

Over Easy Solar AS

Installation Manual

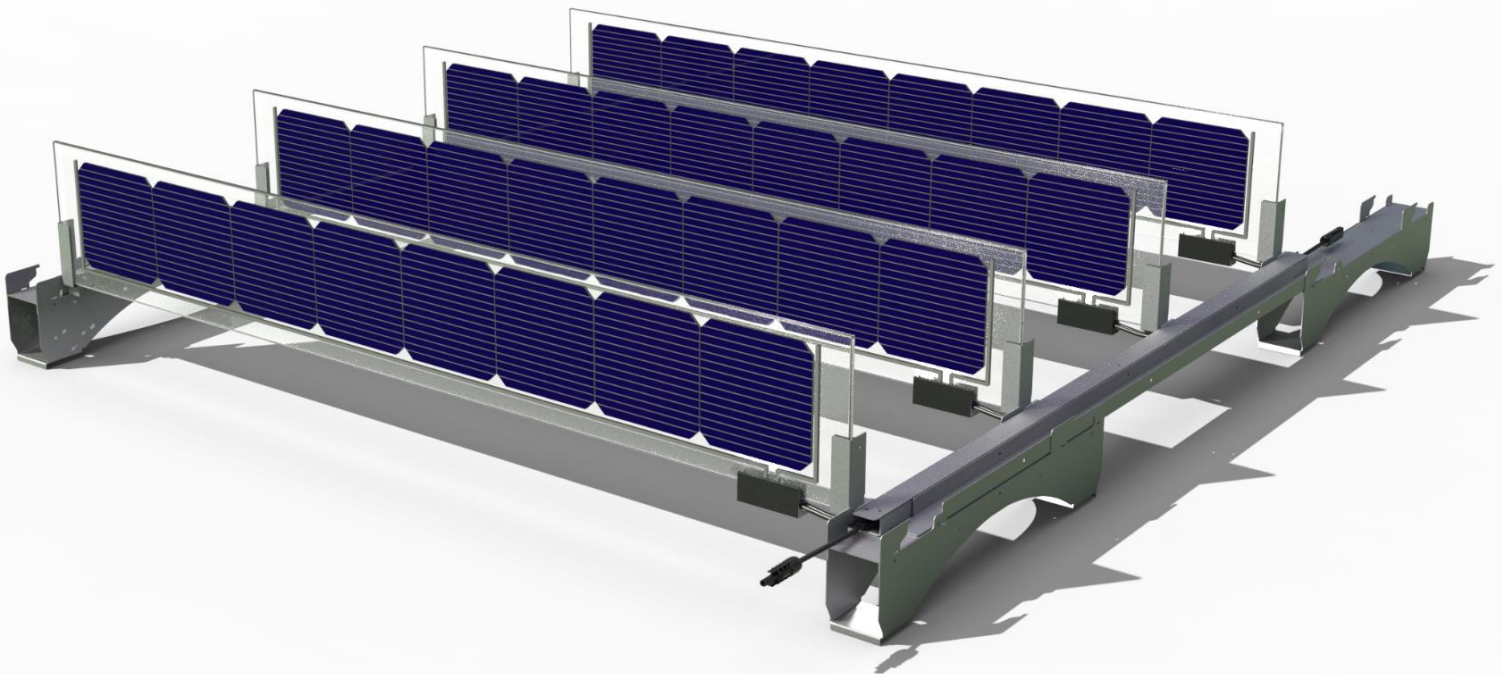


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1 GENERAL INFORMATION

Thanks for choosing *Over Easy Solar AS* vertical photovoltaic units, hereinafter referred to as *Over Easy VPV* units. This general manual provides important safety information relating to the installation, maintenance and handling of VPV units. To ensure the VPV units are installed correctly, please read the following installation instructions carefully before the units are installed and connected. The installation and handling of VPV units require professional skills and should only be performed by qualified professionals. Please remember that these products generate electricity and certain safety measures need to be taken to avoid danger. Failure to follow these instructions may result in death, injury or property damage.

This manual is valid for: xM-2.1 QUATTRO-200S.

1.1 Warnings

The instructions related to safety and use indicated in this installation manual are intended for the prevention of unexpected danger, damage or failure and should therefore be read and understood. Non-compliance with the instructions may cause product damage, product failure and/or serious bodily injury or death.

All VPV units must be installed by licensed electricians in accordance with the local applicable electrical codes.



VPV units generate DC current when exposed to sunlight or other light sources. Do not contact electrically active parts of the unit, such as terminals, without appropriate safety gear. Contact may result in lethal spark or electrical shock.



Use proper equipment, connectors and wires for the installation of the VPV units. Failure to comply may result in product damage, product failure or bodily injury.



Do not exceed maximum system voltage of any component. Do not disconnect any of the units when under load.



Do not reconnect or repair junction box cables. Do not bend junction box's cables while under stress. It may occur spark, electric shocks or panel damage.



Do not apply a shock to the junction box or pull the cables. Do not remove the labels attached to the panels. Failure to comply may result in damage to the product.



Do not remove any part installed by *Over Easy* or disassemble the unit.



The VPV unit does not contain any serviceable parts. Do not attempt to repair any part of the unit. Do not disassemble a unit or remove any part of the unit.











Do not artificially concentrate sunlight on the solar panel surface. Failure to comply may result in product damage or failure.



Do not use or install if the unit is broken or torn. Damaged panels must be treated with safety protection equipment.



Do not approach the damaged or broken panel unless you are an authorized or qualified expert. Failure to comply may result in electric shock, serious bodily injury or death.

-  Holes in the structural frame, brackets or glass of the panel may decrease the strength of the structural frame or break the glass.
-  Do not stand on or step on the panels or the metallic beams. Do not drop the unit. Do not lift the unit at the attached cables or the junction box. Failure to comply may result in product damage, product failure or bodily injury.
-  Perform all work in dry conditions and use only dry tools. Do not handle wet units without appropriate protection equipment. Failure to comply may result in accident or death.
-  When installing units in rainy conditions or morning dew, take appropriate measures to prevent water ingress into the connector.
-  Do not use units to replace parts of the roof/wall.
-  Do not install units during strong wind.
-  Do not install units where flammable gas may be present.
-  Do not connect units that have different electrical properties or physical configurations in the same system. Do not connect it with other PV systems.

1.2 Product identification

To ensure simple handling and installation of the units, the following naming is introduced (see Figure 1).

A preassembled *Over Easy* VPV unit consists of four bifacial, vertical PV panels, including cables, junction boxes and the structural frame. The VPV panels are attached to two beams with two brackets on each side, forming the structural frame. Each panel has a label, which specifies the model type, as well as the main electrical and safety characteristics of the panel. These four panels are internally connected via DC connectors and secured within the beam. There is only one positive and one DC connector per unit and can therefore be regarded as a single module.

These units are placed on connection feet that ensure both the necessary ground clearance and the connection to the next unit. Two different connection feet are offered, which differ in terms of their ground clearance and their intended use:

- LM ("low mount") with friction pads and a ground clearance of 4.0 cm for flat roofs (see Figure 2),
- HM ("high mount") with anchoring hooks and a ground clearance of 12.0 cm for green roofs (see
- Figure 3).

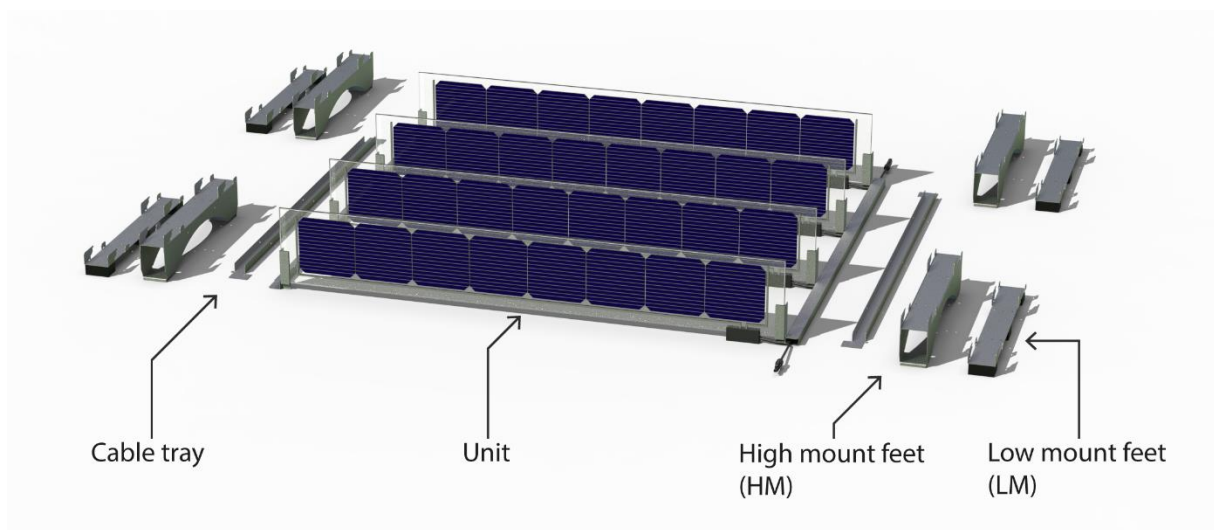


Figure 1: Product identification

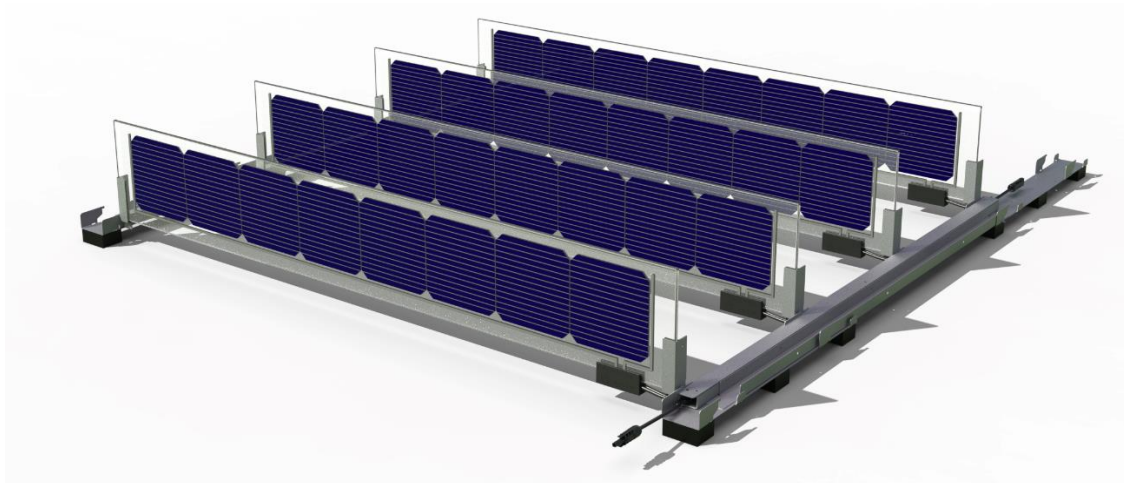


Figure 2: VPV unit with LM feet for flat roof tops

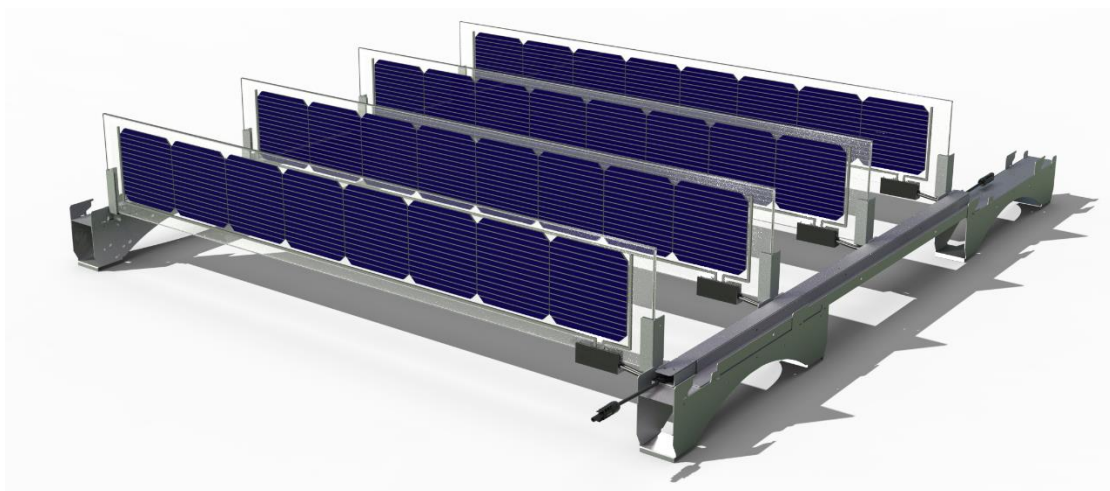


Figure 3: VPV unit with HM feet for green roof tops

The used panels are bifacial, which means that both sides generate electrical energy when illuminated. Due to a bifaciality of approx. 96%, a classification into a main (front) and back side is used. The product label marks the main (front) side of the panel. Furthermore, the main (front) side can easily be located by the male DC connector or the junction box on the right side of the panel.

2 STORAGE, LIFTING & UNPACKING

Over Easy units are delivered preassembled on a pallet with 33 units each (see Figure 4).

Before unpacking, check for damage caused during transportation. Check the completeness of the delivery and compare it with the delivery note. If the units are not going to be mounted in the foreseeable future, store the pallet in a dry and ventilated environment. If the units are stored in an uncontrolled environment, the storage time should be less than 3 months and extra precautions should be taken to prevent the DC connectors from being exposed to moisture or sunlight, like using connector endcaps.



Do not stack more than two pallets. The maximum height is two pallets. Severe stacking can cause stress to the wooden collars and may cause product damage.

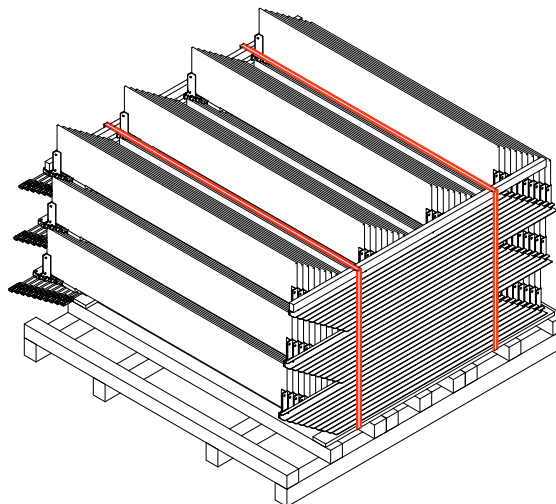


Figure 4: 33 preassembled VPV units on a pallet

Use appropriate lifting equipment (e.g., crane forks, slings, etc.) with the appropriate load capacity (min. 1 ton) and lift it onto the roof. Respect the load-bearing capacity of the roof. When lifting with slings, make sure to use long enough slings that do not squeeze or twist the units and that no point pressure is exerted on the units (see Figure 5).






Do not tilt the pallet.



Handle with care. The pallet includes fragile products made of glass.

On the roof, loosen the lifting equipment and remove it. Loosen the screws of the collars (if available) with a suitable tool (e.g., screwdriver or cordless screwdriver), remove the collars and store them safely. The cables of the units are fastened with cable ties. Remove them with a suitable tool (e.g., side cutter).

-  Do not use a crowbar or other sharp objects to remove the collars that could damage the units.
-  Do not cut or damage the cables. This may result in product damage, product failure or bodily injury.
-  Do not place or stack the units on the ground without a pallet or on the appropriate feet. This could damage the junction box.

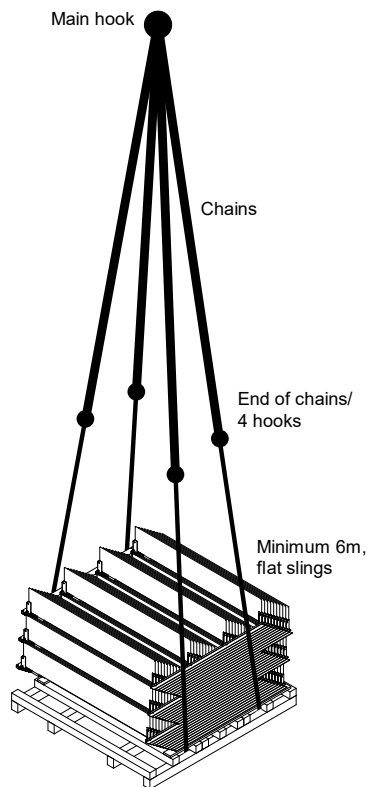


Figure 5: Appropriate lifting of pallet using slings

2.1 Precautions

- Always use both hands when handling the units.
- Do not stand, step/walk or jump on the units or any part of the units including the structural frame. This may lead to structural deformations.
- Do not lift the units by their wires or junction box, lift them by the beams or panels.
- Do not leave units unsupported or unsecured.
- Keep all connectors clean and dry at all times.
- Do not expose the units and their connectors to any unauthorized chemical substances.

3 MOUNTING INSTRUCTIONS

Prior to installing the units, please obtain information about any requirements and necessary approvals for the site, installation and inspection from the relevant authorities. Please carefully read this manual before installation.

3.1 Safety precautions

3.1.1 General

- VPV unit installation and maintenance must be performed by qualified and authorized installers.
- All installation instructions should be read and understood before performing any installation.
- Secure all necessary permits and licenses to install the VPV units.
- Check applicable building codes to ensure that the construction and roof can bear the VPV system load. Protect the roof integrity.
- Always wear protective head gear, safety shoes and insulating gloves according to the local regulations when installing VPV systems.

3.1.2 Fire rating requirements

- Consult your local authority for guidelines and requirements for building or structural fire safety.
- The units are to be mounted over a fire-resistant roof covering rated for the application.

3.1.3 Environmental conditions

- Keep the units packed on the pallet until the time of installation.
- Keep flammable gases away from the installation site.
- Do not immerse units in water or constantly expose units to water (e.g., fountains, sea spray, ...).
- Exposing units to salt in marine environments or sulfur incurs the risk of corrosion.
- Do not expose the system to any unauthorized chemical substances.
- VPV units are not intended for use indoors or on moving vehicles of any kind.
- Always keep the VPV units and system away from children.

3.1.4 Installation requirements

- Ensure that the units meet the general technical system requirements.
- Before installing the units, measure their voltage to ensure a proper electrical connection between the panels.
- Ensure that other system components do not damage the units mechanically or electrically.
- Small drainage holes on the underside of the structural frame must not be blocked.
- The units are designed for a max. roof pitch < 5°.

3.2 Installation conditions

Before mounting the units on the roof, make sure that the roof is free of snow, dirt, oil, water, etc. that could interfere with the mounting and functionality of the units. Use appropriate tools such as a broom, shovel, etc. to do this. Make sure that the roof drain is not blocked by leaves, etc. and is working properly. A blocked drain can cause water/snow/ice accumulation that can reduce the functionality and life of the units. Consider the weather forecast. Do not work in rain, snow or windy conditions. While working on the roof, keep a safety distance to the edge of at least 2 m. If the provided layout plan requires the installation to be closer to the edge, the use of an appropriate safety harness according to local regulation is necessary. The applicable regulations pertaining to work safety, accident prevention and securing the construction site must be observed. Any third party needs to be protected against injuries and damages.

3.3 Mechanical installation

Before installing the units, make sure that the above-mentioned points have been understood and respected. An illustrated mounting plan intended for the use on the roof can be found in the appendix.

First, a suitable starting point must be chosen. For this, consult the layout plan provided and find a suitable corner of the VPV array. Measure the distance to the reference edge or parapet wall with a folding ruler, measuring tape, laser distance meter etc. and mark it. Repeat it for the perpendicular reference edge or parapet wall. From this starting point, stretch a string along the edge and make sure that the same distance to the edge is maintained until the end of the array. Repeat it for the perpendicular side. A laser, chalk line or similar serves the same purpose. Particularly with large installations and narrow distances it is important to ensure that the dimensions in the plan, the starting point as well as the distances to the reference edges are correct, as it is no longer possible to move the installation later.

With the pallet on the roof, the collars removed, the unwrapping of the pallet and the placement in the designated location can start. Place the first foot on the surface of the roof according to the orientation of the array and make sure it is correctly aligned. Continue by placing the next feet of the rest of the first row in an approximate unit's length. Take the cable trays and attach them on the outer side of the feet. The lips of cable trays of the first and the last unit of each row needs to be placed in the second hole (see Figure 6 and Figure 7). All other cable trays are positioned at the outer holes (see Figure 8).

After the cable trays have been placed on the feet, the feet are at the correct distance from each other. Check again for the correct alignment to the roof edges. Then carefully lift the first unit from the pallet with two people, walk along the roof to the starting point and place the unit on the feet. The main side of the unit (as described in section 1.2) shall be aligned as described in the provided layout plan. The feet of the first and last unit need to be engaged with the hook of the foot and therefore stick out a bit (see Figure 9). The rest of the units should be placed as illustrated in Figure 10. Make sure that all units are correctly engaged with the hook of the foot (see Figure 11)! Lift the next unit from the pallet and place it on the next feet. Continue to form the first row. To ensure the correct alignment of the whole array, continue by placing the feet of the first unit of each row on the roof surface to form an 'L'. Take the next unit and place it on the previously laid down feet and check the correct alignment. Continue to finish a column. Place the feet of the rest of the array on the roof with an appropriate unit's distance, grab the next unit and start filling the array. A well aligned VPV array should look like as illustrated in Figure 12.

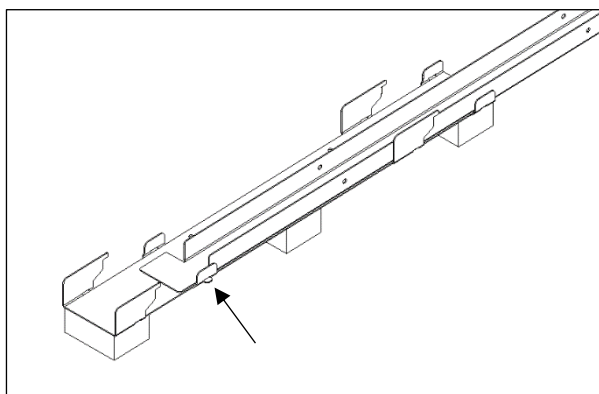


Figure 6: Cable tray placement on the first foot

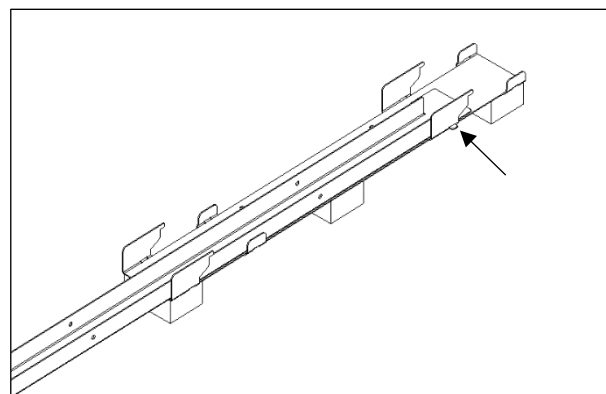


Figure 7: Cable tray placement on the last foot

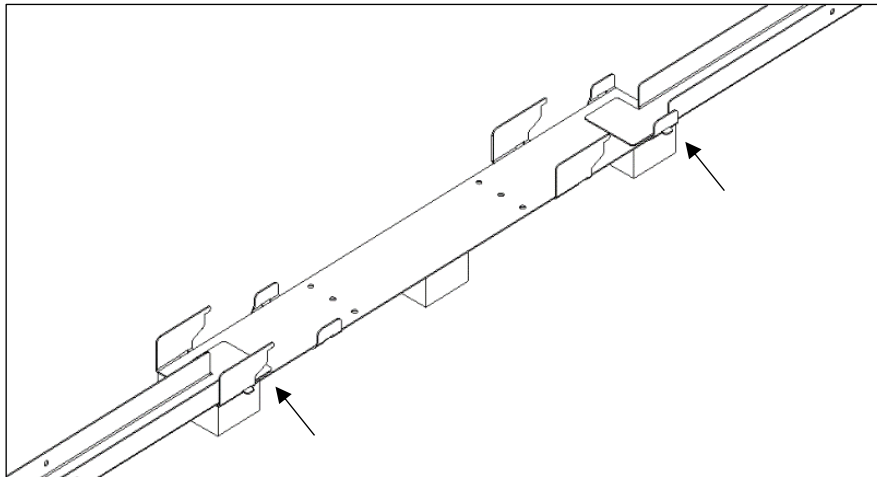


Figure 8: Cable tray placement for middle feet

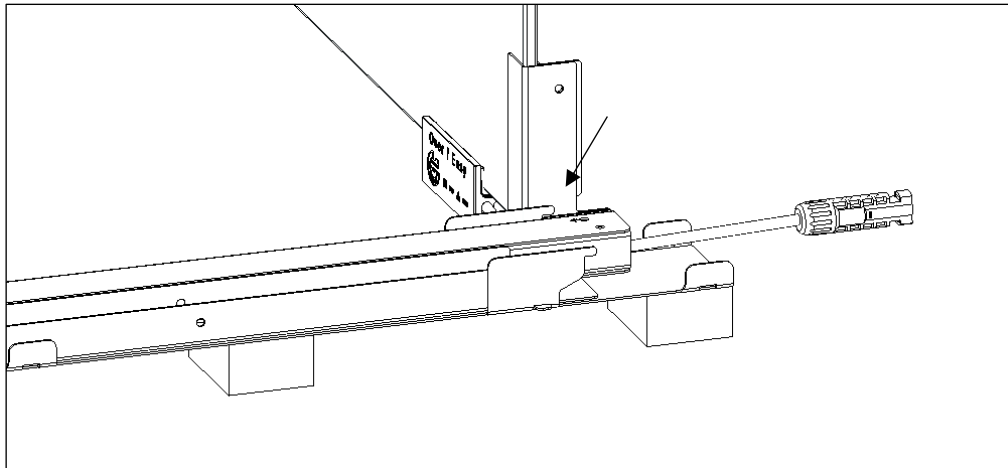


Figure 9: Unit placement of the first/last unit

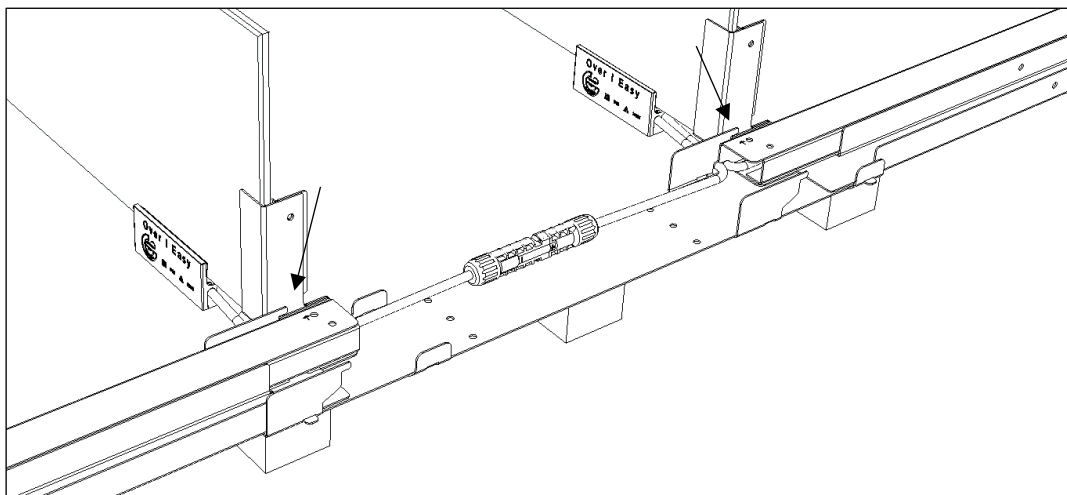


Figure 10: Unit placement on middle feet

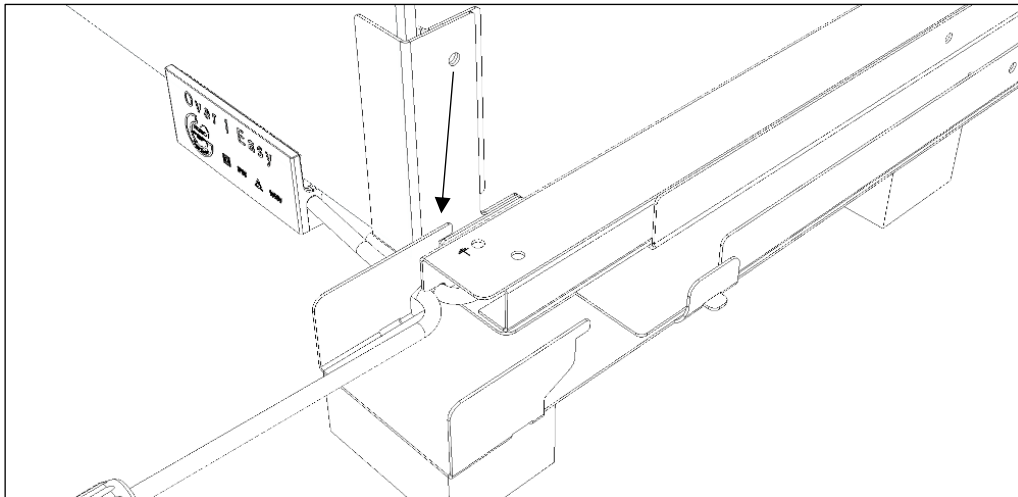


Figure 11: Correct locking of the unit

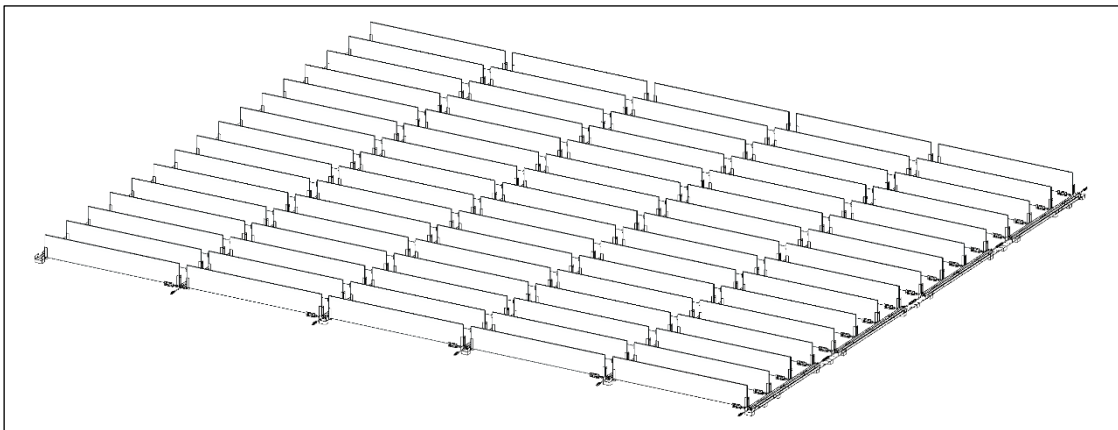


Figure 12: Finished array

3.4 Ballasting

Ballasting is not required for most VPV systems, as the vertically mounted panels of *Over Easy* do not create any vertical uplift force. In addition, the load sharing capability of the interconnected substructure allows high wind loads to be redistributed across the statically connected rows and columns, further reducing the need for additional ballast. For more detailed information, please refer to the provided wind load report and, if applicable, the ballast plan.

3.5 Wiring and connections

Once the units have been correctly installed and are in the correct location, a certified and authorized electrician may start the electrical installation. Therefore, the provided string plan for the correct wiring of the units needs to be considered. To electrically connect two units, connect the terminal of the first unit of a row to the opposing terminal of the next unit (see Figure 13).

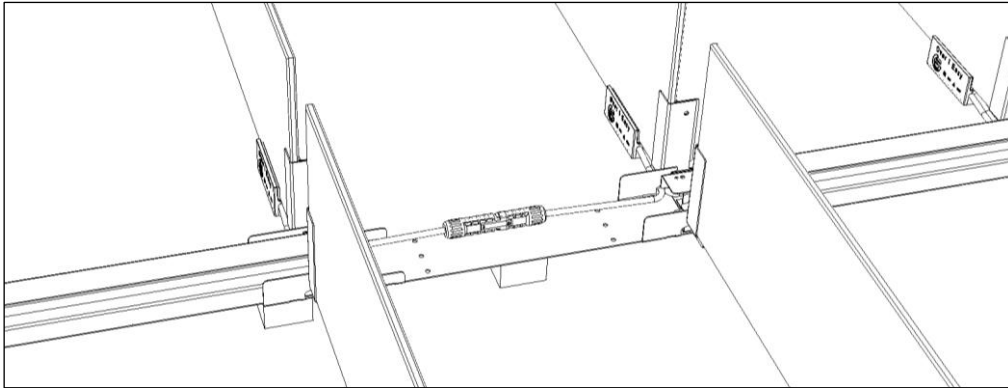


Figure 13: Electrical connection between two units

The cable management of *Over Easy* VPV units is designed in such a way that the connectors rest on the feet and do not lie on the floor and do not require fastening with cable ties.

String cables can be safely stowed in the provided shaft formed by two laterally connected units (see Figure 14) and along the outside of the outermost rows in the designated cable trays (see Figure 15).

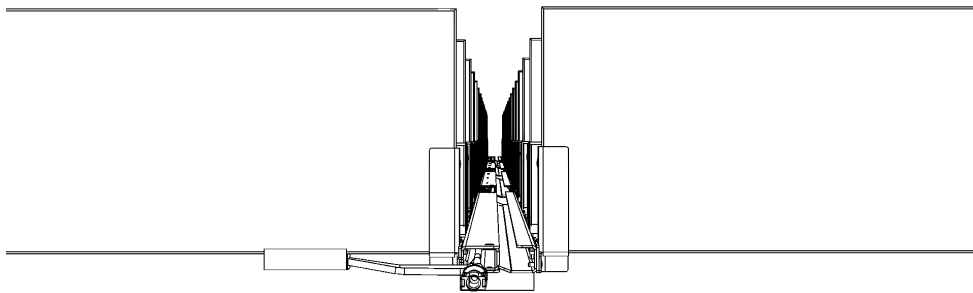


Figure 14: Integrated cable tray formed by two units

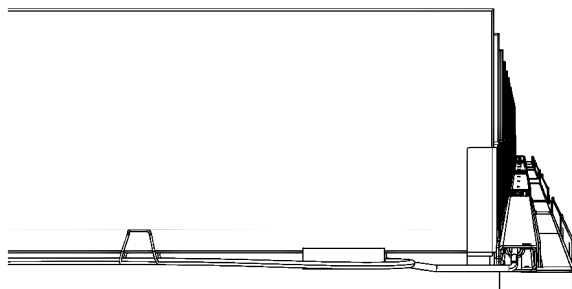


Figure 15: Cable tray along the outside of a row

Only connect the number of units in a string that corresponds to the voltage specifications of the inverters used in the system. In addition, units must not be connected to create a voltage higher than the maximum permitted system voltage stated on the panel's datasheet. A maximum of two strings can be connected in parallel without the need to incorporate an over-current protection device (fuses, etc.) in series within each string. Three or more strings can be connected in parallel if an appropriate, certified over-current protection device is installed in series within each string. To minimize risk in the event of an indirect lightning strike, avoid forming loops with the wiring when designing the system. Ensure that the wiring is correct

before starting up the system. If the measured open-circuit voltage V_{oc} and short-circuit current I_{sc} differ substantially from the specifications, this indicates a wiring fault.



Under normal conditions, a photovoltaic module is likely to experience conditions that produce higher current and/or voltage than reported at standard test conditions. Accordingly, the values of I_{sc} and V_{oc} , marked on this PV module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor current ratings, and size of controls (e.g. inverter) connected to the PV output.



The safety factor of 1.25 for the minimum voltage rating of the components can be modified during the design of a system according to the minimum temperature of the location of the installation and the temperature coefficient for V_{oc} . I_{sc} can be adjusted based on maximal temperature, irradiance and orientation of the module. To this end a full simulation for the specific location is required using long-term weather data.



The cables and connectors should not be subject to stress from the exterior. Connectors should only be used to connect the circuit, never to turn it on and off.



Connectors are not waterproof when unmated. When installing panels, connectors should be connected to each other as soon as possible or appropriate measures should be taken to avoid moisture and dust penetrating into the connector.



Only use dedicated solar cable and suitable connectors (wiring should be sheathed in a sunlight-resistant conduit or, if exposed, should be sunlight-resistant itself) that meet local fire, building and electrical regulations. Please ensure that all wiring is in perfect electrical and mechanical condition.



Installers may only use single-conductor cable with proper insulation which is able to withstand the maximum possible system open-circuit voltage.



Only copper conductor material should be used. Select a suitable conductor gauge to minimize voltage drop and ensure that the conductor's ampacity complies with local regulations.



Only units oriented in the same direction should be wired in the same string.

3.6 Grounding and lightning protection

VPV installations should comply with all applicable local electrical codes and regulations including potential equalization, grounding/earthing and lightning protection. If local regulations require equipotential bonding or grounding, *Over Easy* recommends connecting the rows with a suitable electrical conductor (wire with terminals, steel band etc.) using the grounding holes marked on the end of each beam (see Figure 16). Therefore, use flat head, thread rolling/cutting (not self-drilling) screws with the correct diameter (grounding hole: $\varnothing 5\text{mm}$, 1.2mm steel sheet) and a max. length of 15 mm. The tip of the screw should not be sharp to avoid cutting of the internal cables. Other grounding equipment like grounding clips etc. may also be used. Within the rows, the beams and feet have the necessary electrical continuity. In arrays larger than 20 units, more conductors on both sides of the units can be used. All electrical connections must be installed by qualified electricians. The grounding method must not result in the direct contact of dissimilar metals of the structural frame, which could result in galvanic corrosion. Use adequate grounding cables to connect the structural frame of the units together. The grounding hardware must not damage critical parts of the VPV unit such as brackets and solar panels. Be aware of internally routed cables. *Over Easy* does not provide grounding hardware.

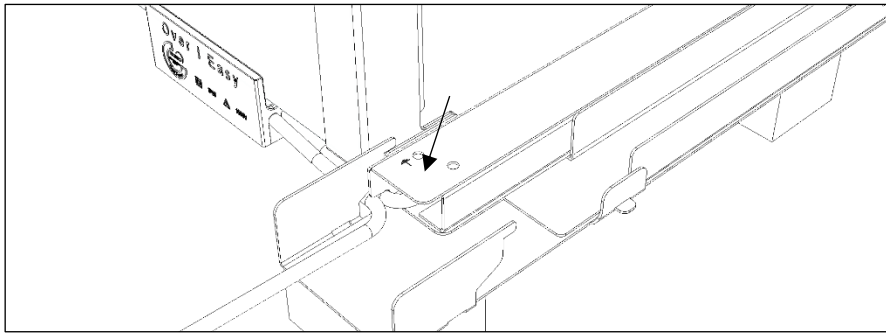


Figure 16: Marked grounding hole on one side of the beam

4 MAINTENANCE AND CARE

It is required to perform regular inspections and maintenance of the units, especially during the warranty period. To ensure optimum performance, *Over Easy* recommends the following measures.

4.1 Visual inspection

Conduct periodic inspections of the units for damage to cells, glass, structural frame, junction box, and external electrical connections.

Damage that can negatively affect the performance of the panels can be:

- Broken glass,
- Corrosion of the connections of the individual cells,
- Moisture in between the glasses,
- Formation of bubbles between the glasses,
- Burn marks in the connections.

A slight cell color difference is a normal phenomenon and does not affect the overall performance of the panel. Furthermore, check the mechanical stability of the units by visually inspecting the correct position of the beams inside the feet, the friction pads underneath the feet and the tilt angle of each individual panel.

If damage to the units has occurred, please send a brief description including a photo to info@overeasy.no and wait for further instructions.

4.2 Inspection of connectors and cables

To ensure the proper functionality of the VPV system and not to pose a security risk to any third parties, the following inspections and measures of the electrical connections must be taken:

- Check electrical connections for loose connections and corrosion,
- Cables and plugs must not touch the roof.

4.3 Cleaning

The cleaning of the unit once a year is recommended to ensure maximum performance of the VPV system. Please consider the following aspects:

- To avoid electrical and thermal shock, cleaning is recommended early in the morning or late afternoon or on a cloudy day when solar radiation is low.
- Water (with low mineral content recommended), ethanol or a conventional glass cleanser with a micro-fiber cloth can be used for regular washing or rinsing of the glass to remove dust, dirt or other deposits.
- Aggressive and abrasive cleansers or chemicals such as alkali chemicals including ammonia-based solution should not be used on cleaning the panel.
- Deposits of foreign material on the surface can be cleaned by using a wet sponge or cloth and dried in air or by using a clean chamois.
- Do not use abrasive material under any circumstances.
- Do not use high pressure water to remove dust, dirt or other deposits.

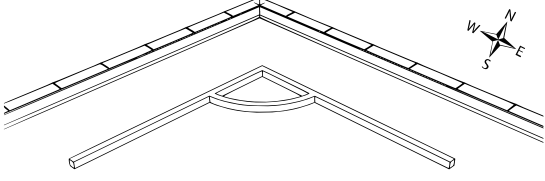
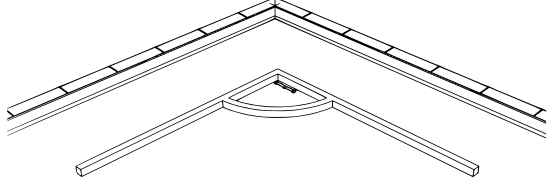
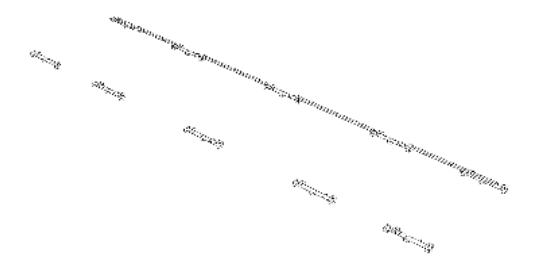
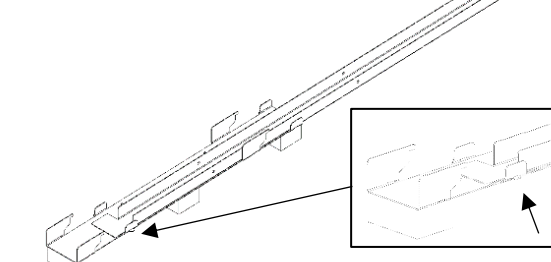
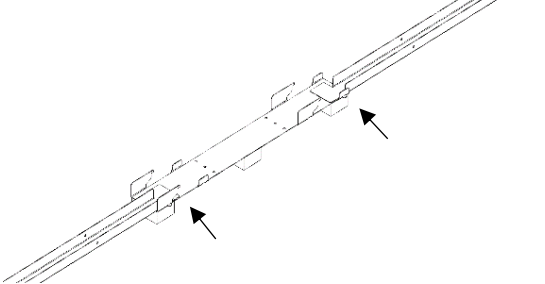
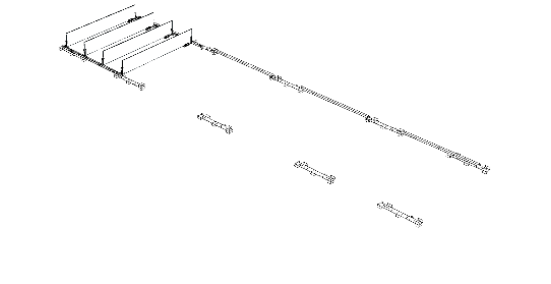
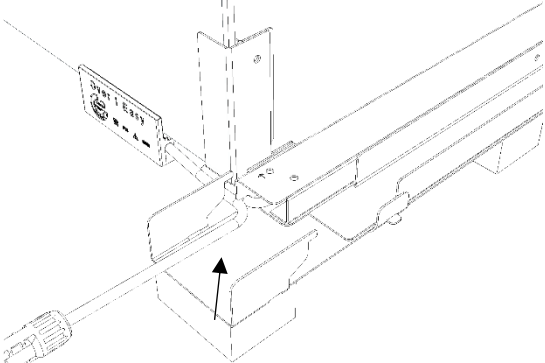
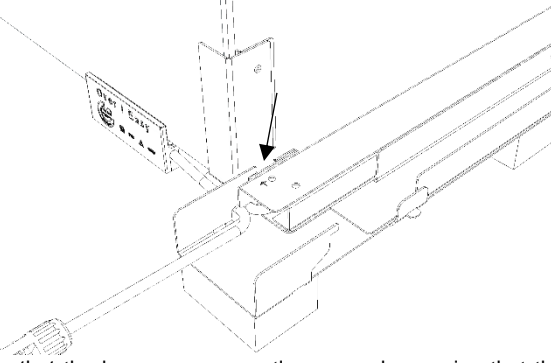
5 DISCLAIMER OF LIABILITY

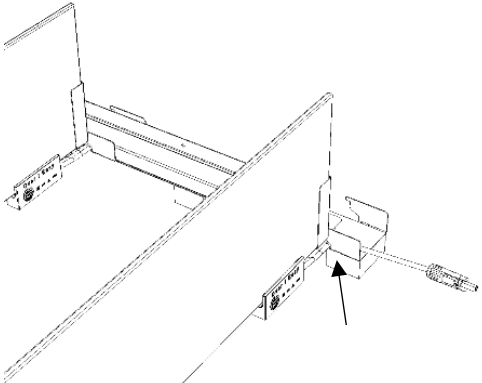
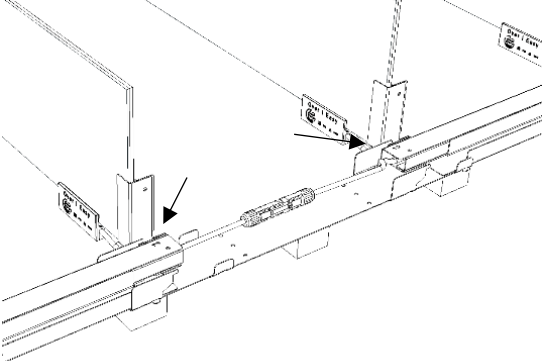
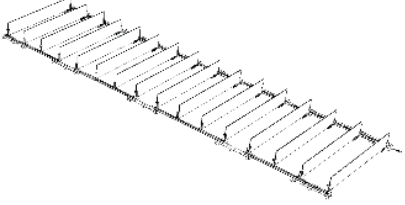
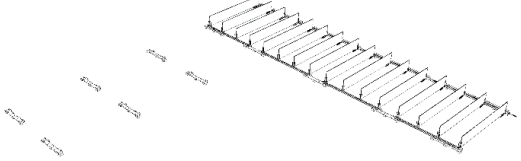
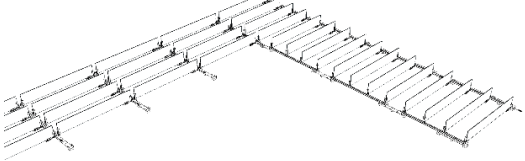
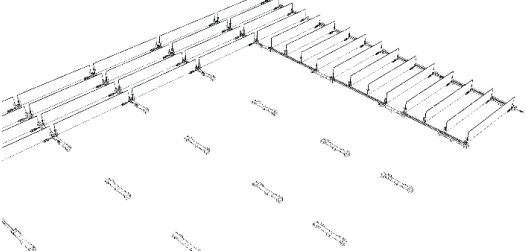
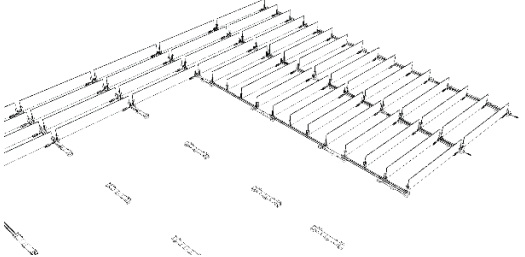
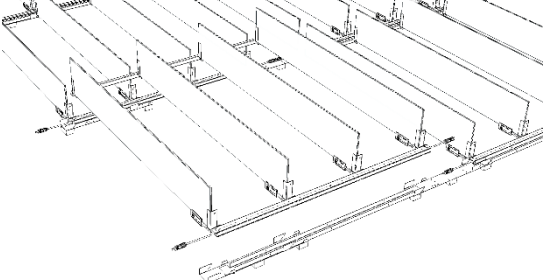
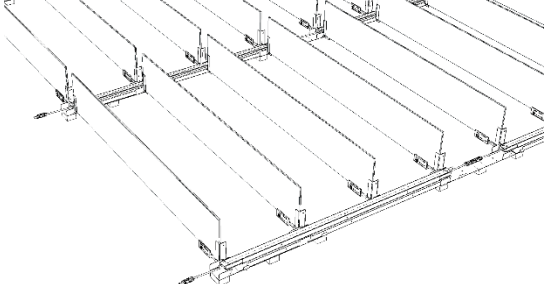
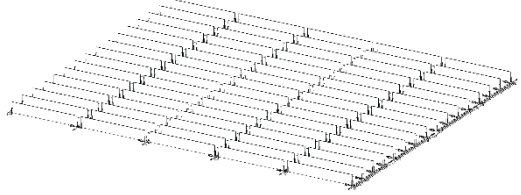
Over Easy shall not held responsible for damages of any kind, including – without limitation – bodily harm, injury or damage to property, in connection with handling VPV units, system installation, or compliance or non-compliance with the instructions set forth in this manual.

Specifications included in this manual are subject to change by *Over Easy* without prior notice. *Over Easy* gives no warranty of any kind whatsoever, either explicitly or implicitly, with respect to the information contained herein.

APPENDIX

Mounting guide

 <p>Start by measuring the distances of the array to the edge of the roof, considering the layout plan, and mark the boundaries using a laser, chalk lines, etc. Make sure they are aligned correctly and at right angles.</p>	 <p>Consult the layout plan for the correct orientation of the units and start by placing the first foot on the roof surface.</p>
 <p>Continue spreading the feet of the first row and attach the cable tray on the outside. The installation of the cable trays ensures the exact spacing of the feet for the subsequent installation of the units.</p>	 <p>The cable tray of the first and last foot is placed in the second hole.</p>
 <p>All subsequent cable trays are installed in the outermost hole of the foot.</p>	 <p>Carefully lift the first unit with two people from the pallet and place it on the previously laid down feet.</p>
 <p>When placing the units, make sure that the cable on the junction box side of the unit is placed inside the hook and ...</p>	 <p>... that the beams are correctly engaged, meaning that the hook is above the bracket.</p>

 <p>The units at the end of a row (also applies to first unit) are aligned as illustrated in the picture above.</p>	 <p>To connect two units in a row, they are placed and positioned as displayed on the picture.</p>
 <p>Lift the next unit from the pallet and place it on the feet. Continue until the first row is finished.</p>	 <p>To make sure that the array is correctly aligned, the feet of the first units of each row are now placed on the surface of the roof to form an 'L'.</p>
 <p>Place every first unit of each row on the previously laid down feet and check the correct alignment.</p>	 <p>Place the feet of the rest of the array on the roof surface with an appropriate spacing.</p>
 <p>Start filling the rows by placing the units on the designated feet.</p>	 <p>In the last row, start placing the cable supports on the feet again and then place the devices as shown in the illustration above.</p>
 <p>Make sure they are locked in placed.</p>	 <p>Continue until the array is finished.</p>

Electrical data

Registered trade name	Over Easy Solar AS		
Model	OES48-EU	OES49-EU	OES50-EU
Maximum system voltage (V_{sys})	1000 V		
Max. Power at STC (P_{max})	48 Wp	49 Wp	50 Wp
Power Tolerance	± 3 %		
Max. Power Voltage (V_{mpp})	5.10 V	5.17 V	5.25 V
Max. Power Current (I_{mpp})	9.42 A	9.47 A	9.52 A
Open-circuit Voltage (V_{oc})	5.85 V ± 3%	5.95 V ± 3%	6.05 V ± 3%
Short circuit Current (I_{sc})	10.26 A ± 3%	10.28 A ± 3%	10.30 A ± 3%
Cell Efficiency	23.9 %		
Temperature Coefficient of P_{mpp} ($\alpha_{P_{mpp}}$)	-0.26 %/K		
Temperature Coefficient of V_{oc} ($\alpha_{V_{oc}}$)	-0.27 %/K		
Temperature Coefficient of I_{sc} ($\alpha_{I_{sc}}$)	0.055 %/K		
Max. Overcurrent Protection Rating	20 A		
Fire Safety Class	Class C		

All electrical data shall be shown as relative to standard test conditions (1 000 W/m², (25±2) °C, AM 1.5 according to IEC 60904-3).

Mechanical data

Cell technology	Silicon heterojunction solar cells (HJT cells)
Cell arrangement	32 (8x4)
Dimensions (LM-2.1 QUATTRO-200S)	1600x1500x265 mm
Dimensions (HM-2.1 QUATTRO-200S)	1600x1500x345 mm
Ground clearance (LM-2.1 QUATTRO-200S)	40 mm
Ground clearance (HM-2.1 QUATTRO-200S)	120 mm
Weight (LM-2.1 QUATTRO-200S)	approx. 25 kg
Weight (HM-2.1 QUATTRO-200S)	approx. 26 kg
Roof area covered	2.4 m ² /unit
Area load	< 11 kg/m ²
Glass technology	2x3.2 mm tempered solar glass with anti-reflection surface
Structural frame	steel (Magnelis®)
Design load	1600 Pa
Safety factor	1.5
Test load @	2400 Pa

Junction box	IP-68, 4x1 bypass diode
Cables	4 mm ² solar cable, 23.5 cm long
DC connectors	IP-68
Packaging configuration	33 units per pallet

Working conditions

Ambient air temperature	-40°C to +40°C
Operating Temperature	-40°C to +85°C
Application Classification	Class A



Over Easy
Solar

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