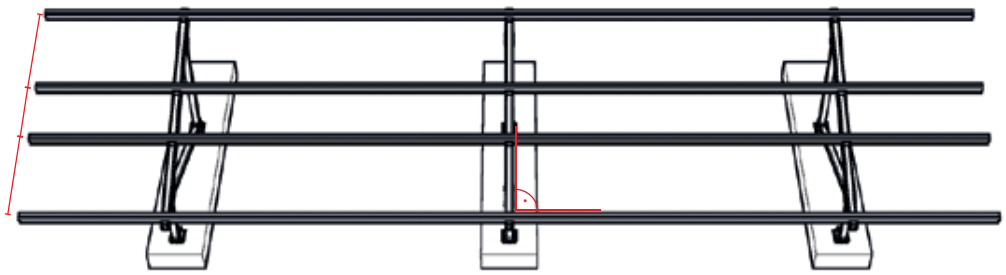


Fig. 5.2.-3 (fastening the girder assembly)

5.3. Mounting the module-bearing rails

NOTICE
The module-bearing rail must be mounted at a 90°angle to the girder! The distances between purlins must be observed as specified in the drawing!

The pre-assembled distances between the mounting clamps on the girder assembly are not always as required according to the general layout drawing. It is essential that you check these distances before mounting the module-bearing rails in order to avoid problems when it comes to mounting the modules. Please again check the distances after you have mounted the module-bearing rails!



Distance between the module-bearing rails *Check the 90° angle (at all junction points)*

Fig. 5.3.-1 (checking the module-bearing rails)

1. Loosen the mounting clamps

2. Place the module-bearing rail onto the girder, between the mounting clamps

3. Position the mounting clamps onto the edge of the module-bearing rail and fasten according to the torque specifications

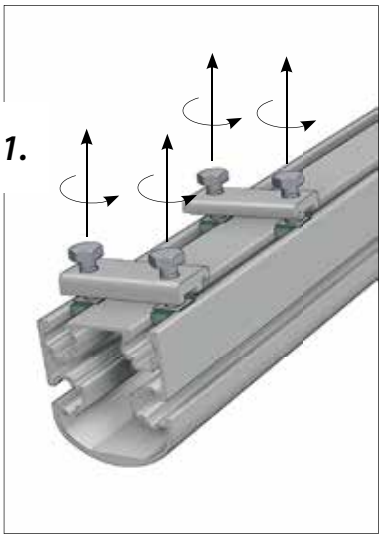


Fig. 5.3.-2 (loosening the mounting clamps)

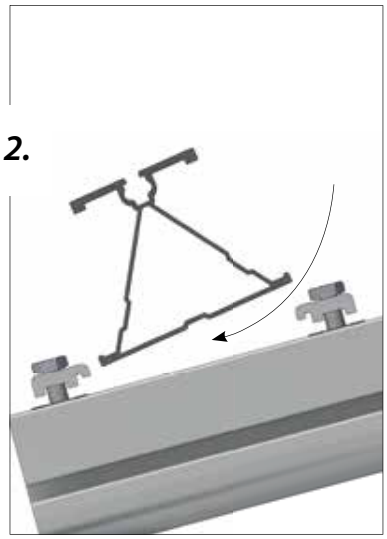


Fig. 5.3.-3 (swiveling in the module-bearing rail)

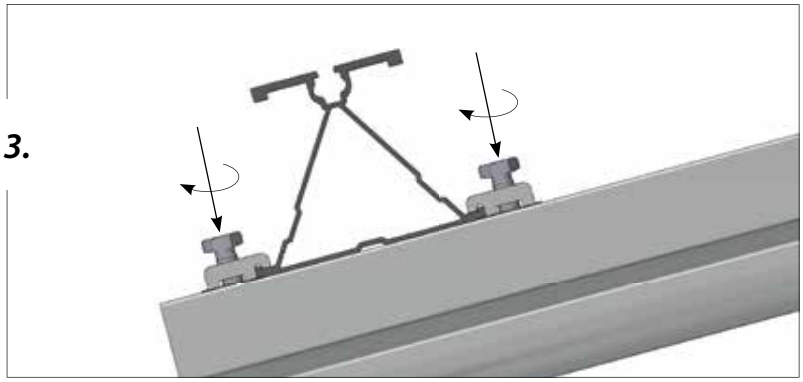


Fig. 5.3.-4. (fastening the mounting clamps)

5.4. Mounting the purlin connectors (optional)

1. Shift one half of the purlin connector into the module-bearing rail and fasten with a self-drilling screw. Then slide the second module-bearing rail onto the connector and again fasten with a self-drilling screw.

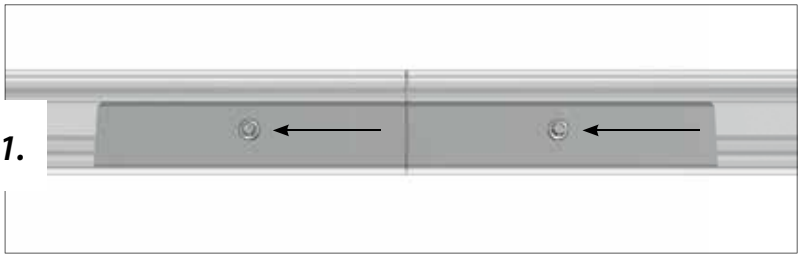


Fig. 5.4.-1 (mounting the purlin connector)

6. Module mounting and module clamping

Solar modules are third party components that are not included in the scope of delivery of the PvMax3 substructure. Schletter GmbH thus points out that the safety notices and mounting instructions of the module manufacturer are to be observed. And please also note the notices given in these Mounting Instructions when mounting the photovoltaic modules!

The following points must be taken into consideration at any event:

- *Photovoltaic modules are electrical devices. They must be treated carefully!*
- *Impacts, kicks, shocks or vibrations must be avoided.*
- *It is not allowed to put loads on the modules (trespassing, storing of items, etc.).*
- *Scratches or dirts on the module surface must be avoided.*
- *It is not allowed to pull or tear at the module cables. Do not heavily bend the module cables.*

The module clamping is carried out according to the project planning (portrait, landscape or combined module arrangement). The distance between modules can deviate from the standard value.
Standard value:

- clamped side ***23 mm***
- side without clamping ***5 - 10 mm***

(according to the specifications in the technical drawing; specifications by the module manufacturer are considered)

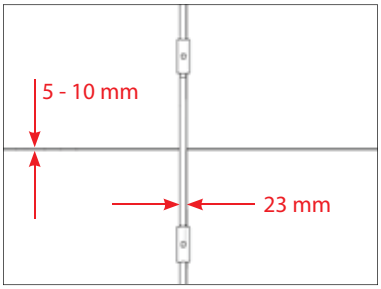


Fig. 6.-1 (distance between modules)

Clearance (= distance between module and module clamp) of

- ***min. 0.5 mm***
- ***max. 2 mm***

must be observed (module abuts on the spacer notches).

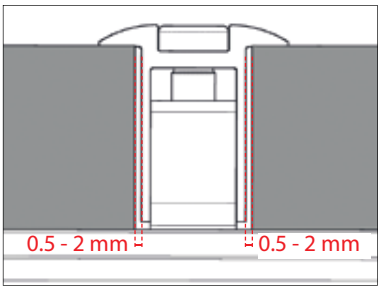


Fig. 6.-2 (clearance)

Tolerance from module front edge to ground level

- ***± 50 mm***

The M8 hexagon socket screws of the module clamps must be tightened to a torque of 14 Nm unless otherwise specified by the manufacturer!

Observe the clamping points specified by the module manufacturer!
Please note the data sheet of the photovoltaic module provided by the manufacturer to verify the clamping points.

6.1. Module mounting in case of horizontal (landscape) or vertical (portrait) module bearing

The modules are fastened to the module-bearing rails using standard clamps or Rapid^{2+} clamps:

1. Insert the module clamp into the click channel (duct) of the module-bearing rail.

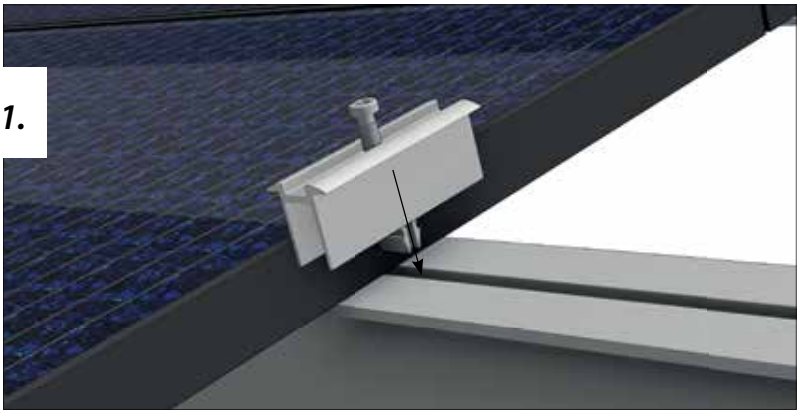


Fig. 6.1.-1 (clicking in the module clamp)

2. Push the module to the clamp (observing the clearance!)

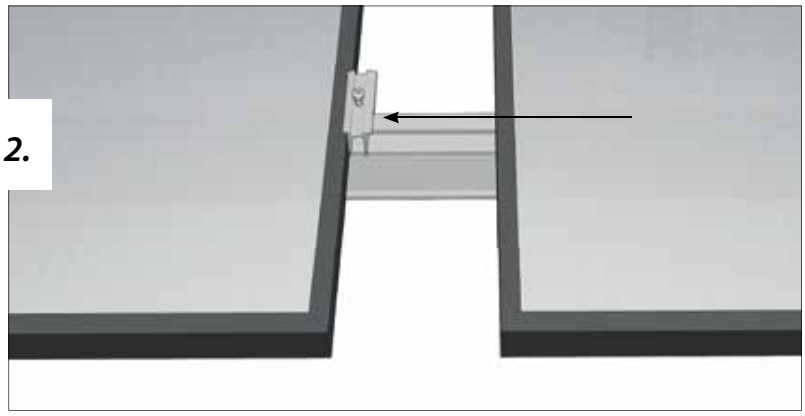


Fig. 6.1.-2. (pushing/sliding the module to the clamp)

3. Fasten hexagon socket screw with a torque of 14 Nm

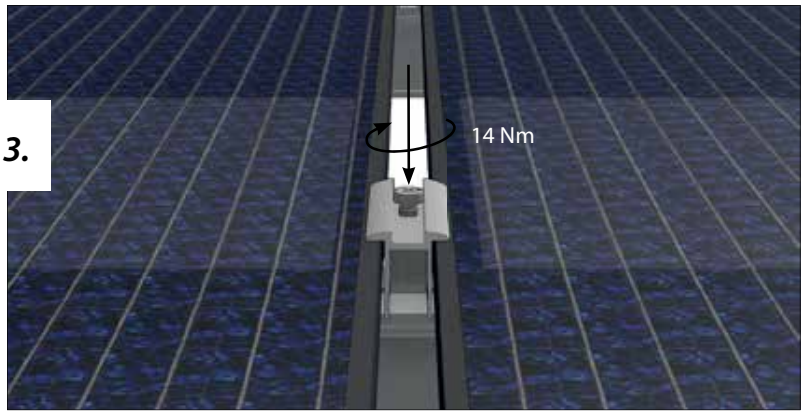


Fig. 6.1.-3. (fastening the hex socket screw)

6.2. Module mounting and clamping in case of combined module bearing

Combination of vertical (portrait) and horizontal (landscape) module clamping:

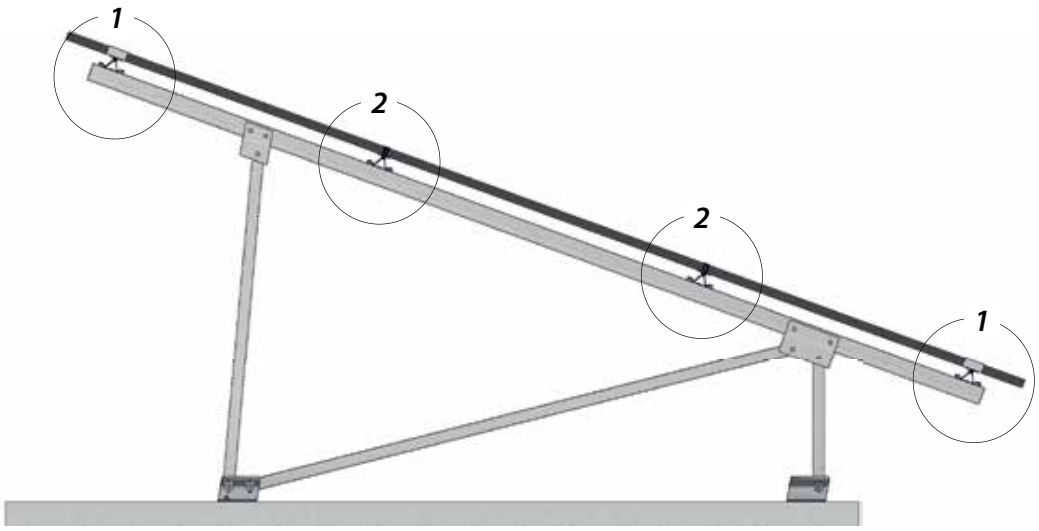


Fig. 6.2.-1 (combined module clamping)

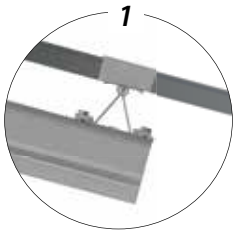


Fig. 6.2.-2.(upper and lower module clamping)

Clamping at the long side of the module to the upper and lower module-bearing rail.

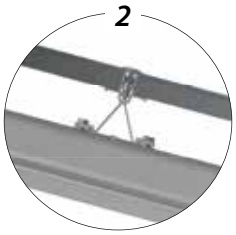


Fig. 6.2.-3 (module clamping at the inner side)

Clamping at the short side of the module to the inner module-bearing rail.

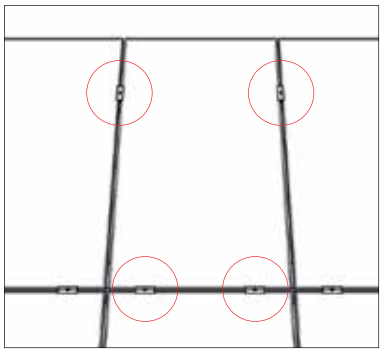


Fig. 6.2.-4 (clamping of the upper module)

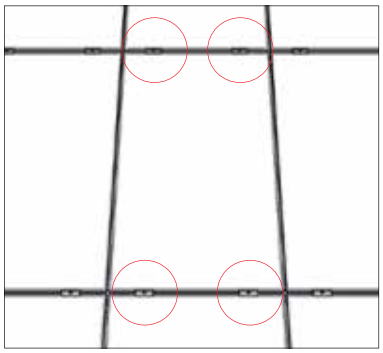


Fig. 6.2.-5 (clamping of the inner module)

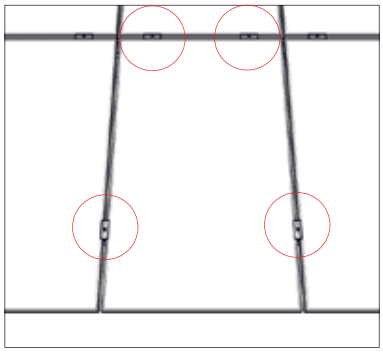


Fig. 6.2.-6 (clamping of the lower module)

7. Disassembly and disposal

DANGER

- *The plant operates with high voltage.*
- *Please abide by all instruction manuals and safety guidelines provided by the manufacturer of the modules or of electrical components before putting the plant out of operation.*
- *The plant may only be disconnected from the power supply provided on site by a certified electrical technician.*

WARNING

- *Always wear protective equipment (safety shoes, hard hat, safety glasses, protective gloves and high-visibility vest) when disassembling the PvMax3 components.*
- *And make sure that no unauthorized persons can enter the danger area.*
- *Do not step under suspended loads!*

- We recommend to wait for the confirmation by a certified electrical technician regarding the correct decommissioning of the plant before starting the disassembly of the PvMax3 system.
- Have an accordingly trained and certified professional disassemble the plant in transportable units.
- Observe all information and instructions provided in these Mounting Instructions.
- Also make these Mounting Instructions available to the personnel that is in charge of the disassembling operations.
- Ensure that the disassembling operations are performed exactly in reverse order of the mounting steps.

Faulty waste disposal can lead to environmental damage.
With regard to the environment it is recommended to dispose of recyclable materials in an appropriate manner.

Fig. 7.-1 (general recycling symbol)

Properly dispose of components

- Separate the materials steel, plastics, electric scrap, aluminium, stainless steel, copper, brass, etc.
- Dispose of the components in accordance with the local regulations

8. Maintenance and care

We recommend as follows:

INSPECTION OF THE PLANT
- *after exceptional weather conditions (storm, heavy snowfall or rain, etc.)*
- *after natural convulsions (earthquake, landslip, settlements, etc.)*

MAINTENANCE OF THE PLANT
- *Cleaning of the modules*
- *Verification of the bolted connections*
- *Check of the plant regarding corrosion*
- *Maintenance of the access roads and walkways*

CORRECTIVE MAINTENANCE OF THE PLANT
after detecting damages on the racks or earth movements (for example removing corrosion, replacement of faulty components, detection of unfastened bolted connections, etc.)

9. Warranty and liability

Generally, the customer is responsible for the proper mounting and installation of the PvMax3 system.

Exclusions
Guarantee, warranty and liability claims against the manufacturer Schletter GmbH in case of injury to persons or material damage shall be excluded if they result from one or several of the causes listed below:
- Non-observance of the Mounting Instructions and/or maintenance instructions in combination with a warranty extension
- Any use other than the intended use of the PvMax3 system or faulty operation
- Incorrect mounting, maintenance or repair
- Operation with spare or equipment parts that are faulty or have not been approved by the manufacturer
- Unauthorized constructional modifications or manipulation of the PvMax3 system or its equipment or components
- Utilization of components made by other manufacturers (third party components)
- Neglect or non-observance of the prescribed maintenance and/or testing and inspection intervals

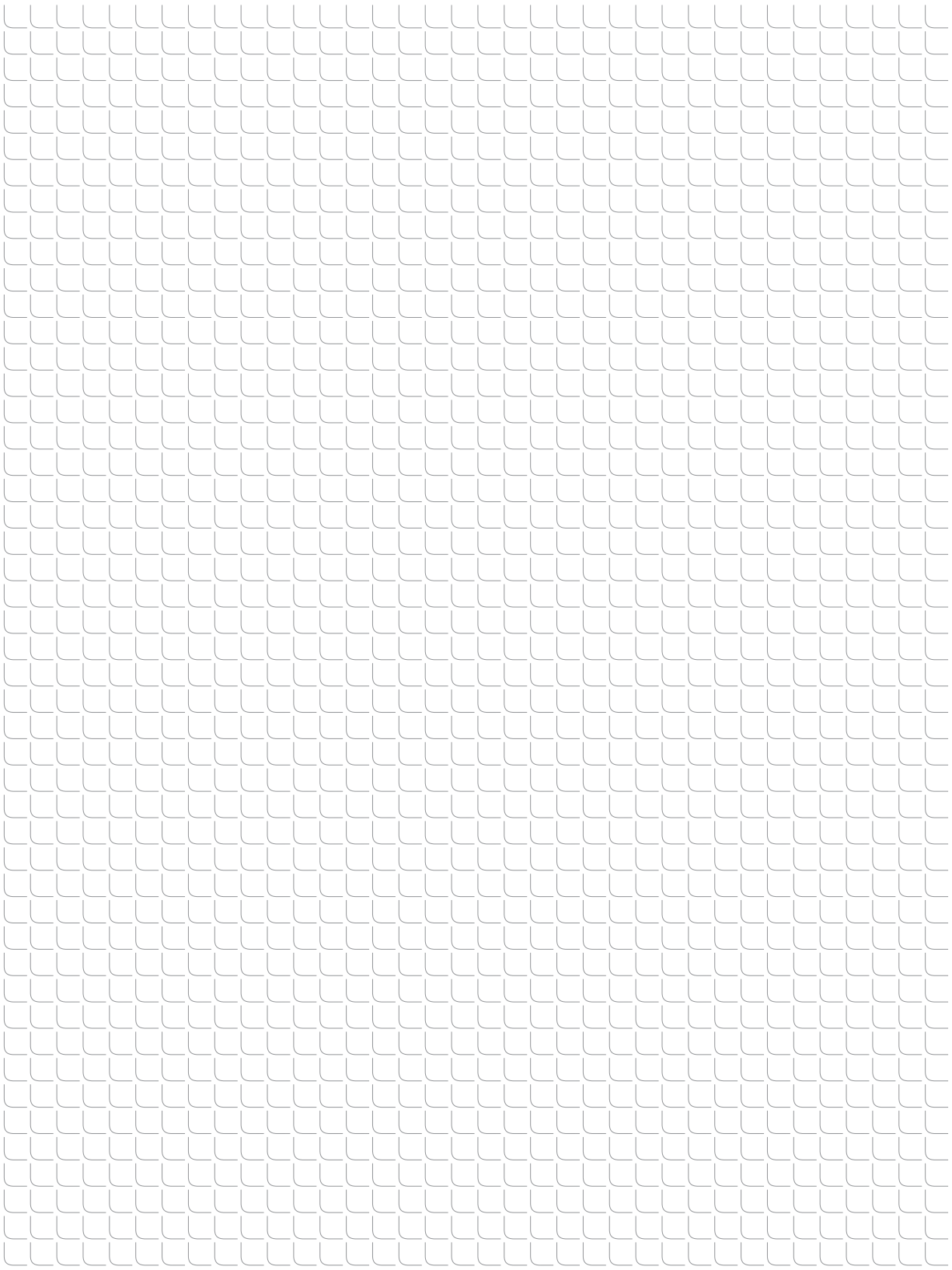
The customer exclusively shall bear the costs for damage or consequential damage that is due to one or several of the causes mentioned above.

The Mounting Instructions as well as the maintenance instructions in combination with a warranty extension refer exclusively to the mechanical metal structure supplied by Schletter GmbH.

Components of the solar plant like modules, cables and plug connectors, inverters or electric switch boxes are not part of these parts of the Mounting Instructions and thus are exempt from warranty and liability by Schletter GmbH.

Material damage to objects that are not included in the scope of delivery are generally excluded from any liability.

Notes



MOUNTING

PvMax-S

Mounting Instructions with SRF Foundations

Schletter GmbH
Gewerbegebiet an der B15
Alustrasse 1
83527 Kirchdorf / Haag in OB
GERMANY

Tel.: +49 8072 9191 -0
E-mail: info@schletter.eu

Your contact:

Technical advice for ground-mounted solar plants
Tel.: +49 8072 9191 - 203
E-mail: tb-freiflaeche@schletter.de

SCHLETTER

Table of Contents

1. General Information

1.1. Short Description

PvMax-S is a modular unit assembly system for the installation of ground-mount substructures in high-quality and efficient steel design. As the individual components have been optimized and structurally synchronized, a minimum system price is achieved. The dimensioning is intended in such a manner that continuous module rows are created simply by stringing together individual units of standardized lengths. Due to the individual units, thermal tensions within the system are avoided. If the lengths of the rows are determined by the boundaries of the terrain, the rows are made out of as many equal units as possible, then completed by a unit shortened to obtain the required length.
It is also possible to assembly additional accessories for the cable management or components for the internal potential equalization.

1.2. Intended Use

PvMax-S is a substructure for the mounting of photovoltaic modules. Any kind of different use that is not mentioned in these Mounting Instructions or an incorrect mounting (e.g. the utilization of components made by other producers or non-observance of tolerances specified here and/or exceeding the indicated loads) are considered as non-intended use and, thus, exclude any liability of the manufacturer.
The manufacturer accepts no liability for damage caused by failure to observe these Mounting Instructions.

1.3. Copyright and Intellectual Property Rights

These Mounting Instructions are subject to change without notice.

All names of products stated in these Mounting Instructions are trademarks of Schletter GmbH and are herewith recognized and acknowledged.
Schletter GmbH is not liable for any damage of a product or consequential damage caused by the product that are due to improper handling.
First and foremost, Schletter GmbH is not responsible or liable for failures and faults that are caused by modifications made by the customer or other persons.
There is no claim for availability of previous designs and for the ability to retrofit delivered components to the respective latest state of the series.

Schletter GmbH has made considerable efforts to make sure that these Mounting Instructions are free of errors and omissions.
Schletter GmbH does not assume any responsibility or liability for possible errors included in these Mounting Instructions and/or incidental, concrete or consequential damages arising from the publication of these Mounting Instructions.

1.4. Safety Information

Please read these Mounting Instructions carefully before starting the assembly and keep it in a safe place for further reference. Please observe and abide by the regional and national applicable standards, building regulations and accident prevention regulations.

Read and make sure you understand the safety and warning notes in these Mounting Instructions and always apply them according to the relevant conditions and type of operation!

This instruction manual contains guidelines and notices you have to observe in order to ensure your personal safety and to prevent physical injuries or damage to property. Such safety and warning notes are marked with a warning triangle. Depending on the kind and degree of danger, **warning notices** are displayed as follows:

DANGER
*indicates that death or serious personal injury **will** result, if proper safety precautions are not taken.*

WARNING
*indicates that death or serious personal injury **can** result, if proper safety precautions are not taken.*

CAUTION
indicates that minor personal injury may result, if proper safety precautions are not taken.

DANGER
due to operations with electricity. Electric power can lead to serious accidents and can cause serious injuries. Appropriate safety precautions are to be taken by all means.

Securing the working area
Before the start of construction, the building site must be inspected by a supervising person by sight check or using plans showing all supply lines (water, electricity, gas) in the relevant area. For this purpose, the position of all supply lines (water, gas, electricity, etc.) must be marked using marking paint and unstable ground and areas that are landslide-prone must be sealed off with stable barriers or warning signs.

Important information and notices
regarding the product and its handling and/or mounting of the product are characterized by the following symbol.

PLEASE NOTE
warns about situations that can lead to material damage and disturbances during the operating procedure, if the instructions are not observed.

REFERENCES
All documents relevant for the mounting that are not included in these Mounting Instructions, are marked with this symbol.

We absolutely recommend to observe the following protective measures when mounting PvMax-S system:

Remember to wear high-visibility vests and safety shoes *all the time*

Always wear ear protection *when carrying out noisy work*

Always wear a hard hat *when there might be falling objects or if you could hurt your head in some other way*

Wear protective gloves *when working with sharp-edged components*

When carrying out dusty work, *always wear breathing protection*

Wear safety glasses *when carrying out grinding and abrasive cutting operations in order to avoid any danger to your eyes caused by flying liquids or parts (sparks, splinters)*

Apart from that, please consider the applicable rules and regulations on accident prevention and environmental protection that apply at the respective installation site as well as the work instructions and directives by the plant owner/operating company or at the place of operation.

1.5. Obligation of the Plant Owner / Operating Company

The plant owner ensures that all parts of these Mounting Instructions are readily available and handy at the plant.

The plant owner/operating company undertakes to only let people work at and in the striking distance of the plant who
- have read and understood the parts of the mounting instruction that are relevant for the respective operations,
- are familiar with the fundamental regulations on work safety, accident prevention and protection of the environment
- and have been instructed in the safe handling of the plant (training course).

Before starting any mounting works, the plant owner/operating company designates
- a supervising person and ensures that
- the construction site is inspected using plans showing all supply lines (water, electricity, gas) and thus
- the position of all underground supply lines and unstable ground without sufficient load-bearing capacities are marked properly or sealed off with barriers.

1.6. Commitment of the Personnel

Only people who give reason to expect that they will reliably do their job are allowed. Persons whose ability to react is affected, for example by drugs, alcohol or medication, are NOT allowed.
- Every person that is involved in the mounting of PvMax-S must have read and understood these Mounting Instructions, especially chapter "1.4. Safety Information", as well as all relevant chapters regarding the corresponding operations.
- These Mounting Instructions should always be kept available and easily accessible for all persons involved.
- Only trained and instructed qualified and certified personnel are allowed to execute the operations mentioned in this instruction manual.
- Personnel that still is to be trained may only mount the PvMax-S system under the supervision of an experienced person.

We recommend the operator to insist on a confirmation in writing in each case.

1.7. Training of the Personnel

These Mounting Instructions are addressed to certified personnel qualified in the areas of transportation and loading, mounting, disassembly and disposal, having the following qualifications:
- The certified professionals must be capable of fulfilling the tasks they have been assigned with and must be able to realize and avoid dangers on the basis of their professional formation, experience, expertise and their specific knowledge of the relevant regulations.
- The certified staff members must have the required knowledge of the guidelines regarding safety, accident prevention and environmental protection, as well as of loading and unloading regulations that apply at the respective construction site.
- The certified professionals have the driving licenses required at the specific construction site to be able to drive site vehicles and operate construction machines.

1.8. Additional Documents Relevant for the Mounting

In addition to these Mounting Instructions, the following documents are required for the mounting of PvMax-S:

- *Reinforcement plan (optional)*
- *Blueprint drawing / general layout drawing*
- *Bill of materials / parts list*
- *Delivery note*
- *DIS unloading guidelines for transport in maritime containers*
- *General Terms and Conditions of Sale and Supply of Schletter GmbH*

2. Transportation, Loading and Unloading

WARNING

- *Always wear protective equipment (safety shoes, hard hat, safety glasses, protective gloves and high-visibility vest) when unloading the components of the PvMax-S system.*
- *Besides also wear the personal protective equipment that is specified in your intra-company regulations for the respective activity.*
- *It is compulsory to monitor and supervise the complete unloading process.*
- *Do not step under suspended loads!*
- *Please make sure that there are no unauthorized persons in the danger area.*

Please observe all country-specific regulations and standards of the country of destination and its work instructions!

2.1. Delivery of the components

The delivery of the components for PvMax-S is carried out with an appropriate vehicle, for example

- truck/lorry or
- overseas container.

2.2. Preparing the delivery

- Provide a stable and drivable surface for the delivery.
- Please make sure that all access roads, manoeuvring and unloading areas are suitable for trucks (up to 40 tons) and can be used by forklift trucks and hoisting equipments.
- Ensure that loading/unloading and transport activities are carried out by trained and certified personnel only.

2.3. Provide forklift trucks and hoisting equipment

- Organize suitable forklift trucks and hoisting equipment to be available at the moment of delivery.
- Choose the suitable forklift trucks and hoisting equipment in cooperation with the site manager in charge.
- Make sure that the components, pallets and long items can properly be unloaded.
- Provide forklifts and hoisting equipment with different fork intervals or with adjustable forks.

2.4. Check the scope of delivery

The following shipping documents need to be verified on delivery:
- *Delivery note*
- *Packing lists*

We recommend to observe the following points when receiving the goods:
- Visual inspection of the delivered goods
- Check whether the supplied goods correspond to the delivery order
- Delivered quantity / comparison with packing lists and delivery note
- General condition of the goods
- Damages of the delivery
- Delivery documents

Claims as to defects by the customer shall require that he has complied with his duties of examination and notification of complaint contained in
Sections 377, 381 of the German Commercial Code [HGB]. Defects discovered during incoming goods inspection or later shall be notified to Schletter GmbH in writing without undue delay. A notification shall not be unduly delayed if it has been made within two weeks; the timely dispatch of this notification shall be deemed sufficient to meet the deadline. Regardless of the obligation to inspect and notify, the customer shall notify Schletter of obvious defects (including delivery of the wrong product or in not enough quantity) within two weeks of delivery in writing; the timely dispatch of this notification shall also be deemed sufficient in this case to meet the deadline. A general right to return purchased goods is not granted.

Extract from the General Terms and Conditions of Sale and Supply of Schletter GmbH - download available at www.schletter.de/AGB_en

2.5. Storage of the components

The components will also be delivered in cardboard boxes on pallets. And there also are fragile and sensitive items among those components.
- Unload the items on firm and stable ground only.
- Protect all components against rain, snow, moisture and other weather conditions.
- Store the items in dry and well-ventilated storage buildings or tents.
- Never store components outdoors or covered by a plastic sheet only.

If you adhere to the hints above, you can prevent the goods from being damaged already before mounting.

3. Technical data

3.1. System description and properties

System description	PvMax-S, steel ground mount system with concrete foundation
Material	• Foundation posts: Steel, hot-dip galvanized • Profiles / rails: Steel, hot-dip galvanized • Fastening elements and screws/bolts: Steel, hot-dip galvanized or high-grade steel (fastening device, bolts)
Construction	• Quick and easy installation • Highly efficient and material-saving rail geometries
Foundation	• Cast-in-place concrete provided by the customer on site according to our specifications • Pre-cast concrete foundations according to data taken from the system structural analysis
Delivery and services	• Delivery of single components as well as a maximum level of pre-assembly possible • Transport to the installation site in accordance with the mounting progress • Delivery of the complete mounting material • Structural analysis of the soil and calculation of the foundation including screw anchor (dowel) recommendation • Site-specific structural analysis based on local loading data • Optional: Rack mounting • Optional: Complete module assembly
Structural analysis	• Individual system structural analysis based on regional load values • Load assumptions according to DIN EN 1990 (Eurocode 0), DIN EN 1991 (Eurocode 1), DIN EN 1993 (Eurocode 3), DIN EN 1999 (Eurocode 9) and further resp. corresponding national standards • Structural verification of all construction components based on FEM calculation
Module types	• Framed modules with a frame thickness of up to 50 mm • Unframed modules on request

3.2. Rack tolerances

PvMax-S is always configured specifically for the wind and snow loads at the respective installation site. In the interest of economic efficiency, usually the maximum load-bearing capacity of the individual component is exploited. To achieve this, however, the racks must be mounted with the utmost precision. If there are significant deviations from the mounting plans, this can lead to structural overstress which in turn can lead to damage cases. Schletter GmbH will not assume any liability for such damages nor for any consequences thereof. Adherence to the specified tolerances is therefore essential to the structural safety of the rack.

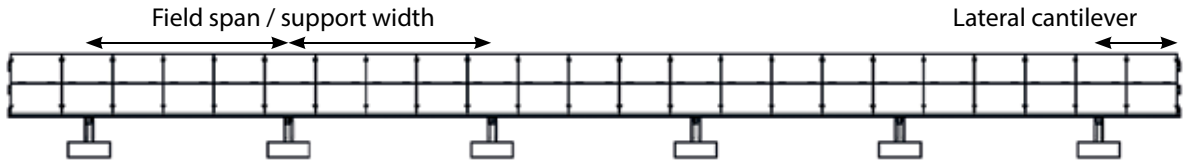


Fig. 3.2.-1 (field span / support width)

Support width	± 150 mm
Lateral cantilever of purlins	± 100 mm
Lower girder connection	± 100 mm
Upper girder connection	± 100 mm
Clearance between module and clamp	0.5 to 2 mm

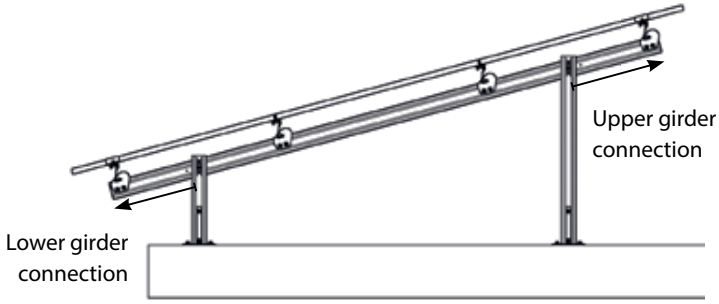


Fig. 3.2.-2 (girder connections)

3.3. Systems overview

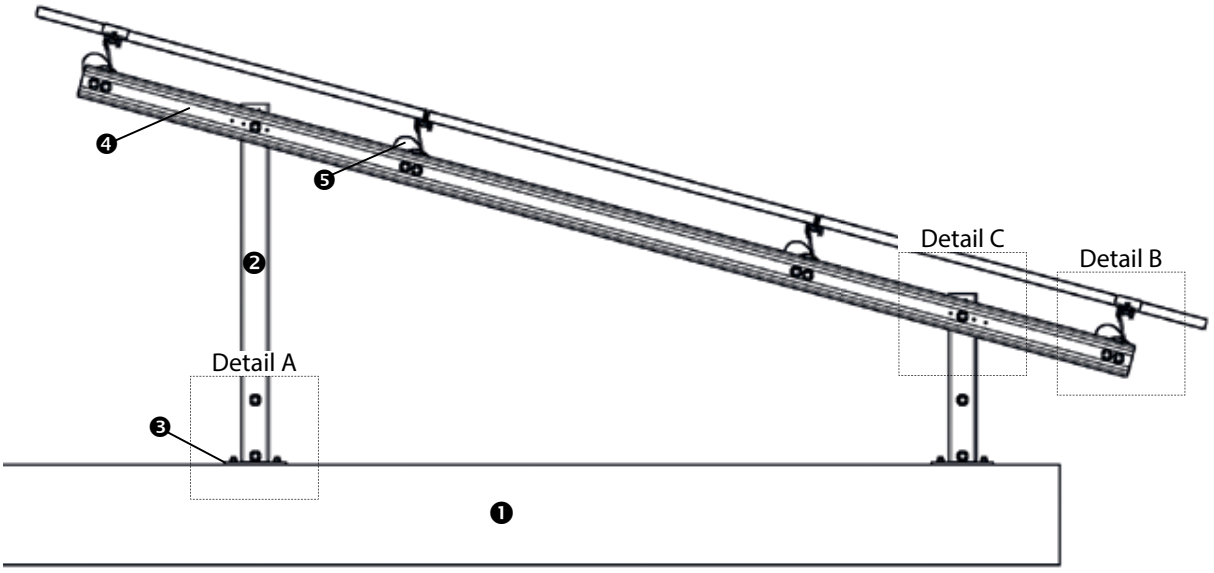


Fig. 3.3-1 (system visualisation)

Components

❶ Concrete foundation
❷ SRF foundation
❸ Connection to the concrete foundation
❹ Girder
❺ Fastening plate
❻ Module-bearing rail (purlin)
❼ Module clamp adapter kit

Connection elements / fasteners

① Hexagon bolt M12x30 DIN933, flange nut M12 DIN6923 and washer M12 DIN9021
② Fastening device
③ Drill screw

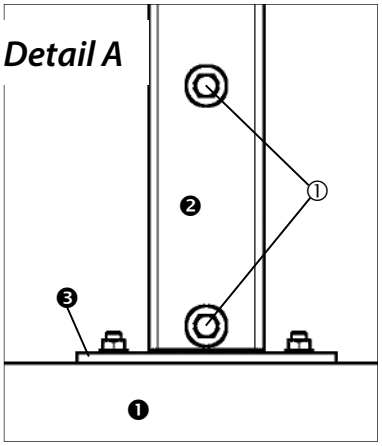


Fig. 3.3.-2. (detail A)

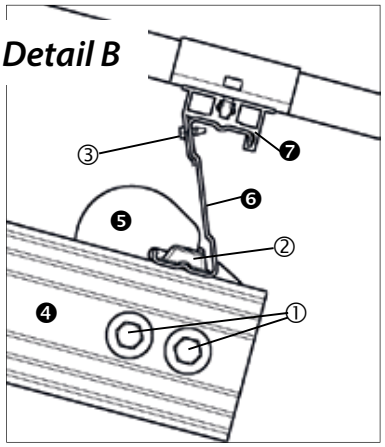


Fig. 3.3.-3. (detail B)

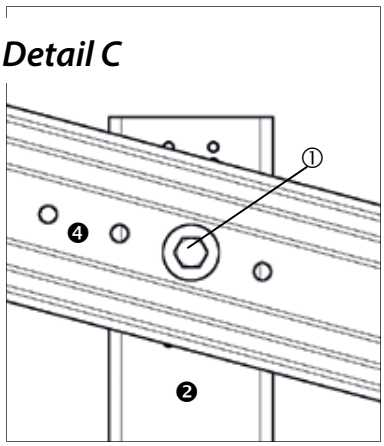


Fig. 3.3.-4. (detail C)

3.4. Components

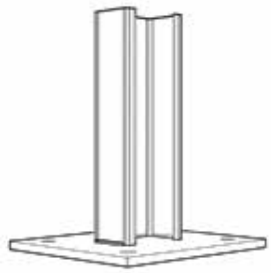


Fig. 3.4.1.-1 (143018-001)

3.4.1. PvMax foundation and components

143006-200	PvMax-S foundation SRF6
143018-001	Base bracket - concrete connection PvMax-S
943612-090	Hexagon head bolt M12x90 DIN933 A2 GMC
943912-012	Flange nut M12 serrated DIN6923 A4
943922-012	Large washer M12 DIN9021 A2

3.4.2. Module-bearing rails and connection elements

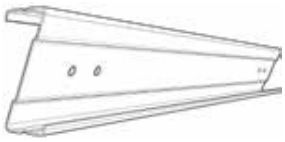


Fig. 3.4.2.-1 (144901-001)

144901-001	FS Uno / Duo purlin
144999-003	FS Uno / Duo fastening device
144999-008	FS Uno / Duo purlin connector Gen2 kit

Fig. 3.4.2.-2 (144999-003)

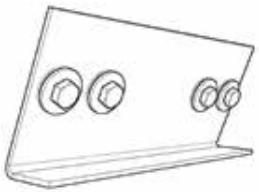


Fig. 3.4.2.-3 (144999-008)

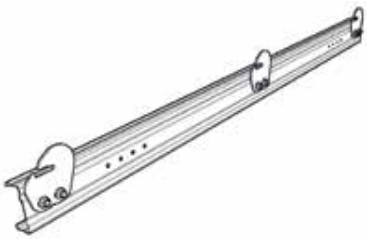


Fig. 3.4.3.-1 (144302-200)

Fig. 3.4.3.-2 (144999-006)

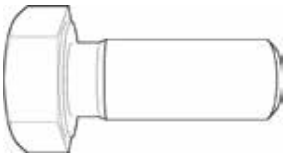


Fig. 3.4.3.-3 (943612-030)

Fig. 3.4.3.-4 (943912-012)

Fig. 3.4.3.-5 (943922-012)

3.4.3. Girder assemblies and components

144301-000	FS Duo girder assembly 1V custom cut
144302-200	FS Duo girder assembly 2V custom cut
144303-200	FS Duo girder assembly 3V custom cut
144304-200	FS Duo girder assembly 4V custom cut
144305-200	FS Duo girder assembly 5V custom cut
144306-200	FS Duo girder assembly 6V custom cut
144307-200	FS Duo girder assembly 7V custom cut
144308-200	FS Duo girder assembly 8V custom cut
144301-000	FS Duo girder assembly 1H custom cut
144302-100	FS Duo girder assembly 2H custom cut
144303-100	FS Duo girder assembly 3H custom cut
144304-100	FS Duo girder assembly 4H custom cut
144305-100	FS Duo girder assembly 5H custom cut
144306-100	FS Duo girder assembly 6H custom cut
144307-100	FS Duo girder assembly 7H custom cut
144308-100	FS Duo girder assembly 8H custom cut
144999-006	FS Uno / Duo fastening plate galvanized
943612-030	Hexagon head bolt M12x30 DIN933 A2 GMB
943912-012	Flange nut M12 serrated DIN6923 A4
943922-012	Large washer M12 DIN9021 A2

3.4.4. Module clamps for vertical module mounting

	Steel clamp			Rapid clamp*		Standard clamp*	
Module height	***End clamp left***	***Middle clamp***	***End clamp right***	***End clamp***	***Middle clamp***	***End clamp***	***Middle clamp***
20 mm	---	---	---	---	---	130001-020	130002-000
24 mm	---	---	---	---	---	130001-024	130002-000
28 mm	---	---	---	---	---	130001-028	130002-000
30 mm	144912-030	144910-001	144911-030	131001-030	131002-000	130001-030	130002-000
31 mm	144912-031	144910-001	144911-031	131001-031	131002-000	130001-031	130002-001
32 mm	144912-032	144910-001	144911-032	131001-032	131002-000	130001-032	130002-001
33 mm	144912-033	144910-002	144911-033	131001-033	131002-000	---	---
34 mm	144912-034	144910-002	144911-034	131001-034	131002-000	130001-034	130002-001
35 mm	144912-035	144910-002	144911-035	131001-035	131002-000	130001-035	130002-001
36 mm	144912-036	144910-002	144911-036	131001-036	131002-000	130001-036	130002-001
37 mm	144912-037	144910-002	144911-037	131001-037	131002-000	---	---
38 mm	144912-038	144910-003	144911-038	131001-038	131002-000	130001-038	130002-001
39 mm	144912-039	144910-003	144911-039	131001-039	131002-000	---	---
40 mm	144912-040	144910-003	144911-040	131001-040	131002-001	300001-040	130002-001
41 mm	144912-041	144910-003	144911-041	131001-041	131002-001	130001-041	130002-001
42 mm	144912-042	144910-003	144911-042	131001-042	131002-001	130001-042	130002-001
43 mm	144912-043	144910-004	144911-043	131001-043	131002-001	130001-043	130002-001
44 mm	144912-044	144910-004	144911-044	131001-044	131002-001	130001-044	130002-001
45 mm	144912-045	144910-004	144911-045	131004-045	131002-001	130001-045	130002-001
46 mm	144912-046	144910-004	144911-046	131001-046	131002-001	130001-046	130002-001
47 mm	144912-047	144910-004	144911-047	131001-047	131002-001	---	---
48 mm	144912-048	144910-005	144911-048	131001-048	131002-001	130001-048	130002-001
49 mm	144913-049	144910-005	144913-049	131001-049	131002-001	---	---
50 mm	144913-050	144910-005	144913-050	131001-050	131002-001	130001-050	130002-001
51 mm	---	---	---	---	---	130001-051	130002-001

* in combination with module clamp adapter

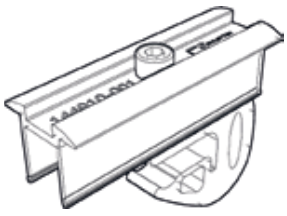


Fig. 3.4.4.-1 (144912-030)

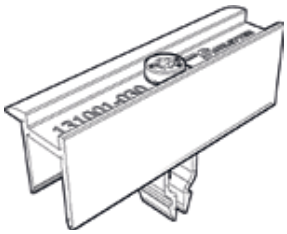


Fig. 3.4.4.-2 (131001-030)

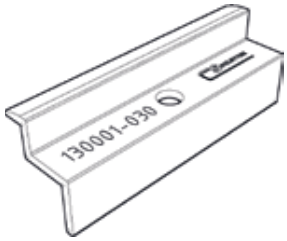


Fig. 3.4.4.-3 (130001-030)

3.4.5. Module clamps for horizontal module mounting

	Rapid clamp*		Standard clamp*	
Module height	***End clamp***	***Middle clamp***	***End clamp***	***Middle clamp***
20 mm	---	---	130001-020	130002-000
24 mm	---	---	130001-024	130002-000
28 mm	---	---	130001-028	130002-000
30 mm	131001-030	131002-000	130001-030	130002-000
31 mm	131001-031	131002-000	130001-031	130002-001
32 mm	131001-032	131002-000	130001-032	130002-001
33 mm	131001-033	131002-000	---	---
34 mm	131001-034	131002-000	130001-034	130002-001
35 mm	131001-035	131002-000	130001-035	130002-001
36 mm	131001-036	131002-000	130001-036	130002-001
37 mm	131001-037	131002-000	---	---
38 mm	131001-038	131002-000	130001-038	130002-001
39 mm	131001-039	131002-000	---	---
40 mm	131001-040	131002-001	300001-040	130002-001
41 mm	131001-041	131002-001	130001-041	130002-001
42 mm	131001-042	131002-001	130001-042	130002-001
43 mm	131001-043	131002-001	130001-043	130002-001
44 mm	131001-044	131002-001	130001-044	130002-001
45 mm	131004-045	131002-001	130001-045	130002-001
46 mm	131001-046	131002-001	130001-046	130002-001
47 mm	131001-047	131002-001	---	---
48 mm	131001-048	131002-001	130001-048	130002-001
49 mm	131001-049	131002-001	---	---
50 mm	131001-050	131002-001	130001-050	130002-001
51 mm	---	---	130001-051	130002-001

* in combination with module clamp adapter

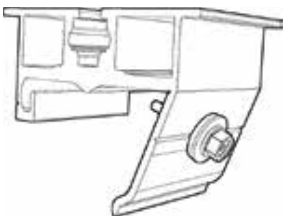


Fig. 3.4.6.-1 (144919-050)

3.4.6. Module clamp adapter and connection elements for module clamps

144919-050	FS Steel Module clamp adapter KIT
129010-008	KlickIn click component for nut M8
943914-008	Square nut M8 DIN557 A4

The nuts and bolts of the Standard clamps are not included in the scope of delivery and must be ordered separately.

With big order quantities, clamps for other module thicknesses can be manufactured on request!

The Standard clamps are not pre-assembled when they are delivered. These clamps are combined with a hexagon socket head bolt, a KlickIn click component and a square nut. The screws/bolts listed below can be used for that purpose:

3.4.7. Screws/bolts for Standard module clamps

	Frame height in mm	*Hexagon socket bolt in mm*	*Name*
943308-125	20	25	Hexagon socket bolt M8x25 serrated DIN912 A3
943308-130	24.	30.	Hexagon socket bolt M8x30 serrated DIN912 A3
943308-135	28 - 30	35.	Hexagon socket bolt M8x35 serrated DIN912 A3
943308-120	31 - 35	20.	Hexagon socket bolt M8x20 serrated DIN912 A3
943308-125	36 - 40	25.	Hexagon socket bolt M8x25 serrated DIN912 A3
943308-130	41 - 45	30.	Hexagon socket bolt M8x30 serrated DIN912 A3
943308-135	46 - 51	35.	Hexagon socket bolt M8x35 serrated DIN912 A3

Fig. 3.4.8.-1 (144999-009)

3.4.8. Auxiliary equipment / accessories

964000-176	Paint zinc dust silver gray satin-gloss
149023-001	Cable fastening retainer 1.0-3.0mm, guidance at the top
149023-002	Cable fastening retainer 1.0-3.0mm, guidance at the side
149023-003	Cable fastening retainer 3.0 - 6.0 mm
144999-009	FS Uno / Duo cable fastener purlin
144999-010	Empty cable conduit

Fig. 3.4.8.-2 (149023-003)

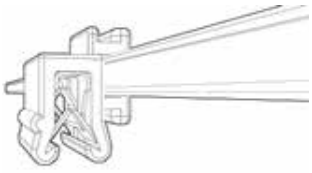


Fig. 3.4.8.-3 (149023-002)

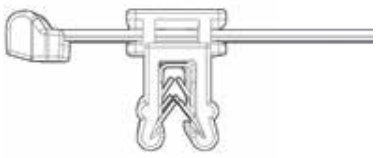


Fig. 3.4.8.-4 (149023-001)

4. Mounting information

The PvMax-S system is customized for the respective installation site. The following indications are already needed during the planning process:

- Site boundaries
- Rights of way / easements (the building site must be accessible for vehicles at any time)
- Obstacles in the subsoil (pipes, subterranean cables, etc.)
- Weather conditions (wind, rain, snow, etc.)
- Conditions that may influence the building ground (seismic activities, erosion risks, etc.)
- Geotechnical reports about the topology of the site and the composition of the soil

When mounting the ground-mount system, we recommend:

- Keeping a clearly laid out and detailed daily construction report (site journal), where all daily work steps, employment of personnel and assembled components are exactly specified.
- Accurately checking and comparing the delivery notes with the delivered goods on the site.

4.1. Terrain

When planning the ground-mounted system, make sure that the ground slope is within the tolerances. In the following, the guiding values for a structurally safe solar plant are specified.

Maximum admissible ground slope East-West: **10°**

Regarding the structural calculations, additional measures may be required (for example reinforcements)

Maximum admissible ground slope North-South: **10°**

(depending on the condition of the slope, soil composition, rocks, etc.)

Installations on steeper slopes are only possible if special measures such as anchoring or excavations of the terrain are taken!

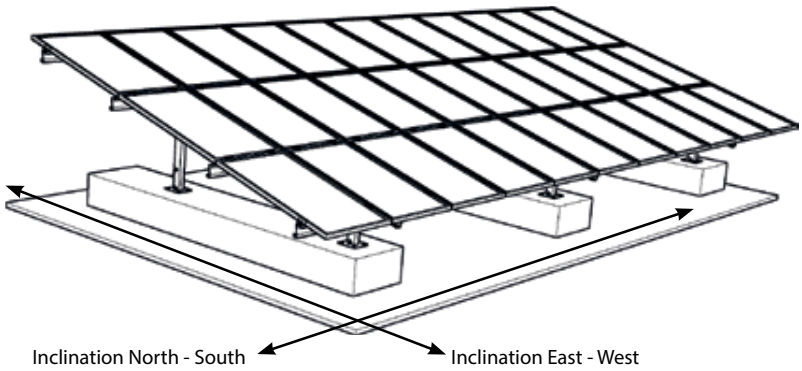


Fig. 4.1.-1 (ground slope)

4.2. Foundation

PvMax-S can basically be combined with all kinds of concrete foundations!
Ground-mounted solar plants are often built on re-vegetated landfill sites or agricultural terrains of low quality with bad subsoil conditions. In such cases a foundation using posts at frost penetration depth mostly is not possible or not reasonable. Thus, a foundation on concrete blocks made of pre-cast concrete or cast-in-place concrete is recommended as a standard option. This kind of foundation is virtually always possible and easy to carry out.

Other types of foundation on request!

Whether or not the subsoil is suitable for a certain type of foundation generally has to be determined on site in each case.

4.2.1. Pre-cast strip foundations

As a standard, strip foundations are put under the supports (continuous strips parallel to the module rows are also possible). The weight of the foundations has to be dimensioned in such a manner that the wind loads are compensated by the foundation weight only.

4.2.2. Dimensioning and reinforcement

The dimensioning of the foundations is carried out according to the structural analysis (by all means do specify the load parameters - especially the wind loads!) The foundations have to be reinforced by the concrete builder according to the loads that have to be considered.

4.2.3. Preparation of the terrain and positioning of the foundations

Before setting up the PvMax-S system, the terrain must be prepared for the positioning of the concrete foundations. Please consider that individual sub-racks that are part of one rack are not parallel to the subsoil beneath them. Thus, the foundations have to aligned correctly. This alignment must be maintained for all the racks in order to avoid "terracing" that would lead to shades on individual racks.

WARNING

- *Only use construction machines and site vehicles that comply with local safety requirements and which ensure protection of health and safety when used as intended.*
- *Secure the work area by taking appropriate measures and make sure that there are no unauthorized persons in the work area of the construction machines.*
- *See to it that persons who are performing earthworks are protected by personal protective equipment (PPE), such as high-visibility vest, safety shoes and hard hat).*

NOTICE

If the terrain structure is too uneven, soil has to be removed and the terrain has to be graded, if necessary.

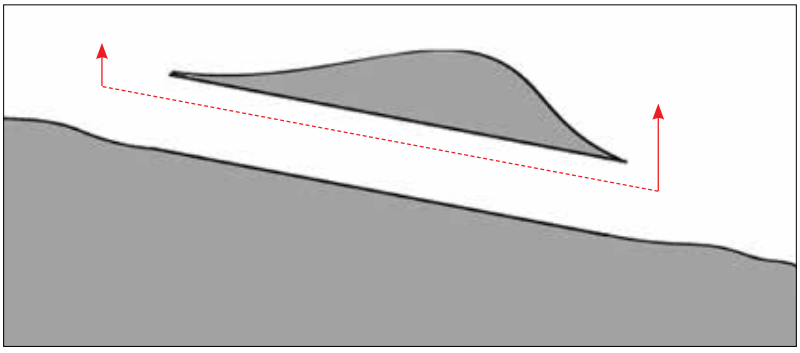


Fig. 4.2.3.-1 (removing soil and grading the terrain structure)

NOTICE

The concrete foundations must be aligned flush on a gravel bed. The rack can only be installed properly, if all foundations are correctly aligned and at the same level.

Maximum height tolerance within the foundations: ± 30 mm.

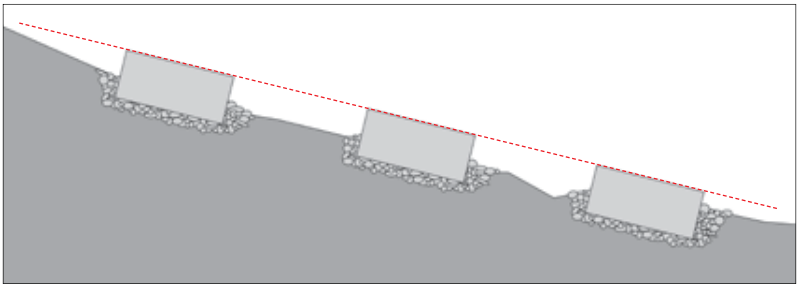


Fig. 4.2.3.-2 (flush alignment of the concrete foundations)

NOTICE

Also when using a cast-in-place foundation, make sure that the foundations are cast up to the same height.

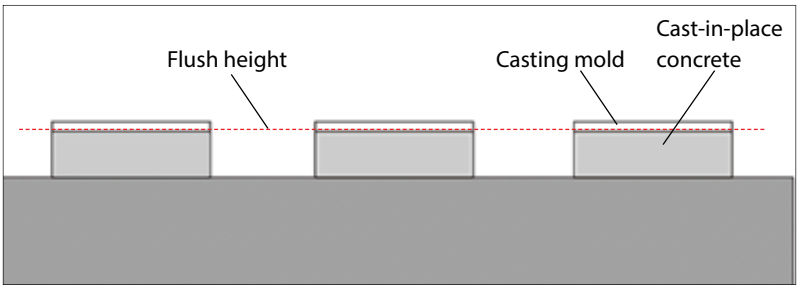


Fig. 4.2.3.-3 (casting up the concrete foundations to the same height)

4.2.4. Tolerances regarding inclination and distortion (twist)

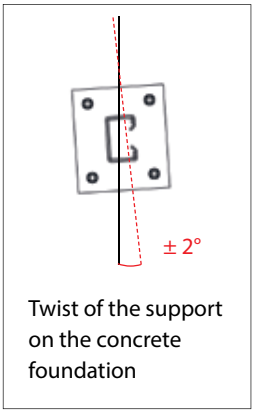


Fig. 4.2.4.-1 (twist / distortion)

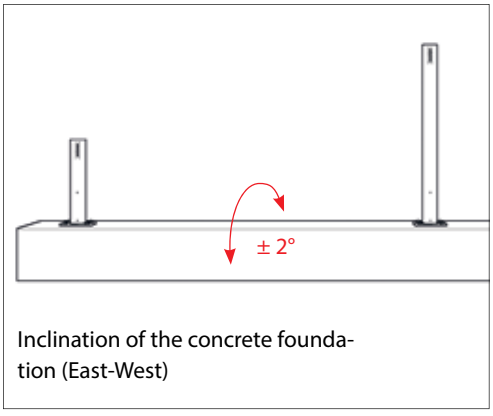


Fig. 4.2.4.-2 (east-west tilt of the concrete foundation)

4.3. Tools

In the following, the tools that are usually required for mounting the PvMax-S system are listed. Additional tools that are required for special cases (for example encasing the foundations in concrete) are not listed here.

NOTICE
For the assembly of the PvMax-S system, please exclusively use the tools recommended.
If you use tools that are not intended for this purpose, the rack can be damaged and the structural safety of the plant could thus be endangered!
The selected fasteners (e.g. screw anchors/dowels) must be appropriate for the fastening forces that are specified in the structural analysis! The customer has to add an accordant structural verification to the documents.

We recommend using torque wrenches for all bolted connections. With fast rotary motions, there is an increased danger of "jamming / bolt blocking"!

The fasteners (e.g. dowels/screw anchors) are not included in the scope of delivery!

4.3.1. Surveying, staking and aligning the foundations

- Measuring tapes (100 m)
- Line pins (about 20 pieces)
- Mason's lacing cord
- Club hammer
- Wooden stakes
- Color spray (for ground marking etc.)
- Permanent marker
- Spirit level
- Shovel
- Chains / straps to lift the foundations

4.3.2. Rack mounting

- Torque wrench (30 Nm to 60 Nm)
- Wrench socket size 17
- Wrench socket size 19
- Hammer
- Club hammer (to hold against the connector hook)
- Plastic tip hammer
- Angle meter (goniometer) - spirit level
- Mason's lacing cord
- Cordless screw driver
- Drill hammer with drill
- Air pump for blowing out the drill holes

4.3.4. Module mounting

- Mason's lacing cord
- Measuring tape
- Possibly distance template for distances between the modules
- Cordless screw driver
- Size 8 socket for cordless screwdriver
- Size 6 hexagon socket wrench / 40TX key
- Torque wrench (< 8 Nm)
- Size 6 hexagon socket wrench / 40TX bit for torque wrench

4.4. Torque specifications

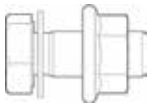


Fig. 4.4.1.-1 (screw connection M12)

4.4.1. Bolted connections in the substructure

Name	*Tightening torque (MA-Nm)*
Hexagon head bolt DIN933 M12x30 A2 GMB Flange nut DIN6923 M12 A4 Washer, large DIN9021 M12 A2	**56 Nm**

Fig. 4.4.2.-1 (Standard module clamp)

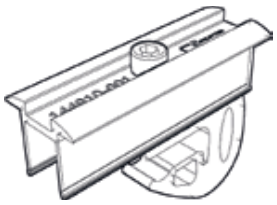


Fig. 4.4.2.-2 (steel module clamp)

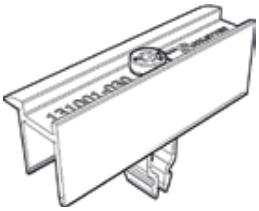


Fig. 4.4.2.-3 (Rapid²⁺ module clamp)

4.4.2. Fastening of the module clamps

Name	*Tightening torque (MA-Nm)*	*Module arrangement*
Hexagon socket bolt DIN4762 M8 (20 - 35 mm) KlickIn click component for nut M8 Square nut DIN557 M8 A4	**14 Nm**	H and V in combination with module clamp adapter
Hexagon socket bolt DIN912 M8 A2 (25 - 45 mm)	**8 Nm**	V
TX stud screw M8 A2 GMC (42.5 - 55 mm)	**14 Nm**	H and V in combination with module clamp adapter

Always fasten the bolted connection by turning the bolt head! When checking the pre-stress of the bolts, it has to be considered that constraints and frictional forces can lead to a loss of clamping force. This was taken into consideration when the tightening torques were determined. When a bolted connection is checked, it must not loosen when 50% of the specified tightening torque is applied.

5. Assembly steps

5.1. Pre-drilling the concrete foundation and inserting the dowels/screw anchors

WARNING when handling drilling machines

- *Always wear appropriate protective equipment (PPE), above all respiratory protection, ear protection and safety glasses, when performing drilling operations.*
- *Do not wear clothes that could get caught in the drill chuck and abide by all further safety guidelines provided by the manufacturer as to handling the drilling equipment.*
- *In case of special ambient conditions, appropriate additional measures must be taken, or the operations must be stopped. Such special ambient conditions are, for example, moisture or conductive dust. And additional measures are, for example, weather protection, coverings and protective hood or cap.*

CAUTION when handling concrete

- *Irritant - Avoid contact with skin and eyes! Wear adequate protective equipment (PPE), such as protective gloves and eye and face protection.*
- *In case of spray applications, a suitable respirator mask (half mask respirator) is to be used!*
- *Please observe all further hazard notes and safety precautions given by the manufacturer!*

WARNING when handling precast foundations

- *Use appropriate auxiliary devices to move heavy loads.*
- *Never walk under suspended loads and do not stay in the turning radius of the lifting vehicle!*
- *Ensure that the loads are properly and professionally fastened to guarantee a safe transport.*
- *Only move the lifting vehicle on sufficiently compacted terrain and in adequate distance from overhead power lines or other obstacles.*

NOTICE

The selected fasteners (for example screw anchors/dowels) must be appropriate for the fastening forces that are specified in the structural analysis! For this purpose, a corresponding data sheet has to be added to the documents.

Please note that the required fasteners are not included in the scope of delivery!

1. Please refer to the rack drawing to determine the positions of the base brackets and measure the concrete foundations as indicated there. Then drill the holes on the concrete foundations.

2. Anchor the dowels / screw anchors in the foundation as specified in the manufacturer information.

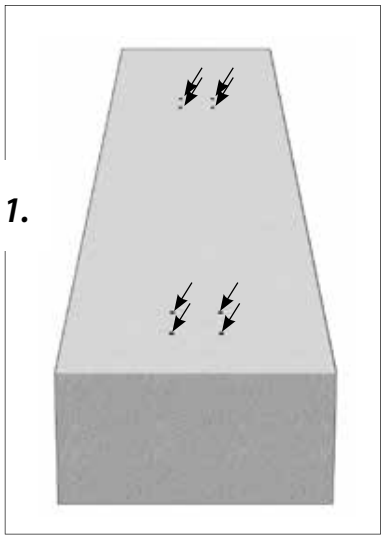


Fig. 5.1.-1 (drilled holes on the concrete foundation)

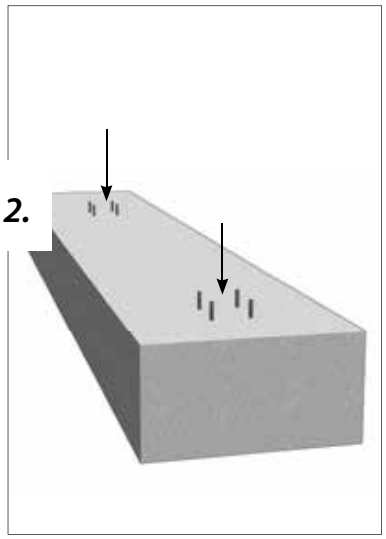


Fig. 5.1.-2 (inserting the dowels/screw anchors)

5.2. Fastening the base bracket and foundation rail

NOTICE
Check whether the individual foundation rails are aligned to each other and verify the tolerances stated.

The exact positions of the base brackets on the concrete foundations can be referenced in the specifications provided in the corresponding ***technical general layout drawing****.*

1. Fasten the base bracket at the inserted fasteners

2. Bolt the foundation rail to the base bracket using two hexagon head bolts M12x30 DIN933, two washers 12 DIN 125 and two flange nuts M12 DIN6923

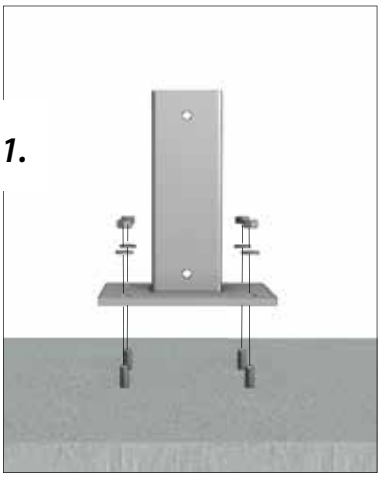


Fig. 5.2.-1. (fastening the base bracket)

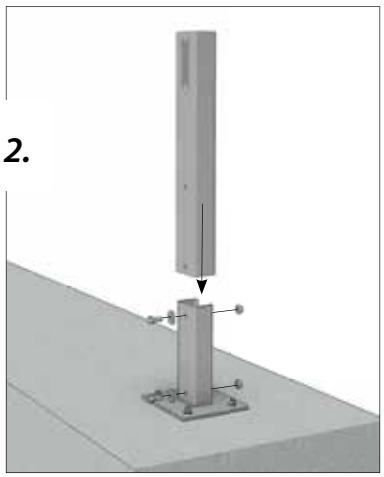
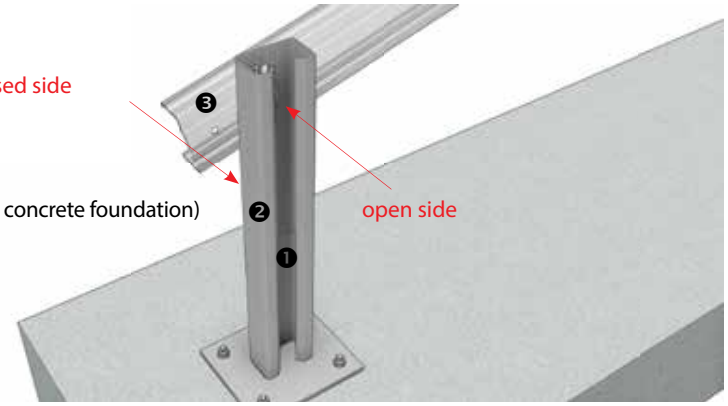


Fig. 5.2.-2. (fastening the foundation rail)

The foundation rail must be placed onto the base bracket in such a way that the open sides of the rails show in the same direction. The closed side of the rail must attach at the girder.



❶ Base bracket (connection to concrete foundation)
❷ Foundation rail (SRF)
❸ Girder assembly

Fig. 5.2.-3 (showing the assembled base bracket and foundation rail and indicating the position and alignment of the girder)

5.3. Mounting the girder assembly

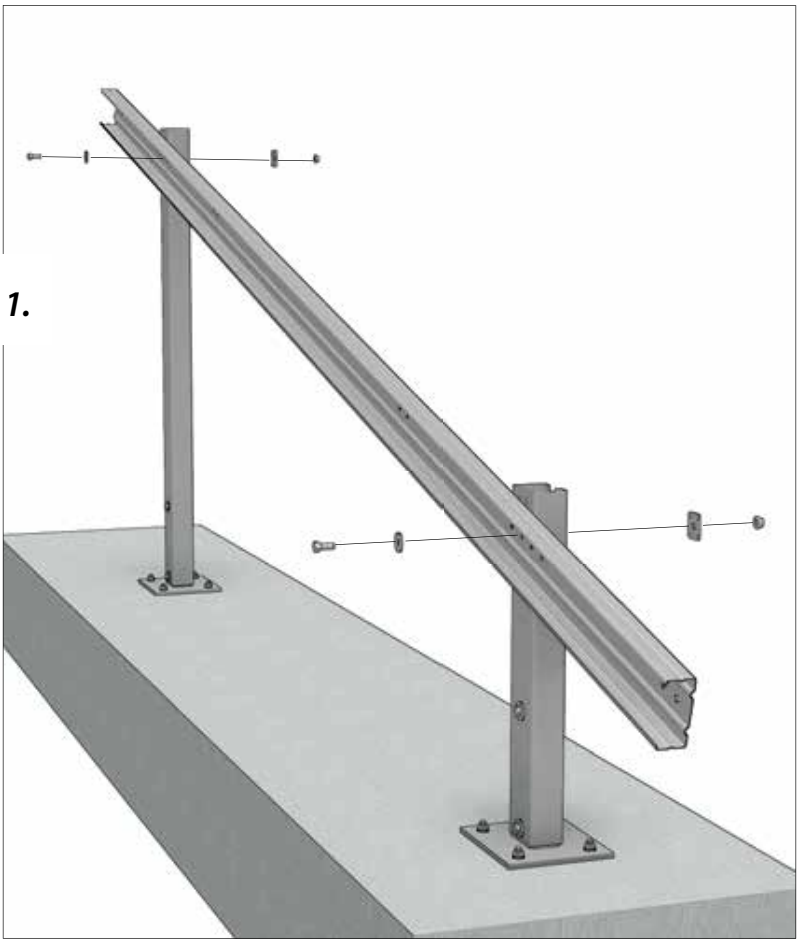
CAUTION

- *Wear adequate protective equipment, especially a hard hat, when mounting the girder assembly!*
- *Secure all parts that need to be fastened against slipping!*
- *Use appropriate auxiliary devices to handle heavy loads and ask your co-workers for help!*
- *Keep the work area clean to avoid falls!*
- *Never walk under suspended loads and secure objects and tools against falling down.*

Fasten the bolted connection by turning the bolt head! Do not turn the nut, just hold it!

1. Lift the girder assembly to the foundation rails. Please make sure that the closed side of the girder is placed at the (left side) of the foundation rails. Fasten at the top and at the base, using a hexagon head bolt M12x30 DIN933, a washer 12 DIN9021, a locking plate and a flange nut M12 DIN6923 for each joint.

1.



5.4. Mounting the module-bearing rail (purlin)

CAUTION

- *Wear adequate protective equipment, especially a hard hat, when mounting the module-bearing rails!*
- *Secure all parts that need to be fastened against slipping!*
- *Use appropriate auxiliary devices to handle heavy loads and ask your co-workers for help!*
- *Keep the work area clean to avoid falls!*
- *Never walk under suspended loads and secure objects and tools against falling down.*

NOTICE

Please note that the module-bearing rail must be mounted at a 90° angle to the girder assembly to safe-guard that the modules are correctly supported. In case of imprecise mounting, the modules could fall down in the worst case.

1. Swivel the module-bearing rail into the pre-assembled fastening plates on the girder assembly.

2. Hammer in the fastening device using a plastic tip hammer. Hold a hammer against the other side of the fastening plate for stabilization reasons.

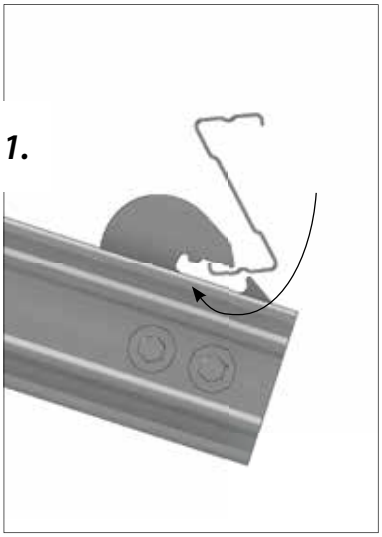


Fig. 5.4.-1 (swiveling in the purlin)

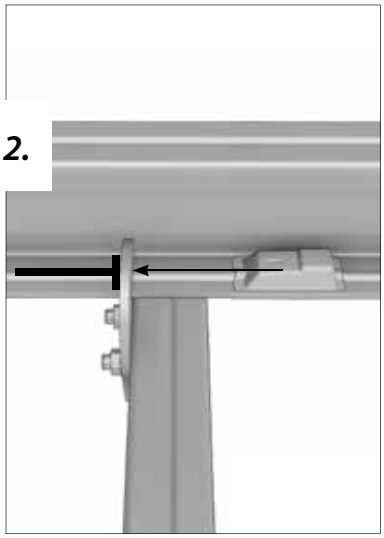


Fig. 5.4.-2 (hammering in the fastening device)

5.5. Mounting the purlin connectors (optional)

When mounting the purlin connectors, please use the designated drilled holes on the module-bearing rails!

1. Fasten each purlin connector with four hexagon head bolts M12x30 DIN933, washers DIN9021 and flange nuts M12 DIN6923 to the module-bearing rail.

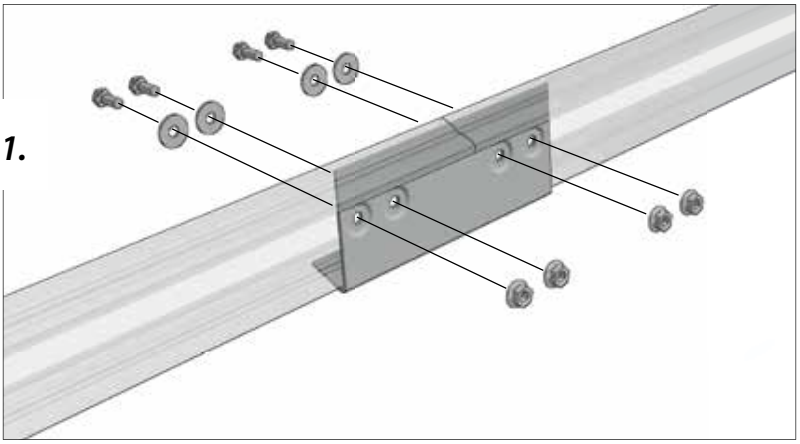


Fig. 5.5.-1 (mounting the purlin connector)

5.6. Mounting the module clamp adapter (optional)

The module clamp adapter must be used in the case of a horizontal bearing of the modules or when using a combined clamping. Moreover, the module clamp adapter is used when the modules are mounted vertically (in portrait), in combination with Rapid 2+ or Standard clamps.

The exact positions of the module clamp adapters can be referenced in the specifications provided in the ***technical general layout drawing****.*

PLEASE NOTE
Please ensure that no drilling chips are left in the module-bearing rails after screwing the self-drilling screws to avoid contact corrosion!
After positioning the module clamp adapter, please clean the module-bearing rail during the screwing process (e.g. with a cardboard).

1. Clip the module clamp adapter onto the Z-purlin at the indicated points.

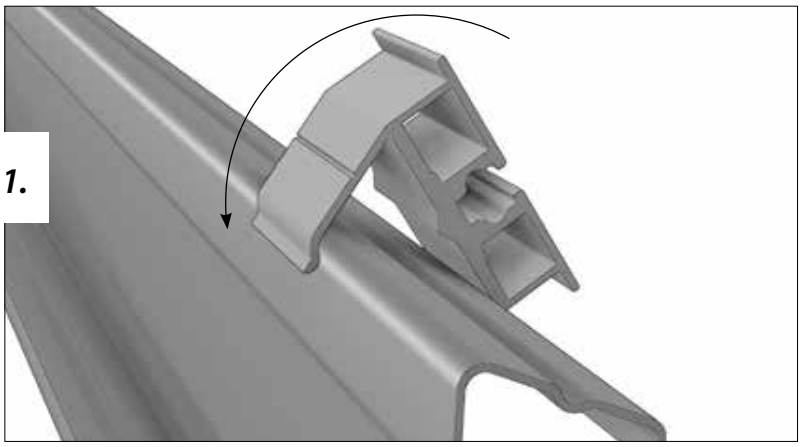


Fig. 5.6.-1 (snapping in the module clamp adapter)

2. Screw the module clamp adapter in the designated hollow space (notch) with a self-drilling screw to the module-bearing rail.

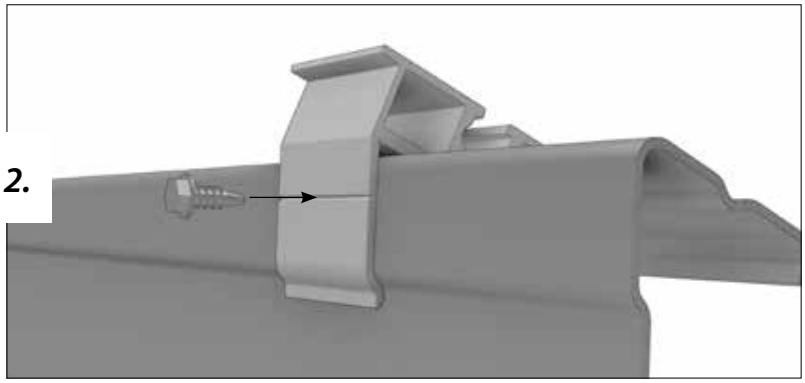


Fig. 5.6.-2 (fastening the module clamp adapter)

6. Module mounting and module clamping

Solar modules are third party components that are not included in the scope of delivery of the PvMax-S substructure. Schletter GmbH thus points out that the safety notices and mounting instructions of the module manufacturer are to be abided. And please also note the notices given in these Mounting Instructions when mounting the photovoltaic modules!

The following points must be taken into consideration at any event:

- *Photovoltaic modules are electrical devices. They must be treated carefully!*
- *Impacts, kicks, shocks or vibrations must be avoided.*
- *It is not allowed to put loads on the modules (trespassing, storing of items, etc.).*
- *Scratches or dirts on the module surface must be avoided.*
- *It is not allowed to pull or tear at the module cables. Do not heavily bend the module cables.*

The module clamping is carried out according to the project planning (portrait, landscape or combined module arrangement). The distance between modules can deviate from the standard value.
Standard value:

- clamped side ***23 mm***
- side without clamping ***5 - 10 mm***

(according to the specifications in the technical drawing; specifications by the module manufacturer are considered)

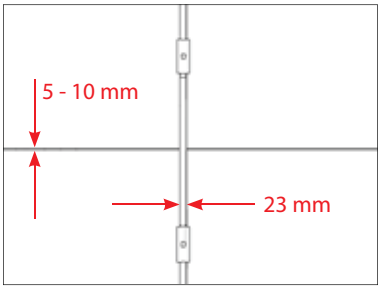


Fig. 6.-1 (distance between modules)

Clearance (= distance between module and module clamp) of

- ***min. 0.5 mm***
- ***max. 2 mm***

must be observed (module abuts on the spacer notches).

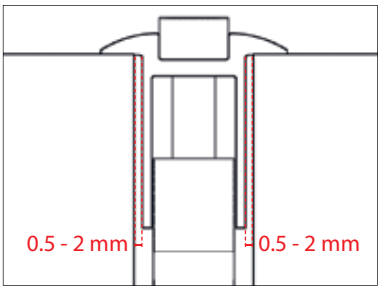


Fig. 6.-2 (clearance)

Observe the clamping points specified by the module manufacturer!
Please note the data sheet of the photovoltaic module provided by the manufacturer to verify the clamping points.

6.1. Module mounting and clamping in the case of vertical module bearing

The modules are fastened with special steel clamps in the case of vertical module arrangements:

1. Attach the module clamp on the rail of the Z-purlin.

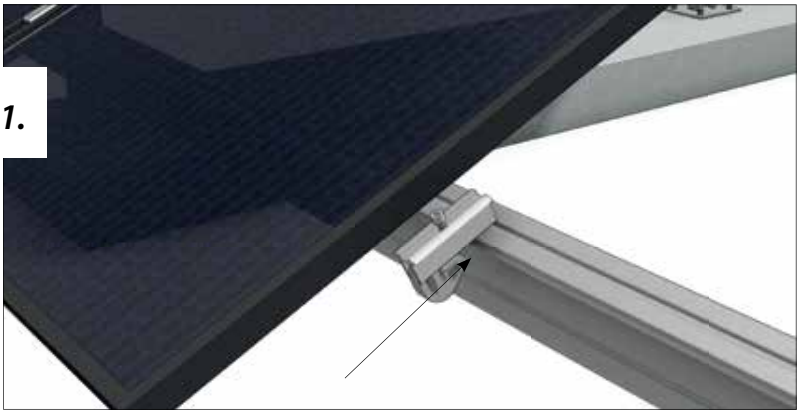


Fig. 6.1.-1 (attaching the module clamp)

2. Push the module to the clamp (observing the clearance!)

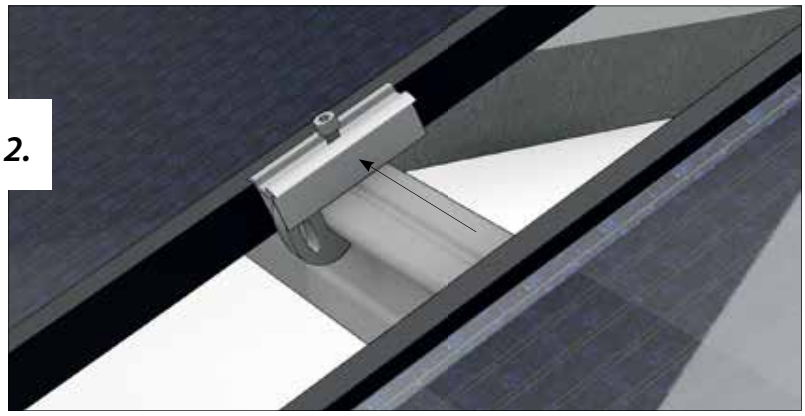


Fig. 6.1.-2. (pushing/sliding the module to the clamp)

3. Fasten hexagon socket screw with a torque of 8 Nm

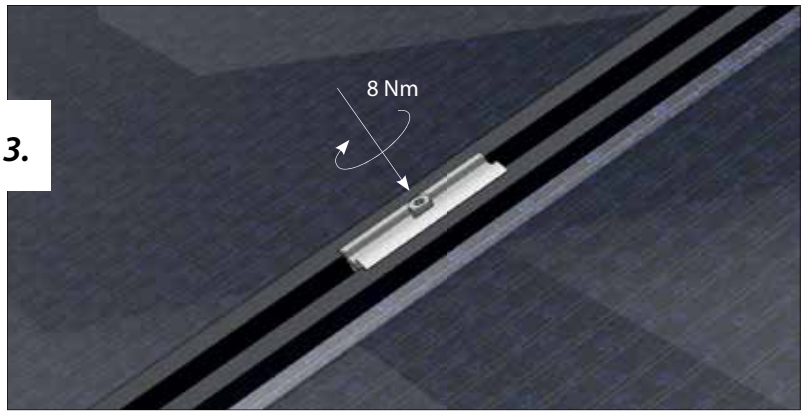


Fig. 6.1.-3. (fastening the hex socket screw)

6.2. Module mounting and clamping in the case of horizontal module bearing

The horizontal module clamping is carried out with a module clamp adapter in combination with Rapid 2+ clamps or Standard clamps:

1. Insert the module clamp into the notch of the module clamp adapter

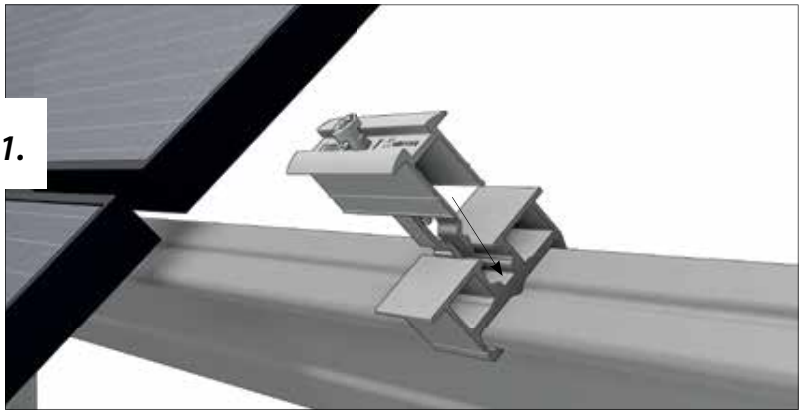


Fig. 6.2.-1 (clicking in the module clamp)

2. Push the module to the clamp (observing the clearance!)

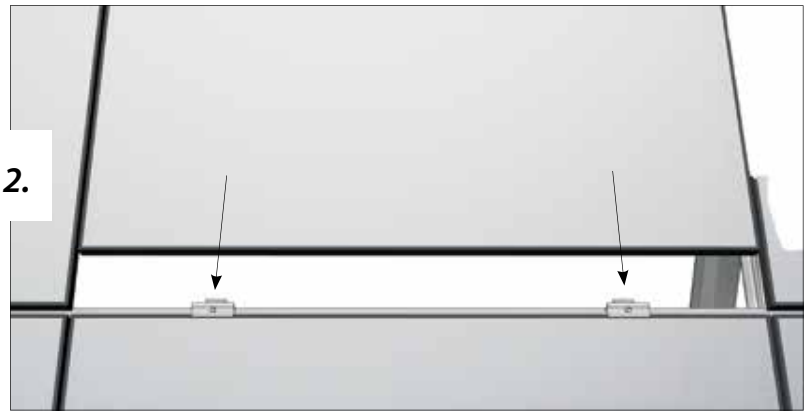


Fig. 6.2.-2. (pushing/sliding the module to the clamp)

3. Fasten hexagon socket screw with a torque of 14 Nm

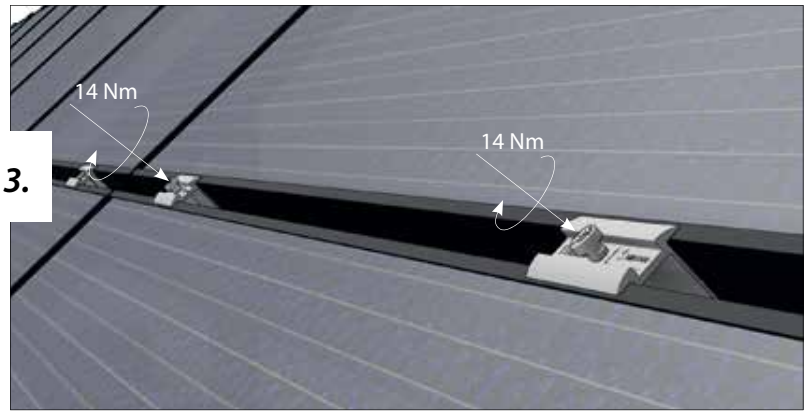


Fig. 6.2.-3. (fastening the hex socket screw)

6.3. Module mounting and clamping in case of combined module bearing

The combined module clamping is carried out with a module clamp adapter in combination with Rapid 2+ clamps or Standard clamps.

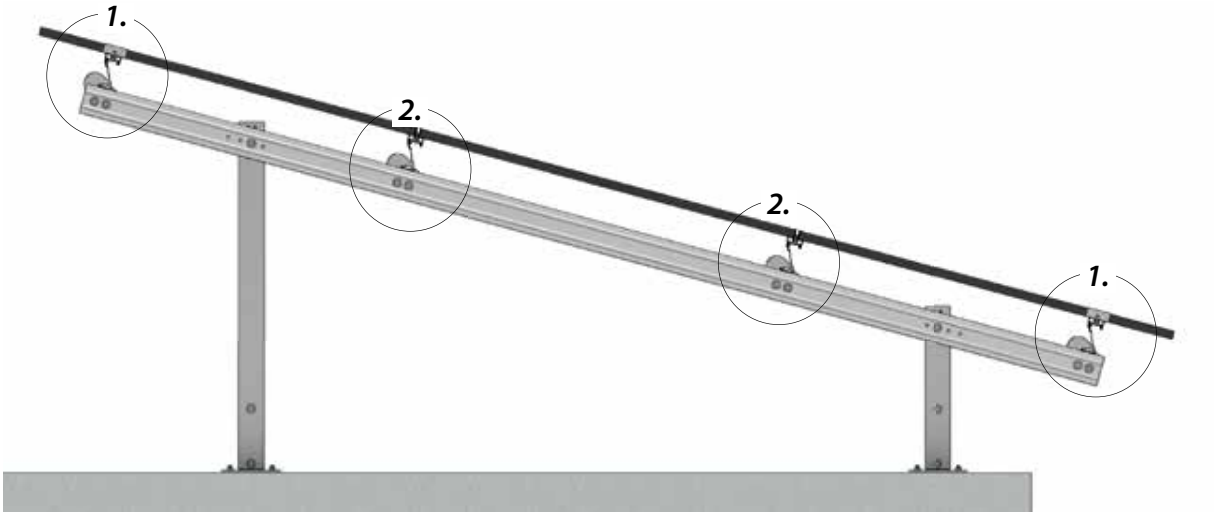


Fig. 6.3.-1 (combined module clamping)

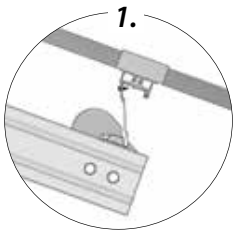


Fig. 6.3.-2.(upper and lower module clamping)

Clamping at the long side of the module to the upper and lower module-bearing rail.

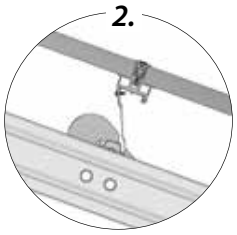


Fig. 6.3.-3 (module clamping at the inner side)

Clamping at the short module side to the inner module-bearing rails (comparable to clamping in the case of horizontal module arrangement).

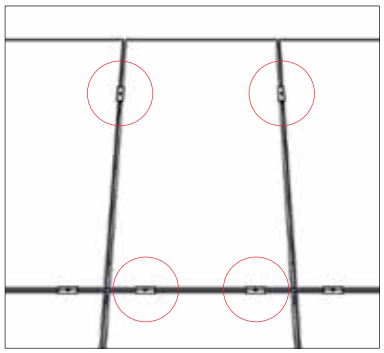


Fig. 6.3.-4 (clamping of the upper module)

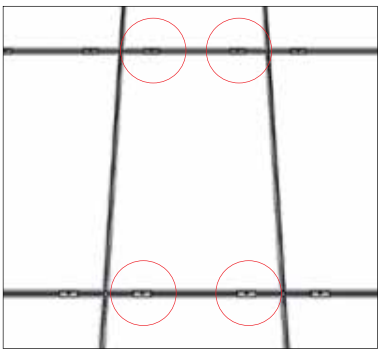


Fig. 6.3.-5 (clamping of the inner module)

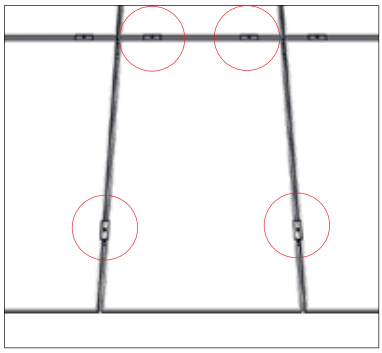


Fig. 6.3.-6 (clamping of the lower module)

7. Disassembly and disposal

DANGER

- *The plant operates with high voltage.*
- *Please abide by all instruction manuals and safety guidelines provided by the manufacturer of the modules or of electrical components before putting the plant out of operation.*
- *The plant may only be disconnected from the power supply provided on site by a certified electrical technician.*

WARNING

- *Always wear protective equipment (safety shoes, hard hat, safety glasses, protective gloves and high-visibility vest) when disassembling the PvMax-S components.*
- *And make sure that no unauthorized persons can enter the danger area.*
- *Do not step under suspended loads!*

- We recommend to wait for the confirmation by a certified electrical technician regarding the correct decommissioning of the plant before starting the disassembly of the PvMax-S system.
- Have an accordingly trained and certified professional disassemble the plant in transportable units.
- Observe all information and instructions provided in these Mounting Instructions.
- Also make these Mounting Instructions available to the personnel that is in charge of the disassembling operations.
- Ensure that the disassembling operations are performed exactly in reverse order of the mounting steps.

Faulty waste disposal can lead to environmental damage.
With regard to the environment it is recommended to dispose of recyclable materials in an appropriate manner.

Fig. 7.-1 (general recycling symbol)

Properly dispose of components

- Separate the materials steel, plastics, electric scrap, aluminium, stainless steel, copper, brass, etc.
- Dispose of the components in accordance with the local regulations

8. Maintenance and care

We recommend as follows:

INSPECTION OF THE PLANT
- *after exceptional weather conditions (storm, heavy snowfall or rain, etc.)*
- *after natural convulsions (earthquake, landslip, settlements, etc.)*

MAINTENANCE OF THE PLANT
- *Cleaning of the modules*
- *Verification of the bolted connections*
- *Check of the plant regarding corrosion*
- *Maintenance of the access roads and walkways*

CORRECTIVE MAINTENANCE OF THE PLANT
after detecting damages on the racks or earth movements (for example removing corrosion, replacement of faulty components, detection of unfastened bolted connections, etc.)

9. Warranty and liability

Generally, the customer is responsible for the proper mounting and installation of the PvMax-S system.

Exclusions
Guarantee, warranty and liability claims against the manufacturer Schletter GmbH in case of injury to persons or material damage shall be excluded if they result from one or several of the causes listed below:
- Non-observance of the Mounting Instructions and/or maintenance instructions in combination with a warranty extension
- Any use other than the intended use of the PvMax-S system or faulty operation
- Incorrect mounting, maintenance or repair
- Operation with spare or equipment parts that are faulty or have not been approved by the manufacturer
- Arbitrary constructional modifications or manipulation of the PvMax-S system or its equipment or components.
- Utilization of components made by other manufacturers (third party components)
- Neglect or non-observance of the prescribed maintenance and/or testing and inspection intervals

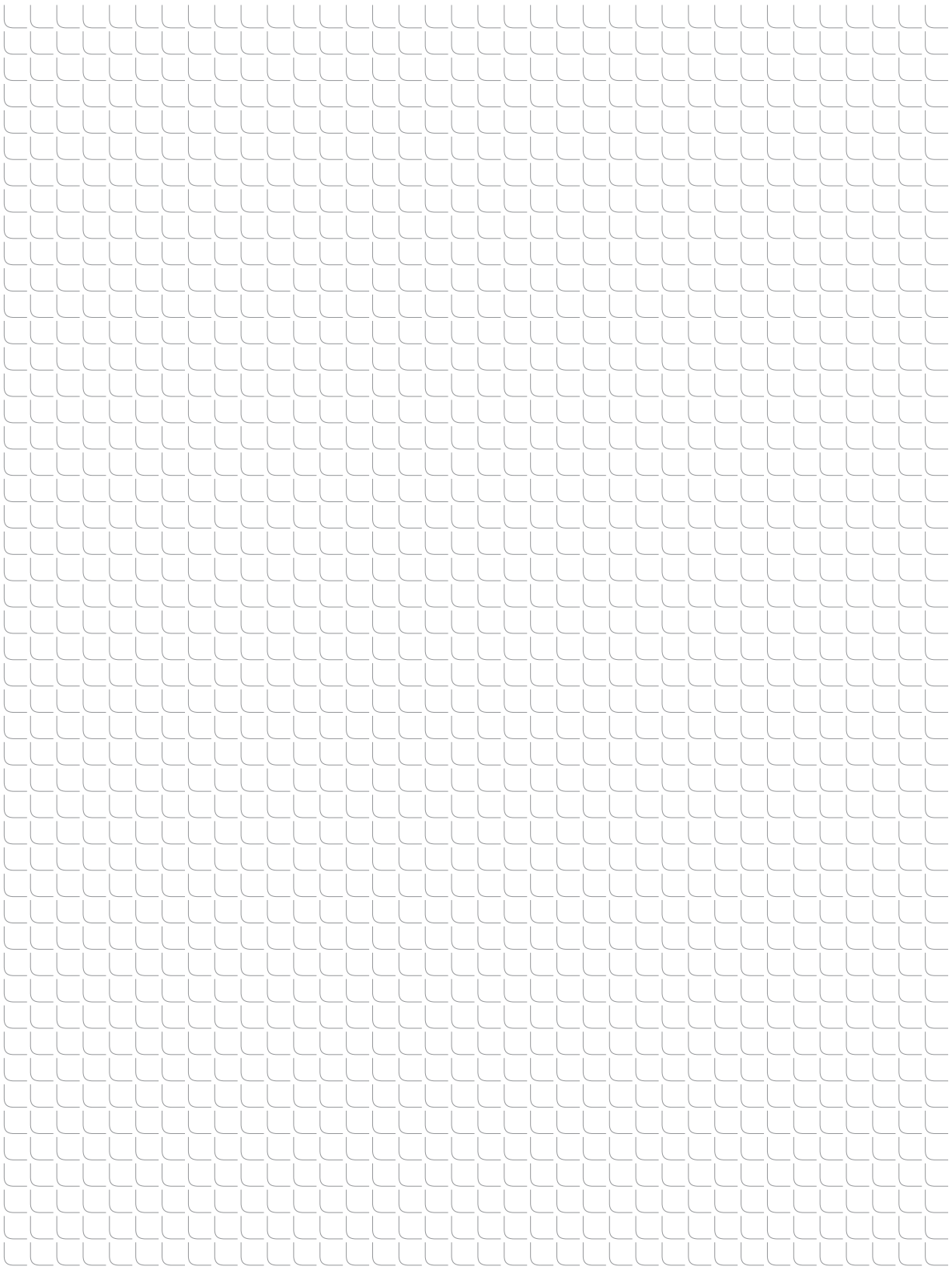
The customer exclusively shall bear the costs for damage or consequential damage that is due to one or several of the causes mentioned above.

The Mounting Instructions as well as the maintenance instructions in combination with a warranty extension refer exclusively to the mechanical metal structure supplied by Schletter GmbH.

Components of the solar plant like modules, cables and plug connectors, inverters or electric switch boxes are not part of these parts of the manual and thus are exempt from warranty and liability by Schletter GmbH.

Material damage to objects that are not included in the scope of delivery are generally excluded from any liability.

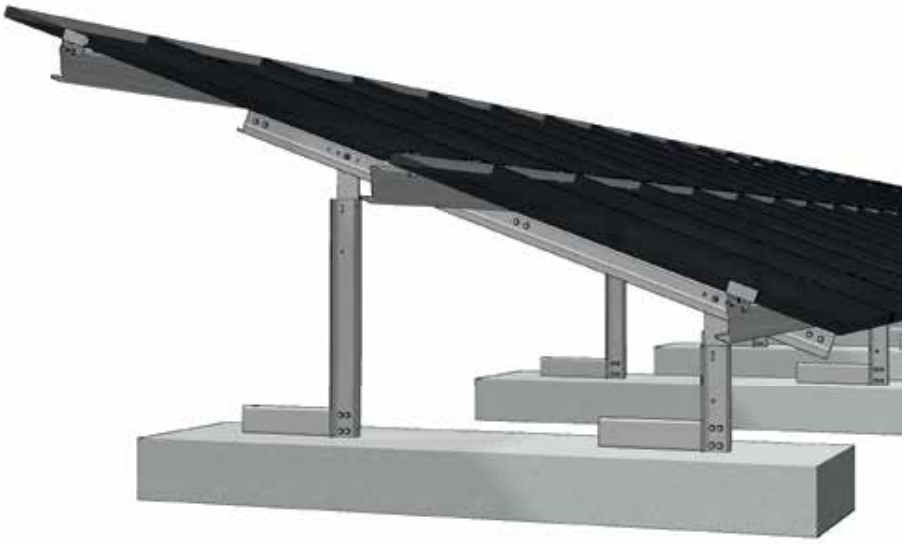
Notes



MOUNTING

PvMax-S

Mounting Instructions with FG Foundations



Schletter GmbH
Gewerbegebiet an der B15
Alustrasse 1
83527 Kirchdorf / Haag in OB
GERMANY

Tel.: +49 8072 9191 -0
E-mail: info@schletter.eu

Your contact:

Technical advice for ground-mounted solar plants
Tel.: +49 8072 9191 - 203
E-mail: tb-freiflaeche@schletter.de

SCHLETTER

Table of Contents

1. General Information

1.1. Short Description

PvMax-S is a modular unit assembly system for the installation of ground-mount substructures in high-quality and efficient steel design. As the individual components have been optimized and structurally synchronized, a minimum system price is achieved. The dimensioning is intended in such a manner that continuous module rows are created simply by stringing together individual units of standardized lengths. Due to the individual units, thermal tensions within the system are avoided. If the lengths of the rows are determined by the boundaries of the terrain, the rows are made out of as many equal units as possible, then completed by a unit shortened to obtain the required length.
It also possible to assemble additional accessories for the cable management or components for the internal potential equalization.

1.2. Intended Use

PvMax-S is a substructure for the mounting of photovoltaic modules. Any kind of different use that is not mentioned in these Mounting Instructions or an incorrect mounting (e.g. the utilization of components made by other producers or non-observance of tolerances specified here and/or exceeding the indicated loads) are considered as non-intended use and, thus, exclude any liability of the manufacturer.
The manufacturer accepts no liability for damage caused by failure to observe these Mounting Instructions.

1.3. Copyright and Intellectual Property Rights

The entire content of these Mounting Instructions is the intellectual property of Schletter GmbH and is subject to the German copyright law.
Any reproduction, editing, propagation, transfer to third parties - also in excerpts - and any kind of utilization beyond the limits of the copyright law must be approved in writing by Schletter GmbH.
Schletter GmbH reserves the right to take legal action in case of infringements.

These Mounting Instructions are subject to change without notice.

All names of products stated in these Mounting Instructions are trademarks of Schletter GmbH and are herewith recognized and acknowledged.
Schletter GmbH is not liable for any damage of a product or consequential damage caused by the product that are due to improper handling.
First and foremost, Schletter GmbH is not responsible or liable for failures and faults that are caused by modifications made by the customer or other persons.
There is no claim for availability of previous designs and for the ability to retrofit delivered components to the respective latest state of the series.

Schletter GmbH has made considerable efforts to make sure that these Mounting Instructions are free of errors and omissions.
Schletter GmbH does not assume any responsibility or liability for possible errors included in these Mounting Instructions and/or incidental, concrete or consequential damages arising from the publication of these Mounting Instructions.

1.4. Safety information

Please read these Mounting Instructions carefully before starting the assembly and keep it in a safe place for further reference. Please observe and abide by the regional and national applicable standards, building regulations and accident prevention regulations.

Read and make sure you understand the safety and warning notes in these Mounting Instructions and always apply them according to the relevant conditions and type of operation!

This instruction manual contains guidelines and notices you have to observe in order to ensure your personal safety and to prevent physical injuries or damage to property. Such safety and warning notes are marked with a warning triangle. Depending on the kind and degree of danger, **warning notices** are displayed as follows:

DANGER
*indicates that death or serious personal injury **will** result, if proper safety precautions are not taken.*

WARNING
*indicates that death or serious personal injury **can** result, if proper safety precautions are not taken.*

CAUTION
indicates that minor personal injury may result, if proper safety precautions are not taken.

DANGER
due to operations with electricity. Electric power can lead to serious accidents and can cause serious injuries. Appropriate safety precautions are to be taken by all means.

Securing the working area
Before the start of construction, the building site must be inspected by a supervising person by sight check or using plans showing all supply lines (water, electricity, gas) in the relevant area. For this purpose, the position of all supply lines (water, gas, electricity, etc.) must be marked using marking paint and unstable ground and areas that are landslide-prone must be sealed off with stable barriers or warning signs.

Important information and notices
regarding the product and its handling and/or mounting of the product are characterized by the following symbol.

NOTICE
warns about situations that can lead to material damage and disturbances during the operating procedure, if the instructions are not observed.

REFERENCES
All documents relevant for the mounting that are not included in these Mounting Instructions, are marked with this symbol.

We absolutely recommend to observe the following protective measures when mounting PvMax-S system:

Remember to wear high-visibility vests and safety shoes *all the time*

Always wear ear protection *when carrying out noisy work*

Always wear a hard hat *when there might be falling objects or if you could hurt your head in some other way*

Wear protective gloves *when working with sharp-edged components*

When carrying out dusty work, *always wear breathing protection*

Wear safety glasses *when carrying out grinding and abrasive cutting operations in order to avoid any danger to your eyes caused by flying liquids or parts (sparks, splinters)*

Apart from that, please consider the applicable rules and regulations on accident prevention and environmental protection that apply at the respective installation site as well as the work instructions and directives by the plant owner/operating company or at the place of operation.

1.5. Obligation of the Plant Owner / Operating Company

The plant owner ensures that all parts of these Mounting Instructions are readily available and handy at the plant.

The plant owner/operating company undertakes to only let people work at and in the striking distance of the plant who
- have read and understood the parts of the mounting instruction that are relevant for the respective operations,
- are familiar with the fundamental regulations on work safety, accident prevention and protection of the environment
- and have been instructed in the safe handling of the plant (training course).

Before starting any mounting works, the plant owner/operating company designates
- a supervising person and ensures that
- the construction site is inspected using plans showing all supply lines (water, electricity, gas) and thus
- the position of all underground supply lines and unstable ground without sufficient load-bearing capacities are marked properly or sealed off with barriers.

1.6. Commitment of the Personnel

Only people who give reason to expect that they will reliably do their job are allowed. Persons whose ability to react is affected, for example by drugs, alcohol or medication, are NOT allowed.
- Every person that is involved in the mounting of PvMax-S must have read and understood these Mounting Instructions, especially chapter "1.4. Safety Information", as well as all relevant chapters regarding the corresponding operations.
- These Mounting Instructions should always be kept available and easily accessible for all persons involved.
- Only trained and instructed qualified and certified personnel are allowed to execute the operations mentioned in this instruction manual.
- Personnel that still is to be trained may only mount the PvMax-S system under the supervision of an experienced person.

We recommend the operator to insist on a confirmation in writing in each case.

1.7. Training of the Personnel

These Mounting Instructions are addressed to certified personnel qualified in the areas of transportation and loading, mounting, disassembly and disposal, having the following qualifications:
- The certified professionals must be capable of fulfilling the tasks they have been assigned with and must be able to realize and avoid dangers on the basis of their professional formation, experience, expertise and their specific knowledge of the relevant regulations.
- The certified staff members must have the required knowledge of the guidelines regarding safety, accident prevention and environmental protection, as well as of loading and unloading regulations that apply at the respective construction site.
- The certified professionals have the driving licenses required at the specific construction site to be able to drive site vehicles and operate construction machines.

1.8. Additional Documents Relevant for the Mounting

In addition to these Mounting Instructions, the following documents are required for the mounting of PvMax-S:

- *Reinforcement plan (optional)*
- *Blueprint drawing / general layout drawing*
- *Bill of materials / parts list*
- *Delivery note*
- *DIS unloading guidelines for transport in maritime containers*
- *General Terms and Conditions of Sale and Supply of Schletter GmbH*

2. Transportation, Loading and Unloading

WARNING

- *Always wear protective equipment (safety shoes, hard hat, safety glasses, protective gloves and high-visibility vest) when unloading the components of the PvMax-S system.*
- *Besides also wear the personal protective equipment that is specified in your intra-company regulations for the respective activity.*
- *It is compulsory to monitor and supervise the complete unloading process.*
- *Do not step under suspended loads!*
- *Please make sure that there are no unauthorized persons in the danger area.*

Please observe all country-specific regulations and standards of the country of destination and its work instructions!

2.1. Delivery of the components

The delivery of the components for PvMax-S is carried out with an appropriate vehicle, for example

- truck/lorry or
- overseas container.

2.2. Preparing the delivery

- Provide a stable and drivable surface for the delivery.
- Please make sure that all access roads, manoeuvring and unloading areas are suitable for trucks (up to 40 tons) and can be used by forklift trucks and hoisting equipments.
- Ensure that loading/unloading and transport activities are carried out by trained and certified personnel only.

2.3. Provide forklift trucks and hoisting equipment

- Organize suitable forklift trucks and hoisting equipment to be available at the moment of delivery.
- Choose the suitable forklift trucks and hoisting equipment in cooperation with the site manager in charge.
- Make sure that the components, pallets and long items can properly be unloaded.
- Provide forklifts and hoisting equipment with different fork intervals or with adjustable forks.

2.4. Check the scope of delivery

The following shipping documents need to be verified on delivery:
- *Delivery note*
- *Packing lists*

We recommend to observe the following points when receiving the goods:
- Visual inspection of the delivered goods
- Check whether the supplied goods correspond to the delivery order
- Delivered quantity / comparison with packing lists and delivery note
- General condition of the goods
- Damages of the delivery
- Delivery documents

Claims as to defects by the customer shall require that he has complied with his duties of examination and notification of complaint contained in
Sections 377, 381 of the German Commercial Code [HGB]. Defects discovered during incoming goods inspection or later shall be notified to Schletter GmbH in writing without undue delay. A notification shall not be unduly delayed if it has been made within two weeks; the timely dispatch of this notification shall be deemed sufficient to meet the deadline. Regardless of the obligation to inspect and notify, the customer shall notify Schletter of obvious defects (including delivery of the wrong product or in not enough quantity) within two weeks of delivery in writing; the timely dispatch of this notification shall also be deemed sufficient in this case to meet the deadline. A general right to return purchased goods is not granted.

Extract from the General Terms and Conditions of Sale and Supply of Schletter GmbH - download available at www.schletter.de/AGB_en

2.5. Storage of the components

The components will also be delivered in cardboard boxes on pallets. And there also are fragile and sensitive items among those components.
- Unload the items on firm and stable ground only.
- Protect all components against rain, snow, moisture and other weather conditions.
- Store the items in dry and well-ventilated storage buildings or tents.
- Never store components outdoors or covered by a plastic sheet only.

If you adhere to the hints above, you can prevent the goods from being damaged already before mounting.

3. Technical data

3.1. System description and properties

System description	PvMax-S, steel ground mount system with concrete foundation
Material	• Foundation posts: Steel, hot-dip galvanized • Profiles / rails: Steel, hot-dip galvanized • Fastening elements and screws/bolts: Steel, hot-dip galvanized or high-grade steel (fastening device, bolts)
Construction	• Quick and easy installation • Highly efficient and material-saving rail geometries
Foundation	• Cast-in-place concrete provided by the customer on site according to our specifications • Pre-cast concrete foundations according to data taken from the system structural analysis
Delivery and services	• Delivery of single components as well as a maximum level of pre-assembly possible • Transport to the installation site in accordance with the mounting progress • Delivery of the complete mounting material • Structural analysis of the soil and calculation of the foundation including screw anchor (dowel) recommendation • Site-specific structural analysis based on local loading data • Optional: Rack mounting • Optional: Complete module assembly
Structural analysis	• Individual system structural analysis based on regional load values • Load assumptions according to DIN EN 1990 (Eurocode 0), DIN EN 1991 (Eurocode 1), DIN EN 1993 (Eurocode 3), DIN EN 1999 (Eurocode 9) and further resp. corresponding national standards • Structural verification of all construction components based on FEM calculation
Module types	• Framed modules with a frame thickness of up to 50 mm • Unframed modules on request

3.2. Rack tolerances

PvMax-S is always configured specifically for the wind and snow loads at the respective installation site. In the interest of economic efficiency, usually the maximum load-bearing capacity of the individual component is exploited. To achieve this, however, the racks must be mounted with the utmost precision. If there are significant deviations from the mounting plans, this can lead to structural overstress which in turn can lead to damage cases. Schletter GmbH will not assume any liability for such damages nor for any consequences thereof. Adherence to the specified tolerances is therefore essential to the structural safety of the rack.

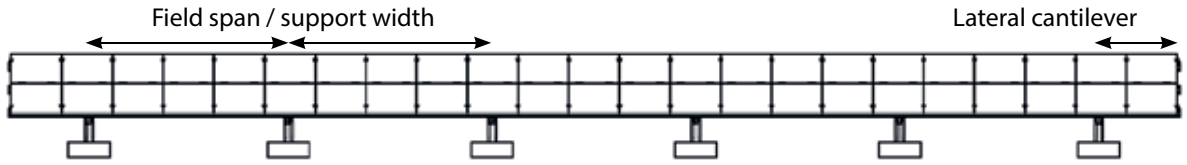


Fig. 3.2.-1 (field span / support width)

Support width	± 150 mm
Lateral cantilever of purlins	± 100 mm
Lower girder connection	± 100 mm
Upper girder connection	± 100 mm
Clearance between module and clamp	0.5 to 2 mm

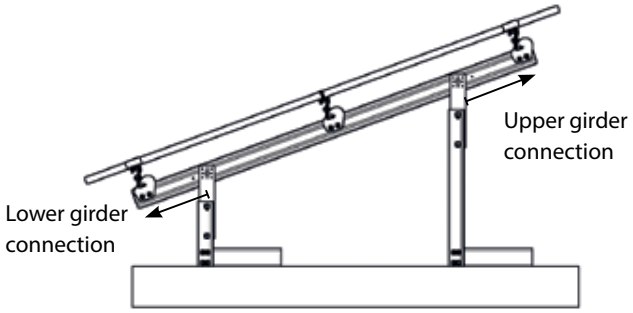


Fig. 3.2.-2 (girder connections)

3.3. Systems overview

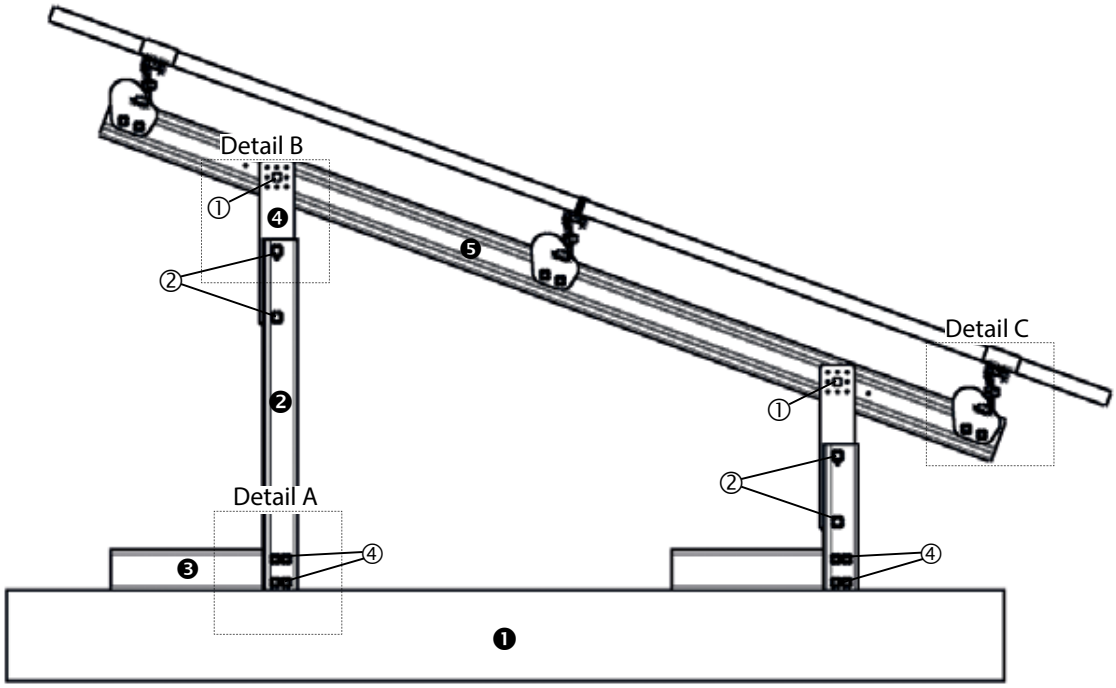


Fig. 3.3-1 (system visualisation)

Components

❶ Concrete foundation
❷ FG foundation
❸ Connection to the concrete foundation
❹ Steel head
❺ Girder
❻ Fastening plate
❼ Module-bearing rail (purlin)
❽ Module clamp adapter kit

Connection elements / fasteners

① Hexagon bolt M12x30 DIN933, flange nut M12 DIN6923 and washer 12 DIN9021
② Hexagon head bolt M10x30 DIN933, flange nut M10 DIN6923, washer 10 DIN125
③ Fastening device
④ Hexagon bolt M12x90 DIN933, flange nut M12 DIN6923, washer 12 DIN9021

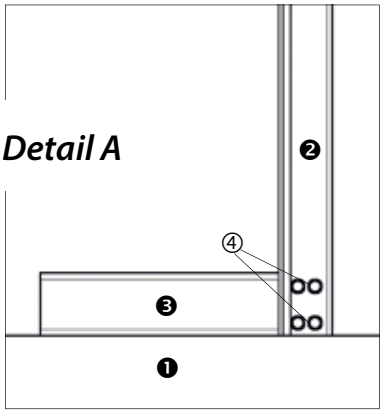


Fig. 3.3.-2. (detail A)

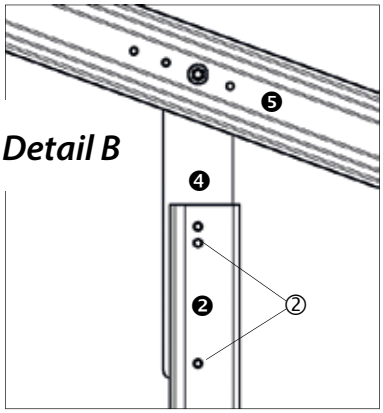


Fig. 3.3.-3. (detail B)

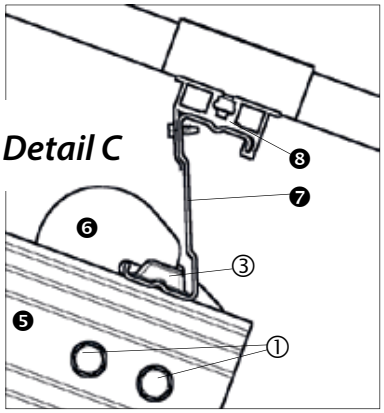


Fig. 3.3.-4. (detail C)

3.4. Components

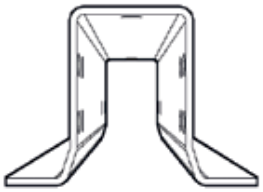


Fig. 3.4.1.-1 (148000-006)

Fig. 3.4.1.-2 (000010-203)

3.4.1. PvMax foundation and components

143006-005	PvMax-S foundation FG6
143007-010	PvMax-S foundation FG7
149019-000	Concrete connection FG6
000010-203	PvMax-S steel head
943610-030	Hexagon head bolt M10x30 DIN933 A2 GMC
943912-010	Flange nut M10 serrated DIN6923 A4
943921-010	Washer 10 A2 ISO 7089
943612-090	Hexagon head bolt M12x90 DIN933 A2 GMC
943912-012	Flange nut M12 serrated DIN6923 A4
943922-012	Large washer M12 DIN9021 A2

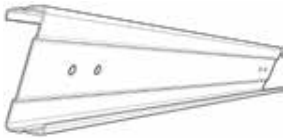


Fig. 3.4.2.-1 (144901-001)

Fig. 3.4.2.-2 (144999-003)

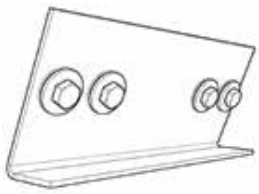


Fig. 3.4.2.-3 (144999-008)

3.4.2. Module-bearing rails and connection elements

144901-001	FS Uno / Duo purlin
144999-003	FS Uno / Duo fastening device
144999-008	FS Uno / Duo purlin connector Gen2 kit

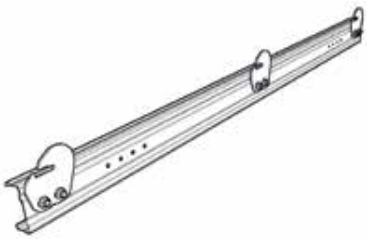


Fig. 3.4.3.-1 (144302-200)

Fig. 3.4.3.-2 (144999-006)

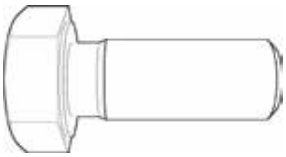


Fig. 3.4.3.-3 (943612-030)

Fig. 3.4.3.-4 (943912-012)

Fig. 3.4.3.-5 (943922-012)

3.4.3. Girder assemblies and components

144301-000	FS Duo girder assembly 1V custom cut
144302-200	FS Duo girder assembly 2V custom cut
144303-200	FS Duo girder assembly 3V custom cut
144304-200	FS Duo girder assembly 4V custom cut
144305-200	FS Duo girder assembly 5V custom cut
144306-200	FS Duo girder assembly 6V custom cut
144307-200	FS Duo girder assembly 7V custom cut
144308-200	FS Duo girder assembly 8V custom cut
144301-000	FS Duo girder assembly 1H custom cut
144302-100	FS Duo girder assembly 2H custom cut
144303-100	FS Duo girder assembly 3H custom cut
144304-100	FS Duo girder assembly 4H custom cut
144305-100	FS Duo girder assembly 5H custom cut
144306-100	FS Duo girder assembly 6H custom cut
144307-100	FS Duo girder assembly 7H custom cut
144308-100	FS Duo girder assembly 8H custom cut
144999-006	FS Uno / Duo fastening plate galvanized
943612-030	Hexagon head bolt M12x30 DIN933 A2 GMB
943912-012	Flange nut M12 serrated DIN6923 A4
943922-012	Large washer M12 DIN9021 A2

3.4.4. Module clamps for vertical module mounting

	Steel clamp			Rapid clamp*		Standard clamp*	
Module height	***End clamp left***	***Middle clamp***	***End clamp right***	***End clamp***	***Middle clamp***	***End clamp***	***Middle clamp***
20 mm	---	---	---	---	---	130001-020	130002-000
24 mm	---	---	---	---	---	130001-024	130002-000
28 mm	---	---	---	---	---	130001-028	130002-000
30 mm	144912-030	144910-001	144911-030	131001-030	131002-000	130001-030	130002-000
31 mm	144912-031	144910-001	144911-031	131001-031	131002-000	130001-031	130002-001
32 mm	144912-032	144910-001	144911-032	131001-032	131002-000	130001-032	130002-001
33 mm	144912-033	144910-002	144911-033	131001-033	131002-000	---	---
34 mm	144912-034	144910-002	144911-034	131001-034	131002-000	130001-034	130002-001
35 mm	144912-035	144910-002	144911-035	131001-035	131002-000	130001-035	130002-001
36 mm	144912-036	144910-002	144911-036	131001-036	131002-000	130001-036	130002-001
37 mm	144912-037	144910-002	144911-037	131001-037	131002-000	---	---
38 mm	144912-038	144910-003	144911-038	131001-038	131002-000	130001-038	130002-001
39 mm	144912-039	144910-003	144911-039	131001-039	131002-000	---	---
40 mm	144912-040	144910-003	144911-040	131001-040	131002-001	300001-040	130002-001
41 mm	144912-041	144910-003	144911-041	131001-041	131002-001	130001-041	130002-001
42 mm	144912-042	144910-003	144911-042	131001-042	131002-001	130001-042	130002-001
43 mm	144912-043	144910-004	144911-043	131001-043	131002-001	130001-043	130002-001
44 mm	144912-044	144910-004	144911-044	131001-044	131002-001	130001-044	130002-001
45 mm	144912-045	144910-004	144911-045	131004-045	131002-001	130001-045	130002-001
46 mm	144912-046	144910-004	144911-046	131001-046	131002-001	130001-046	130002-001
47 mm	144912-047	144910-004	144911-047	131001-047	131002-001	---	---
48 mm	144912-048	144910-005	144911-048	131001-048	131002-001	130001-048	130002-001
49 mm	144913-049	144910-005	144913-049	131001-049	131002-001	---	---
50 mm	144913-050	144910-005	144913-050	131001-050	131002-001	130001-050	130002-001
51 mm	---	---	---	---	---	130001-051	130002-001

* in combination with module clamp adapter

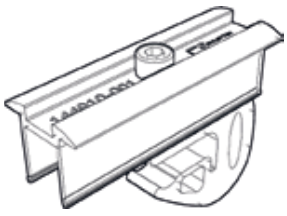


Fig. 3.4.4.-1 (144912-030)

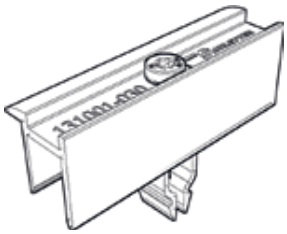


Fig. 3.4.4.-2 (131001-030)

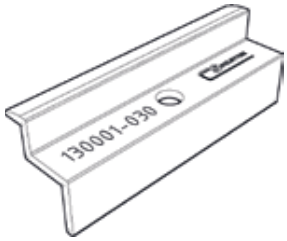


Fig. 3.4.4.-3 (130001-030)

3.4.5. Module clamps for horizontal module mounting

	Rapid clamp*		Standard clamp*	
Module height	***End clamp***	***Middle clamp***	***End clamp***	***Middle clamp***
20 mm	---	---	130001-020	130002-000
24 mm	---	---	130001-024	130002-000
28 mm	---	---	130001-028	130002-000
30 mm	131001-030	131002-000	130001-030	130002-000
31 mm	131001-031	131002-000	130001-031	130002-001
32 mm	131001-032	131002-000	130001-032	130002-001
33 mm	131001-033	131002-000	---	---
34 mm	131001-034	131002-000	130001-034	130002-001
35 mm	131001-035	131002-000	130001-035	130002-001
36 mm	131001-036	131002-000	130001-036	130002-001
37 mm	131001-037	131002-000	---	---
38 mm	131001-038	131002-000	130001-038	130002-001
39 mm	131001-039	131002-000	---	---
40 mm	131001-040	131002-001	300001-040	130002-001
41 mm	131001-041	131002-001	130001-041	130002-001
42 mm	131001-042	131002-001	130001-042	130002-001
43 mm	131001-043	131002-001	130001-043	130002-001
44 mm	131001-044	131002-001	130001-044	130002-001
45 mm	131004-045	131002-001	130001-045	130002-001
46 mm	131001-046	131002-001	130001-046	130002-001
47 mm	131001-047	131002-001	---	---
48 mm	131001-048	131002-001	130001-048	130002-001
49 mm	131001-049	131002-001	---	---
50 mm	131001-050	131002-001	130001-050	130002-001
51 mm	---	---	130001-051	130002-001

* in combination with module clamp adapter

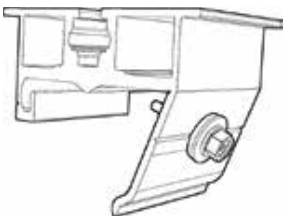


Fig. 3.4.6.-1 (144919-050)

3.4.6. Module clamp adapter and connection elements for module clamps

144919-050	FS Steel Module clamp adapter KIT
129010-008	KlickIn click component for nut M8
943914-008	Square nut M8 DIN557 A4

The nuts and bolts of the Standard clamps are not included in the scope of delivery and must be ordered separately.

With big order quantities, clamps for other module thicknesses can be manufactured on request!

The Standard clamps are not pre-assembled when they are delivered. These clamps are combined with a hexagon socket head bolt, a KlickIn click component and a square nut. The screws/bolts listed below can be used for that purpose:

3.4.7. Screws/bolts for Standard module clamps

	Frame height in mm	*Hexagon socket bolt in mm*	*Name*
943308-125	20	>25	Hexagon socket bolt M8x25 serrated DIN912 A3
943308-130	24	30	Hexagon socket bolt M8x30 serrated DIN912 A3
943308-135	28 - 30	35	Hexagon socket bolt M8x35 serrated DIN912 A3
943308-120	31 - 35	20	Hexagon socket bolt M8x20 serrated DIN912 A3
943308-125	36 - 40	25	Hexagon socket bolt M8x25 serrated DIN912 A3
943308-130	41 - 45	30	Hexagon socket bolt M8x30 serrated DIN912 A3
943308-135	46 - 51	35	Hexagon socket bolt M8x35 serrated DIN912 A3

Fig. 3.4.8.-1 (144999-009)

3.4.8. Auxiliary equipment / accessories

964000-176	Paint zinc dust silver gray satin-gloss
149023-001	Cable fastening retainer 1.0-3.0mm, guidance at the top
149023-002	Cable fastening retainer 1.0-3.0mm, guidance at the side
149023-003	Cable fastening retainer 3.0 - 6.0 mm
144999-009	FS Uno / Duo cable fastener purlin
144999-010	Empty cable conduit

Fig. 3.4.8.-2 (149023-003)

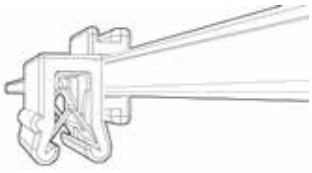


Fig. 3.4.8.-3 (149023-002)

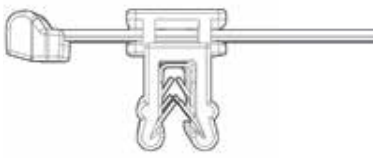


Fig. 3.4.8.-4 (149023-001)

4. Mounting information

The PvMax-S system is customized for the respective installation site. The following indications are already needed during the planning process:

- Site boundaries
- Rights of way / easements (the building site must be accessible for vehicles at any time)
- Obstacles in the subsoil (pipes, subterranean cables, etc.)
- Weather conditions (wind, rain, snow, etc.)
- Conditions that may influence the building ground (seismic activities, erosion risks, etc.)
- Geotechnical reports about the topology of the site and the composition of the soil

When mounting the ground-mount system, we recommend:

- Keeping a clearly laid out and detailed daily construction report (site journal), where all daily work steps, employment of personnel and assembled components are exactly specified.
- Accurately checking and comparing the delivery notes with the delivered goods on the site.

4.1. Terrain

When planning the ground-mounted system, make sure that the ground slope is within the tolerances. In the following, the guiding values for a structurally safe solar plant are specified.

Maximum admissible ground slope
East-West: **10°**

Regarding the structural calculations, additional measures may be required (for example reinforcements)

Maximum admissible ground slope
North-South: **10°**

(depending on the condition of the slope, soil composition, rocks, etc.)

Installations on steeper slopes are only possible if special measures such as anchoring or excavations of the terrain are taken!

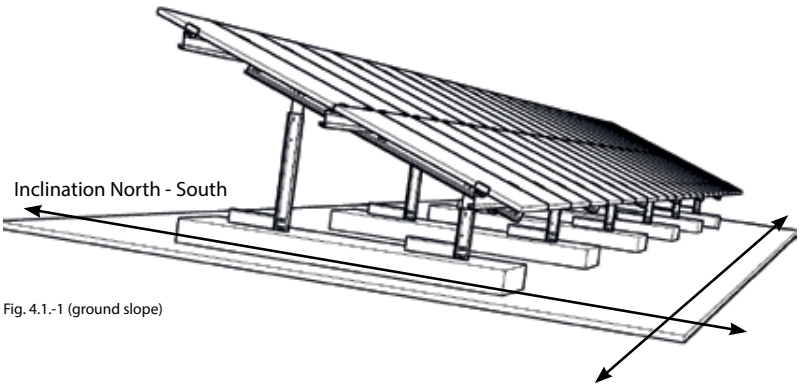


Fig. 4.1.-1 (ground slope)

4.2. Foundation

PvMax-S can basically be combined with all kinds of concrete foundations!
Ground-mounted solar plants are often built on re-vegetated landfill sites or agricultural terrains of low quality with bad subsoil conditions. In such cases a foundation using posts at frost penetration depth mostly is not possible or not reasonable. Thus, a foundation on concrete blocks made of pre-cast concrete or cast-in-place concrete is recommended as a standard option. This kind of foundation is virtually always possible and easy to carry out.

Other types of foundation on request!

Whether or not the subsoil is suitable for a certain type of foundation generally has to be determined on site in each case.

4.2.1. Pre-cast strip foundations

As a standard, strip foundations are put under the supports (continuous strips parallel to the module rows are also possible). The weight of the foundations has to be dimensioned in such a manner that the wind loads are compensated by the foundation weight only.

4.2.2. Dimensioning and reinforcement

The dimensioning of the foundations is carried out according to the structural analysis (by all means do specify the load parameters - especially the wind loads!) The foundations have to be reinforced by the concrete builder according to the loads that have to be considered.

4.2.3. Preparation of the terrain and positioning of the foundations

Before setting up the PvMax-S system, the terrain must be prepared for the positioning of the concrete foundations. Please consider that individual sub-racks that are part of one rack are not parallel to the subsoil beneath them. Thus, the foundations have to aligned correctly. This alignment must be maintained for all the racks in order to avoid "terracing" that would lead to shades on individual racks.

WARNING

- *Only use construction machines and site vehicles that comply with local safety requirements and which ensure protection of health and safety when used as intended.*
- *Secure the work area by taking appropriate measures and make sure that there are no unauthorized persons in the work area of the construction machines.*
- *See to it that persons who are performing earthworks are protected by personal protective equipment (PPE), such as high-visibility vest, safety shoes and hard hat).*

NOTICE

If the terrain structure is too uneven, soil has to be removed and the terrain has to be graded, if necessary.

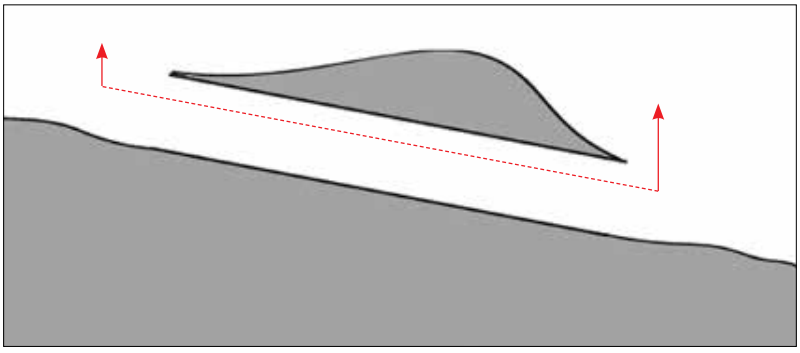


Fig. 4.2.3.-1 (removing soil and grading the terrain structure)

NOTICE
The concrete foundations must be aligned flush on a gravel bed. The rack can only be installed properly, if all foundations are correctly aligned and at the same level.
Maximum height tolerance within the foundations: ± 30 mm.

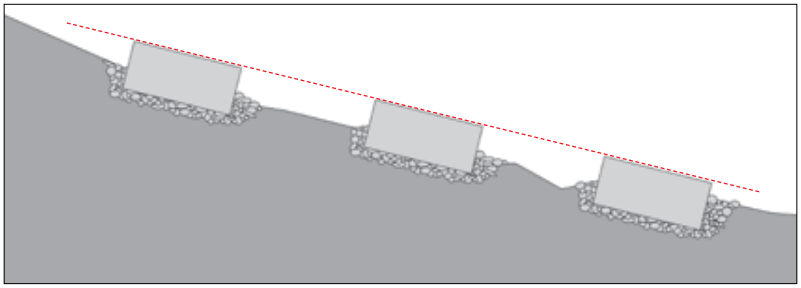


Fig. 4.2.3.-2 (flush alignment of the concrete foundations)

NOTICE
Also when using a cast-in-place foundation, make sure that the foundations are cast up to the same height.

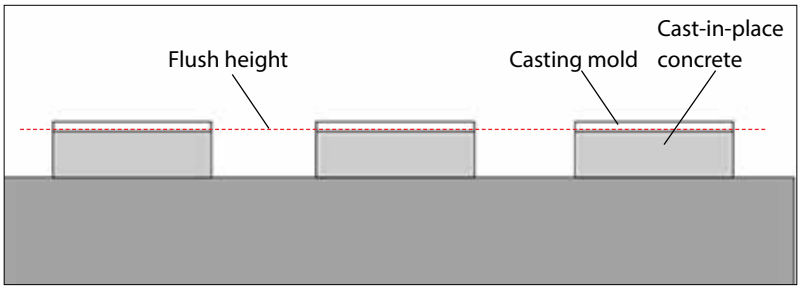


Fig. 4.2.3.-3 (casting up the concrete foundations to the same height)

4.2.4. Tolerances regarding inclination and distortion (twist)

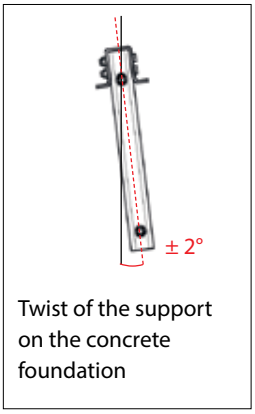


Fig. 4.2.4.-1 (twist / distortion)

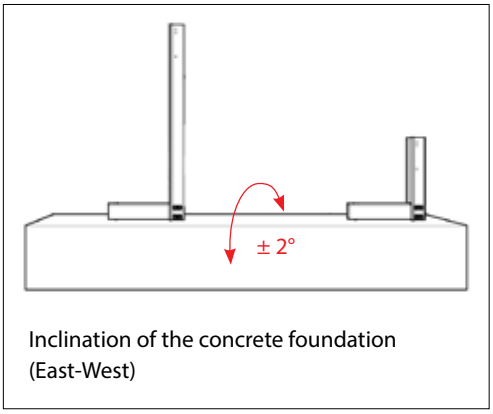


Fig. 4.2.4.-2 (east-west tilt of the concrete foundation)

4.3. Tools

In the following, the tools that are usually required for mounting the PvMax-S system are listed. Additional tools that are required for special cases (for example encasing the foundations in concrete) are not listed here.

NOTICE
For the assembly of the PvMax-S system, please exclusively use the tools recommended.
If you use tools that are not intended for this purpose, the rack can be damaged and the structural safety of the plant could thus be endangered!
The selected fasteners (e.g. screw anchors/dowels) must be appropriate for the fastening forces that are specified in the structural analysis! The customer has to add an accordant structural verification to the documents.

We recommend using torque wrenches for all bolted connections. With fast rotary motions, there is an increased danger of "jamming / bolt blocking"!

The fasteners (e.g. dowels/screw anchors) are not included in the scope of delivery!

4.3.1. Surveying, staking and aligning the foundations

- Measuring tapes (100 m)
- Line pins (about 20 pieces)
- Mason's lacing cord
- Club hammer
- Wooden stakes
- Color spray (for ground marking etc.)
- Permanent marker
- Spirit level
- Shovel
- Chains / straps to lift the foundations

4.3.2. Rack mounting

- Torque wrench (30 Nm to 60 Nm)
- Wrench socket size 17
- Wrench socket size 19
- Hammer
- Club hammer (to hold against the connector hook)
- Plastic tip hammer
- Angle meter (goniometer) - spirit level
- Mason's lacing cord
- Cordless screw driver
- Drill hammer with drill
- Air pump for blowing out the drill holes

4.3.4. Module mounting

- Mason's lacing cord
- Measuring tape
- Possibly distance template for distances between the modules
- Cordless screw driver
- Size 8 socket for cordless screwdriver
- Size 6 hexagon socket wrench / 40TX key
- Torque wrench (< 8 Nm)
- Size 6 hexagon socket wrench / 40TX bit for torque wrench

4.4. Torque specifications

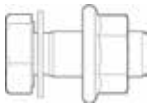


Fig. 4.4.1.-1 (screw connection M12)

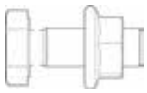


Fig. 4.4.1.-2 (screw connection M10)

Fig. 4.4.1.-3 (screw connection M12)

4.4.1. Bolted connections in the substructure	
Name	***Tightening torque (MA-Nm)***
Hexagon head bolt DIN933 M12x30 A2 GMC Flange nut DIN6923 M12 A4 Washer, large DIN9021 M12 A2	**56 Nm**
Hexagon head bolt DIN933 M10x30 A2 GMC Flange nut M10 serrated DIN6923 A4 Washer 10 A2 ISO 7089	**33 Nm**
Hexagon head bolt DIN933 M12x90 A2 GMC Flange nut M12 serrated DIN6923 A4 Large washer DIN9021 M12 A2	**56 Nm**

Fig. 4.4.2.-1 (Standard module clamp)

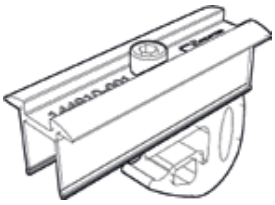


Fig. 4.4.2.-2 (steel module clamp)

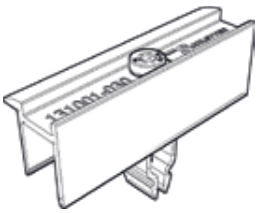


Fig. 4.4.2.-3 (Rapid^{2+} module clamp)

4.4.2. Fastening of the module clamps

Name	*Tightening torque (MA-Nm)*	*Module arrangement*
Hexagon socket bolt DIN4762 M8 (20 - 35 mm) KlickIn click component for nut M8 Square nut DIN557 M8 A4	**14 Nm**	H and V in combination with module clamp adapter
Hexagon socket bolt DIN912 M8 A2 (25 - 45 mm)	**8 Nm**	V
TX stud screw M8 A2 GMC (42.5 - 55 mm)	**14 Nm**	H and V in combination with module clamp adapter

Always fasten the bolted connection by turning the bolt head! When checking the pre-stress of the bolts, it has to be considered that constraints and frictional forces can lead to a loss of clamping force. This was taken into consideration when the tightening torques were determined. When a bolted connection is checked, it must not loosen when 50% of the specified tightening torque is applied.

5. Assembly steps

5.1. Pre-drilling the concrete foundation and inserting the dowels/screw anchors

CAUTION when handling drilling equipment

- *Always wear appropriate protective equipment (PPE), above all respiratory protection, ear protection and safety glasses, when performing drilling operations.*
- *Do not wear clothes that could get caught in the drill chuck and abide by all further safety guidelines provided by the manufacturer as to handling the drilling equipment.*
- *In case of special ambient conditions, appropriate additional measures must be taken, or the operations must be stopped. Such special ambient conditions are, for example, moisture or conductive dust. And additional measures are, for example, weather protection, coverings and protective hood or cap.*

CAUTION when handling concrete

- *Irritant - Avoid contact with skin and eyes! Wear adequate protective equipment (PPE), such as protective gloves and eye and face protection.*
- *In case of spray applications, a suitable respirator mask (half mask respirator) is to be used!*
- *Please observe all further hazard notes and safety precautions given by the manufacturer!*

WARNING when handling precast foundations

- *Use appropriate auxiliary devices to move heavy loads.*
- *Never walk under suspended loads and do not stay in the turning radius of the lifting vehicle!*
- *Ensure that the loads are properly and professionally fastened to guarantee a safe transport.*
- *Only move the lifting vehicle on sufficiently compacted terrain and in adequate distance from overhead power lines or other obstacles.*

NOTICE

The selected fasteners (for example screw anchors/dowels) must be appropriate for the fastening forces that are specified in the structural analysis! For this purpose, a corresponding data sheet has to be added to the documents.

Please note that the required fasteners are not included in the scope of delivery!

1. Please refer to the rack drawing to determine the positions of the base brackets and measure the concrete foundations as indicated there. Then drill the holes on the concrete foundations.

2. Anchor the dowels / screw anchors in the foundation as specified in the manufacturer information.

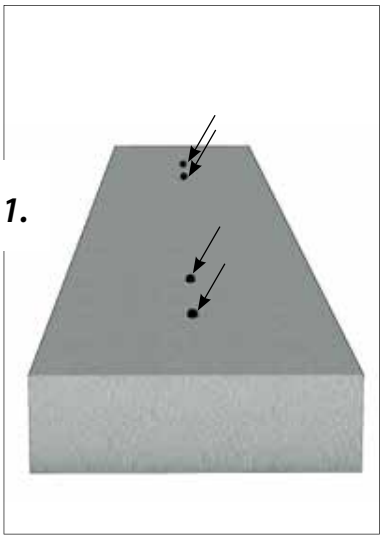


Fig. 5.1.-1 (drilled holes on the concrete foundation)

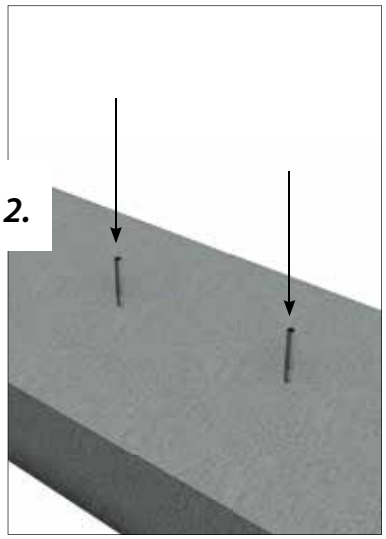


Fig. 5.1.-2 (inserting the dowels/screw anchors)

The exact positions of the base brackets on the concrete foundations can be referenced in the specifications provided in the corresponding ***technical general layout drawing****.*

5.2. Fastening the base bracket and foundation rail

1. Fasten the base bracket at the inserted fasteners

Fig. 5.2.-1. (fastening the base bracket)

2. Bolt the foundation rail to the base bracket using four hexagon head bolts M12x90 DIN931, four washers 12 DIN 125 and four flange nuts M12 DIN6923

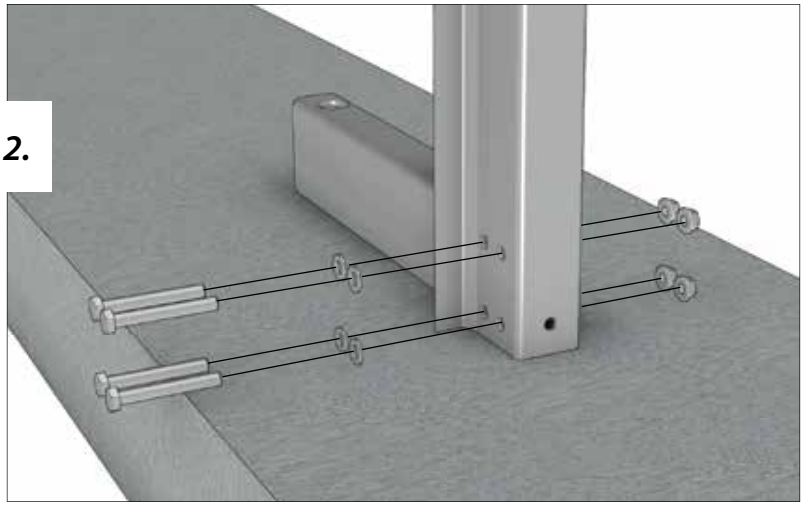


Fig. 5.2.-2. (fastening the foundation rail)

Mount the front and the rear foundation profile (rail) with the open side facing backwards!

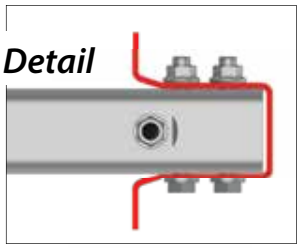


Fig. 5.2.-3. (detail top view foundation rail)

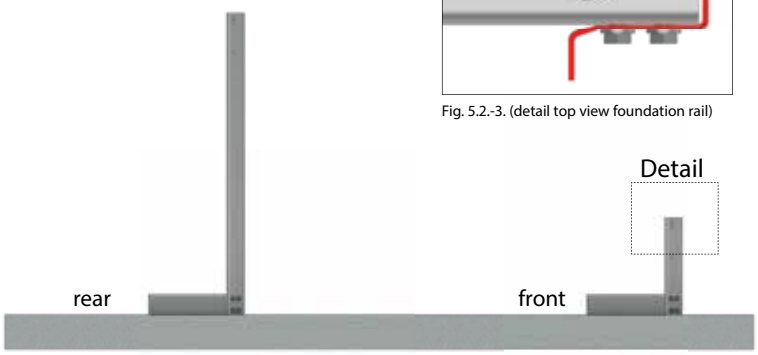


Fig. 5.2.-4 (lateral view of the assembled foundation rails)

5.3. Mounting the steel head

1. Bolt the steel head to the right inner foundation side using two hexagon head bolts M10x30 DIN933, two washers 10 DIN9021 and two flange nuts M10 DIN6923.

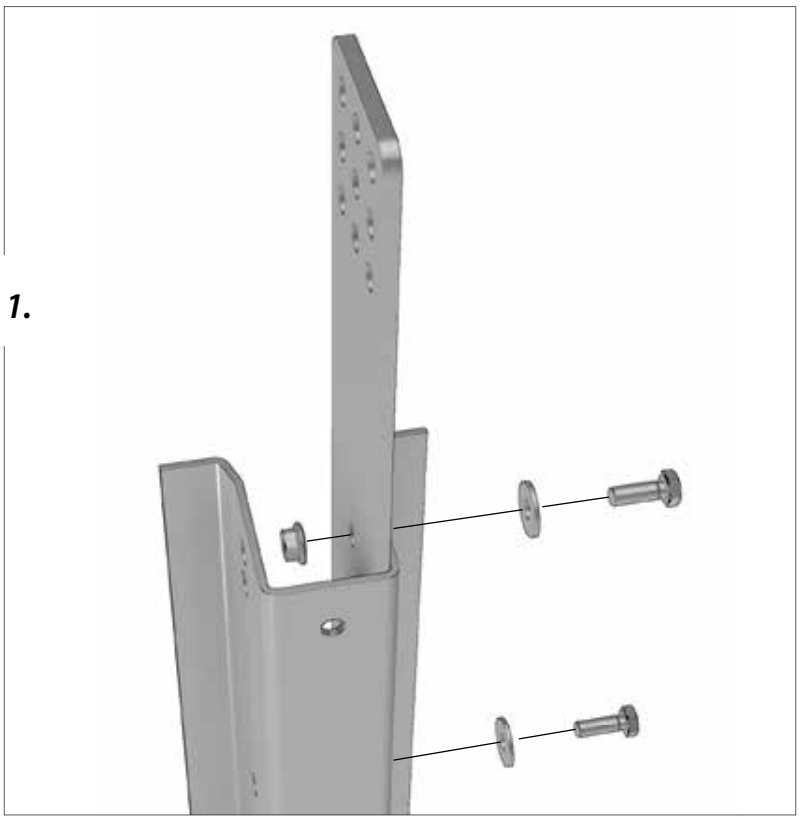


Fig. 5.3.-1 (mounting the steel head)

Always mount the steel heads at the same inner face of the foundation rail! (see detailed view)

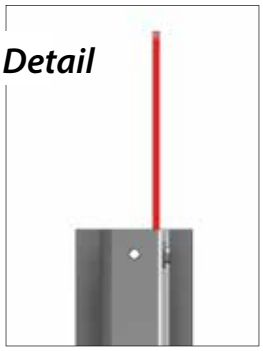


Fig. 5.3.-2 (detailed view, mounted steel head)

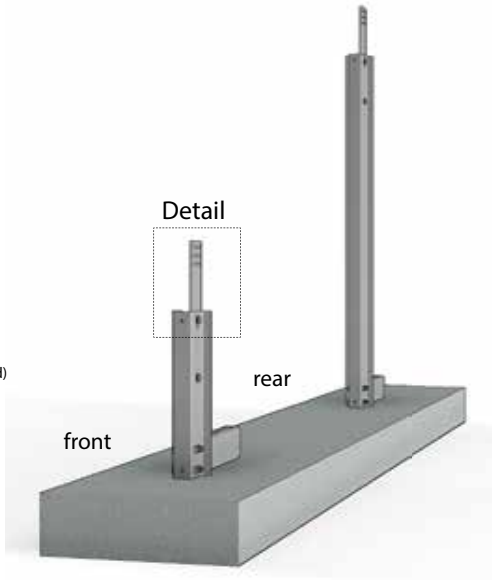


Fig. 5.3.-3 (front view, foundation rails with steel heads)

5.4. Mounting the girder assembly

CAUTION

- *Wear adequate protective equipment, especially a hard hat, when mounting the girder assembly!*
- *Secure all parts that need to be fastened against slipping!*
- *Use appropriate auxiliary devices to handle heavy loads and ask your co-workers for help!*
- *Keep the work area clean to avoid falls!*
- *Never walk under suspended loads and secure objects and tools against falling down.*

Fasten the bolted connection by turning the bolt head! Do not turn the nut, just hold it!

1. Lift the girder assembly to the steel heads. Please make sure that the closed side of the girder is placed at the (left side) of the steel heads. Fasten at the top and at the base, using a hexagon head bolt M12x30 DIN933, a washer 12 DIN9021 and a flange nut M12 DIN6923 for each joint.

1.

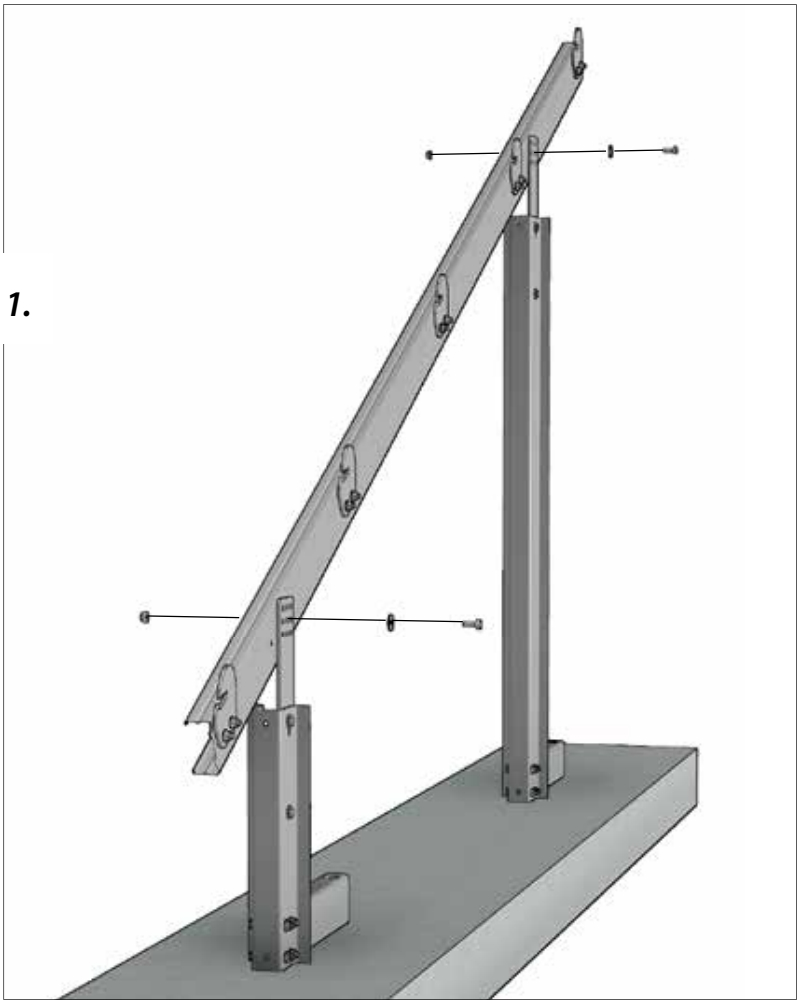


Fig. 5.4.-1 (mounting the girder assembly)

5.5. Mounting the module-bearing rail (purlin)

CAUTION

- *Wear adequate protective equipment, especially a hard hat, when mounting the module-bearing rails!*
- *Secure all parts that need to be fastened against slipping!*
- *Use appropriate auxiliary devices to handle heavy loads and ask your co-workers for help!*
- *Keep the work area clean to avoid falls!*
- *Never walk under suspended loads and secure objects and tools against falling down.*

NOTICE

Please note that the module-bearing rail must be mounted at a 90° angle to the girder assembly to safeguard that the modules are correctly supported. In case of imprecise mounting, the modules could fall down in the worst case.

1. Swivel the module-bearing rail into the pre-assembled fastening plates on the girder assembly.

2. Hammer in the fastening device using a plastic tip hammer. Hold a hammer against the other side of the fastening plate for stabilization reasons.

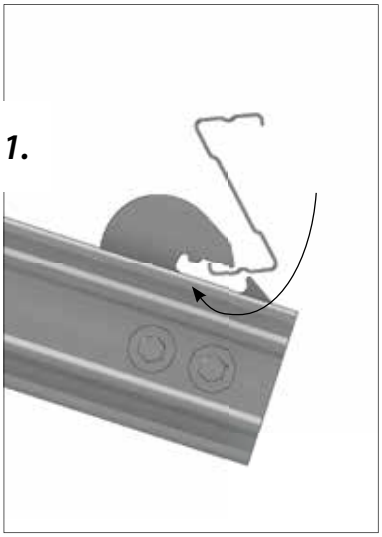


Fig. 5.5.-1 (swiveling in the purlin)

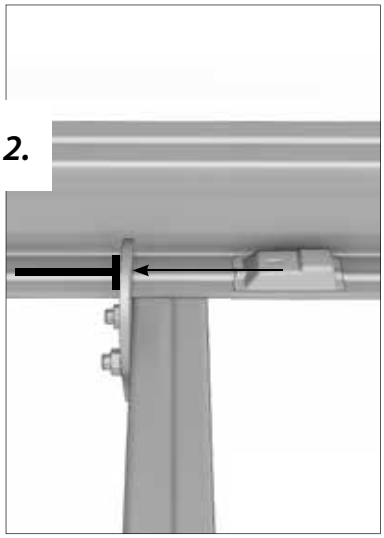


Fig. 5.5.-2 (hammering in the fastening device)

5.6. Mounting the purlin connectors (optional)

When mounting the purlin connectors, please use the designated drilled holes on the module-bearing rails!

1. Fasten each purlin connector with four hexagon head bolts M12x30 DIN933, washers DIN9021 and flange nuts M12 DIN6923 to the module-bearing rail.

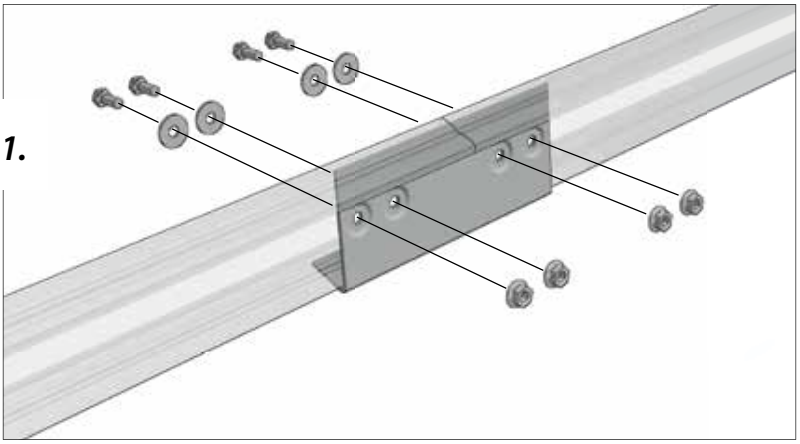


Fig. 5.5.-1 (mounting the purlin connector)

5.7. Mounting the module clamp adapter (optional)

The module clamp adapter must be used in the case of a horizontal bearing of the modules or when using a combined clamping. Moreover, the module clamp adapter is used when the modules are mounted vertically (in portrait), in combination with Rapid 2+ or Standard clamps.

The exact positions of the module clamp adapters can be referenced in the specifications provided in the ***technical general layout drawing****.*

NOTICE
Please ensure that no drilling chips are left in the module-bearing rails after screwing the self-drilling screws to avoid contact corrosion!
After positioning the module clamp adapter, please clean the module-bearing rails with a hand brush or cover the module-bearing rail during the screwing process (e.g. with a cardboard).

1. Clip the module clamp adapter onto the Z-purlin at the indicated points.

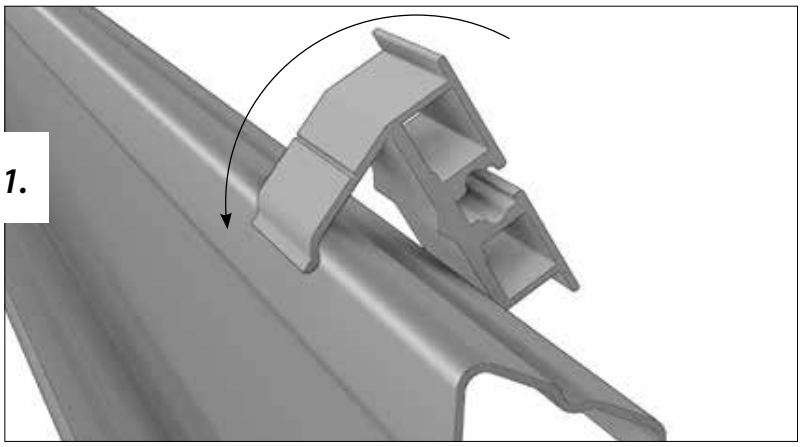


Fig. 5.6.-1 (snapping in the module clamp adapter)

2. Screw the module clamp adapter in the designated hollow space (notch) with a self-drilling screw to the module-bearing rail.

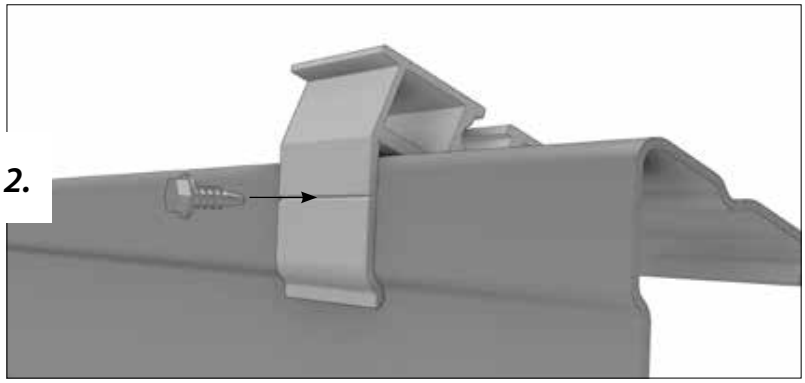


Fig. 5.6.-2 (fastening the module clamp adapter)

6. Module mounting and module clamping

Solar modules are third party components that are not included in the scope of delivery of the PvMax-S substructure. Schletter GmbH thus points out that the safety notices and mounting instructions of the module manufacturer are to be abided. And please also note the notices given in these Mounting Instructions when mounting the photovoltaic modules!

The following points must be taken into consideration at any event:

- *Photovoltaic modules are electrical devices. They must be treated carefully!*
- *Impacts, kicks, shocks or vibrations must be avoided.*
- *It is not allowed to put loads on the modules (trespassing, storing of items, etc.).*
- *Scratches or dirts on the module surface must be avoided.*
- *It is not allowed to pull or tear at the module cables. Do not heavily bend the module cables.*

The module clamping is carried out according to the project planning (portrait, landscape or combined module arrangement). The distance between modules can deviate from the standard value.
Standard value:

- clamped side ***23 mm***
- side without clamping ***5 - 10 mm***

(according to the specifications in the technical drawing; specifications by the module manufacturer are considered)

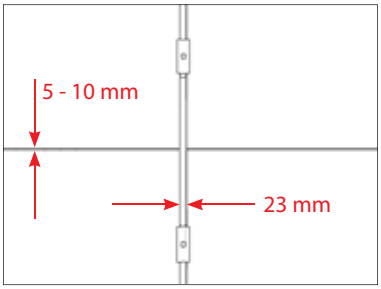


Fig. 6.-1 (distance between modules)

Clearance (= distance between module and module clamp) of

- ***min. 0.5 mm***
- ***max. 2 mm***

must be observed (module abuts on the spacer notches).

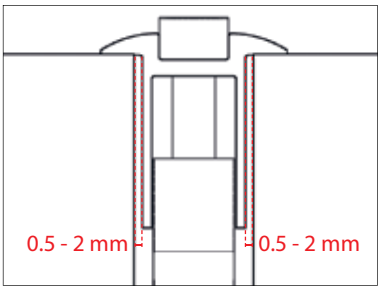


Fig. 6.-2 (clearance)

Observe the clamping points specified by the module manufacturer!
Please note the data sheet of the photovoltaic module provided by the manufacturer to verify the clamping points.

6.1. Module mounting and clamping in the case of vertical module bearing

The modules are fastened with special steel clamps in the case of vertical module arrangements:

1. Attach the module clamp on the rail of the Z-purlin.

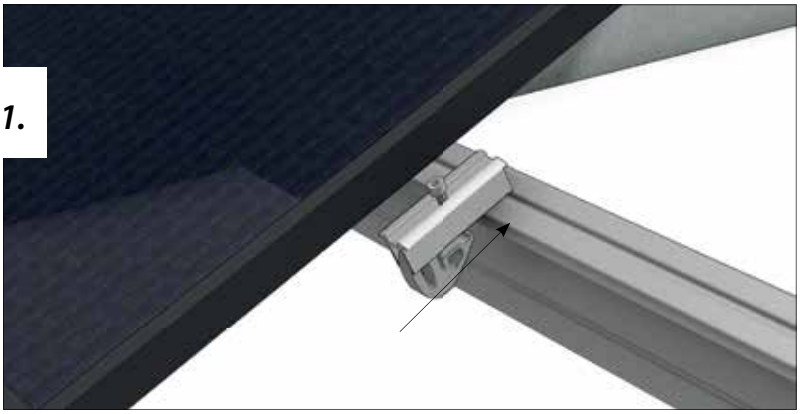


Fig. 6.1.-1 (attaching the module clamp)

2. Push the module to the clamp (observing the clearance!)

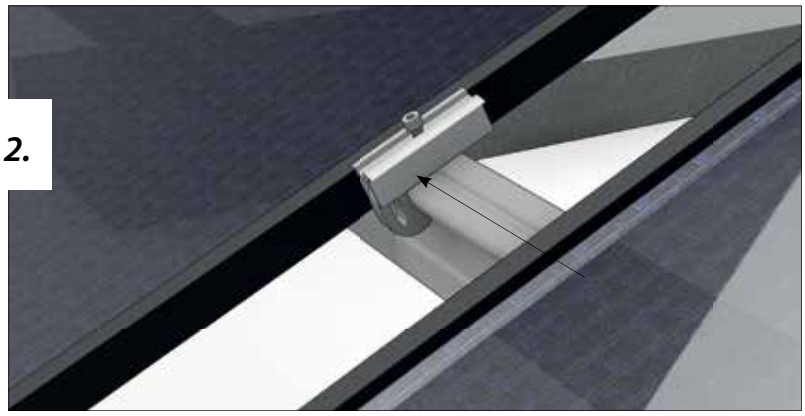


Fig. 6.1.-2. (pushing/sliding the module to the clamp)

3. Fasten hexagon socket screw with a torque of 8 Nm

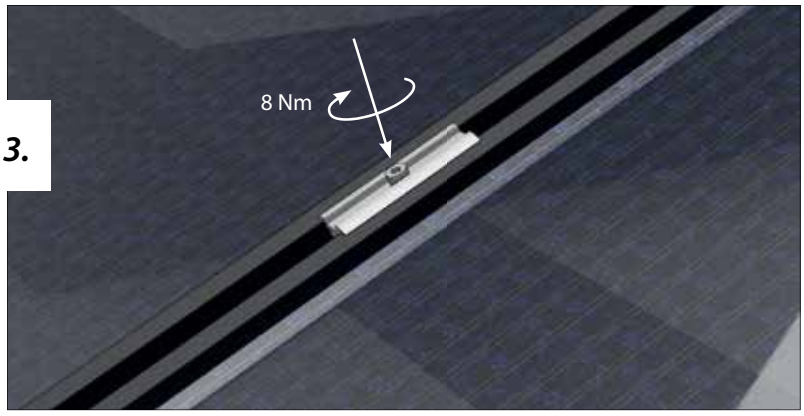


Fig. 6.1.-3. (fastening the hex socket screw)

6.2. Module mounting and clamping in the case of horizontal module bearing

The horizontal module clamping is carried out with a module clamp adapter in combination with Rapid 2+ clamps or Standard clamps:

1. Insert the module clamp into the notch of the module clamp adapter

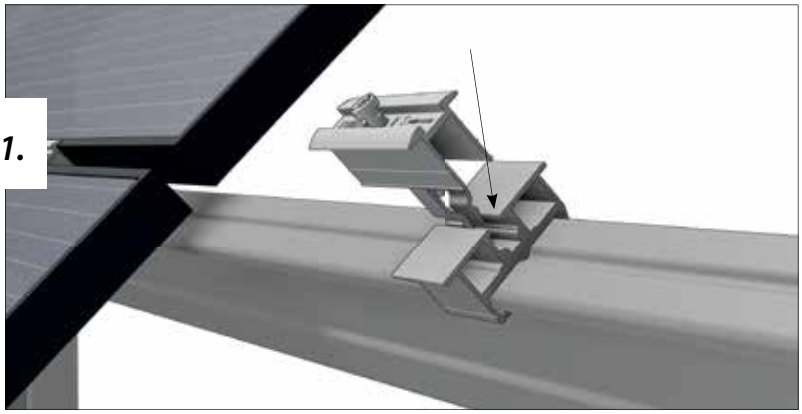


Fig. 6.2.-1 (clicking in the module clamp)

2. Push the module to the clamp (observing the clearance!)

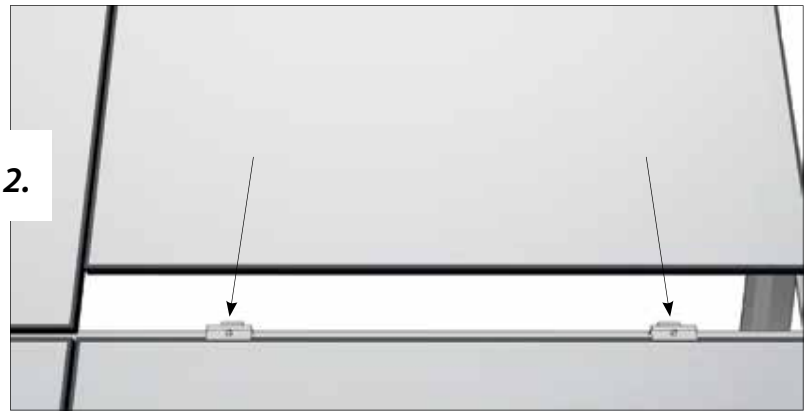


Fig. 6.2.-2. (pushing/sliding the module to the clamp)

3. Fasten hexagon socket screw with a torque of 14 Nm

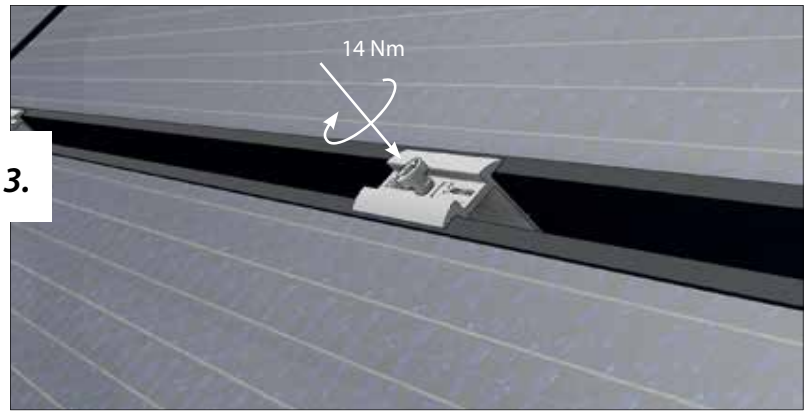


Fig. 6.2.-3. (fastening the hex socket screw)

6.3. Module mounting and clamping in case of combined module bearing

The combined module clamping is carried out with a module clamp adapter in combination with Rapid 2+ clamps or Standard clamps.

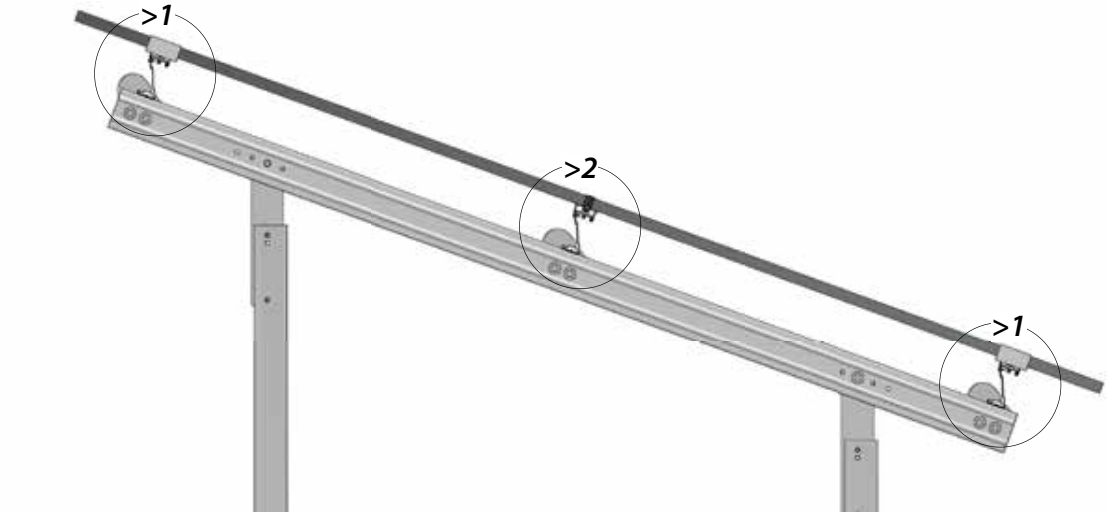


Fig. 6.3.-1 (combined module clamping)

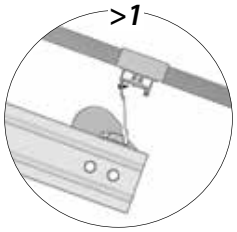


Fig. 6.3.-2.(upper and lower module clamping)

Clamping at the long side of the module to the upper and lower module-bearing rail.

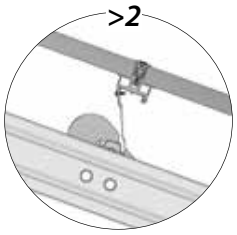


Fig. 6.3.-3 (module clamping at the inner side)

Clamping to the inner module-bearing rails at the short module side (comparable to clamping in the case of horizontal module arrangement)

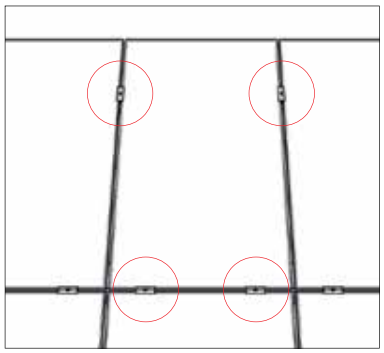


Fig. 6.3.-4 (clamping of the upper module)

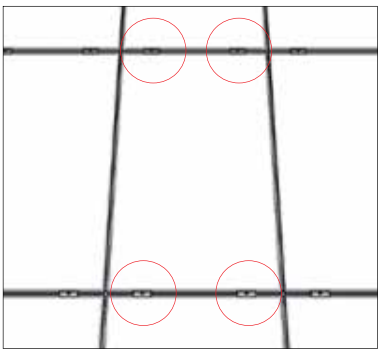


Fig. 6.3.-5 (clamping of the inner module)

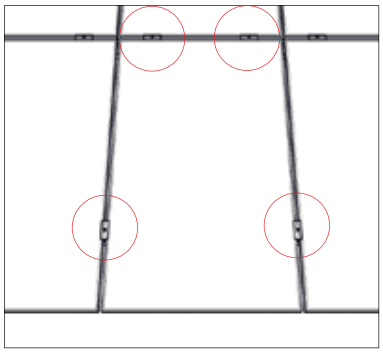


Fig. 6.3.-6 (clamping of the lower module)

7. Disassembly and disposal

DANGER

- *The plant operates with high voltage.*
- *Please abide by all instruction manuals and safety guidelines provided by the manufacturer of the modules or of electrical components before putting the plant out of operation.*
- *The plant may only be disconnected from the power supply provided on site by a certified electrical technician.*

WARNING

- *Always wear protective equipment (safety shoes, hard hat, safety glasses, protective gloves and high-visibility vest) when disassembling the PvMax-S components.*
- *And make sure that no unauthorized persons can enter the danger area.*
- *Do not step under suspended loads!*

- We recommend to wait for the confirmation by a certified electrical technician regarding the correct decommissioning of the plant before starting the disassembly of the PvMax-S system.
- Have an accordingly trained and certified professional disassemble the plant in transportable units.
- Observe all information and instructions provided in these Mounting Instructions.
- Also make these Mounting Instructions available to the personnel that is in charge of the disassembling operations.
- Ensure that the disassembling operations are performed exactly in reverse order of the mounting steps.

Faulty waste disposal can lead to environmental damage.
With regard to the environment it is recommended to dispose of recyclable materials in an appropriate manner.

Fig. 7.-1 (general recycling symbol)

Properly dispose of components

- Separate the materials steel, plastics, electric scrap, aluminium, stainless steel, copper, brass, etc.
- Dispose of the components in accordance with the local regulations

8. Maintenance and care

We recommend as follows:

INSPECTION OF THE PLANT
- *after exceptional weather conditions (storm, heavy snowfall or rain, etc.)*
- *after natural convulsions (earthquake, landslip, settlements, etc.)*

MAINTENANCE OF THE PLANT
- *Cleaning of the modules*
- *Verification of the bolted connections*
- *Check of the plant regarding corrosion*
- *Maintenance of the access roads and walkways*

CORRECTIVE MAINTENANCE OF THE PLANT
after detecting damages on the racks or earth movements (for example removing corrosion, replacement of faulty components, detection of unfastened bolted connections, etc.)

9. Warranty and liability

Generally, the customer is responsible for the proper mounting and installation of the PvMax-S system.

Exclusions
Guarantee, warranty and liability claims against the manufacturer Schletter GmbH in case of injury to persons or material damage shall be excluded if they result from one or several of the causes listed below:
- Non-observance of the Mounting Instructions and/or maintenance instructions in combination with a warranty extension
- Any use other than the intended use of the PvMax-S system or faulty operation
- Incorrect mounting, maintenance or repair
- Operation with spare or equipment parts that are faulty or have not been approved by the manufacturer
- Arbitrary constructional modifications or manipulation of the PvMax-S system or its equipment or components.
- Utilization of components made by other manufacturers (third party components)
- Neglect or non-observance of the prescribed maintenance and/or testing and inspection intervals

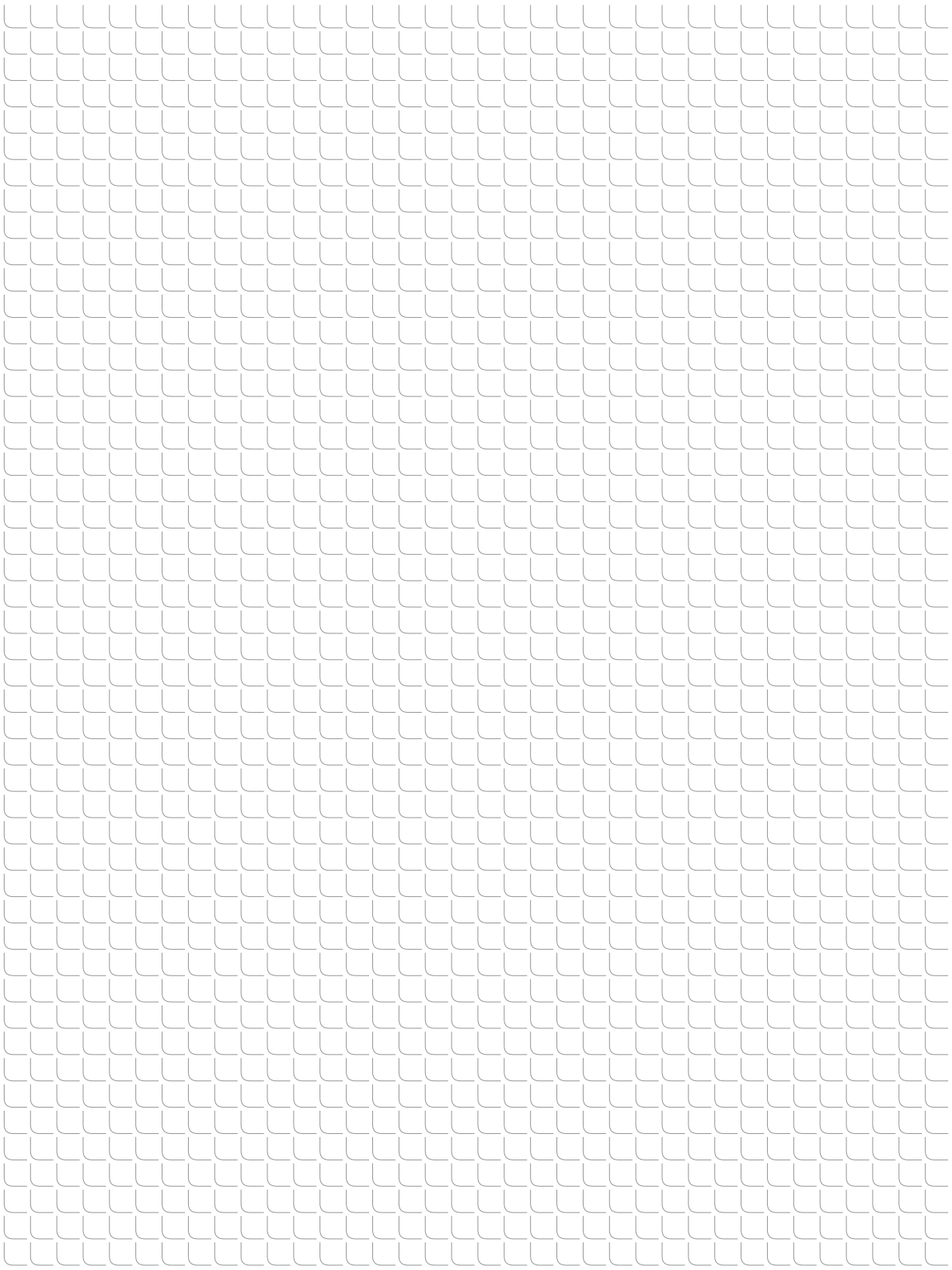
The customer exclusively shall bear the costs for damage or consequential damage that is due to one or several of the causes mentioned above.

The Mounting Instructions as well as the maintenance instructions in combination with a warranty extension refer exclusively to the mechanical metal structure supplied by Schletter GmbH.

Components of the solar plant like modules, cables and plug connectors, inverters or electric switch boxes are not part of these parts of the manual and thus are exempt from warranty and liability by Schletter GmbH.

Material damage to objects that are not included in the scope of delivery are generally excluded from any liability.

Notes



MOUNTING

FS Uno

Mounting Instructions with SRF Foundation Posts

Schletter GmbH
Gewerbegebiet an der B15
Alustrasse 1
83527 Kirchdorf / Haag in OB, GERMANY

Tel.: **+49 8072 9191 -0**
E-mail: **info@schletter.eu**

Your contact persons:

Technical advice for ground-mounted solar plants
Tel.: +49 8072 9191 - 203
E-mail: tb-freiflaeche@schletter.de

SCHLETTER

Table of Contents

1. General Information

1.1. Short Description

The system FS Uno is a one-support substructure for the mounting of photovoltaic modules in ground mount plants. The supporting structure and the module-bearing rails are made of hot-dip galvanized steel, the fastening elements and screws/ bolts are made of steel or stainless steel. By means of the leveling holes, it is possible to adjust the system to the result of the pile-driving process and even out tolerances. FS Uno allows to use framed as well as unframed modules that can be mounted either in portrait or in landscape, or with the Schletter combined clamping system. It is also possible to mount additional accessories for the cable management or components for the internal potential equalization.

1.2. Intended Use

FS Uno is a substructure for the mounting of photovoltaic modules. Any kind of different use that is not mentioned in these Mounting Instructions or an incorrect mounting (e.g. the utilization of components made by other producers or non-observance of tolerances specified here and/or exceeding the indicated loads) are considered as non-intended use and, thus, exclude any liability of the manufacturer.
The manufacturer accepts no liability for damage caused by failure to observe these Mounting Instructions.

1.3. Copyright and Intellectual Property Rights

These Mounting Instructions are subject to change without notice.

All names of products stated in these Mounting Instructions are trademarks of Schletter GmbH and are herewith recognized and acknowledged.
Schletter GmbH is not liable for any damage of the product or subsequential damage caused by the product that are due to improper handling.
First and foremost, Schletter GmbH is not responsible or liable for failures and faults that are caused by modifications made by the customer or other persons.
There is no claim for availability of previous designs and for the ability to retrofit delivered components to the respective latest state of the series.

Schletter GmbH has made considerable efforts to make sure that these Mounting Instructions are free of errors and omissions.
Schletter GmbH does not assume any responsibility or liability for possible errors included in these Mounting Instructions and/or incidental, concrete or consequential damages arising from the publication of these Mounting Instructions.

1.4. Safety Precautions

Please read these Mounting Instructions carefully before starting the assembly and keep it in a safe place for further reference. Please observe and adhere to the regional and national applicable standards, building regulations and accident prevention regulations.

Read and make sure you understand the safety and warning notes in these Mounting Instructions and always apply them according to the relevant conditions and type of operation!

This instruction manual contains guidelines and notices you have to observe in order to ensure your personal safety and to prevent physical injuries or damage to property. Such safety and warning notes are marked with a warning triangle. Depending on the kind and degree of danger, **warning notices** are displayed as follows:

DANGER
*indicates that death or severe personal injury **will** result, if proper safety precautions are not taken.*

WARNING
*indicates that death or severe personal injury **may** result, if proper safety precautions are not taken.*

CAUTION
indicates that minor personal injury can result, if proper safety precautions are not taken.

DANGER
due to operations with electricity. Electric power can lead to serious accidents and can cause severe injuries. Appropriate safety precautions are to be taken by all means.

Securing of the working area
Before the start of construction, the building site must be inspected by a supervising person by sight check or using plans showing all supply lines (water, electricity, gas) in the relevant area. For this purpose, the position of all supply lines (water, gas electricity, etc.) must be marked using marking paint and unstable ground and areas that are landslide-prone must be sealed off with stable barriers or warning signs.

Important information and notices
regarding the product and its handling and/or mounting of the product are characterized by the following symbol.

NOTICE
warns about situations that can lead to material damage and disturbances during the operating procedure, if the instructions are not observed.

REFERENCES
All documents relevant for the mounting that are not included in these Mounting Instructions, are marked with this symbol.

We absolutely recommend to observe the following protective measures when mounting of FS Uno:

Remember to wear reflective vests and safety shoes *all the time*

Always wear ear protection *when carrying out noisy work*

Always wear a hard hat *when there might be falling objects or if you could hurt your head in some other way*

Wear protective gloves *when working with sharp-edged components*

When carrying out dusty work, *always* ***wear breathing protection***

Wear safety glasses *when carrying out grinding and abrasive operations in order to avoid any danger to your eyes caused by flying liquids or parts (sparks, splinters)*

Apart from that, please consider the applicable rules and regulations on accident prevention and environmental protection that apply at the respective installation site as well as the work instructions and directives by the plant owner/operating company or at the place of operation.

1.5. Obligation of the Plant Owner / Operating Company

The plant owner ensures that all parts of these Mounting Instructions are stored readily available and handy at the plant.

The plant owner/operating company undertakes to only let people work at and in the striking distance of the plant who
- have read and understood the parts of the mounting instruction that are relevant for the respective operations,
- are familiar with the fundamental regulations on work safety, accident prevention and protection of the environment
- and have been instructed in the safe handling of the plant (training course).

Before starting any mounting works, the plant owner/operating company designates
- a supervising person and ensures that
- the construction site is inspected using plans showing all supply lines (water, electricity, gas) and thus
- the position of all underground supply lines and unstable ground without sufficient load-bearing capacities are marked properly or sealed off with barriers.

1.6. Commitment of the Staff

Only people who give reason to expect that they will reliably do their job are allowed. Persons whose ability to react is affected, for example by drugs, alcohol or medication, are NOT allowed.
- Every person that is involved in the mounting of FS Uno must have read and understood these Mounting Instructions, especially chapter "1.4 Safety Precautions", as well as all relevant chapters regarding the corresponding operations.
- These Mounting Instructions should always be kept available and easily accessible for all persons involved.
- Only trained and instructed qualified personnel are allowed to execute the operations mentioned in this instruction manual.
- Staff that still is to be trained may only mount the FS Uno system under the supervision of an experienced person.

We recommend the operator to insist on a confirmation in writing in each case.

1.7. Training of the Staff

These Mounting Instructions are addressed to personnel qualified in the areas of transportation and loading, mounting, disassembly and disposal, having the following qualifications:
- The professional staff members must be capable of fulfilling the tasks they have been assigned with and must be able to realize and avoid dangers on the basis of their professional formation, experience, expertise and their specific knowledge of the relevant regulations.
- The qualified staff members must have the required knowledge of the guidelines regarding safety, accident prevention and environmental protection, as well as of loading and unloading regulations that apply at the respective construction site.
- The qualified personnel have the driving licenses required at the specific construction site to be able to drive site vehicles and operate construction machines.

1.8. Additional documents relevant for the mounting

In addition to these Mounting Instructions, the following documents are required for the mounting of FS Uno:

- *Pile-driving plan*
- *Blueprint drawing / general layout drawing*
- *Bill of materials / parts list*
- *Delivery note*
- *DIS unloading guidelines for transport in maritime containers*
- *General Terms and Conditions of Sale and Supply of Schletter GmbH*
- *Data sheet and instructions of the module manufacturer*

2. Transportation, Loading and Unloading

WARNING

- *Always wear protective equipment (safety shoes, hard hat, safety glasses, protective gloves and reflective vest) when unloading the FS Uno components.*
- *Besides also wear the personal protective equipment that is specified in your intra-company regulations for the respective activity.*
- *It is compulsory to monitor and supervise the complete unloading process .*
- *Do not step under suspended loads!*
- *Please make sure that there are no unauthorized persons in the danger area.*

Please observe all country-specific regulations and standards of the country of destination and its work instructions!

2.1. Delivery of the components

The delivery of the components for FS Uno is carried out with an appropriate vehicle, for example

- trucks/lorries or
- overseas containers

2.2. Preparing the delivery

- Provide a stable and drivable surface for the delivery.
- Please make sure that all access roads, manoeuvring and unloading areas are suitable for trucks (up to 40 tons) and can be used by forklift trucks and hoisting equipments.
- Please exclusively provide trained professionals for the loading and transportation activities.

2.3. Provide forklift trucks and hoisting equipment

- Organize suitable forklift trucks and hoisting equipment to be available at the moment of delivery.
- Choose the suitable forklift trucks and hoisting equipment in cooperation with the site manager in charge.
- Make sure that the components, pallets and long items can properly be unloaded.
- Provide forklifts and hoisting equipment with different fork intervals or with adjustable forks.

2.4. Check the scope of delivery (for completeness)

The following shipping documents need to be verified on delivery:
- *Delivery note*
- *Packing list*

We recommend to observe the following points on receiving the goods:
- Visual inspection of the delivered goods
- Check whether the supplied goods correspond to the delivery order
- Delivered quantity / comparison with packing lists and delivery note
- General condition of the goods
- Damages of the delivery
- Delivery documents

Claims as to defects by the customer shall require that he has complied with his duties of examination and notification of complaint contained in Sections 377, 381 of the German Commercial Code [HGB]. Defects discovered during incoming goods inspection or later shall be notified to Schletter GmbH in writing without undue delay. A notification shall not be unduly delayed if it has been made within two weeks; the timely dispatch of this notification shall be deemed sufficient to meet the deadline. Regardless of the obligation to inspect and notify, the customer shall notify Schletter of obvious defects (including delivery of the wrong product or in not enough quantity) within two weeks of delivery in writing; the timely dispatch of this notification shall also be deemed sufficient in this case to meet the deadline. A general right to return purchased goods is not granted.

Extract from the General Terms and Conditions of Sale and Supply of Schletter GmbH - download available at www.schletter.de/AGB_en

2.5. Storage of the components

The components will also be delivered in cardboard boxes on pallets. And there also are fragile and sensitive items among those components.
- Unload the items on firm and stable ground only.
- Protect all components against rain, snow, moisture and other weather conditions.
- Store the items in dry and well-ventilated storage buildings or tents.
- Never store components outdoors or covered by a plastic sheet only.

If you adhere to the hints above, you can prevent the goods from being damaged already before mounting.

3. Technical data

3.1. System description and properties

System description	FS Uno - one-support ground mount system by Schletter
Material	• Pile-driven foundation posts: Steel, hot-dip galvanized • Profiles (rails): Steel, strip-galvanized • Fastening elements and screws: Steel, hot-dip galvanized or high-grade steel (fastening device, bolts)
Structural dimensioning	• Customized structural analysis of the respective terrain based upon a geological survey • Individual system structural analysis based on local data • Load assumptions according to DIN1055, part 4 (03/2006), part 5 (06/2005), part 100 (03/2001), Eurocode 1 (06/2002), DIN4113, DIN18800, Eurocode 9 and further resp. corresponding national standards. • Structural verification of all construction components based on FEM-calculation
Characteristics of the structure	• Quick and easy assembly • Highly efficient and material-saving rail geometries • Available in individual parts or highly pre-assembled if desired
Delivery and services	• Ground survey and structural analysis • Site-specific structural analysis based on local data • Ramming (pile-driving) of foundation posts and delivery of the complete mounting material • Optional: Rack mounting • Optional: Complete module assembly
Module types	• Framed modules with a frame thickness of up to 50 mm • Unframed modules on request

3.2. Rack tolerances

FS Uno is always configured specifically for the wind and snow loads at the respective installation site. In the interest of economic efficiency, usually the maximum load-bearing capacity of the individual component is exploited. To achieve this, however, the racks must be mounted with the utmost precision. If there are significant deviations from the mounting plans, this can lead to structural overstress which in turn can lead to damage cases. Schletter GmbH will not assume any liability for such damages nor for any consequences thereof. Adherence to the specified tolerances is therefore essential to the structural safety of the rack.

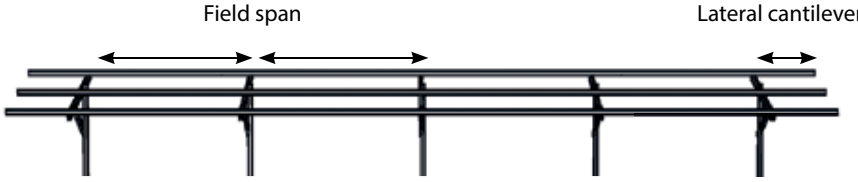


Fig. 3.2.-1 (field span / support width)

Support width	± 150 mm
Lateral cantilever of purlins	± 100 mm
Lower girder connection	± 100 mm
Upper girder connection	± 100 mm
Clearance between module and clamp	0.5 to 2 mm

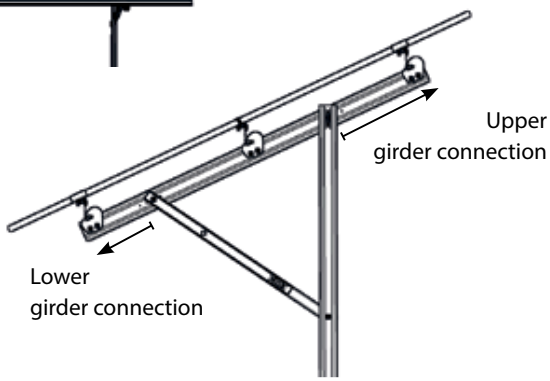


Fig. 3.2.-2 (girder connections)

3.3. Systems overview

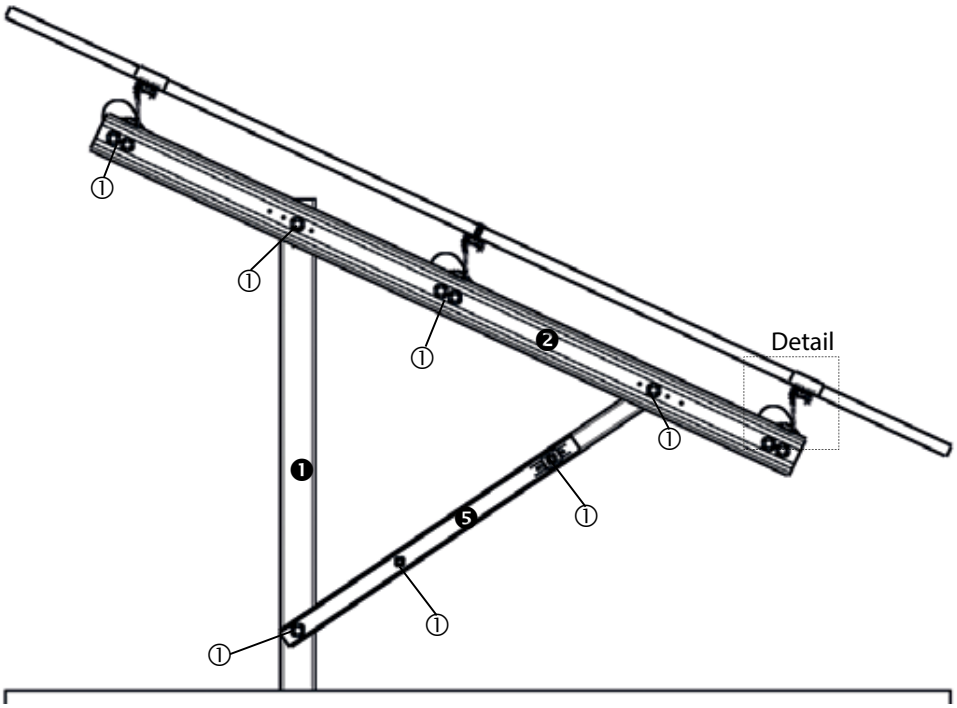


Fig. 3.3-1 (system visualisation)

Components

❶ SRF foundation post
❷ Girder assembly
❸ Module-bearing rail
❹ Module clamp adapter
❺ Strut assembly

Connection elements / fasteners

① Hexagon bolt M12x30 DIN933, flange nut M12 DIN6923 and washer M12 DIN9021
② Fastening device
③ Drill screw

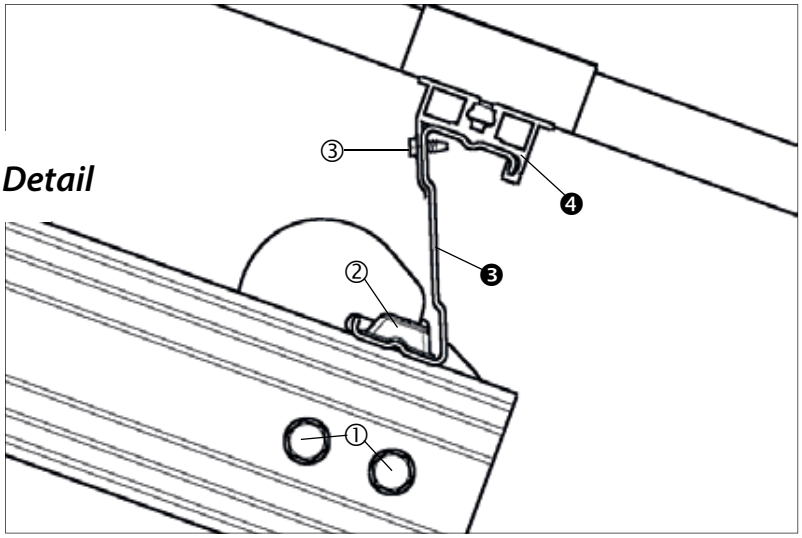


Fig. 3.3.-2 (detail)

3.4. Components

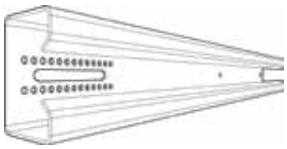


Fig. 3.4.1.-1 (143006-200)

3.4.1. Foundation posts

143006-200	Steel foundation post SRF6
143007-200	Steel foundation post SRF7
143008-200	Steel foundation post SRF8

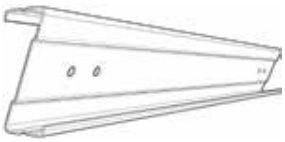


Fig. 3.4.2.-3 (144901-001)

Fig. 3.4.2.-2 (144999-003)

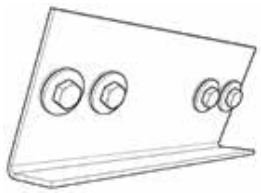


Fig. 3.4.2.-1 (144999-008)

3.4.2. Module-bearing rails and connection elements

144901-001	FS Uno / Duo purlin
144999-003	FS Uno / Duo fastening device
144999-008	FS Uno / Duo purlin connector Gen2 kit

3.4.3. Strut assembly

144970-099	Strut assembly SRF
000022-235	Strut element SRF
000016-673	FS steel locking plate
943612-030	Hexagon head bolt M12x30 DIN933 A2 GMB
943912-012	Flange nut M12 serrated DIN6923 A4
943921-012	Washer 12 DIN125 A2

Fig. 3.4.3.-1 (144970-099)

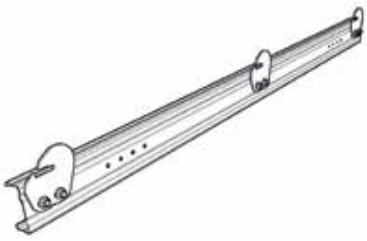


Fig. 3.4.3.-1 (144302-200)

Fig. 3.4.3.-2 (144999-006)

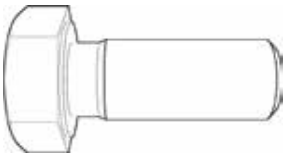


Fig. 3.4.3.-3 (943612-030)

Fig. 3.4.3.-4 (943912-012)

Fig. 3.4.3.-5 (943922-012)

3.4.4. Girder assemblies and components

144301-000	FS Uno girder assembly 1V custom cut
144302-200	FS Uno girder assembly 2V custom cut
144303-200	FS Uno girder assembly 3V custom cut
144304-200	FS Uno girder assembly 4V custom cut
144305-200	FS Uno girder assembly 5V custom cut
144306-200	FS Uno girder assembly 6V custom cut
144307-200	FS Uno girder assembly 7V custom cut
144308-200	FS Uno girder assembly 8V custom cut
144301-000	FS Uno girder assembly 1H custom cut
144302-100	FS Uno girder assembly 2H custom cut
144303-100	FS Uno girder assembly 3H custom cut
144304-100	FS Uno girder assembly 4H custom cut
144305-100	FS Uno girder assembly 5H custom cut
144306-100	FS Uno girder assembly 6H custom cut
144307-100	FS Uno girder assembly 7H custom cut
144308-100	FS Uno girder assembly 8H custom cut
144999-006	FS Uno / Duo fastening plate galvanized
943612-030	Hexagon head screw M12x30 DIN933 A2 GMB
943912-012	Flange nut M12 serrated DIN6923 A4
943922-012	Large washer M12 DIN9021 A2

3.4.5. Module clamps for vertical module mounting

	Steel clamp			Rapid clamp*		Standard clamp*	
Module height	***End clamp left***	***Middle clamp***	***End clamp right***	***End clamp***	***Middle clamp***	***End clamp***	***Middle clamp***
20 mm	---	---	---	---	---	130001-020	130002-000
24 mm	---	---	---	---	---	130001-024	130002-000
28 mm	---	---	---	---	---	130001-028	130002-000
30 mm	144912-030	144910-001	144911-030	131001-030	131002-000	130001-030	130002-000
31 mm	144912-031	144910-001	144911-031	131001-031	131002-000	130001-031	130002-001
32 mm	144912-032	144910-001	144911-032	131001-032	131002-000	130001-032	130002-001
33 mm	144912-033	144910-002	144911-033	131001-033	131002-000	---	---
34 mm	144912-034	144910-002	144911-034	131001-034	131002-000	130001-034	130002-001
35 mm	144912-035	144910-002	144911-035	131001-035	131002-000	130001-035	130002-001
36 mm	144912-036	144910-002	144911-036	131001-036	131002-000	130001-036	130002-001
37 mm	144912-037	144910-002	144911-037	131001-037	131002-000	---	---
38 mm	144912-038	144910-003	144911-038	131001-038	131002-000	130001-038	130002-001
39 mm	144912-039	144910-003	144911-039	131001-039	131002-000	---	---
40 mm	144912-040	144910-003	144911-040	131001-040	131002-001	300001-040	130002-001
41 mm	144912-041	144910-003	144911-041	131001-041	131002-001	130001-041	130002-001
42 mm	144912-042	144910-003	144911-042	131001-042	131002-001	130001-042	130002-001
43 mm	144912-043	144910-004	144911-043	131001-043	131002-001	130001-043	130002-001
44 mm	144912-044	144910-004	144911-044	131001-044	131002-001	130001-044	130002-001
45 mm	144912-045	144910-004	144911-045	131004-045	131002-001	130001-045	130002-001
46 mm	144912-046	144910-004	144911-046	131001-046	131002-001	130001-046	130002-001
47 mm	144912-047	144910-004	144911-047	131001-047	131002-001	---	---
48 mm	144912-048	144910-005	144911-048	131001-048	131002-001	130001-048	130002-001
49 mm	144912-049	144910-005	144911-049	131001-049	131002-001	---	---
50 mm	144912-050	144910-005	144911-050	131001-050	131002-001	130001-050	130002-001
51 mm	---	---	---	---	---	130001-051	130002-001

* in combination with module clamp adapter

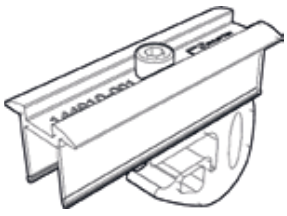


Fig. 3.4.4.-1 (144912-030)

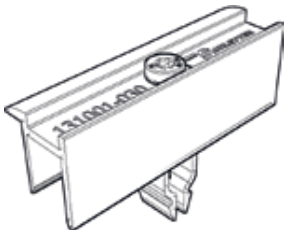


Fig. 3.4.4.-2 (131001-030)

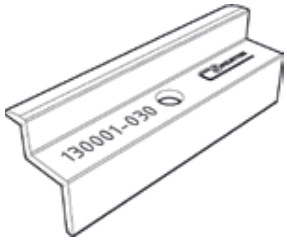


Fig. 3.4.4.-3 (130001-030)

3.4.6. Module clamps for horizontal module mounting

	Rapid clamp*		Standard clamp*	
Module height	***End clamp***	***Middle clamp***	***End clamp***	***Middle clamp***
20 mm	---	---	130001-020	130002-000
24 mm	---	---	130001-024	130002-000
28 mm	---	---	130001-028	130002-000
30 mm	131001-030	131002-000	130001-030	130002-000
31 mm	131001-031	131002-000	130001-031	130002-001
32 mm	131001-032	131002-000	130001-032	130002-001
33 mm	131001-033	131002-000	---	---
34 mm	131001-034	131002-000	130001-034	130002-001
35 mm	131001-035	131002-000	130001-035	130002-001
36 mm	131001-036	131002-000	130001-036	130002-001
37 mm	131001-037	131002-000	---	---
38 mm	131001-038	131002-000	130001-038	130002-001
39 mm	131001-039	131002-000	---	---
40 mm	131001-040	131002-001	300001-040	130002-001
41 mm	131001-041	131002-001	130001-041	130002-001
42 mm	131001-042	131002-001	130001-042	130002-001
43 mm	131001-043	131002-001	130001-043	130002-001
44 mm	131001-044	131002-001	130001-044	130002-001
45 mm	131004-045	131002-001	130001-045	130002-001
46 mm	131001-046	131002-001	130001-046	130002-001
47 mm	131001-047	131002-001	---	---
48 mm	131001-048	131002-001	130001-048	130002-001
49 mm	131001-049	131002-001	---	---
50 mm	131001-050	131002-001	130001-050	130002-001
51 mm	---	---	130001-051	130002-001

* in combination with module clamp adapter

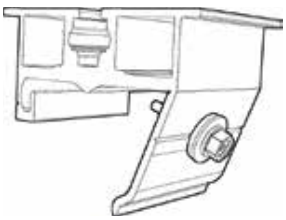


Fig. 3.4.6.-1 (144919-050)

3.4.7. Module clamp adapter and connection elements for module clamps

144919-050	FS Steel Module clamp adapter KIT
129010-008	KlickIn click component for nut M8
943914-008	Square nut M8 DIN557 A4

The nuts and bolts of the Standard clamps are not included in the scope of delivery and must be ordered separately.

With big order quantities, clamps for other module thicknesses can be manufactured on request!

The Standard clamps are not pre-assembled when they are delivered. These clamps are combined with a hexagon socket head screw, a KlickIn click component and a square nut. The screws listed below can be used for that purpose:

3.4.8. Screws for standard module clamps

	Frame height in mm	*Hexagon socket screw in mm*	*Name*
943308-125	20	25	Hexagon socket screw M8x25 serrated DIN912 A3
943308-130	24	30	Hexagon socket screw M8x30 serrated DIN912 A3
943308-135	28 - 30	35	Hexagon socket screw M8x35 serrated DIN912 A3
943308-120	31 - 35	20	Hexagon socket screw M8x20 serrated DIN912 A3
943308-125	36 - 40	25	Hexagon socket screw M8x25 serrated DIN912 A3
943308-130	41 - 45	30	Hexagon socket screw M8x30 serrated DIN912 A3
943308-135	46 - 51	35	Hexagon socket screw M8x35 serrated DIN912 A3

Fig. 3.4.8.-1 (144999-009)

3.4.9. Auxiliary equipment / accessories

964000-176	Paint zinc dust silver gray satin-gloss
149023-001	Cable fastening retainer 1.0-3.0mm, guidance at the top
149023-002	Cable fastening retainer 1.0-3.0mm, guidance at the side
149023-003	Cable fastening retainer 3.0 - 6.0 mm
144999-009	FS Uno / Duo cable fastener purlin
144999-010	Empty cable conduit

Fig. 3.4.8.-2 (149023-003)

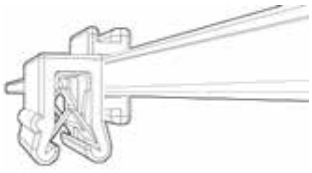


Fig. 3.4.8.-3 (149023-002)

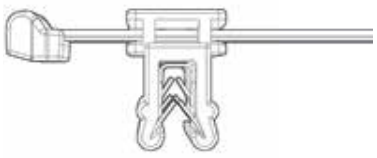


Fig. 3.4.8.-4 (149023-001)

4. Mounting information

The FS Uno system is customized for the respective installation site. The following indications are already needed during the planning process:

- Site boundaries
- Rights of way / easements (the building site must be accessible for vehicles at any time)
- Obstacles in the subsoil (pipes, subterranean cables, etc.)
- Weather conditions (wind, rain, snow, etc.)
- Conditions that may influence the building ground (seismic activities, erosion, etc.)
- Geo-technical reports about the topology of the site and the composition of the soil

When mounting the ground-mount system, we recommend:

- Keeping a clearly laid out and detailed daily construction report (site journal), where all daily work steps, employment of staff and assembled components are exactly specified.
- Accurately checking and comparing the delivery notes with the delivered goods on the site.

4.1. Terrain

When planning the ground-mounted system, make sure that the ground slope is within the tolerances. In the following, the guiding values for a structurally safe solar plant are specified.

Maximum admissible ground slope East-West: **3°**

Regarding the structural calculations, additional measures may be required (for example reinforcements)

Maximum admissible ground slope North-South: **35°**

(depending on the condition of the slope, soil composition, rocks, etc.)

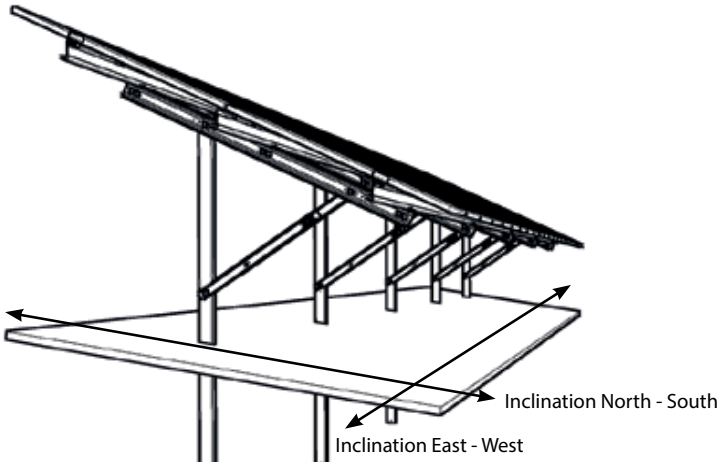


Fig. 4.1.-1 (ground slope)

The Schletter ground mount plants within one rack are always parallel to the terrain topography beneath them. Height differences of the subsoil under a rack can be equalized with the foundation posts. Please already align the piles with a cord when pile-driving. The tolerance of the anchoring depth is ±100 mm.

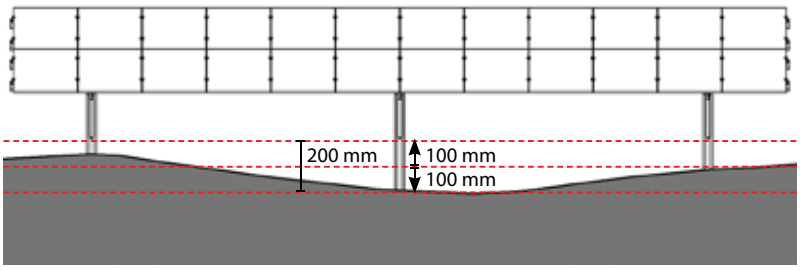


Fig. 4.1.-2 (tolerances of the anchoring depth)

4.2. Foundation

4.2.1. Ramming (pile-driving) tolerances

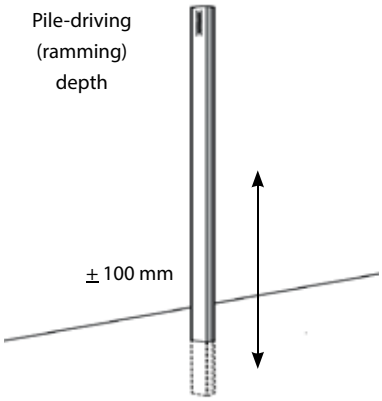


Fig 4.2.1.-1 (pile-driving tolerances - depth)

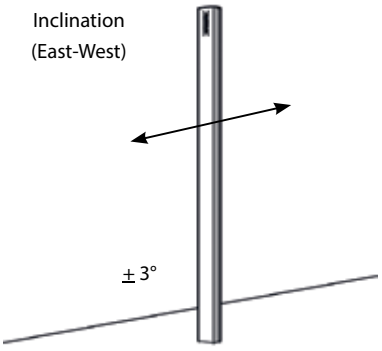


Fig 4.2.1.-2 (pile-driving tolerances - E/W tilt)

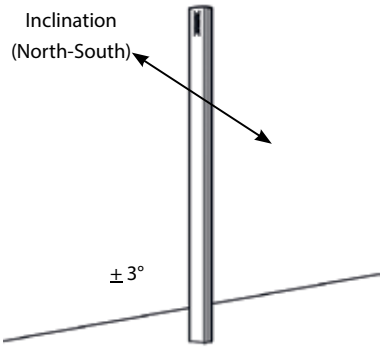


Fig 4.2.1.-3 (pile-driving tolerances - N/S tilt)

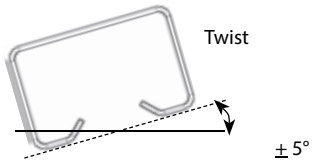


Fig 4.2.1.-4 (pile-driving tolerances - twist / distortion)

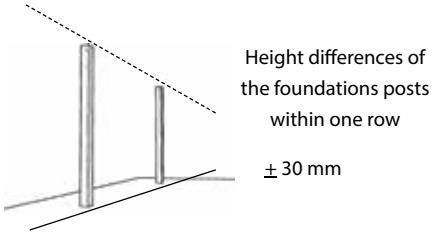


Fig 4.2.1.-5 (pile-driving tolerances - difference in height)

Pile-driving operations must be undertaken by specialist companies. Special pile-driving plans are created on the basis of a digital terrain model with exactly specified contour lines. These plans must be available at least one week before the start of the pile-driving operations and must include the positions of the foundation posts and their corresponding dimensions. The position of the first and last pile in each row must be marked on the terrain with a wooden stake. If a row length exceeds 50 meters, additional markings (wooden stakes) must be used within the row.

4.2.2. Pile-driving obstacles and concreting

Extraordinary foundation posts must be clearly identified and documented in a pile-driving plan. Inconsistencies during the pile-driving procedure which could affect the adhesive force of the piles must be documented, (e.g. slant position, deceleration and subsequent, sudden acceleration of the penetration speed, swift penetration of the foundation pile while pile-driving etc.). All pile-driving procedures deviating from the specifications as to the ramming of the foundation posts must be approved by Schletter GmbH.
If pile-driving operations are impeded by unexpected obstacles (blocks, solid rock on the site), the following procedure must be implemented:

1. Pre-drill down to the intended target depth.
2. If possible, vacuum the drill cuttings out of the borehole. Otherwise, the drill cuttings that remain in the borehole have to be compacted.
3. The borehole must be filled in layers with compressed concrete of strength C16/20 and compacted.
4. After that, ram (pile-drive) the pile without delay.

4.3. Tools

In the following, the tools that are usually required for the mounting of FS Uno are listed. Additional tools that are required for special cases (for example encasing the foundation posts in concrete) are not listed here.

NOTICE
Please exclusively use the tools recommended for the assembly of FS Uno.
If you use tools that are not intended for this purpose, the rack can be damaged and the structural safety of the plant could thus be endangered!

We recommend using torque wrenches for all bolted connections. With fast rotary motions, there is an increased danger of "bolt blocking"!

4.3.1. Defining the positions of the foundation posts and marking these positions (staking)

- Measuring tapes (100 m)
- Line pins (about 20 pieces)
- Mason's lacing cord
- Club hammer
- Wooden stakes
- Color spray (for ground marking etc.)
- Permanent marker
- Zinc dust primer
- Brush

4.3.2. Pile-driving (ramming)

- Pile-driver with suitable ram
- Spirit level

4.3.3. Rack mounting

- Torque wrench (30 Nm to 60 Nm)
- Wrench socket size 17
- Wrench socket size 19
- Hammer
- Club hammer (to hold against the connector hook)
- Plastic tip hammer
- Angle meter (goniometer) - spirit level
- Mason's lacing cord
- Cordless screw driver

4.3.4. Module mounting

- Mason's lacing cord
- Measuring tape
- Possibly distance template for distances between the modules
- Cordless screw driver
- Size 8 socket for cordless screwdriver
- Size 6 hexagon socket wrench / 40TX key
- Torque wrench (< 8 Nm)
- Size 6 hexagon socket wrench / 40TX bit for torque wrench

4.4. Torque specifications

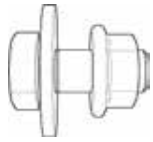


Fig. 4.4.1.-1 (screw connection M12)

4.4.1. Bolted connections in the substructure

Name	*Tightening torque (MA-Nm)*
Hexagon head bolt DIN933 M12x30 A2 GMB Hexagon nut DIN6923 M12 A4 Washer, large DIN9021 M12 A2	**56 Nm**

Fig. 4.4.2.-1 (Standard module clamp)

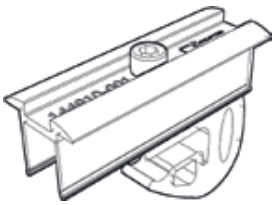


Fig. 4.4.2.-2 (steel module clamp)

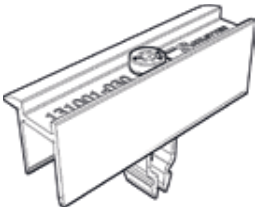


Fig. 4.4.2.-2 (Rapid 2+ module clamp)

4.4.2. Fastening of the module clamps

Name	*Tightening torque (MA-Nm)*	*Module arrangement*
Hexagon socket screw DIN4762 M8 (20 - 35 mm) KlickIn click component for nut M8 Square nut DIN557 M8 A4	**15 Nm**	H and V in combination with module clamp adapter
Hexagon socket screw DIN912 M8 A2 (25 - 45 mm)	**8 Nm**	V
TX stud screw M8 A2 GMB (42.5 - 55 mm)	**15 Nm**	H and V in combination with module clamp adapter

Always fasten the bolted connection by turning the bolt head! When checking the pre-stress of the bolts, it has to be considered that constraints and frictional forces can lead to a loss of clamping force. This was taken into consideration when the tightening torques were determined. When a bolted connection is checked, it must not loosen when 50% of the specified tightening torque is applied.

5. Assembly steps

5.1. Pile-driving of foundation posts and applying corrosion protection

WARNING

- *Wear adequate protective equipment during the pile-driving operations, especially ear protection and protective gloves, reflective vest and safety shoes!*
- *Always keep looking on the machine and the surrounding area.*
- *Please especially pay attention to mechanically moving parts in the danger area of the ramming machine to avoid crushing injuries.*
- *Prevent the ramming machine from toppling over by exclusively driving on adequate, stable ground!*

Check the stability and firm embedment of the pile-driven foundations before mounting the racks!

*Only a special paint (**zinc dust primer**) will give the required protection and is approved according to the standards. Basic zinc spray coatings do not provide long-term protection.*

The tolerances specified here must not be exceeded!

1. Pile-drive the foundation post according to the indicated tolerances

Height tolerance of the piles to each other: ± ***30 mm***

Tolerance of pile tilt in N-S and E-W direction: ± ***3°***

Tolerance of the pile height according to terrain topography: ± ***100 mm***

2. A zinc dust primer is to be used to coat the top 30 mm of the foundation post, inside and outside.

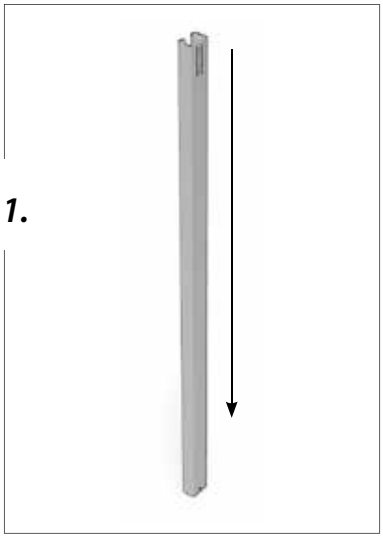


Fig. 5.1.-1 (pile-driving tolerances)

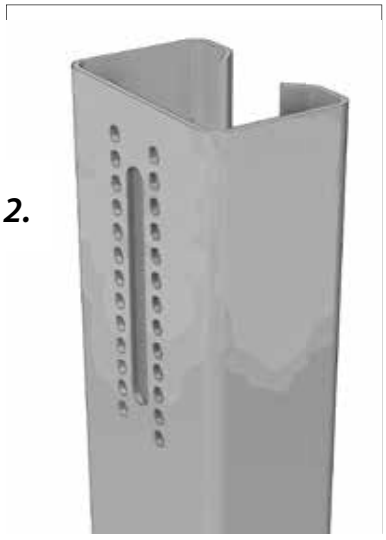


Fig. 5.1.-2 (prime-coated foundation post)

*The exact positions of the foundation posts can be referenced in the corresponding **pile-driving plan**.*

3. Check whether the individual foundation posts are aligned to each other and verify the posts regarding their corresponding tolerances (see item 5.1.- step 1)

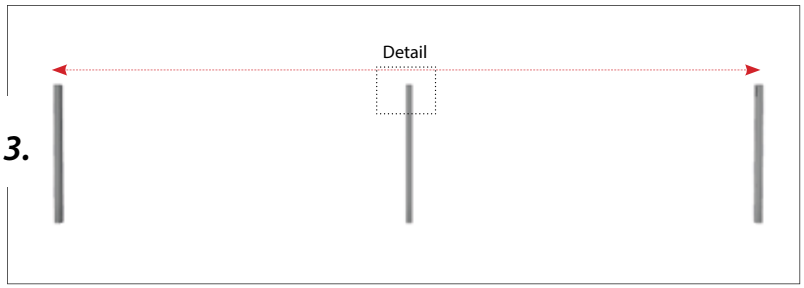


Fig. 5.1.-3 (flush alignment of the foundation posts)

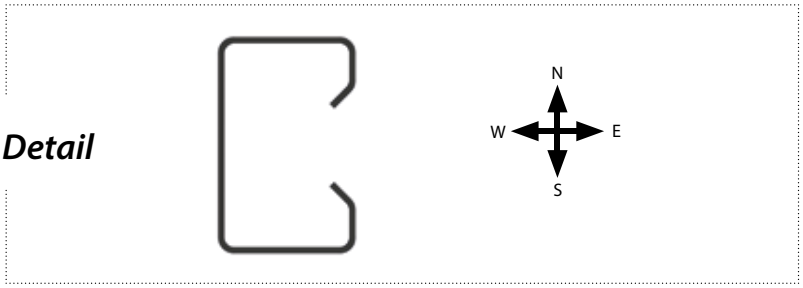


Fig. 5.1.-4 (detailed view of the foundation post - from above)

5.2. Mounting the girder assembly

CAUTION

- *Wear adequate protective equipment, especially a hard hat, when mounting the girder assembly!*
- *Secure all parts that need to be fastened against slipping!*
- *Use appropriate auxiliary devices to handle heavy loads and ask your co-workers for help!*
- *Keep the work area clean to avoid falls!*
- *Never walk under suspended loads and secure objects and tools against falling down.*

Fasten the bolted connection by turning the bolt head! Do not turn the nut, just hold it!

1. Fold out the strut.

Fasten the girder assembly to the top of the foundation post using a hexagon head bolt M12x30 DIN933, a washer 12 DIN9021, a locking plate and a flange nut M12 DIN6923.

Fasten the strut assembly to the lower part of the foundation post using a hexagon head bolt M12x30 DIN933, a washer 12 DIN9021 and a flange nut M12 DIN6923.

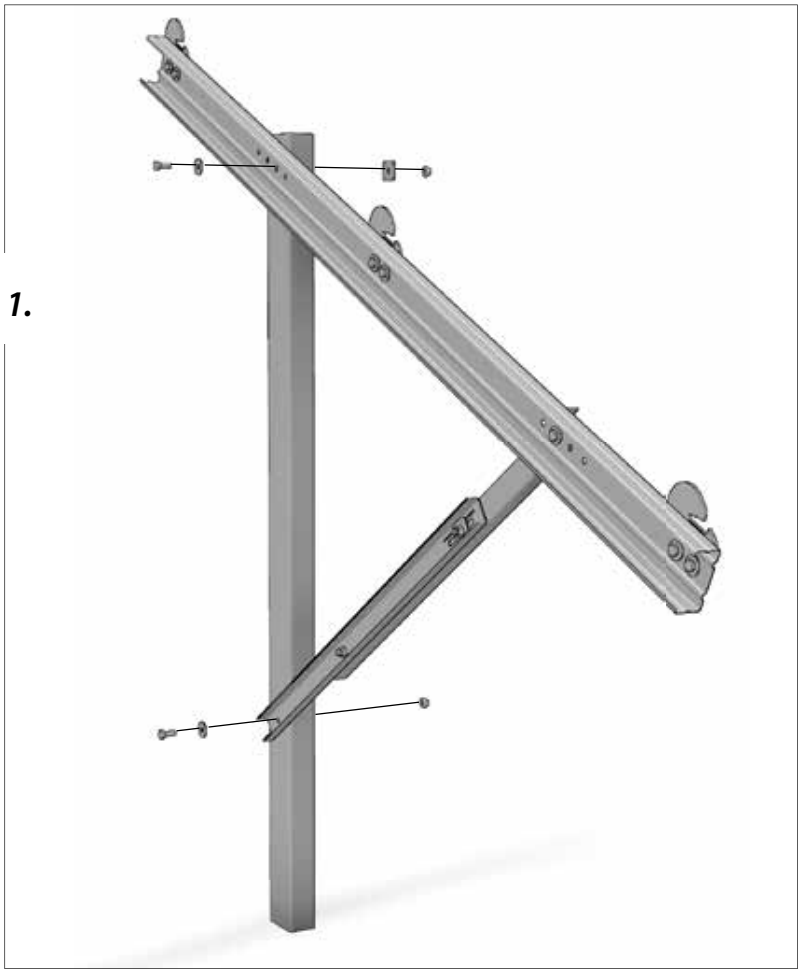


Fig. 5.3.-1 (mounting the girder assembly)

5.3. Mounting the module-bearing rail (purlin)

CAUTION

- *Wear adequate protective equipment, especially a hard hat, when mounting the module-bearing rails!*
- *Secure all parts that need to be fastened against slipping!*
- *Use appropriate auxiliary devices to handle heavy loads and ask your co-workers for help!*
- *Keep the work area clean to avoid falls!*
- *Never walk under suspended loads and secure objects and tools against falling down.*

NOTICE

Please note that the module-bearing rail must be mounted at a 90° angle to the girder assembly to safeguard that the modules are correctly supported. In the case of an imprecise mounting, the modules could fall down in the worst case.

1. Swivel the module-bearing rail into the pre-assembled fastening plates on the girder assembly.

2. Hammer in the fastening device using a plastic tip hammer. Hold a hammer against the other side of the fastening plate for stabilization reasons.

3. Use a zinc dust primer to coat the top 3 cm of the module-bearing rails.

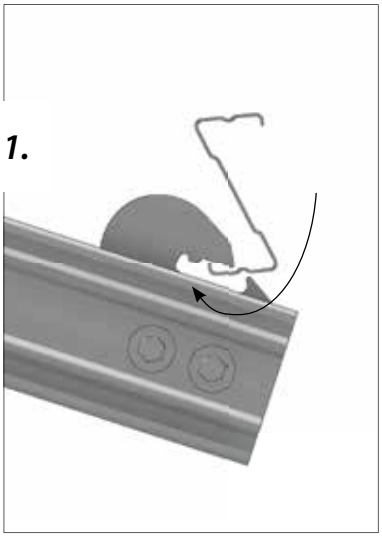


Fig. 5.4.-1 (swiveling in the purlin)

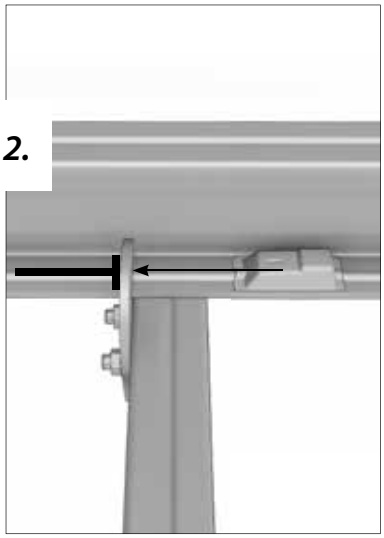


Fig. 5.4.-2 (hammering in the fastening device)

ATTENTION

The fastening plates have slotted holes for fine adjustment and have to be readjusted, if required.

5.4. Mounting the purlin connectors (optional)

When mounting the purlin connectors, please use the designated drilled holes on the module-bearing rails!

1. Fasten each purlin connector with four hexagon head bolts M12x30 DIN933, washers DIN9021 and flange nuts M12 DIN6923 to the module-bearing rail.

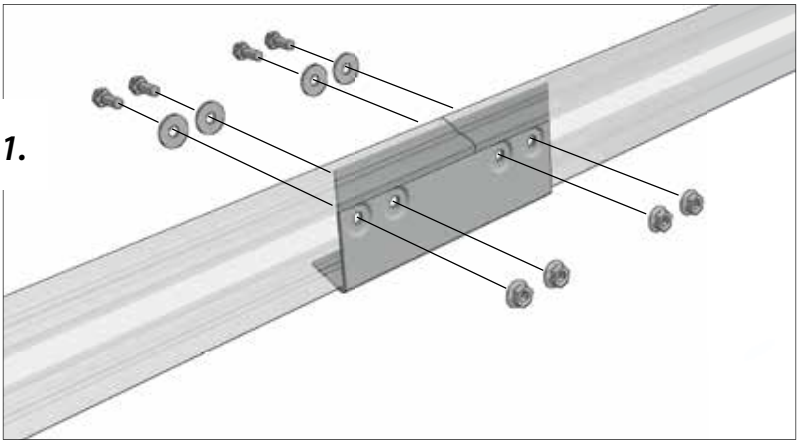


Fig. 5.5.-1 (mounting the purlin connector)

5.5. Mounting the module clamp adapter (optional)

The module clamp adapter must be used in the case of a horizontal bearing of the modules or when using a combined clamping. Moreover, the module clamp adapter is used when the modules are mounted vertically (in portrait), in combination with Rapid 2+ or Standard clamps.

*The exact positions of the module clamp adapters can be referenced in the **technical general layout drawing**.*

NOTICE
Please ensure that no drilling chips are left in the module-bearing rails after screwing the self-drilling screws to avoid contact corrosion!
After positioning the module clamp adapter, please clean the module-bearing rails with a hand brush or cover the module-bearing rail during the screwing process (e.g. with a cardboard).

1. Clip the module clamp adapter onto the Z-purlin at the indicated points.

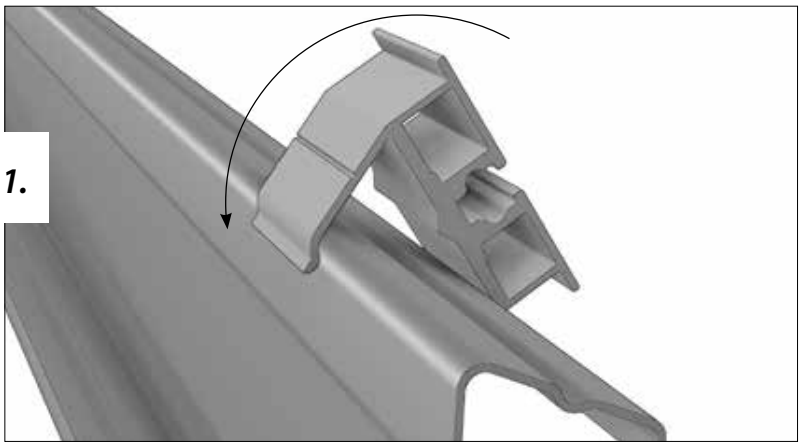


Fig. 5.6.-1 (snapping in the module clamp adapter)

2. Screw the module clamp adapter in the designated hollow space (notch) with a self-drilling screw to the module-bearing rail.

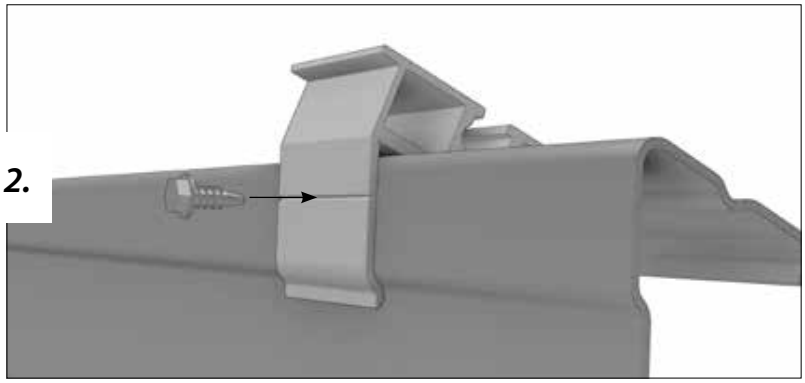


Fig. 5.6.-2 (fastening the module clamp adapter)

6. Module mounting and module clamping

Solar modules are third party components that are not included in the scope of delivery of the FS Uno substructure. Schletter GmbH thus points out that the safety notices and mounting instructions of the module manufacturer are to be observed. And please also note the notices given in these Mounting Instructions when mounting the photovoltaic modules!

The following points must be taken into consideration at any event:

- *Photovoltaic modules are electric devices. They must be treated carefully!*
- *Impacts, kicks, shocks or vibrations must be avoided.*
- *It is not allowed to put loads on the modules (trespassing, storing of items, etc.).*
- *Scratches or dirts on the module surface must be avoided.*
- *It is not allowed to pull or tear at the module cables. Do not heavily bend the module cables.*

The module clamping is carried out according to the project planning (vertical, horizontal or combined module arrangement). The distance between modules can deviate from the standard value.
Standard value:

- clamped side ***23 mm***
- side without clamping ***5 - 10 mm***

(according to the specifications in the technical drawing; specifications by the module manufacturer are considered)

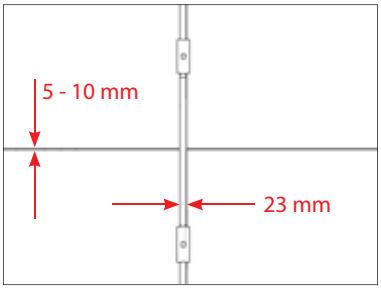


Fig. 6.-1 (distance between modules)

Clearance (= distance between module and module clamp) of

- ***min. 0.5 mm***
- ***max. 2 mm***

must be observed (module abuts on the spacer notches).

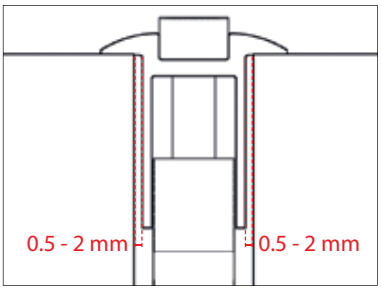


Fig. 6.-2 (clearance)

Observe the clamping points specified by the module manufacturer!
Please note the data sheet of the photovoltaic module provided by the manufacturer to verify the clamping points.

6.1. Module mounting and clamping in the case of vertical module bearing

The modules are fastened with special steel clamps in the case of vertical module arrangements:

1. Attach the module clamp on the rail of the Z-purlin.

Fig. 6.1.-1 (attaching the module clamp)

2. Push the module towards the clamp (observe the clearance!)

Fig. 6.1.-2 (pushing/sliding the module towards the clamp)

3. Fasten hex socket screw with a torque of 8 Nm

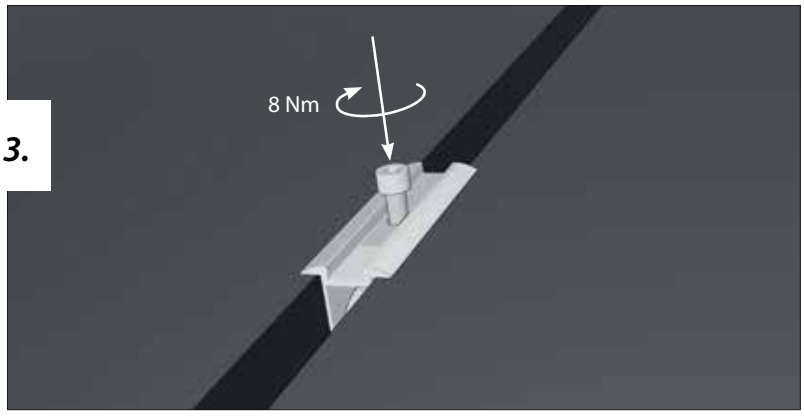


Fig. 6.1.-3 (fastening the hex socket screw)

6.2. Module mounting and clamping in the case of horizontal module bearing

The horizontal module clamping is carried out with a module clamp adapter in combination with Rapid 2+ clamps or Standard clamps:

1. Insert the module clamp into the rail of the module clamp adapter

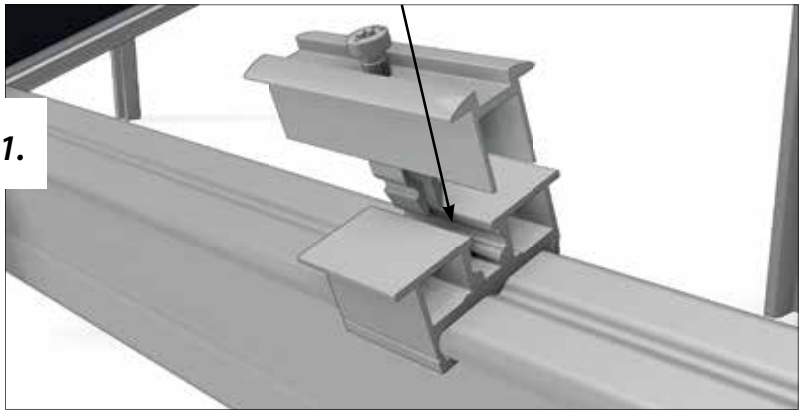


Fig. 6.2.-1 (clicking in the module clamp)

2. Push the module towards the clamp (observe the clearance!)

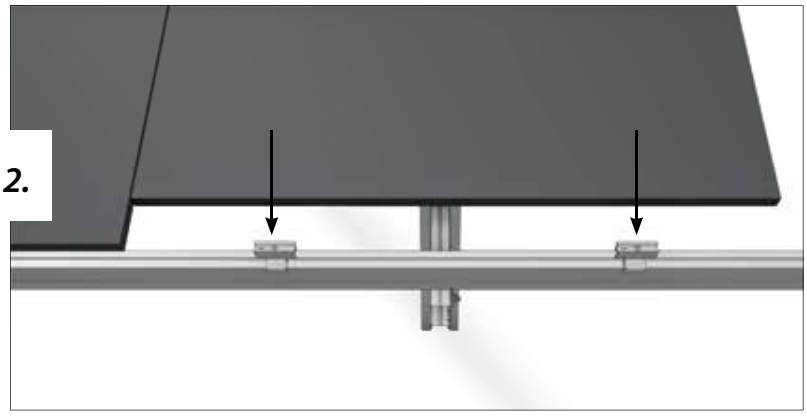


Fig. 6.2.-2 (pushing/sliding the module towards the clamp)

3. Fasten hex socket screw with a torque of 15 Nm

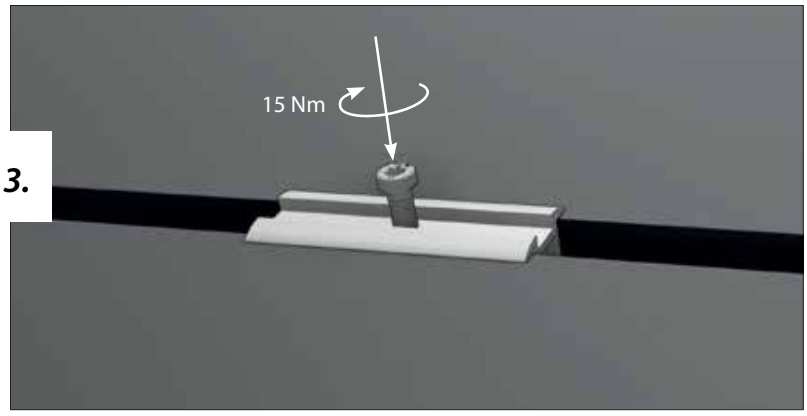


Fig. 6.2.-3 (fastening the hex socket screw)

6.3. Module mounting and clamping in the case of combined module bearing

The combined module clamping is carried out with a module clamp adapter in combination with Rapid 2+ clamps or Standard clamps:

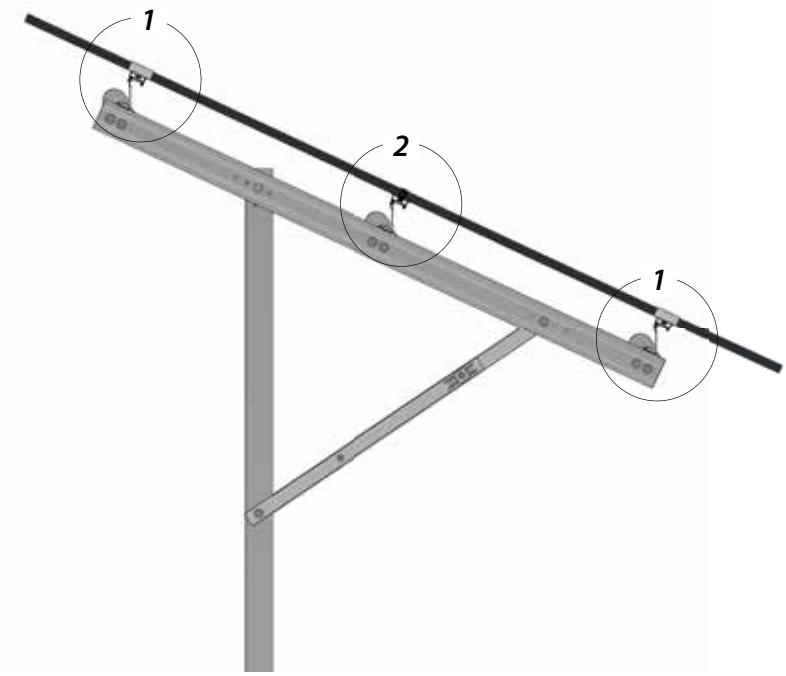


Fig. 6.3.-1 (combined module clamping)

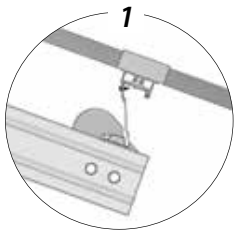


Fig. 6.3.-2.(upper and lower module clamping)

Clamping at the long side of the module to the upper and lower module-bearing rail.

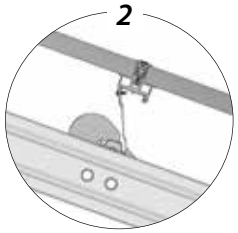


Fig. 6.3.-3 (module clamping at the inner side)

Clamping to the inner module-bearing rails at the short module side (comparable to clamping in the case of horizontal module arrangement)

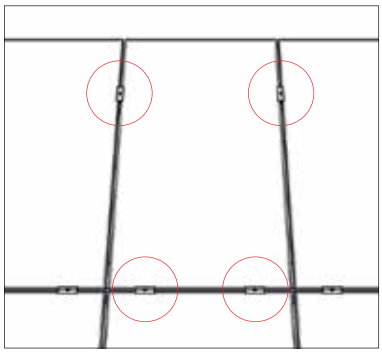


Fig. 6.3.-4 (clamping of the upper module)

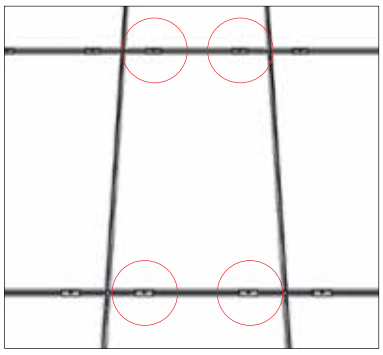


Fig. 6.3.-5 (clamping of the inner module)

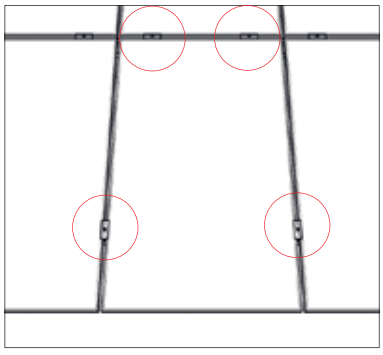


Fig. 6.3.-6 (clamping of the lower module)

7. Disassembly and disposal

DANGER

- *The plant operates with high voltage.*
- *Please note all tutorials and safety guidelines provided by the manufacturer of the modules or electrical components before shutting down the plant.*
- *The plant may only be disconnected from the power supply provided on site by a qualified electrical technician.*

WARNING

- *Always wear protective equipment (safety shoes, hard hat, safety glasses, protective gloves and reflective vest) when disassembling the FS Uno components.*
- *Make sure that no unauthorized persons can enter the danger area.*
- *Do not step under suspended loads!*

- We recommend to wait for the confirmation by a qualified electrical technician regarding the correct decommissioning of the plant before starting the disassembly of the FS Uno.
- Have an accordingly trained professional disassemble the plant in transportable units.
- Observe all information and instructions provided in these Mounting Instructions.
- Also make these Mounting Instructions available to the staff that is in charge of the disassembling operations.
- Ensure that the disassembling operations are performed exactly in reverse order of the mounting steps.

Faulty waste disposal can lead to environmental damage.
With regard to the environment it is recommended to dispose of recyclable materials in an appropriate manner.

Fig. 7.-1 (general recycling symbol)

Properly dispose of components

- Separate the materials steel, plastics, electric scrap, aluminium, stainless steel, copper, brass, etc.
- Dispose of the components in accordance with the local regulations

8. Maintenance and care

We recommend as follows:

INSPECTION OF THE PLANT
- *after exceptional weather conditions (storm, heavy snowfall or rain, etc.)*
- *after natural convulsions (earthquake, landslip, settlements, etc.)*

MAINTENANCE OF THE PLANT
- *Cleaning of the modules*
- *Verification of the bolted connections*
- *Check of the plant regarding corrosion*
- *Maintenance of the access roads and walkways*

REMEDIAL MAINTENANCE OF THE PLANT
after detecting damages on the racks or earth movements (for example removing corrosion, replacement of faulty components, detection of unfastened bolted connections, etc.)

9. Warranty and liability

Generally, the customer is responsible for the proper mounting and installation of the FS Uno.

Exclusions
Guarantee, warranty and liability claims against the manufacturer Schletter GmbH in case of injury to persons or material damage shall be excluded if they result from one or several of the causes listed below:
- Non-observance of the Mounting Instructions and/or maintenance instructions in combination with a warranty extension
- Any use other than the intended use of the FS Uno or faulty operation
- Incorrect mounting, maintenance or repair
- Operation with spare or equipment parts that are faulty or have not been approved by the manufacturer
- Arbitrary constructional modifications or manipulation of the FS Uno or its equipment or components
- Utilization of components made by other manufacturers (third party components)
- Neglect or non-observance of the prescribed maintenance and/or testing and inspection intervals

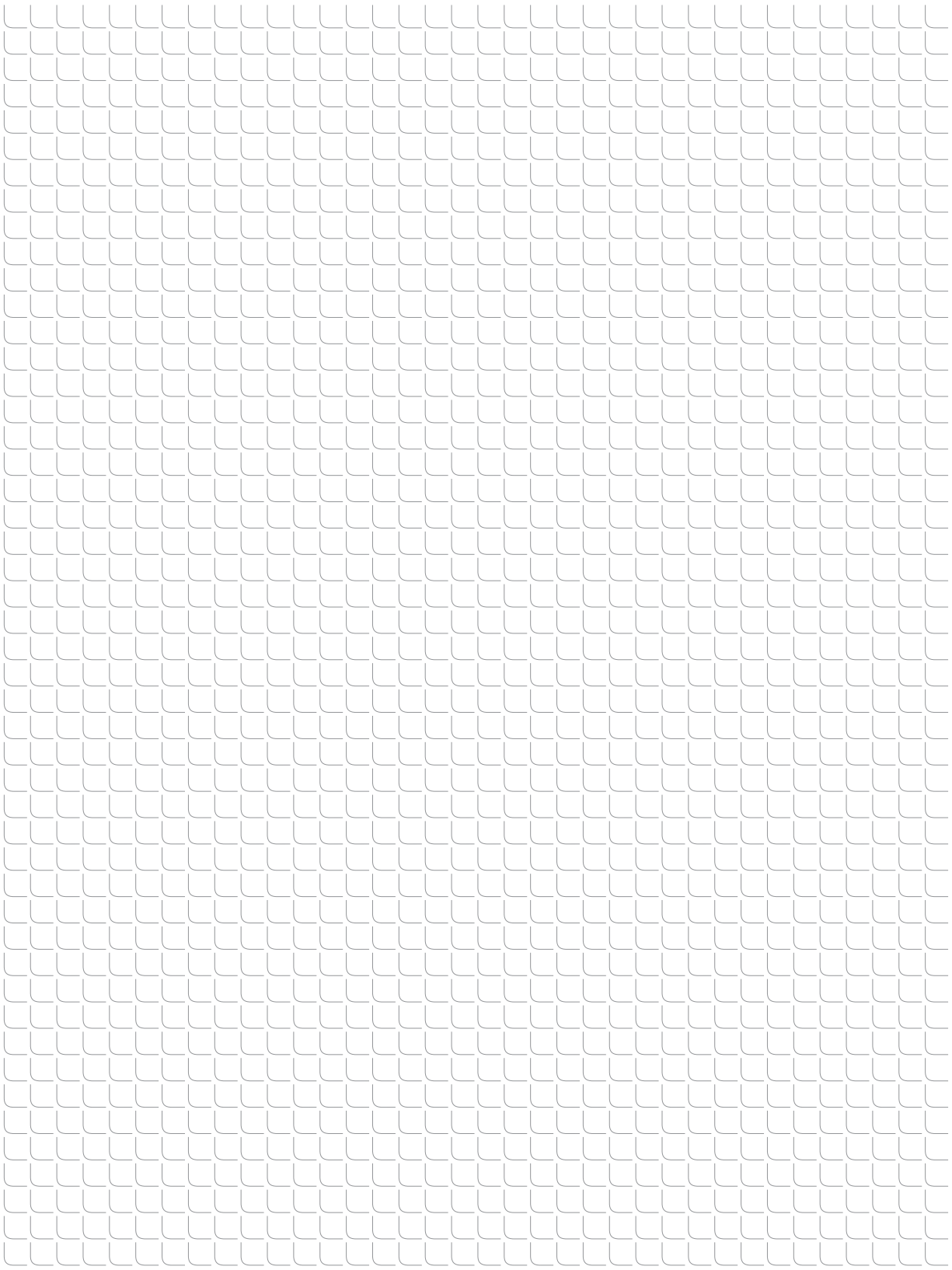
The customer exclusively shall bear the costs for damage or consequential damage that is due to one or several of the causes mentioned above.

The Mounting Instructions as well as the maintenance instructions in combination with a warranty extension refer exclusively to the mechanical metal structure supplied by Schletter GmbH.

Components of the solar plant like modules, cables and plug connectors, inverters or electric switch boxes are not part of these parts of the manual and thus are exempt from warranty and liability by Schletter GmbH.

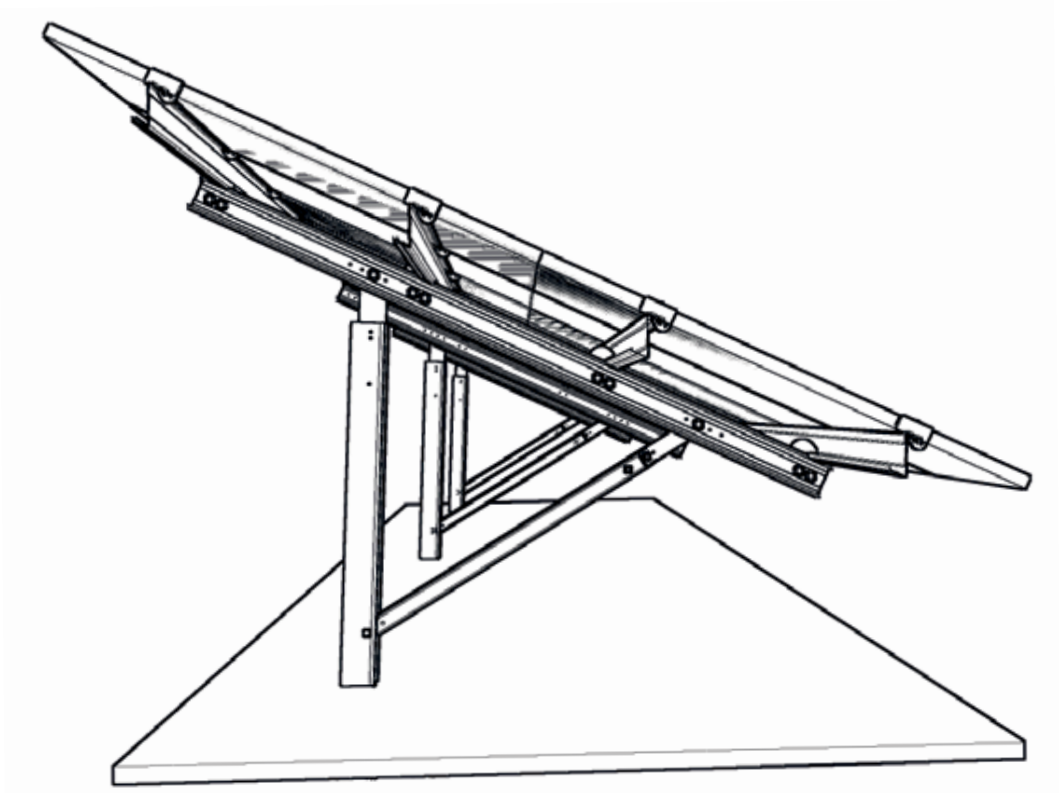
Material damage to objects that are not included in the scope of delivery are generally excluded from any liability.

Notes



FS Uno System

Mounting instructions



CONTENTS **Page**

1 General

1.1. Information

The FS ground-mounted system is customized for the respective installation site. A corresponding detailed structural analysis must be created to determine the required cross sections of the profiles, as well as a geotechnical report to determine the required pile-driving (ramming) depth.
It is compulsory to create a well-arranged and detailed documentation (site journal) where all daily work steps, employment of staff and assembled material are exactly specified.
Please remember that wrong deliveries or damaged components must be reported to Schletter immediately.
If the mounting instructions are not adhered to or components made by other manufacturers are used, Schletter GmbH will not assume any liability for resulting damage or defects.

Only qualified personnel and accordingly trained staff is allowed to carry out mounting operations, drive building site vehicles and operate building machines!

Securing of the working area
Before the start of construction, the building site must be inspected by a supervising person by sight check or using plans showing all supply lines (water, electricity, gas) in the relevant area. For this purpose, the positions of all supply lines (water, gas electricity, etc.) must be marked using marking paint and unstable ground and areas that are landslide-prone must be sealed off with stable barriers or warning signs.

When mounting the solar modules, the safety regulations and mounting instructions of the respective module manufacturer must be observed!

Due to production tolerances, there may be deviations from the dimensions specified in the overview drawing. The specialist company that carries out the mounting operations is responsible for the adaptation of these deviations within the admissible tolerances!

It is compulsory to wear safety vests and safety shoes all the time

Always wear ear protection when carrying out noisy work

Always wear a hard hat when there might be falling objects or if you could hurt your head in some other way.

Wear protective gloves when working with sharp-edged components

Wear respiratory protection when carrying out dusty work

Wear safety glasses when carrying out grinding and abrasive cutting operations and any other operations that are dangerous to your eyes in order to avoid any danger to your eyes caused by flying liquids or parts (sparks, splinters)

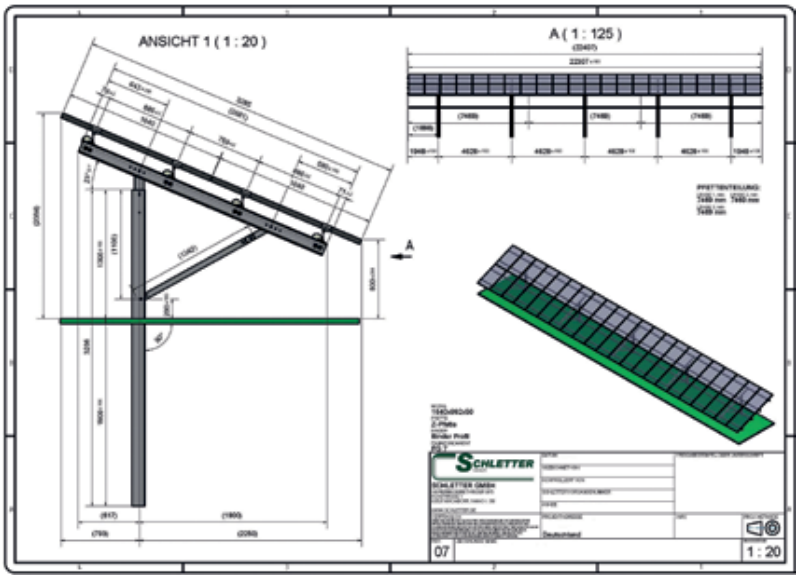
1.2. Planning

An accordant overview drawing is drawn up for each system before delivery. All defined measurements and the positions of the individual components and fasteners are displayed on these drawings. The respective torques are also listed in this instruction.

In the general layout drawing, the components are shown from various perspectives and defined by name. Thus, items, quantities and article numbers on the delivery note can be looked up.

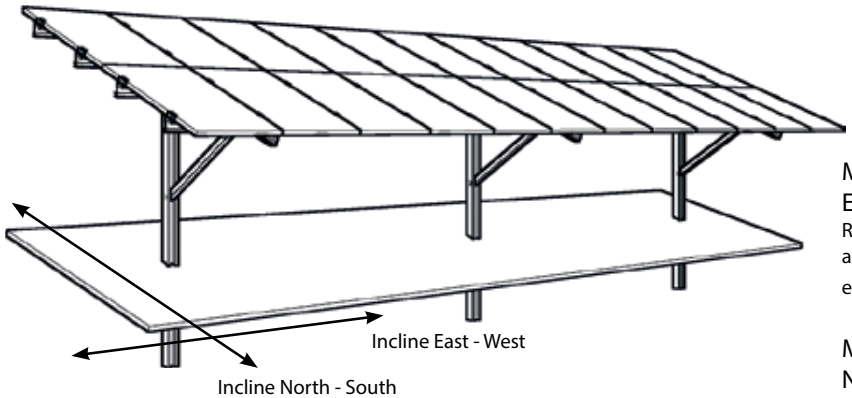
The tolerance values of the individual components must be strictly observed in order to safeguard the structural safety of the solar plant!

Example general layout drawing



1.3. Terrain

When planning the ground-mounted system, make sure that the slope (incline) is within the tolerances. In the following, the guiding values for a structurally safe solar plant are specified.



Maximum admissible slope (incline)
East - West: **3°**
Regarding the structural calculations, additional measures may be required (for example reinforcements)

Maximum admissible slope (incline)
North - South: **35°**
Depending on the condition of the slope (soil composition, rocks, etc.)

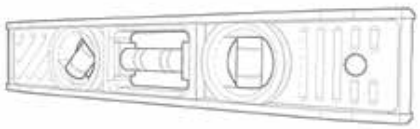
⚠ Pay regard to item 8 "Tolerances regarding terrain topography"!

1.4. Tools list

In the following, the tools that are usually required for the mounting of FS Uno are listed. Additional tools that are required for special cases (for example encasing the foundation piles in concrete) are not listed here.

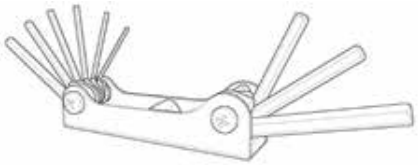
1.4.1. Defining the positions of the pile-driven supports and marking these positions

- Measuring tapes (100 m)
- Line pins (about 20 pieces)
- Mason´s lacing cord
- Club hammer
- Wooden stakes
- Color spray (for ground marking etc.)
- Permanent marker
- Zinc dust primer
- Brush



1.4.2. Pile-driving (ramming)

- Pile-driver (with suitable ram)
- Water level

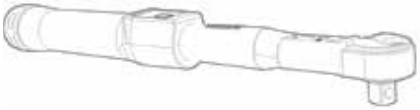


1.4.3. Rack mounting

- Torque wrench (30 Nm to 60 Nm)
- Wrench socket size 17
- Wrench socket size 19
- Hammer
- Club hammer (to hold against the holding plates)
- Plastic tip hammer
- Angle meter - spirit level
- Measuring tape
- Mason´s lacing cord
- Cordless screw driver

1.4.4. Module mounting

- Mason´s lacing cord
- Measuring tape
- Possibly distance template for distances between the modules
- Cordless screw driver
- Wrench socket size 8 for cordless screwdriver
- Allen key size 6 / 40TX key
- Torque wrench (< 8 Nm)
- Allen key socket size 6 / 40TX bit for torque wrench
- Plastic tip hammer (for driving in the nails of the lay-in system)

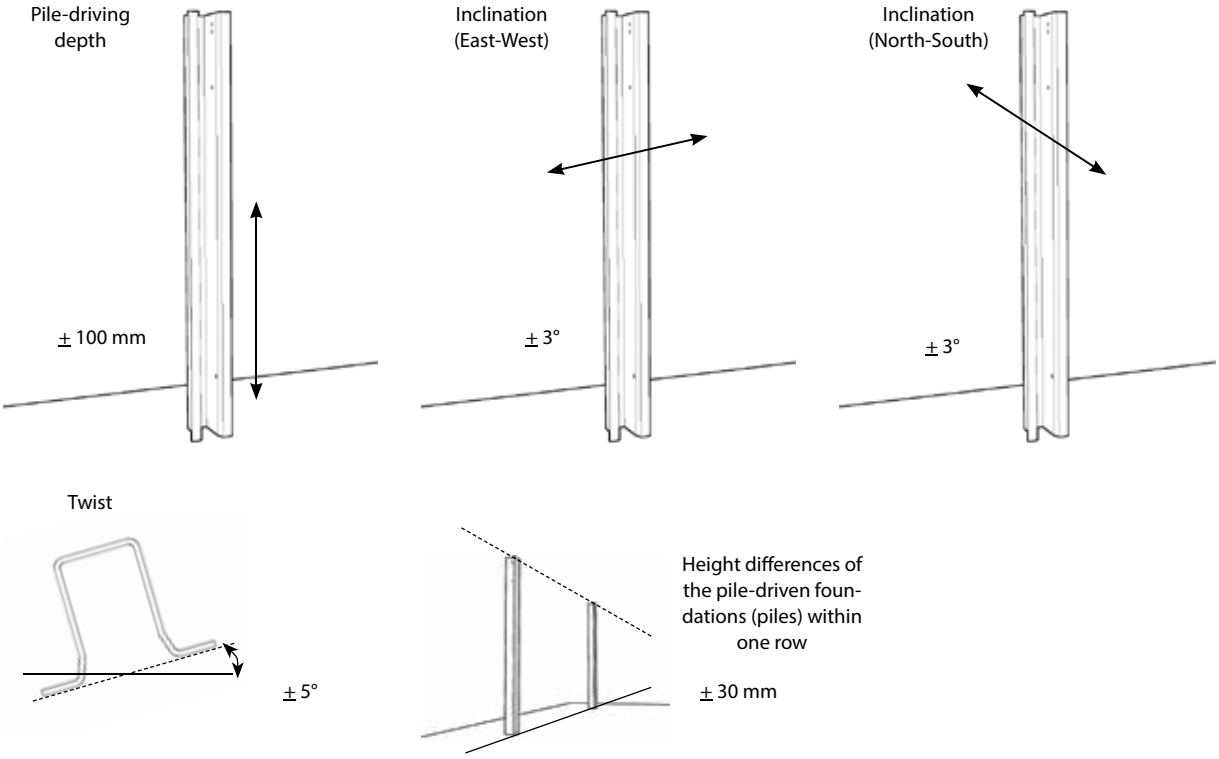


⚠ We recommend using torque wrenches for all bolted connections.
With quick rotation, there is an increased danger of "bolt blocking"!

2 Pile driving (Ramming)

2.1 Positioning

Pile-driving operations must be carried out by specialist companies. Special pile-driving plans are created on the basis of a digital terrain model with exactly specified contour lines. These plans must be available at least one week before the start of the pile-driving operations and must include the positions of the pile-driven foundations and their corresponding dimensions. The position of the first and last pile in each row must be marked on the terrain with a wooden stake. If a row length exceeds 50 meters, additional markings (wooden stakes) must be used within the row.

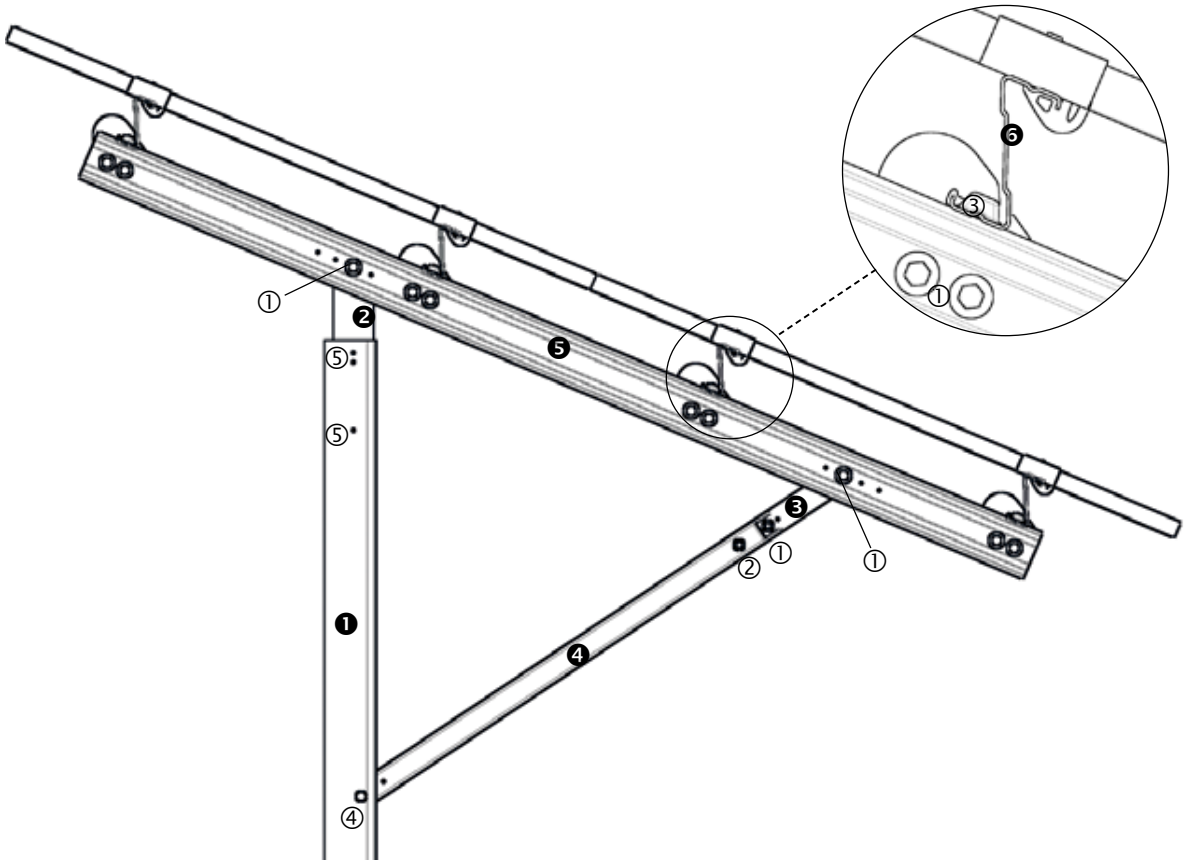


2.2 Pile-driving on difficult subsoil

- Extraordinary driven piles must be clearly identified and documented in a pile-driving plan.
- Inconsistencies during the pile-driving procedure which could affect the adhesive force of the piles must be documented, (e.g. slant position, deceleration and subsequent, sudden acceleration of the penetration speed, swift penetration of the foundation pile while pile-driving etc.).
- All pile-driving procedures deviating from the specifications must be approved by Schletter GmbH.
- If pile-driving operations are impeded by unexpected obstacles (blocks, solid rock on the site), the following procedure must be implemented:

1. Pre-drill down to the target depth.
2. If possible, vacuum the drill cuttings out of the borehole. Otherwise, the drill cuttings that remain in the borehole have to be compacted.
3. The borehole must be filled in layers with compressed concrete of strength C16/20 and compacted.
4. After that, pile-drive the pile without delay.

3 Rack overview



Components

- ❶ Pile-driven foundation (pile-driven support)
- ❷ Steel head
- ❸ Strut connector
- ❹ Strut
- ❺ Girder assembly
- ❻ Purlin

Fasteners

- ① Bolt M12x30, nut M12 and washer DIN9021
- ② Bolt M12x85, nut M12 and washer DIN9021
- ③ Fastening device
- ④ Screw M10x90, nut M10 and washer M10 DIN125
- ⑤ Screw M10x30, nut M10 and washer M10 DIN125

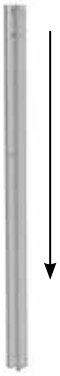
4 Mounting of the individual assemblies

4.1. Drive the foundations into the ground and coat the upper end with a zinc dust primer

⚠ Check the stability of foundations before mounting the racks!

⚠ **Zinc dust primer** is the only coating approved according to the standards to provide the required protection. Basic zinc spray coatings do not provide long-term protection.

⚠ The tolerances specified here must not be exceeded!



Height tolerance of the piles to each other ±**30mm**

Tolerance of N-S and E-W pile inclination ± **3°**

Tolerance of the foundation height in accordance with terrain topography ±**100mm**

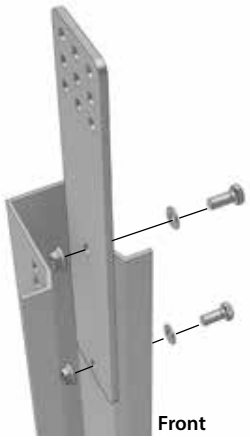
A zinc dust primer is to be used to coat the top 30 mm of the pile-driven foundation (pile), inside and outside.

4.2. Mounting of the head

⚠ Always fasten the bolted connection by turning the bolt head! Do not turn the nut, just hold it!

⚠ Fasten the steel head in the pile-driven foundation at the right (view from the front)!

⚠ Depending on the standard conditions, two respectively three bolted connections per head are required.



Front

Position the steel head to the inner side of the foundation post and fasten it with M10x30 bolts as shown.

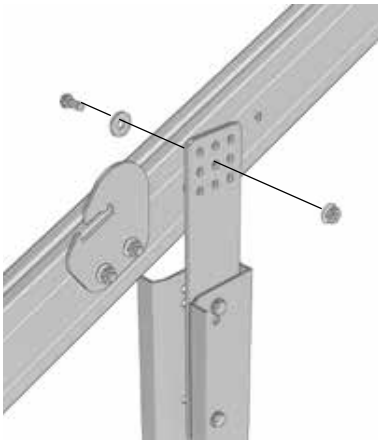
Mounted head assembly group with multiple holes for flexible adjustment

4.3. Mounting of the girders

⚠ Check the torques of all screws!

⚠ Do not fully tighten the bolt on the steel head yet. For the mounting of the strut, the girder must still be movable.

⚠ If required, use the multiple drilling at the steel head for the adjustment and alignment of the girder.

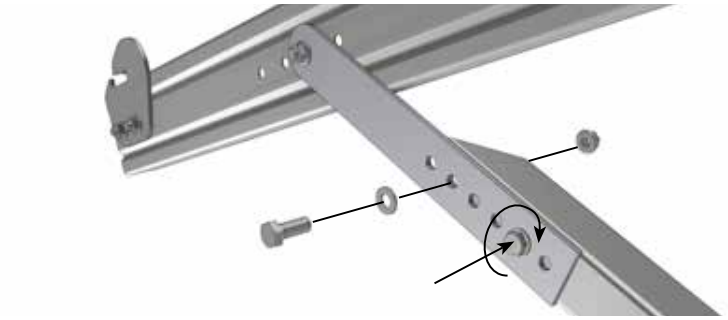


Feed the M12x30 bolt through the predrilled third hole from above through the girder and tighten it loosely with nut and washer to the steel head.

Side view

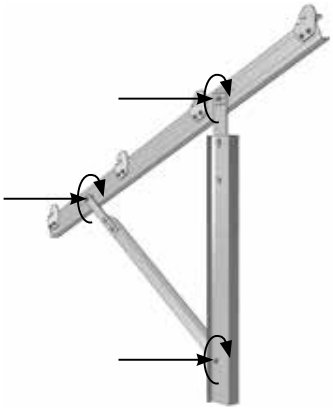
⚠ The strut must be inserted into the open side of the pile-driven profile and fastened.

⚠ Adjust and align the girder according to the desired angle and alignment! If necessary, use the alignment options on the steel head, the girder or on the strut connection to ensure correct alignment of the girder!



Fasten the strut connector with bolt M12x30, big washer DIN 9021 and nut to the strut and tighten both bolted connections according to the torque specifications.

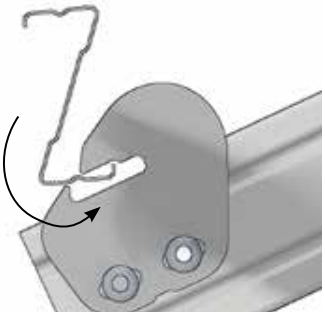
Fold out the strut and fasten it to the pile-driven foundation with a M10x90 bolt, a washer and a M10 nut



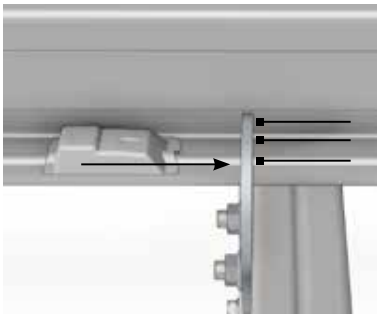
Tighten the bolts on the steel head and strut according to torque specifications

4.4. Mounting of the purlins

⚠ Please note that the purlin must be at a 90° angle to the girder!



Insert the purlin into the pre-assembled fastening plates



Fasten the fastening device by holding one hammer against the fastening plate and knocking in the wedge (fastening device) with a second hammer (plastic tip hammer).

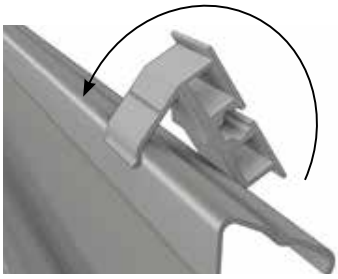
4.5. Mounting of the connectors (optional)

⚠ Use the pre-drilled holes to screw the connectors to the purlins!

Fasten the connector to the purlins, using four M12x30 bolts, DIN 9021 washers and four M12 flange nuts

Side view

4.6. With horizontal module arrangement or vertical and horizontal module arrangement at the same time, mount a module clamp adapter (optional with vertical arrangement of the modules)



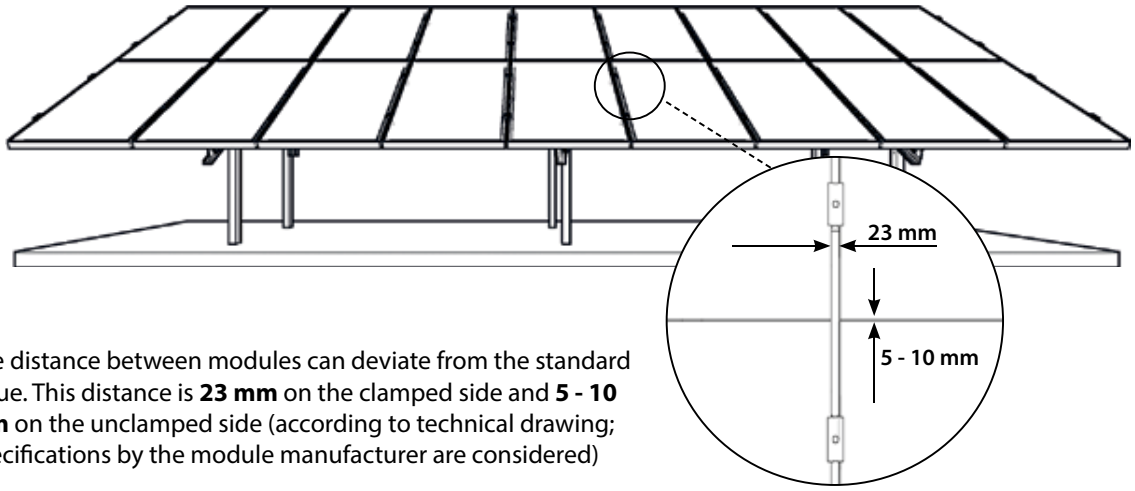
Snap the module clamp adapter onto the Z-purlin at the indicated points

Side view

Fasten the module clamp adapter to the Z-purlin using a drilling screw

5 Module mounting and module clamping

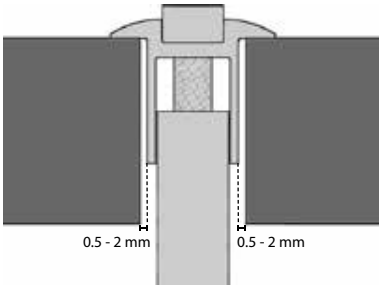
The modules are mounted with suitable module clamps depending on the module arrangement (horizontal, vertical, combined module arrangement). The clamps are attached onto the module-bearing profile or the module clamp adapter and are tightened with screws.



The distance between modules can deviate from the standard value. This distance is **23 mm** on the clamped side and **5 - 10 mm** on the unclamped side (according to technical drawing; specifications by the module manufacturer are considered)

⚠ **When mounting the modules, always consider the clamping points specified by the module manufacturer!**

⚠ **Make sure that the distance from the module to the clamp is at least 0.5 mm and not more than 2 mm!**
(= distance between module and module clamp, see picture on the right)



5.1. Module clamping with vertical module arrangement

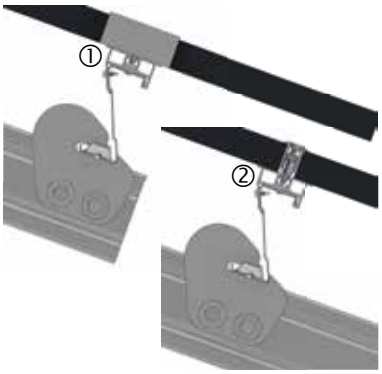
When mounting the modules, the module clamp screws must be tightened with a torque of 8 Nm!

Optionally, the vertical module mounting can also be carried out in combination with the module clamp adapter and Rapid 2+ or Standard clamps.

5.2. Module clamping with horizontal module arrangement

Attach the Rapid 2+ or Standard clamp on the module clamp adapter and fasten it with a tightening torque of 14 Nm.

5.3. Module clamping with horiziontal and vertical module arrangement at the same time



Attach the Rapid 2+ or Standard clamp on the module clamp adapter and fasten it with a tightening torque of 14 Nm.

① Clamping at the long sides of the module to the uppermost and to the lowermost purlin.

② Clamping to the middle purlins at the short module sides (comparable to clamping with horizontal module arrangement)

5.5. Module clamp overview

Module clamps for vertical module mounting

	Steel clamp			Rapid clamp*		Standard clamp*	
Module height	**End clamp left**	**Middle clamp**	**End clamp right**	**End clamp**	**Middle clamp**	**End clamp**	**Middle clamp**
20 mm	---	---	---	---	---	130001-020	130002-000
24 mm	---	---	---	---	---	130001-024	130002-000
28 mm	---	---	---	---	---	130001-028	130002-000
30 mm	144912-030	144910-001	144911-030	131001-030	131002-000	130001-030	130002-000
31 mm	144912-031	144910-001	144911-031	131001-031	131002-000	130001-031	130002-001
32 mm	144912-032	144910-001	144911-032	131001-032	131002-000	130001-032	130002-001
33 mm	144912-033	144910-002	144911-033	131001-033	131002-000	---	---
34 mm	144912-034	144910-002	144911-034	131001-034	131002-000	130001-034	130002-001
35 mm	144912-035	144910-002	144911-035	131001-035	131002-000	130001-035	130002-001
36 mm	144912-036	144910-002	144911-036	131001-036	131002-000	130001-036	130002-001
37 mm	144912-037	144910-002	144911-037	131001-037	131002-000	---	---
38 mm	144912-038	144910-003	144911-038	131001-038	131002-000	130001-038	130002-001
39 mm	144912-039	144910-003	144911-039	131001-039	131002-000	---	---
40 mm	144912-040	144910-003	144911-040	131001-040	131002-001	130001-040	130002-001
41 mm	144912-041	144910-003	144911-041	131001-041	131002-001	130001-041	130002-001
42 mm	144912-042	144910-003	144911-042	131001-042	131002-001	130001-042	130002-001
43 mm	144912-043	144910-004	144911-043	131001-043	131002-001	130001-043	130002-001
44 mm	144912-044	144910-004	144911-044	131001-044	131002-001	130001-044	130002-001
45 mm	144912-045	144910-004	144911-045	131001-045	131002-001	130001-045	130002-001
46 mm	144912-046	144910-004	144911-046	131001-046	131002-001	130001-046	130002-001
47 mm	144912-047	144910-004	144911-047	131001-047	131002-001	---	---
48 mm	144912-048	144910-005	144911-048	131001-048	131002-001	130001-048	130002-001
49 mm	144913-049	144910-005	144913-049	131001-049	131002-001	---	---
50 mm	144913-050	144910-005	144913-050	131001-050	131002-001	130001-050	130002-001
51 mm	---	---	---	---	---	130001-051	130002-001

*** in combination with module clamp adapter**

Steel module clamps (V mounting)

Rapid module clamps

Standard module clamps

Module clamps for horizontal module mounting

	Rapid clamp*		Standard clamp*	
Module height	**End clamp**	**Middle clamp**	**End clamp**	**Middle clamp**
20 mm	---	---	130001-020	130002-000
24 mm	---	---	130001-024	130002-000
28 mm	---	---	130001-028	130002-000
30 mm	131010-030	131012-000	130001-030	130002-000
31 mm	131010-031	131012-000	130001-031	130002-001
32 mm	131010-032	131012-000	130001-032	130002-001
33 mm	131010-033	131012-000	---	---
34 mm	131010-034	131012-000	130001-034	130002-001
35 mm	131010-035	131012-000	130001-035	130002-001
36 mm	131010-036	131012-000	130001-036	130002-001
37 mm	131010-037	131012-000	---	---
38 mm	131010-038	131012-000	130001-038	130002-001
39 mm	131010-039	131012-000	---	---
40 mm	131010-040	131012-001	130001-040	130002-001
41 mm	131010-041	131012-001	130001-041	130002-001
42 mm	131010-042	131012-001	130001-042	130002-001
43 mm	131010-043	131012-001	130001-043	130002-001
44 mm	131010-044	131012-001	130001-044	130002-001
45 mm	131010-045	131012-001	130001-045	130002-001
46 mm	131010-046	131012-001	130001-046	130002-001
47 mm	131010-047	131012-001	---	---
48 mm	131010-048	131012-001	130001-048	130002-001
49 mm	131010-049	131012-001	---	---
50 mm	131010-050	131012-001	130001-050	130002-001
51 mm	---	---	130001-051	130002-001

*** in combination with module clamp adapter**

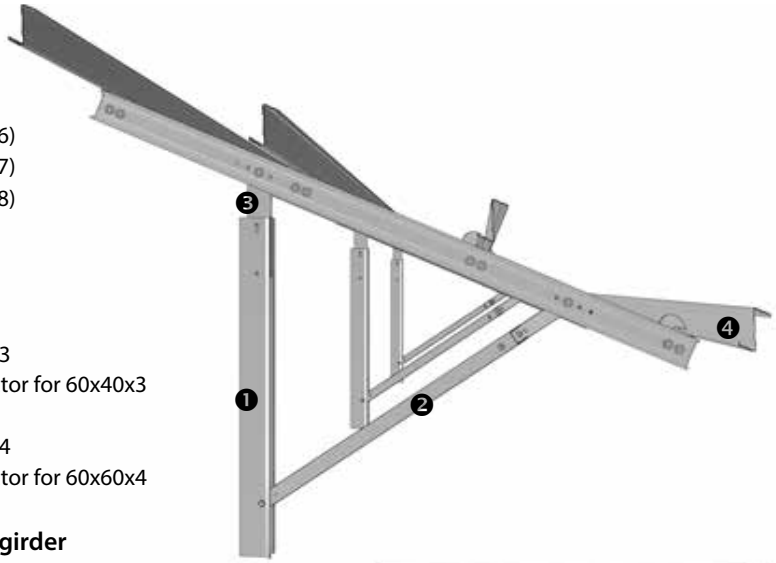
The Standard clamps are not pre-assembled when they are delivered. These clamps are combined with a socket head screw, a KlickIn click component and a square nut. The screws listed below can be used for that purpose:

Frame height	Suitable socket head screw mm	Item number	Name
20	25	943308-125	M8x25 socket head screw with serrated flange
24	30	943308-130	M8x30 socket head screw with serrated flange
28-30	35	943308-135	M8x35 socket head screw with serrated flange
31-35	20	943308-120	M8x20 socket head screw with serrated flange
36-40	25	943308-125	M8x25 socket head screw with serrated flange
41-45	30	943308-130	M8x30 socket head screw with serrated flange
46-51	35	943308-135	M8x35 socket head screw with serrated flange
129010-008		KlickIn click component	
943914-008		Square nut M8, V4A	

With big order quantities, clamps for other module thicknesses can be manufactured on request!

With big order quantities, the clip-on profiles for lay-in mounting can also be manufactured for other module thicknesses on request.

6 Components list



❶ Pile-driven foundation FG

143006-002	Foundation pile (FG6)
143007-004	Foundation pile (FG7)
143008-003	Foundation pile (FG8)

❷ Strut and connector

144970-002	FS Uno strut 60x40x3
000017-435	FS Uno strut connector for 60x40x3

Alternatively:

144970-001	FS Uno strut 60x60x4
000017-434	FS Uno strut connector for 60x60x4

❸ Connector for foundation pile FG - girder

000010-203	FS Uno/Uno 100 steel head


Steel head

❹ Module-bearing rail (custom cut)

144901-001	FS Uno/Duo purlin
144999-003	FS Uno/Duo fastening device


Fastening device

Module clamp adapter

144919-050	FS steel module clamp adapter kit (incl. drill screw)

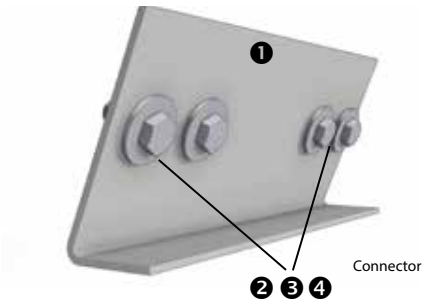

Module clamp adapter

Module-bearing rail - connector (optional)

144999-008	FS Uno/Duo purlin connector Gen2 kit

consisting of:

000014-577	❶	1x FS Uno/FS Duo purlin connector Gen2
943922-012	❷	4x washer large M12 DIN9021 A2
943612-030	❸	4x hexagon head bolt M12x30 DIN933 A2
943912-012	❹	4x flange nut M12 serrated DIN6923 A4

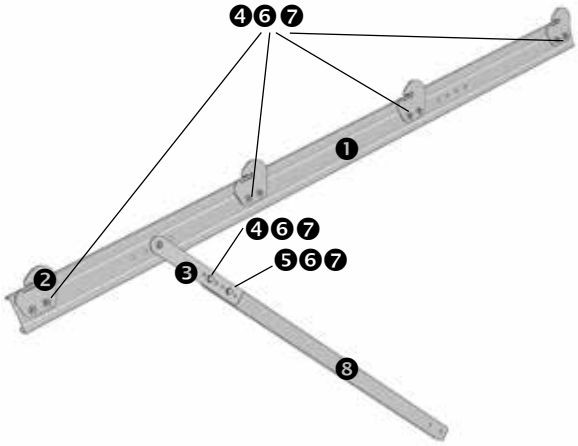


Connector

Girder assemblies (optionally pre-assembled)

consisting of:

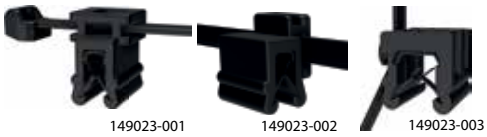
*144YXX-ZZZ**	❶	1x girder custom cut * varying depending on girder assembly: XX: Number of installed modules Y: System type ZZZ: H or V arrangement
144999-006	❷	*x FS Uno/Duo fastening plate
000017-43x	❸	1x FS Uno/Uno100 strut connector
943612-030	❹	*x Bolt M12x30 DIN 933 A2
943000-748	❺	1x Bolt M12x85 DIN 933 A2
943912-012	❻	*x Flange nut M12 DIN 6923 A4
943922-012	❼	*x Washer large M12 DIN 9021 A2
144970-00x	❽	1x FS Uno strut * varying depending on girder assembly



144101-000	FS Uno girder assembly 1V custom cut
144102-200	FS Uno girder assembly 2V custom cut
144103-200	FS Uno girder assembly 3V custom cut
144101-000	FS Uno girder assembly 1H custom cut
144102-100	FS Uno girder assembly 2H custom cut
144103-100	FS Uno girder assembly 3H custom cut
144104-100	FS Uno girder assembly 4H custom cut

Auxiliary equipment / accessories

964000-176	Zinc dust silver-grey satin-finished
149023-001	Cable fastener 1.0 - 3.0 mm, guidance at the top
149023-002	Cable fastener 1.0 - 3.0 mm, guidance at the side
149023-003	Cable fastener 3.0 - 6.0 mm
144999-009	FS Uno/FS Duo cable fastener for purlin
144999-010	Ductwork

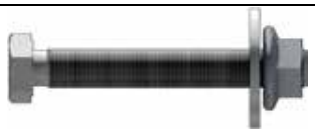
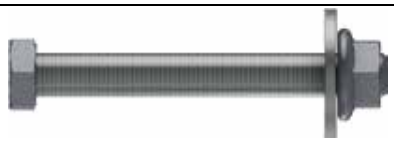


149023-001 149023-002 149023-003

Purlin cable fastener for the fastening of cable conduits

7 Torque specifications

7.1. Bolted connections in the substructure

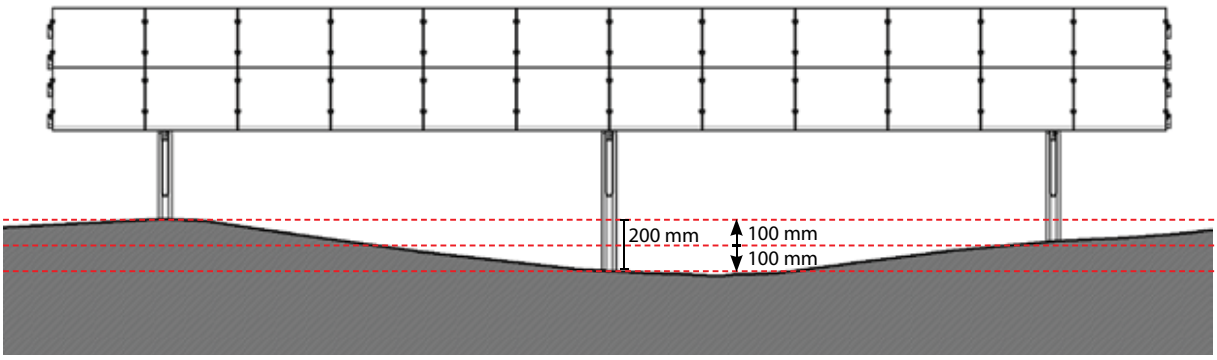
Picture	Name	Tightening torque (MA-Nm)
	Hexagon head bolt DIN 933 - M12x30 A2 GMB Hexagon nut DIN6923 - M12 A4 Washer DIN9021 - M12 A2 Hexagon head bolt DIN 933 - M10x30 GMB	56 Nm 32 Nm
	Hexagon head bolt DIN 933 - M12x85 A2 GMB Hexagon nut DIN6923 - M12 A4 Washer DIN9021 - M12 A2	56 Nm
	Hexagon head bolt DIN 931 - M10x90 GMB Hexagon nut DIN6923 - M10 A4 Washer DIN9021 - M10 A2	32 Nm

7.2. Fastening of the module clamps

Picture	Name	Tightening torque (MA-Nm)	Type of module mounting
Standard module clamps 	Socket head screw DIN4762 - M8 (20 - 35 mm) KlickIn click component for nut M8 Square nut DIN557 A4 - M8	14 Nm	H and V in combination with module clamp adapter
Steel module clamps 	Socket head screw DIN912 A2 - M8 (25 - 45 mm)	8 Nm	V
Rapid 2+ module clamps 	TX-drive stud screw A2 GMB - M8 (42.5 - 55 mm)	14 Nm	H and V in combination with module clamp adapter

Always fasten the bolted connection by turning the bolt head! When checking the prestress of the bolts, it has to be considered that constraints and frictional forces can lead to a loss of clamping force. This was taken into consideration when the tightening torques were determined. When a bolted connection is checked, it must not loosen when 50% of the specified tightening torque is applied.

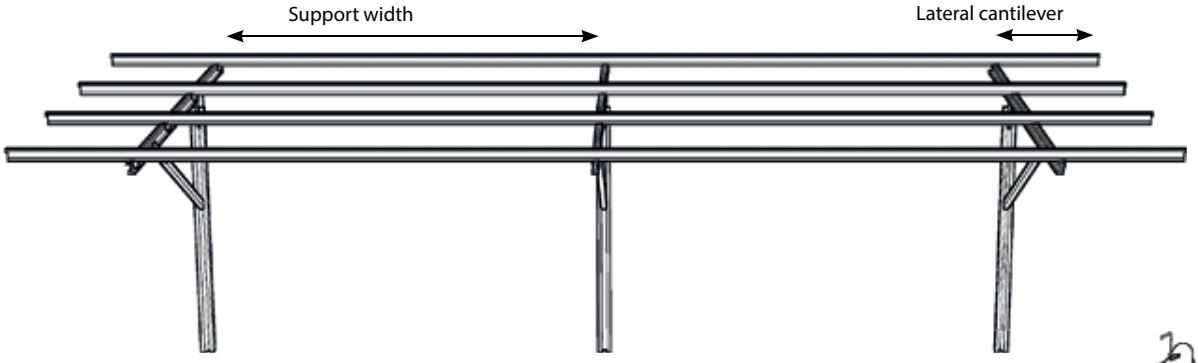
8 Tolerances regarding terrain topography



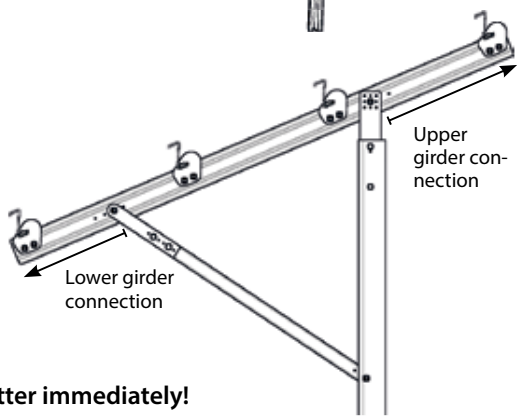
Individual Schletter racks are not parallel to the subsoil below them. Height differences of the subsoil under a rack can be equalized with the driven piles. Please already align the piles with a cord when pile-driving. The tolerance of the anchoring depth is ±100 mm (see picture).

9 Tolerances regarding rack mounting

Schletter mounting racks for ground-mounted solar plants are always custom-dimensioned to withstand the wind and snow loads at the respective location. In the interest of economic efficiency, usually the maximum load-bearing capacity of the individual components is exploited. To achieve this, however, the racks must be mounted with the utmost precision. If there are significant deviations from the mounting plans, this can lead to structural overstress which in turn can lead to damage cases. Schletter will not assume any liability for such damage cases. Adherence to the specified tolerances is therefore essential to the structural safety of the rack.



Support width	± 150 mm
Lateral cantilever of purlins	± 100 mm
Lower girder connection	± 100 mm
Upper girder connection	± 100 mm
Clearance between module and clamp	0.5 to 2 mm



In the event of deviation, this must be communicated to Schletter immediately!

© Schletter GmbH · Gewerbegebiet an der B15 · Alustraße 1 · 83527 Kirchdorf/Haag i. OB · Germany · Tel.: +49 8072 9191-200
Fax: +49 8072 9191-9200 · E-mail: solar@schletter.eu · www.schletter.eu · Updated 03/2016 · Subject to change without notice
Your contact in the UK: Schletter UK Limited, Tel.: +44 1296 461 800, Fax: +44 1296 461 801, E-mail: info@schletter.co.uk

FS II

Mounting Instruction

CONTENTS

1 General

1.1 Information

The FS open area system is customized to each individual location. A corresponding detailed structural analysis must be carried out to determine the cross section, as well as a geotechnical report to identify the depth required for pile driving.

1.2 Planning

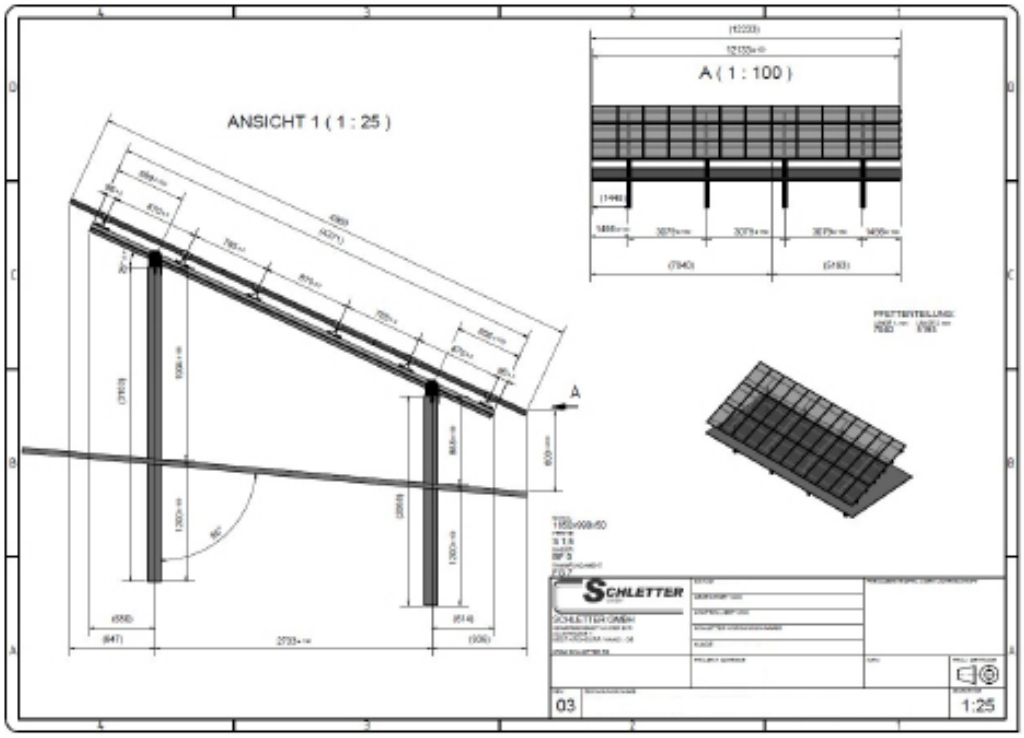
A general layout drawing and a screw layout plan are drawn up for each system prior to delivery. Defined measurements and the position of individual components and connecting materials must all be discernible on these drawings. The recommended torque specifications are outlined in this mounting instruction under Point 5.

In the general layout drawing the components of one cross-section must be displayed with their corresponding dimensions. A parts list is supplied with the drawing. Items, quantities and article numbers can therefore be referenced on both the delivery note and on the detail drawing.

Example parts list

Rammfundament	Bezeichnung	Artikelnummer	Länge in mm	A-Mass in mm	je Tisch	Gesamt:
FG7	Rammfundament (FG7)	143007-000	2.068	0	4	16
FG7	Rammfundament (FG7)	143007-000	3.103	0	4	16
Binder	**Bezeichnung**	**Artikelnummer**	**Länge in mm**		**Stückzahl**	
FS3V-BF0	Binderbaugruppe FS3V-BF0	146130-000			4	16
	incl. Binder BF 0	124500-001	4.371		4	16
Pfetten	**Bezeichnung**	**Artikelnummer**	**Länge in mm**		**Stückzahl**	
S1,5	**Modultragprofil S1,5**	**124303-001**	**7.040**		6	24
	Modultragprofil S1,5	**124300-001**	**5.193**		6	24
Verbinder	**Bezeichnung**	**Artikelnummer**			**Stückzahl**	
S1,5	**Verbinder S1,5 Set**	**129303-000**			6	24
Modulklemmen	**Bezeichnung**	**Artikelnummer**			**Stückzahl**	
50	**Endklemme 50mm**	**130001-050**			12	48
	Modulmittelklemme ab 31mm	**130002-001**			66	264

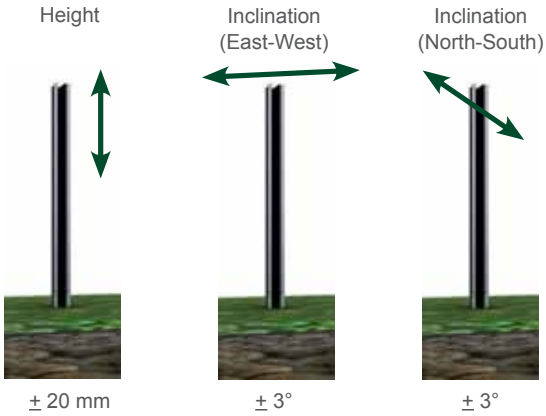
Example general layout drawing



2 Pile driving (Ramming)

2.1 Positioning

Pile driving work must be undertaken by specialist companies. In order to ensure a smooth workflow, pile-driving plans must be generated by the client based on our rack drawings. These plans must be available at least one week prior to the beginning of the pile-driving operations. These plans must include the positions of the piles and their corresponding dimensions. The position of the first and last pile of each row must be marked on the terrain with a wooden stake. If a row length exceeds 50 meters, additional stakes must be used to mark out the row.



2.2 Pile-driving on difficult subsoil

- Irregular pile-driven profiles must be clearly identified and documented in a pile driving plan.
- Inconsistencies in the terrain which could hinder pile driving efforts must be documented, (e.g. slant position, deceleration and subsequent sudden acceleration of the penetration speed, swift penetration of the pile while pile-driving etc.).
- All pile-driving procedures derogating from the specifications must be approved by Schletter GmbH.
- If pile-driving operations are impeded by unexpected obstacles (blocks, solid rock on the site), the following procedure must be implemented:

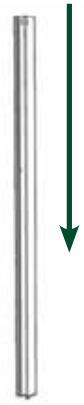
1. Pre-drill to the target pile-driving depth.
2. Clear the borehole. Alternatively, the remaining cuttings should be compacted.
3. The borehole must be filled in layers with compressed concrete of strength C16/20 then compacted.
4. The post should then be driven without delay.

3 Mounting individual assemblies

1. Drive the piles and coat with a zinc dust primer

⚠ Verify stability of the piles prior to mounting the racks!

⚠ Zinc dust primer is the only coating approved, according to the standards, to provide the required protection. Basic zinc spray coatings do not provide long-term protection.



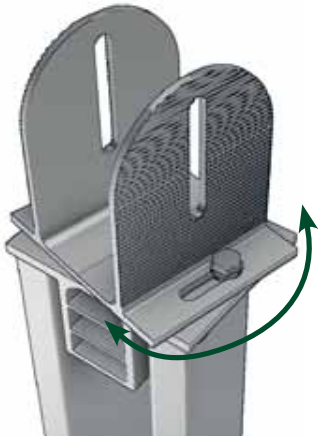
Tolerance of N-S and O-W inclination **+-3°**

Tolerance of the pile height in accordance with terrain topography **+-100mm**

A zinc dust primer should be used to coat the top 3cm of the profile, inside and out

2. Mount and adjust the head

⚠ Components must be accurately adjusted to avoid cumulative tension in the module. The foundation heads are aligned with the help of a string line.
Once the head assembly has been aligned, please verify the torque of the bolts!

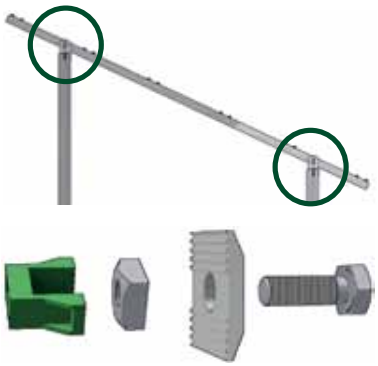


Adjust the head assembly

3. Mount the girders

⚠ Verify the torque of all screws! Readjust the inclination of the girder if required!

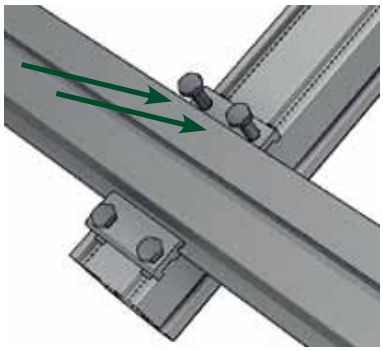
Mount and fasten the pre-assembled girder assembly to both head assemblies using two M10x30 screws, two base clamps and two Klickin components in each case.



4. Mount purlins

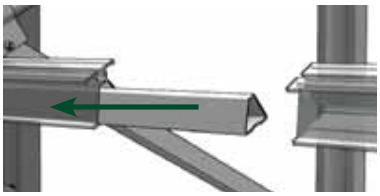
⚠ Please note that the purlin must be mounted at a 90°-angle to the girder! The distances between purlins must be observed as specified in the drawing!

Loosen the upper mounting clamp and slide the purlin into the lower clamp

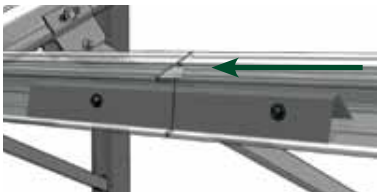


Tighten the mounting clamp

5. Mounting the splice (optional)



Slide one half of the splice into the purlin and fasten with an EJOT screw

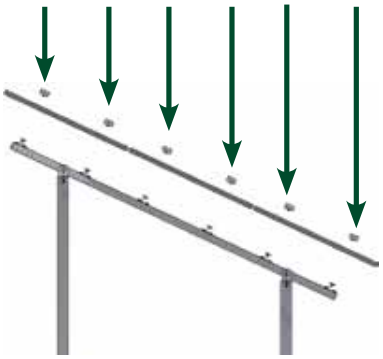


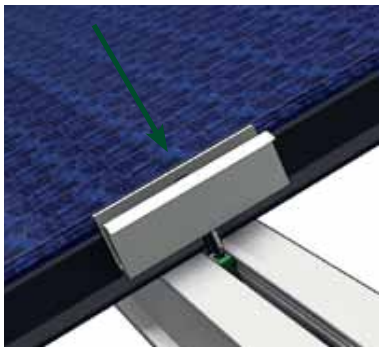
Mount the next purlin and fasten with an EJOT screw

6. Module mounting

⚠ Please observe the manufacturer stipulations regarding clamping points when mounting modules!

⚠ Verify stability of all mounted module clamps!





Tighten module clamps

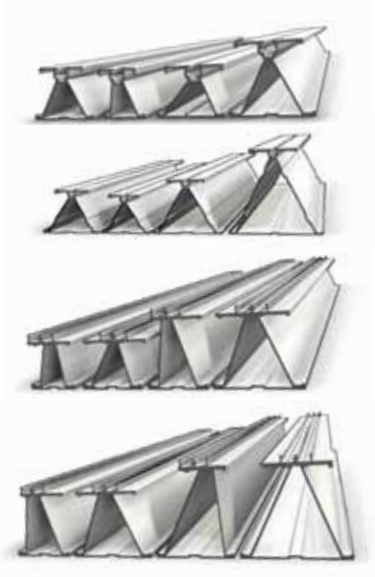
4 Components list

Foundation post

143007-000	Foundation post (FG7) custom cut
143008-000	Foundation post (FG8) custom cut

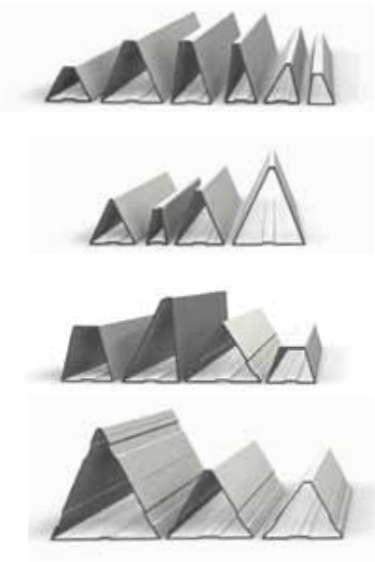
Module-bearing rail (custom cut)

124300-001	Module-bearing rail S0
124301-001	Module-bearing rail S1 exterior
124302-001	Module-bearing rail S1 interior
124303-001	Module-bearing rail S1.5
124307-001	Module-bearing rail S1.8
124304-001	Module-bearing rail S2
124400-001	Module-bearing rail KP0 exterior
124401-001	Module-bearing rail KP0 interior
124402-001	Module-bearing rail KP1 exterior
124403-001	Module-bearing clamp KP1 interior
124404-001	Module-bearing rail KP1.5 exterior
124405-001	Module-bearing rail KP1.5 interior
124406-001	Module-bearing rail KP2 exterior
124407-001	Module-bearing rail KP2 interior
124700-001	Module-bearing rail Optibond OS0
124701-001	Module-bearing rail Optibond OS1



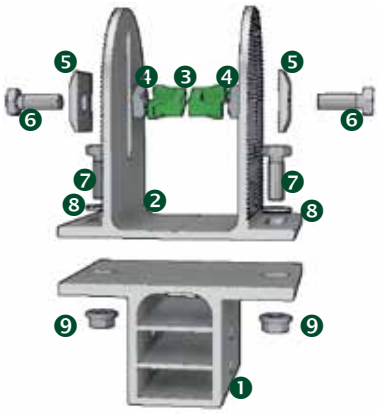
Module-bearing rail - splice (optional)

129300-000	Splice for module-bearing rail S0 kit
129301-000	Splice for module-bearing rail S1 kit
129303-000	Splice for module-bearing rail S1.5 kit
129304-000	Splice for module-bearing rail S2 kit
129305-000	Splice for module-bearing rail S3 kit
129306-000	Splice for module-bearing rail S1.5 kit
129307-000	Splice for module-bearing rail S4 kit
129400-000	Splice for module-bearing rail KP0 kit
129401-000	Splice for module-bearing rail KP0 kit internal
129402-000	Splice for module-bearing rail KP1 kit exterior
129403-000	Splice for module-bearing rail KP1 kit interior
129404-000	Splice for module-bearing rail KP1.5 kit exterior
129405-000	Splice for module-bearing rail KP1.5 kit interior
129406-000	Splice for module-bearing rail KP2 kit interior
129407-000	Splice for module-bearing rail KP2 kit exterior
129600-000	Splice for module-bearing rail OptibondS0 kit
129601-000	Splice for module-bearing rail OptibondS1 kit



Head assembly group

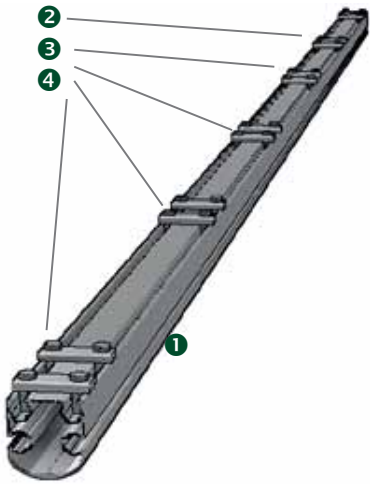
142500-001	❶ 1x foundation collar
142500-005	❷ 1x foundation head
129010-010	❸ 2x KlickIn components M10
943914-010	❹ 2 x square nut M10
147005-000	❺ 2 x base clamp
943610-030	❻ 2 x hexagon head screw M10x30
943610-030	❼ 2 x hexagon head screw M10x30
943921-010	❽ 2 x washer M10
943912-010	❾ 4x flange nut M10



Girder assemblies (pre-assembled)

each consisting of:

1xxxxx-001	❶ 1x girder BF
or 1xxxxx-001	1x girder BF
or 1xxxxx-001	1x girder BF
129010-001	❷ *x KlickIn click component for nut M10
943914-010	❸ *Nut M10 square DIN557
943610-025	❹ *x bolt M10x25 hex DIN933
141006-000	❺ *x mounting clamp 40 mm
141006-004	❻ Mounting clamp new 40mm terminal
943610-080	❼ *x Mounting clamp new 40 mm open
	* variable depending on girder assembly



146510-000	Girder assembly 1H-BF0
146511-000	Girder assembly 1H-BF1
146512-000	Girder assembly 1H-BF2
146513-000	Girder assembly 1H-BF3
146110-000	Girder assembly 1V-BF0
146111-000	Girder assembly 1V-BF1
146112-000	Girder assembly 1V-BF2
146113-000	Girder assembly 1V-BF3
146520-000	Girder assembly 2H-BF0
146521-000	Girder assembly 2H-BF1
146522-000	Girder assembly 2H-BF2
146523-000	Girder assembly 2H-BF3
146120-000	Girder assembly 2V-BF0
146121-000	Girder assembly 2V-BF1
146122-000	Girder assembly 2v-BF2
146123-000	Girder assembly 2V-BF3
146530-000	Girder assembly 3H-BF0
146531-000	Girder assembly 3H-BF1
146532-000	Girder assembly 3H-BF2
146533-000	Girder assembly 3H-BF3
146130-000	Girder assembly 3V-BF0
146131-000	Girder assembly 3V-BF1
146132-000	Girder assembly 3V-BF2
146133-000	Girder assembly 3V-BF3
146540-000	Girder assembly 4H-BF0
146541-000	Girder assembly 4H-BF1
146542-000	Girder assembly 4H-BF2
146543-000	Girder assembly 4H-BF3
146140-000	Girder assembly 4V-BF0
146141-000	Girder assembly 4V-BF1
146142-000	Girder assembly 4V-BF2
146143-000	Girder assembly 4V-BF3
146550-000	Girder assembly 5H-BF0
146551-000	Girder assembly 5H-BF1
146552-000	Girder assembly 5H-BF2
146553-000	Girder assembly 5H-BF3
146150-000	Girder assembly 5V-BF0
146151-000	Girder assembly 5V-BF1
146152-000	Girder assembly 5V-BF2
146153-000	Girder assembly 5V-BF3

146560-000	Girder assembly 6H-BF0
146561-000	Girder assembly 6H-BF1
146562-000	Girder assembly 6H-BF2
146563-000	Girder assembly 6H-BF3
146160-000	Girder assembly 6V-BF0
146161-000	Girder assembly 6V-BF1
146162-000	Girder assembly 6V-BF2
146163-000	Girder assembly 6V-BF3

Accessories

964000-176	Coating: Zinc Dust Silver-Grey Silky Luster

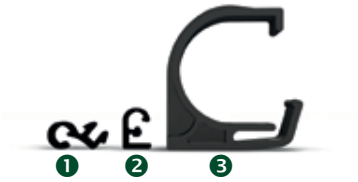
943610-090	❶ Bolt M10x90 hex for mounting the head assembly to the pile-driven foundation
943921-010	❷ Washer 10 DIN125
943912-010	❸ Flange nut M10 serrated

119008-050 - 119008-853	Module anchor Optibond 80 mm rubber assembly
149115-001	Edge brace kit KP0 689 mm
149114-001	Edge brace kit KP1 717 mm
149113-001	Edge brace kit KP1.5 726 mm
149112-001	Edge brace kit KP2 751 mm

943755-925	Screw 5.5x25 self-tapping

119015-000	Punched mounting tape 12x0.8 hole 5.2mm-50m
135005-000	Grounding splice kit
149100-900	Grounding pin kit variable
149100-000	Grounding pin kit

128014-000	Interior cable duct, pre-assembled
128014-001	Exterior left cable duct, pre-assembled
128014-002	Exterior right cable duct, pre-assembled
129012-010	❶ Proklip2000-B cable clip round duct M10
129012-002	❷ Proklip2000-P cable clip round design S
129042-001	❸ Proklip-F



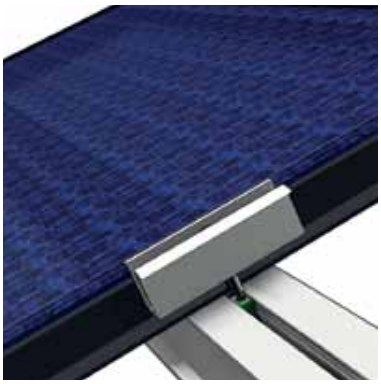
5 Torque specifications

Image	Name	Tightening torque (MA-Nm)
	Hexagon head bolt DIN933 M10x25 Square nut DIN557 M10 KlickIn click component M10	30 Nm
	Hexagon head bolt DIN931 M10x30 Washer DIN9021 Flange nut DIN6923 M10	30 Nm
	Hexagon head bolt DIN931 M10x90 Washer DIN125 10 Flange nut DIN6923 M10	30 Nm
	Hexagon head bolt DIN931 M10x80 Flange nut DIN6923 M10	30 Nm
	Hexagon head bolt DIN931 M12x120 Flange nut DIN6923 M12	50 Nm

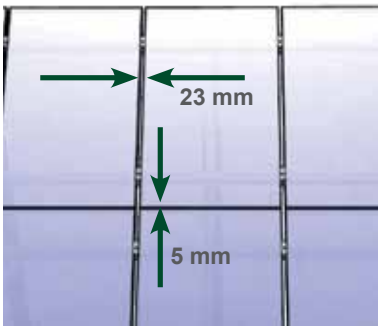
When checking preload of the bolts, care must be taken that constraints and frictional forces cannot lead to a loss of tension. This is taken into account when drawing up the tightening torque specification. When tested, the nut must retain it's scheduled torque to 50% if the connection is twisted.

6 Module mounting

Modules are mounted according to the drawing, using the supplied module clamps.



Modules are fastened to the module-bearing rail using end- and middle clamps. Arrange the KlickIn click components M8 and the square nuts along the module-bearing rail, position the module clamps at the clamping points and fasten with M8 Inbus screws.



The distance between modules can deviate from the standard value. Tolerated variance is 23 mm on the clamped side and 5 mm on the unclamped side.

The variance is outlined with a detail drawing in the overview plan. (c.f. example gen. layout drawing, Page 2)

⚠ **Please ensure a joint clearance of 1.5mm!**

⚠ **The M8 bolts for the module clamps must be tightened to a torque of 14Nm unless otherwise specified by the manufacturer!**

⚠ **When mounting modules, please observe the clamping points specified by the module manufacturer!**

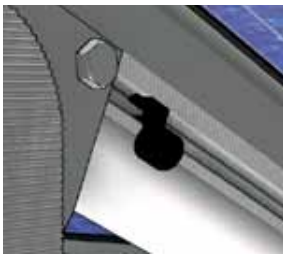
7 Cable mounting

In the majority of installations, cables are fastened with simple cable ties. These become brittle very quickly, however, particularly in hotter climates, with the result that cables often hang down from the profiles after only two years. This can lead to water damage in the plugs and loosened connections due to wind impact on the cables.

Cable mounting accessories (ref. Page 8):

Proklip-Q The running of cables along the module-bearing profile by clipping these in to the lower flange of the profile

Proklip2000-B: Routing of cables along the girder by running through and clipping into the *Klick* duct



Proklip-F For the mounting of ductwork for running cables along the piles

Cable duct: Bolted to the module-bearing profile, the duct provides optimal cable routing with edge protection.

8 Tolerances

Schletter mounting racks for open area plants are always explicitly dimensioned for the wind and snow loads at the target location. In the interest of economic efficiency, the maximum capacity potential of individual components is generally exploited. To achieve this, however, the racks must be mounted with the utmost precision. Significant deviation from the mounting plans can lead to mechanical tension in the cells. Adherence to the specified tolerances is therefore essential to the structural safety.

Span between fields	± 150 mm
Linear projection of purlins	± 100 mm
Lower girder connection	± 100 mm
Upper girder connection	± 100 mm
Clearance within the clamp	- 1.5 mm

In the event of deviation, this must be communicated to Schletter immediately!

© Schletter GmbH · Gewerbegebiet an der B15 · Alustraße 1 · 83527 Kirchdorf/Haag i. OB · Germany · Tel.: +49 8072 9191-200
Fax: +49 8072 9191-9200 · E-mail: solar@schletter.eu · www.schletter.eu · Updated 11/2012 · Subject to change without notice
Your contact in the UK: Schletter UK Limited, Tel.: +44 1296 461 800, Fax: +44 1296 461 801, E-mail: info@schletter.co.uk

MOUNTING

FS Duo

Mounting Instructions with SRF Foundation Posts

Schletter GmbH
Gewerbegebiet an der B15
Alustrasse 1
83527 Kirchdorf / Haag in OB
GERMANY

Tel.: **+49 8072 9191 -0**
E-mail: **info@schletter.eu**

Your contact persons:

Technical advice for ground-mounted solar plants
Tel.: +49 8072 9191 - 203
E-mail: tb-freiflaeche@schletter.de

SCHLETTER

Table of Contents

1. General Information

1.1. Short Description

The system FS Duo is a two-support substructure for the mounting of photovoltaic modules in ground mount plants. The supporting structure and the module-bearing rails are made of hot-dip galvanized steel, the fastening elements and the screws/bolts are made of steel or stainless steel. By means of the leveling holes, it is possible to adjust the system to the result of the pile-driving process and even out tolerances. FS Duo allows to use framed as well as unframed modules that can be mounted either in portrait or in landscape, or with the Schletter combined clamping system. It is also possible to mount additional accessories for the cable management or components for the internal potential equalization.

1.2. Intended Use

FS Duo is a substructure for the mounting of photovoltaic modules. Any kind of different use that is not mentioned in these Mounting Instructions or an incorrect mounting (e.g. the utilization of components made by other producers or non-observance of tolerances specified here and/or exceeding the indicated loads) are considered as non-intended use and, thus, exclude any liability of the manufacturer.
The manufacturer accepts no liability for damage caused by failure to observe these Mounting Instructions.

1.3. Copyright and Intellectual Property Rights

These Mounting Instructions are subject to change without notice.

All names of products stated in these Mounting Instructions are trademarks of Schletter GmbH and are herewith recognized and acknowledged.
Schletter GmbH is not liable for any damage of a product or consequential damage caused by the product that are due to improper handling.
First and foremost, Schletter GmbH is not responsible or liable for failures and faults that are caused by modifications made by the customer or other persons.
There is no claim for availability of previous designs and for the ability to retrofit delivered components to the respective latest state of the series.

Schletter GmbH has made considerable efforts to make sure that these Mounting Instructions are free of errors and omissions.
Schletter GmbH does not assume any responsibility or liability for possible errors included in these Mounting Instructions and/or incidental, concrete or consequential damages arising from the publication of these Mounting Instructions.

1.4. Safety Precautions

Please read these Mounting Instructions carefully before starting the assembly and keep it in a safe place for further reference. Please observe and adhere to the regional and national applicable standards, building regulations and accident prevention regulations.

Read and make sure you understand the safety and warning notes in these Mounting Instructions and always apply them according to the relevant conditions and type of operation!

This instruction manual contains guidelines and notices you have to observe in order to ensure your personal safety and to prevent physical injuries or damage to property. Such safety and warning notes are marked with a warning triangle. Depending on the kind and degree of danger, **warning notices** are displayed as follows:

DANGER
*indicates that death or severe personal injury **will** result, if proper safety precautions are not taken.*

WARNING
*indicates that death or severe personal injury **may** result, if proper safety precautions are not taken.*

CAUTION
indicates that minor personal injury can result, if proper safety precautions are not taken.

DANGER
due to operations with electricity. Electric power can lead to serious accidents and can cause severe injuries. Appropriate safety precautions are to be taken by all means.

Securing the working area
Before the start of construction, the building site must be inspected by a supervising person by sight check or using plans showing all supply lines (water, electricity, gas) in the relevant area. For this purpose, the position of all supply lines (water, gas electricity, etc.) must be marked using marking paint and unstable ground and areas that are landslide-prone must be sealed off with stable barriers or warning signs.

Important information and notices
regarding the product and its handling and/or mounting of the product are characterized by the following symbol.

NOTICE
warns about situations that can lead to material damage and disturbances during the operating procedure, if the instructions are not observed.

REFERENCES
All documents relevant for the mounting that are not included in these Mounting Instructions, are marked with this symbol.

We absolutely recommend to observe the following protective measures when mounting of FS Duo:

Remember to wear reflective vests and safety shoes *all the time*

Always wear ear protection *when carrying out noisy work*

Always wear a hard hat *when there might be falling objects or if you could hurt your head in some other way*

Wear protective gloves *when working with sharp-edged components*

When carrying out dusty work, always ***wear breathing protection***

Wear safety glasses *when carrying out grinding and cutting operations in order to avoid any danger to your eyes caused by flying liquids or parts (sparks, splinters)*

Apart from that, please consider the applicable rules and regulations on accident prevention and environmental protection that apply at the respective installation site as well as work instruction and directives by the plant owner/operating company or at the place of operation.

1.5. Obligation of the Plant Owner / Operating Company

The plant owner ensures that all parts of these Mounting Instructions are stored readily available and handy at the plant.

The plant owner/operating company undertakes to only let people work at and in the striking distance of the plant who
- have read and understood the parts of the mounting instruction that are relevant for the respective operations,
- are familiar with the fundamental regulations on work safety, accident prevention and protection of the environment
- and have been instructed in the safe handling of the plant (training course).

Before starting any mounting works, the plant owner/operating company designates
- a supervising person and ensures that
- the construction site is inspected using plans showing all supply lines (water, electricity, gas) and thus
- the position of all underground supply lines and unstable ground without sufficient load-bearing capacities are marked properly or sealed off with barriers.

1.6. Commitment of the Staff

Only people who give reason to expect that they will reliably do their job are allowed. Persons whose ability to react is affected, for example by drugs, alcohol or medication, are NOT allowed.
- Every person that is involved in the mounting of FS Duo must have read and understood these Mounting Instructions, especially chapter "1.4 Safety Precautions", as well as all relevant chapters regarding the corresponding operations.
- These Mounting Instructions should always be kept available and easily accessible for all persons involved.
- Only trained and instructed qualified personnel are allowed to execute the operations mentioned in this instruction manual.
- Staff that still is to be trained may only mount the FS Duo system under the supervision of an experienced person.

We recommend the operator to insist on a confirmation in writing in each case.

1.7. Training of the Staff

These Mounting Instructions are addressed to personnel qualified in the areas of transportation and loading, mounting, disassembly and disposal, having the following qualifications:
- The professional staff members must be capable of fulfilling the tasks they have been assigned with and must be able to realize and avoid dangers on the basis of their professional formation, experience, expertise and their specific knowledge of the relevant regulations.
- The qualified staff members must have the required knowledge of the guidelines regarding safety, accident prevention and environmental protection, as well as of loading and unloading regulations that apply at the respective construction site.
- The qualified personnel have the driving licenses required at the specific construction site to be able to drive site vehicles and operate construction machines.

1.8. Additional documents relevant for the mounting

In addition to these Mounting Instructions, the following documents are required for the mounting of FS Duo:

- *Pile-driving plan*
- *Blueprint drawing / general layout drawing*
- *Bill of materials / parts list*
- *Delivery note*
- *DIS unloading guidelines for transport in maritime containers*
- *General Terms and Conditions of Sale and Supply of Schletter GmbH*

2. Transportation, Loading and Unloading

WARNING

- *Always wear protective equipment (safety shoes, hard hat, safety glasses, protective gloves and reflective vest) when unloading the FS Duo components.*
- *Besides also wear the personal protective equipment that is specified in your intra-company regulations for the respective activity.*
- *It is compulsory to monitor and supervise the complete unloading process.*
- *Do not step under suspended loads!*
- *Please make sure that there are no unauthorized persons in the danger area.*

Please observe all country-specific regulations and standards of the country of destination and your company work instructions!

2.1. Delivery of the components

The delivery of the components for FS Duo is carried out with an appropriate vehicle, for example

- trucks/lorries or
- overseas containers

2.2. Preparing the delivery

- Provide a stable and drivable surface for the delivery.
- Please make sure that all access roads, manoeuvring and unloading areas are suitable for trucks (up to 40 tons) and can be used by forklift trucks and hoisting equipments.
- Ensure that loading/unloading and transport activities are carried out by trained and qualified personnel only.

2.3. Provide forklift trucks and hoisting equipment

- Organize suitable forklift trucks and hoisting equipment to be available at the moment of delivery.
- Choose the suitable forklift trucks and hoisting equipment in cooperation with the site manager in charge.
- Make sure that the components, pallets and long items can properly be unloaded.
- Provide forklifts and hoisting equipment with different fork intervals or with adjustable forks.

2.4. Check the scope of delivery

The following shipping documents need to be verified on delivery:
- *Delivery note*
- *Packing list*

We recommend to observe the following points when receiving the goods:
- Visual inspection of the delivered goods
- Check whether the supplied goods correspond to the delivery order
- Delivered quantity / comparison with packing lists and delivery note
- General condition of the goods
- Damages of the delivery
- Delivery documents

Claims as to defects by the customer shall require that he has complied with his duties of examination and notification of complaint contained in Sections 377, 381 of the German Commercial Code [HGB]. Defects discovered during incoming goods inspection or later shall be notified to Schletter GmbH in writing without undue delay. A notification shall not be unduly delayed if it has been made within two weeks; the timely dispatch of this notification shall be deemed sufficient to meet the deadline. Regardless of the obligation to inspect and notify, the customer shall notify Schletter of obvious defects (including delivery of the wrong product or in not enough quantity) within two weeks of delivery in writing; the timely dispatch of this notification shall also be deemed sufficient in this case to meet the deadline. A general right to return purchased goods is not granted.

Extract from the General Terms and Conditions of Sale and Supply of Schletter GmbH - download available at www.schletter.de/AGB_en

2.5. Storage of the components

The components will also be delivered in cardboard boxes on pallets. And there also are fragile and sensitive items among those components.
- Unload the items on firm and stable ground only.
- Protect all components against rain, snow, moisture and other weather conditions.
- Store the items in dry and well-ventilated storage buildings or tents.
- Never store components outdoors or covered by a plastic sheet only.

If you adhere to the hints above, you can prevent the goods from being damaged already before mounting.

3. Technical data

3.1. System description and properties

System description	FS Duo - two-support ground mount system by Schletter
Material	• Pile-driven foundation posts: Steel, hot-dip galvanized • Profiles (rails): Steel, strip-galvanized • Fastening elements and screws: Steel, hot-dip galvanized or high-grade steel (fastening device, bolts)
Structural dimensioning	• Customized structural analysis of the respective terrain based upon a geological survey • Individual system structural analysis based on local data • Load assumptions according to DIN1055, part 4 (03/2006), part 5 (06/2005), part 100 (03/2001), Eurocode 1 (06/2002), DIN4113, DIN18800, Eurocode 9 and further resp. corresponding national standards. • Structural verification of all construction components based on FEM-calculation
Characteristics of the structure	• Quick and easy assembly • Highly efficient and material-saving rail geometries • Available in individual parts or highly pre-assembled if desired
Delivery and services	• Ground survey and structural analysis • Site-specific structural analysis based on local data • Ramming (pile-driving) of foundation posts and delivery of the complete mounting material • Optional: Rack mounting • Optional: Complete module assembly
Module types	• Framed modules with a frame thickness of up to 50 mm • Unframed modules on request

3.2. Rack tolerances

FS Duo is always configured specifically for the wind and snow loads at the respective installation site. In the interest of economic efficiency, usually the maximum load-bearing capacity of the individual component is exploited. To achieve this, however, the racks must be mounted with the utmost precision. If there are significant deviations from the mounting plans, this can lead to structural overstress which in turn can lead to damage cases. Schletter GmbH will not assume any liability for such damages nor for any consequences thereof. Adherence to the specified tolerances is therefore essential to the structural safety of the rack.

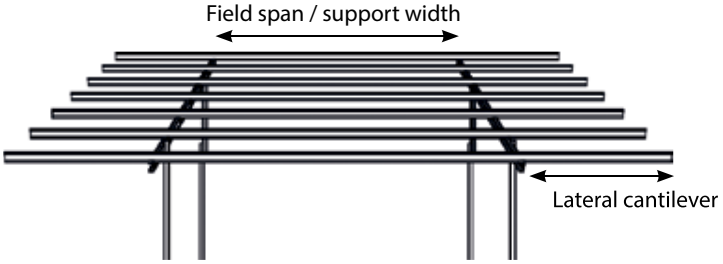


Fig. 3.2.-1 (field span / support width)

Support width	± 150 mm
Lateral cantilever of purlins	± 100 mm
Lower girder connection	± 100 mm
Upper girder connection	± 100 mm
Clearance between module and clamp	0.5 to 2 mm

Fig. 3.2.-2 (girder connections)

3.3. Systems overview

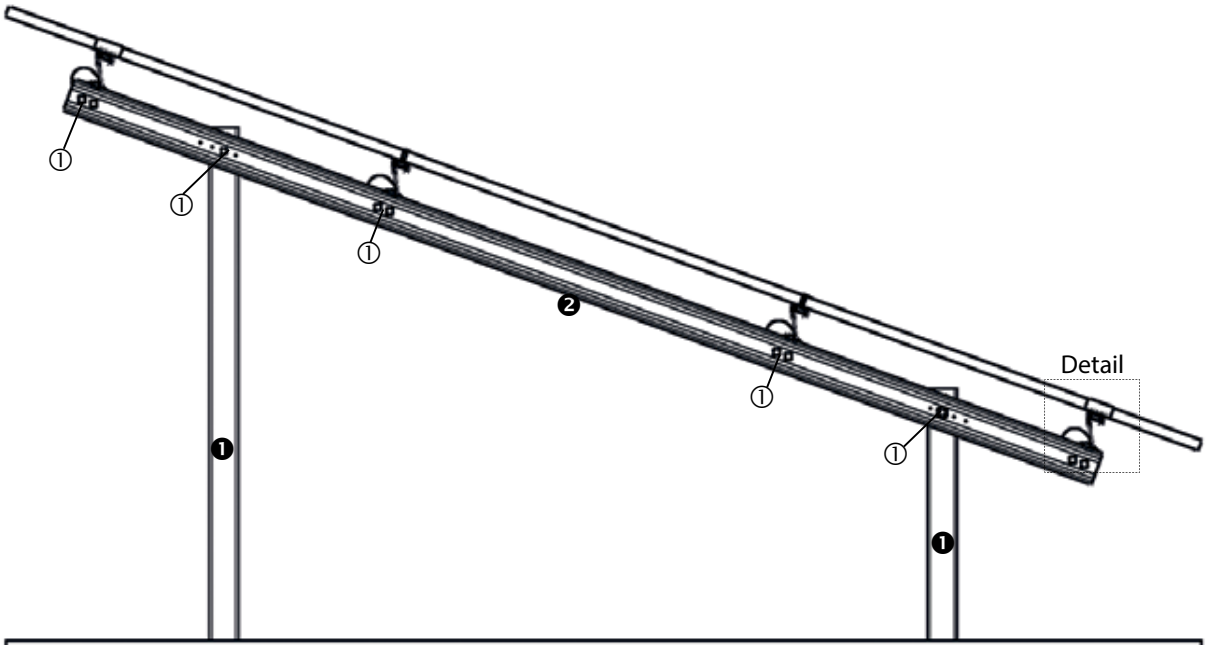


Fig. 3.3-1 (system visualisation)

Components

- ❶ SRF foundation post
- ❷ Girder assembly
- ❸ Module-bearing rail
- ❹ Module clamp adapter

Connection elements / fasteners

- ① Hexagon bolt M12x30 DIN933, flange nut M12 DIN6923 and washer M12 DIN9021
- ② Fastening device
- ③ Drill screw

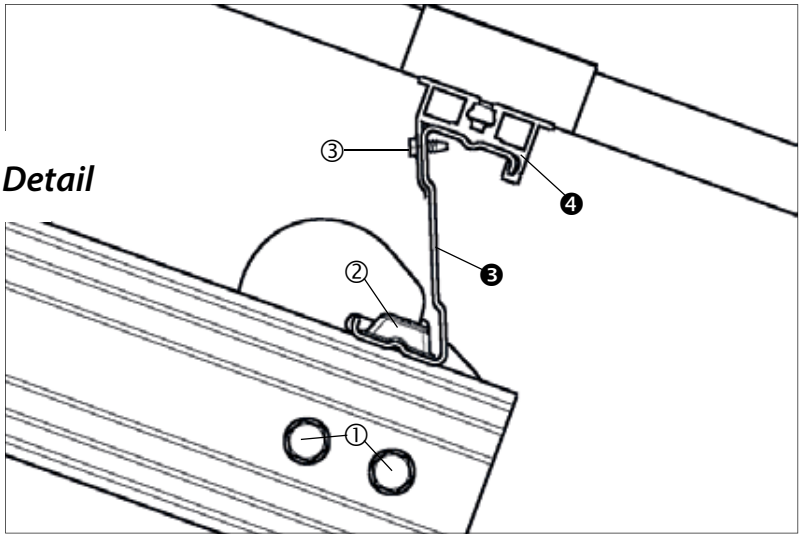


Fig. 3.3.-2 (detail)

3.4. Components

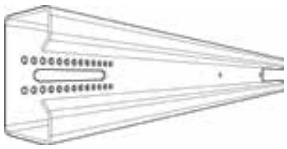


Fig. 3.4.1.-1 (143006-200)

3.4.1. Foundation posts

143006-200	Steel foundation post SRF6
143007-200	Steel foundation post SRF7
143008-200	Steel foundation post SRF8

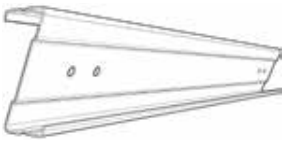


Fig. 3.4.2.-1 (144901-001)

3.4.2. Module-bearing rails and connection elements

144901-001	FS Uno / Duo purlin
144999-003	FS Uno / Duo fastening device
144999-008	FS Uno / Duo purlin connector Gen2 kit

Fig. 3.4.2.-2 (144999-003)

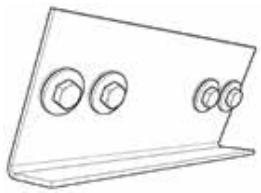


Fig. 3.4.2.-3 (144999-008)

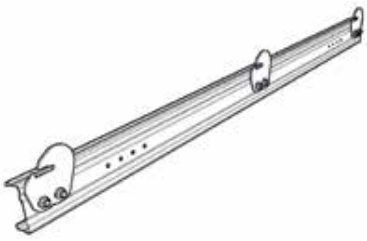


Fig. 3.4.3.-1 (144302-200)

Fig. 3.4.3.-2 (144999-006)

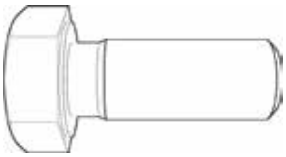


Fig. 3.4.3.-3 (943612-030)

Fig. 3.4.3.-4 (943912-012)

Fig. 3.4.3.-5 (943922-012)

3.4.3. Girder assemblies and components

144301-000	FS Duo girder assembly 1V custom cut
144302-200	FS Duo girder assembly 2V custom cut
144303-200	FS Duo girder assembly 3V custom cut
144304-200	FS Duo girder assembly 4V custom cut
144305-200	FS Duo girder assembly 5V custom cut
144306-200	FS Duo girder assembly 6V custom cut
144307-200	FS Duo girder assembly 7V custom cut
144308-200	FS Duo girder assembly 8V custom cut
144301-000	FS Duo girder assembly 1H custom cut
144302-100	FS Duo girder assembly 2H custom cut
144303-100	FS Duo girder assembly 3H custom cut
144304-100	FS Duo girder assembly 4H custom cut
144305-100	FS Duo girder assembly 5H custom cut
144306-100	FS Duo girder assembly 6H custom cut
144307-100	FS Duo girder assembly 7H custom cut
144308-100	FS Duo girder assembly 8H custom cut
144999-006	FS Uno / Duo fastening plate galvanized
943612-030	Hexagon head screw M12x30 DIN933 A2 GMB
943912-012	Flange nut M12 serrated DIN6923 A4
943922-012	Large washer M12 DIN9021 A2

3.4.4. Module clamps for vertical module mounting

	Steel clamp			Rapid clamp*		Standard clamp*	
Module height	***End clamp left***	***Middle clamp***	***End clamp right***	***End clamp***	***Middle clamp***	***End clamp***	***Middle clamp***
20 mm	---	---	---	---	---	130001-020	130002-000
24 mm	---	---	---	---	---	130001-024	130002-000
28 mm	---	---	---	---	---	130001-028	130002-000
30 mm	144912-030	144910-001	144911-030	131001-030	131002-000	130001-030	130002-000
31 mm	144912-031	144910-001	144911-031	131001-031	131002-000	130001-031	130002-001
32 mm	144912-032	144910-001	144911-032	131001-032	131002-000	130001-032	130002-001
33 mm	144912-033	144910-002	144911-033	131001-033	131002-000	---	---
34 mm	144912-034	144910-002	144911-034	131001-034	131002-000	130001-034	130002-001
35 mm	144912-035	144910-002	144911-035	131001-035	131002-000	130001-035	130002-001
36 mm	144912-036	144910-002	144911-036	131001-036	131002-000	130001-036	130002-001
37 mm	144912-037	144910-002	144911-037	131001-037	131002-000	---	---
38 mm	144912-038	144910-003	144911-038	131001-038	131002-000	130001-038	130002-001
39 mm	144912-039	144910-003	144911-039	131001-039	131002-000	---	---
40 mm	144912-040	144910-003	144911-040	131001-040	131002-001	300001-040	130002-001
41 mm	144912-041	144910-003	144911-041	131001-041	131002-001	130001-041	130002-001
42 mm	144912-042	144910-003	144911-042	131001-042	131002-001	130001-042	130002-001
43 mm	144912-043	144910-004	144911-043	131001-043	131002-001	130001-043	130002-001
44 mm	144912-044	144910-004	144911-044	131001-044	131002-001	130001-044	130002-001
45 mm	144912-045	144910-004	144911-045	131004-045	131002-001	130001-045	130002-001
46 mm	144912-046	144910-004	144911-046	131001-046	131002-001	130001-046	130002-001
47 mm	144912-047	144910-004	144911-047	131001-047	131002-001	---	---
48 mm	144912-048	144910-005	144911-048	131001-048	131002-001	130001-048	130002-001
49 mm	144912-049	144910-005	144911-049	131001-049	131002-001	---	---
50 mm	144912-050	144910-005	144911-050	131001-050	131002-001	130001-050	130002-001
51 mm	---	---	---	---	---	130001-051	130002-001

* in combination with module clamp adapter

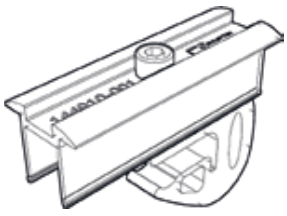


Fig. 3.4.4.-1 (144912-030)

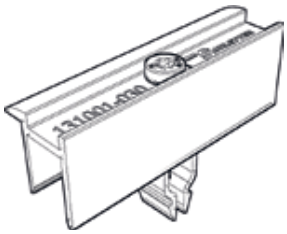


Fig. 3.4.4.-2 (131001-030)

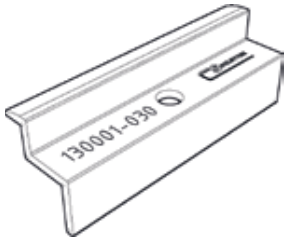


Fig. 3.4.4.-3 (130001-030)

3.4.5. Module clamps for horizontal module mounting

	Rapid clamp*		Standard clamp*	
Module height	***End clamp***	***Middle clamp***	***End clamp***	***Middle clamp***
20 mm	---	---	130001-020	130002-000
24 mm	---	---	130001-024	130002-000
28 mm	---	---	130001-028	130002-000
30 mm	131001-030	131002-000	130001-030	130002-000
31 mm	131001-031	131002-000	130001-031	130002-001
32 mm	131001-032	131002-000	130001-032	130002-001
33 mm	131001-033	131002-000	---	---
34 mm	131001-034	131002-000	130001-034	130002-001
35 mm	131001-035	131002-000	130001-035	130002-001
36 mm	131001-036	131002-000	130001-036	130002-001
37 mm	131001-037	131002-000	---	---
38 mm	131001-038	131002-000	130001-038	130002-001
39 mm	131001-039	131002-000	---	---
40 mm	131001-040	131002-001	300001-040	130002-001
41 mm	131001-041	131002-001	130001-041	130002-001
42 mm	131001-042	131002-001	130001-042	130002-001
43 mm	131001-043	131002-001	130001-043	130002-001
44 mm	131001-044	131002-001	130001-044	130002-001
45 mm	131004-045	131002-001	130001-045	130002-001
46 mm	131001-046	131002-001	130001-046	130002-001
47 mm	131001-047	131002-001	---	---
48 mm	131001-048	131002-001	130001-048	130002-001
49 mm	131001-049	131002-001	---	---
50 mm	131001-050	131002-001	130001-050	130002-001
51 mm	---	---	130001-051	130002-001

* in combination with module clamp adapter

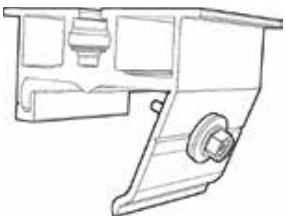


Fig. 3.4.6.-1 (144919-050)

3.4.6. Module clamp adapter and connection elements for module clamps

144919-050	FS Steel Module clamp adapter KIT
129010-008	KlickIn click component for nut M8
943914-008	Square nut M8 DIN557 A4

The nuts and bolts of the Standard clamps are not included in the scope of delivery and must be ordered separately.

With big order quantities, clamps for other module thicknesses can be manufactured on request!

The Standard clamps are not pre-assembled when they are delivered. These clamps are combined with a hexagon socket head screw, a KlickIn click component and a square nut. The screws listed below can be used for that purpose:

3.4.7. Screws for standard module clamps

	Frame height in mm	*Hexagon socket screw in mm*	*Name*
943308-125	20	25	Hexagon socket screw M8x25 serrated DIN912 A3
943308-130	24	30	Hexagon socket screw M8x30 serrated DIN912 A3
943308-135	28 - 30	35	Hexagon socket screw M8x35 serrated DIN912 A3
943308-120	31 - 35	20	Hexagon socket screw M8x20 serrated DIN912 A3
943308-125	36 - 40	25	Hexagon socket screw M8x25 serrated DIN912 A3
943308-130	41 - 45	30	Hexagon socket screw M8x30 serrated DIN912 A3
943308-135	46 - 51	35	Hexagon socket screw M8x35 serrated DIN912 A3

Fig. 3.4.8.-1 (144999-009)

3.4.8. Auxiliary equipment / accessories

964000-176	Paint zinc dust silver gray satin-gloss
149023-001	Cable fastening retainer 1.0-3.0mm, guidance at the top
149023-002	Cable fastening retainer 1.0-3.0mm, guidance at the side
149023-003	Cable fastening retainer 3.0 - 6.0 mm
144999-009	FS Uno / Duo cable fastener purlin
144999-010	Empty cable conduit

Fig. 3.4.8.-2 (149023-003)

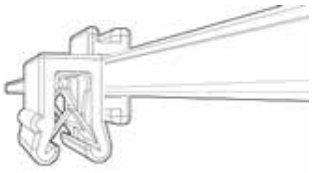


Fig. 3.4.8.-3 (149023-002)

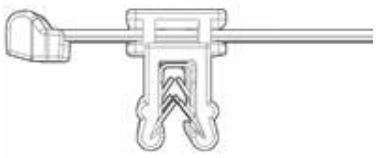


Fig. 3.4.8.-4 (149023-001)

4. Mounting information

The FS Duo system is customized for the respective installation site. The following indications are already needed during the planning process:

- Site boundaries
- Rights of way / easements (the building site must be accessible for vehicles at any time)
- Obstacles in the subsoil (pipes, subterranean cables, etc.)
- Weather conditions (wind, rain, snow, etc.)
- Conditions that may influence the building ground (seismic activities, erosion risks, etc.)
- Geo-technical reports about the topology of the site and the composition of the soil

When mounting the ground-mount system, we recommend:

- Keeping a clearly laid out and detailed daily construction report (site journal), where all daily work steps, employment of staff and assembled components are exactly specified.
- Accurately checking and comparing the delivery notes with the delivered goods on the site.

4.1. Terrain

When planning the ground-mounted system, make sure that the ground slope is within the tolerances. In the following, the guiding values for a structurally safe solar plant are specified.

Maximum admissible ground slope East-West: **5°**

Maximum admissible ground slope North-South: **35°**

(depending on the condition of the slope, soil composition, rocks, etc.)

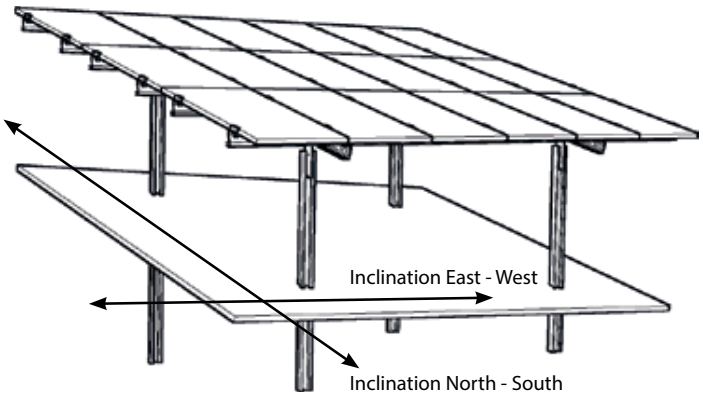


Fig. 4.1.-1 (ground slope)

The Schletter ground mount plants within one rack are always parallel to the terrain topography beneath them. Height differences of the subsoil under a rack can be equalized with the foundation posts. Please already align the piles with a cord when pile-driving. The tolerance of the anchoring depth is ±100 mm.

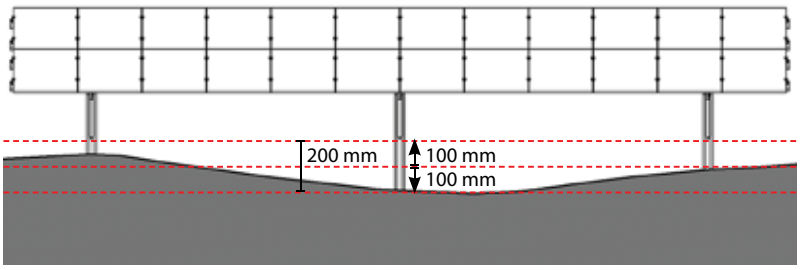


Fig. 4.1.-2 (tolerances of the anchoring depth)

4.2. Foundation

4.2.1. Check of the GPS coordinates

Especially with very uneven subsoil, it is essential to check the GPS coordinates. As in such cases, there often are rather substantial offsets or misalignments of the foundation posts in north-south direction. And module mounting may thus be impeded because the girders are not parallel to one another.
Therefore, please exactly check and verify the GPS points, as displayed in the sketch below, using a square and string line before starting the pile-driving operations.

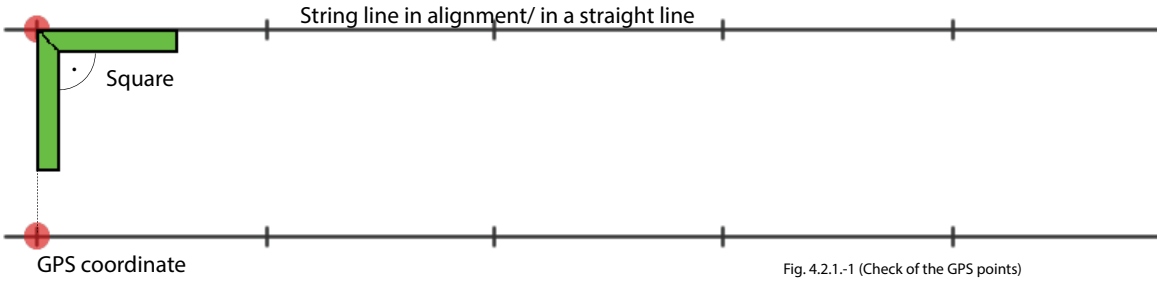


Fig. 4.2.1.-1 (Check of the GPS points)

4.2.2. Ramming (pile-driving) tolerances

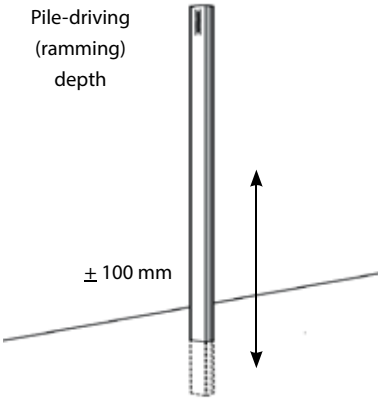


Fig 4.2.2.-1 (pile-driving tolerances - depth)

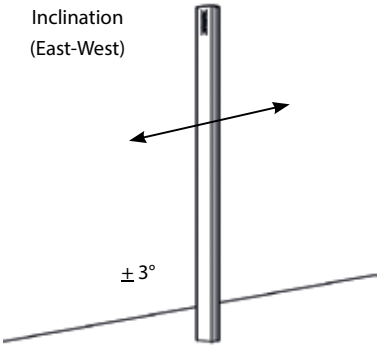


Fig 4.2.2.-2 (pile-driving tolerances - E/W tilt)

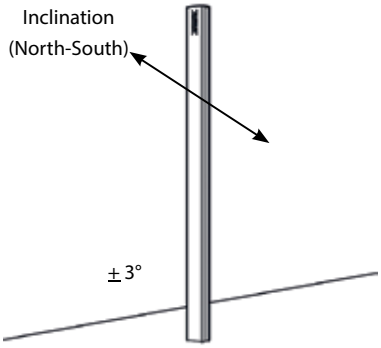


Fig 4.2.2.-3 (pile-driving tolerances - N/S tilt)

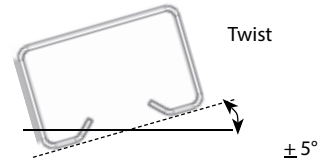


Fig 4.2.1.-4 (pile-driving tolerances - twist / distortion)

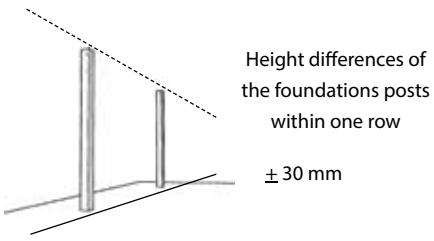


Fig 4.2.1.-5 (pile-driving tolerances - difference in height)

Pile-driving operations must be undertaken by specialist companies. Special pile-driving plans are created on the basis of a digital terrain model with exactly specified contour lines. These plans must be available at least one week before the start of the pile-driving operations and must include the positions of the foundation posts and their corresponding dimensions. The position of the first and last pile in each row must be marked on the terrain with a wooden stake. If a row length exceeds 50 meters, additional markings (wooden stakes) must be used within the row.

4.2.3. Pile-driving obstacles and concreting

Extraordinary foundation posts must be clearly identified and documented in a pile-driving plan. Inconsistencies during the pile-driving procedure which could affect the adhesive force of the piles must be documented (e.g. slant position, deceleration and subsequent, sudden acceleration of the penetration speed, swift penetration of the foundation post while pile-driving etc.). All pile-driving procedures deviating from the specifications as to the ramming of the foundation posts must be approved by Schletter GmbH. If pile-driving operations are impeded by unexpected obstacles (blocks, solid rock on the site), the following procedure must be implemented:

1. Pre-drill down to the intended target depth.
2. If possible, vacuum the drill cuttings out of the borehole. Otherwise, the drill cuttings that remain in the borehole have to be compacted.
3. The borehole must be filled in layers with compressed concrete of strength C16/20 and compacted.
4. After that, ram (pile-drive) the pile without delay.

4.3. Tools

In the following, the tools that are usually required for the mounting of FS Duo are listed. Additional tools that are required for special cases (for example encasing the foundation posts in concrete) are not listed here.

NOTICE
Please exclusively use the tools recommended for the assembly of FS Duo.
If you use tools that are not intended for this purpose, the rack can be damaged and the structural safety of the plant could thus be endangered!

We recommend using torque wrenches for all bolted connections. With fast rotary motions, there is an increased danger of "bolt blocking"!

4.3.1. Defining the positions of the foundation posts and marking these positions (staking)

- Measuring tapes (100 m)
- Line pins (about 20 pieces)
- Mason's lacing cord
- Club hammer
- Wooden stakes
- Color spray (for ground marking etc.)
- Permanent marker
- Zinc dust primer
- Brush
- Goniometer (angle meter)

4.3.2. Pile-driving (ramming)

- Pile-driver with suitable ram
- Spirit level

4.3.3. Rack mounting

- Torque wrench (30 Nm to 60 Nm)
- Wrench socket size 17
- Wrench socket size 19
- Hammer
- Club hammer (to hold against the connector hook)
- Plastic tip hammer
- Angle meter (goniometer) - spirit level
- Mason's lacing cord
- Cordless screw driver

4.3.4. Module mounting

- Mason's lacing cord
- Measuring tape
- Possibly distance template for distances between the modules
- Cordless screw driver
- Size 8 socket for cordless screwdriver
- Size 6 hexagon socket wrench / 40TX key
- Torque wrench (< 8 Nm)
- Size 6 hexagon socket wrench / 40TX bit for torque wrench

4.4. Torque specifications

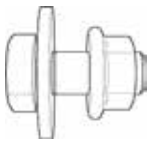


Fig. 4.4.1.-1 (screw connection M12)

4.4.1. Bolted connections in the substructure	
Name	***Tightening torque (MA-Nm)***
Hexagon head bolt DIN933 M12x30 A2 GMB Hexagon nut DIN6923 M12 A4 Washer, large DIN9021 M12 A2	**56 Nm**

Fig. 4.4.2.-1 (Standard module clamp)

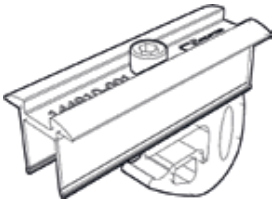


Fig. 4.4.2.-2 (steel module clamp)

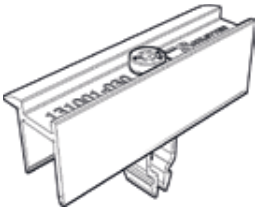


Fig. 4.4.2.-3 (Rapid 2+ module clamp)

4.4.2. Fastening of the module clamps

Name	*Tightening torque (MA-Nm)*	*Module arrangement*
Hexagon socket screw DIN4762 M8 (20 - 35 mm) KlickIn click component for nut M8 Square nut DIN557 M8 A4	**15 Nm**	H and V in combination with module clamp adapter
Hexagon socket screw DIN912 M8 A2 (25 - 45 mm)	**8 Nm**	V
TX stud screw M8 A2 GMB (42.5 - 55 mm)	**15 Nm**	H and V in combination with module clamp adapter

Always fasten the bolted connection by turning the bolt head! When checking the pre-stress of the bolts, it has to be considered that constraints and frictional forces can lead to a loss of clamping force. This was taken into consideration when the tightening torques were determined. When a bolted connection is checked, it must not loosen when 50% of the specified tightening torque is applied.

5. Assembly steps

5.1. Pile-driving of foundation posts and applying corrosion protection

WARNING

- *Wear adequate protective equipment during the pile-driving operations, especially ear protection and protective gloves, reflective vest and safety shoes!*
- *Always keep looking on the machine and the surrounding area.*
- *Please especially pay attention to mechanically moving parts in the danger area of the ramming machine to avoid crushing injuries.*
- *Prevent the ramming machine from toppling over by exclusively driving on adequate, stable ground!*

Check the stability and firm embedment of the pile-driven foundations before mounting the racks!

*Only a special paint (**zinc dust primer**) will give the required protection and is approved according to the standards. Basic zinc spray coatings do not provide long-term protection.*

The tolerances specified here must not be exceeded!

1. Pile-drive the foundation post according to the indicated tolerances

Height tolerance of the piles to each other: ± ***30 mm***

Tolerance of pile tilt in N-S and E-W direction: ± ***3°***

Tolerance of the pile height according to terrain topography: ± ***100 mm***

2. A zinc dust primer is to be used to coat the top 30 mm of the foundation post, inside and outside.

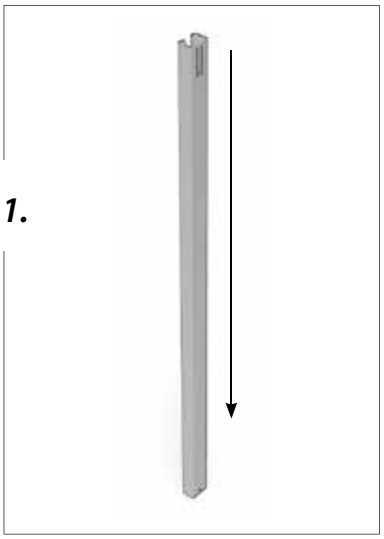


Fig. 5.1.-1 (pile-driving tolerances)

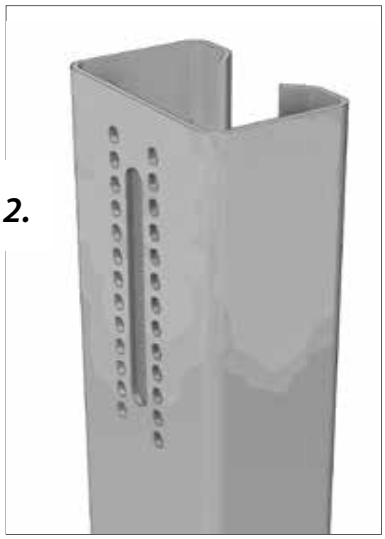


Fig. 5.1.-2 (prime-coated foundation post)

*The exact positions of the foundation posts can be referenced in the corresponding **pile-driving plan**.*

3. Check whether the individual foundation posts are aligned to each other and verify the posts regarding their corresponding tolerances (see item 5.1.- step 1)

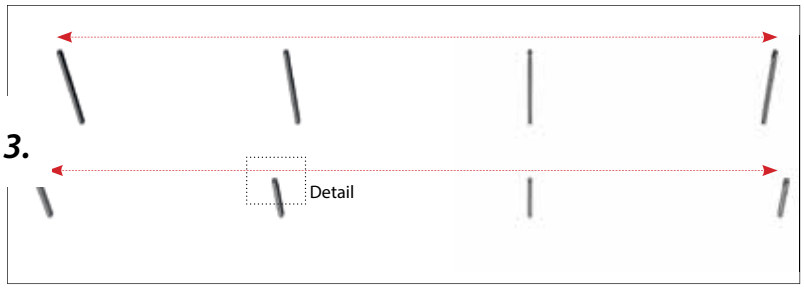


Fig. 5.1.-3 (flush alignment of the foundation posts)

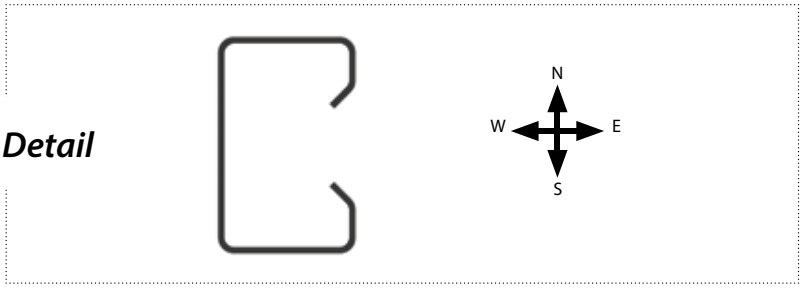


Fig. 5.1.-4. (detailed view of the foundation post - from above)

5.2. Mounting the foundation extensions (optional)

Please refer to the specifications given in the technical drawing as to the exact position of the foundation extensions.

1. Insert the extension rail into the SRF foundation post

2. Adjust the extension rail to the correct position (length)

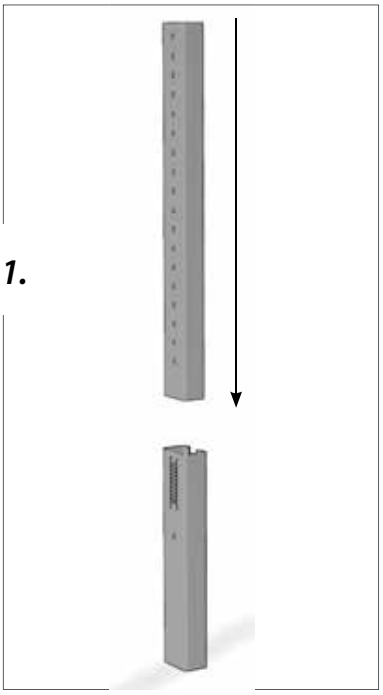


Fig. 5.2.-1. (inserting the extension rail)

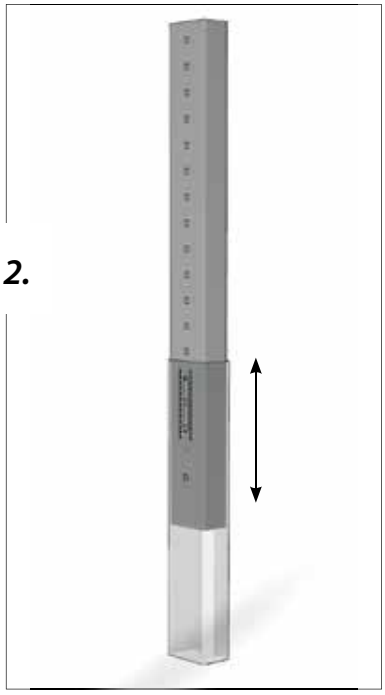


Fig. 5.2.-2. (adjusting the extension rail)

3. Fasten the extension rail to the foundation post. Position two hexagon head screws M12x30 DIN933 and two washers DIN9021 at the open side of the rail and fasten them using a locking plate (at the area with multiple holes on the foundation post) and two flange nuts M12 DIN6923.

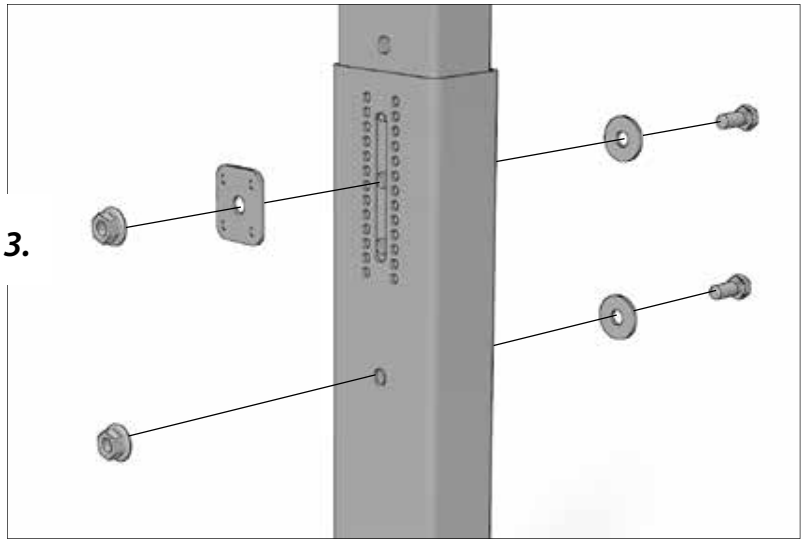


Fig. 5.2.-3. (fastening the extension rail)

5.3. Mounting the girder assembly

CAUTION

- *Wear adequate protective equipment, especially a hard hat, when mounting the girder assembly!*
- *Secure all parts that need to be fastened against slipping!*
- *Use appropriate auxiliary devices to handle heavy loads and ask your co-workers for help!*
- *Keep the work area clean to avoid falls!*
- *Never walk under suspended loads and secure objects and tools against falling down.*

Fasten the bolted connection by turning the bolt head! Do not turn the nut, just hold it!
If the girder assembly is to be mounted on the foundation extension, you do not need any locking plates!

1. Fasten the girder assembly to the foundation post using a hexagon head bolt M12x30 DIN933, a washer 12 DIN9021, a locking plate and flange nut M12 DIN6923.

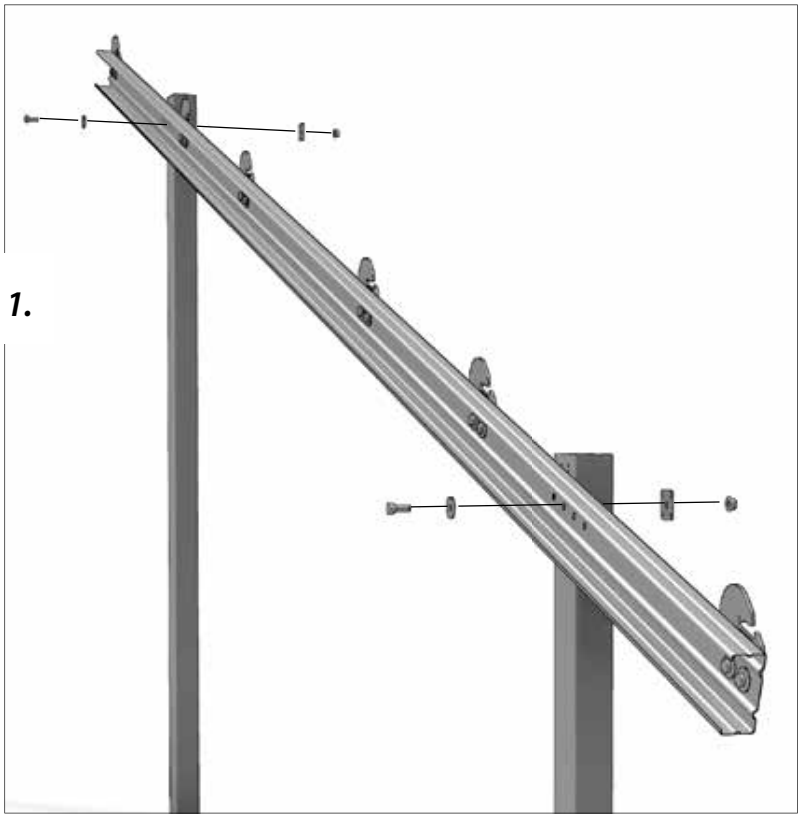


Fig. 5.3.-1 (mounting the girder assembly)

5.4. Mounting the module-bearing rail (purlin)

CAUTION

- *Wear adequate protective equipment, especially a hard hat, when mounting the module-bearing rails!*
- *Secure all parts that need to be fastened against slipping!*
- *Use appropriate auxiliary devices to handle heavy loads and ask your co-workers for help!*
- *Keep the work area clean to avoid falls!*
- *Never walk under suspended loads and secure objects and tools against falling down.*

NOTICE

Please note that the module-bearing rail must be mounted at a 90° angle to the girder assembly to safeguard that the modules are correctly supported. In case of imprecise mounting, the modules could fall down in the worst case.

1. Swivel the module-bearing rail into the pre-assembled fastening plates on the girder assembly.

2. Hammer in the fastening device using a plastic tip hammer. Hold a hammer against the other side of the fastening plate for stabilization reasons.

3. Use a zinc dust primer to coat the top (approx. 3 cm) of the module-bearing rails.

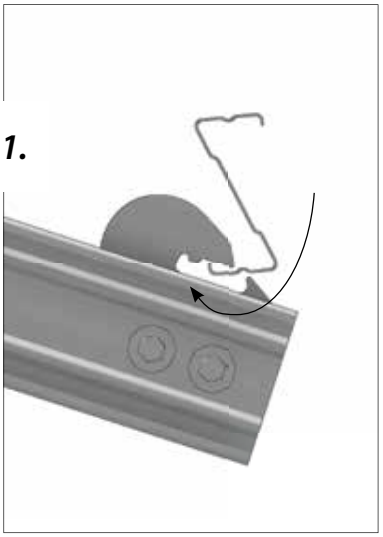


Fig. 5.4.-1 (swiveling in the purlin)

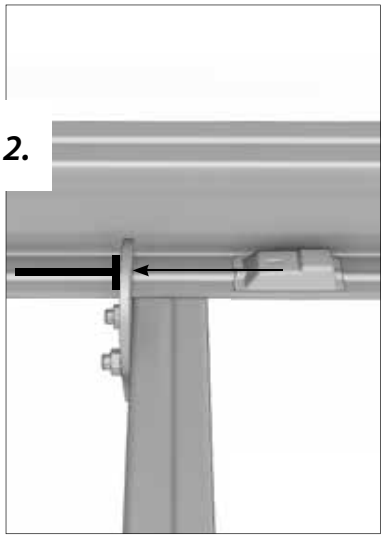


Fig. 5.4.-2 (hammering in the fastening device)

ATTENTION

The fastening plates have slotted holes for fine adjustment and have to be readjusted, if required.

5.5. Mounting the purlin connectors (optional)

When mounting the purlin connectors, please use the designated drilled holes on the module-bearing rails!

1. Fasten each purlin connector with four hexagon head bolts M12x30 DIN933, washers DIN9021 and flange nuts M12 DIN6923 to the module-bearing rail.

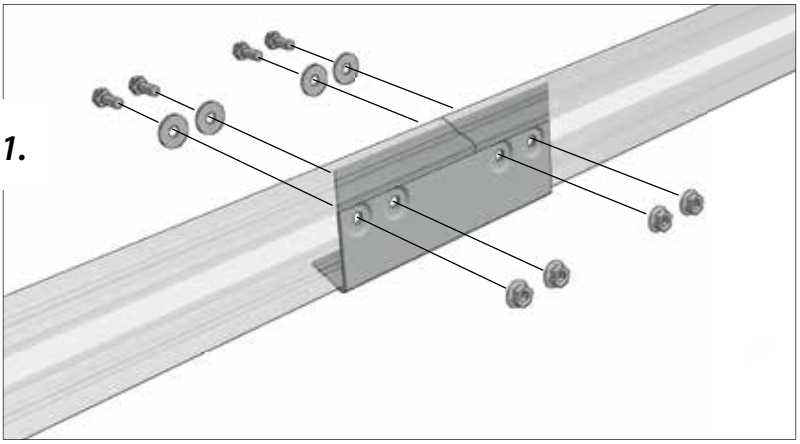


Fig. 5.5.-1 (mounting the purlin connector)

5.6. Mounting the module clamp adapter (optional)

The module clamp adapter must be used in the case of a horizontal bearing of the modules or when using a combined clamping. Moreover, the module clamp adapter is used when the modules are mounted vertically (in portrait), in combination with Rapid 2+ or Standard clamps.

The exact positions of the module clamp adapters can be referenced in the specifications provided in the ***technical general layout drawing****.*

NOTICE
Please ensure that no drilling chips are left in the module-bearing rails after screwing the self-drilling screws to avoid contact corrosion!
After positioning the module clamp adapter, please clean the module-bearing rails with a hand brush or cover the module-bearing rail during the screwing process (e.g. with a cardboard).

1. Clip the module clamp adapter onto the Z-purlin at the indicated points.

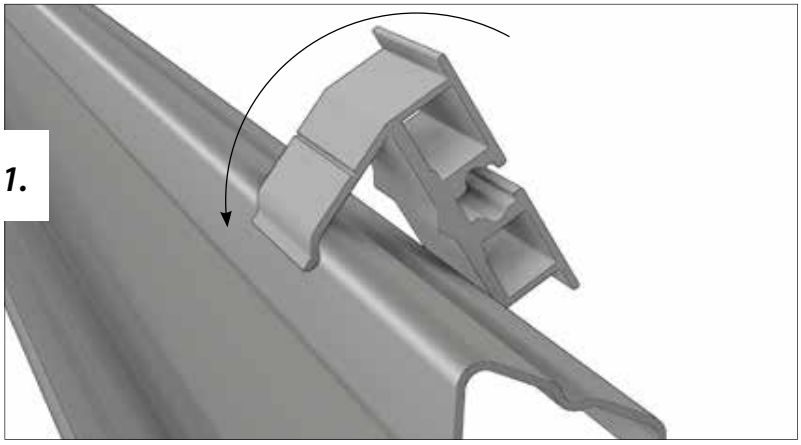


Fig. 5.6.-1 (snapping in the module clamp adapter)

2. Screw the module clamp adapter in the designated hollow space (notch) with a self-drilling screw to the module-bearing rail.

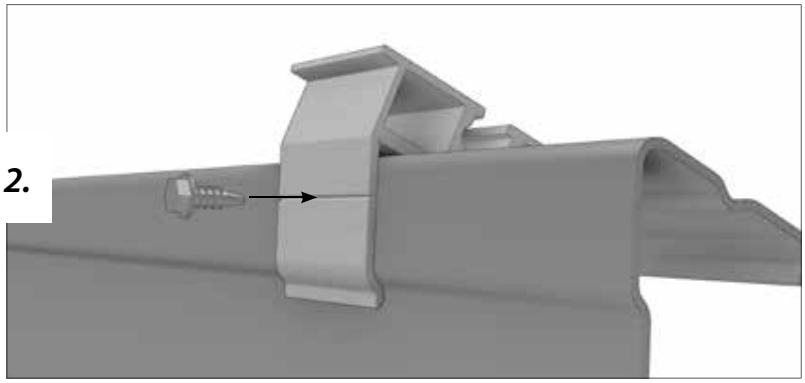


Fig. 5.6.-2 (fastening the module clamp adapter)

6. Module mounting and module clamping

Solar modules are third party components that are not included in the scope of delivery of the FS Duo substructure. Schletter GmbH thus points out that the safety notices and mounting instructions of the module manufacturer are to be observed. And please also note the notices given in these Mounting Instructions when mounting the photovoltaic modules!

The following points must be taken into consideration at any event:

- *Photovoltaic modules are electrical devices. They must be treated carefully!*
- *Impacts, kicks, shocks or vibrations must be avoided.*
- *It is not allowed to put loads on the modules (trespassing, storing of items, etc.).*
- *Scratches or dirts on the module surface must be avoided.*
- *It is not allowed to pull or tear at the module cables. Do not heavily bend the module cables.*

The module clamping is carried out according to the project planning (vertical, horizontal or combined module arrangement). The distance between modules can deviate from the standard value.
Standard value:

- clamped side ***23 mm***
- side without clamping ***5 - 10 mm***

(according to the specifications in the technical drawing; specifications by the module manufacturer are considered)

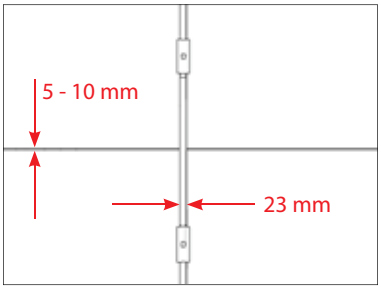


Fig. 6.-1 (distance between modules)

Clearance (= distance between module and module clamp) of

- ***min. 0.5 mm***
- ***max. 2 mm***

must be observed (module abuts on the spacer notches).

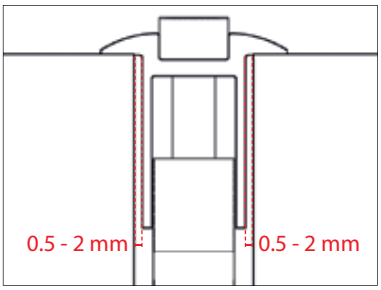


Fig. 6.-2 (clearance)

Observe the clamping points specified by the module manufacturer!
Please note the data sheet of the photovoltaic module provided by the manufacturer to verify the clamping points.

6.1. Module mounting and clamping in the case of vertical module bearing

The modules are fastened with special steel clamps in the case of vertical module arrangements:

1. Attach the module clamp on the rail of the Z-purlin.

Fig. 6.1.-1 (attaching the module clamp)

2. Push the module to the clamp (observing the clearance!)

Fig. 6.1.-2. (pushing/sliding the module to the clamp)

3. Fasten hex socket screw with a torque of 8 Nm

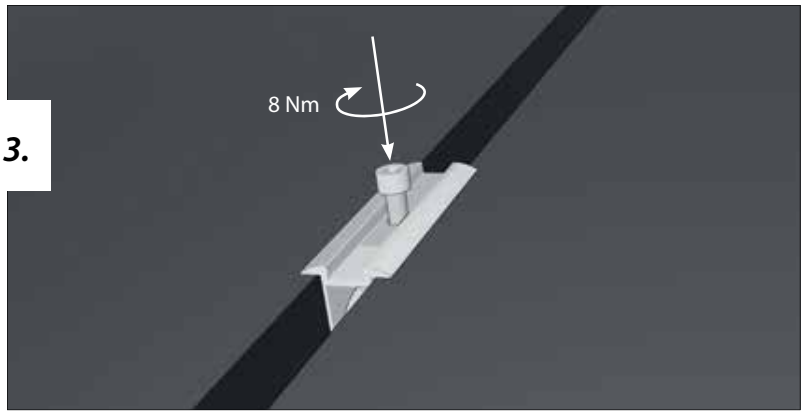


Fig. 6.1.-3. (fastening the hex socket screw)

6.2. Module mounting and clamping in the case of horizontal module bearing

The horizontal module clamping is carried out with a module clamp adapter in combination with Rapid 2+ clamps or Standard clamps:

1. Insert the module clamp into the notch of the module clamp adapter

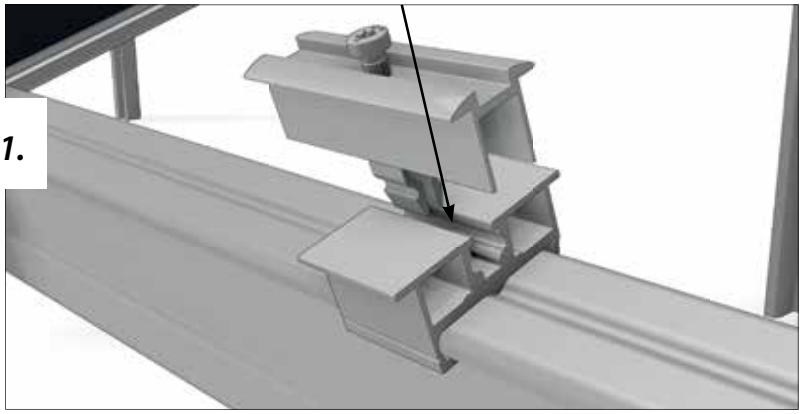


Fig. 6.2.-1 (clicking in the module clamp)

2. Push the module to the clamp (observing the clearance!)

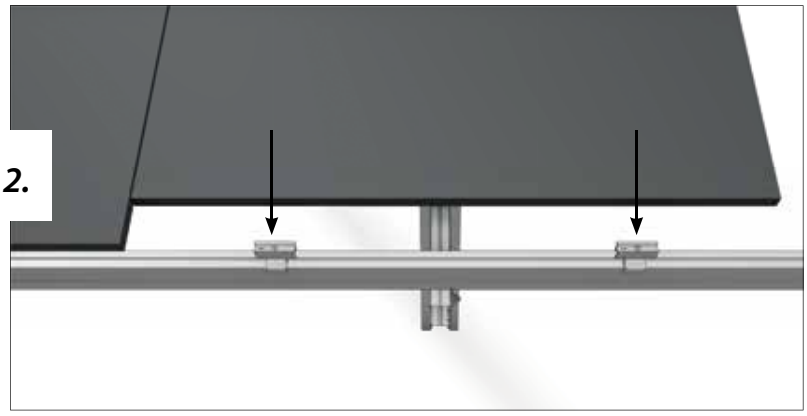


Fig. 6.2.-2. (pushing/sliding the module to the clamp)

3. Fasten hex socket screw with a torque of 15 Nm

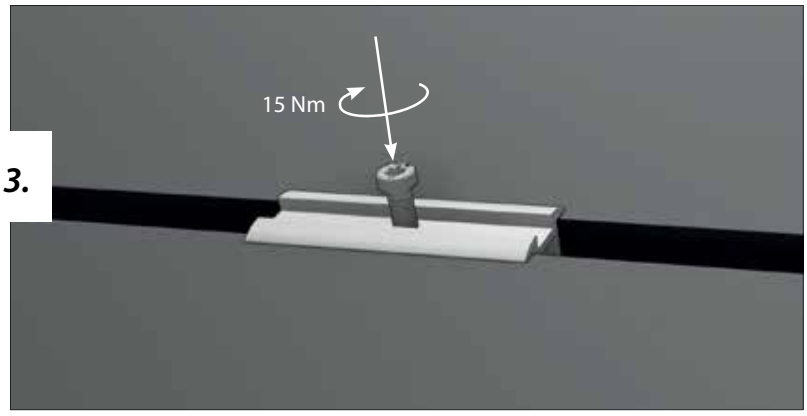


Fig. 6.2.-3. (fastening the hex socket screw)

6.3. Module mounting and clamping in the case of combined module bearing

The combined module clamping is carried out with a module clamp adapter in combination with Rapid 2+ clamps or Standard clamps:

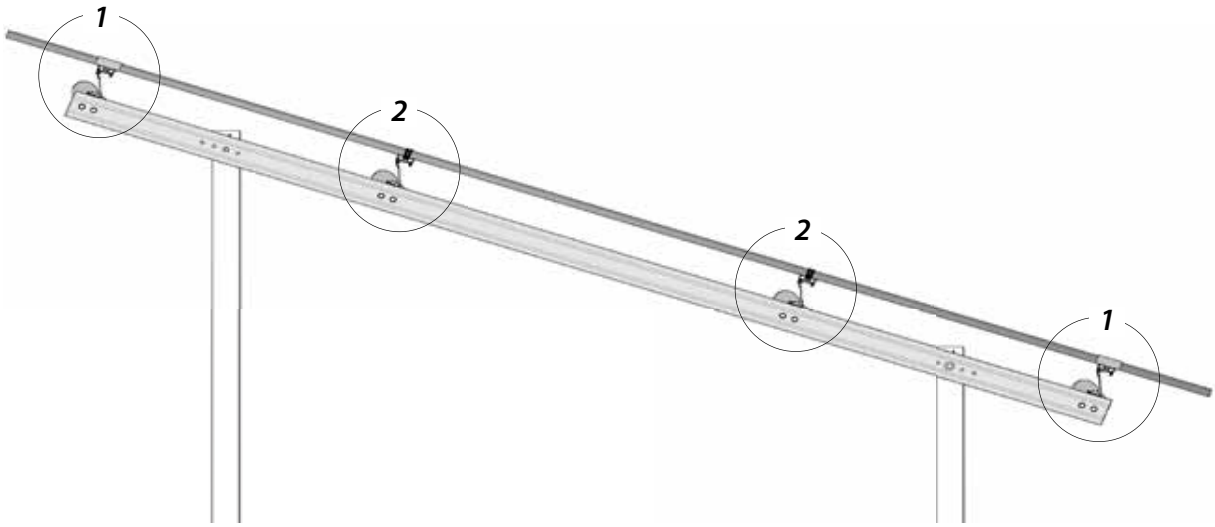


Fig. 6.3.-1 (combined module clamping)

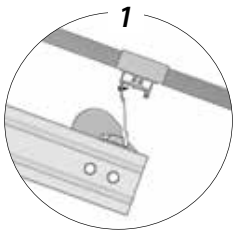


Fig. 6.3.-2.(upper and lower module clamping)

Clamping at the long side of the module to the upper and lower module-bearing rail.

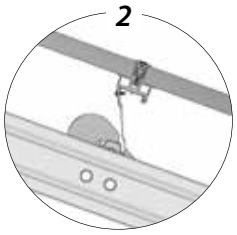


Fig. 6.3.-3 (module clamping at the inner side)

Clamping at the short module side to the inner module-bearing rails (comparable to clamping in the case of horizontal module arrangement).

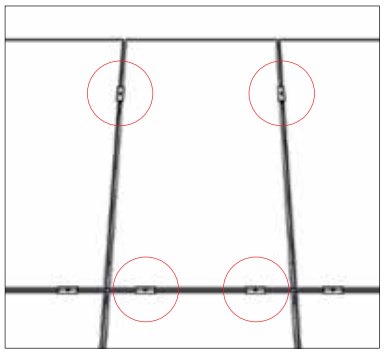


Fig. 6.3.-4 (clamping of the upper module)

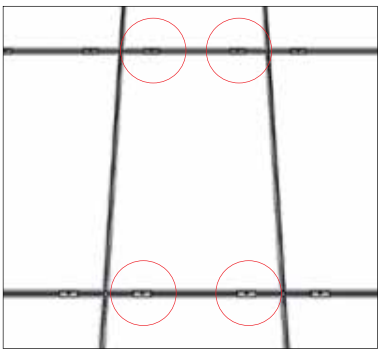


Fig. 6.3.-5 (clamping of the inner module)

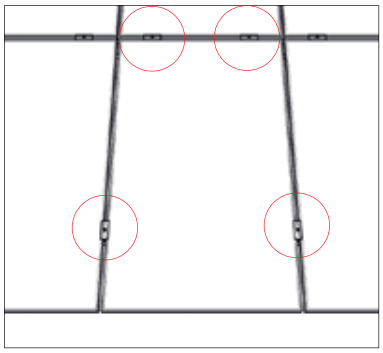


Fig. 6.3.-6 (clamping of the lower module)

7. Disassembly and disposal

DANGER

- *The plant operates with high voltage.*
- *Please note all tutorials and safety guidelines provided by the manufacturer of the modules or electrical components before shutting down the plant.*
- *The plant may only be disconnected from the power supply provided on site by a qualified electrical technician.*

WARNING

- *Always wear protective equipment (safety shoes, hard hat, safety glasses, protective gloves and reflective vest) when disassembling the FS Duo components.*
- *Make sure that no unauthorized persons can enter the danger area.*
- *Do not step under suspended loads!*

- We recommend to wait for the confirmation by a qualified electrical technician regarding the correct decommissioning of the plant before starting the disassembly of the FS Duo.
- Have an accordingly trained professional disassemble the plant in transportable units.
- Observe all information and instructions provided in these Mounting Instructions.
- Also make these Mounting Instructions available to the staff that is in charge of the disassembling operations.
- Ensure that the disassembling operations are performed exactly in reverse order of the mounting steps.

Faulty waste disposal can lead to environmental damage.
With regard to the environment it is recommended to dispose of recyclable materials in an appropriate manner.

Fig. 7.-1 (general recycling symbol)

Properly dispose of components

- Separate the materials steel, plastics, electric scrap, aluminium, stainless steel, copper, brass, etc.
- Dispose of the components in accordance with the local regulations

8. Maintenance and care

We recommend as follows:

INSPECTION OF THE PLANT
- *after exceptional weather conditions (storm, heavy snowfall or rain, etc.)*
- *after natural convulsions (earthquake, landslide, settlements, etc.)*

MAINTENANCE OF THE PLANT
- *Cleaning of the modules*
- *Verification of the bolted connections*
- *Check of the plant regarding corrosion*
- *Maintenance of the access roads and walkways*

REMEDIAL MAINTENANCE OF THE PLANT
after detecting damages on the racks or earth movements (for example removing corrosion, replacement of faulty components, detection of unfastened bolted connections, etc.)

9. Warranty and liability

Generally, the customer is responsible for the proper mounting and installation of the FS Duo.

Exclusions
Guarantee, warranty and liability claims against the manufacturer Schletter GmbH in case of injury to persons or material damage shall be excluded if they result from one or several of the causes listed below:
- Non-observance of the Mounting Instructions and/or maintenance instructions in combination with a warranty extension
- Any use other than the intended use of the FS Duo or faulty operation
- Incorrect mounting, maintenance or repair
- Operation with spare or equipment parts that are faulty or have not been approved by the manufacturer
- Arbitrary constructional modifications or manipulation of the FS Duo or its equipment or components
- Utilization of components made by other manufacturers (third party components)
- Neglect or non-observance of the prescribed maintenance and/or testing and inspection intervals

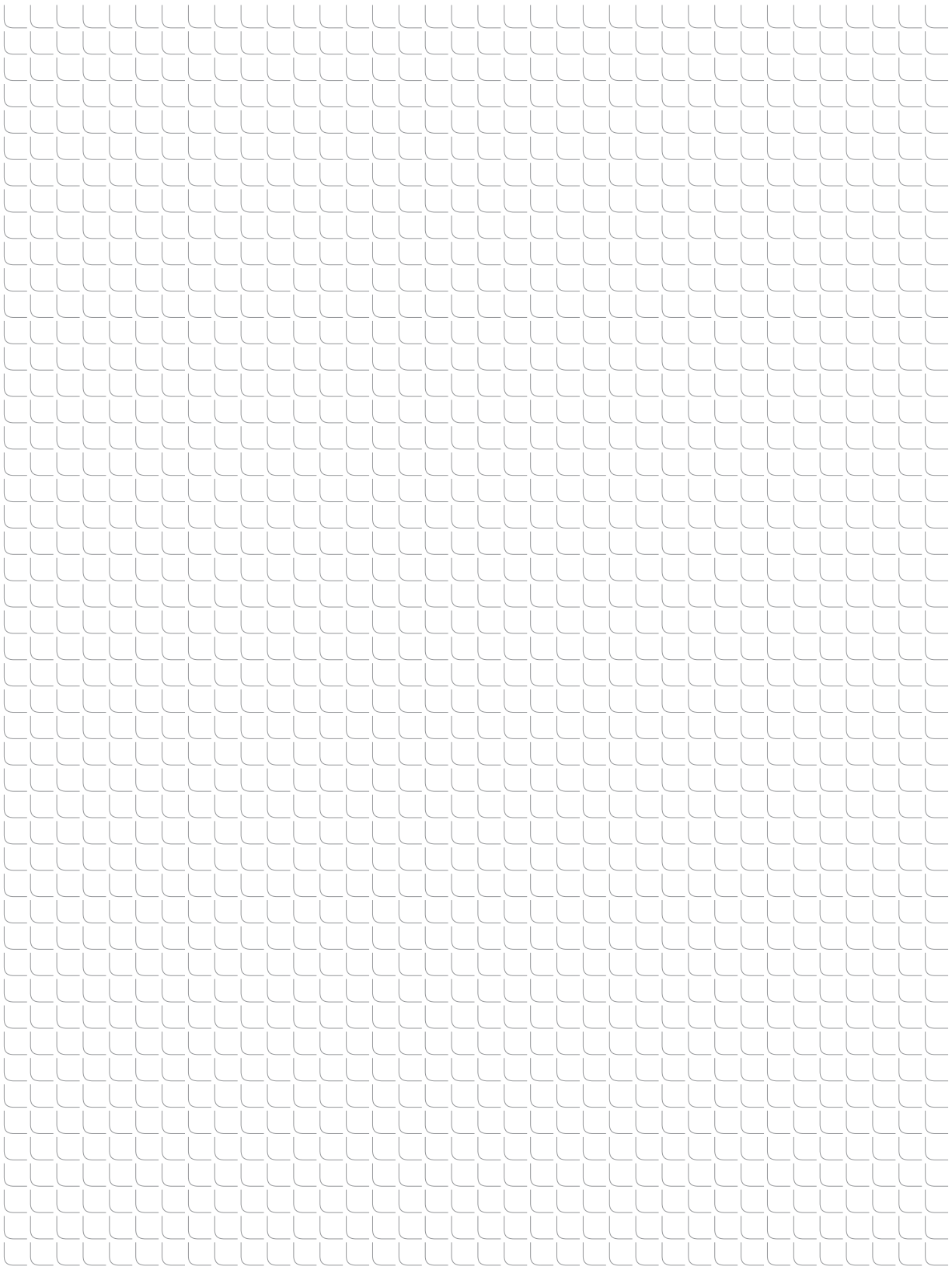
The customer exclusively shall bear the costs for damage or consequential damage that is due to one or several of the causes mentioned above.

The Mounting Instructions as well as the maintenance instructions in combination with a warranty extension refer exclusively to the mechanical metal structure supplied by Schletter GmbH.

Components of the solar plant like modules, cables and plug connectors, inverters or electric switch boxes are not part of these parts of the manual and thus are exempt from warranty and liability by Schletter GmbH.

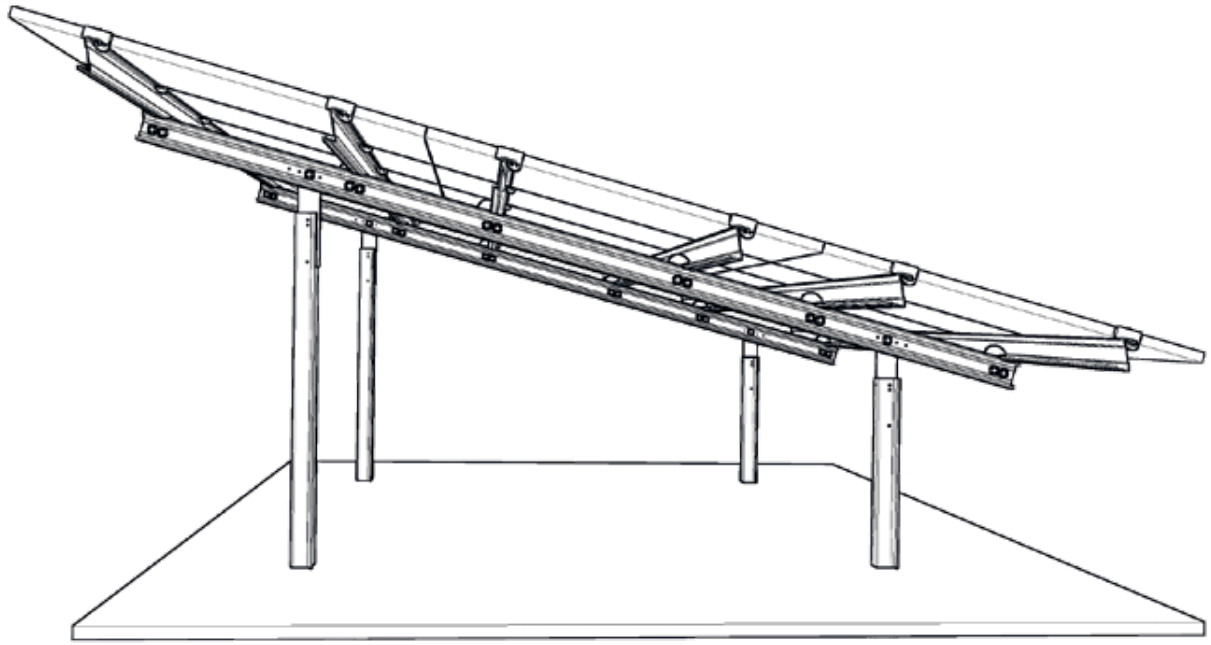
Material damage to objects that are not included in the scope of delivery are generally excluded from any liability.

Notes



FS Duo System

Mounting instructions



CONTENTS **Page**

1 General

1.1. Information

The FS ground-mounted system is customized for the respective installation site. A corresponding detailed structural analysis must be created to determine the required cross sections of the profiles, as well as a geo-technical report to determine the required pile-driving (ramming) depth.
It is compulsory to create well-arranged and detailed documentation (site journal) where all daily work steps, employment of staff and assembled material are exactly specified.
Please remember that wrong deliveries or damaged components must be reported to Schletter immediately.
If the mounting instructions are not adhered to or components made by other manufacturers are used, Schletter GmbH will not assume any liability for resulting damage or defects.

Only qualified personnel and accordingly trained staff is allowed to carry out mounting operations, drive building site vehicles and operate building machines!

Securing of the working area
Before the start of construction, the building site must be inspected by a supervising person by sight check or using plans showing all supply lines (water, electricity, gas) in the relevant area. For this purpose, the positions of all supply lines (water, gas electricity, etc.) must be marked using marking paint and unstable ground and areas that are landslide-prone must be sealed off with stable barriers or warning signs.

When mounting the solar modules, the safety regulations and mounting instructions of the respective module manufacturer must be observed!

Due to production tolerances, there may be deviations from the dimensions specified in the overview drawing. The specialist company that carries out the mounting operations is responsible for the adaptation of these deviations within the admissible tolerances!

It is compulsory to wear safety vests and safety shoes all the time

Always wear ear protection when carrying out noisy work

Always wear a hard hat when there might be falling objects or if you could hurt your head in some other way.

Wear protective gloves when working with sharp-edged components

Wear respiratory protection when carrying out dusty work

Wear safety glasses when carrying out grinding and abrasive cutting operations and any other operations that are dangerous to your eyes in order to avoid any danger to your eyes caused by flying liquids or parts (sparks, splinters)

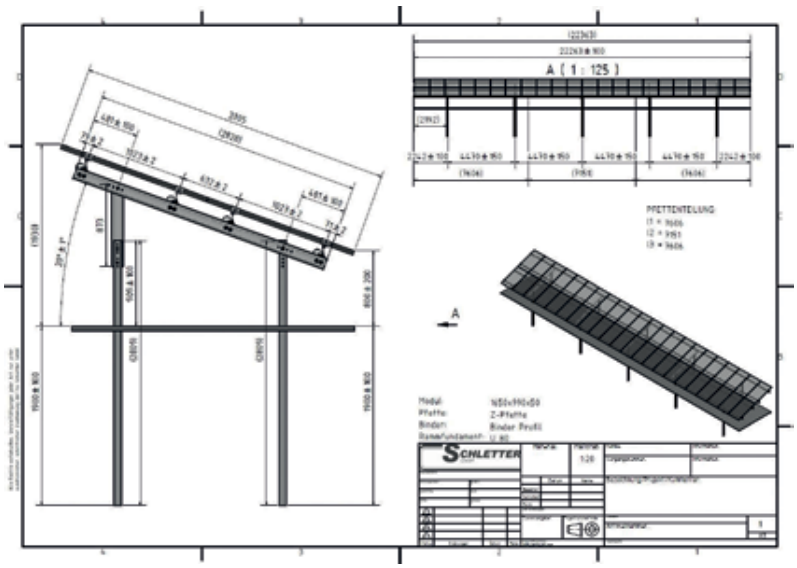
1.2. Planning

An accordant overview drawing is drawn up for each system before delivery. All defined measurements and the positions of the individual components and fasteners are displayed on these drawings. The respective torques are also listed in this instruction.

In the general layout drawing, the components are shown from various perspectives and defined by name. Thus, items, quantities and article numbers on the delivery note can be looked up.

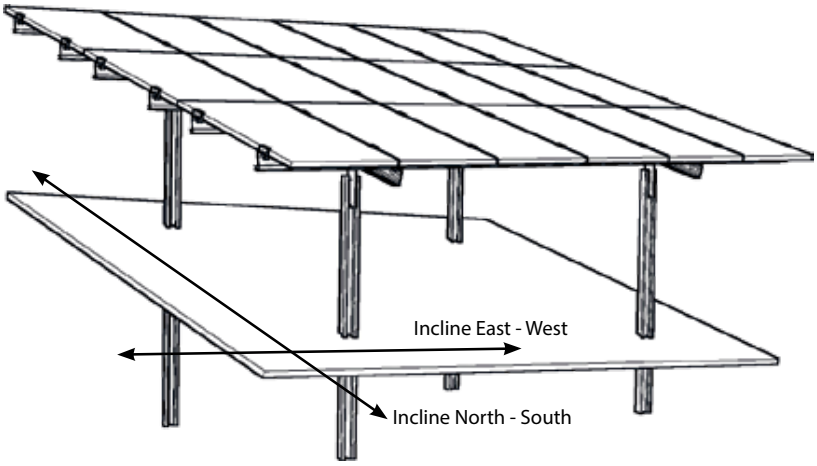
The tolerance values of the individual components must be strictly observed in order to safeguard the structural safety of the solar plant!

Example general layout drawing



1.3. Terrain

When planning the ground-mounted system, make sure that the slope (incline) is within the tolerances. In the following, the guiding values for a structurally safe solar plant are specified.



Maximum admissible slope (incline)
East - West: **5°**

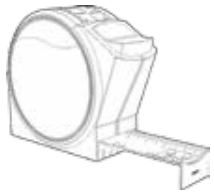
Maximum admissible slope (incline)
North - South: **35°**
Depending on the condition of the slope (soil composition, rocks, etc.)

⚠ Pay regard to item 8 "Tolerances regarding terrain topography"!

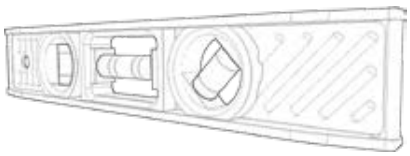
1.4. Tools list

In the following, the tools that are usually required for the mounting of FS Duo are listed. Additional tools that are required for special cases (for example encasing the foundation piles in concrete) are not listed here.

1.4.1. Defining the positions of the pile-driven supports and marking these positions

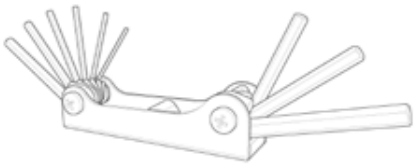


- Measuring tapes (100 m)
- Line pins (about 20 pieces)
- Mason´s lacing cord
- Club hammer
- Wooden stakes
- Color spray (for ground marking etc.)
- Permanent marker
- Zinc dust primer
- Brush



1.4.2. Pile-driving (ramming)

- Pile-driver (with suitable ram)
- Water level



1.4.3. Rack mounting

- Torque wrench (30 Nm to 60 Nm)
- Wrench socket size 17
- Wrench socket size 19
- Hammer
- Club hammer (to hold against the holding plates)
- Plastic tip hammer
- Angle meter - spirit level
- Measuring tape
- Mason´s lacing cord
- Cordless screw driver

1.4.4. Module mounting

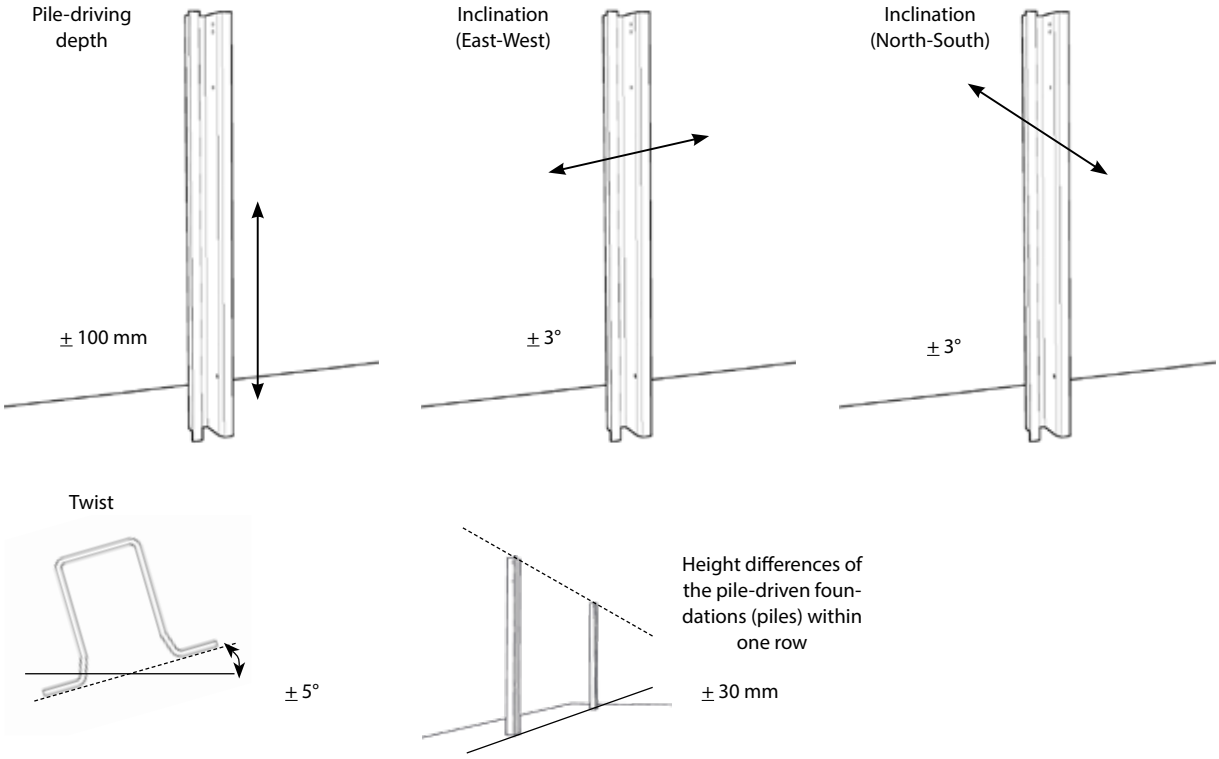
- Mason´s lacing cord
- Measuring tape
- Possibly distance template for distances between the modules
- Cordless screw driver
- Wrench socket size 8 for cordless screwdriver
- Allen key size 6 / 40TX key
- Torque wrench (< 8 Nm)
- Allen key socket size 6 / 40TX bit for torque wrench
- Plastic tip hammer (for driving in the nails of the lay-in system)

⚠ We recommend to use torque wrenches for all bolted connections. With quick rotation, there is an increased danger of "bolt blocking"!

2 Pile driving (Ramming)

2.1. Positioning

Pile-driving operations must be carried out by specialist companies. Special pile-driving plans are created on the basis of a digital terrain model with exactly specified contour lines. These plans must be available at least one week before the start of the pile-driving operations and must include the positions of the pile-driven foundations and their corresponding dimensions. The position of the first and last pile in each row must be marked on the terrain with a wooden stake. If a row length exceeds 50 meters, additional markings (wooden stakes) must be used within the row.



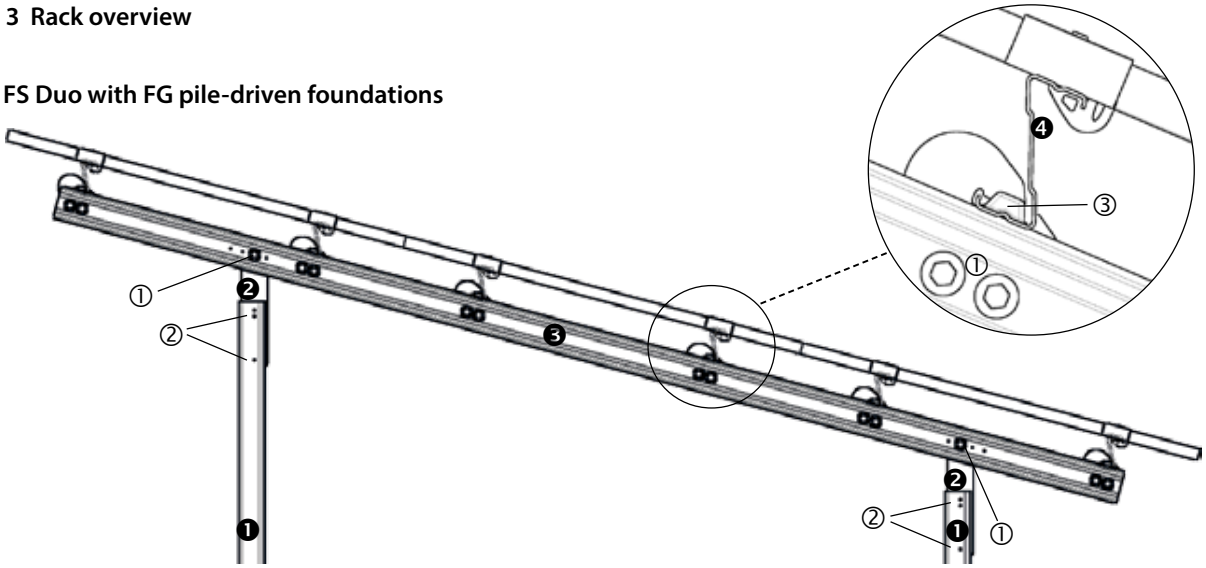
2.2. Pile-driving on difficult subsoil

- Extraordinary driven piles must be clearly identified and documented in a pile-driving plan.
- Inconsistencies during the pile-driving procedure which could affect the adhesive force of the piles must be documented, (e.g. slant position, deceleration and subsequent, sudden acceleration of the penetration speed, swift penetration of the foundation pile while pile-driving etc.).
- All pile-driving procedures deviating from the specifications must be approved by Schletter GmbH.
- If pile-driving operations are impeded by unexpected obstacles (blocks, solid rock on the site), the following procedure must be implemented:

1. Pre-drill down to the target depth.
2. If possible, vacuum the drill cuttings out of the borehole. Otherwise, the drill cuttings that remain in the borehole have to be compacted.
3. The borehole must be filled in layers with compressed concrete of strength C16/20 and compacted.
4. After that, pile-drive the pile without delay.

3 Rack overview

FS Duo with FG pile-driven foundations



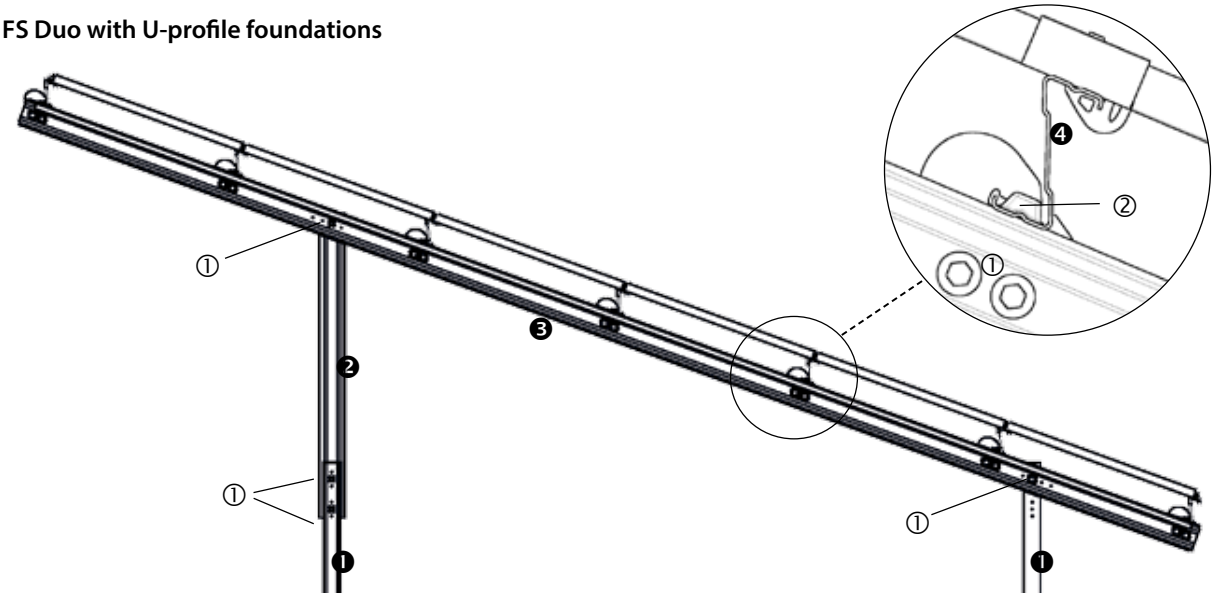
Components

- ❶ FG pile-driven foundation
- ❷ Steel head
- ❸ Girder assembly
- ❹ Purlin

Fasteners

- ① Bolt M12x30, nut M12 and washer M12 DIN9021
- ② Screw M10x30, nut M10 and washer M10 DIN125
- ③ Fastening device

FS Duo with U-profile foundations



Components

- ❶ U-profile foundation
- ❷ Foundation collar
- ❸ Girder assembly
- ❹ Purlin

Fasteners

- ① Bolt M12x30, nut M12 and washer M12 DIN9021
- ② Fastening device

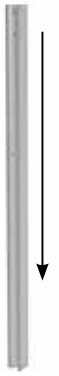
4 Mounting of the individual assemblies

4.1. Drive the foundations into the ground and coat the upper end with a zinc dust primer

⚠ Check the stability of foundations before mounting the racks!

⚠ **Zinc dust primer** is the only coating approved according to the standards to provide the required protection. Basic zinc spray coatings do not provide long-term protection.

⚠ The tolerances specified here must not be exceeded!



Height tolerance of the piles to each other ±**30mm**

Tolerance of the N-S and E-W inclination ±**3°**

Tolerance of the foundation height in accordance with terrain topography ±**100mm**

A zinc dust primer is to be used to coat the top 30 mm of the pile-driven foundation (pile), inside and outside.

⚠ Pile-driving schematic for two-support design **with** FG-type pile-driven foundations

⚠ Pile-driving schematic for two-support design **with** U-profile

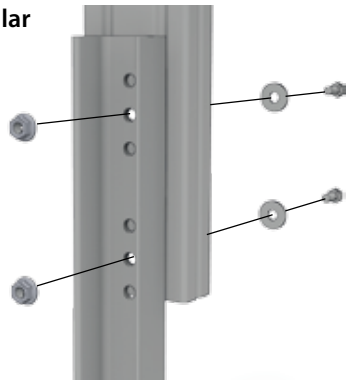
4.2. Mounting of the girders

4.2.1. Girder mounting when U-profile foundations are used

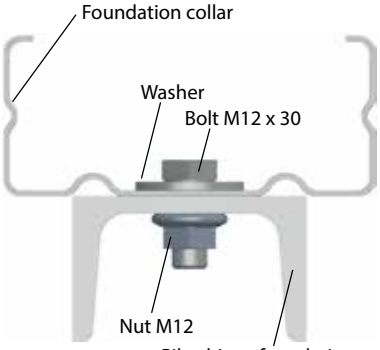
4.2.1.1 Mounting of the foundation collar

⚠ As a standard, the middle holes should be used for the bolts. Other holes should be used only for height tolerance compensation.

⚠ Always fasten the bolts by turning the bolt heads! Do not turn the nut, just hold it!



Connect the foundation collar to the pile-driven profile using two M12x30 screws, washers and nuts (position the washers on the side of the foundation collar!)



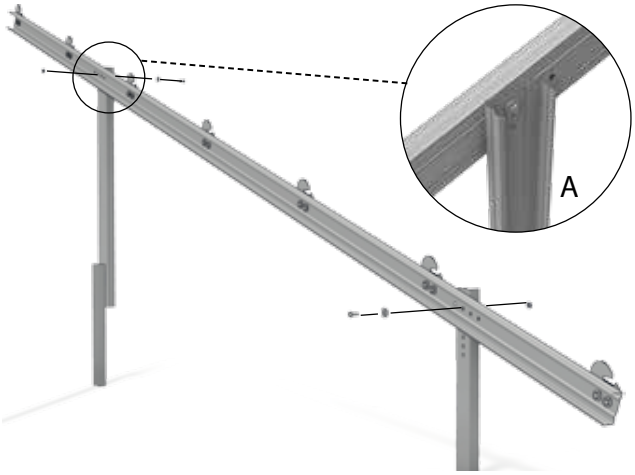
View from above.

4.2.1.2 Mounting of the girders

⚠ The girders as well as the other components must be aligned with the utmost precision, so that there will be no stresses in the module later.

⚠ The girders must be fastened with the closed side to the foundation collar and to the lower pile-driven foundation pile! (See detailed view A)

⚠ A foundation collar is not required when mounting rack structures using FG pile-driven foundations!



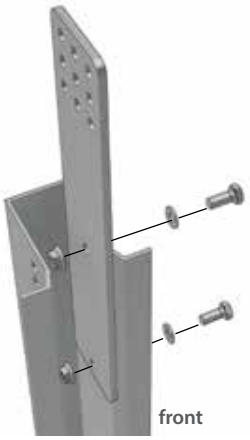
Position the girder and, using M12x30 bolts, washers and nuts fasten it above to the foundation collar and below to the foundation pile.

4.2.2. Girder assembly when FG pile-driven foundations are used

4.2.2.1 Mounting of the steel head

⚠ Always fasten the bolted connection by turning the bolt head! Do not turn the nut, just hold it!

⚠ Depending on the local conditions, two respectively three bolted connections per head are required.



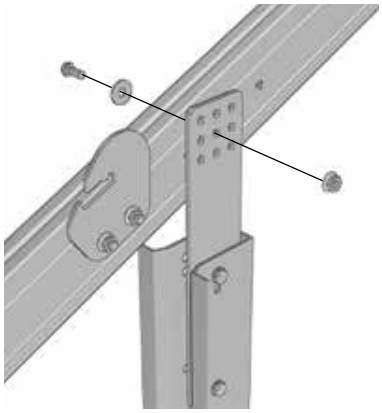
Position the steel head to the inner side of the pile-driven foundation pile and fasten it with M10x30 bolts

Mounted head assembly with multiple holes for flexible adjustment

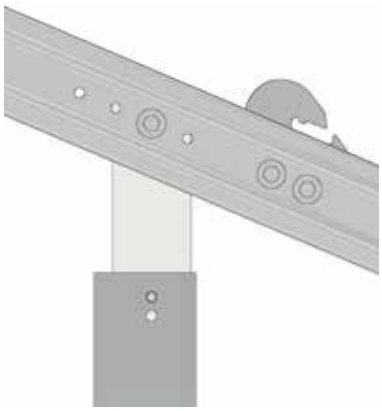
4.2.2.2 Mounting of the girders

⚠ Check the torques of all screws!

⚠ If required, use the drilled holes at the steel head for the adjustment and alignment of the girders.



Feed the M12x30 bolt through the predrilled third hole through the girder and tighten it loosely with nut and washer to the foundation collar

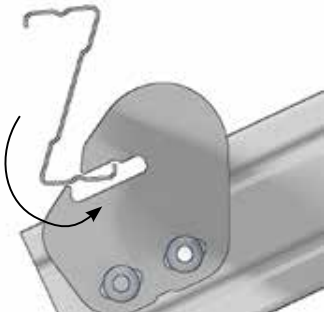


Side view

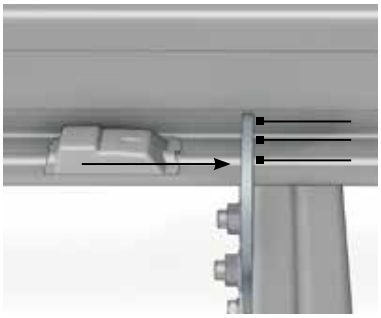
4.3. Mounting of the purlins

⚠ Please note that the purlin must be at a 90° angle to the girder!

⚠ For fine adjustment, there are slotted holes in the fastening plate. It may be necessary to readjust the fastening plate.



Insert the purlin into the pre-assembled fastening plates



Fasten the fastening device by holding one hammer against the fastening plate and knocking in the wedge (fastening device) with a second hammer (plastic tip hammer)

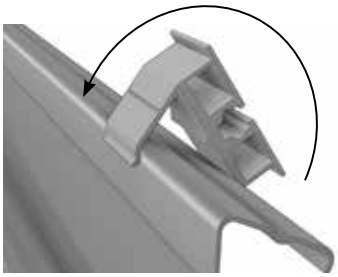
4.4. Mounting of the connectors (optional)

⚠ Use the pre-drilled holes to screw the connectors to the purlin!

Fasten the connector to the purlins, using four M12x30 bolts, DIN 9021 washers and four M12 flange nuts

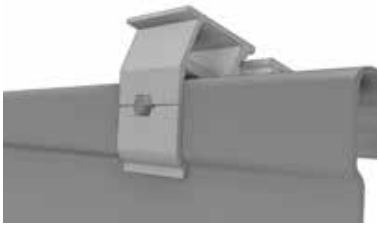
Side view

4.5. With horizontal module arrangement or vertical and horizontal module arrangement at the same time, mount a module clamp adapter (optional with vertical arrangement of the modules)



Snap the module clamp adapter onto the Z-purlin at the indicated points

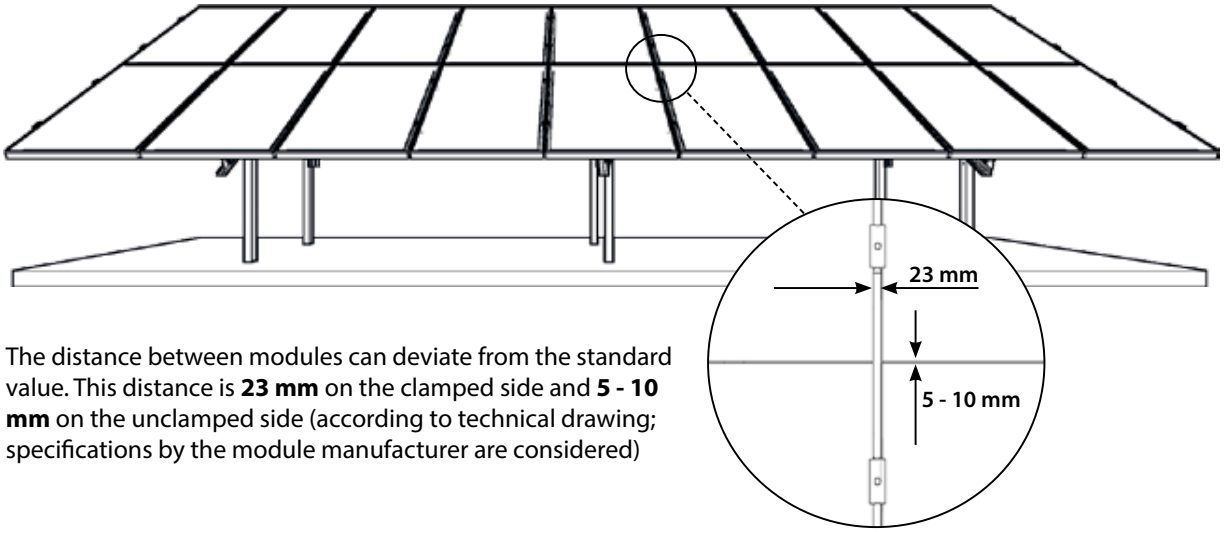
Side view



Fasten the module clamp adapter to the Z-purlin using a drilling screw

5 Module mounting and module clamping

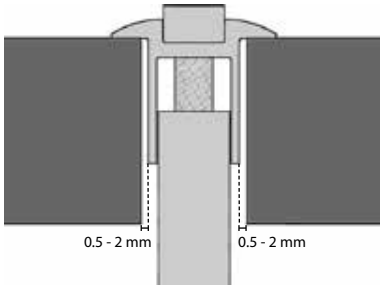
The modules are mounted with suitable module clamps depending on the module arrangement (horizontal, vertical, combined clamping). The clamps are attached onto the module-bearing profile or the module clamp adapter and are tightened with screws.



The distance between modules can deviate from the standard value. This distance is **23 mm** on the clamped side and **5 - 10 mm** on the unclamped side (according to technical drawing; specifications by the module manufacturer are considered)

⚠ **When mounting the modules, always observe the clamping points specified by the module manufacturer!**

⚠ **Make sure that the distance from the module to the clamp is at least 0.5 mm and not more than 2mm!**
(= distance between module and module clamp, see picture on the right)



5.1. Module clamping with vertical module arrangement

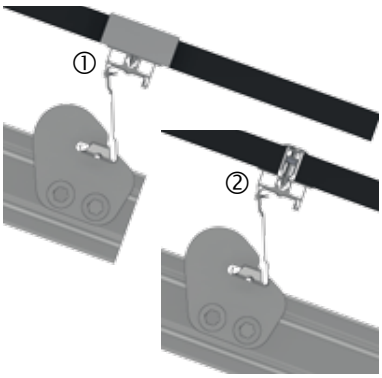
When mounting the modules, the module clamp screws must be tightened with a torque of 8 Nm!

Optionally, the vertical module mounting can also be carried out in combination with the module clamp adapter and Rapid 2+ or Standard clamps.

5.2. Module clamping with horizontal module arrangement

Attach the Rapid 2+ or Standard clamp on the module clamp adapter and fasten it with a tightening torque of 14 Nm.

5.3. Module clamping with vertical and horizontal module arrangement at the same time



Attach the Rapid 2+ or Standard clamp on the module clamp adapter and fasten it with a tightening torque of 14 Nm.

① Clamping at the long sides of the module to the uppermost and to the lowermost purlin.

② Clamping to the middle purlins at the short module sides (comparable to clamping with horizontal module arrangement)

Module clamps for vertical module mounting

	Steel clamp			Rapid clamp*		Standard clamp*	
Module height	**End clamp left**	**Middle clamp**	**End clamp right**	**End clamp**	**Middle clamp**	**End clamp**	**Middle clamp**
20 mm	---	---	---	---	---	130001-020	130002-000
24 mm	---	---	---	---	---	130001-024	130002-000
28 mm	---	---	---	---	---	130001-028	130002-000
30 mm	144912-030	144910-001	144911-030	131001-030	131002-000	130001-030	130002-000
31 mm	144912-031	144910-001	144911-031	131001-031	131002-000	130001-031	130002-001
32 mm	144912-032	144910-001	144911-032	131001-032	131002-000	130001-032	130002-001
33 mm	144912-033	144910-002	144911-033	131001-033	131002-000	---	---
34 mm	144912-034	144910-002	144911-034	131001-034	131002-000	130001-034	130002-001
35 mm	144912-035	144910-002	144911-035	131001-035	131002-000	130001-035	130002-001
36 mm	144912-036	144910-002	144911-036	131001-036	131002-000	130001-036	130002-001
37 mm	144912-037	144910-002	144911-037	131001-037	131002-000	---	---
38 mm	144912-038	144910-003	144911-038	131001-038	131002-000	130001-038	130002-001
39 mm	144912-039	144910-003	144911-039	131001-039	131002-000	---	---
40 mm	144912-040	144910-003	144911-040	131001-040	131002-001	130001-040	130002-001
41 mm	144912-041	144910-003	144911-041	131001-041	131002-001	130001-041	130002-001
42 mm	144912-042	144910-003	144911-042	131001-042	131002-001	130001-042	130002-001
43 mm	144912-043	144910-004	144911-043	131001-043	131002-001	130001-043	130002-001
44 mm	144912-044	144910-004	144911-044	131001-044	131002-001	130001-044	130002-001
45 mm	144912-045	144910-004	144911-045	131001-045	131002-001	130001-045	130002-001
46 mm	144912-046	144910-004	144911-046	131001-046	131002-001	130001-046	130002-001

*** in combination with module clamp adapter**

46 mm	144912-046	144910-004	144911-046	131001-046	131002-001	130001-046	130002-001
47 mm	144912-047	144910-004	144911-047	131001-047	131002-001	---	---
48 mm	144912-048	144910-005	144911-048	131001-048	131002-001	130001-048	130002-001
49 mm	144913-049	144910-005	144913-049	131001-049	131002-001	---	---
50 mm	144913-050	144910-005	144913-050	131001-050	131002-001	130001-050	130002-001
51 mm	---	---	---	---	---	130001-051	130002-001

Module clamps for horizontal module mounting

	Rapid clamp*		Standard clamp*	
Module height	**End clamp**	**Middle clamp**	**End clamp**	**Middle clamp**
20 mm	---	---	130001-020	130002-000
24 mm	---	---	130001-024	130002-000
28 mm	---	---	130001-028	130002-000
30 mm	131010-030	131012-000	130001-030	130002-000
31 mm	131010-031	131012-000	130001-031	130002-001
32 mm	131010-032	131012-000	130001-032	130002-001
33 mm	131010-033	131012-000	---	---
34 mm	131010-034	131012-000	130001-034	130002-001
35 mm	131010-035	131012-000	130001-035	130002-001
36 mm	131010-036	131012-000	130001-036	130002-001
37 mm	131010-037	131012-000	---	---
38 mm	131010-038	131012-000	130001-038	130002-001
39 mm	131010-039	131012-000	---	---
40 mm	131010-040	131012-001	130001-040	130002-001
41 mm	131010-041	131012-001	130001-041	130002-001
42 mm	131010-042	131012-001	130001-042	130002-001
43 mm	131010-043	131012-001	130001-043	130002-001
44 mm	131010-044	131012-001	130001-044	130002-001
45 mm	131010-045	131012-001	130001-045	130002-001
46 mm	131010-046	131012-001	130001-046	130002-001
47 mm	131010-047	131012-001	---	---
48 mm	131010-048	131012-001	130001-048	130002-001
49 mm	131010-049	131012-001	---	---
50 mm	131010-050	131012-001	130001-050	130002-001
51 mm	---	---	130001-051	130002-001

Steel module clamps (V mounting)

Rapid module clamps

Standard module clamps

*** in combination with module clamp adapter**

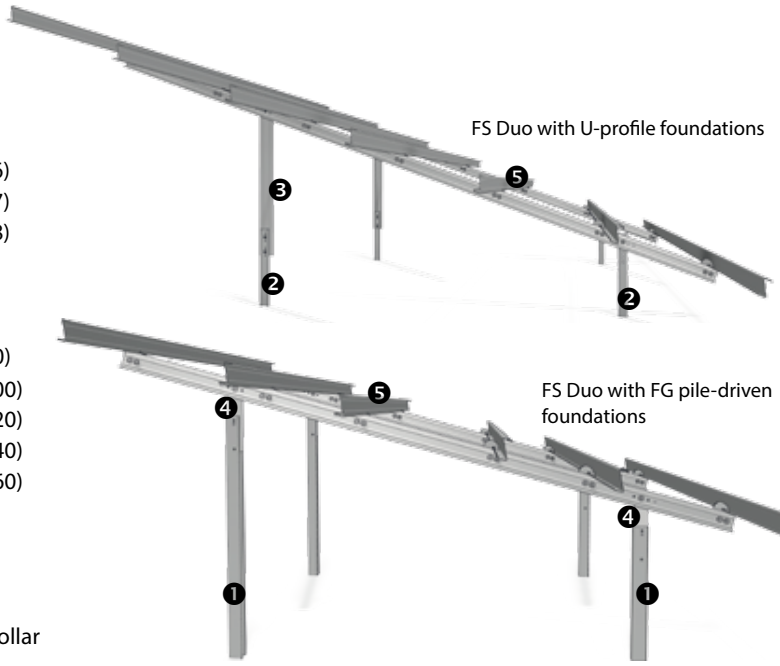
The nuts and bolts of the standard clamps are not included in the scope of delivery and are delivered separately.

With big order quantities, clamps for other module thicknesses can be manufactured on request!

The Standard clamps are not pre-assembled when they are delivered. These clamps are combined with a socket head screw, a KlickIn click component and a square nut. The screws listed below can be used for that purpose:

Frame height	Suitable socket head screw mm	Item number	Module name
20	25	943308-125	M8x25 socket head screw with serrated flange
24	30	943308-130	M8x30 socket head screw with serrated flange
28-30	35	943308-135	M8x35 socket head screw with serrated flange
31-35	20	943308-120	M8x20 socket head screw with serrated flange
36-40	25	943308-125	M8x25 socket head screw with serrated flange
41-45	30	943308-130	M8x30 socket head screw with serrated flange
46-51	35	943308-135	M8x35 socket head screw with serrated flange
129010-008		KlickIn click component	
943914-008		Square nut M8, V4A	

6 Components list



❶ Pile-driven foundation FG

143006-002 Foundation pile (FG6)
143007-004 Foundation pile (FG7)
143008-003 Foundation pile (FG8)

❷ Pile-driven foundation U

144971-001 Foundation pile (U80)
144972-001 Foundation pile (U100)
144973-001 Foundation pile (U120)
144974-001 Foundation pile (U140)
144975-001 Foundation pile (U160)

❸ Connector U-profile - Girder

144951-001 FS Duo foundation collar

❹ Connector for foundation pile FG - girder

000010-203 FS Uno/Uno 100 steel head


Steel head

❺ Module-bearing rail (custom cut)

144901-001 FS Uno/Duo purlin

144999-003 FS Uno/Duo fastening device

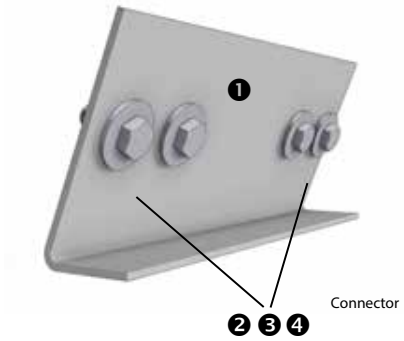

Fastening device

Module clamp adapter

144919-050 FS steel module clamp adapter kit (incl. drill screw)


Module clamp adapter

Module-bearing rail - connector (optional)

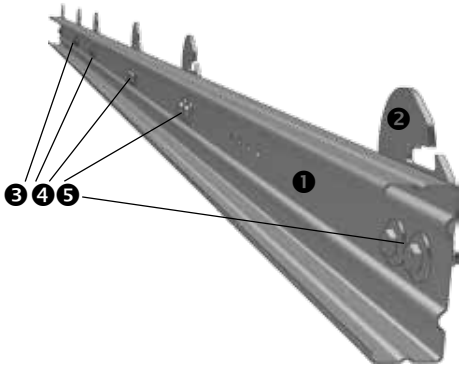


144999-008	FS Uno/Duo purlin connector Gen2 kit

consisting of:

000014-577	❶ 1x FS Uno/FS Duo purlin connector Gen2
943922-012	❷ 4x washer large M12 DIN9021 A2
943612-030	❸ 4x hexagon head bolt M12x30 DIN933 A2
943912-012	❹ 4x flange nut M12 serrated DIN6923 A4

Girder assemblies (optionally pre-assembled)



consisting of:

*144YXX-ZZZ** ❶ 1x girder custom cut

* varying depending on girder assembly:

XX: Number of installed modules
Y: System type
ZZZ: H or V mounting

144999-006	❷ *x FS Uno/Duo fastening plate
943612-030	❸ *x Bolt M12x30 DIN 933 A2
943912-012	❹ *x Flange nut M12 DIN 6923 A4
943922-012	❺ *x Washer large M12 DIN 9021 A2

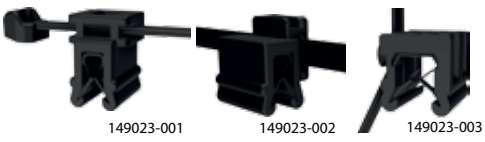
* varying depending on girder assembly

144301-000	FS Duo girder assembly 1V custom cut
144302-200	FS Duo girder assembly 2V custom cut
144303-200	FS Duo girder assembly 3V custom cut
144304-200	FS Duo girder assembly 4V custom cut
144305-200	FS Duo girder assembly 5V custom cut
144306-200	FS Duo girder assembly 6V custom cut
144307-200	FS Duo girder assembly 7V custom cut
144308-200	FS Duo girder assembly 8V custom cut

144301-000	FS Duo girder assembly 1H custom cut
144302-100	FS Duo girder assembly 2H custom cut
144303-100	FS Duo girder assembly 3H custom cut
144304-100	FS Duo girder assembly 4H custom cut
144305-100	FS Duo girder assembly 5H custom cut
144306-100	FS Duo girder assembly 6H custom cut
144307-100	FS Duo girder assembly 7H custom cut
144308-100	FS Duo girder assembly 8H custom cut

Auxiliary equipment / accessories

964000-176	Zinc dust silver-grey satin-finished



149023-001	Cable fastener 1.0 - 3.0 mm, guidance at the top
149023-002	Cable fastener 1.0 - 3.0 mm, guidance at the side
149023-003	Cable fastener 3.0 - 6.0 mm

144999-009	FS Uno/FS Duo cable fastener for purlin
144999-010	Ductwork

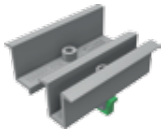
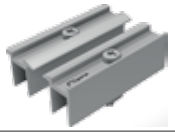
Purlin cable fastener for the fastening of cable conduits

7 Torque specifications

7.1. Bolted connections in the substructure

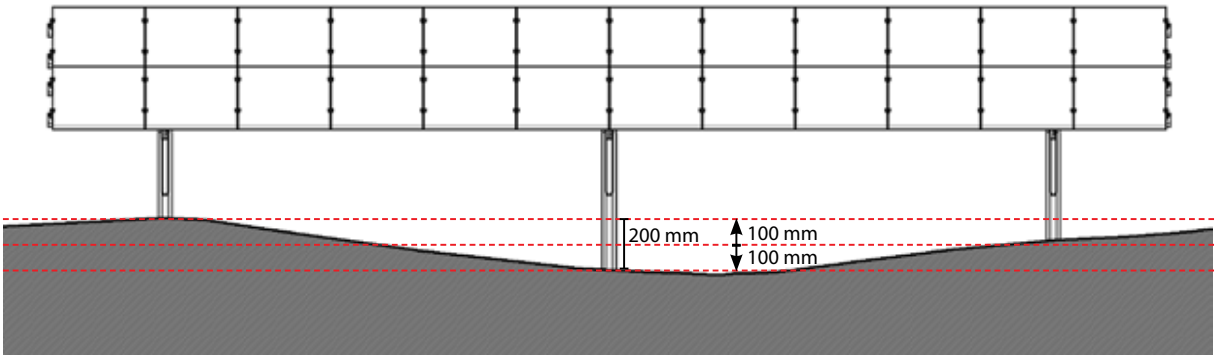
Picture	Name	Tightening torque (MA-Nm)
	Hexagon head bolt DIN933 - M12x30 A2 GMB Hexagon nut DIN6923 - M12 A4 Washer, large DIN9021 - M12 A2 Hexagon head bolt DIN 933 - M10x30 GMB	56 Nm 32 Nm

7.2. Fastening of the module clamps

Picture	Name	Tightening torque (MA-Nm)	Type of module mounting
Standard module clamps 	Socket head screw DIN4762 - M8 (20 - 35 mm) KlickIn click component for nut M8 Square nut DIN557 A4 - M8	14 Nm	H and V in combination with module clamp adapter
Steel module clamps 	Socket head screw DIN912 A2 - M8 (25 - 45 mm)	8 Nm	V
Rapid 2+ module clamps 	TX-drive stud screw A2 GMB - M8 (42.5 - 55 mm)	14 Nm	H and V in combination with module clamp adapter

Always fasten the bolted connection by turning the bolt head! When checking the prestress of the bolts, it has to be considered that constraints and frictional forces can lead to a loss of clamping force. This was taken into consideration when the tightening torques were determined. When a bolted connection is checked, it must not loosen when 50% of the specified tightening torque is applied.

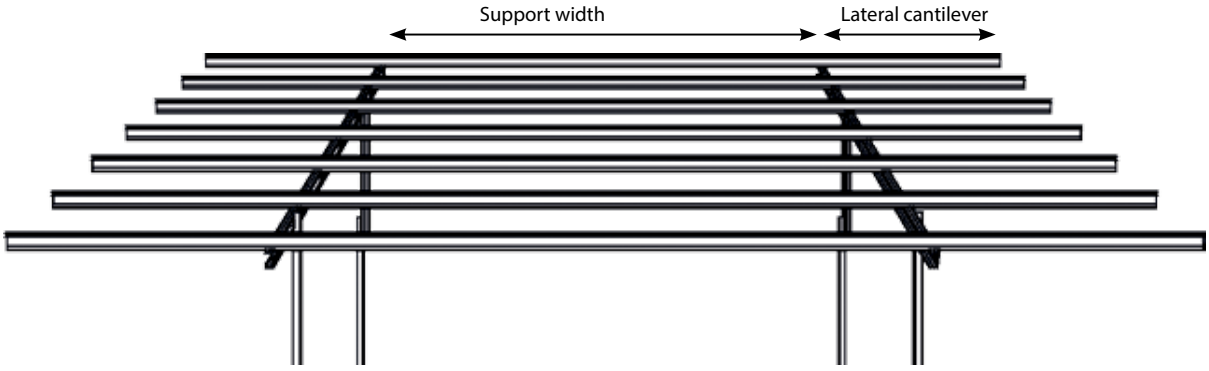
8 Tolerances regarding terrain topography



Individual Schletter racks are not parallel to the subsoil below them. Height differences of the subsoil under a rack can be equalized with the driven piles. Please already align the piles with a cord in the course of pile-driving. The tolerance of the anchoring depth is ±100 mm (see picture).

9 Tolerances regarding rack mounting

Schletter mounting racks for ground-mounted solar plants are always custom-dimensioned to withstand the wind and snow loads at the respective location. In the interest of economic efficiency, usually the maximum load-bearing capacity of the individual components is exploited. To achieve this, however, the racks must be mounted with the utmost precision. If there are significant deviations from the mounting plans, this can lead to structural overstress which in turn can lead to damage cases. Schletter will not assume any liability for such damage cases. Adherence to the specified tolerances is therefore essential to the structural safety of the rack.



Support width	± 150 mm
Lateral cantilever of purlins	± 100 mm
Lower girder connection	± 100 mm
Upper girder connection	± 100 mm
Clearance between module and clamp	0.5 to 2 mm

In the event of deviation, this must be communicated to Schletter immediately!

© Schletter GmbH · Gewerbegebiet an der B15 · Alustraße 1 · 83527 Kirchdorf/Haag i. OB · Germany · Tel.: +49 8072 9191-200
Fax: +49 8072 9191-9200 · E-mail: solar@schletter.eu · www.schletter.eu · Updated 06/2015 · Subject to change without notice
Your contact in the UK: Schletter UK Limited, Tel.: +44 1296 461 800, Fax: +44 1296 461 801, E-mail: info@schletter.co.uk