



Schletter Solar Mounting Systems ©
Mounting and project planning

Legal notice

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With this **instruction for mounting and project planning** we would like to give you important hints for both planning and mounting. Please read this mounting instruction and the further documents mentioned carefully before the mounting and pay regard to the according hints. The Schletter solar mounting system offers solutions for almost all mounting cases and is exclusively made of high-quality and durable components. Please consider that a correct selection, mounting and application of the components are very important for the whole system and that the installation of photovoltaic plants should only be carried out by experienced specialized companies. If you have any questions concerning application and mounting, we will be glad to help you.

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1 General application hints and further information

- Swift and simple mounting saves costs
- 10-year warranty creates customer-confidence
- Modular design solves (almost) any mounting problem by individual combinations
- Useful calculation tools and support programs save time during the process of offer creation
- Complete documentation and statical dimensioning charts allow optimum and cost-efficient plant-plannings



Besides this mounting instruction, by all means please also use our further documentations in order to dimension and mount your photovoltaic plant in an optimum manner:

- **The system statics**
 program-aided load calculations and well-arranged charts give important hints on dimensioning and are an individual statical verification at the same time. In addition to the mounting instruction, the hints given in the system statics have to be bindingly considered!
- **The system overview**
 gives an overview of the different system combinations and solution possibilities.
- **The component overview**
 shows all available components in a well arranged manner with many pictures.
- **The auto-calculator**
 is an efficient program which facilitates the plant dimensioning, incl. price calculation and piece list creation. The included schematic picture gives useful mounting hints.
- **Product sheets and application hints**
 contain further system-specific information, mounting examples and new developments.
- **On the internet**
 all current information is always available for download.
- **Load determination / superimposed load calculation**
 for a simple project planning, we give our regular customers access to our location-specific load determination and superimposed load calculation software.
- **Certifications**
 We meet highest quality standards. VDE, TÜV, ...

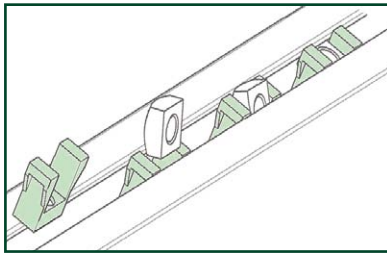


Within the RAL-Solar working group, we promote, independently of certain brands, a further development of quality standards in the area of solar mounting systems. Please categorically also pay regard to our general summaries concerning mounting problems:

- ➔ Laminat mounting general hints
- ➔ Module mounting general hints
- ➔ Facade mounting general hints
- ➔ Flat roof mounting general hints
- ➔ Earthing and lightning protection with PV-plants and others ...

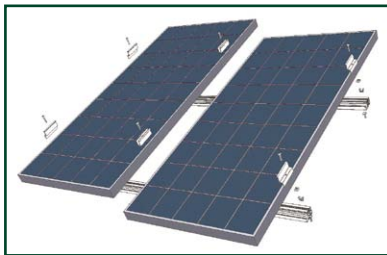
2 System characteristics (please also take a look at the system overview)

In the further development of the system, we put first priority on system safety, durability and quick mounting times. Further factors are the universal compatibility and the utilization of standard components (bolts, nuts, etc.).



The Klick system

The fixation spots for the module clamps can be chosen at will by means of square nuts in the aluminium duct of the rail. Here, the M8 quality steel nut can be clicked in at any spot of the duct. This spares the painstaking pulling-through of the nuts over the whole rail length.

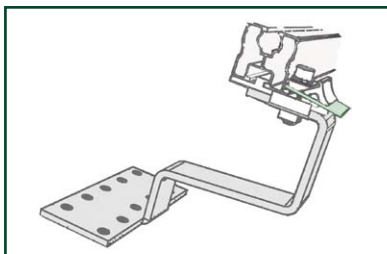


The cross beam program

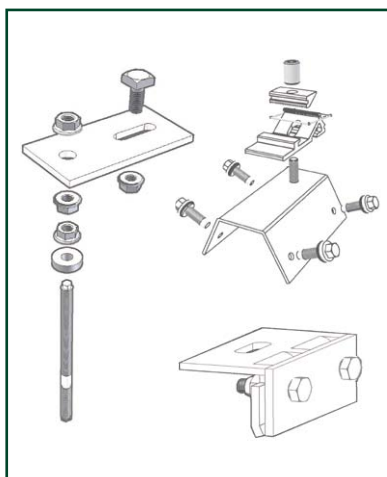
The standard cross beam is the interface between roof fixation and module fixation.

Upwards, in direction of the module square nuts (Klick system) serve as variable fixation spots.

Downwards, towards the roof, M10 standard respectively square head screws are inserted in the lower groove of the cross rail, and then screwed to the respective fixation element (roof hook, for example). This is the safest (screws cannot get lost) and the most universal solution at the same time, because for all areas of application on pitched and flat roofs universal profiles can be used.



Alternatively, the KlickTop system grants a mounting-friendly screwing from above.



Universal fixation elements for (almost) any roof, no matter if it is

- Tiled roof
 - Trapezoidal sheet metal roof
 - Corrugated roof
 - Sandwich roof
 - Standing seam roof
- and others...

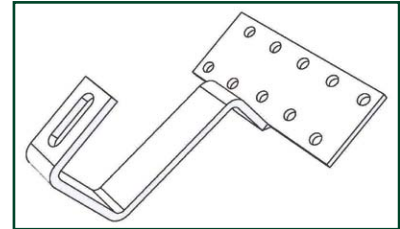
We exclusively use high-value and durable materials (certified aluminium alloys. Quality steel in 1.4301. rubber form parts made of vulcanized UV-resistant EPDM, etc.). Almost any fixation element is universally applicable for fixations on pitched roofs and elevations. Statical suitability charts respectively application programs are available for all fixation elements.

3 Roof forms and fixation elements

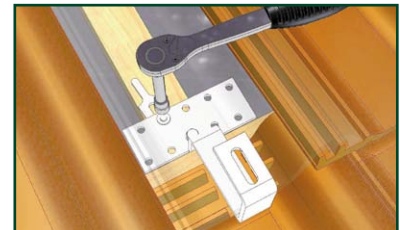
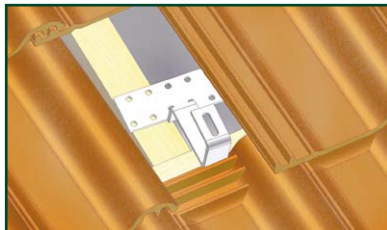
On the following pages we will give you an overview of all important fixation elements as well as the required mounting hints.

3.1 Tiled and pan-tiled roofs

With grooved tiled roofs or pantiled roofs, standard roof hooks are used. For special tiled forms special roof hooks are available (please also take a look at the component overview).



i Tools:
 Handy angle grinder with small diamond grinding wheel, socket wrench insert 13 with ratchet or drilling machine with socket wrench insert and torque control, a bit of grease with brush for wood screws, drilling machine with drill 6mm.



1 Determination of the position of the cross beam

The cross beams should be positioned 1/4-1/5 of the module height away from the lower resp. the upper module edge (respectively according to the manufacturer's information in the module data sheet). The position of the connector boxes has to be considered! The position of the cross beams for module rows on top of each other has to be aligned to the tile rows.

2 Choice and arrangement of roof hooks

The roof hooks are arranged vertically according to the intended cross beam positions. Adjustable roof hooks are used for height adjustment in case of uneven roofs. If the substructure does not give any suitable fixation spots for cross rails, often a cross rail system is recommendable. Find more information on this under ➔ item 6.1.2 GridNorm

3 Fixation of roof hooks

The covering tile is lifted respectively removed. The bar of the roof hook lies in the hollow respectively in the flat area of the pantile. A distance of 3 – 5 mm must be maintained between roof hook and tile. Therefore, at the bottom plate of the roof hook an according distance piece has to be applied (plywood or **metal distance pieces item nr. 400 893-2 o. 5mm** which are available as accessories). The roof hook is fixed to the rafter with at least 2 screws – 8mm, about 2/3 of the whole screw length has to be pre-drilled. Make sure that at least 70 mm of the screw have a grip in the rafter – if necessary, use longer screws! Greasing the screws prevents the shearing-off while screwing. Screw lengths of 80mm for un-boarded roofs and screw lengths of 120mm for boarded roofs have been well-proven. Only use screws that are allowed according to the system statics, do not use simple Spax-screws!

4 Hook in the covering tile

According to the form of the roof tile a grinding may be necessary (use an angle grinder with a small diamond grinding wheel!) so that the tiles can be closed neatly over the roof hooks.

➔ continue with item 6: system mounting

i Statics:

Bearing profiles:

The maximum span widths of the bearing profiles for the respective wind and snow loads can be looked up in the charts for statical dimensioning. On pitched roof, the span widths of the profiles is not the limiting factor in most cases (Example: Profi Solo 05 ca. 1.6m in case of normal snow loads). With standard applications, the profiles should not bear out for more than 0.4m at the sides.

Roof hooks:

By all means, make sure the statical dimensioning of the roof hooks is sufficient, in order to avoid damage caused by snow loads! In areas with high snow loads, it is generally recommendable to apply hooks on every rafter in order to distribute the load more evenly onto the roof. In case of high snow loads, sheet metal substitute tiles are generally recommendable, because due to the individual statical dimensioning, it might happen that the roof hooks put pressure on the tiles.

The required number of roof hooks per square meter of module area can be looked up in the charts for statical dimensioning. The required information on local wind and snow loads are provided by our "load determination" service, which is available on the internet. When dimensioning the number of required roof hooks, if necessary a higher number of required roof hooks has to be considered for the edge and corner areas of the roof. In the edge areas, one roof hook onto each of the first two rafters is generally recommended in order to compensate the higher stresses caused by wind turbulences.

i Roof tightness!

Caution is the order of the day when roof hooks are supposed to be applied on very flat roofs! The installer of the photovoltaic plant can be held responsible for later leakages! Therefore, you should know that tile producers only guarantee a limited tightness!

The data by a renowned roof tile producer given here as an example are supposed to make the realization of problems easier:

Grooved tiles

- usually are recommended for roof inclinations of at least 30 degrees
- are only recommended in special cases for roof inclinations of at least 24 degrees (tight roofing felt, glued if required)

Flat roof pan tile MZ3

- are usually required for roof inclinations of at least 22 degrees
- are only recommended in special cases for roof of at least 16 degrees (tight roofing felt, glued if required)

Plain tile (Biberschwanz)

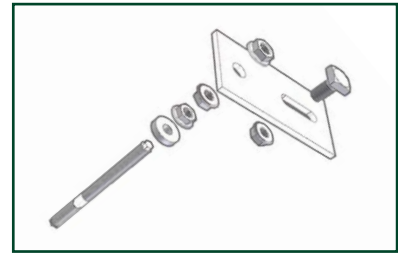
- like grooved tiles

Frankfurter concrete pan tile

- like MZ3

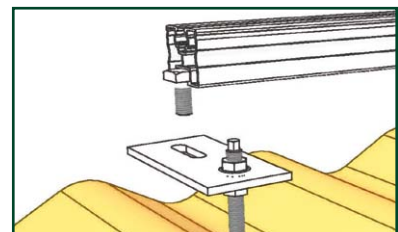
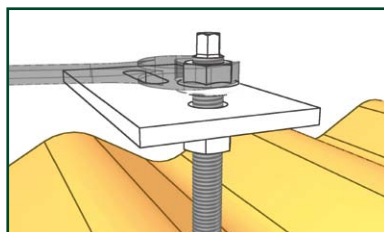
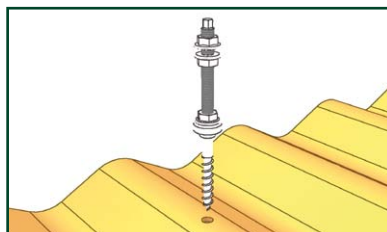
3.2 Corrugated Eternit (and trapezoidal sheet metal)

For corrugated Eternit- or trapezoidal sheet metal roofs so called corrugated roof fixation sets consisting of a special hanger bolt with EPDM-sealing and a mounting plate are used. Usually, a fixation set with a hanger bolt M12x300/ M12x200 is recommended. For special kinds of fixations with reduced horizontal distances, also a version M10x200 is available.



i Tools, drill diameter:

Hanger bolts M10: combination wrench with wrench size 15, power screwdriver with insert 7 mm. Wood is predrilled with a diameter of 7 mm, the roof is predrilled with a diameter of 15 mm. Hanger bolts M12, combination wrench with wrench size 18, power screwdriver with insert 9mm. Wood is predrilled with a diameter of 8.5, the roof is predrilled with a diameter of 16.



1 The fixation of mounting sets

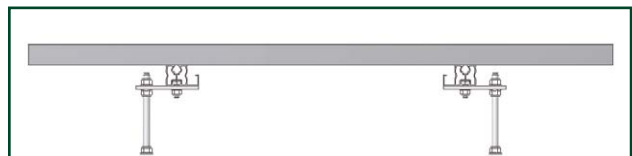
The roof cladding is drilled through at the according spots. The drillings are not carried out in the water-bearing hollows, but in the top areas of the plate profile! By the mounting drilling, the fixation drilling is drilled into the rafter or the purlin. The hanger bolt should be completely screwed into the wood. Screw in the hanger bolt in such a manner that only the metric thread stands out of the roof cladding, and if possible a bit of the even shaft as a seating for the sealing. Greasing the screw makes the screwing easier!

2 Creation and check of the sealing

For sealing, the rubber sealing is pushed down as far as possible and slightly pressed onto the roof cladding with the flange nut. In case of corrugated eternit, the pressing has to be done with special caution – danger of breakage!

3 Alignment of mounting plates

In case of cross rails, an upwards arrangement of the plates is recommendable, in case of vertical rails the plates should be arranged according to the symmetrical load distribution and screwed with flange nuts. ➔ continue with item 6: system mounting

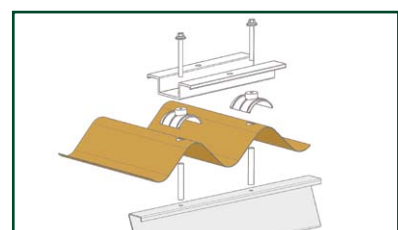


i The number of fixation spots per square meter of module area has to be dimensioned according to the statics charts and the local wind and snow loads. Due to the position of the roof cladding, a fixation to the vertical rafters is not possible in many cases. If a screwing to the cross purlins or to the cross battens is intended, usually a vertical rail position is required. In this case it should be checked, if the modules can be fixed vertically onto two vertical rails, thus the optimum rail combination regarding statics with the minimum of required rails is possible.

Fixation elements for Eternit - FixE

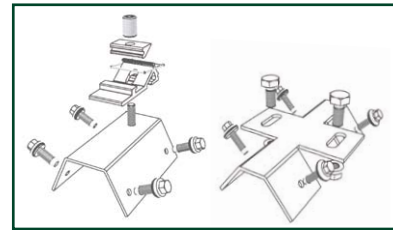
Universal fixation system for eternit roofings

➔ Mounting instruction and additional hints on FixE (available for wood and steel)



3.3 Trapezoidal sheet metal roofs

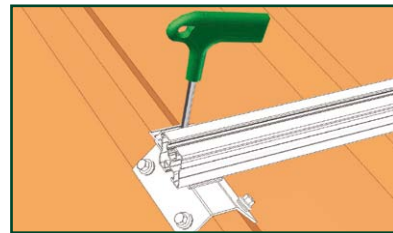
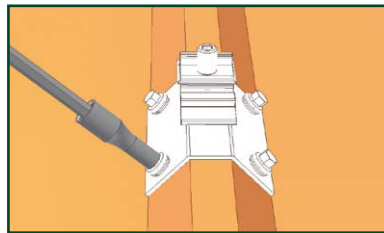
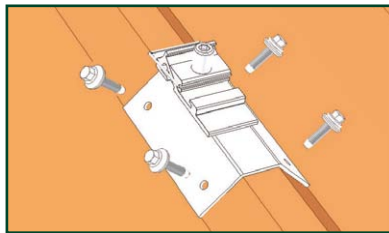
The solution for trapezoidal and sandwich roofs: In some cases a fixation to the substructure (for example with hanger bolts – see 3.2) is generally preferable due to the unknown static characteristics of the sheet metal roof. For cases, in which this is not possible (for example self-supporting trapezoidal sheet metal roofs or sheet metal roofs made of sandwich elements), Fix2000 (here a mounting example with KlickTop), provides an unapproachably simple and swift fixation solution!



- ➔ Fix2000 application
- ➔ Consider checklist measurements Fix2000!

- The screws must not spin without grip during the mounting process (use a depth-stop).
- Screwable from 0,5mm on in case of steel sheet metal resp. screwable from 0,8mm on in case of aluminium sheet metal.
- The roof must have sufficient load bearing reserves to bear the additional load of the photovoltaic installation.
- The fixation of the trapezoidal sheet metal must be able to absorb the additional wind suction forces. (a roof-parallel PV-plant does not increase the uplift forces)
- In case of sandwich elements, a sufficient adhesive force between the layers must be granted.

➔ continue with item 6: system mounting



i Statics:

The Fix2000 elements have to be able to transfer exactly defined forces, so that a reliable system statics can be created for the complete system.

For the statical dimensioning of Fix2000, the wind load is more relevant than the snow load.

The snow load onto the plant is transferred into the roof by all ribs of the trapezoidal sheet metal; due to a slight elastic deformation, the ribs between the clamps are also loaded. Therefore, the cross beams should also be arranged vertically to the ribs.

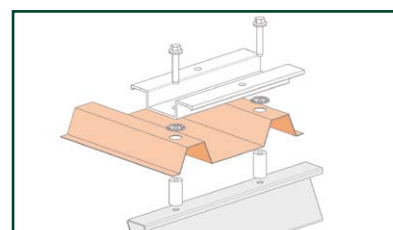
It is an essential precondition for the load transfer of the wind load that the trapezoidal sheet metal is sufficiently fixed to the substructure. Only if this is granted, the mounting with Fix2000 is allowable. By choosing a sufficient number of Fix2000 elements, the adhesive force of the clamps to the sheet metal according to the statics dimensioning charts is partly granted. Strictly speaking, individual verifications for the load transfer into the sheet metal are required. Usually, a horizontal distance of 1.2 – 1.4 m between the clamps is sufficient for that; more clamps should be placed at the edges. Elevation on Fix2000 are only recommendable, when the adhesive force of the sheet metal can definitely be verified.

➔ ® By all means pay regard to the application hints for Fix2000!

For trapezoidal sheet metal - FixT

Universal fixation system for trapezoidal sheet metal roofs.

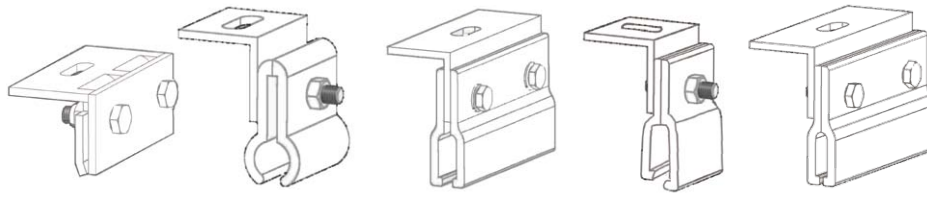
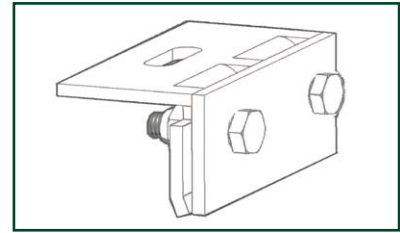
- ➔ Mounting instruction additional hints on FixT (available for wood and steel)



3.4 Standing seam roof and sheet metal system roofs

The fixation takes place by means of special standing seam clamps, onto which the cross beam profile is screwed. Many different designs are available for all kinds of roof systems.

Alternatively, using FixPlan, a direct screwing onto the substructure is possible.



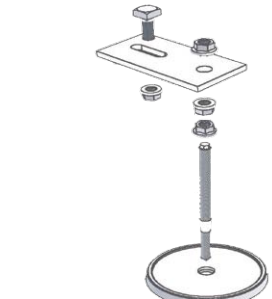
400503
Stehfalz

400510
KalZip, Bemo

400520
Zambelli Series 465

400522-A
Zambelli Baur.500

400524
Fischer KlipTec



400879-12-...
Altern.: FixPlan

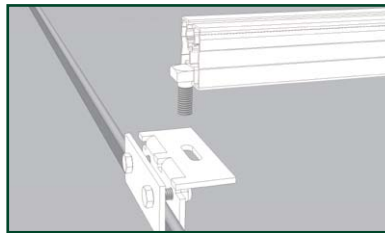
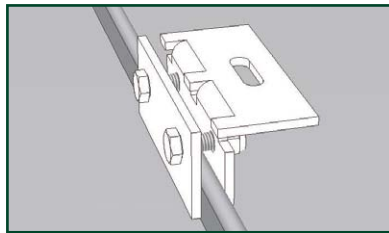
➔ Mounting instruction FixPlan



Statics:

Ring wrench 13 plus insert 13, preferably torque wrench, if necessary power screwdriver with torque setting

Alternative: FixPlan, tools like for corrugated roof kit mounting (see above)



➊ Arrangement of standing seam clamps.

The clamps are arranged vertically according to the desired cross beam positions. In case of horizontal applications the following has to be considered: Usually, one clamp should be positioned on each standing seam. The cross beam should not bear out any more than max. 0.4 m at the left and at the right.

➋ Fixation of standing seam clamps

The clamp is put on the seam and loosely tightened. The alignment is carried out when the cross beams are fastened. In any case the clamp has to be shifted onto the seam as far as possible!

➔ continue with item 6: system mounting



Statics:

Torque for the clamp screws of the standing seam clamp: 15 Nm;

Rule of thumb: Fasten tightly with a short ratchet!

In any case of fixation of a PV-plant onto sheet metal roofs, the roof cladding must be able to absorb the wind suction forces. It has to be checked by the installer on the installation site, if the roof has the required adhesive force.

Attention! With system roofs (for example Kalzip, etc.), the standing seams must not be deformed when the clamps are tightened to make sure that the roof sheetings are not blocked in case of thermal expansions.

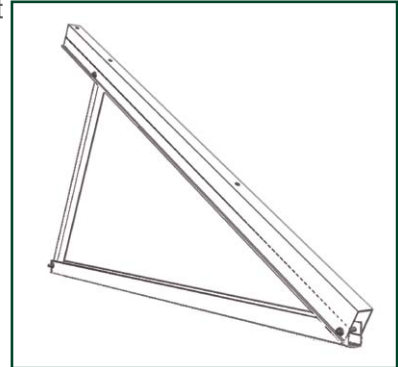
4 Elevation elements for yield optimization on flat roofs

4.1 Standard – support designs

Screwed flat roof supports are used, if the installations can be screwed directly onto the subsoil or onto concrete weights that are put on the flat roof.

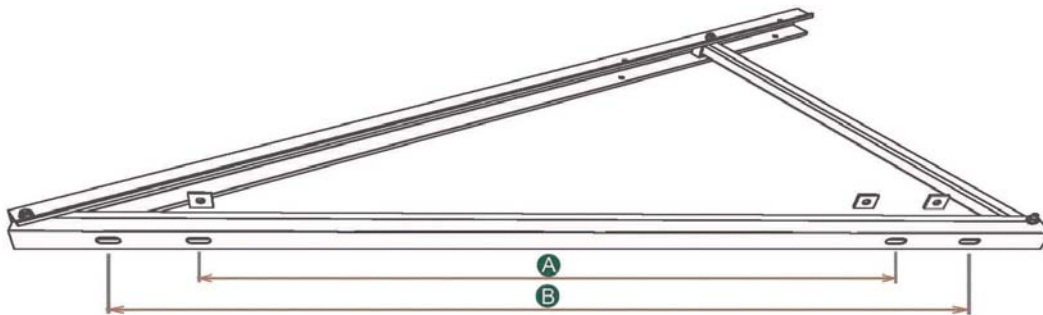
For the screw sizes M10 and M12 there are special washers, which grant extra flexibility.

- The **support type series Light** offers especially light and cost-efficient constructions for modules from ca. 0.8m - 1.6 m. Light 10/13/15
- The **support type series Profi** is intended for application cases with very high snow loads, for example.
 Module heights: Profi 15: ca. 1.3m -1.7m; Profi 22: up to ca. 2.2m
- The **flat roof support XL** is especially suitable for bigger modules or two-rowed mounting, usually up to 3.6 m.



Special sizes available on request. Find detailed information concerning the optimum support design in the statics charts.

The pre-assembled supports are unfolded and screwed by means of socket head screws M8 and self-locking nuts M8. For the connection to the fixation element, usually long holes (13 mm) with adapter plates 10 mm are available, according to the individual design.



Bottom beam hole distances	Light U07 1m item no. 430911	LightU07 1,3m item no. 430912	Light U07 1,5m item no. 430913	Profi U07 1,5m item no. 430941
A	537mm +/-8mm	635mm +/-8mm	940mm +/-8mm	940mm +/-8mm
B	757mm +/-8mm	855mm +/-8mm	1160mm +/-8mm	1160mm +/-8mm



Statics:

Diagonal struts resp. tensile struts have to be checked individually

No – if the support is tightly screwed – for example concrete, FixT

Yes – if the row is not horizontal; for example east/ west roof, elevation to the south

4.2 Special support designs

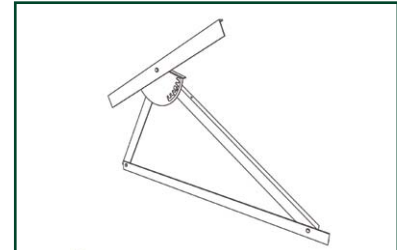
The flat roof support „Gründach“ (vegetated roof) is a variation of the support designs Light/Profi. Due to the higher module level it is especially suitable for vegetated roofs.

The mounting is carried out in the same manner as with the Light/Profi supports. Available angles: 15°, 20°, 25° and 30°



The VarioTop support is especially suitable for flat roof installations in schools, public buildings, etc. A module string that is mounted on a row of supports can be inclined in settings from 10° to 60° in steps of 10°.

➔ Product sheet VarioTop

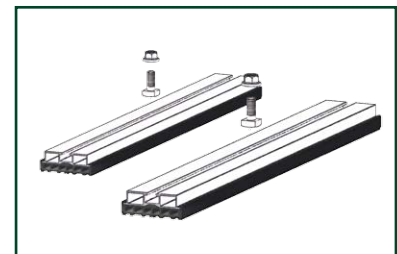


4.3 Support fixation

Above all, the modularity of the Schletter system allows many combinations with different fixation and loading possibilities. The most important ones are listed here.

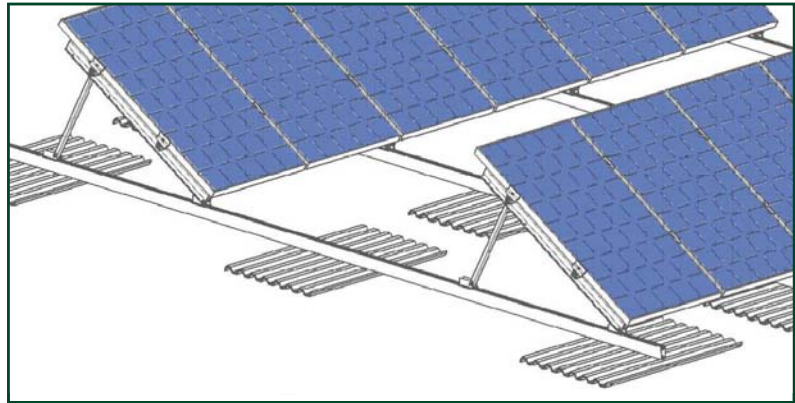
4.3.1 Loading kit

A loading kit consists of 2 aluminium profiles with special EPDM-profiles. The profiles are unfolded at right angle to the support, screwed with one screw each, and loaded with concrete stone, or the like. The special EPDM profile evenly distributes the loads onto the roof cladding. A mat for the protection of the roof surface is not required.



4.3.2 SolRack

If loading elements are used, additional weight is put on the flat roof. In many cases, the load bearing capacity of flat roofs is strained to its limit by the gravel loading. The SolRack plastic plate is a cost-efficient and at the same time stable possibility for the loading of support constructions with gravel that is already on the roof, anyway. If necessary, a protection mat is required for the protection of the roof surface!



➔ Produktblatt SolRack

❶ Mount the supports and arrange them in a row on the roof surface

The lateral distance of the supports has to be determined according to the boundary conditions (building height, snow load, wind load, module height). In normal cases, distances from 1.4 up to 2.0m are usual (according to the individual design). The lateral overhang of the profiles must not be longer than ca. 0.4 up to 0.5m.

❷ Fasten the cross beam loosely onto the supports

The screws of the pipe clamps are inserted in the groove of the cross beam profile, one by one, the supports are aligned in a row, then the cross beam is loosely screwed onto the supports together with the clamps. The cross beam is connected to the connector plate at the lower side. After aligning all cross beam rails, tighten all connection screws tightly!!

Only use special nuts with locking teeth! If the installation is supposed to be integrated in the lightning protection of the building, please pay regard to the hint in the last paragraph!

❸ Choose the right position for the rack

❹ Gravel loading

Remove the gravel loading at the desired place (make sure that the roof cladding is not damaged!) and put on protection mat, if necessary – Attention: No sharp stones must remain under the tray!

❺ Position the rack and refill the gravel loading

❻ Fasten all screws of the substructure tightly

➔ continue with item 7: hints on module mounting

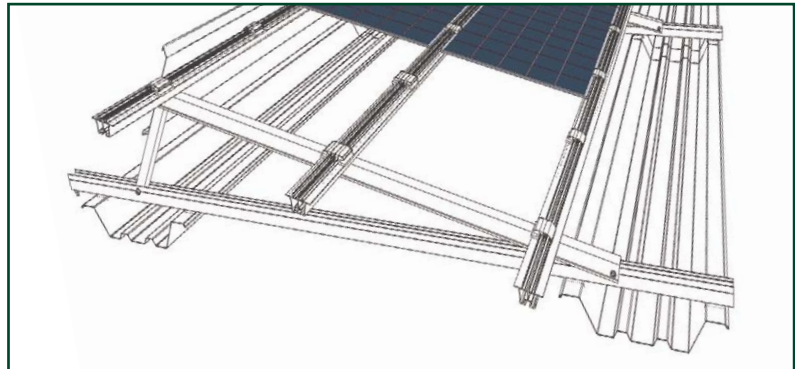
4.3.3 SolTub

- Loading with gravel or concrete blocks
- Good load distribution on the roof
- Different tray widths available
- All-metal construction

If necessary, a roof surface protection mat is required!

- Mounting similar like with Sol Rack.

➔ **Product sheet SolTub**



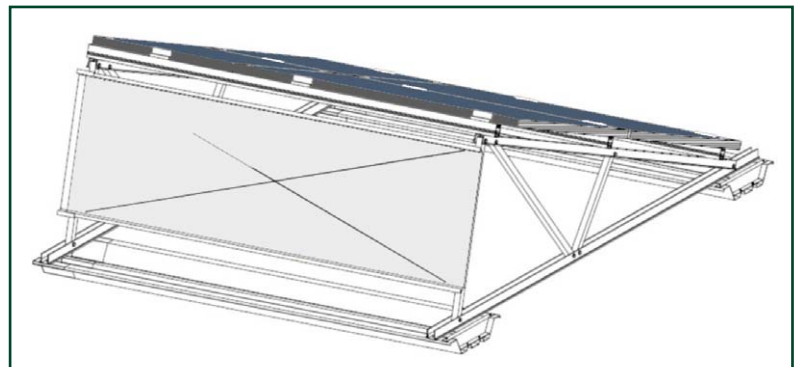
4.3.4 SolCube planne dfor mid 2009

- Loading with gravel or concrete blocks
- Optimum load distribution
- Reliable and swift loading with few screwings
- Later loading is possible
- Modular design
- Also applicable for roof parallel mounting

If necessary, a roof surface protection mat is required!

4.3.5 Windsafe

- considerable reduction of the required loading.
- wider span widths of the module bearing profiles are possible
- considerable lower loading of the roof construction
- Verification of safety against „over turning“ and “lifting off“ is possible with lower superimposed loads.



The Windsafe © system is designed modularly and due to its construction with a special wind deflector, the verification of structural safety is possible with considerable lower loads than with conventional constructions. In case of metal sheets for standard systems which are mounted onto the Light-support, respectively the Profi support, the mounting is carried with 3 sheet metal screws per strut. One is screwed in the upper quarter of the sheet metal height one screw each in the two lower quarters of the sheet metal height.

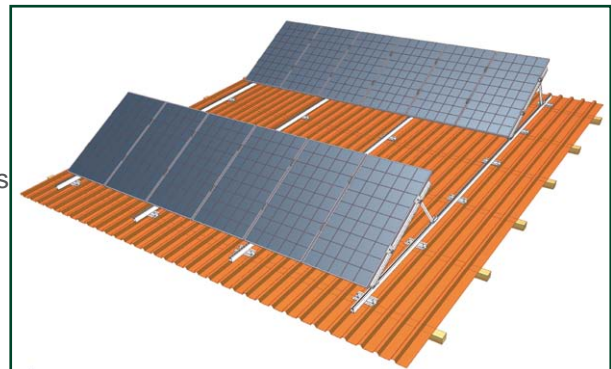
➔ **product sheet WindSafe**

5 Combined construction forms

The basic idea of compact support construction forms is the optimum integration of the roof construction in the static arrangement of the module elevation respectively an optimized even load distribution into the roof structure (usually by continuous beams). Therefore, the continuous beams are installed vertically to the roof construction (CompactVario, CompactGrid). If it is possible to screw the supports directly to the roof structure (CompactDirect), the span of the module beam must be aligned to the distances of the roof structure when carrying out the static planning.

5.1 Continuous beam vertical CompactVario

The fixation system Schletter CompactVario© is a very flexible elevation system for both flat and pitched roofs, especially for the bridging of big purlin distances. A complete series of double groove profiles DN0 -DN2,5 are available as distribution beams in north-south direction, so that the most economic solution can be compiled for any mounting case respectively for any span width.



➔ Mounting instruction CompactVario

This construction is designed in such a manner that no drillings at all have to be made on the installation site!! A wide range of fixation elements for different roof systems is available. Please also consider:

➔ **Product sheet FixT (trapezoidal and sandwich roofs)**

➔ **product sheet FixE (eternit roof)**

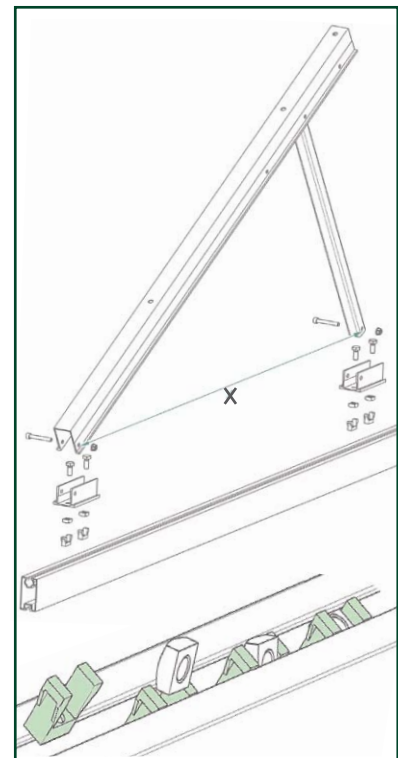
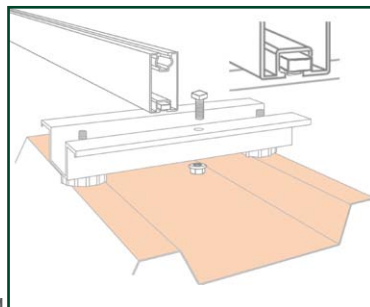
- ➊ First define the positions of the continuous beams, then mount the according fixation elements (FixT, FixE, Fix2000 etc.) For the mounting of the cross beams, the lower groove of the cross beam is equipped with standard screws resp. square head screws M10x25, insert them into the according holes of the fixation elements and screw them with flange nuts M10.
- ➋ Click in the square nuts M10 into the upper groove and fix the fittings using hexagon head screws M10x20.

Measurement X with support series 07:

- Light 1.0 m = 811 mm
- Light 1.3 m = 965 mm
- Light 1.5 m = 1360 mm
- Profi 1.5 m = 1360 mm

- ➌ Now unfold the supports, and assemble them using socket head screws M8 and self-locking nuts M8.

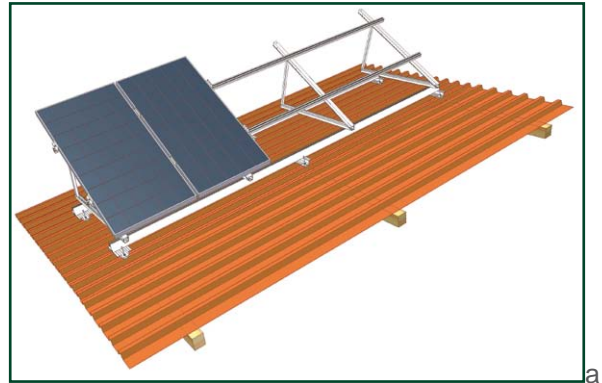
- ➍ The next step is to screw the cross beams onto the supports using standard respectively square head screws M10x25 and flange nuts M10. ➔ continue with 7: Module mounting



5.2 Horizontal continuous beam Compact-Grid

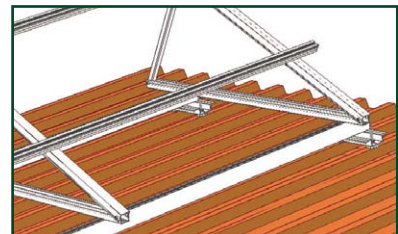
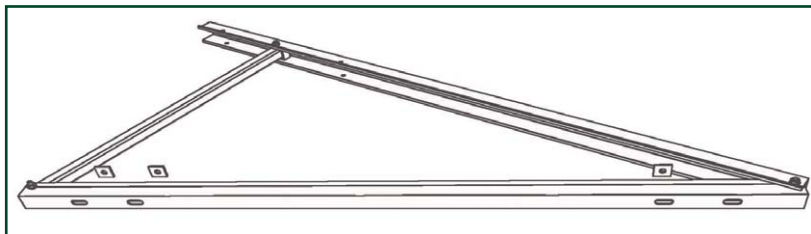
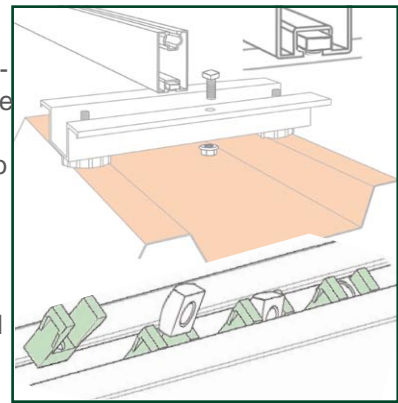
With the CompactGrid system (former version: Standard + continuous beam), we offer you an optimum solution for the mounting of elevated PV-plants, for example on roofs that are inclined to the east respectively to the west. The application of our well-proven double-groove mounting beams makes it possible to optimize the support distances and to transfer the arising loads evenly and safely into the roof cladding or into the substructure. The installation of diagonal strut kits prevents any twisting of the module rows.

In combination with our fixation elements we offer the individual solution.



➔ Mounting instruction CompactGrid

Just like with CompactVario, the connection of CompactGrid to the substructure is carried out with well-proven FixT-connectors, for example. The distances of the continuous beams have to be adapted to the support holes as exactly as possible. In certain circumstances the support has to be adapted to the fixation distance by drilling an additional hole (10mm). The support fixation is carried out by clicking in square nuts into the upper groove of the cross beam and screwing them with hexagon head screws M10x20. The insertion plates (see below) are required for that. A twisting of the module rows is prevented by the installation of diagonal strut kits.

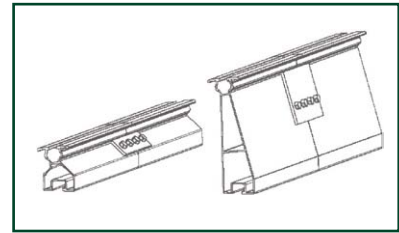
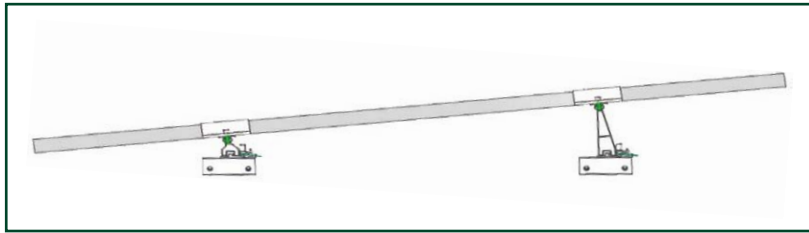


5.3 Without continuous beam – CompactDirect

In many cases of elevated systems, the distances of the module rows are directly determined by the shade distances. Therefore, a load distribution beam is required for an unimpeded arrangement of the module rows and a maximum module laying of the PV-plant. Roofs that are aligned in east-west direction with purlins in north-west direction in certain cases allow a direct mounting of the supports. In these cases we just use the roof construction and fix the flat roof supports directly onto the wooden resp, steel substructure by means of hanger bolts or FixT/FixE. In any case, the connections have to be placed as close as possible to the assemblage points of the supports. All standard support from our range are suitable for this combination. Feel free to send us your inquiry for an elaboration.



5.4 Yield optimization for trapezoidal sheet metal roofs – FixZ-7



➔ Product sheet FixZ-7

... the optimum additional elevation for slightly inclined trapezoidal sheet metal roofings

Please consider that...

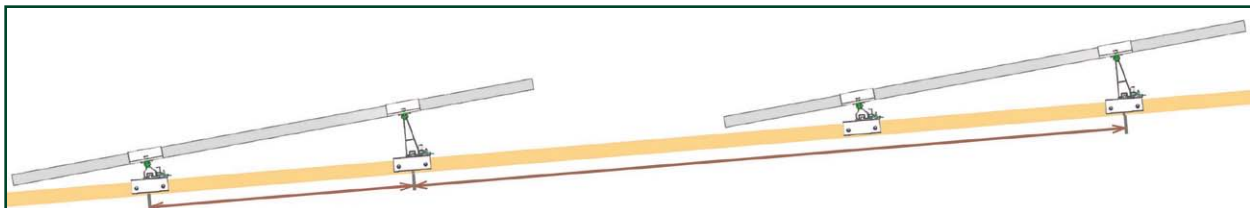
...the system is designed for module heights from about 1.3 m up to 1.7 m and setting angles from 5 – 7 degrees. For technical reasons, FixZ-7 is only suitable for framed modules in vertical mounting. The effective setting angle depends on the position of the clamping spots. They should be positioned in a range from 1/4 to 1/5 of the module height (resp. according to manufacturer's information).

For statical reasons, a mounting on other fixation elements than Fix2000KlickTop (Kalzip-clamps, roof hooks, etc..), is only possible with an extra bottom layer of rails (cross rail combination): Moreover, only the KlickTop-attachment can be used for the fixation to the system profiles.

Please also pay regard to the mounting hints for Fix2000 and the distances to the roof edges that have to be kept, which are 1.5 m at the sides and 1.2 m at both the northern and the southern roof edge.

Distance acc. to module height

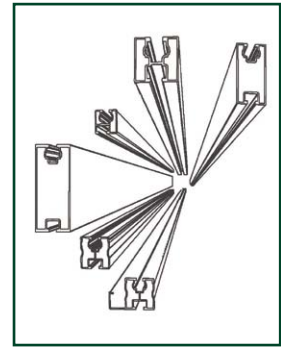
Rows acc. to shade distance



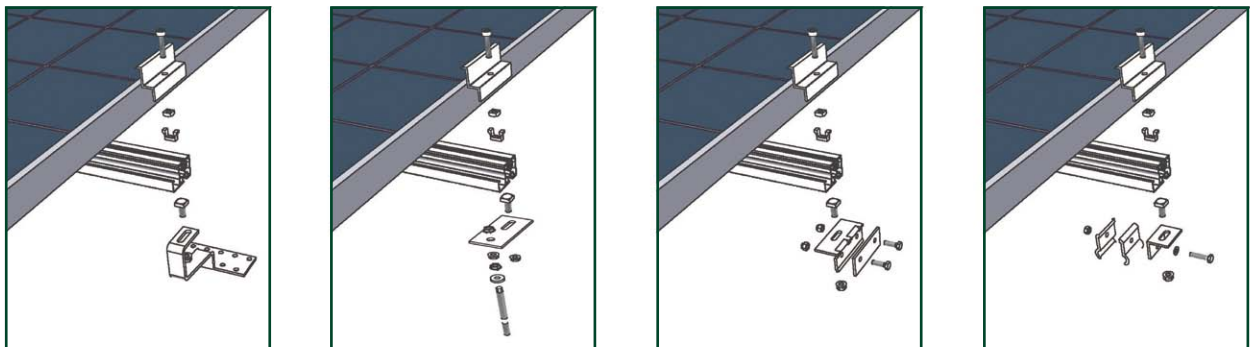
In case of the FixZ-7 design, the module frame itself is integrated into the support system. The special FixZ-7-profiles are designed for a module inclination of 5° - 7° (in relation to the roof surface). Therefore, the mounting positions of both the front beam and the back beam have to be determined according to the module height. During mounting it has to be made sure that the module frames are not twisted! Therefore, this kind of mounting is only permitted for framed modules!

6 System mounting

As soon as the fixation elements (item 3) are mounted, the next step is to apply the profiles (cross beams, resp. cross rails)



6.1 Pitched roof mounting



6.1.1 Cross beam mounting

In case of classic pitched roof fixations, two rows of roof hooks resp. roof fixation elements are fixed to the supporting roof substructure. The cross beam profile is mounted onto these profiles. Two cross beam profiles bear one module row, which is aligned and fixed to the cross beams by means of end and middle clamps. Usually, the modules are mounted vertically.

i Attention!

Due to thermal expansions, consider that the rows must not be too long! Therefore, long rows should be subdivided. The auto-calculator provides hints on thermal expansion. On tiled roofs a maximum length of about 20m is usual, on sheet metal roofs without the possibility of thermal equalization a maximum length of about 10m is usual.

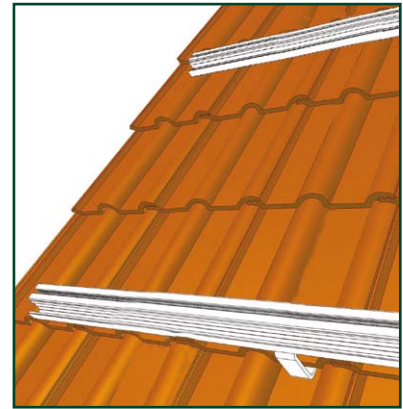
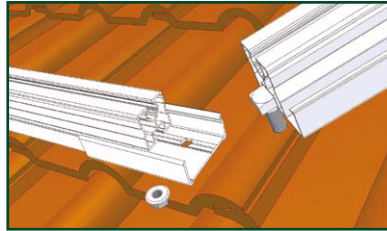
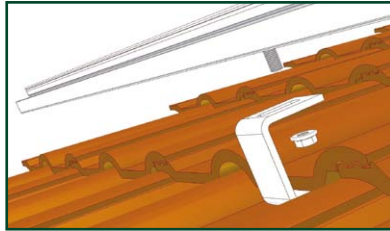
If plug-in connectors are installed in profiles with cable ducts, drainage drillings should be made in the cable ducts.

i Attention!

Within a module combination, the connection of profiles is only to be carried out with fixed screw connections.

i Tools:

combination wrench with wrench size 15, socket head wrench 6 mm



1 Screw and align the cross beams on the fixation spots

Insert the screws (usually M10x25 hexagon head resp. square head) into the groove of the cross beam profiles and arrange them in approximate distances. Then insert the first piece of the cross beam (starting with the first screw) in the fixation row (roof hooks, corrugated roof fixations, standing seam clamps). The best way to do it is to secure the first screw with a nut at the roof fixation, then lift the rail slightly diagonal and then insert screw by screw and secure them with a nut each (do not tighten yet!) If necessary, extend the cross beam profile with a connector plate.

How to even out different heights on roofs

a) for tiled and pan tiled roofs:

Use height-adjustable hooks or use underlayments and accordingly longer M10 for fixation.

b) for corrugated eternit or trapezoidal sheet metal roofs:

Suitably adapt the mounting plate at the hanger bolt by adjusting the fixation nuts.

c) for standing seam roofs: if necessary, use underlayments and accordingly longer M10-screws.

After that, the lowest rail is aligned straight. After the fixation of the lowest row of rails the other rails are attached. Make sure that the rails at the sides are aligned to the roof covering. Important: Make sure that the rails at the sides are aligned at an angle of 90 degrees, because otherwise the rails in the complete module field cannot be aligned in one direction! Tip: The application of the right angle can be carried out by means of so-called "number triples" (for example 60cm, 80cm result in a diagonal of 100 cm) After aligning all cross beam rails screw down all connection screws tightly! Use only special nuts with locking teeth! If the installation is supposed to be integrated in the lightning protection of the building, pay regard to the hint in the last paragraph!

2 All screws of the substructure have to be fastened tightly resp, checked

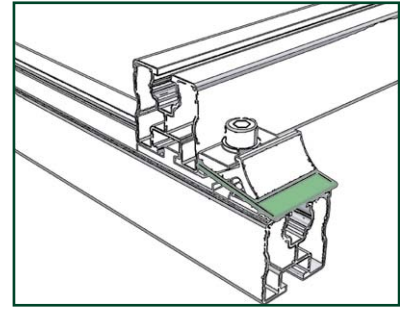
➔ continue with item 7: Module mounting

i Tip:

If the wiring is to be installed within the cable duct, water accumulations have to be avoided. This can be done by a suitable alignment or also by drilling individual holes at the lowest spots of the cable duct. When plugs are installed in the cable duct, this has to be especially considered!

6.1.2 Cross beam mounting - GridNorm with KlickTop

- Can be assembled with cost-efficient standard rails
- flexible mounting
- Can be combined with all Schletter system components
- with cross-rail connector KlickTop© for short mounting times



Tip:

The cross rail mounting (regardless of the mounting system) should be used when the substructure does not offer fixation spots for cross rails. The intention of cross rail mounting is not to reduce the number of required roof hooks for certain module arrangements! The number of required roof hooks per square meter is determined by the static requirements and is actually not influenced by the mounting systems that are applied!

For all normal cases of application, we keep recommending the Schletter standard system, the uniquely simple, flexible, and swift mounting of cross rails directly onto the substructures.

In contrast, the cross rail system GridNorm is ideal for cases in which the substructure only offers unfavourable fixation spots or the position of the cross beams has to be aligned better to the module rows. Thereby, Schletter GridNorm enlarges the series of the simply and quickly mountable systems offered by Schletter.

Examples of application are the module mountings on all eternit or trapezoidal sheet metal roofs with only horizontal battens or also horizontal mounting of modules on pantiled roofs with unfavourable row partition.

Special hints for GridNorm-mounting:

• Arrangement

Usually, the bottom profiles are arranged vertically from the eaves to the ridge and fixed onto the fixation spots (roof hooks, corrugated roof kits, etc.). Then the cross beam profiles are arranged onto the vertically mounted profiles in suitable distances to the module. The cross rail connector KlickTop© is comfortably screwed from above with a socket head screw.

• Profile distances and span widths

The allowable distances of the profiles and support spots can be looked up in the system statics. It has to be considered that also the minimum number of fixation spots per square meter must be maintained!

• Calculation and compilation

Like the normal standard system, GridNorm can be compiled using the auto-calculator. Thereby, a very swift overview of rail compilations, etc. is possible!

• Conventional cross rail mounting

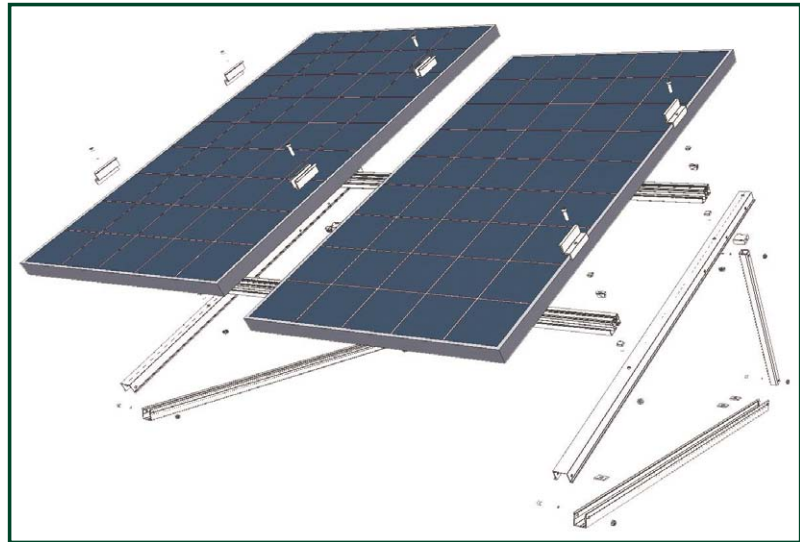
Besides GridNorm-mounting, also the VA-plate can be used as cross rail connector (see component overview).

6.2 Flat roof mounting

6.2.1 General hints

With flat roof elevations, usually a module row of vertically arranged modules is fixed onto a pair of cross beams. The pair of cross beams is mounted onto a row of supports.

Most supports are available in different settings: For example in Germany 25-30 degrees gain the optimum annual utilization ratio for grid-connected plants, in case of island locations, 45 degrees can optimize the yield in the winter half year, 20 degrees can be used as an additional elevation on slightly inclined flat roofs.



The cross beam profiles are attached onto the support elements. Usually, two cross beam profiles bear one module row, which is aligned and fixed to the cross beams by means of end clamps and middle clamps. Special alignments of modules are also possible. Different kinds of supports allow the adaption to different conditions.

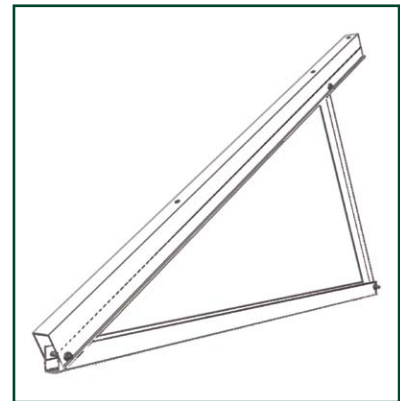


Tip:

As a tool for the determination of the row distances, an automatic shade calculation is available on our website www.schletter.eu.

- The calculations for all supports have to be done considering the boundary conditions (building height, snow load zone, module height, etc.) The allowable support distances can be looked up in our system statics.
- It has to be made sure that the roof can safely bear the additional loads of the self-weight of the PV-plant, the loading and snow.
- Regarding the wind load it has to be considered that especially with elevations very high concentrated forces can arise at the fixation spots. When supports are combined with fixation elements (for example supports on hanger bolts, clamps, etc.....), the verification of structural safety has to be carried out within in the framework of a type statics, because such cases usually cannot be listed in the system statics. Moreover, a statical verification of the constructional conditions on the installation site has to be carried out.
- In case of fixation by superimposed loads, the required loads can be looked up in the system statics. Here it has to be considered by all means that the roof substructure must be able to bear both the additional load of the PV-plant and the required loadings!
- The statical calculations for the supports usually refer to vertical loads and not the very individual lateral and tilt stabilities. For example, it has to be determined individually in each case, if the support combinations have to be stabilized by means of additional diagonal struts, or the like.
- With tight roof claddings, in many cases only a fixation by loading without perforation of the roof cladding is possible. In these cases, it has to be special care of that no stones of the gravel loading or anything of that kind remain under the loadings and might damage the roof cladding (a mat for the protection of the roof cladding is recommendable)

6.2.2 Mounting



i Tools:
 Extended socket wrench 15mm

❶ Mount the supports and arrange them on the roof area

The sidewise distance of the supports has to be determined according to the boundary conditions (building height, snow load, wind load, module height). In normal cases 1.6m to 1.8m are usual. The sidewise bearing-out of the profile should be 0.4m to 0.5m at the most.

❷ Only in case of mounting on concrete elements: Screw the supports individually onto the elements

❸ Arrange the supports in a row

❹ Fasten the cross beams loosely onto the supports

Insert the screws into the groove of the cross beam profile and arrange them roughly in distances according to the support distances. Then loosely fasten the first cross beam profile (starting with the first screw) in the first support. Then arrange all supports one by one in a row. Connect the cross beam with a connector plate to the lower side. After aligning all cross beam rails to the supports screw down all screws tightly!

Only use special nuts with locking teeth! If the installation is supposed to be integrated in the lightning protection of the building, please pay regard to the hint in the last paragraph!

❺ Bring the rack in the right position, if necessary

❻ All screws of the substructure have to be screwed tightly respectively checked (M8: 5 resp. 15Nm; M10: 40Nm)

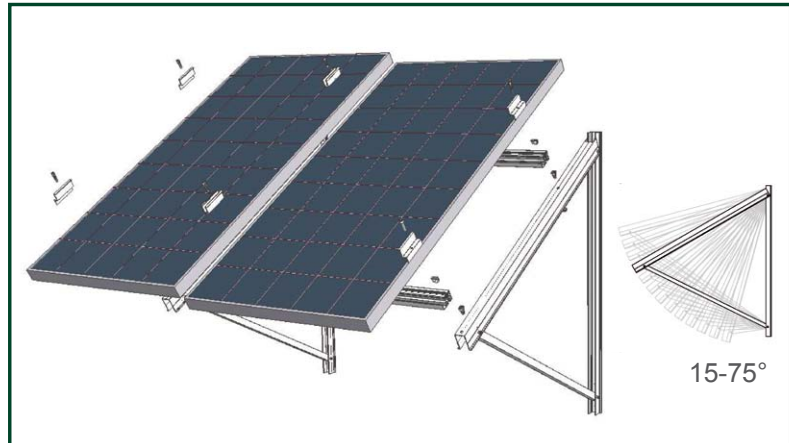
❼ Cross beam mounting

The next step is to screw the cross beam onto the supports using standard resp. square head screws M10x25 and flange nuts M10.

➔ continue with item 7: Module mounting

6.3 Facade fixation

Facade fixation represents a special case of module mounting where the mounting is usually carried out to vertical walls. For plants in visible areas, the fixation elements can also be delivered with a processed surface (for example anodized or powder-coated). Attention: Anodized or coated elements are only conductive to a limited extent. (capacity charge, lightning protection)!



➔ Mounting general hints

❶ Draft a sketch of the plant configuration and determine the desired positions of the facade supports

The cross beams should not bear out for more than 0.4m at the left and at the right. The maximum support distance is determined by statical dimensioning charts.

- Mount of bottom beams
- Module beam/ hook in the strut and screw it

❷ Check the position of the cross beams according to the module height.

The cross beams should be positioned in a distance about 1/4 - 1/5 of the module height from the upper respectively lower edge of the module. The position of the connector boxes has to be considered! It has to be checked, if the drillings at the supports are suitable for the modules used. If not, please make an inquiry for façade supports with according special measurements

❸ Check the substructure and choose a suitable fixation system

It has to be made sure that both substructure and fixations can take the arising forces (especially in case of wind and snow loads). Usually, heavy-duty anchors or adhesive anchors are recommended. If necessary, the fixation spots have to be integrated in the plant statics.

❹ Levelling and mounting of the supports of a row

In order to align the supports, the two most outmost elements are fixed in the same height (horizontal alignment by means of a hose water level or laser measuring). Stretch a cord between the external supports from the top corner to the bottom corner and align the inner supports to the cord (if necessary, use underlayments).

❺ Screw the cross beam onto the facade supports and align them

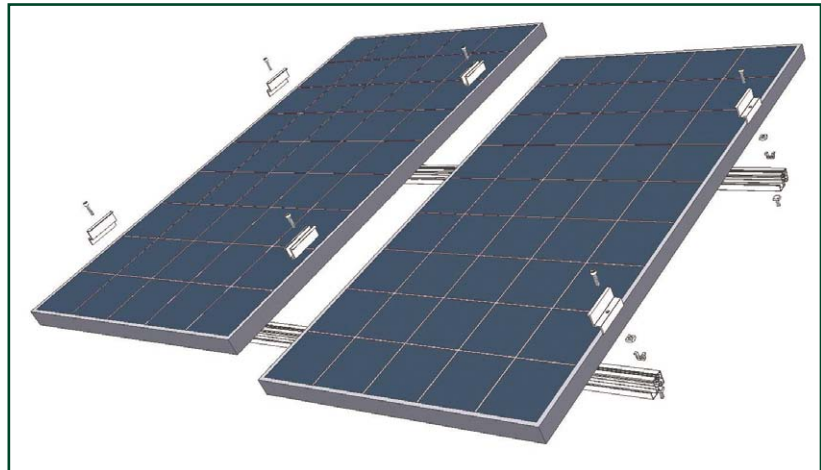
Insert the screws (usually M10x25) in the groove of the cross beam profile and arrange them in approximate distances. Then insert the first part of the cross beam (starting with the first screw) into the outmost rail. The best way to do that is to secure the first screw at the support with a nut, to lift the support slightly and then insert the screws one by one and secure them with nuts (do not tighten them yet!). If the walls are uneven, corrections can be made by using underlayments at the fixation side of the facade support or by using underlayments between the support and the cross beam (if necessary use longer screws). Extensions of the cross beams are carried out by means of cross beam connectors. Then the lower rail is aligned straightly. After fixation of the lower rail attach the upper rail. The alignment at the sides must be exact. Important: The alignment at the sides has to be carried out at right angles. After aligning the cross beam rails, screw all connection screws down tightly. Only use special nuts with locking teeth! If the plant is supposed to be integrated in the lightning protection of the building, please pay regard to the hint in the last paragraph!

❻ Screw down all screws of the substructure tightly

➔ continue with item 7: Module mounting

7 Hints on module mounting

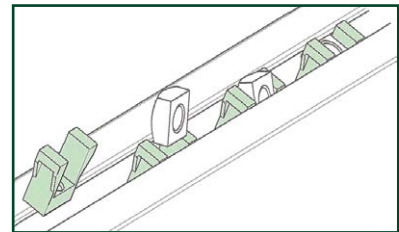
7.1 Framed modules



❶ Preparation of the mounting of the modules

The cabling up to the module rows have to be prepared. Attention. In the course of the partition of the string and the preparation of the cabling, the hints on lightning protection (last paragraph) have to be considered by all means! Preparation of the module cabling: At the end of the string cables suitable plugs/sockets for the individual module type have to be mounted. Connect the first module as specified by the manufacturer and connect the other modules.

Click in the square nuts into the upper groove of the cross beam profile in approximate distances by means of the click-in component (item nr. 430024). Loosely fix the first two end clamps. Loosely fix the first two end clamps at the end of the cross beam rail. Then apply the first module and fix them loosely with the end clamps (the end clamps should be positioned 2mm or more away from the edges of the cross beams). Now align the first module to the cross beam (use a cord, auxiliary device is available as an accessory).

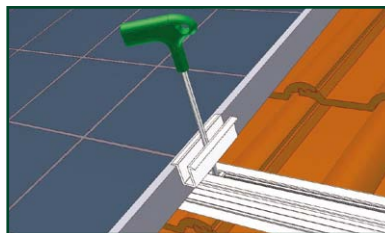
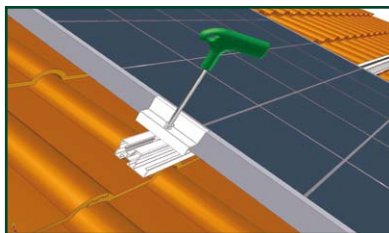


❷ Mounting of the module rows

After aligning the first modules, one middle clamp per cross beam is loosely fixed to the according cross beam. Then the next module is slightly clamped, shifted under the module clamp and fixed. The next middle clamp is fixed accordingly. The cables can be placed in the cable duct of the rail. They have to be secured to the cross beam by means of UV-resistant cable straps. At the end of the module row, another end clamp is placed.

❸ Screw down tightly all screws of the module fixation resp. check them.

❹ End cap: If desired, the cross beam profile can be finished with an end cap (for Solo and Profi).



7.2 Unframed modules

In order to adapt the Schletter standard system also for laminate modules the laminate clamping system has been designed. It consists of a two-part clamp that is suitable for the clamping of laminates from 3 mm up to 14 mm. Fitting to the middle clamps, there are individually corresponding end clamps. The clamps are designed in such a manner that the laminate only has direct contact to rubber on all sides, also on the front side. So the module is not directly clamped to metal parts.

- ➔ Laminate mounting general hints
- ➔ Product sheet LaminatEco
- ➔ Product sheet LaminatGS

- **Mounting of the clamps**

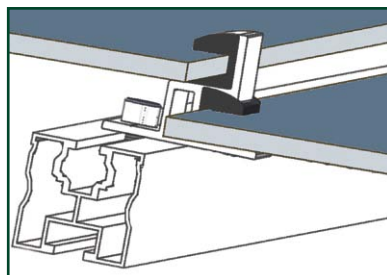
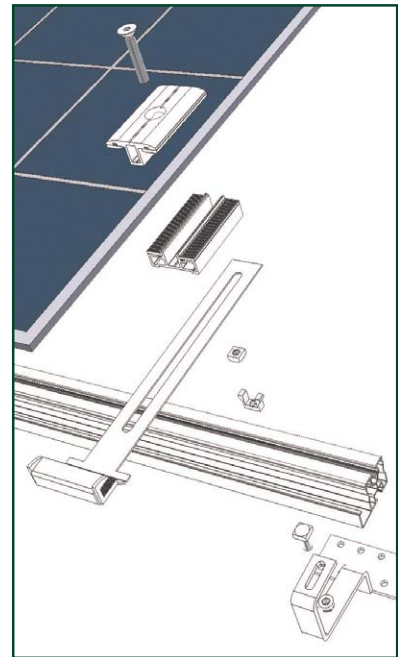
The mounting of the end clamps and the middle clamps is carried out in the same manner as the mounting of normal clamps for framed modules.

- **Mounting of safety hooks**

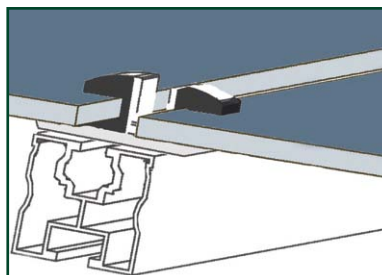
With pitched roofs, laminates can not be fixed so tightly that a delocation can be ruled out. Therefore, a safety hook is screwed with each lower module clamp in order to secure the module against sliding off. The safety hook is shifted under the module clamp and clamped by means of the clamp screw after the respective module has been aligned. In case of two-part middle clamps it has to be made sure that the module clamps are not screwed to tightly!

- **In case of laminated modules with very narrow edges** the module should not be covered to much by the module. In such cases it is recommendable to use distance strips when mounting. As the distances between the modules become bigger due to the distance strips, it has to be made sure that longer rails are ordered and installed. The results of the auto-calculator have to be corrected in such cases the results of the auto-calculator have to be corrected.

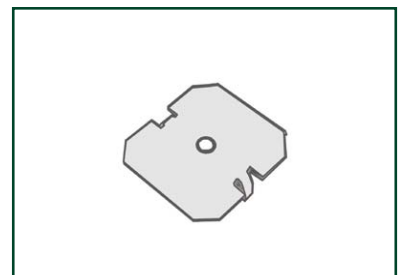
- **With bigger laminates or in case of cross mountings**, the laminate should definitely be additionally supported in the middle between the clamps by a support rubber or underlying sheet metal (available as an accessory).



Cross mounting with **LaminatGS**



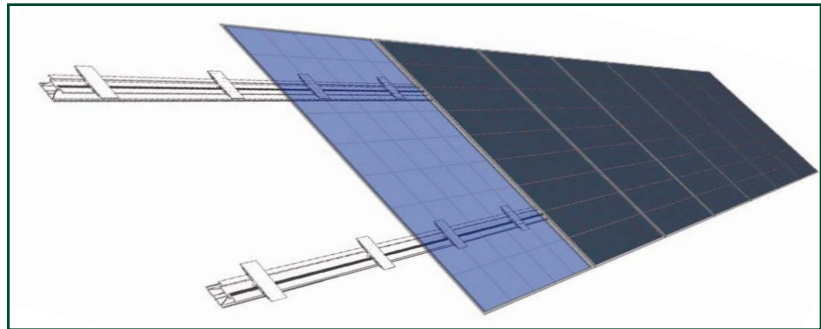
Cross mounting with **LaminatEco**



Shim for LaminatEco to heighten the support area

7.3 OptiBond

- Statically optimized for big module surfaces
- Minimum assembly time
- With anti-theft device



Due to the cost pressure caused by the annual decrease of the compensation for electricity fed into the grid, the tendency, especially with big and free area plants, goes more and more towards modules with thin layer technology. Therefore, the aim of many module producers are often very big-surfaced modules in double-glass construction as they are likely to bring about a cost optimization, as well in the production and in the photovoltaic plant itself.

An increase of the carrying capacity and thereby an enlargement of the module measurements is only possible by suitable fastenings in the module area.

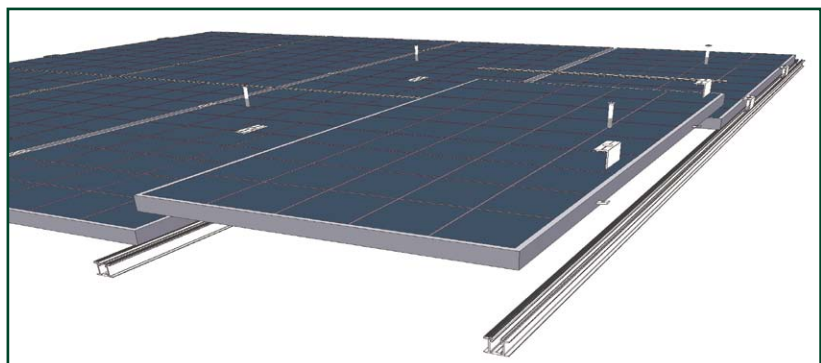
Therefore, the Schletter GmbH is developing suitable bonding techniques in cooperation with several module producers, in order to connect even these extensive modules mechanically to the substructure in an optimum manner.

➔ [Product sheet OptiBond](#)

8 Special systems

8.1 In-roof system Plandach5

- optimum water tightness
- flexible and modular, applicable for all module types and sizes
- optimum yields due to defined rear airing
- optimum appearance



Conventional roofing sheeting known from the industrial roof sector (e.g. Alwitra Evalon V) are laid onto the roof boarding (e.g. wood material plate V100 G or massive boarding plus fire prevention mats) or onto a correspondingly pressure-stable on-roof insulation. On the roofing sheets, vertical system rails are screwed to the boarding; roof penetration holes are extensively sealed between rail and roofing (EPDM molded rubber parts). The clamping is carried out punctually by means of suitable clamping components, which can be hooked in and screwed at any desired spot of the rail.

The system is suitable for roof inclinations of app. 20 degrees.

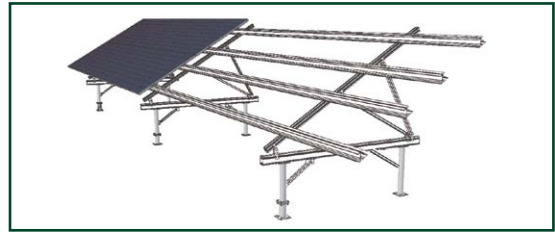
Unlike for framed modules, a cross rubber is required for unframed modules.

➔ [Plandach 5 Mounting and project planning](#)

➔ [Product sheet Plandach 5](#)

8.2 Industrial roof – IsoTop

- Support widths of up to 10 m are possible
- Direct load transfer into the supporting structure of the building
- We will assist you in the planning of the project

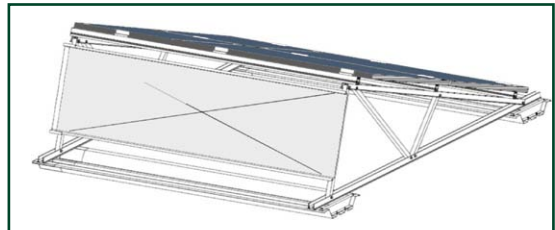


Usually the constructions are optimized in such a manner that only a few fastening points in big distances are necessary. These penetration points can be welded by the roofer reliably and inexpensively; thereby the liabilities are clearly separated.

➔ **Product sheet IsoTop**

8.3 Special project plannings for flat roofs Windsafe

- considerable reduction of the required loading
- bigger span widths of the module beam profiles are possible
- considerably less load onto the roof construction
- Verification of structural safety from “keeling over” and “lifting off” is possible with lower superimposed load



The System Windsafe © is designed in a modular manner and due to its design including a special additional wind deflector makes the proof of the plant stability possible with much less burden than with conventional constructions. ➔ **Produktblatt WindSafe**

8.4 Park@Sol

Parking areas with solar car ports offer a welcome completion for the extensive use of photovoltaic utilization of photovoltaic electricity generation, especially as the roof areas on car ports are granted the maximum compensation according to the electricity feeding law!

➔ **Product sheet Park@Sol**



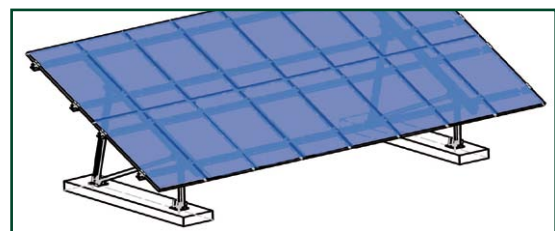
8.5 Open area

The open area system FS is individually planned for the respective installation site. Besides the pile-driving technology of the FS system, PvMax3 is available as a system for concrete foundations.

➔ **Product-/mounting sheets FS/PvMax3**



System FS



PvMax3

9 Accessories

9.1 Anti-theft device

Schletter SecuFix© is simple in an unparalleled manner, can be upgraded at any time and can only be re-opened with electric tools in a substantial amount of time. How that works? On request, we will deliver you, together with the ordinary socket head screws, a stainless steel ball with an exactly fitting ball diameter. After implementing the plant (when you are certain that no connection has to be opened anymore) you secure all screws by hammering in the SecuFix-metal ball – and that's it! Of course, the Schletter SecuFix© is applicable for pitched roofs and flat roofs as well as for open area plants



Hammer in the metal ball - that's it!

Screw cannot be unscrewed with normal tools!
 Due to the very narrow middle clamp a loosening by using pliers is also not possible.



Reopening (e.g. in case of damaged modules):
 Cut a groove and loosen the screw with a big screw driver



SecuFix2 is the logical extension of the SecuFix system. An additional „protection of the flanks“ results in a further considerable improvement of theft-proofness. SecuFix2 has to be regarded as an addition to the securing of the module clamp connections and of course can be combined with other concepts (plant surveillance, etc.) in an advantageous manner.



Important hint:

We explicitly point out that all mechanical safety measures generally only are a delay and not a prevention of theft and therefore have to be combined with other precautions.

9.2 Cable laying

Besides the bearing beam Profi 05 with cable duct we deliver, together with our cable clips and cable duct extensions a flexible cable duct. You can find further models in our component overview.



9.3 Lightning protection and potential equalization

For the integration of anodized module frame in the potential equalization the following components can be used:

- Middle clamp with earthing pin (series 430...) instead of normal middle clamp
- Earthing shim (item nr. 430036) in combination with normal middle clamps

The lightning protection (item nr. 430035) can be used for the internal potential equalization in the rack (for example vertical connection of all cross beams with aluminium wire 8mm). A connection to an existing lightning protection system (according to lightning protection concept) is possible with this clamp.



10 Important hints

10.1 Lightning and overvoltage

Lightning protection and overvoltage protection are generally not the subject of this instruction!

In such matters, we recommend the counselling of a expert company.

A few general hints may be a little help for the planning.

➔ Earthing and lightning protection for PV-plants

Generally, it has to be clarified resp. agreed with the customer, if measures of outward lightning protection (arresters, conductions, etc.) and/ or measures of inward lightning protection have to be taken. Special caution is required, when plants are installed on roofs that already have an external lightning protection. In these cases the customer has to be informed

Generally the PV-plant should be installed in a sufficient separation distance to existing lightning protection systems. In this case, the potential equalization of the PV-rack has to be implemented independently from the lightning protection system – also in case of sheet metal roofs, for example.

If the separation distances cannot be maintained due to the constructional conditions, the rack can alternatively be connected to the lightning protection system according to the lightning protection standard. This has to be done at several spots (for example using lightning protection clamp item nr. 430035). In this case it has to be considered that all components of the interior lightning protection have to be lightning-proof.

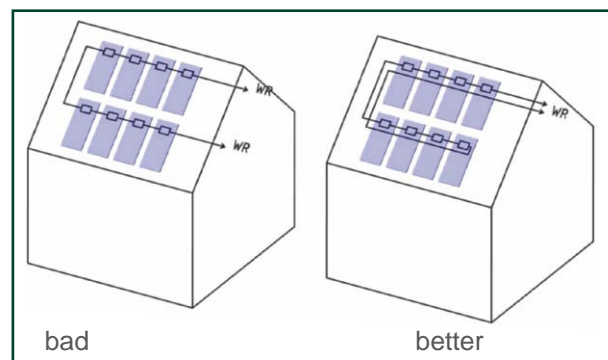


Literature:

Reasonable hints on lightning on lightning protection, as well as hints on the complete dimensioning of PV-plants can be found in the planning file “Photovoltaische Anlagen” (photovoltaic plants) published by the DGS, for example.

10.2 Cable laying

Regarding the protection of the plant from close lightning strikes, the cable laying is of primary importance. Damage to the plant (for example the destruction of the inverters by overvoltage) is often caused by induction voltage in the module wiring. A lightning strike close to a PV-plant goes along with a very high current flow. This current flow (respectively its temporal change di/dt) induces an induction voltage into the “looped circuit” that is formed by the module wiring installed on the roof.



Therefore, it has to be considered that looped circuits are avoided as far as possible in the course of rack planning, string partition and cable laying. After running through the modules that are connected in series, the module wiring should be led back in the same module string and re-enters the roof at the exit spot. For the return path along the module rows, the cable duct at the cross beam profile can be used.

10.3 Safety and liability

10.3.1 Electric Installation

Hints on electric installation are generally not the subject of this instruction. Anyway, the general hints listed below have to be considered:

- Installation and putting in operation may only be carried out by certified electronic experts
- The relevant regulations and hints on safety have to be considered
- Electronic installations must not be carried out in case of dampness
- Even if there is only little light, very high direct voltages arise at the series connection of modules, which can be life-threatening in case of direct contact. Especially the danger of secondary damage in case of electric shocks has to be considered!

10.3.2 Working on the roof

If any kind of work has to be done on the roof (also on flat roofs) the relevant accident prevention regulations have to be considered.

The Accident Prevention & Insurance Association can give you information on the prescribed safety measures. Starting from a working height of 3 m, the use of fall arresting installations is mandatory! If such installations are not possible, safety harnesses have to be used that are fixed as prescribed. All tools have to be secured accordingly, if necessary, the danger area on the ground has to be secured by closing off.

10.3.3 Exclusion of liability

This instruction gives reasonable hints on the mounting of the fastening system by the Schletter GmbH (limited company).

- In addition to these hints, the expert company that carries out the installation has to consider the relevant regulations and the generally accepted rules of technology.
- The hints on dimensioning given in this instruction are only hints gained from practical experience; but the hints on dimensioning from the individual system statics are mandatory.
- The installing company is responsible for the dimensioning of the plants. The Schletter GmbH provides the according hints in the system statics.
- The Schletter company is not liable for hints on dimensioning given in commercial offers, because usually not all technical determining factors (snow load zone, building height, wind loads, etc.) can be aligned. We will be glad to assist you in your detailed planning!
- The installing company is responsible for the mechanical durability of the installed interface connections at the building surface, and especially for their water tightness. The components produced by Schletter are designed according to the loads that are to be expected and the state of the art.
- The Schletter GmbH is not liable if the installed components are handled in an inappropriate manner.

The Schletter GmbH grants a voluntary 10-year product warranty on all rack systems if the following conditions are fulfilled: Correct handling, dimensioning according to the statical framework requirements (unless there is a separate agreement), normal conditions regarding environment and surrounding. This applies for the environmental conditions that have to be considered acc. to DIN 1055, for example.

- The product durability that is to be expected is considerably higher than the durability of the photovoltaic modules.
- As a statical dimensioning for all plant under consideration of all possible environmental conditions is not possible, but is carried out according to the regulations of the valid norms, we generally recommend an insurance against natural hazards.



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For a comprehensive and competent consulting during the planning of your plant and for questions concerning logistics and order processing, our members of staff are available from Monday to Friday from 7:30 am to 5 pm.