A & B Engineering Building Services, 11 Derby Lane, Liverpool, L13 6QA
Tel : 0151 228 4661 ~ Fax : 0151 220 4206 E-Mail : info@abeng.co.uk

TECHNICAL SUBMITTAL – No16

PV System

Document Ref: 63073-ABE-ZZ-XX-TS-E-0016

Project:	**Echo St**		
A&B Contract No:	**8889**	**Date:**	**30.09.2024**
Engineers:	**Jordan Thompson**		**Rev.C01 Updated inline with Path Energy Proposals**

Proposal: ***Please refer to layouts for positions**

The following schedule and datasheets are based on our proposed PV System.

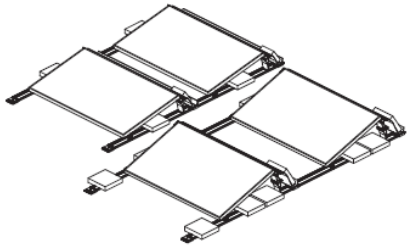
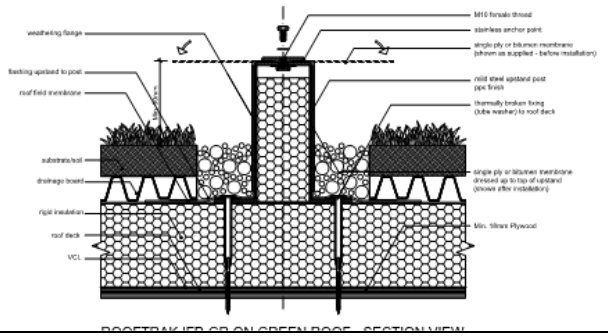
The PV supplies will be fed via the main incoming LV Switchboard please refer to LV Schematic for reference.

Inverters will be sized to suit Array and kWp

Note reference to separate Technical Submittal for PV Calculations.

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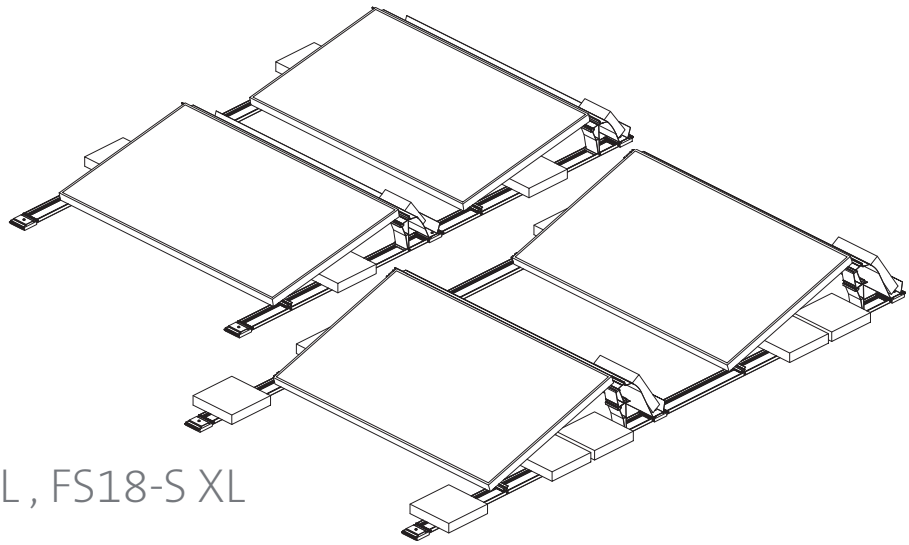
PV System Schedule – Echo St

Ref	Description	Manufacturer	Image
-	PV System Mounting Frame	Renusol	
-	PV Mount System / Roof Fixings	Nicholson Rooftrak	

-	PV Shutdown and monitoring equipment	Tigo	
-	PV Inverter	Solis	

-	PV Panels	AIKO N-Type ABC	

Renusol Europe GmbH



System Datasheet

Renusol FS10-S, FS10-S XL , FS18-S XL

General

System	Ballasted PV-mounting system
Content	Ground rails, rail connector, building protection mat, low post, high post, wind deflector, clamps
System warranty	10 years
Application area	Flat roof on industrial, agricultural (except hydrogen sulfide exposition) and residential buildings
Roof covering	Bitumen, concrete, foil, gravel
Roof slope	max. 5° without additional measures

System properties

System orientation	South
Module tilt	≈10° /≈ 18°
System weight approx.	2.2 kg/m² (FS10-S) / 2.3 kg/m² (FS18-S) plus ballast (project specific)
Weight PV-module included approx.:	9.3 kg/m² (FS10-S) / 8.1 kg/m² (FS18-S) plus ballast (project specific)
Friction coefficient	μ =0,5 is to be determined and ensured upon installation surface.
Material	Aluminum, stainless steel , strip-galvanized steel metal sheet, rubber granulate
Minimum edge distance	0,6 m
Shading angle	12° to 17.5°

Modules

Type	Approval for panel corner clamping is to be obtained.
Module size (max)	FS10-S: 950-1.052 mm / FS10-S XL: 1.053-1.168 mm / FS18S XL: 990-1.065 mm
Module guidance	Horizontal/Landscape

Certifications

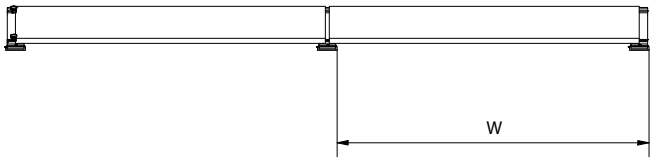
Wind loads	Determined in wind tunnel tests by Ruscheweyh Consult GmbH

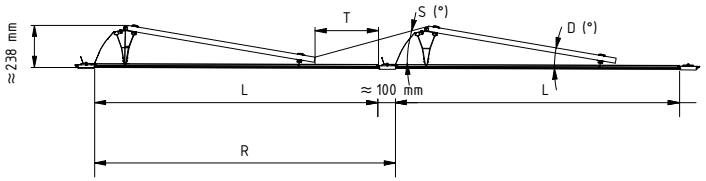
Services

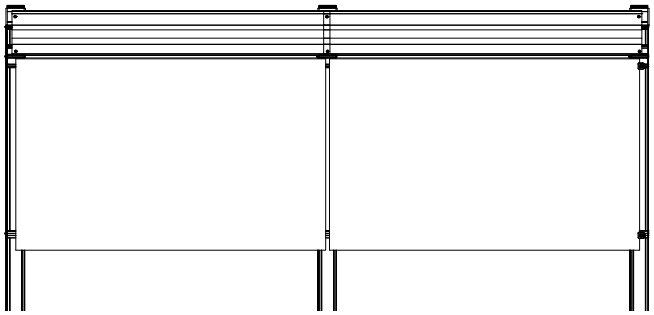
PV layout	Provided by Renusol (www.pv-configurator.com)

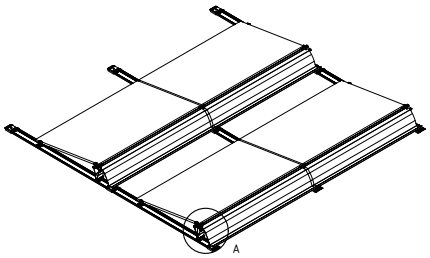
Misprints and errors, technical or other changes and changes in the availability of products are expressively reserved

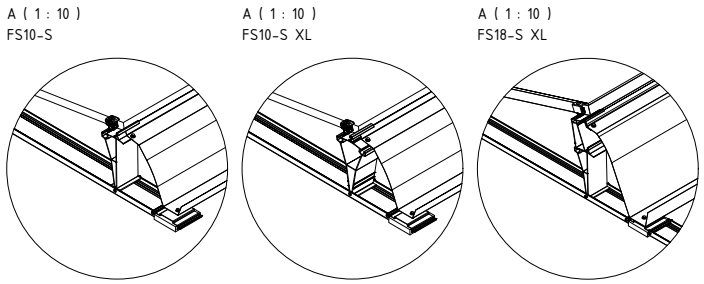
Renusol Europe GmbH











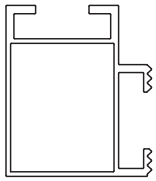
System		*FS10-S*	*FS10-S*	*FS10-S XL*
Bottom rail		R500400	R500402	R500409
Rail length	L:	1389 mm	1639 mm	1639 mm
Row spacing	R:	1490 mm	1740 mm	1740 mm
Module width	X:	Min: 950 mm	Min: 950 mm	Min: 1053 mm
		Max: 1052 mm	Max: 1052 mm	Max: 1168 mm
Throughway without Streamliner	T(X):	Min: 466 mm	Min: 716 mm	Min: 618 mm
		Max: 404 mm	Max: 654 mm	Max: 505 mm
Throughway with Streamliner	T(X):	Min: 281 mm	Min: 531 mm	Min: 433 mm
		Max: 219 mm	Max: 469 mm	Max: 320 mm
System width	W:	Modullänge + 24 mm	Modullänge + 24 mm	Modullänge + 24 mm
Module inclination	D:	10°	10°	10°
Shading angle	S:	18,2° - 21,7°	11,0° - 13,8°	13,8° - 18,2°

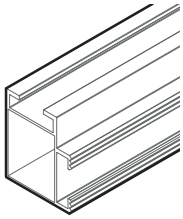
System		*FS18-S XL*	*FS18-S XL*
Bottom rail		R500505	R500506
Rail length	L:	1739 mm	1989 mm
Row spacing	R:	1840 mm	2090 mm
Module width	X:	Min: 990 mm	Min: 990 mm
		Max: 1065 mm	Max: 1065 mm
Throughway without Streamliner	T(X):	Min: 818 mm	Min: 1068 mm
		Max: 742 mm	Max: 1318 mm
Throughway with Streamliner	T(X):	Min: 532 mm	Min: 782 mm
		Max: 456 mm	Min: 706 mm
System width	W:	Modullänge + 24 mm	Modullänge + 24 mm
Module inclination	D:	17°	17°
Shading angle	S:	17,4° - 20,3 °	13,7°-15,8°

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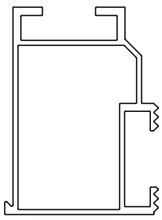
B

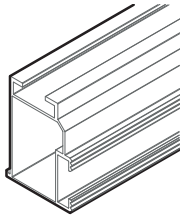
VS+ mounting rail 41 x 35



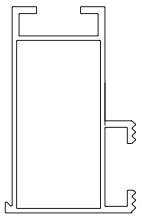


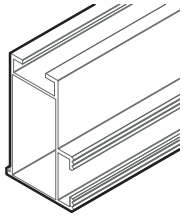
VS+ mounting rail 50 x 37



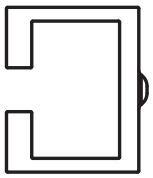


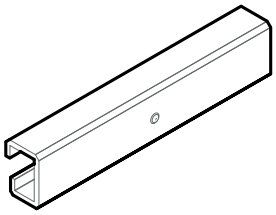
VS+ mounting rail 60 x 38



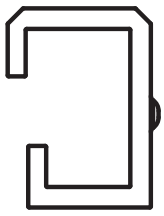


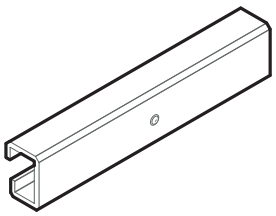
VS+ rail connector 41 x 35 - R400531



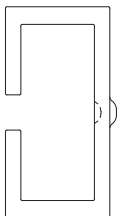


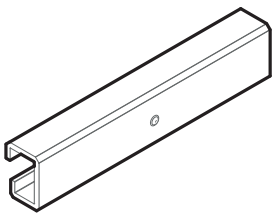
VS+ rail connector 50 x 37 - R400532



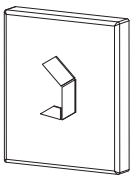


VS+ rail connector 60 x 38 - R400533



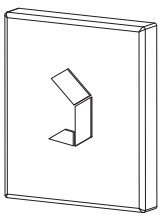


Cover cap for mounting rail 41 x 35



Item number	*Colour*
R900245	*Black*
R900246	*Blank*

Cover cap for mounting rail 50 x 37



Item number	*Colour*
R920043	*Black*
R920044	*Blank*

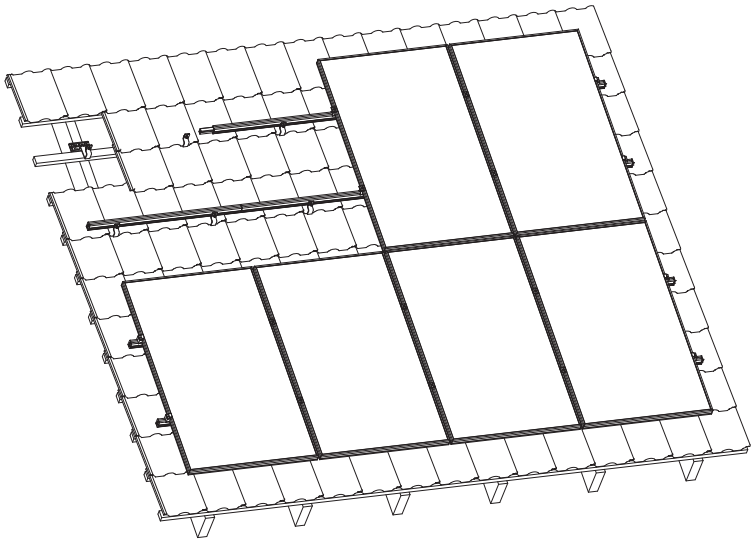
Mounting rail

Item number	*Length*	*Colour*
R400523	*41x35x**2250** mm*	*Blank*
R400523-B	*41x35x**2250** mm*	*Black*
R400524	*41x35x**3300** mm*	*Blank*
R400524-B	*41x35x**3300** mm*	*Black*
R400525	*41x35x**4400** mm*	*Blank*
R400525-B	*41x35x**4400** mm*	*Black*
R400513	*41x35x**6200** mm*	*Blank*
R400519	*Pre-cut part*	*Blank*
R400519		*Black*

Item number	*Length*	*Colour*
R400527	*50x37x**2250** mm*	*Blank*
R400527-B	*50x37x**2250** mm*	*Black*
R400528	*50x37x**3300** mm*	*Blank*
R400528-B	*50x37x**3300** mm*	*Black*
R400529	*50x37x**4400** mm*	*Blank*
R400529-B	*50x37x**4400** mm*	*Black*
R400506	*50x37x**6200** mm*	*Blank*
R400509	*Pre-cut part*	*Blank*
R400509-B		*Black*

Item number	*Length*	*Colour*
R400535	*60x38x**3300** mm*	*Blank*

Renusol Europe GmbH



System Datasheet

VS+

General

System	Rooftop mounting system for pitched roofs
Content	Connection of roof substructure (wood, steel, concrete), fixing material, assembly profiles, module clamps
System warranty	10 years
Application area	Pitched roof on commercial, industrial, agricultural (except hydrogen sulfide exposition) and residential buildings
Roof covering	Tile, slate, sheet metal (trapezoidal/corrugated), sandwich, fibre-cement
Roof slope	min. 5°/max. 70° (please check the admissibility with the Renusol Configurator)

System properties

Module tilt	Roof paralell
Material	Stainless steel, aluminum

Modules

Type	PV-modules with frame height between 30-50 mm
Module size (max)	Length: unlimited; Width: unlimited
Module guidance	Portrait/Landscape

Certifications

TÜV	ID1111212485 according to 2PfG
Building authority approval	Roof hook Aluminum (Z-14-4-515) Fastening material (Solar fasteners, Hanger bolts, wood screws)
MCS012	IK0197/03, IK0197/04, IK0197/05

Services

PV layout	Provided by Renusol

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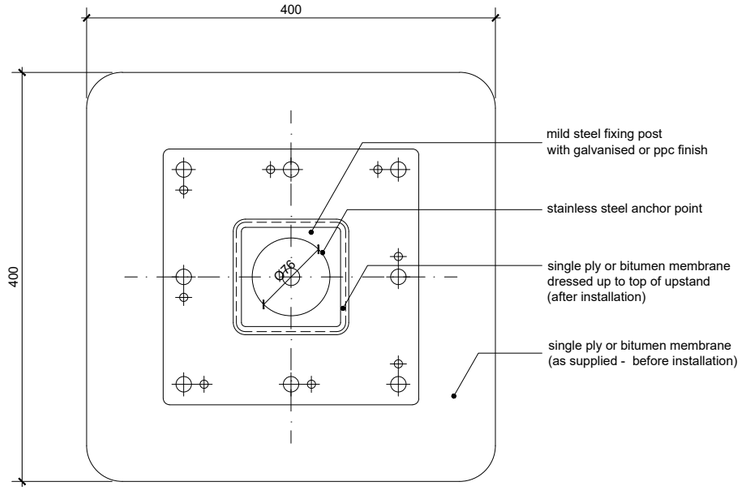
Typical Frame Images



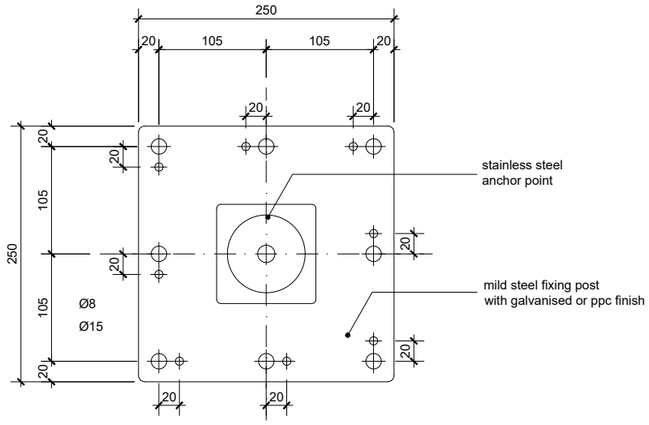




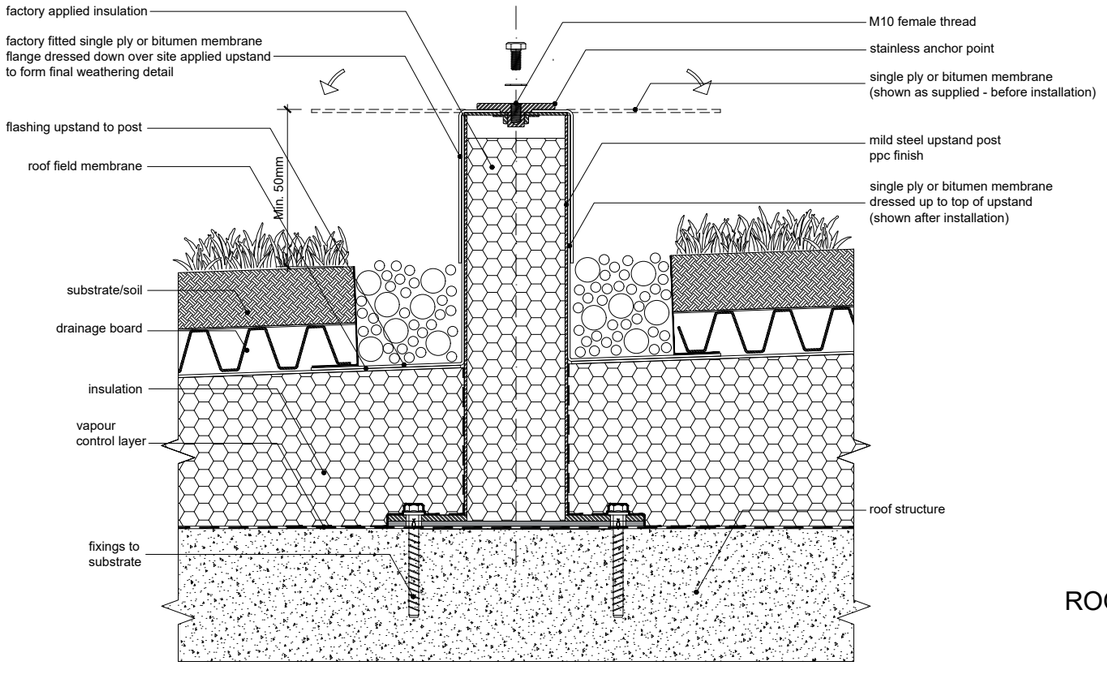
integrated fixing point
ROOFTRAK®



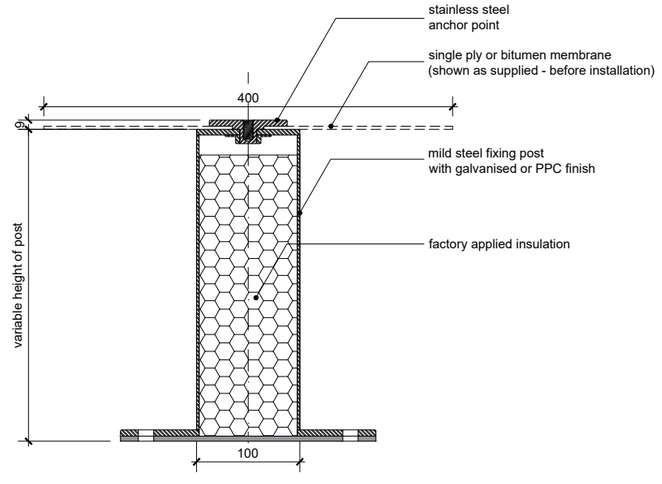
ROOFTRAK IFP-GR - PLAN VIEW INCLUDING ROOFING MEMBRANE.



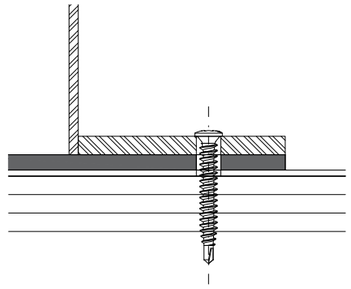
ROOFTRAK IFP-GR FIXING PLATE DIMENSIONS - PLAN VIEW
WEATHERING MEMBRANE NOT SHOWN



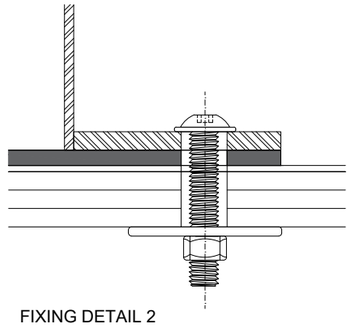
ROOFTRAK IFP-GR ON GREEN ROOF - SECTION VIEW



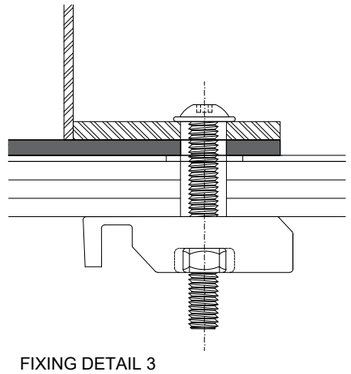
ROOFTRAK IFP-GR FIXING UPSTAND DIMENSIONS - SECTION VIEW
WEATHERING MEMBRANE NOT SHOWN



FIXING DETAIL 1
SF-RS-5.8x40 FIXING
INTO MIN.18MM PLY
DECK
SCALE 1:2



FIXING DETAIL 2
M10x50 SOCKET BUTTON
FLANGE + SQ WASHER & NUT
THROUGH MIN. 18MM PLY DECK
SCALE 1:2



FIXING DETAIL 3
M10SB BOLT & TOGGLE FOR
BOLTING THROUGH MIN. 18MM
PLY DECK
SCALE 1:2

TYPICAL FIXING DETAILS - STRUCTURAL CAPACITY OF SUBSTRATE TO BE CONFIRMED BY STRUCTURAL ENGINEER

The IFP is protected by European Patent 2855794 and US Patent 9637917

roof products
NICHOLSON®

Tel 01763 295 828
Email info@nicholsonsts.com
Web www.nicholsonsts.com

Drawing title:
ROOFTRAK IFP-GR
warm, green roof constructions - direct fixings

IFP-GR-WDF-02/24

1:5 @ A3

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integrated fixing point

ROOFTRAK®

ROOFTRAK IFP-GR

The IFP-GR is a member of the IFP family , providing a weatherproof fixing point for warm, green roof constructions. The IFP-GR is designed for use in warm, green and inverted roof constructions and can be fixed directly to the roof deck below the insulation or in some instances on top of the insulation (see separate detail). To waterproof the post, the IFP-GR is factory fitted with an appropriate flange material to enable it to be weathered or sealed to the main roof area weathering which extends up the post.

Uses
The IFP-GR is designed for use in green and inverted roof build ups that are weathered with a membrane system and can be used in applications where a connection to the structure is required. This would include uses such as solar pv, solar thermal, roof plant supports and roof mounted signage.

Not for Use with
Balustrade or any use which applies a non-axial load.

Compatability
The IFP-GR is designed for roof constructions where the roofing membrane or weathering layer is on top of the insulation layer. It can also be used where the membrane is laid below the insulation as in an inverted roof scenario.

Materials

304 stainless steel anchor point	machined finish, also available in 316 stainless steel for marine environments
Mild steel fixing plate and post upstand	PPC or galvanised finish
Thermal break	5mm HDPE
Internal insulation	PIR

Dimensions

Baseplate	250mm x 250mm x 6mm
Post	100mm x 100mm
OA height	Variable to suit roof build up
Max height	900mm
Single connection point	M10 x 20mm
Weathering flange dimension	400mm x 400mm for all membranes

Installation
The ROOFTRAK IFP-GR can be installed directly to the structural roof substrate, prior to the insulation being fitted. 8no. fixings should be used to secure the GR to the structure. Fixing types should be selected depending on the substrate type. It is important that the IFP-GR units are sealed into the vapour control layer. Insulation should be tightly fitted around the IFP-GR upstand.

The IFP-GR flange membrane should be dressed down the upstand post and onto the field membrane and a lap seal made in accordance it normal good practice and in line with any specific guidelines as set out by the membrane manufacturer. For higher post dimensions extra membrane may be required to complete the weathering. Detailing of the membrane at this point must be carried out in a manner that provides a completely waterproof upstand weathering.

The IFP-GR upstand post must extend a minimum of 50mm past any green roof medium. Green roofing should be fitted around the IFP-GR allowing surface water to drain away from the fixing point. The IFP-GR fixing point should not become submerged at any time.

IFP-GR loading values
The following values assume that the supporting structure is adequate to support the design values that will be imposed on the IFP-GR.

Compressive load as 'A'
Maximum compressive load 5kN

Shear load as 'B'
Maximum shear load — Up to 600mm high - 2.5kN; 600 - 900mm high - 1.5kN

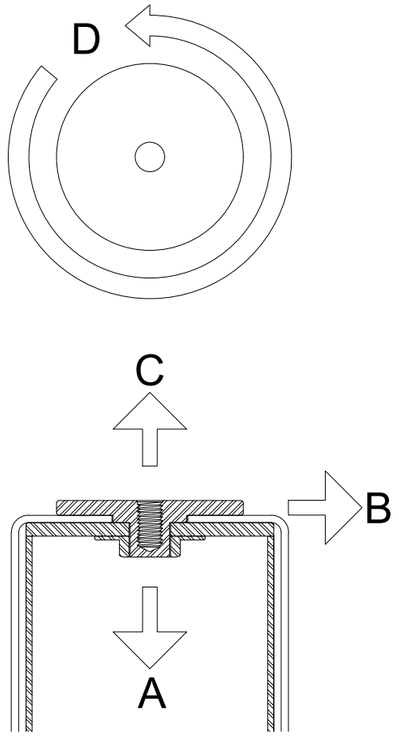
Tensile load as 'C'
Tensile Load as 'C' for direct fixings to metal wood and concrete
Values given below are based on the Fixfast HD5.8 and HD6.1 fasteners as per European Technical Approval 15/0406 and allow a safety factor of three on the combined mean axial pullout value of the fixings. Values are also given for steel decks where normally only 6 no fixings into the profile crown can be achieved.

	8 fixings
BS5.8 fixed to 18mm plywood to EN 636	5.0 kN
BS5.8 fixed to 18mm OSB/3 to EN300	4.2kN
BS5.8 fixed to 38mm softwood timber	5.0 kN
BS5.8 fixed to 0.7mm galvanised profiled steel	3.8 kN
BS 5.8 fixed to 0.9mm galvanised profiled steel	5.0 kN
BS5.8 fixed to 1.2mm galvanised profiled steel	5.0 kN
HD6.1 fixed to C25 concrete	5.0 kN

Rotational as 'D'
Configuration of the IFPs should be such that turning motion is not exerted on individual fixing points

Important Notes:
- It is the responsibility of the designer/specifier/purchaser to ensure that the intended use of the IFP in any given application is approved by a competent structural engineer
- On site pull-out testing may be required to determine pull out values where the substrate is an existing roof structure

Warranty
Rooftrak IFP products are covered by the Nicholson standard warranty - available on the website or by request.
Rooftrak IFP components are always supplied as a factory assembled product. Tampering with, or adjustment of the factory finished unit will invalidate the warranty



IFP GR- Loading diagram.

The IFP is protected by European Patent 2855794 and US Patent 9637917

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Web www.nicholsonsts.com

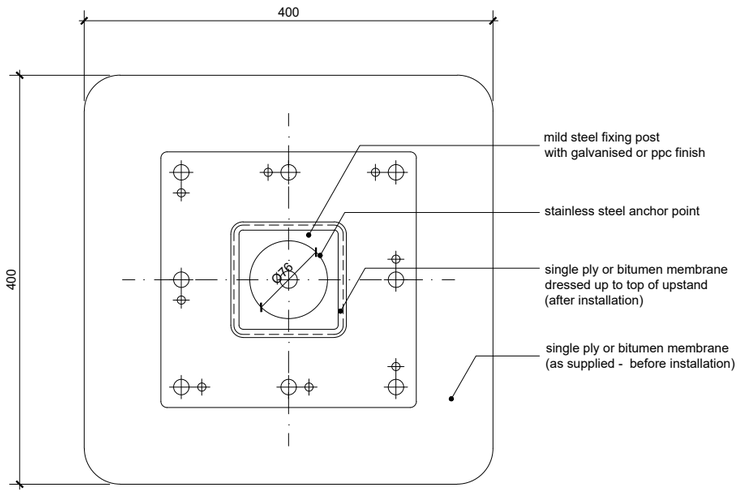
Drawing title:
ROOFTRAK IFP-GR
warm, green roof constructions - direct fixings

IFP-GR-WDF-02/24

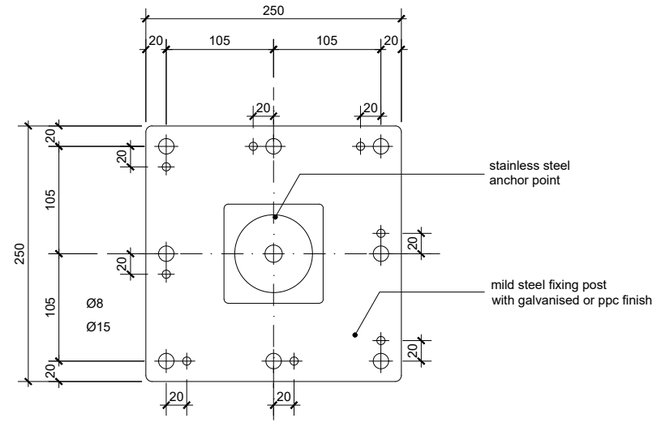
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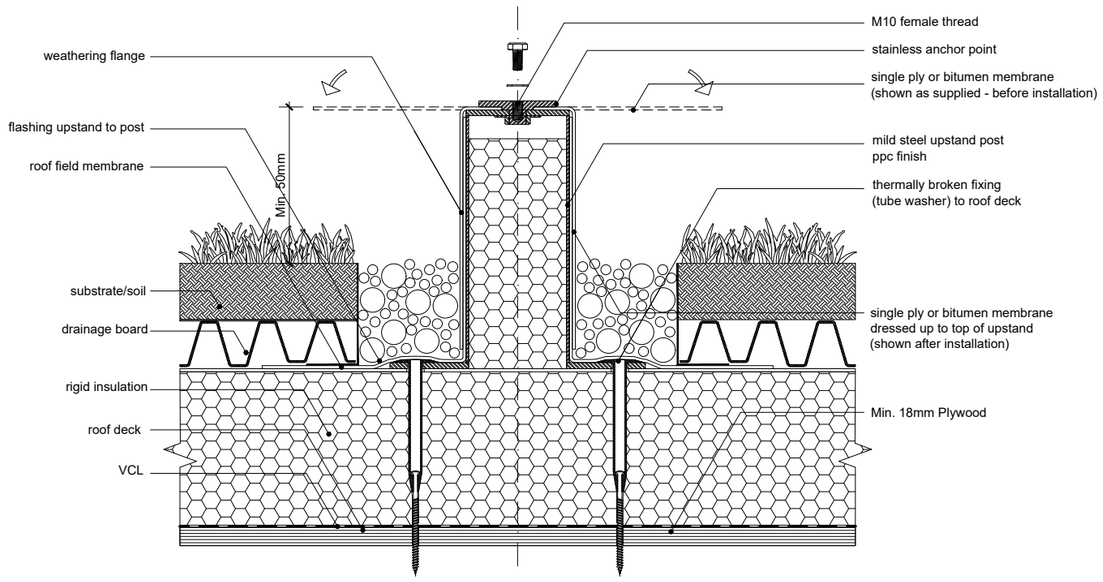
integrated fixing point
ROOFTRAK®



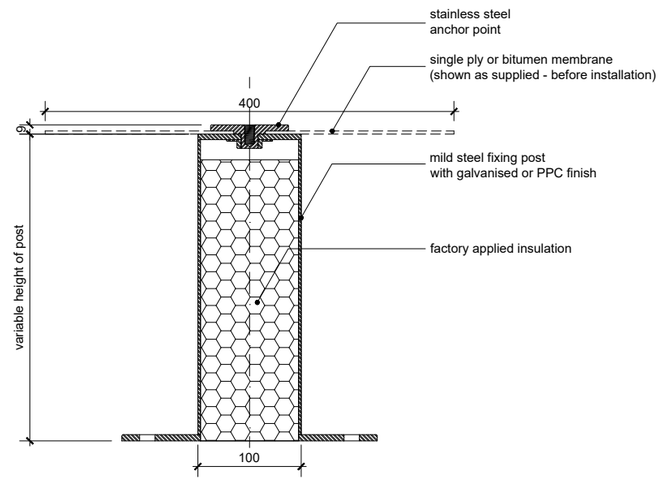
ROOFTRAK IFP-GR - PLAN VIEW INCLUDING ROOFING MEMBRANE.



ROOFTRAK IFP-GR FIXING PLATE DIMENSIONS - PLAN VIEW
WEATHERING MEMBRANE NOT SHOWN



ROOFTRAK IFP-GR ON GREEN ROOF - SECTION VIEW



ROOFTRAK IFP-GR FIXING UPSTAND DIMENSIONS - SECTION VIEW
WEATHERING MEMBRANE NOT SHOWN

The IFP is protected by European Patent 2855794 and US Patent 9637917

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Drawing title:
ROOFTRAK IFP-GR
warm, green roof constructions - thermally broken fixings

IFP-GR-WTB-02/24

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integrated fixing point

ROOFTRAK®

ROOFTRAK IFP-GR

The IFP-GR is a member of the IFP family , providing a weatherproof fixing point for warm, inverted roofing applications, where the weathering membrane is below the insulation in the roof build up. The post upstand is fabricated to suit the depth of the roof build up, providing an upstand above the roof build up to raise the supported structure above the finished roof deck

Uses
The IFP-GR is designed for use in green and inverted roof build ups that are weathered with a membrane system and can be used in applications where a connection to the structure is required. This would include uses such as solar pv, solar thermal, roof plant supports and roof mounted signage.

Not for use with
Balustrade or any use which applies a non-axial load.

Compatability
The IFP-GR is designed for roof constructions where the roofing membrane or weathering layer is under the green roof build up or insulation. It can be used where the membrane is laid directly over the roof deck or in green roofs where the insulation is under the membrane.

Materials

304 stainless steel anchor point	machined finish, also available in 316 stainless steel for marine environments
Mild steel fixing plate and post upstand	PPC or galvanised finish
Thermal break	5mm HDPE
Internal insulation	PIR

Dimensions

Baseplate	250mm x 250mm x 6mm
Post	100mm x 100mm
OA height	Variable to suit roof build up
Max height	250mm
Single connection point	M10 x 20mm
Weathering flange dimension	400mm x 400mm for all membranes

Installation
The ROOFTRAK IFP-GR can be fitted once the insulation and field membrane is completed. 8no. thermally broken fixings should be used to secure the GR to the structural substrate. Fixing types should be selected depending on the substrate type.

The IFP-GR flange membrane should be dressed down the upstand post and onto the field membrane and a lap seal made in accordance it normal good practice and in line with any specific guidelines as set out by the membrane manufacturer. For higher post dimensions extra membrane may be required to complete the weathering. Detailing of the membrane at this point must be carried out in a manner that provides a completely waterproof upstand weathering.

The IFP-GR upstand post must extend a minimum of 50mm past any green roof medium. Green roofing should be fitted around the IFP-GR allowing surface water to drain away from the fixing point. The IFP-GR fixing point should not become submerged at any time.

IFP-GR loading values
The following values assume that the supporting structure is adequate to support the design values that will be imposed on the IFP-GR.

IFP-GR for green roof warm roof constructions

Compressive load as 'A'
The maximum compressive load will be determined by the insulation manufacturers static load rating. These figures can be obtained from the relevant insulation manufacturer.

A minimum static load rating of 30kPa and a maximum loading of 1.8kN.

It is the purchaser or specifiers responsibility to check that the insulation will bear any compressive load without compression. The insulation manufacturer should be consulted if there is any doubt.

If there is a compressive insulation in use such as mineral wool, the Rooftrak IFP-MW fixing point should be considered in lieu of the Rooftrak IFP-GR

Shear load as 'B'
Maximum height of post is 250mm above roof membrane
Maximum shear load 1kN

Tensile Load as 'C' for direct fixings to metal wood and concrete
Values given below are based on the Fixfast HD5.8 and HD6.1 fasteners as per European Technical Approval 15/0406 and allow a safety factor of three on the combined mean axial pullout value of the fixings. Values are also given for steel decks where normally only 6 no fixings into the profile crown can be achieved.

	6 fixings	8 fixings
BS5.8 fixed to 18mm plywood to EN 636	4.2 kN	5.0 kN
BS5.8 fixed to 18mm OSB/3 to EN300	3.1 kN	4.2kN
BS5.8 fixed to 38mm softwood timberment	5.0 kN	5.0 kN
BS5.8 fixed to 0.7mm galvanised profiled steel	2.8 kN	3.8 kN
BS 5.8 fixed to 0.9mm galvanised profiled steel	3.8 kN	5.0 kN
BS5.8 fixed to 1.2mm galvanised profiled steel	5.0 kN	5.0 kN
HD6.1 fixed to C25 concrete	3.9 kN	5.0 kN
M10 x 90 concrete screw	5.0 kN	5.0 kN

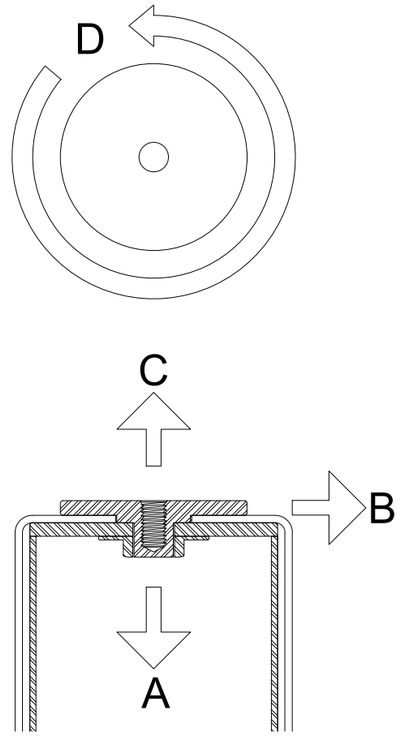
Tensile Load as 'C' for thermally broken fixings to metal, wood and concrete
Values given below are based on the Fixfast SF-RS-5.8 fasteners and SF-T-50 tube washers as per European Technical Approval 15/0406 and allow a safety factor of three on the combined mean axial pullover value of the thermal washers. Values are also given for steel decks where normally only 6 no fixings into the profile crown can be achieved.

	6 fixings	8 fixings
Fixing into all substrate materials*	3.1 kN	4.1 kN

Rotational as 'D'
Configuration of the IFPs should be such that turning motion is not exerted on individual fixing points

Important Notes:
- It is the responsibility of the designer/specifier/purchaser to ensure that the intended use of the IFP in any given application is approved by a competent structural engineer
- On site pull-out testing may be required to determine pull out values where the substrate is an existing roof structure

Warranty
Rooftrak IFP products are covered by the Nicholson standard warranty - available on the website or by request.
Rooftrak IFP components are always supplied as a factory assembled product. Tampering with, or adjustment of the factory finished unit will invalidate the warranty



IFP GR- Loading diagram.

The IFP is protected by European Patent 2855794 and US Patent 9637917

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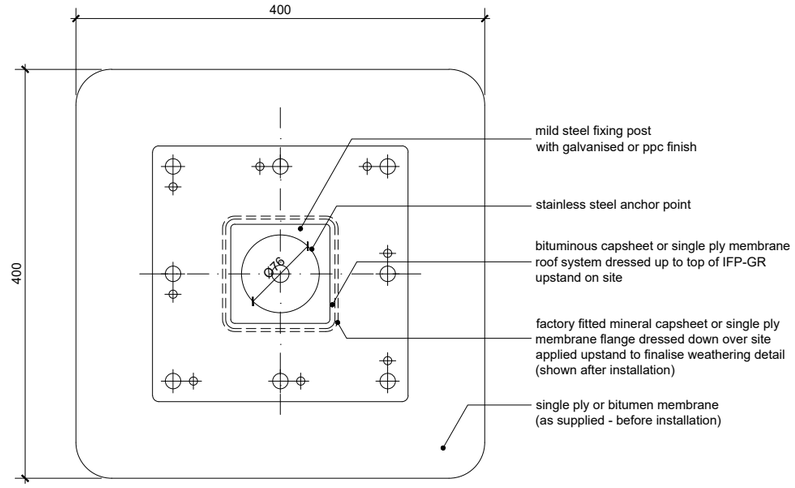
Drawing title:
ROOFTRAK IFP-GR
warm, green roof constructions - thermally broken fixings

IFP-GR-WTB-02/24

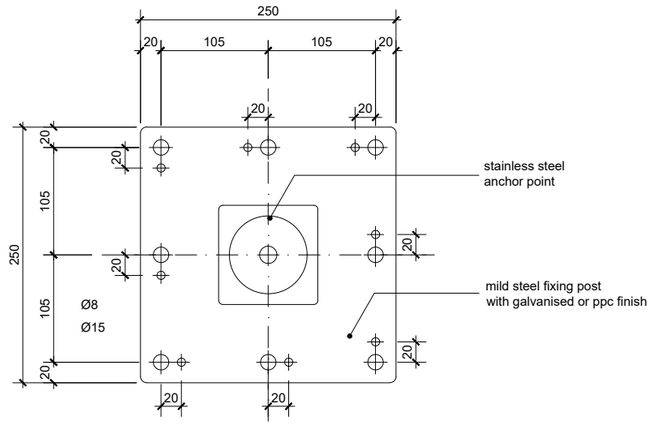
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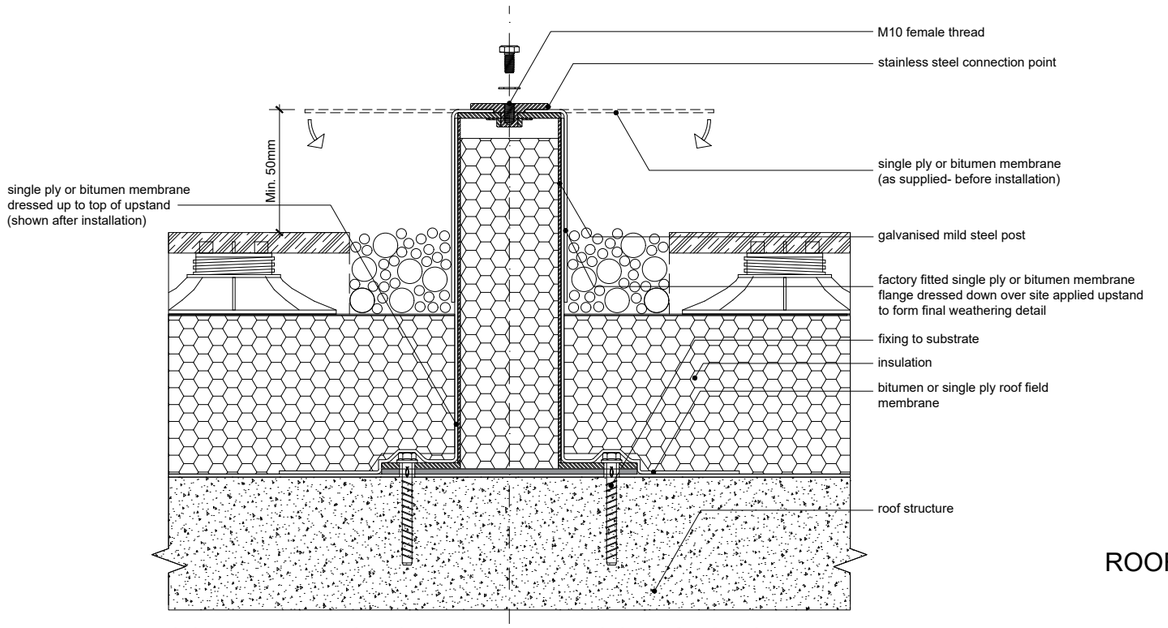
integrated fixing point
ROOFTRAK®



ROOFTRAK IFP-GR - PLAN VIEW INCLUDING ROOFING MEMBRANE.

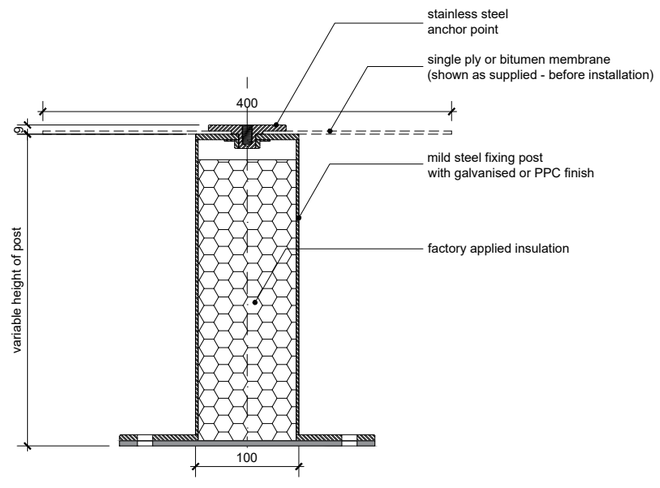


ROOFTRAK IFP-GR FIXING PLATE DIMENSIONS - PLAN VIEW
WEATHERING FLANGE NOT SHOWN

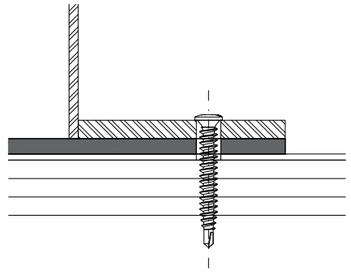


ROOFTRAK IFP-GR ON INVERTED ROOF - SECTION VIEW

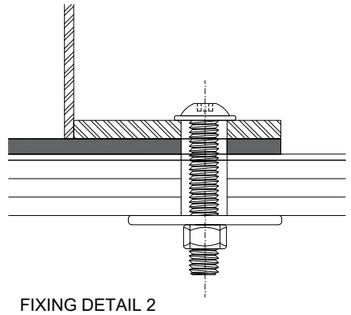
The IFP is protected by European Patent 2855794 and US Patent 9637917



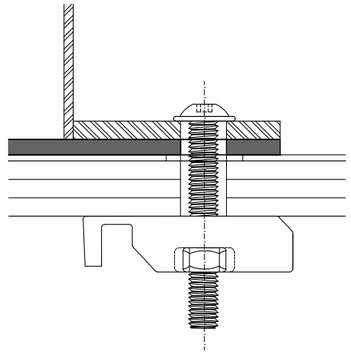
ROOFTRAK IFP-GR FIXING UPSTAND DIMENSIONS - SECTION VIEW
WEATHERING FLANGE NOT SHOWN



FIXING DETAIL 1
SF-RS-5.8x40 FIXING
INTO MIN. 18MM PLY
DECK
SCALE 1:2



FIXING DETAIL 2
M10x50 SOCKET BUTTON
FLANGE + SQ WASHER & NUT
THROUGH MIN. 18MM PLY DECK
SCALE 1:2



FIXING DETAIL 3
M10 SB BOLT & TOGGLE FOR
BOLTING THROUGH MIN. 18MM
PLY DECK
SCALE 1:2

TYPICAL FIXING DETAILS - STRUCTURAL CAPACITY OF SUBSTRATE TO BE CONFIRMED BY STRUCTURAL ENGINEER

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Drawing title:
ROOFTRAK IFP-GR
inverted roof constructions for membrane waterproofing systems

IFP-GR-I-02/24

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integrated fixing point

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ROOFTRAK IFP-GR

The IFP-GR is a member of the IFP family , providing a weatherproof fixing point for warm, green roof constructions and can be fixed directly to the roof deck below the insulation or in some instances on top of the insulation as shown here. To waterproof the post, the IFP-GR is factory fitted with an appropriate flange material to enable it to be weathered or sealed to the main roof area weathering which extends up the post.

Uses
The IFP-GR is designed for use in green and inverted roof build ups that are weathered with a membrane system and can be used in applications where a connection to the structure is required. This would include uses such as solar pv, solar thermal, roof plant supports and roof mounted signage.

Not for use with
Balustrade or any use which applies a non-axial load.

Compatability - roof construction
The IFP-GR is designed for flat and pitched roof constructions up to 10deg. and with a maximum height of 150mm, where the roofing membrane or weathering layer is on top of the insulation layer in a warm roof scenario. It can also be used where the weathering layer is below the insulation, with a max. post height of 1000mm - see 'direct fixed' scenario detail

Materials
Mild steel fixing plate and post upstand- galvanised or PPC finish
304 grade stainless steel connection point with single M10 x 20mm female threaded connection (316 grade SS components available for locations within 2km of the coast)
Weathering flange - material to match main roof weathering system

Dimensions

Baseplate	250mm x 250mm x 6mm
Post	100mm x 100mm
OA height	Variable to suit roof build up
Max height	900mm
Single connection point	M10 x 20mm
Weathering flange dimension	400mm x 400mm for all membranes

Installation
The ROOFTRAK IFP-GR can be installed directly to the structural roof substrate. 8no. fixings should be used to secure the GR to the structure. Fixing types should be selected depending on the substrate type. The inverted roof membrane should be taken up the top of the IFP-GR upstand post.

The IFP-GR flange membrane should be dressed down onto the field membrane upstand and a lap seal made in accordance it normal good practice and in line with any specific guidelines as set out by the membrane manufacturer. Detailing of the membrane at this point must be carried out in a manner that provides a completely waterproof upstand weathering.

Insulation & green roofing should be fitted around the IFP-GR allowing surface water to drain away from the fixing point. The IFP-GR upstand post must extend a minimum of 50mm past any green roof medium. The IFP-GR fixing point should not become submerged at any time.

IFP-GR loading values
The following values assume that the supporting structure is adequate to support the design values that will be imposed on the IFP-GR.

Compressive load as 'A'
Maximum compressive load 5kN

Shear load as 'B'
Maximum shear load Up to 600mm high - 2.5kN
600 - 900mm high - 1.5kN

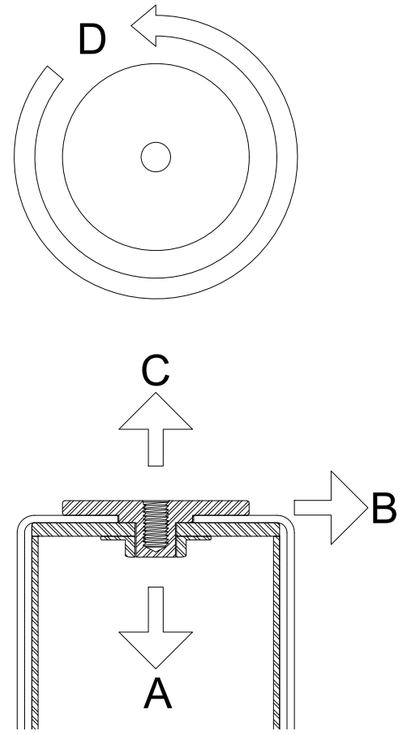
Tensile load as 'C'
Tensile Load as 'C' for direct fixings to metal wood and concrete
Values given below are based on the Fixfast HD5.8 and HD6.1 fasteners as per European Technical Approval 15/0406 and allow a safety factor of three on the combined mean axial pullout value of the fixings. Values are also given for steel decks where normally only 6 no fixings into the profile crown can be achieved.

	8 fixings
BS5.8 fixed to 18mm plywood to EN 636	5.0 kN
BS5.8 fixed to 18mm OSB/3 to EN300	4.2kN
BS5.8 fixed to 38mm softwood timber	5.0 kN
BS5.8 fixed to 0.7mm galvanised profiled steel	3.8 kN
BS 5.8 fixed to 0.9mm galvanised profiled steel	5.0 kN
BS5.8 fixed to 1.2mm galvanised profiled steel	5.0 kN
HD6.1 fixed to C25 concrete	5.0 kN

Rotational as 'D'
Configuration of the IFPs should be such that turning motion is not exerted on individual fixing points

Important Notes:
- It is the responsibility of the designer/specifier/purchaser to ensure that the intended use of the IFP in any given application is approved by a competent structural engineer
- On site pull-out testing may be required to determine pull out values where the substrate is an existing roof structure

Warranty
Rooftrak IFP products are covered by the Nicholson standard warranty - available on the website or by request.
Rooftrak IFP components are always supplied as a factory assembled product. Tampering with, or adjustment of the factory finished unit will invalidate the warranty



IFP GR- Loading diagram.

The IFP is protected by European Patent 2855794 and US Patent 9637917

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Drawing title:
ROOFTRAK IFP-GR
inverted roof constructions for membrane waterproofing systems

IFP-GR-I-02/24

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TS4-A-O

Module-level optimization, monitoring, and rapid shutdown

The Tigo TS4-A-O improves production, safety, and intelligence in new designs and existing systems. Patented technology delivers top performance with high efficiency for a fast ROI. Easy installation and long-term reliability reduce system downtime and truck rolls, while Tigo's Energy Intelligence platform enables quicker onsite commissioning and comprehensive remote monitoring.

Features

- Simple, fast installation – snaps to a standard PV module frame or mounts to racking
- Intelligent optimization – delivers the maximum energy from an array
- Module-level monitoring – full visibility into module- and system-level production
- Rapid shutdown – a UL Standards-certified component for photovoltaic rapid shutdown systems (PVRSS) worldwide
- Works with any system – fully compatible with thousands of different inverter models from more than 50 inverter brands
- 25-year warranty
- Monitoring, rapid shutdown, and remote troubleshooting with Tigo Access Point (TAP) and Cloud Connect Advanced (CCA)

Specifications

Electrical	
Maximum current (I_{MP}/I_{SC})	15 A/20 A
Input voltage range (V_{MP})	16 – 80 V
Maximum input voltage	80 V
Maximum system voltage (V_{MAX})	1000 V/1500 V*
Maximum output current (I_{MAX})	15 A
Maximum output power (P_{MAX})	700 W
Maximum fuse rating	25 A
Maximum efficiency	99.6%
AS 5033: Operational Output	
Maximum output current	$I_{DCU\ MAX}$
Maximum output voltage	$V_{DCU\ MAX}$
Maximum output power	$P_{DCU\ MAX}$
Rapid Shutdown	
TS4 conductor AWG	12
Rapid shutdown time limit	<30 sec.
PVRSE-controlled conductor limits	≤240 VA, ≤8 A, ≤30 V_{DC}
UL 1741-compliant PVRSE	Yes
Communications	Wireless
Connections	
Input (from module) cable lengths	0.12/0.62 m
Output (to string) cable lengths	1.2/2 m
Connectors	MC4/EVO2

* Depending on UL/IEC certification

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Specifications

Environmental	
Operating temperature range	-40 – 70 °C (-40 – 158 °F)
Storage temperature range	-40 – 85 °C (-40 – 185 °F)
Maximum elevation	2000 m (6560 ft.)
Outdoor IP rating	IP68/NEMA 3R
Mechanical	
Dimensions (H/W/D)	139.7 x 138.4 x 22.9 mm (5.4 x 5.5 x 0.9 in.)
Weight	520 g (1.15 lb.)
General	
Standards compliance	
FCC 15b, ETSI EN 301 489, CISPR 31, CSA 22.2, IEC 62109, NEC 690.12 UL 1741 PVRSE/PVRSS	
Warranty	25 years

Ordering Information

Part Number	V_{MAX} Certifications UL/IEC	Cable Lengths	Connectors
461-00252-20	1500 V/1000 V	1.2/2 m	MC4
461-00252-32	1500 V/1000 V	0.12/1.2 m	MC4
461-00252-62	1500 V/1000 V	0.62/1.2 m	MC4
461-00261-32	1500 V/1500 V	0.12/1.2 m	EVO2
461-00261-62	1500 V/1500 V	0.62/1.2 m	EVO2
462-00252-32	1000 V*	0.12/1.2 m	MC4
462-00252-62	1000 V*	0.62/1.2 m	MC4
462-00261-32	1500 V*	0.12/1.2 m	EVO2
462-00261-62	1500 V*	0.62/1.2 m	EVO2

* IEC certified only

More Resources

Home Help Center Downloads



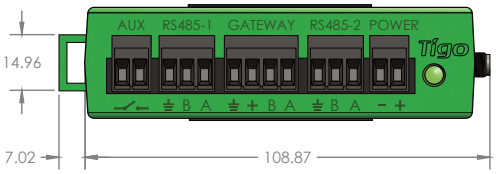
Cloud Connect Advanced (CCA) and Accessories Kit

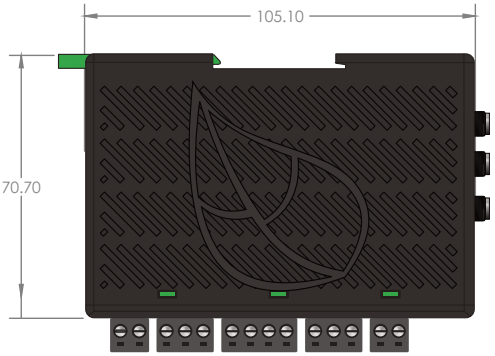
Data logger/gateway, Tigo Access Point (TAP), power supply, and outdoor enclosure options

The Cloud Connect Advanced (CCA) is a compact, powerful data logging and communications gateway that powers the monitoring and safety capabilities of Tigo TS4 module level power electronics (MLPE). CCA Kit options provide all the components needed for communicating between inverters, TAPs, TS4s, and the Tigo Energy Intelligence platform.

CCA

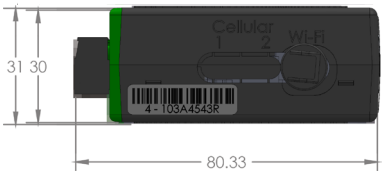
- Enables module-level monitoring through the Tigo cloud platform
- Connects to wired and wireless networks
- Includes a multifunction LED status indicator
- Configured and commissioned with the Tigo Energy Intelligence (EI) app
- Monitors 3rd-party devices via Modbus

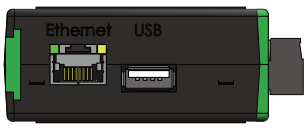




TAP

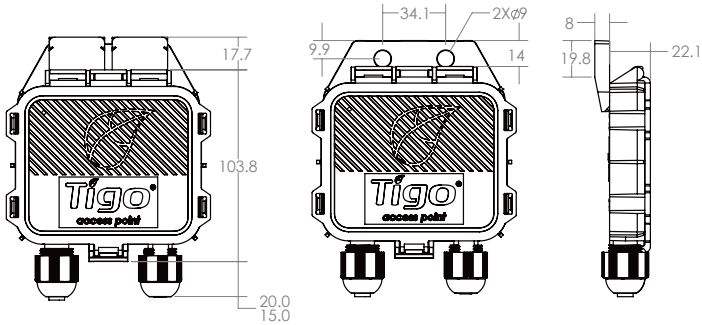
- Collects data from up to 300 TS4s
- Wireless mesh communication
- Scalable architecture
- Mounts easily on module frames without tools





Power Supplies/Outdoor Enclosure

- Outlet and DIN rail power-supply options
- Compact, DIN rail design
- IP67, NEMA 4 rated enclosure



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Specifications

CCA	
Input voltage	2 TAPs or fewer: 12-24V_{DC} ±2% 3 TAPs or more: 24V_{DC} ±2%
Input current	1 A
Power consumption (up to 7 TAPs)	3 – 10 W
Dimensions (W/D/H)	31 x 115.5 x 71.5 mm (1.2 x 4.5 x 2.8 in)
Weight	126 g (0.28 lbs)
Operating temperature range	-20 – 85°C (-4 – 185°F)
Maximum altitude	3000 m (9840 ft)
Cooling	Natural convection
TAP	
Operating temperature range	-20 – 85°C (-4 – 185°F)
Environmental rating	IP68/NEMA 4X
Power Supplies/Outdoor Enclosure	
Operating temperature range	-20 – 70°C (-4 – 185°F)
Input voltage	50/60Hz, 100 – 240 V_{AC}
Power consumption (up to 7 TAPs)	3 – 15 W
Dimensions (W/D/H)	203 x 115 x 278.4 mm (8 x 4.5 x 11 in)
Weight (w/CCA and power supply)	1.1 kg (2.4 lbs)
Environmental rating	IP67/NEMA 4X
Cooling	Natural convection

Includes DIN rail mountable bracket*

Ordering Information

344-00000-52	CCA Kit with TAP, DIN rail power supply*
348-00000-52	CCA Kit with TAP, DIN rail power supply, outdoor enclosure*
346-00000-00	CCA standalone

Additional Resources

Tigo TAP

Downloads

Tigo CCA

Support



Tigo Access Point (TAP)

Wireless mesh communication device

The Tigo Access Point (TAP) improves the data management of your solar array by wirelessly communicating with Tigo smart modules and retrofit devices. TAP also greatly improves safety with module-level deactivation. When paired with a Cloud Connect Advanced (CCA), the TAP provides unparalleled visibility into your solar installation.

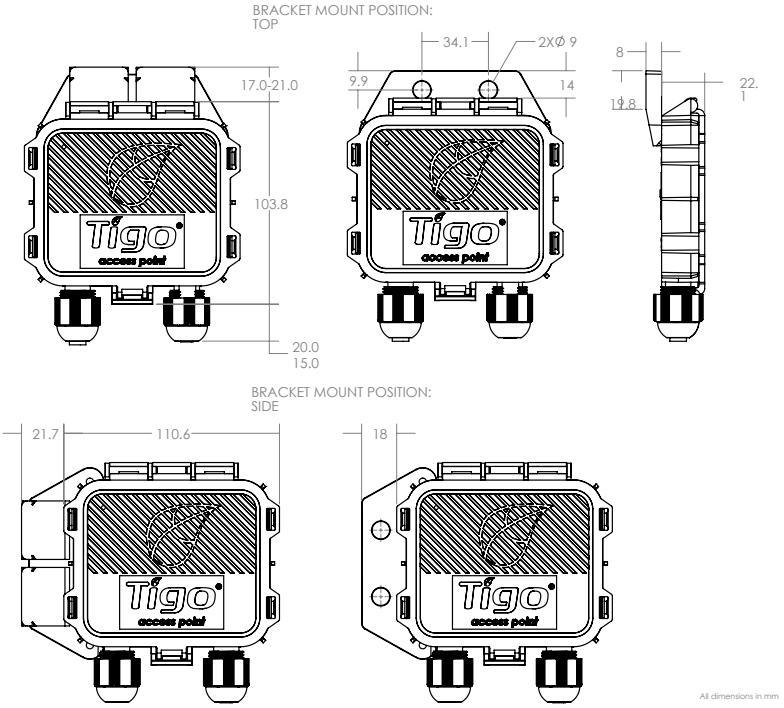
Features

- Wireless communication with Tigo TS4 devices
- Provide grid status to TS4 MLPE for rapid shutdown UL compliance
- Connects to Tigo Cloud Connect Advanced (CCA) via RS485 cable
- For use with TS4-A-O, TS4-A-S, and TS4-A-M

Benefits

- Easy installation on the module frame without tools
- Use the Tigo EI App on a mobile device for quick startup
- Enables wireless module level monitoring
- Enables wireless module-level rapid shutdown
- Connects to up to 300 TS4 units*

Dimensions



E469960

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PN: 002-00050-00 | Rev. 1.2| 2023.06.06

Electrical Specifications

Input voltage range	$5V_{DC}$ - $25V_{DC}$
Consumption	0.5W average, 1W peak
Recommended cable type	RS485, 18-22AWG

Mechanical Specifications

Dimensions	126.2mm x 130.0mm x 26.8mm (with bracket)
Weight	227g (0.5lbs)
Operating temperature range	-30°C to +70°C (-22°F to +158°F)
Environmental rating	IP68, Type 4R

Range and Capacity

Maximum distance from TAP to closest TS4	10m (33ft)
Maximum distance from TAP to farthest TS4	35m (115ft)
Total TS4 units supported*	Up to 300

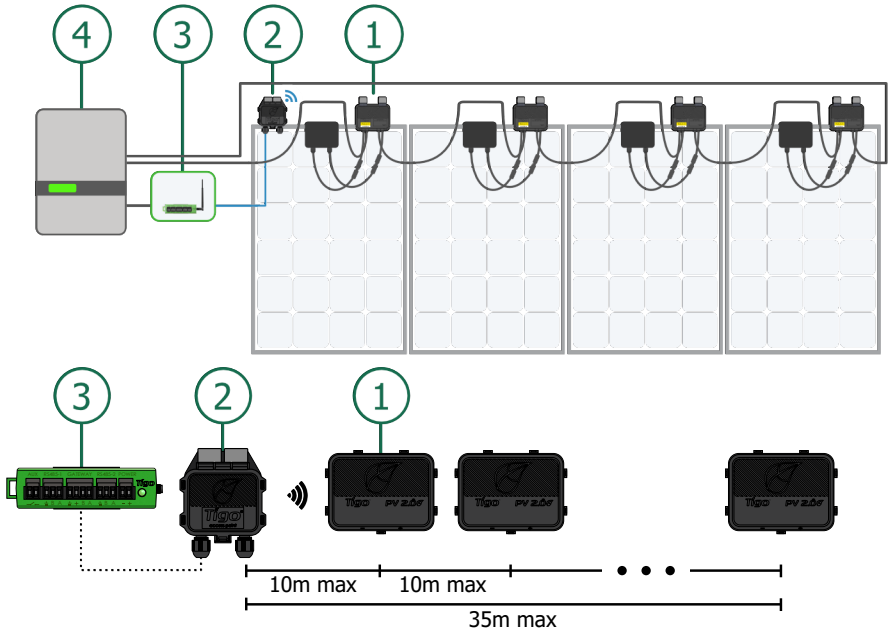
*environmental conditions can impact the number of units supported

Ordering Options

Item #	Description
158-00000-02	TAP, standalone

System Components and Spacing

1. Modules equipped with Tigo MLPE
2. Tigo Access Point (TAP)
3. Tigo Cloud Connect Advanced (CCA)
4. Inverter



Additional resources

Tigo TAP

Community

Support

solis

Solis Three Phase Inverters

» S5-GR3P(3-20)K



360 degree

Efficient

- Max. efficiency 98.7%
- String current up to **16A**
- Wide voltage range and low startup voltage

Safe

- IP66
- AFCI protection, proactively reduces fire risk
- Automatic voltage stabilization technology in weak grid conditions

Smart

- Supports export power control
- Supports RS485, WiFi, GPRS
- Scan to register on SolisCloud, supports remote upgrade and control

Economic

- Compact design, simple installation and maintenance
- > 150% DC/AC ratio
- Supports high power modules for lower installation costs

Model:

S5-GR3P3K S5-GR3P4K S5-GR3P5K S5-GR3P6K S5-GR3P8K S5-GR3P9K S5-GR3P10K
S5-GR3P12K S5-GR3P13K S5-GR3P15K S5-GR3P17K S5-GR3P20K

Datasheet

Model Name	S5-GR3P3K	S5-GR3P4K	S5-GR3P5K	S5-GR3P6K	S5-GR3P8K	S5-GR3P9K	S5-GR3P10K	S5-GR3P12K	S5-GR3P13K	S5-GR3P15K	S5-GR3P17K	S5-GR3P20K
Input DC												
Recommended max. PV power	4.5 kW	6 kW	7.5 kW	9 kW	12 kW	13.5 kW	15 kW	18 kW	19.5 kW	22.5 kW	25.5 kW	30 kW
Max. input voltage	1100 V											
Rated voltage	600 V											
Start-up voltage	180 V											
MPPT voltage range	160-1000 V											
Max. input current	16 A / 16 A							32 A / 32 A				
Max. short circuit current	20 A / 20 A							40 A / 40 A				
MPPT number/Max. input strings number	2/2							2/4				
Output AC												
Rated output power	3 kW	4 kW	5 kW	6 kW	8 kW	9 kW	10 kW	12 kW	13 kW	15 kW	17 kW	20 kW
Max. apparent output power	3.3 kVA	4.4 kVA	5.5 kVA	6.6 kVA	8.8 kVA	9.9 kVA	11 kVA	13.2 kVA	14.3 kVA	16.5 kVA	18.7 kVA	22 kVA
Max. output power	3.3 kW	4.4 kW	5.5 kW	6.6 kW	8.8 kW	9.9 kW	11 kW	13.2 kW	14.3 kW	16.5 kW	18.7 kW	22 kW
Rated grid voltage	3/N/PE, 220 V / 380 V, 230 V / 400 V											
Rated grid frequency	50 Hz / 60 Hz											
Rated grid output current	4.6 A / 4.3 A	6.1 A / 5.8 A	7.6 A / 7.2 A	9.1 A / 8.7 A	12.2 A / 11.5 A	13.7 A / 13.0 A	15.2 A / 14.4 A	18.2 A / 17.3 A	19.8 A / 18.8 A	22.8 A / 21.7 A	25.8 A / 24.6 A	30.4 A / 28.9 A
Max. output current	4.7 A	6.4 A	7.9 A	9.5 A	12.7 A	14.3 A	15.9 A	19.1 A	20.7 A	23.8 A	27 A	31.8 A
Power Factor	>0.99 (0.8 leading - 0.8 lagging)											
THDi	<2%											
Efficiency												
Max. efficiency	98.3%				98.5%			98.6%			98.7%	
EU efficiency	97.7%				97.9%			98.0%			98.1%	
Protection												
DC reverse-polarity protection	Yes											
Short circuit protection	Yes											
Output over current protection	Yes											
Surge protection	Yes											
Grid monitoring	Yes											
Anti-islanding protection	Yes											
Temperature protection	Yes											
Integrated AFCI (DC arc-fault circuit protection)	Yes (1)											
Integrated DC switch	Optional											
General Data												
Dimensions (W*H*D)	310*563*219 mm											
Weight	17.8 kg								18.8 kg		20 kg	
Topology	Transformerless											
Self consumption (night)	<1 W											
Operating ambient temperature range	-25 ~ +60°C											
Relative humidity	0-100%											
Ingress protection	IP66											
Cooling concept	Natural convection							Intelligent redundant fan-cooling				
Max. operation altitude	4000 m											
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC 60068, IEC 61683, EN 50530											
Safety/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4											
Features												
DC connection	MC4 connector											
AC connection	Quick connection plug											
Display	LCD											
Communication	RS485, Optional: Wi-Fi, GPRS											

(1) Activation required.

solis

GINLONG TECHNOLOGIES CO.,LTD.

S5-GC(25-40)K

Solis Three Phase Grid-Tied Inverters

Efficient

- Max. efficiency 98.7%
- String current up to 16A
- 3/4 MPPT design, supports multiple orientation system design
- Night time PID recovery function, increases overall system yield (optional)
- Wide voltage range and low startup voltage

Safe

- IP66
- AFCI protection, proactively reduces fire risk
- Globally recognised branded componentry for longer life
- Intelligent redundant fan-cooling

Smart

- Supports export power control
- Intelligent string monitoring, smart I-V curve scan
- Supports RS485, WiFi, GPRS
- Scan to register on SolisCloud, supports remote upgrade and control

Economic

- Supports GPRS/WiFi communication with less wiring and reduced installation costs
- > 150% DC/AC ratio
- Supports high power modules for lower installation costs

Models:

S5-GC25K / S5-GC30K

S5-GC33K / S5-GC36K

S5-GC40K



360° View

DATASHEET

S5-GC(25-40)K

Models	25K	30K	33K	36K	40K
Input DC					
Recommended max. PV power	37.5 kW	45 kW	49.5 kW	54 kW	60 kW
Max. input voltage	1100 V				
Rated voltage	600 V				
Start-up voltage	180 V				
MPPT voltage range	200-1000 V				
Max. input current	32 A / 32 A / 32 A			4*32 A	
Max. short circuit current	40 A / 40 A / 40 A			4*40 A	
MPPT number/Max. input strings number	3/6			4/8	
Output AC					
Rated output power	25 kW	30 kW	33 kW	36 kW	40 kW
Max. apparent output power	27.5 kVA	33 kVA	36.3 kVA	39.6 kVA	44 kVA
Max. output power	27.5 kW	33 kW	36.3 kW	39.6 kW	44 kW
Rated grid voltage	3/N/PE, 220 V / 380 V, 230 V / 400 V				
Rated grid frequency	50 Hz / 60 Hz				
Rated grid output current	38.0 A / 36.1 A	45.6 A / 43.3 A	50.1 A / 47.6 A	54.7 A / 52.0 A	60.8 A / 57.7 A
Max. output current	41.8 A	50.2 A	55.1 A	60.2 A	66.9 A
Power factor	>0.99 (0.8 leading - 0.8 lagging)				
THDi	<3%				
Efficiency					
Max. efficiency	98.5%		98.6%	98.7%	
EU efficiency	98.1%		98.2%	98.3%	
Protection					
DC reverse-polarity protection	Yes				
Short circuit protection	Yes				
Output over current protection	Yes				
Surge protection	DC Type II / AC Type II				
Grid monitoring	Yes				
Anti-islanding protection	Yes				
Temperature protection	Yes				
Strings monitoring	Yes				
I/V Curve scanning	Yes				
Integrated AFCI 2.0	Optional				
Integrated PID recovery	Optional				
Integrated DC switch	Yes				
General Data					
Dimensions (W*H*D)	647*629*252 mm				
Weight	38.2 kg			42.1 kg	
Topology	Transformerless				
Self-consumption (night)	<1 W				
Operating ambient temperature range	-25 ~ +60°C				
Relative humidity	0-100%				
Ingress protection	IP66				
Noise emission (typical)	≤60 dB(A)				
Cooling concept	Intelligent redundant fan-cooling				
Max. operation altitude	4000 m				
Grid connection standard	G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, EIFS 2018.2, IEC 62116, IEC 61727, IEC60068, IEC 61683, EN 50530				
Safety/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4				
Features					
DC connection	MC4 connector				
AC connection	OT terminal				
Display	LCD				
Communication	RS485, Optional: Wi-Fi, GPRS				

Ginlong Technologies Co., Ltd.
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Zhejiang, 315712, P.R.China.
Tel: +86 (0)574 6578 1806
Fax: +86 (0)574 6578 1606
Email:info@ginlong.com
Web:www.ginlong.com

Please adhere to the actual products in case of any discrepancies in this user manual.

If you encounter any problem on the EPM, please find out the EPM S/N and contact us, we will try to respond to your question ASAP.

Solis 5G PLUS Export Power Manager

Installation and Operation Manual

Ver 1.6

Ginlong Technologies Co., Ltd.

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1.1 Product Description

Solis Export Power Manager can monitor and control the backflow power
from the inverter to the grid thus providing export power control of inverters.
It also has integrated datalogging function as well.
The export power manager is suitable for using with all solar PV grid tie inverters.
Model: Solis-EPM3-5G-PLUS is for three phase systems.

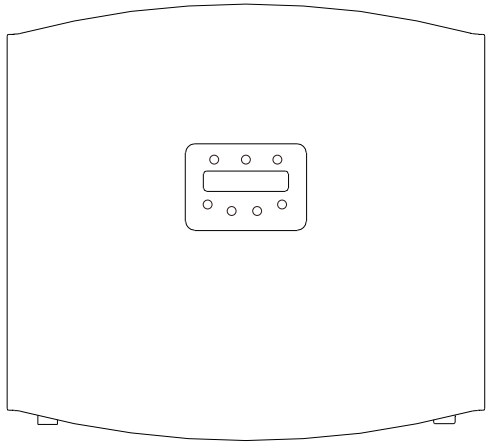


Figure 1.1 Front view

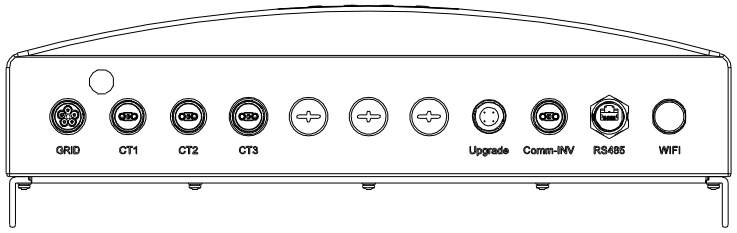
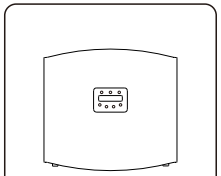


Figure 1.2 Bottom view

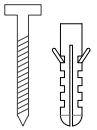
1. Introduction

1.2 Packaging

When you receive the EPM please ensure that all the parts listed below are included:


EPM x1


Back plate x1

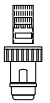

Expansion screw set x4

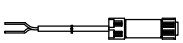

Locking screws x2

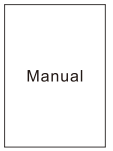

AC connector x1


CT connectors x3
COM connector x1

WiFi antenna x1


RJ45 connector x1


RS485
Communication terminal x5



User manual x1

If anything is missing, please contact your local Solis distributor.

2.1 Safety Symbols

Safety symbols used in this manual, which highlight potential safety risks and important safety information, are listed as follows:



WARNING:
WARNING symbol indicates important safety instructions, which if not correctly followed, could result in serious injury or death.



NOTE:
NOTE symbol indicates important safety instructions, which if not correctly followed, could result in some damage or the destruction of the inverter.



CAUTION:
CAUTION, RISK OF ELECTRIC SHOCK symbol indicates important safety instructions, which if not correctly followed, could result in electric shock.



CAUTION:
CAUTION, HOT SURFACE symbol indicates safety instructions, which if not correctly followed, could result in burns.

2.2 General Safety Instructions



WARNING:
Electrical installations must be done in accordance with the local and national electrical safety standards.



WARNING:
It is forbidden to insert or unplug the CT cable with power on.
If accidentally disconnected the CT cable, please turn off the main AC switch and wait for 5 mins before reconnect the cable.



CAUTION:
Risk of electric shock. Do not remove cover. There is no user serviceable parts inside. Refer servicing to qualified and accredited service technicians.



CAUTION:
Risk of electric shock from energy stored in capacitors.
Do not remove cover until 5 minutes after disconnecting all sources of supply expect service technician. Warranty may be voided if any unauthorized removal of cover.

2. Safety Instructions

2.3 Notice For Use

The Export Power Manager has been constructed according to the applicable safety and technical guidelines.

Use the Export Device in installations that meet the following specification ONLY:

1. Permanent installation is required
2. The electrical installation must all the applicable regulations and standards.
3. The Export Power Manager must be installed according to the instructions stated in this manual.
4. The Export Power Manager must be installed according to correct technical specification.
5. To install the Export Device you should notice the phase of sampling voltage and the direction of sampling current, then you can connect sampling wires and CT (current transformer).

3. Overview

3.1 Front Panel Display

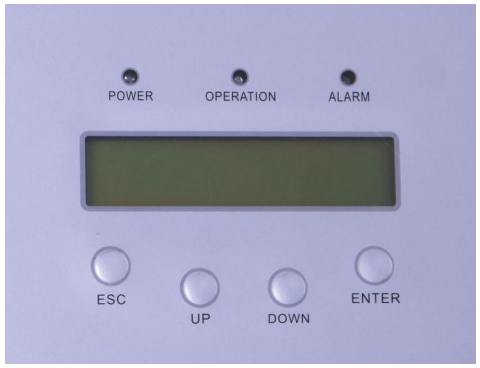


Figure 3.1 Front Panel Display

3.2 LED Status Indicator Lights

	Light	Status	Description
①	POWER	ON	Export Device power on
		OFF	Export Device power off
②	OPERATION	ON	Communication with inverter
		OFF	No communication with inverter
③	ALARM	ON	Inverter, EPM or Communication Fault
		OFF	No alarm

Table 3.1 Status Indicator Lights

3.3 Keypad

There are four keys in the front panel of the Inverter(from left to right): ESC, UP, DOWN and ENTER keys. The keypad is used for:

- Scrolling through the displayed options (the UP and DOWN keys);
- Access to modify the adjustable settings (the ESC and ENTER keys).

3.4 LCD

The two-line Liquid Crystal Display (LCD) is located on the front panel of the EPM, which shows the following information:

- Export Power Manager operation status and data;
- Service messages for operator;

4. Installation

4.1 Select a Location for the EPM

To select a location for the EPM, the following criteria should be considered:

- The temperature of the EPM could up to 75℃.
- The EPM is designed to work in extreme temperature range is from -25℃ to 60℃.
- The EPM should be kept minimum 300mm clearance from the other device.
- The EPM cannot be placed in direct sunlight.

4.2 Mounting the EPM

Please attach mounting plate on to wall horizontally where to install the product. Then mark A , B , C and D to fix mounting plate.(see Figure 4.1)

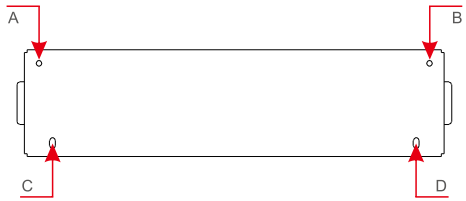


Figure 4.1 Bracket

Drill four φ8 holes and insert expandable shell into the holes which make the bracket alignment. After that fix the bracket on the wall.(see Figure 4.2)

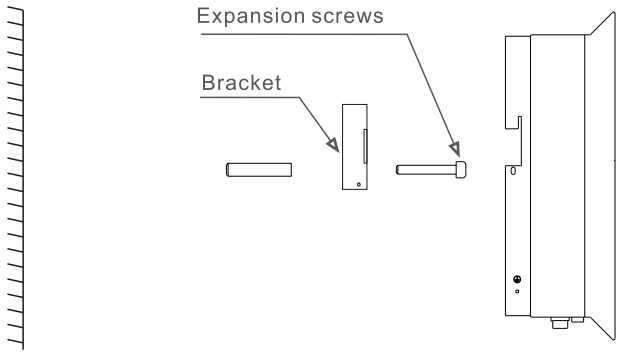


Figure 4.2 Fix the bracket on the wall

Hang the EPM in the bracket by the steps below .(see Figure 4.3)

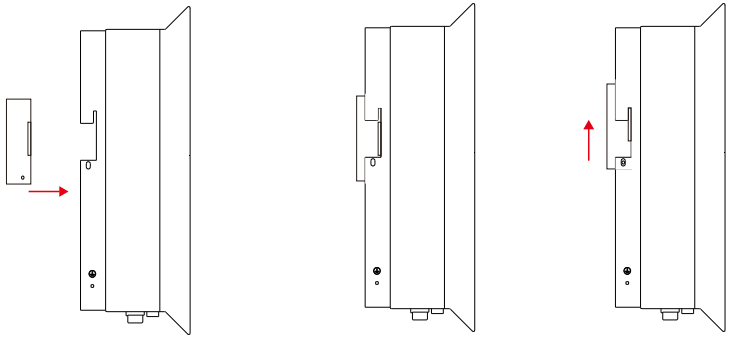


Figure 4.3 Hang the EPM in the bracket

Fix the two screw at the side of bracket.(see Figure 4.4)

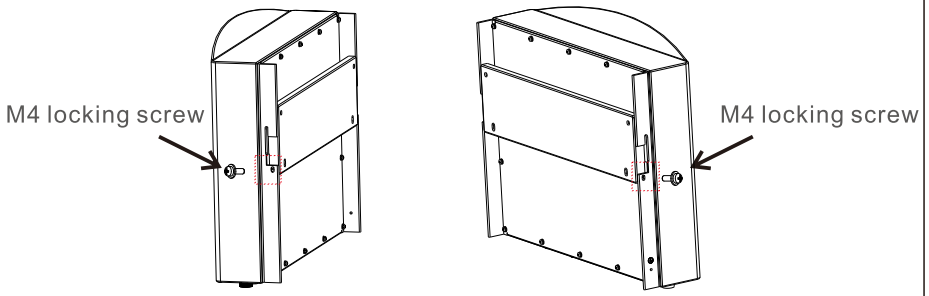


Figure 4.4 Fix the two screw

4.3 Electrical Connections

The Export Power Manager is designed for electrical connection without removing the cover.

The meaning of the symbols located at bottom of the EPM is listed in Table 4.1.

Grid_U.V.W.N	AC voltage sampling terminal
CT1	AC current sampling terminal(U)
CT2	AC current sampling terminal(V)
CT3	AC current sampling terminal(W)
Comm_INV	Connect to solis inverters
RS485	COM for upgrade
LAN	Connect to monitoring platform through wire
WIFI	WiFi antenna to monitoring platform (Wireless)

Table 4.1 The meaning of the symbols located at bottom of the EPM

System connection diagram is as follows:

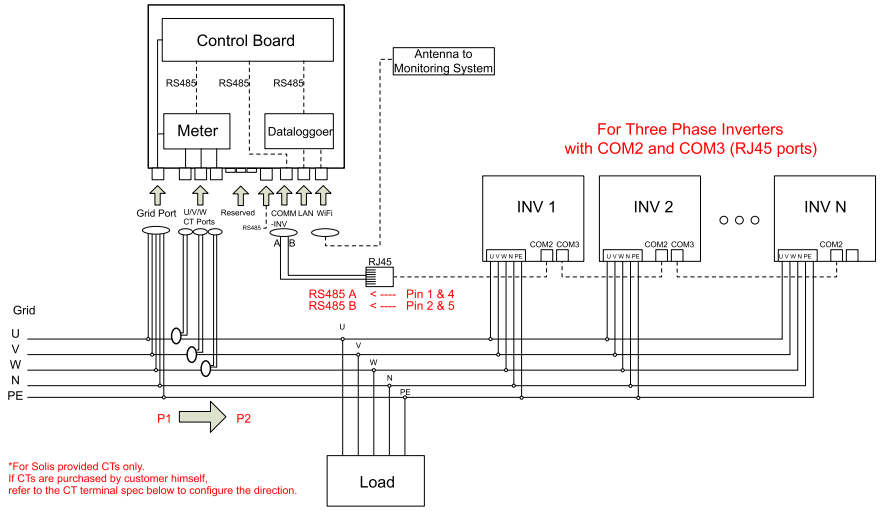


Figure 4.5 For Three Phase Inverters with COM2 and COM3 ports

4. Installation

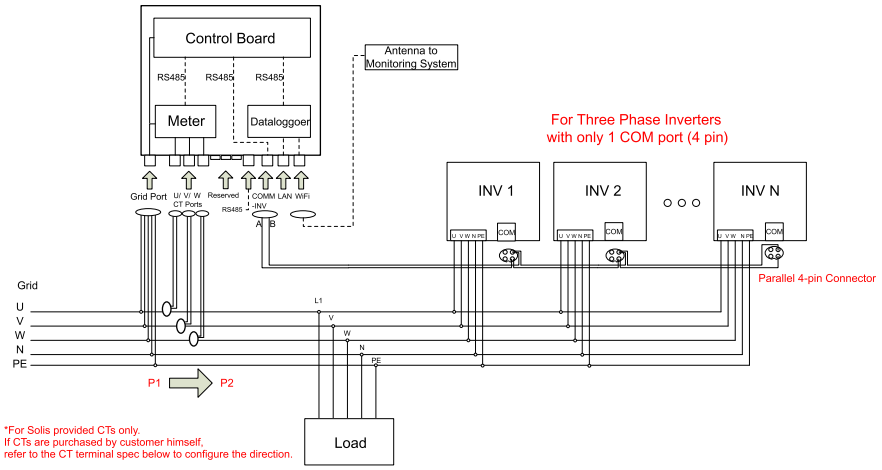


Figure 4.6 For Three Phase Inverters with only 1 COM port

1 Make the Grid input cable

a. Measure the distance from EPM to power distribution box. And find proper cable for grid input. 5 core cable for Solis-EPM3-5G-PLUS.

b. For three phase inverter installation connect U, V, W to pin1, 2,3 and connect N to pin4, connect PE to ⏚ (see figure4.7).

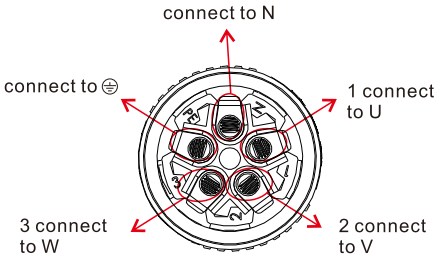


Figure 4.7 Three phase connection

c. Strip the end of cable to 3mm (see Figure 4.8)

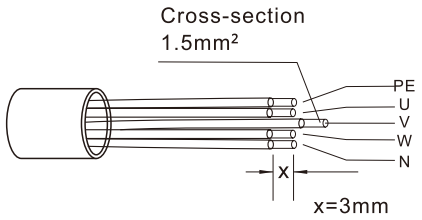


Figure 4.8 Strip the cable

d. Through the cable to the washer and use a suitable screw driver to fix the wire to the connector (see Figure 4.9).

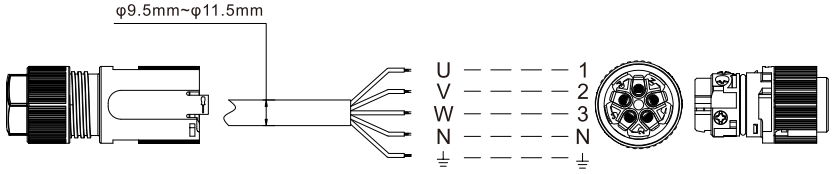


Figure 4.9 Welding wire to connector

e. Assemble the connector (see Figure 4.10)

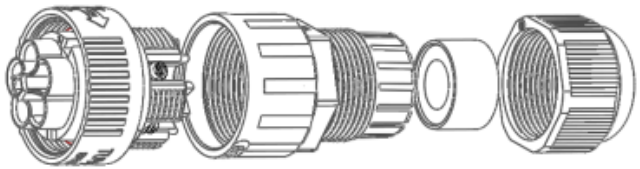


Figure 4.10 Assemble connector

4. Installation

2. Make RS485 cable (COMM-INV port)

a. Refer to figure 4.11, the RS485 terminals for inverter and EPM are already assembled.

Tips:RS485 cable: preferred 0.5mm.

.

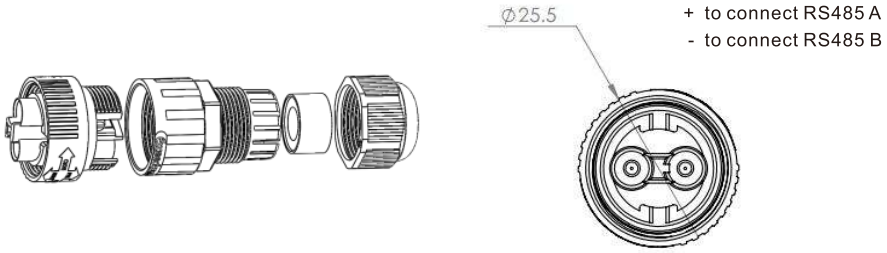


Figure 4.11 RS485 terminal

b. Refer to figure 4.11, connect communication cable between inverter with EPM, and then measure the distance from EPM to inverter. Use proper cable for RS485 connection. (0.5mm²)

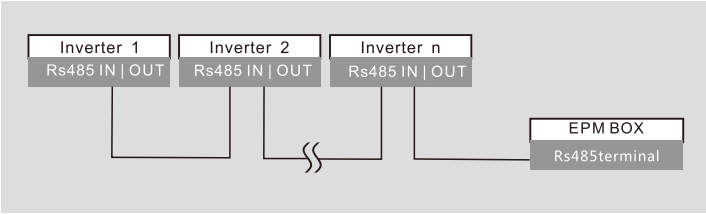


Figure 4.12 RS485 cable connection

c. Follow step1 to assemble 2 connectors to each end of cable.

3. Connect and fix the CT

To detect the backflow power, the CTs need to be installed at the PCC (Point of Common Coupling), instead of the load branch circuit.

Note:

For three phase system, CT1,CT2 and CT3 must be installed on U,V and W with correct sequence, otherwise EPM can not detect the correct data.

“The CT cable outer diameter is 6.5mm-7.5mm, cross-sectional area 1.5mm2”.

a. Switch off the main switch, disconnect the line cables.

b. Insert the cables through the CT, make sure the P1 on CT is towards grid and P2 is towards the inverter.

c. Reconnect the line cables.

Note:

If the CT is installed in the wrong direction, the EPM can't work normally.

Note:

The standard package of EPM DOESN’T include the CT current sensor.

Please select CT with secondary current of 5A.

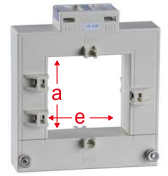
Specification	Dimensions(mm) W x H x D	Hole size(mm) a x e	CT Ratio	AKH-0.66K
CT-30×20-100A	90 x 114 x 40	22 x 32	100:5A	
CT-60×40-300A	114 x 140 x 36	42 x 62	300:5A	
CT-80×40-600A	122 x 162 x 40	42 x 82	600:5A	
CT-80×40-1000A	122 x 162 x 40	42 x 82	1000:5A	
CT-160×80-2000A	184 x 254 x 52	82 x 162	2000:5A	
CT-160×80-3000A	184 x 254 x 52	82 x 162	3000:5A	

Table 4.2 CT Ratio

Note:

Solis recommends customers to purchase suitable current transformers from local suppliers according to the max possible current in different projects.

As long as the secondary current is 5A,it will not affect the warranty of the EPM devices and inverters.

Solis can also provide above current transformers as an optional accessory. Customers can contact Solis sales rep to place the order based on their project requirements.

4. Installation

4. Muti inverter connection

Please follow figure 4.6 system diagram to connect muti-inverters. EPM can control maximum 80 inverters. One grid connection point ONLY.

The inverter address must be set to different value. Please set address from 01 to 80. Before start up inverter please follow 6.5.1 to set inverter number in EPM.

5. Monitoring

Two methods of monitoring are available with the EPM device connected.

1. Through WiFi antenna on the EPM device.

This is similar with the Solis WiFi datalogger. The WiFi antenna can broadcast data to the local router and then to the Solis monitoring platform. No wiring is needed.

2. Through RJ45 cable

This port is used for connection directly to the router.

Note:

When connect the inverters to the EPM, do not use the other ports on inverters to realize the monitoring function.

5. Commission and decommission

5.1 Commissioning

1. Make sure the main switch is off and the system is powered off.
2. Connect all the necessary cables on EPM, such as the CT ports, COMM-INV port, Grid port and (if needed) the LAN port.
3. Connect the other end of the cables to inverter, PCC or monitoring device(if needed), respectively.
4. Turn on the main switch, go to the EPM LCD.
5. Set the inverter number, backflow power, CT parameter as described in section 6.5
6. Check if the backflow power of the system is limited to the set value.

5.2 Decommissioning

In order to aovid the backflow power to grid, please stop the inverter before stop the EPM.

1. Turn off the inverter output AC breaker or select "grid off" on each inverters' LCD.
2. Turn off inverter input DC breaker or pull out PV cable to stop inverter.
3. Turn off the grid input breaker of EPM.
4. Disconnect all cable of EPM, disassemble EPM after 5mins.

6. Operation

During normal operation, the display alternately shows the power of grid side and the operation Status .Screens can also be scrolled manually by pressing the UP and DOWN keys. Press the ENTER key to access to the Main Menu.

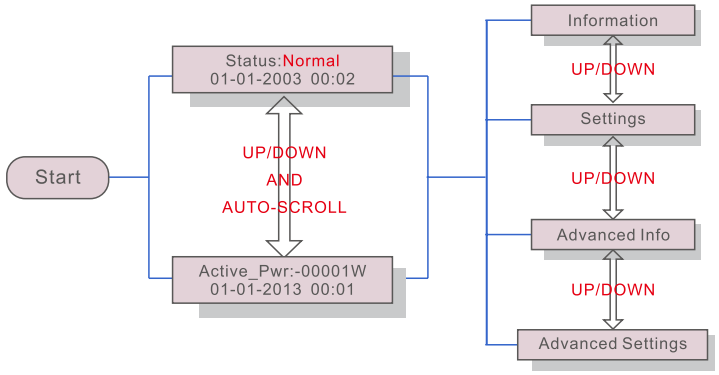


Figure 6.1 Operation Overview

There are 6 status:

Normal: The system works normally

RS485 AllFail: EPM has lost communication with ALL inverters

M-ComFailsafe: EPM has lost communication with the Meter inside

CT-Failsafe: Current Sensor failed

M-VFailsafe: One phase voltage of the meter is ZERO

RS485Fail: EPM has lost communication with one or some of the inverters

6.1 Main Menu

There are four submenus in the Main Menu (see Figure 6.1):

1. Information
2. Settings
3. Advanced Info.
4. Advanced Settings

6.2 Information

Solis Export Power Manager main menu provides access to operational data and information. The information is displayed by selecting "Information" from the menu and then by scrolling up or down.

Display	Description
VacA_Grid: 000.0V IacA_Grid: 000.0A	Vac_Grid: Grid voltage and current.
VacB_Grid: 000.0V IacB_Grid: 000.0A	
VacC_Grid: 000.0V IacC_Grid: 000.0A	
Load_Pwr: 0000.0KW Total_PINV: 0000.0KW	Load_Pwr: Load Power. Total_PINV: Total output power of inverters.
Export Limited: 000% Freqency: 00.00Hz	Export Limited: Inverter output power percentage. Freqency: Grid frequency.
Active_APwr: +00000W Active_BPwr: +00000W	Active_Pwr: Power of the power grid.
Active_CPwr: +00000W Active_TPwr: +00000W	Active_Pwr: Power of the power grid. Active_TPwr: :Power flows through CTs.
Inverter SN: XXXXXXXXXXXXXX	Series number of the inverter.

Table 6.1 Information list

6.2.1 Lock screen

Pressing the ESC key returns to the Main Menu. Pressing the ENTER key locks (Figure 6.2(a)) or unlocks (Figure 6.2 (b)) the screen.



(a) (b)

Figure 6.2 Locks and Unlocks the Screen of LCD

6.3 Settings

The following submenus are displayed when the Settings menu is selected:

1.Set Time

2.Set Address

6.3.1 Set Time

This function allows time and date setting. When this function is selected, the LCD will display a screen as shown in Figure 6.3.



Figure 6.3 Set Time

Press the UP/DOWN keys to set time and data. Press the ENTER key to move from one digit to the next (from left to right). Press the ESC key to save the settings and return to the previous menu.

6.3.2 Set Address

This function is used to set the address when muti inverters are connected to three monitor.
The address number can be assigned from “01”to “99”(see Figure 6.4).
The default address number is “01”.



Figure 6.4 Set Address

Press the UP/DOWN keys to set the address. Press the ENTER key to save the settings.
Press the ESC key to cancel the change and return to the previous menu.

6. Operation

6.4 Advanced Info - Technicians Only

NOTE:
To access to this area is for fully qualified and accredited technicians only.
Enter menu “Advanced Info.” and “Advanced settings” (need password).

Select “Advanced Info.” from the Main Menu.
The screen will require the password as below:



Figure 6.5 Enter password

After enter the correct password the Main Menu will display a screen and be able to access to the following information.

1. Inverter Power 2. CT Connect Status 3. Version

4. Model Inverter 5. Communication Data 6. Energy Info

The screen can be scrolled manually by pressing the UP/DOWN keys.
Pressing the ENTER key gives access to a submenu.
Press the ESC key to return to the Main Menu.

6.4.1 Inverter Power

The screen shows the information of Inverter Power for each inverter which connected to the EPM.

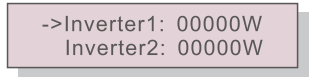


Figure 6.6 Inverter Power

6.4.2 CT Connect Status

The position of three-phase CT installation and direction of current detection refer to 4.3, P1 on CT is towards grid and P2 is towards the inverter, then EPM detection will display OK, as shown in figure 6.7. Otherwise, the status will display "NG" which indicates wrong CT direction.



Figure 6.7 CT Connect Status

6.4.3 Version

The screen shows the model version and the software version of the Inverter.



Figure 6.8 Version

6.4.4 Model Inverter

The screen shows the Rated power of inverters that are connected to the EPM.



Figure 6.9 Model Inverter

6.4.5 Communication Data

The screen shows the internal communication data of the Inverter,
for service technicians only.



Figure 6.10 Communication Data

6.4.6 Energy Info

This shows the energy records on the EPM.
1.Load Total E. 2.INV Send Total E. 3.Send Grid Total E. 4.Get Grid Total E.



Figure 6.11 Energy Info

6. Operation

6.5 Advanced Settings - Technicians Only

NOTE:
To access to this area is for fully qualified and accredited technicians only.
Please follow 6.4 to enter password to access this menu.

Select Advanced Settings from the Main Menu to access the following options:

1. Inverter Qty. Set 2. Backflow Power 3. Set CT Ratio 4. FailSafe ON/OFF

5. Backflow Work Mode 6. PELD ON/OFF 7. Transmit ON/OFF 8. System Updade

9. Reset Password 10. Restore settings 11.Set Capacity

6.5.1 Inverter Qty. Set

This submenu is used for setting inverter number.



Figure 6.12 Inverter Qty. Set

Enter the screen ,it shows all the number of inverters which conected to the EPM.
The number(01~99) can be select by pressing the UP/ DOWN keys.
Press the ENTER key to set the inverter number ESC key to return to the previous menu.

6.5.2 Backflow Power

This submenu is used for setting allowed power that inverter can generate to grid.

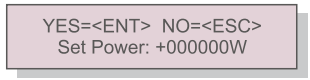


Figure 6.13 Set Backflow Power

Press the UP/DOWN keys to set data.Press the ENTER key to set backflow power
Then press UP/DOWN keys to change the number(the times of 100).
Press the ESC key to save the settings and return to the previous menu.

6.5.3 Set CT Ratio

This is used to set the CT ratio for the current transformer.
Setting range is from 20:1 to 9900:1 with 10:1 interval.
For example, if 1000:5A current transformer is used, please set the ratio as 200:1

YES=<ENT> NO=<ESC>
Set Para:0030:1

Figure 6.14 Set Meter CT

Press the UP/DOWN keys to set data. Press the ENTER key to set CT Para.
Press the ESC key to save the settings and return to the previous menu.

6.5.4 FailSafe ON/OFF

The submenu is used for setting fail Safe ON/OFF.
Fail Safe indicates the communication status between EPM and inverters.
The default setting is "Run". DON'T change it without technicians.

YES=<ENT> NO=<ESC>
FailSafe: RUN

Figure 6.15 FailSafe ON/OFF

When the Fail Safe is set as "Run". If some of inverters lost communication with EPM , EPM's LCD screen will display " RS485 fail"; if all inverters lost communication with EPM, then the LCD screen of EPM will display "fail safe". And The inverter stops output power.

When the Fail Safe is set as "Stop", communication lost between EPM and inverters will not affect the output of inverters.

6.5.5 Backflow Work Mode

This submenu is used for set backflow work mode: 01, 02. "01" is the default mode.

YES=<ENT> NO=<ESC>
Mode:01

Figure 6.16 Backflow Work Mode

Mode "01", As shown in the figure 6.17, the average limiting mode, the output power of each phase is the average of the three-phase load power, and it is more than the phase of the lowest power in three phases.

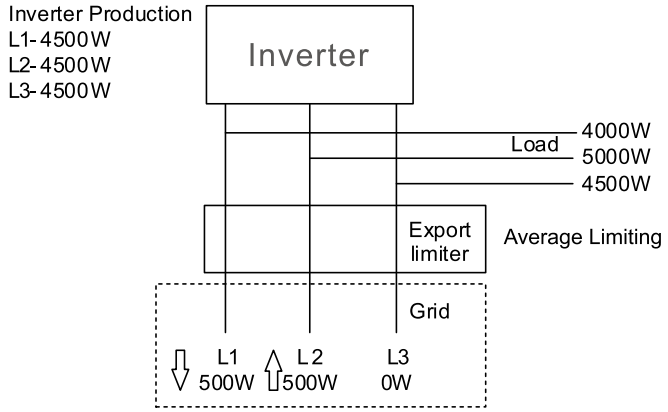


Figure 6.17

Mode "02", As shown in the figure 6.18 the per phase limiting mode, the inverter only generate the power that equals to one of three-phase load power that is the lowest load power of a certain phase.

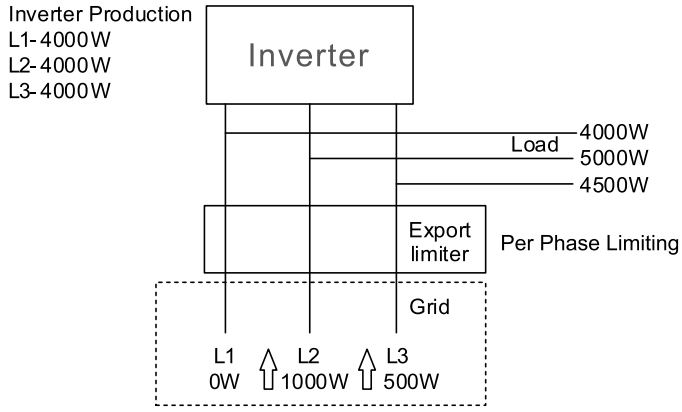


Figure 6.18

6.5.6 PELD ON/OFF

This submenu is used for set PELD on/off. PELD decides EPM works or not.



Figure 6.19 PELD Switch

Set PELD is on, EPM can monitor and manage the working condition of inverters in real time, and it prevents backflow generated. Set PELD is off, which means EPM shutdowns the function of controlling backflow power.

6.5.7 Transmit ON/OFF

This is a setting for Solis technician use only.

Please keep the switch as OFF for normal use.



Figure 6.20 Transmit ON/OFF

6.5.8 System Update

The upgrade of EPM's system can realize by external wire.

Please consult our technical engineer for more details.



Figure 6.21 System Update

6.5.9 Reset Password



Figure 6.22 Reset Password

Firstly, input the origin password and press Enter button;

Second, input the new password, press Enter button to save it. UP/DOWN button can be used to move the cursor.

Third, Press ESC button to get to the previous page.

6.5.10 Restore Settings

When Restore Settings is selected, the LCD will display as shown in Figure 6.21.

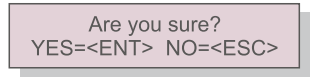


Figure 6.23 Restore Settings

Press the ENTER key to execute the setting.

Press the ESC key to return to the previous menu.

6.5.11 Set Capacity

This item is used to set the sum of the capacities of the connected inverters.



Figure 6.24

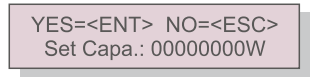


Figure 6.25

6.6 Inverter Set

EPM has two versions: EPM-2G, EPM-5G. While inverter is working with EPM, please be reminded to change the inverters settings as below:

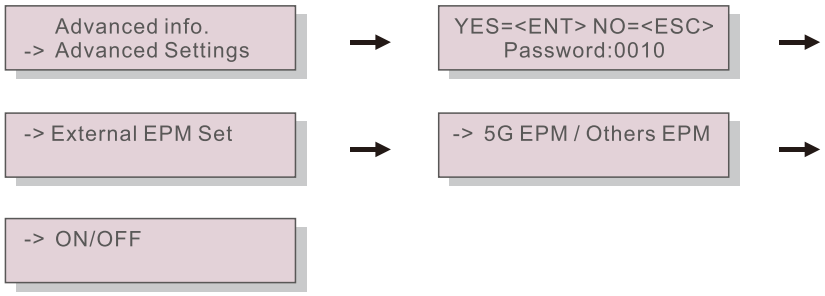


Figure 6.24

NOTE:

If you are using EPM-5G, please choose “5G EPM”, and set it “ON”, if you are using EPM-2G. Please choose “Others EPM”, and set it “ON”, only one setting needs to be set.

NOTE:

If “5G EPM” is chosen, for inverters produced before Nov 30th 2019 (SN: XXXXXX19B30XXXX)need to update the firmware, please contact with Solis local service center or service@ginlong.com for instructions on firmware update.

The EPM is designed in accordance with the most important international safety and EMC requirements. Before delivering to the customer, the EPM has been subjected to several tests to ensure its optimal operation and reliability.

In case of failure, the LCD screen will display alarm message.
The EPM can show Alarm it self or alarm from inverter. There are 3 alarm can be showed on LCD:

1. Backflow

There are backflow current to grid, customer need to stop inverter. and check the connections for the RS485 cable between EPM and inverter.

2. INV. fault

There are fault alarm in inverter, need to check inverter status.

3. Fail safe

RS485 AllFail: EPM has lost communication with ALL inverters
M-ComFailsafe: EPM has lost communication with the Meter inside
CT-Failsafe: Current Sensor failed
M-VFailsafe: One phase voltage of the meter is ZERO
RS485Fail: EPM has lost communication with one or some of the inverters

8. Specifications

Model	Solis-EPM3-5G-PLUS
AC Input	
Rated voltage	400V,3/N/PE
Input voltage range	320V~480V (L to L)
Input frequency range	45~65Hz
Communication	
Inverter communication	Modbus RS485
Communication interface	2pin RS485, RJ45
Maximum communication inverter numbers	80①
Maximum communication distance	1000m
Monitoring	DLB-W (Bulit-in)
General data	
Ambient temperature	-25℃~+60℃
Relative Humidity	5%~95%
Ingress protection	IP65
Self power consumption	＜15W
Dimensions(W*H*D)	488mm*446mm*149mm
Weight	5.4kg
AC connection	Quick connection terminal
Display	LCD，2*20Z
CT conection	Plug terminal
CT specification	Optional（5A）②
Features	
Failsafe fuction	Yes
Remote upgrated	Yes③
Control time	5s
Power Accuracy	3%
Warranty	5 years

①: The AC capacity of EPM system should not exceed 2MW

②: Due to different on-site installation conditions, Solis currently has optional specifications as shown in the above table. It is suggested that the client can choose the appropriate CT specifications according to the actual installation requirements.

③: EPM dedicated version，Non-EPM-dedicated does not support remote upgrade.

9. Appendix

Connection via Ethernet

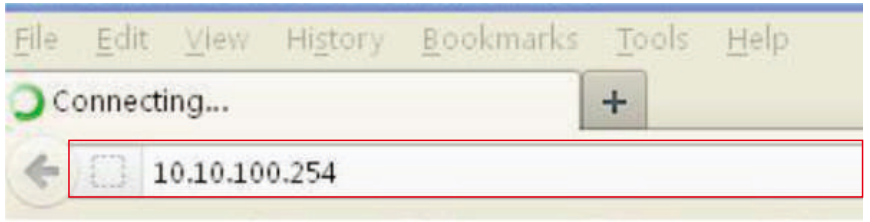
1. Connect router and data logger via Ethernet port with network cable.
2. Reset the data logger.

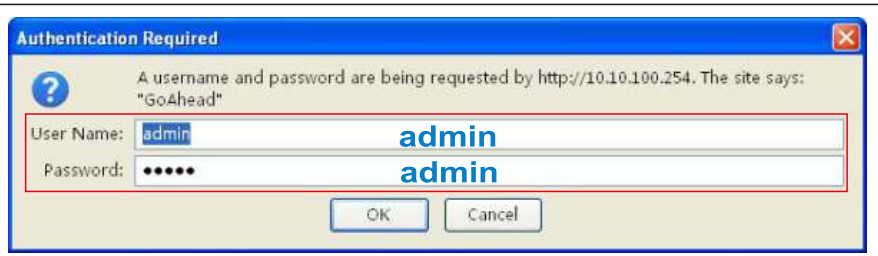
Reset : Press the reset button with a needle or open paper clip and hold for a while when the 4 LEDs should be on. Reset is successful when 3 LEDs, except POWER, turn off.

3. Enter the configuration interface of your router, and check the IP address of the data logger assigned by the router. Open a web browser and enter the assigned IP address to get access to the configuration interface of the data logger.

Fill in username and password, both of which are admin as default.

NOTE:
Supported browsers: Internet Explorer 8+, Google Chrome 15+, Firefox 10+.





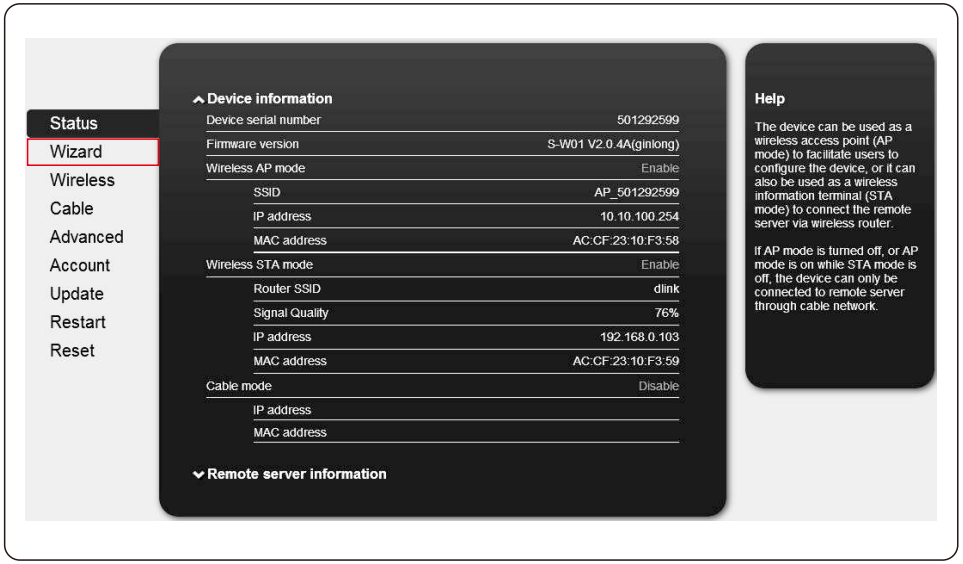
9. Appendix

4. Set parameters of data logger.

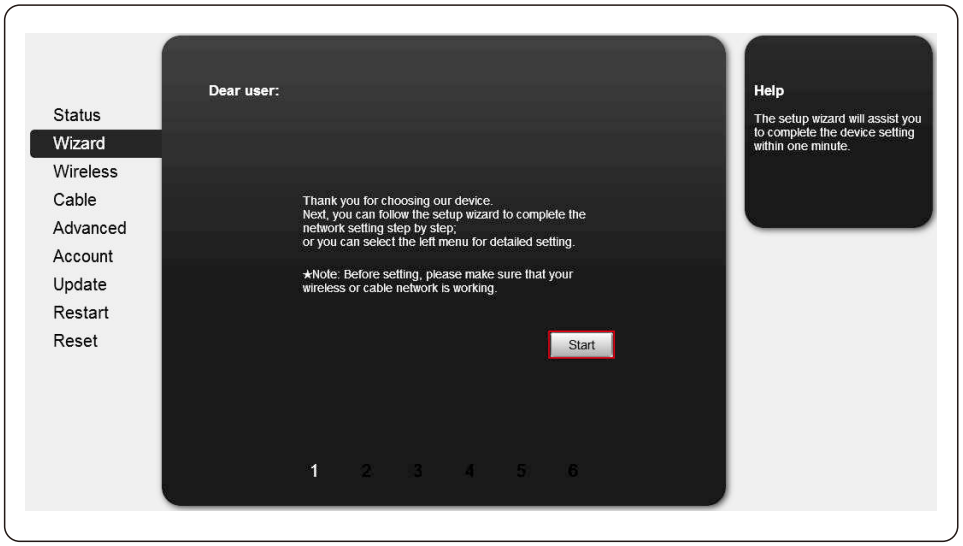
In the configuration interface of data logger, you can view general information of the device.

Follow the setup wizard to start quick setting.

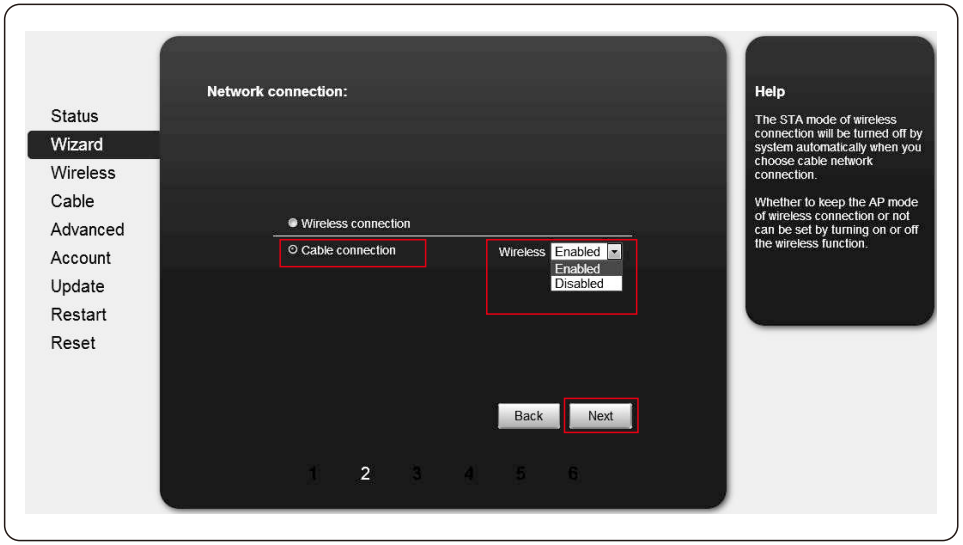
Step1: Click “Wizard” to start.



Step2: Click “Start” to continue.



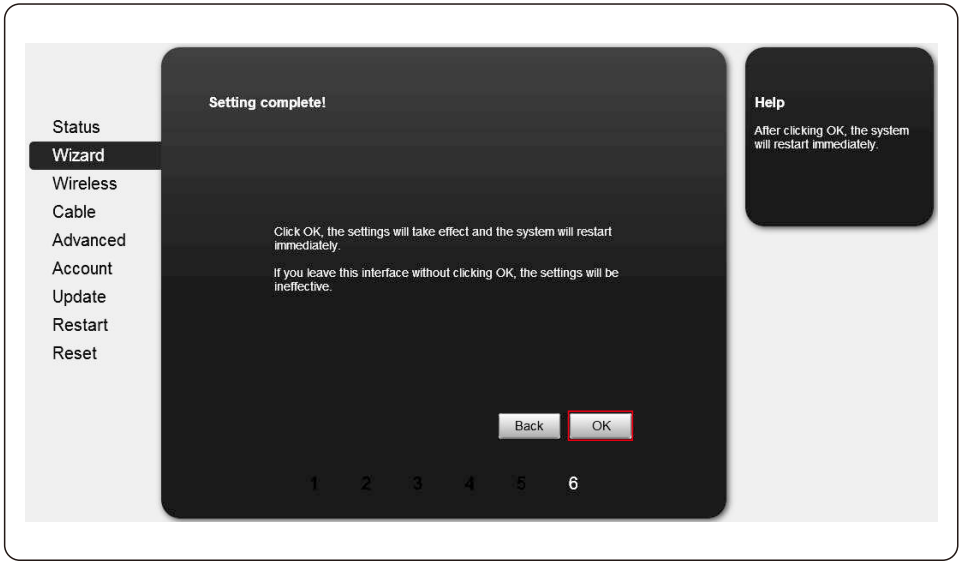
Step3: Select “Cable Connection”, and you can choose to enable or disable the wireless function, then Click “Next”.



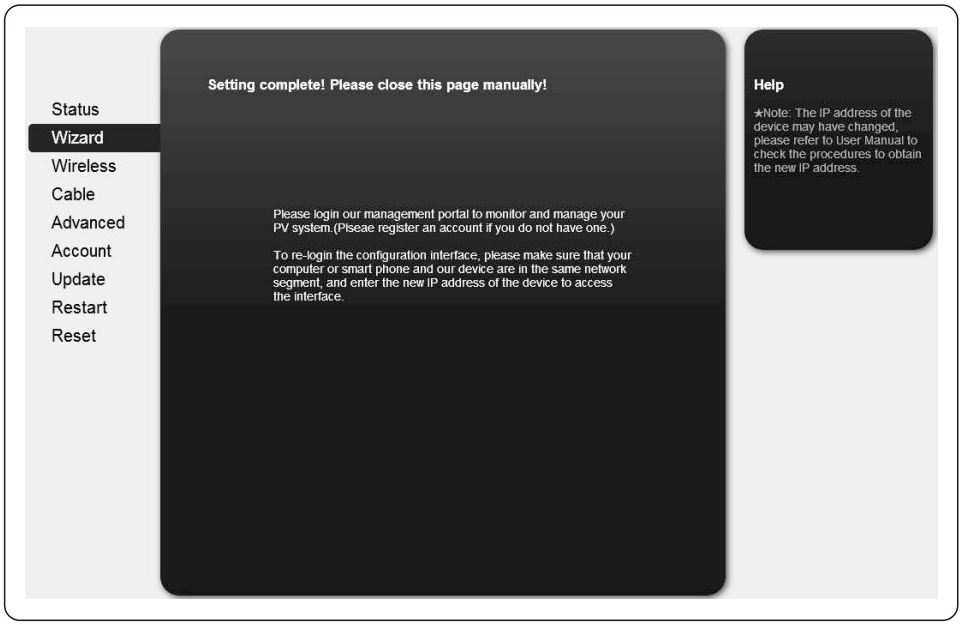
Step4: Select “Enable” to obtain an IP address automatically, then click “Next”.



Step5: If setting is successful, the following page will display. Click “OK" to restart.



Step6: If restart is successful, the following page will display.



NOTE:

After setting is completed, if STATUS is permanently on after about 30 seconds, and the 4 LEDs are all on after 2-5minutes, the connection is successful.
If STATUS is flashing, which means unsuccessful connection, please repeat the setting from step 3.

AIKO

N-Type ABC

Dual-glass Bifacial Module

AIKO-A-MAH72Dw G

Up to 23.7%
605W-625W



15 year
Product Warranty

30 year
Performance Warranty

reddot winner 2023

Premium Appearance

No grid lines on the front

Higher Power Output

Higher efficiency: 23.7%
Lower degradation: 1 Year⩽1.0%, 2 -30 Year⩽0.35%
Better Temperature Coefficient: -0.29%/ ℃

Optimized Balance of System (BOS)

Significant savings on mounting structure, cabling, and labour cost

CE TÜVRheinland

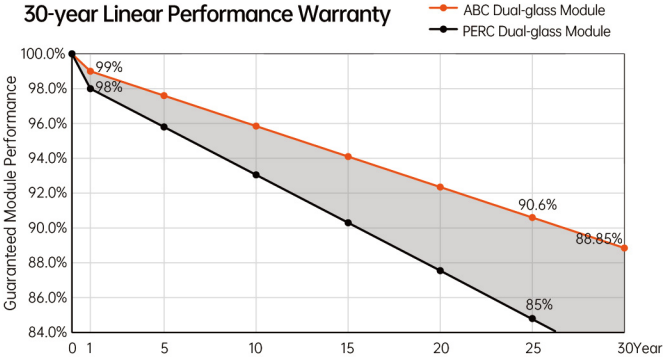
Complete Set of Quality Management System

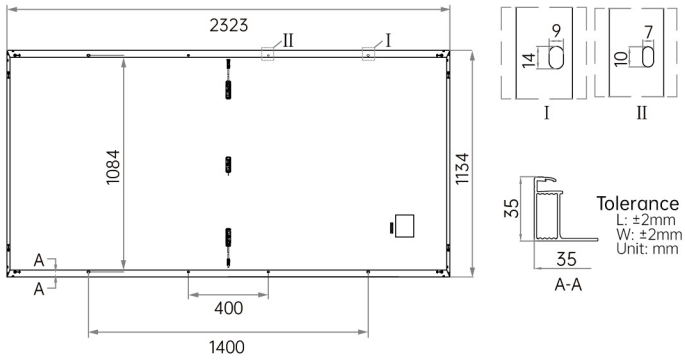
IEC 61730 (2016) IEC 61215 (2021)
ISO 9001:2015 Quality Management System
ISO 14001:2015 Environmental Management System
ISO 45001:2018 Occupational Safety and Management System

N-Type ABC Dual-glass Bifacial Module

AIKO-A-MAH72Dw G

625W	23.7%	⩽1%	⩽0.35%
Output	Efficiency	First-year Degradation	Annual Degradation from Year 2-30





Electrical Characteristics (STC: AM1.5 1000W/m² 25℃ NOCT: AM1.5 800W/m² 20℃ 1m/s) Power Tolerance:0~ + 3% Max Power Test Uncertainty:±3%

Model	AIKO-A605-MAH72Dw G		AIKO-A610-MAH72Dw G		AIKO-A615-MAH72Dw G		AIKO-A620-MAH72Dw G		AIKO-625-MAH72Dw G	
Test Conditions	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
P_{max} [W]	605	456	610	459	615	463	620	467	625	471
V_{oc} [V]	53.25	50.29	53.35	50.38	53.45	50.48	53.55	50.57	53.65	50.67
V_{mp} [V]	44.78	42.29	44.88	42.38	44.98	42.48	45.08	42.57	45.18	42.67
I_{sc} [A]	14.05	11.36	14.11	11.41	14.17	11.46	14.23	11.51	14.29	11.55
I_{mp} [A]	13.52	10.79	13.60	10.85	13.68	10.91	13.76	10.98	13.84	11.04
Module Efficiency	**23.0%**		**23.2%**		**23.3%**		**23.5%**		**23.7%**	

Mechanical Specification

Bifacial Factor	⩾55%
Cell Type	Mono-crystalline Silicon
Glass	Dual glass,2.0+2.0mm Heat Strengthened Glass
Frame	Anodized aluminum
Cable	4mm²(IEC) 12AWG(UL) 350mm or Customized Length
No. of Cells	144(6*24)
Junction Box	IP68, three bypass diodes
Connector	MC4 compatible
Weight	33kg±3%
Dimension	2323*1134*35mm
Package Detail	31pcs per pallet/155 pcs per 20' GP/620pcs per 40' HQ

Temeprature Ratings (STC)

Temperature Coefficient of I_{sc}	+ 0.05%/℃
Temperature Coefficient of V_{oc}	- 0.24%/℃
Temperature Coefficient of P_{max}	- 0.29%/℃

Installation Guide

Operation Temperature	- 40℃-+85℃
Maximum Series Fuse Rating	25A
Protection Class	Class II
V_{oc} and I_{sc} Tolerance	±3%
Maximum System Voltage	DC1500V
Maximum Static Loading	Front 5400Pa Back 2400Pa
Hail Test	25 mm diameter hail at 23 m/s
Fire Rating	IEC Class C

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Futian District, Shenzhen
marketing@aikosolar.com

www.aikosolar.com
*Aiko Energy reserves right to update the specification without notice
AEWHD_EN_202305_V3.0

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Technical project overview

Echo Street, Manchester, M1 7DP

Building project	Echo Street, Manchester, M1 7DP
Date	25.09.2024
In-house project no.	PA_240821_617209
Editor	Renusol Europe GmbH
Link to configurator	Open link
Number of modules	120
Rated output	73.2 kWp

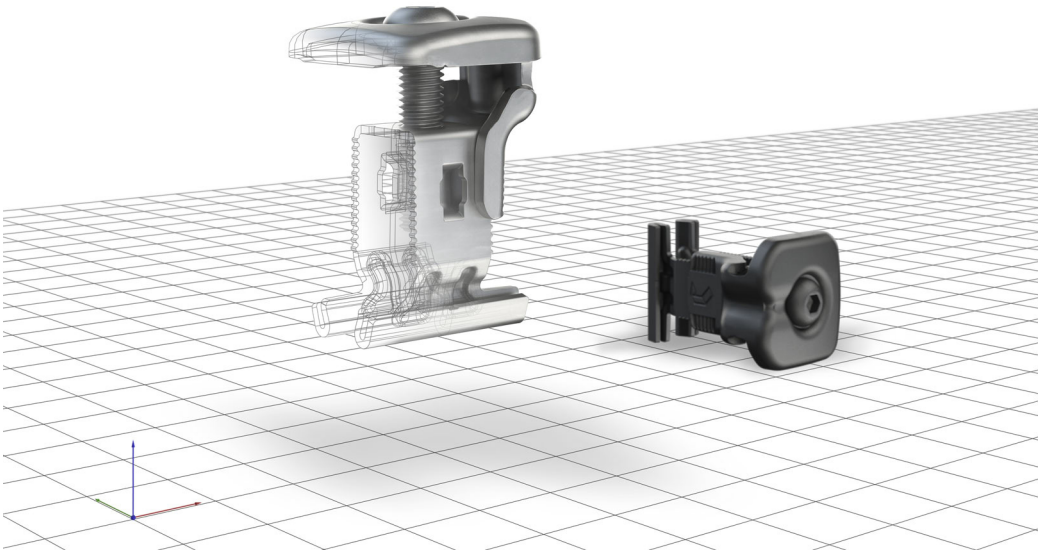


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Important notes	142

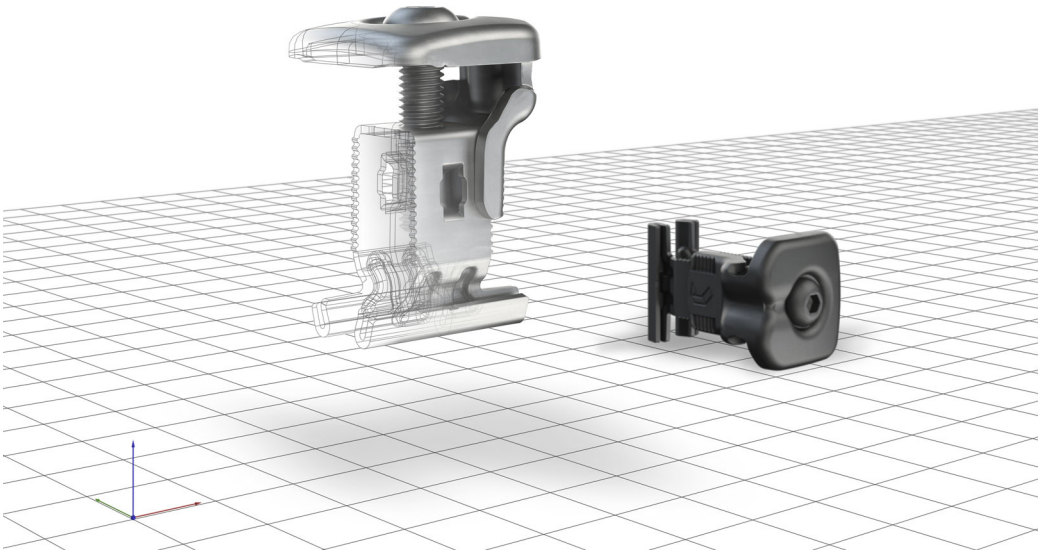
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51063 Köln
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Technical project overview

Echo Street, Manchester, M1 7DP

Building project	Echo Street, Manchester, M1 7DP
Address	Echo Street 17, M1 3AL
Country	United Kingdom
Module Type	Canadian Solar Inc. - CS6.1-72TB-610
Number of modules	22
Rated output	13.42 kWp
Mounting system	FixedFS10EW
Editor	Renusol Europe GmbH



LOCATION

Street	Echo Street 17
City	M1 3AL
Country	United Kingdom

SURROUNDINGS

Code	Eurocode NA GB
Terrain height above sealevel	47,00 m
Snow load zone	Zone 3
Use Pressure coefficients from BRE 489 2014 roof pitch 0 -45°	yes
Terrain category	City
Distance to coast	40,00 km
Distance to edge of city	3,00 km
Surroundings	normal
Service life of PV system	25 years
Failure consequence class	2

LOAD CALCULATION RESULT

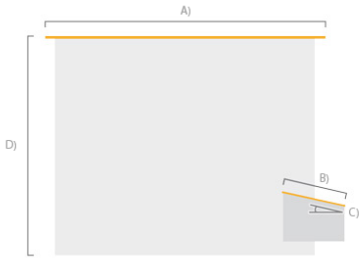
Peak velocity pressure	1,07 kN/m^2
Snow load	0,46 kN/m^2
Snow load on roof	0,37 kN/m^2
Base wind speed ($V_{b,0}$)	22,50 m/s

TOPOGRAPHY

Topography	Not exposed

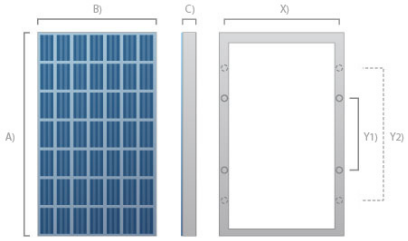
ROOF PROPERTIES

Roof type	Flat roof
Coverage type	Foil
C) Roof pitch	2,00 º
D) Building height	52,00 m
Parapet height	0,00 mm
Parapet width	0,00 mm



MODULE PARAMETERS

Manufacturer	Canadian Solar Inc.
Name	CS6.1-72TB-610
Length	2382 mm
Width	1134 mm
Height	30 mm
Weight	33.6 kg
Rated output	610 W_{peak}



Please check the compatibility of clamping positions with module manufacturer advice.

FASTENER PARAMETERS

Name	Rooftrak IFP-HM/MW
Manufacturer	Nicholson
Pressure load capacity	5,00 kN
Tensile load capacity	3,50 kN
Lateral force	2,50 kN
Interaction	Linear

The third party product(s) listed above, is (are) not (a) product of Renusol but, from third party Manufacturer(s) (Manufacturer). The PV-Configurator uses static properties of this fastener provided by this Manufacturer. The Manufacturer is responsible for the accurateness and correctness of the static values provided by him, Renusol does not assume any liability regarding the product of the Manufacturer and its static properties.

SYSTEM

System type	Fixed
System	FixedFS10EW



Please check the entered row distance for an ideal yield calculation with a correct calculation including consideration of the shading.

FASTENER DETAILS

Mounting rotation	Eave (0º)
Fastener type	Custom fastener
X) Row distance	2462mm

CLAMPS

Clamp type	RS1
Clamp colour	silver
Max value middle clamps	43 %
Max value end clamps	22 %

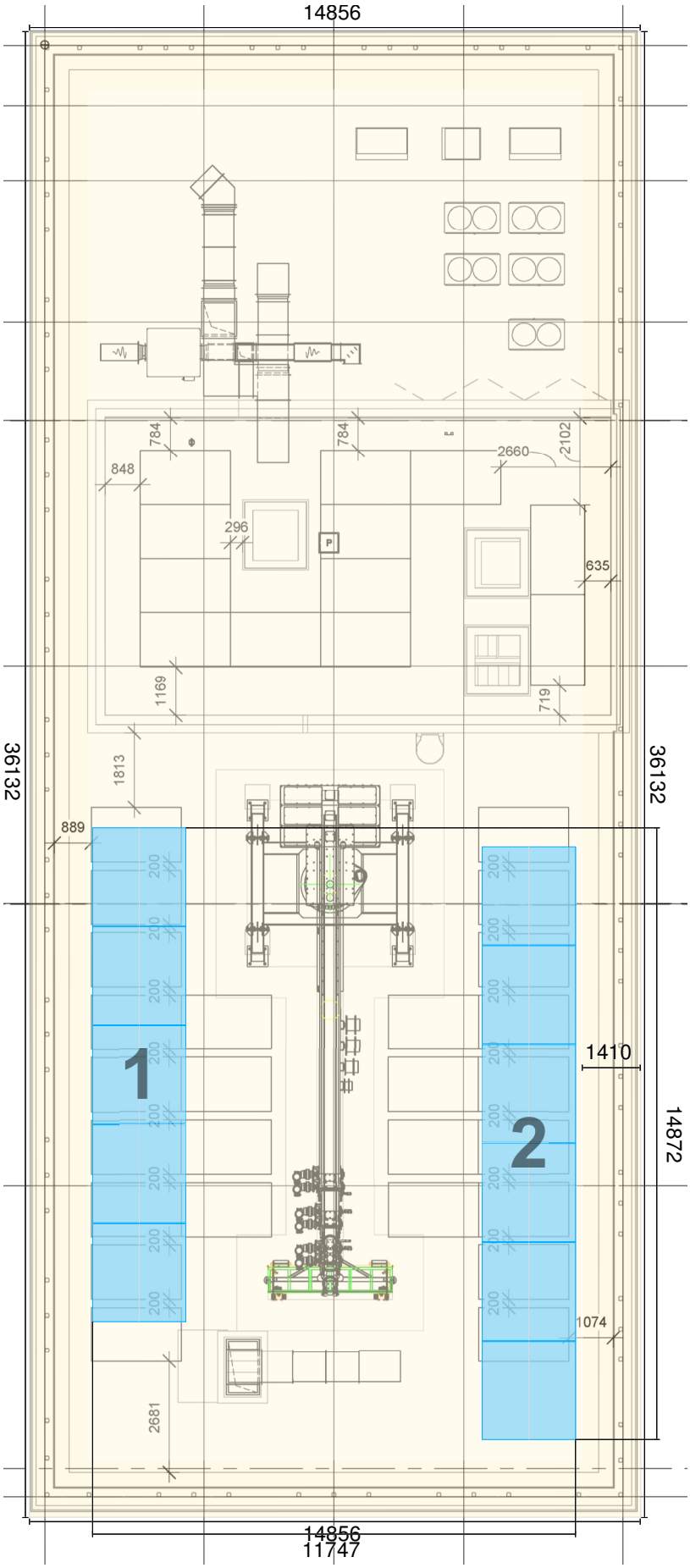
STATIC VALIDATION

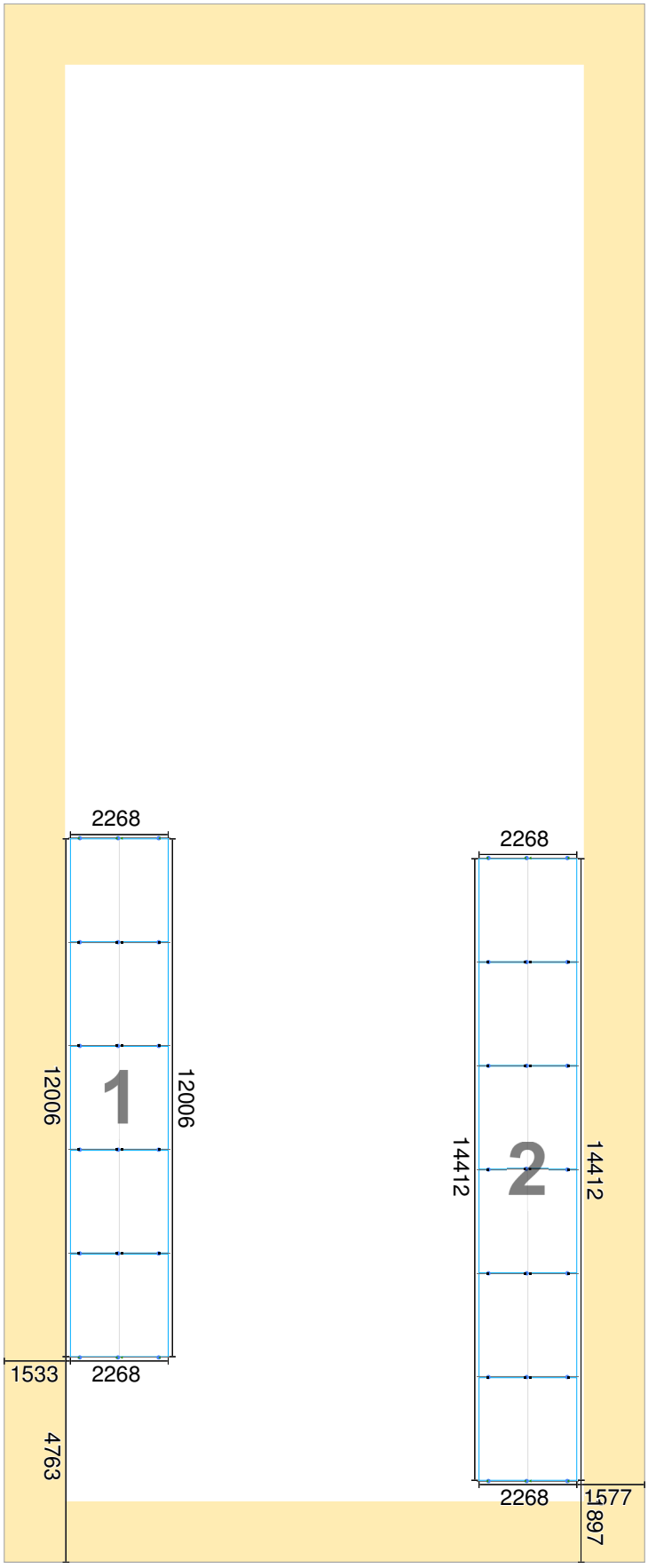
Your project was validated by our statics check successfully.

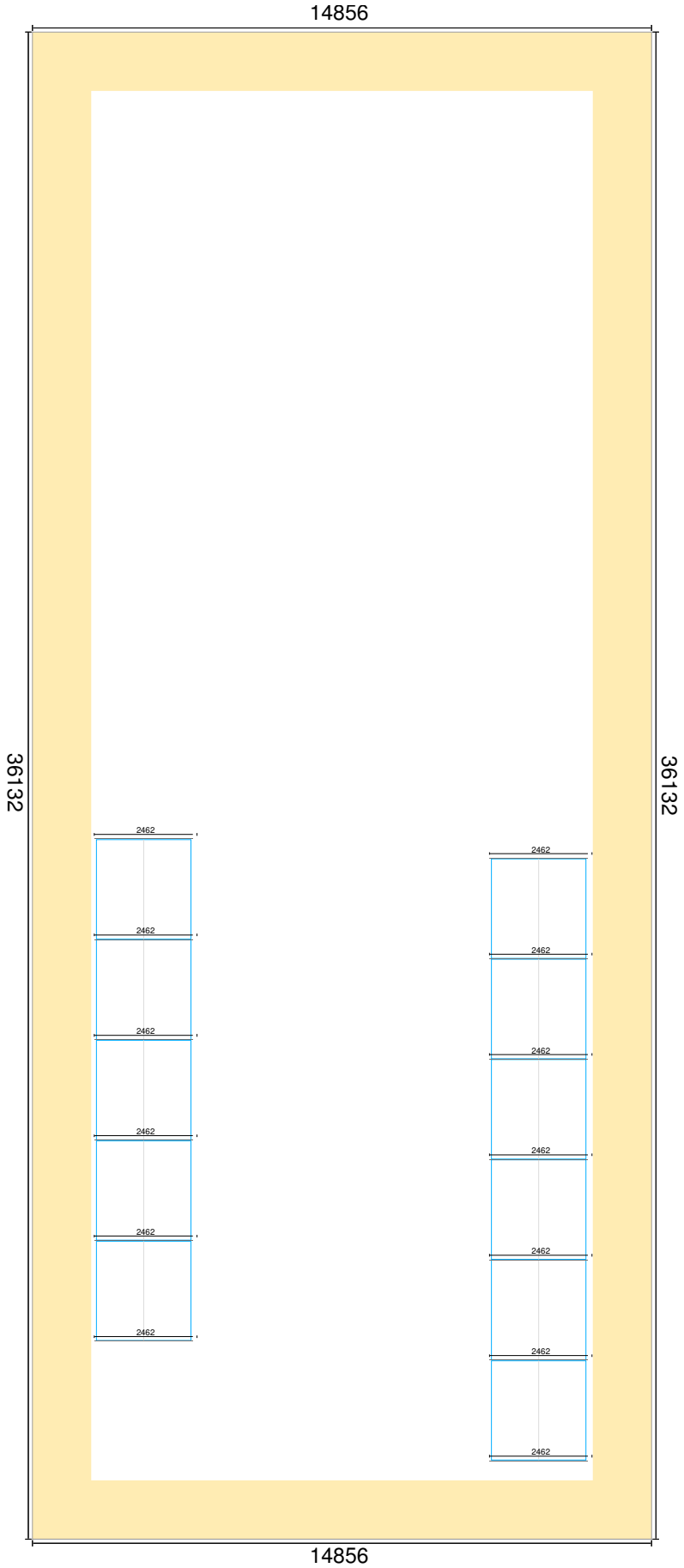
Static utilization factor: 52%

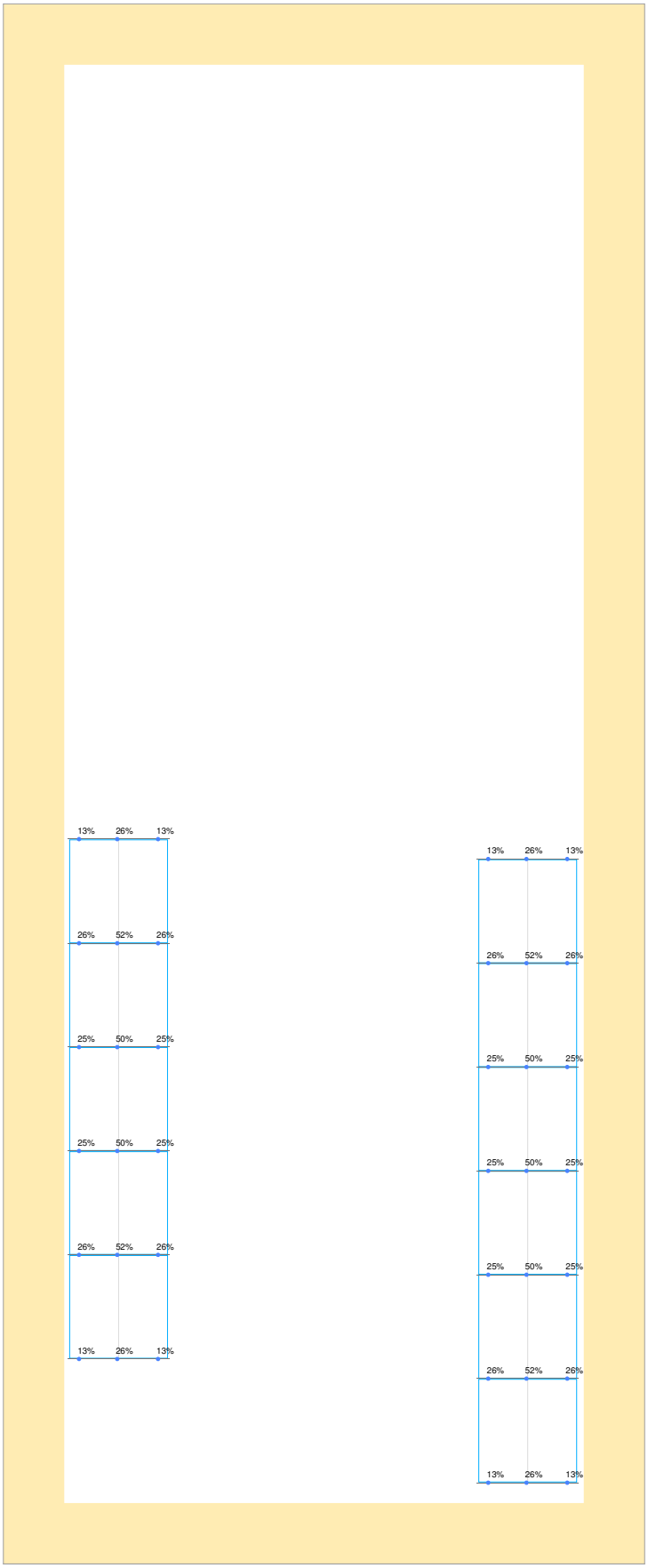
Static utilization fastener: 52%
Static utilization clamp: 43%

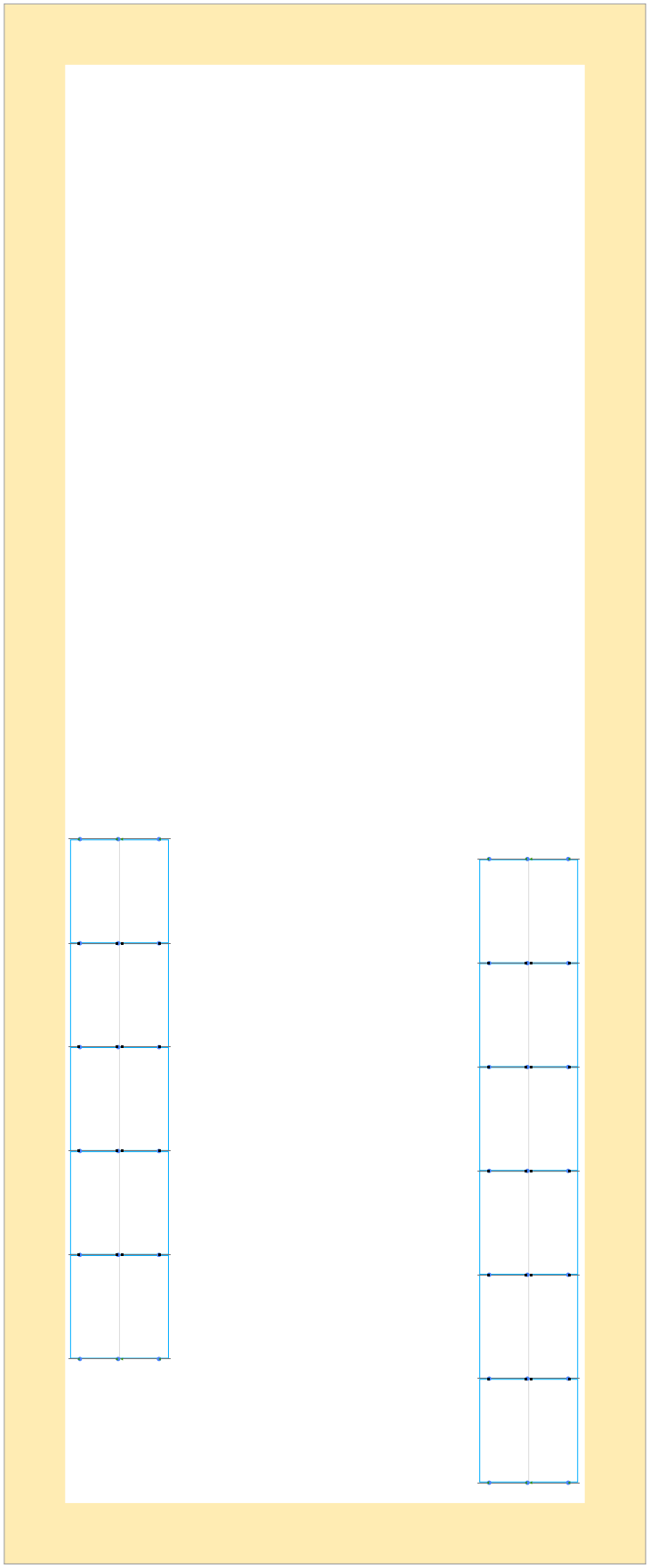
The predefined default values for input fields have to be compared with the conditions of the project. Necessary changes to adapt to local conditions must be carried out. The following relevant input fields contain their default value:
• Service life of PV system: 25 years
• Failure consequence class: 2

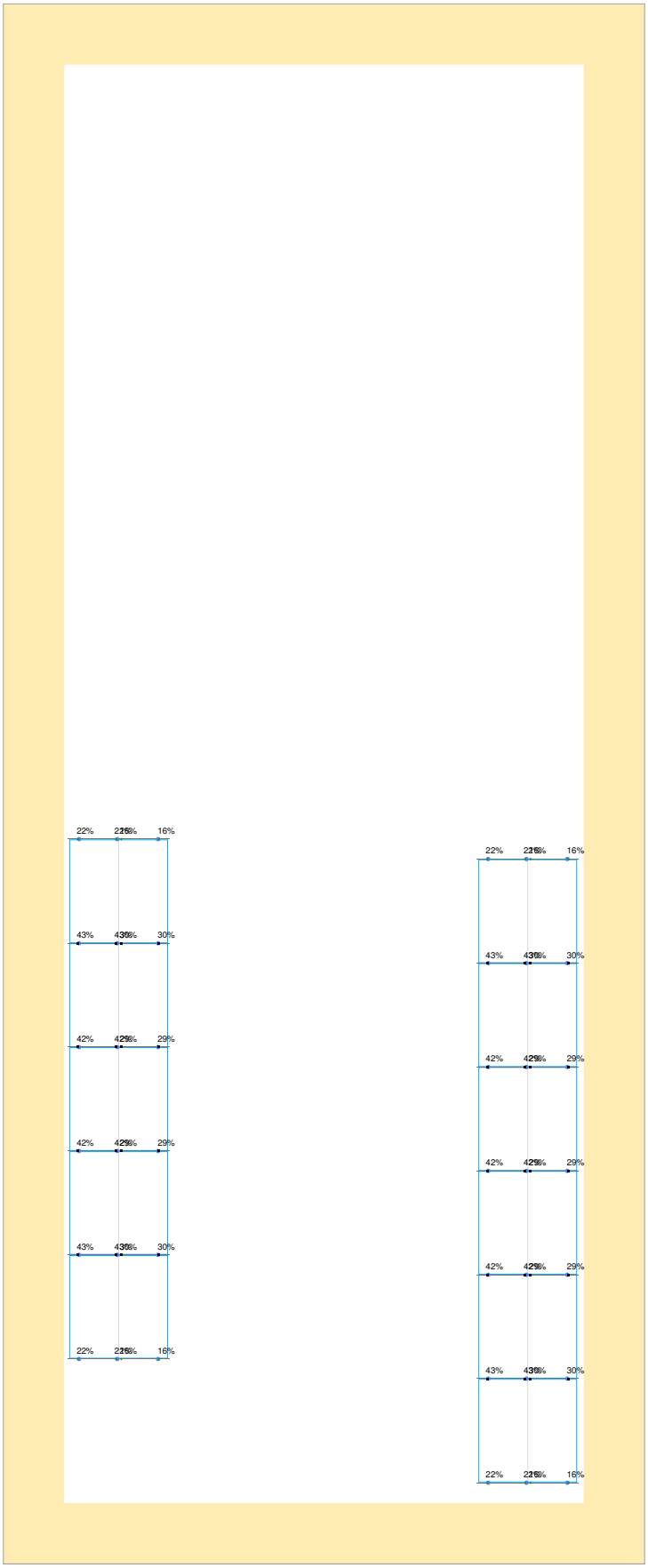

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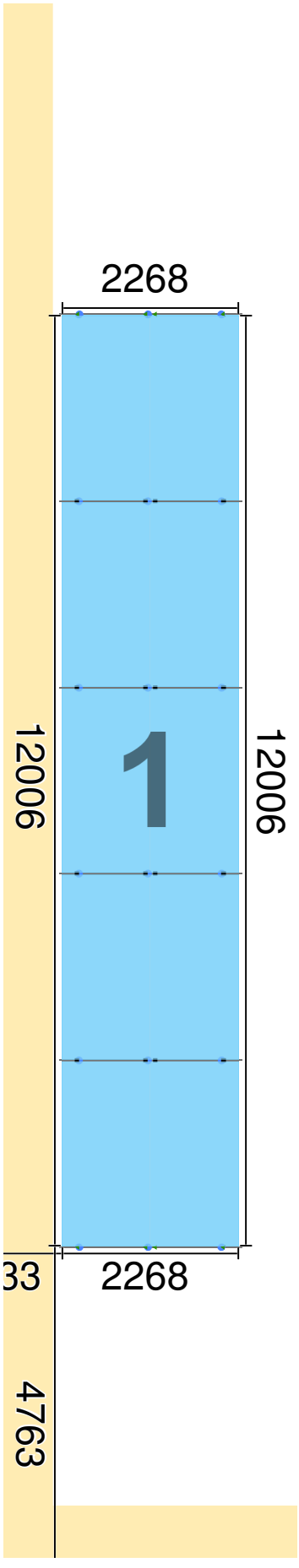

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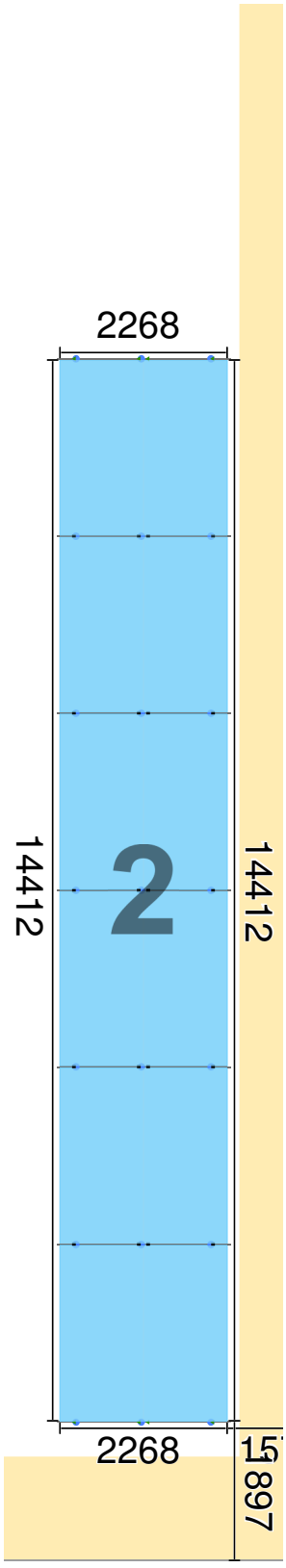

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BILL OF MATERIAL

Article No.	Article	Quantity	Ordering Unit	Weight/Piece	Weight
R420080	RS1	52	1	0,083 kg	4,316 kg
R500419	Eave support XL	26	1	0,049 kg	1,274 kg
R500423	Ridge support 10° XL	13	1	0,443 kg	5,759 kg
R500499	Base rail FS10-EW XL 2362 mm	13	1	1,660 kg	21,580 kg
R900314	Socket bolt 6 x 110 mm	39	1	0,009 kg	0,351 kg
				Total Weight:	33,280 kg

Third party parts	Quantity
Rooftrak IFP-HM/MW	39

The third party product(s) listed above, is (are) not (a) product of Renusol but, from third party Manufacturer(s) (Manufacturer). The PV-Configurator uses static properties of this fastener provided by this Manufacturer. The Manufacturer is responsible for the accurateness and correctness of the static values provided by him, Renusol does not assume any liability regarding the product of the Manufacturer and its static properties.

LOAD ASSUMPTIONS

Dead load

Solar modules type CS6.1-72TB-610 are used.
The modules are angled horizontally on the roof and are fastened on the larger module edges on the vertical rails with module clamps.

Dimensions:	2382 mm x 1134 mm
Weight:	G = 33.6 kg
	F_G = 33.6 kg * 9.81 m/s² = 0.330 kN

Snow load

The determination of the snow load is carried out according to BS EN 1991-1-3:2003/NA:2010-06.
Snow-trap formation or snow-load accumulations are not considered in the calculation. Please contact Renusol if necessary.

Height above sea level:	47 m
Snow load zone:	3
Roof pitch:	α = 2°
Module elevation:	β = 10°
total pitch:	10.2°
Period of use:	25 Year
Snow load:	$s_k = s_{k,50} * f_s$ = 0.50 kN/m² * 0.93 = 0.46 kN/m²
	μ_1 = 0.800
	$s_1 = \mu_1 * s_k$ = 0.8 * 0.46 kN/m² = 0.371 kN/m²
	$s_{1,10°}$ = 0.371 kN/m² * cos(10.2°) = 0.371 kN/m²
	$F_{S,k}$ = 0.371 kN/m² * 2.38m * 1.13m = 0.987 kN

Wind load

The determination of the wind load is carried out according to BS EN 1991-1-4:2005/NA:2011-01.

Building height roof ridge:	52 m
Terrain category:	Town terrain
Basic wind velocity:	22.50 m/s
Distance to shoreline:	40.000 km
Distance inside town terrain:	3.000 km
Period of use:	25 Year
Pressure of the gusts velocity:	q(z) = 1.068 kN/m²

ANALYSIS

Load cases and load case combinations

Load cases

The respective loads are taken from the load assumptions and converted to a reference system perpendicular to the roof area.

LC 1	Dead load
LC 2	Snow load
LC 3	Wind pressure
LC 4	Wind suction

Significant load case combinations
according to: EN 1990:2012

Ultimate state of load-bearing capacity

LCC 1	Predominant action wind pressure $E_{d,LCC\ 1} = 1.35 * E_{Gk,LC\ 1} + 1.50 * (E_{Qk,LC\ 3} + 0.5 * E_{Qk,LC\ 2})$
LCC 2	Predominant action snow $E_{d,LCC\ 2} = 1.35 * E_{Gk,LC\ 1} + 1.50 * (E_{Qk,LC\ 2} + 0.6 * E_{Qk,LC\ 3})$
LCC 3	Predominant action wind suction (lifting) $E_{d,LCC\ 3} = 1.00 * E_{Gk,LC\ 1} + 1.50 * (E_{Qk,LC\ 4})$

Ultimate state of serviceability

LCC 4	Predominant action wind pressure $E_{d,LCC\ 4} = 1.00 * E_{Gk,LC\ 1} + 1.00 * (E_{Qk,LC\ 3} + 0.5 * E_{Qk,LC\ 2})$
LCC 5	Predominant action snow $E_{d,LCC\ 5} = 1.00 * E_{Gk,LC\ 1} + 1.00 * (E_{Qk,LC\ 2} + 0.6 * E_{Qk,LC\ 3})$
LCC 6	Predominant action wind suction $E_{d,LCC\ 6} = 1.00 * E_{Gk,LC\ 1} + 1.00 * (E_{Qk,LC\ 4})$

ANALYSIS

Middle clamp

General

The module clamps consist of bent parts made of the material S500 MC, EN 10149-2. The lower part of the module clamps consists of a click profile made of S500 MC, EN 10149-2, which is attached to the module carrying profile and transfers the loads by form closure. On it the module end clamp or module middle clamp is fastened by a screw. When tightening the screw the module clamp presses the module to the rail.

Sketch



Static analysis

The maximum loads established in the load combinations of the tension loads perpendicular to the roof area and the respective shear loads parallel to the roof area or the maximum shear loads in combination with the corresponding tensile loads perpendicular to the roof area are significant for the analysis. Pressure loads perpendicular to the roof area are transferred by contact bearing.

Analysis

LCC 1
Regarding the calculation the following module clamp at the following position is significant.

Position:	x = 21757 mm y = 12321 mm
Loads:	$V_{x,d}$ = 0.01 kN
	$V_{y,d}$ = 0.30 kN
Comparison stress:	MAX ($V_{x,d}/F_{R,d,y}$; $V_{y,d}/F_{R,d,z}$) = MAX (0.01/1.84; 0.30/1.29) = 0.23 < 1

LCC 2
Regarding the calculation the following module clamp at the following position is significant.

Position:	x = 21757 mm y = 12321 mm
Loads:	$V_{x,d}$ = 0.02 kN
	$V_{y,d}$ = 0.23 kN
Comparison stress:	MAX ($V_{x,d}/F_{R,d,y}$; $V_{y,d}/F_{R,d,z}$) = MAX (0.02/1.84; 0.23/1.29) = 0.18 < 1

LCC 3
Regarding the calculation the following module clamp at the following position is significant.

Position:	x = 21757 mm y = 11105 mm
Loads:	N_d = -0.50 kN
	$V_{x,d}$ = 0.00 kN
	$V_{y,d}$ = 0.34 kN
Comparison stress:	$N_d/F_{R,d,x}$ + MAX ($V_{x,d}/F_{R,d,y}$; $V_{y,d}/F_{R,d,z}$) = 0.50/3.41 + MAX (0.00/1.72; 0.34/1.20) = 0.43 < 1

ANALYSIS

End clamp

General

The module clamps consist of bent parts made of the material S500 MC, EN 10149-2. The lower part of the module clamps consists of a click profile made of S500 MC, EN 10149-2, which is attached to the module carrying profile and transfers the loads by form closure. On it the module end clamp or module middle clamp is fastened by a screw. When tightening the screw the module clamp presses the module to the rail.

Sketch



Static analysis

The maximum loads established in the load combinations of the tension loads perpendicular to the roof area and the respective shear loads parallel to the roof area or the maximum shear loads in combination with the corresponding tensile loads perpendicular to the roof area are significant for the analysis. Pressure loads perpendicular to the roof area are transferred by contact bearing.

Analysis

LCC 1
Regarding the calculation the following module clamp at the following position is significant.

Position:	x = 19345 mm y = 12321 mm
Loads:	$V_{x,d}$ = 0.01 kN
	$V_{y,d}$ = 0.15 kN
Comparison stress:	MAX ($V_{x,d}/F_{R,d,y}$; $V_{y,d}/F_{R,d,z}$) = MAX (0.01/0.95; 0.15/1.32) = 0.11 < 1

LCC 2
Regarding the calculation the following module clamp at the following position is significant.

Position:	x = 19345 mm y = 12321 mm
Loads:	$V_{x,d}$ = 0.01 kN
	$V_{y,d}$ = 0.12 kN
Comparison stress:	MAX ($V_{x,d}/F_{R,d,y}$; $V_{y,d}/F_{R,d,z}$) = MAX (0.01/0.95; 0.12/1.32) = 0.09 < 1

LCC 3
Regarding the calculation the following module clamp at the following position is significant.

Position:	x = 19345 mm y = 11105 mm
Loads:	N_d = -0.26 kN
	$V_{x,d}$ = 0.00 kN
	$V_{y,d}$ = 0.17 kN
Comparison stress:	$N_d/F_{R,d,x}$ + MAX ($V_{x,d}/F_{R,d,y}$; $V_{y,d}/F_{R,d,z}$) = 0.26/3.08 + MAX (0.00/0.93; 0.17/1.29) = 0.22 < 1

ANALYSIS

Fastener

General

The resistances were determined on the user's own responsibility.

Design values of load capacity

$F_{R,d,x}$ = 5.00 kN
$F_{R,d,-x}$ = 3.50 kN
$F_{R,d,y}$ = 2.50 kN
$F_{R,d,z}$ = 2.50 kN

LCC 1
Regarding the calculation the following fastener at the following position is significant.

Position:	x = 21757 mm y = 12219 mm
Loads:	N_d = 0.61 kN
	$V_{x,d}$ = 0.02 kN
	$V_{y,d}$ = 0.50 kN
Comparison stress:	$N_d/F_{R,d,-x} + V_{x,d}/F_{R,d,y} + V_{y,d}/F_{R,d,z}$ = 0.61/5.00 + 0.02/2.50 + 0.50/2.50 = 0.33 < 1

LCC 2
Regarding the calculation the following fastener at the following position is significant.

Position:	x = 21757 mm y = 12219 mm
Loads:	N_d = 0.98 kN
	$V_{x,d}$ = 0.03 kN
	$V_{y,d}$ = 0.30 kN
Comparison stress:	$N_d/F_{R,d,-x} + V_{x,d}/F_{R,d,y} + V_{y,d}/F_{R,d,z}$ = 0.98/5.00 + 0.03/2.50 + 0.30/2.50 = 0.33 < 1

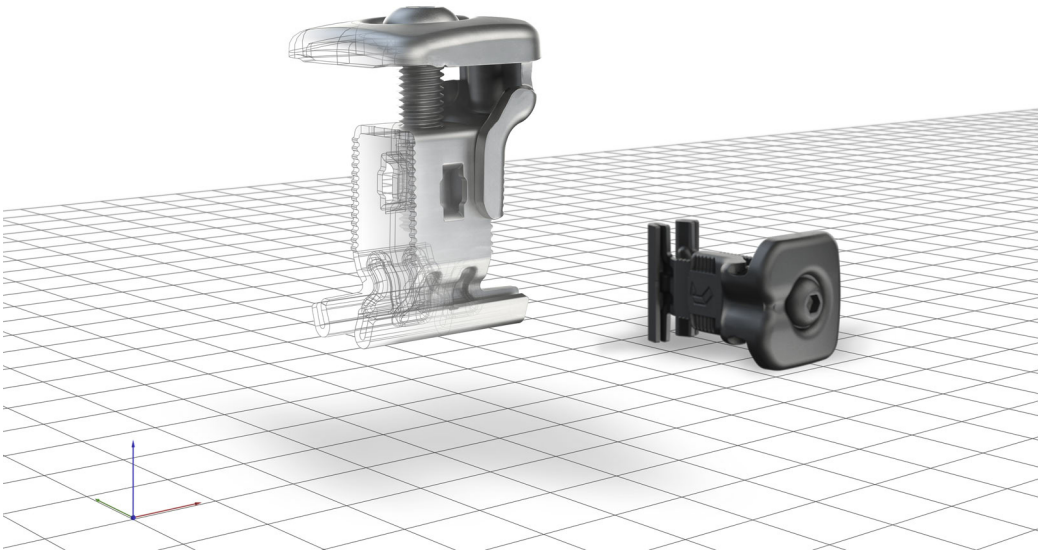
LCC 3
Regarding the calculation the following fastener at the following position is significant.

Position:	x = 21757 mm y = 12219 mm
Loads:	N_d = -1.10 kN
	$V_{x,d}$ = 0.01 kN
	$V_{y,d}$ = 0.50 kN
Comparison stress:	$N_d/F_{R,d,-x} + V_{x,d}/F_{R,d,y} + V_{y,d}/F_{R,d,z}$ = 1.10/3.50 + 0.01/2.50 + 0.50/2.50 = 0.52 < 1

Technical project overview

Echo Street, Manchester, M1 7DP

Building project	Echo Street, Manchester, M1 7DP
Address	Echo Street 17, M1 3AL
Country	United Kingdom
Module Type	Canadian Solar Inc. - CS6.1-72TB-610
Number of modules	28
Rated output	17.08 kWp
Mounting system	FixedFS10EW
Editor	Renusol Europe GmbH



LOCATION

Street	Echo Street 17
City	M1 3AL
Country	United Kingdom

SURROUNDINGS

Code	Eurocode NA GB
Terrain height above sealevel	47,00 m
Snow load zone	Zone 3
Use Pressure coefficients from BRE 489 2014 roof pitch 0 -45°	yes
Terrain category	City
Distance to coast	40,00 km
Distance to edge of city	3,00 km
Surroundings	normal
Service life of PV system	25 years
Failure consequence class	2

LOAD CALCULATION RESULT

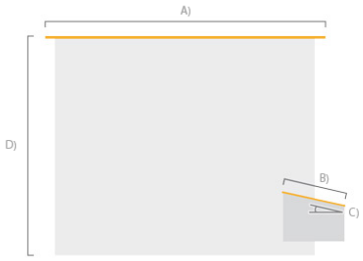
Peak velocity pressure	1,12 kN/m^2
Snow load	0,46 kN/m^2
Snow load on roof	0,37 kN/m^2
Base wind speed ($V_{b,0}$)	22,50 m/s

TOPOGRAPHY

Topography	Not exposed

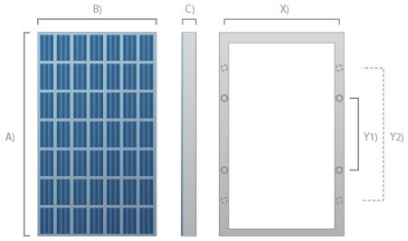
ROOF PROPERTIES

Roof type	Flat roof
Coverage type	Foil
C) Roof pitch	2,00 º
D) Building height	70,00 m
Parapet height	0,00 mm
Parapet width	0,00 mm



MODULE PARAMETERS

Manufacturer	Canadian Solar Inc.
Name	CS6.1-72TB-610
Length	2382 mm
Width	1134 mm
Height	30 mm
Weight	33.6 kg
Rated output	610 W_{peak}



Please check the compatibility of clamping positions with module manufacturer advice.

FASTENER PARAMETERS

Name	Rooftrak IFP-HM/MW
Manufacturer	Nicholson
Pressure load capacity	5,00 kN
Tensile load capacity	3,50 kN
Lateral force	2,50 kN
Interaction	Linear

The third party product(s) listed above, is (are) not (a) product of Renusol but, from third party Manufacturer(s) (Manufacturer). The PV-Configurator uses static properties of this fastener provided by this Manufacturer. The Manufacturer is responsible for the accurateness and correctness of the static values provided by him, Renusol does not assume any liability regarding the product of the Manufacturer and its static properties.

SYSTEM

System type	Fixed
System	FixedFS10EW



Please check the entered row distance for an ideal yield calculation with a correct calculation including consideration of the shading.

FASTENER DETAILS

Mounting rotation	Eave (0º)
Fastener type	Custom fastener
X) Row distance	2462mm

CLAMPS

Clamp type	RS1
Clamp colour	silver
Max value middle clamps	46 %
Max value end clamps	23 %

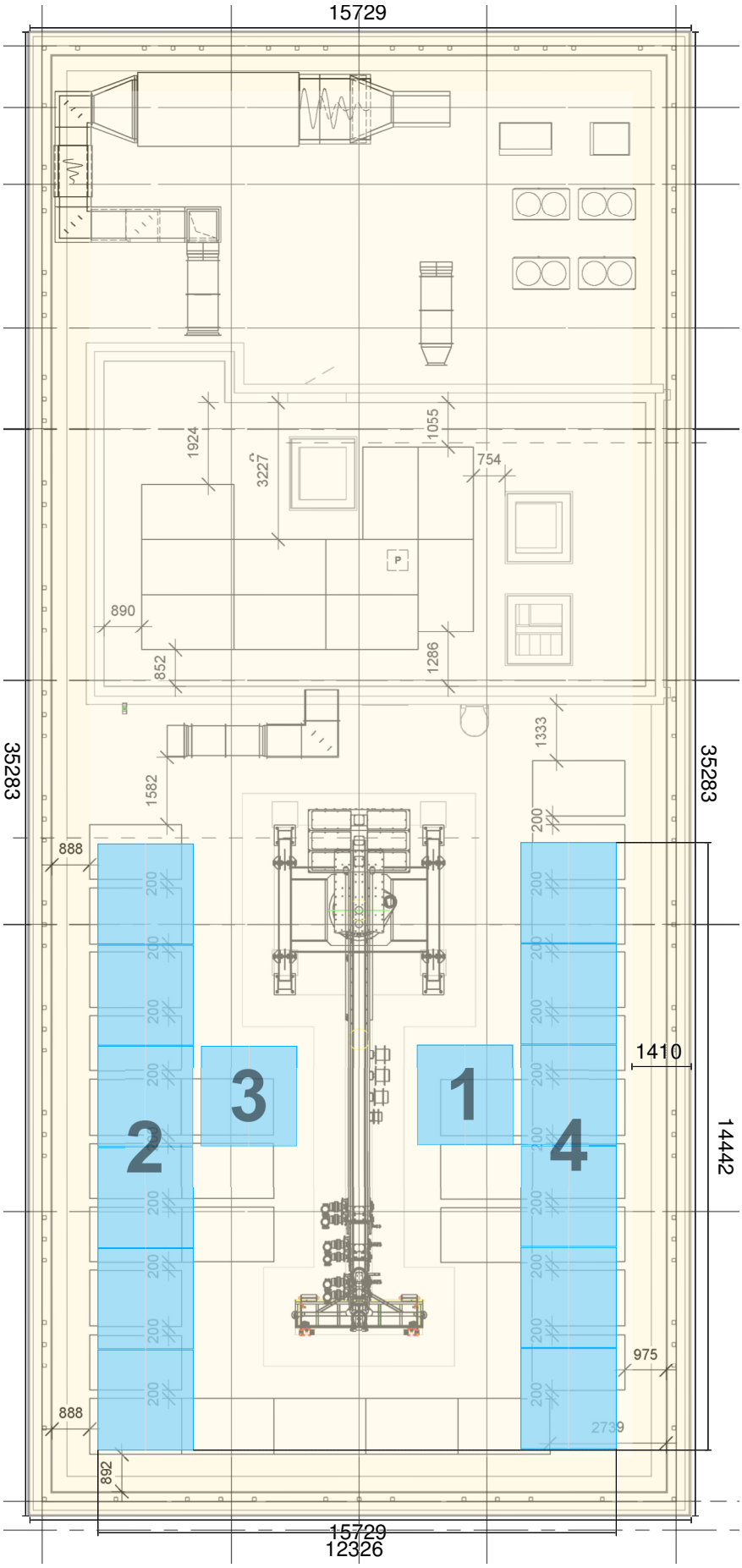
STATIC VALIDATION

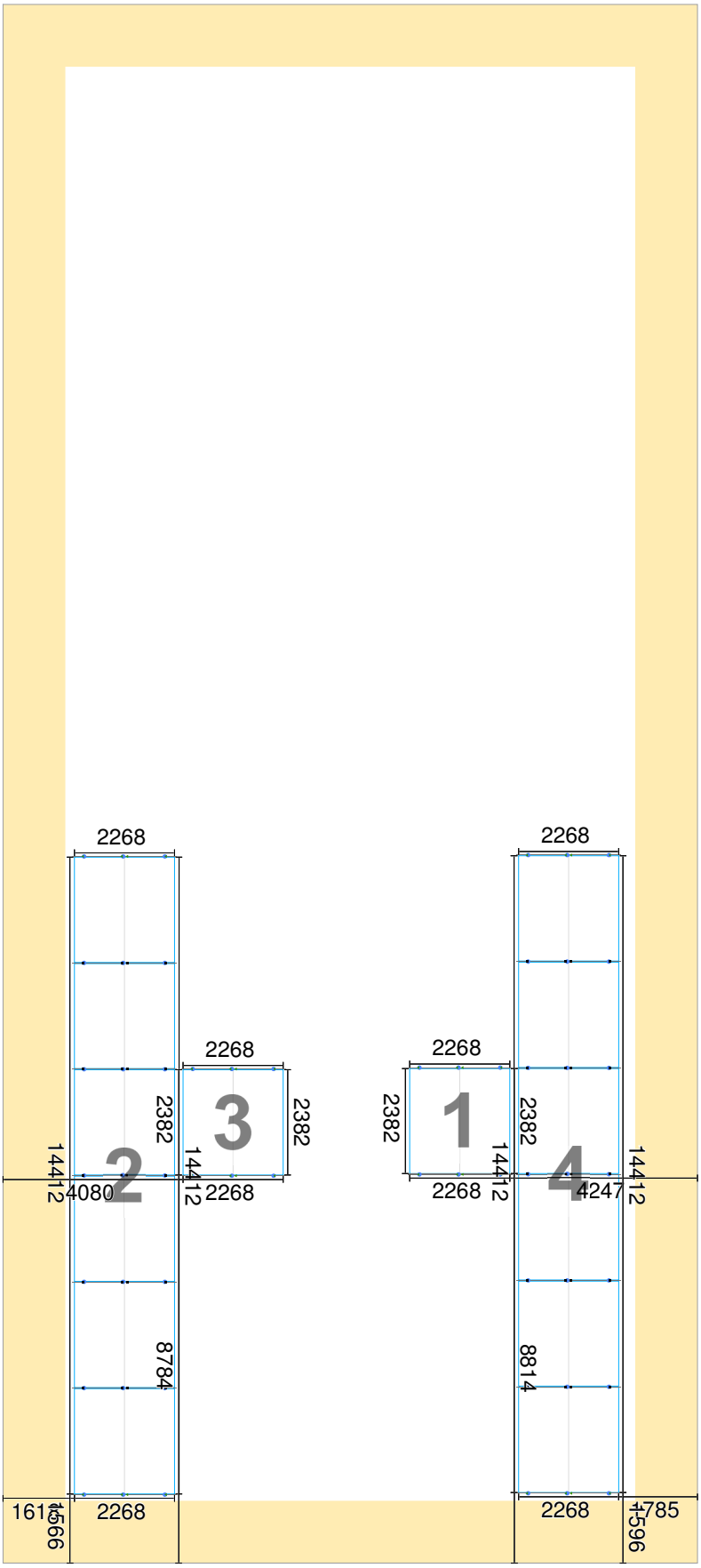
Your project was validated by our statics check successfully.

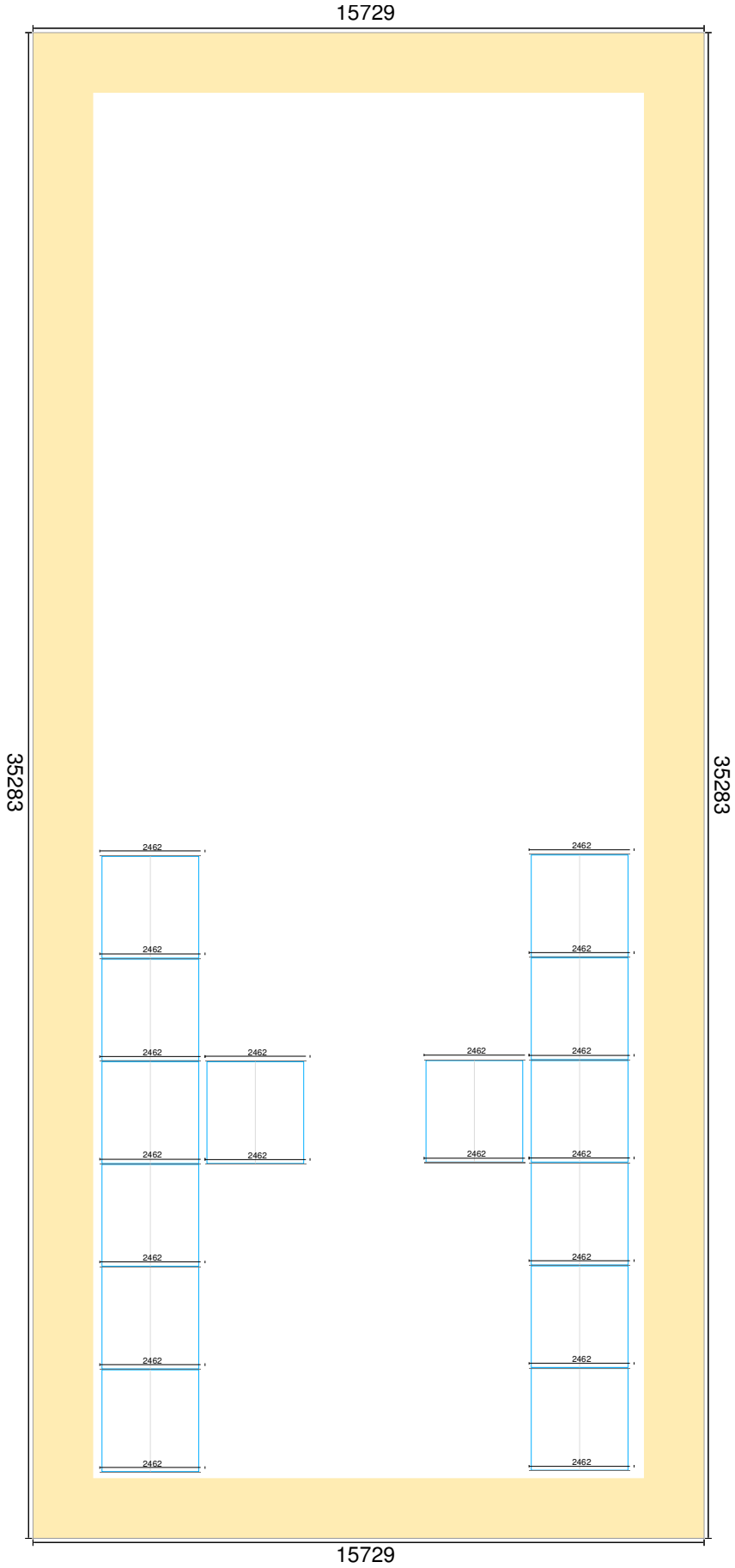
Static utilization factor: 55%

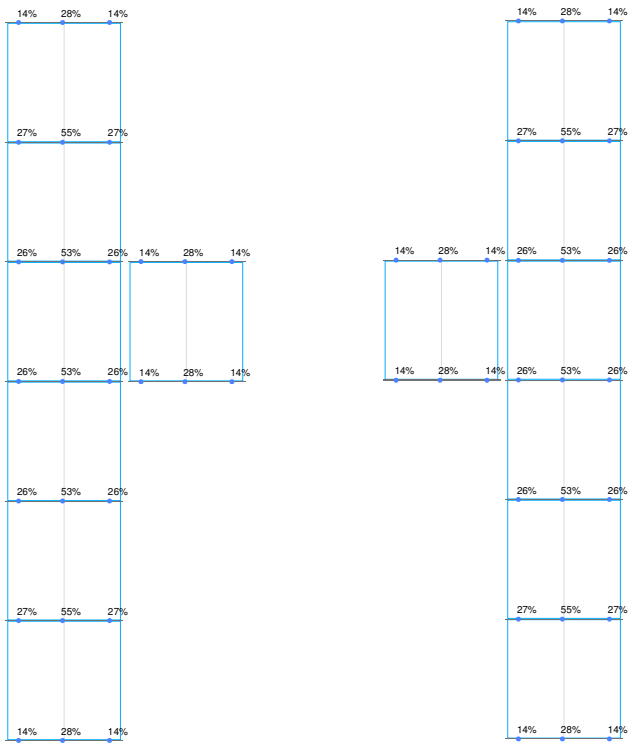
Static utilization fastener: 54%
Static utilization clamp: 46%

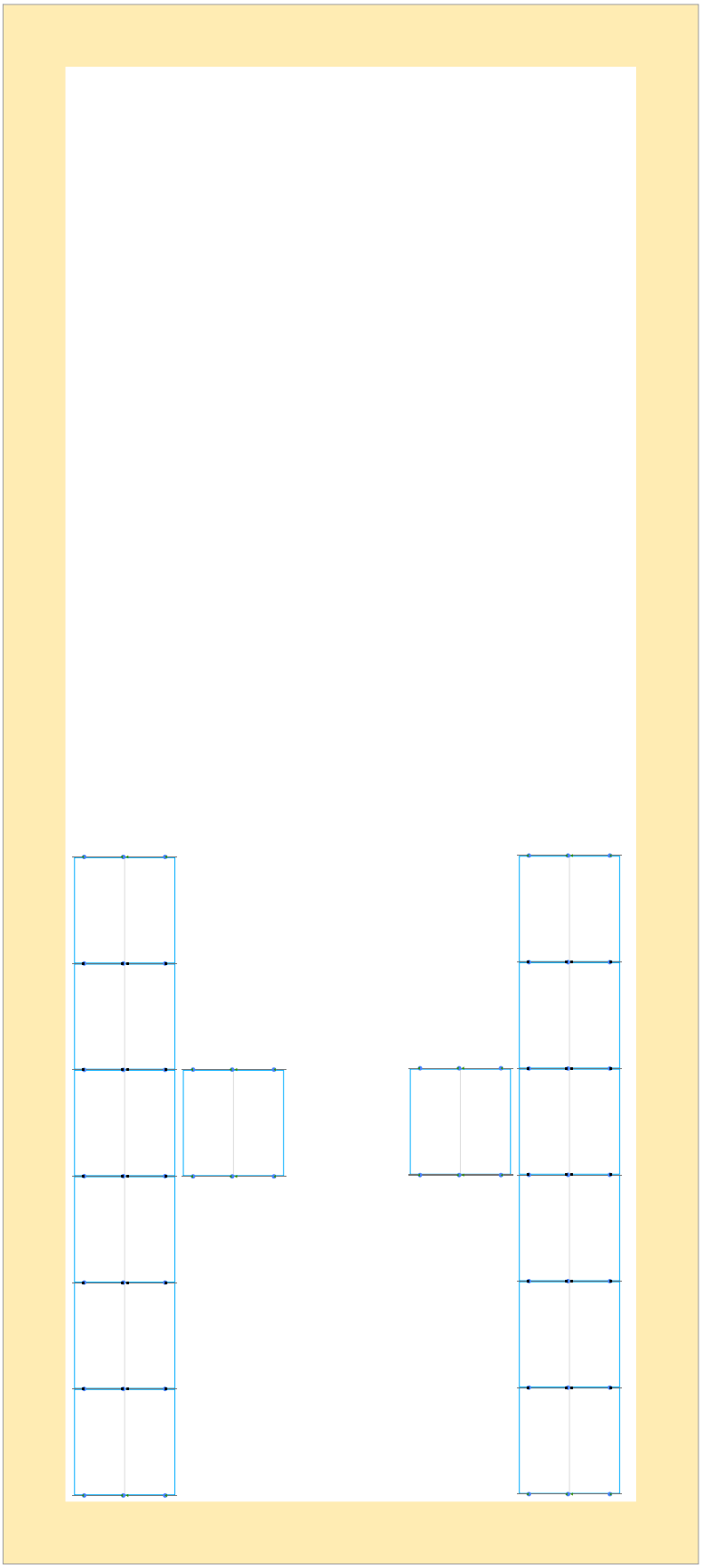
The predefined default values for input fields have to be compared with the conditions of the project. Necessary changes to adapt to local conditions must be carried out. The following relevant input fields contain their default value:
• Service life of PV system: 25 years
• Failure consequence class: 2

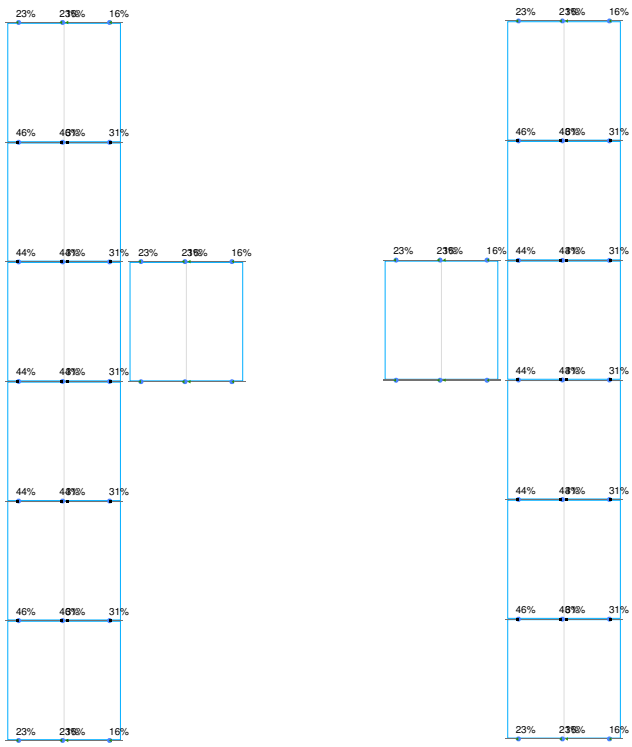

15729
1924
3227
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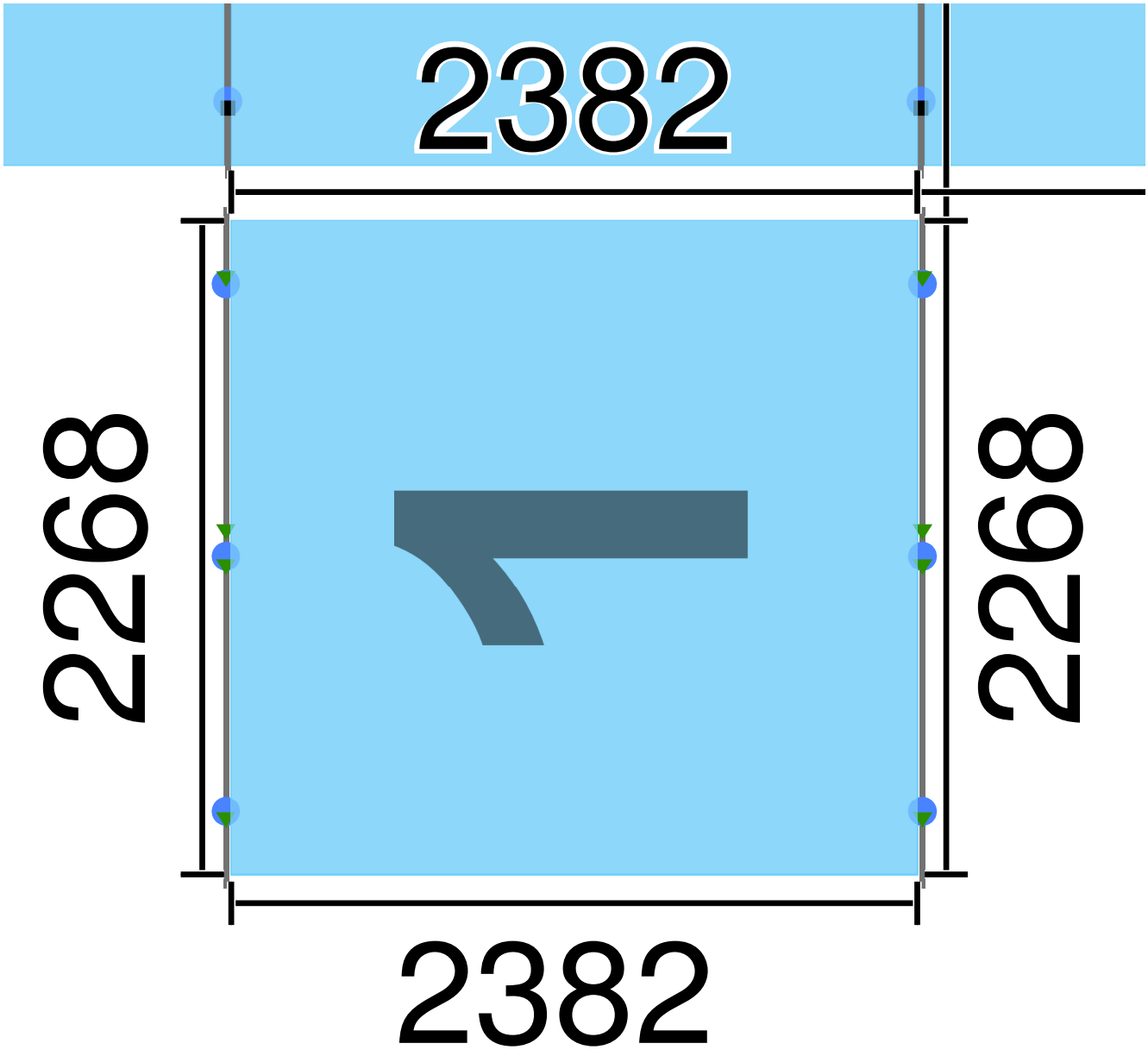

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2268
1785
1596

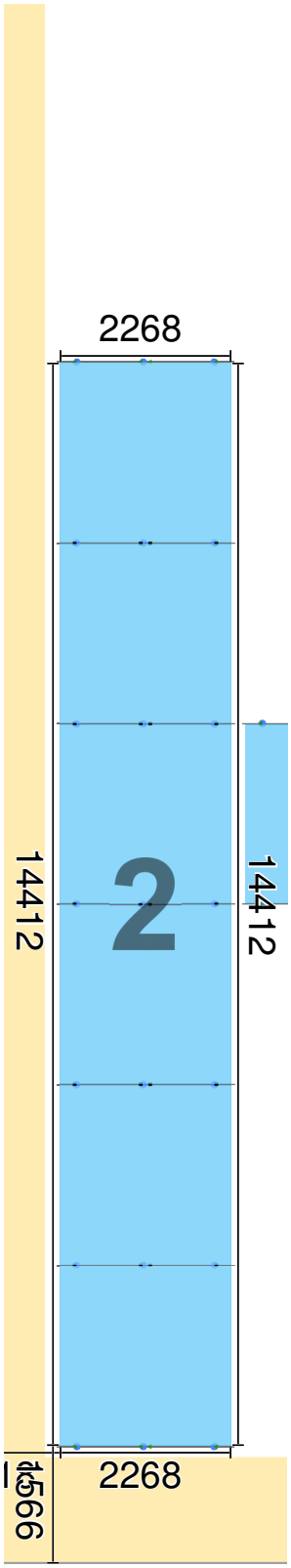

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2462
15729

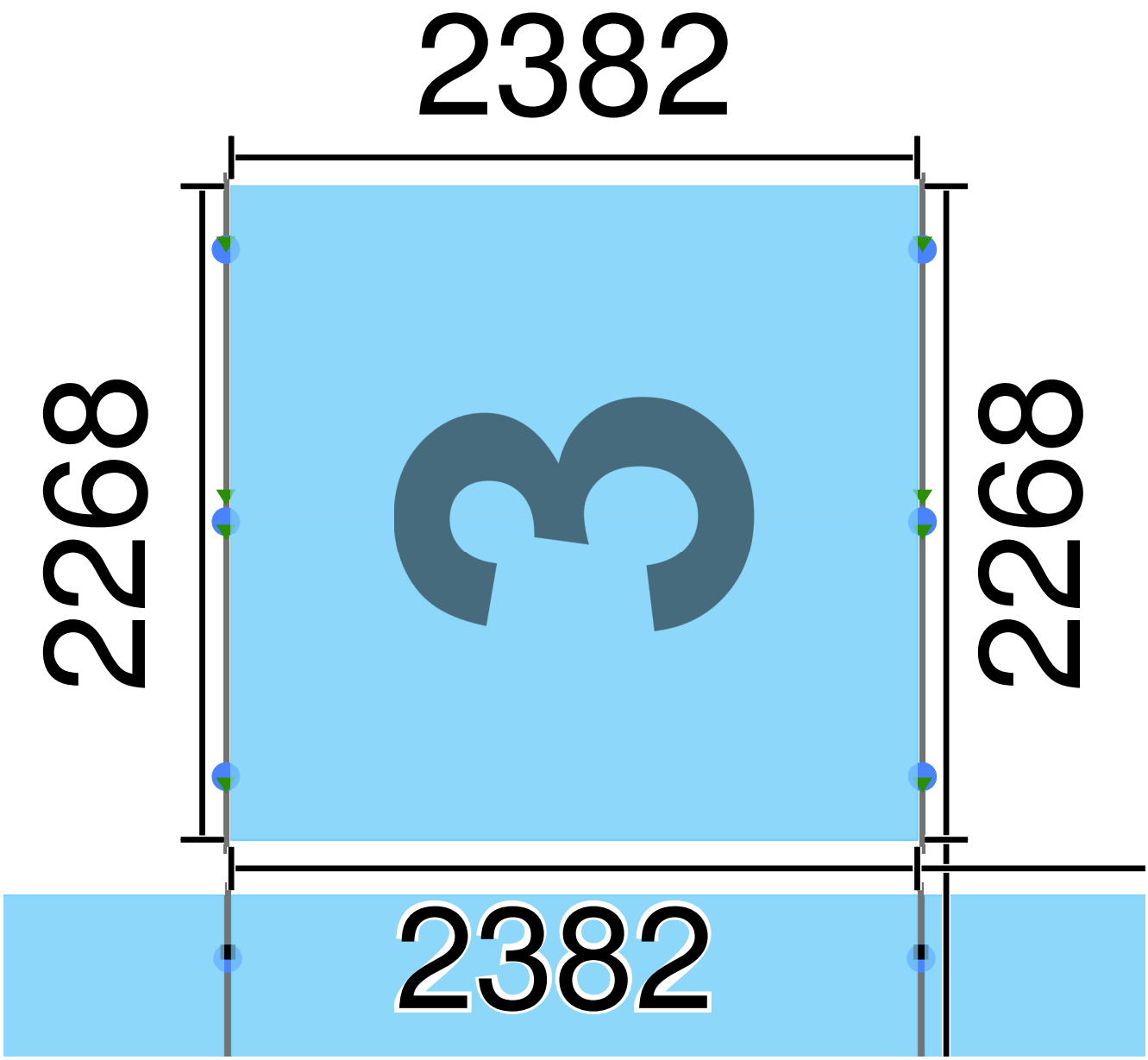

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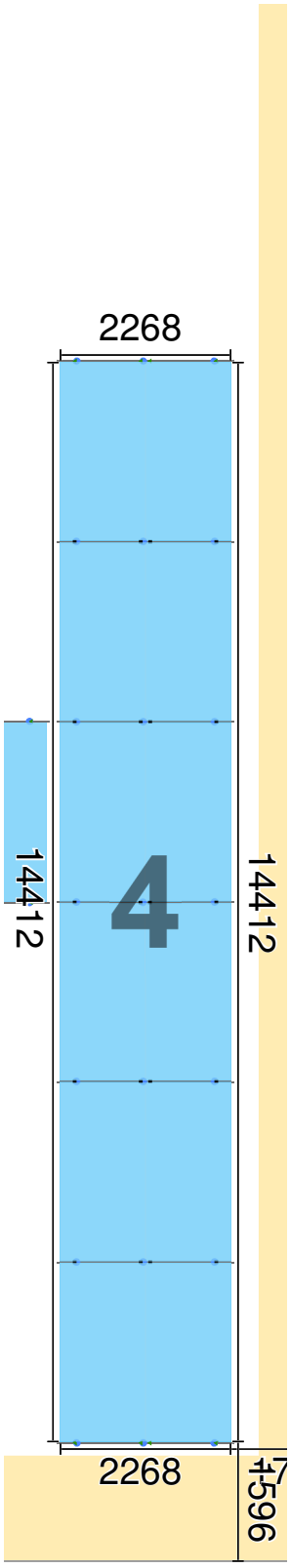



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BILL OF MATERIAL

Article No.	Article	Quantity	Ordering Unit	Weight/Piece	Weight
R420080	RS1	72	1	0,083 kg	5,976 kg
R500419	Eave support XL	36	1	0,049 kg	1,764 kg
R500423	Ridge support 10° XL	18	1	0,443 kg	7,974 kg
R500499	Base rail FS10-EW XL 2362 mm	18	1	1,660 kg	29,880 kg
R900314	Socket bolt 6 x 110 mm	54	1	0,009 kg	0,486 kg
				Total Weight:	46,080 kg

Third party parts	Quantity
Rooftrak IFP-HM/MW	54

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LOAD ASSUMPTIONS

Dead load

Solar modules type CS6.1-72TB-610 are used.
The modules are angled horizontally on the roof and are fastened on the larger module edges on the vertical rails with module clamps.

Dimensions:	2382 mm x 1134 mm
Weight:	G = 33.6 kg
	F_G = 33.6 kg * 9.81 m/s² = 0.330 kN

Snow load

The determination of the snow load is carried out according to BS EN 1991-1-3:2003/NA:2010-06.
Snow-trap formation or snow-load accumulations are not considered in the calculation. Please contact Renusol if necessary.

Height above sea level:	47 m
Snow load zone:	3
Roof pitch:	α = 2°
Module elevation:	β = 10°
total pitch:	10.2°
Period of use:	25 Year
Snow load:	$s_k = s_{k,50} * f_s$ = 0.50 kN/m² * 0.93 = 0.46 kN/m²
	μ_1 = 0.800
	$s_1 = \mu_1 * s_k$ = 0.8 * 0.46 kN/m² = 0.371 kN/m²
	$s_{1,10°}$ = 0.371 kN/m² * cos(10.2°) = 0.371 kN/m²
	$F_{S,k}$ = 0.371 kN/m² * 2.38m * 1.13m = 0.987 kN

Wind load

The determination of the wind load is carried out according to BS EN 1991-1-4:2005/NA:2011-01.

Building height roof ridge:	70 m
Terrain category:	Town terrain
Basic wind velocity:	22.50 m/s
Distance to shoreline:	40.000 km
Distance inside town terrain:	3.000 km
Period of use:	25 Year
Pressure of the gusts velocity:	q(z) = 1.123 kN/m²

ANALYSIS

Load cases and load case combinations

Load cases

The respective loads are taken from the load assumptions and converted to a reference system perpendicular to the roof area.

LC 1	Dead load
LC 2	Snow load
LC 3	Wind pressure
LC 4	Wind suction

Significant load case combinations
according to: EN 1990:2012

Ultimate state of load-bearing capacity

LCC 1	Predominant action wind pressure $E_{d,LCC\ 1} = 1.35 * E_{Gk,LC\ 1} + 1.50 * (E_{Qk,LC\ 3} + 0.5 * E_{Qk,LC\ 2})$
LCC 2	Predominant action snow $E_{d,LCC\ 2} = 1.35 * E_{Gk,LC\ 1} + 1.50 * (E_{Qk,LC\ 2} + 0.6 * E_{Qk,LC\ 3})$
LCC 3	Predominant action wind suction (lifting) $E_{d,LCC\ 3} = 1.00 * E_{Gk,LC\ 1} + 1.50 * (E_{Qk,LC\ 4})$

Ultimate state of serviceability

LCC 4	Predominant action wind pressure $E_{d,LCC\ 4} = 1.00 * E_{Gk,LC\ 1} + 1.00 * (E_{Qk,LC\ 3} + 0.5 * E_{Qk,LC\ 2})$
LCC 5	Predominant action snow $E_{d,LCC\ 5} = 1.00 * E_{Gk,LC\ 1} + 1.00 * (E_{Qk,LC\ 2} + 0.6 * E_{Qk,LC\ 3})$
LCC 6	Predominant action wind suction $E_{d,LCC\ 6} = 1.00 * E_{Gk,LC\ 1} + 1.00 * (E_{Qk,LC\ 4})$