



Installation instructions SmartSolarBox version 5.x

Copyright © 2024 Smartvolt AG, Herzogenbuchsee

All rights reserved



TABLE OF CONTENTS

1	General Information.....	3
2	Product Information.....	4
2.1	Interpretation.....	4
2.2	General disclaimer.....	4
2.3	Scope of application.....	4
2.4	Applicable standards.....	4
3	Security.....	5
3.1	Presentation of safety instructions.....	5
3.2	General and personal safety instructions.....	5
3.3	Electrical security.....	6
3.4	Safe handling of the SmartSolarBox.....	6
3.5	Buildings and regulations.....	7
3.6	Information from other suppliers.....	7
4	Layout and function.....	8
4.1	Overview.....	8
4.2	Packaging and Transport.....	9
4.3	Components.....	9
4.4	Assembly aids.....	11
5	Assembly.....	13
5.1	Preparation of the roof.....	13
5.2	Occupancy plan.....	13
5.3	Transporting the systems to the roof.....	14
5.4	Ballasting.....	17
5.5	Connecting the SSB units – electrically and mechanically.....	17
5.6	Connection of the system to an external lightning protection system.....	18
6	Maintenance.....	19
6.1	Maintenance areas and work.....	19
7	String-planning.....	20
8	Disposal.....	21
9	Register of illustrations.....	22

1 GENERAL INFORMATION

This installation guide describes the information needed to set up PV-systems with the SmartSolarBox.

The installation instructions are aimed at all people who do planning, installation and carry out maintenance and repair work on the PV-system. It must be ensured that the service life of the roof is longer than that of the PV system. Technical changes reserved.

Profile of this operating manual

Doc number	Installation instructions SmartSolarBox 5.x EN
output	22. February 2024
Language	German
Creation Date	July 27, 2023

Warranty and Guarantees

The warranty and guarantee provisions can be found in the General Terms and Conditions of Smartvolt AG or the General Terms and Conditions of our license partner from whom the system was purchased, in the actual version.

2 PRODUCT INFORMATION

These installation instructions serve as a reference for trained specialists for installing the SmartSolarBox “SSB” flat roof mounting system and only describe those aspects that apply to the SSB. Experience and the appropriate know-how for installing PV systems are required. The content of these installation instructions refers exclusively to the assembly of the components supplied by Smartvolt and describes the cabling within the SSB substructure.

This document is not a planning or design guide. Please read these installation instructions carefully before starting the installation. Failure to follow the instructions in this manual can result in personal injury and property damage. Modifying the SSB components, such as drilling holes, is prohibited.

If you have any questions, please contact Smartvolt AG.

Contact details:

Telephone: +41 62 961 92 10

Email: info@smartvolt.ch

2.1 INTERPRETATION

The system-planning for the PV-system is carried out by the customer. Smartvolt AG can provide advice.

2.2 GENERAL DISCLAIMER

No guarantee or liability is accepted for any damage caused by improper installation. Smartvolt AG declines any liability for damage caused by inadequate planning and installation, for example due to insufficiently qualified personnel.

2.3 SCOPE OF APPLICATION

The SmartSolarBox is designed for flat roofs with an inclination of up to a maximum of 5°.





2.4 APPLICABLE STANDARDS

In Switzerland, the relevant standards and regulations of the SIA, ESTI, Electrosuisse and VKF apply. In Germany, the relevant standards and the regulations of the responsible professional associations (BGV A1, BGV A2, BGV C22) must be observed.

3 SECURITY

3.1 PRESENTATION OF SAFETY INSTRUCTIONS

In these operating instructions, all warnings are marked with a signal word that indicates the degree of danger:

Signal word and color	Type of danger	Possible consequence
 DANGER	Imminent danger	Death or serious injuries
 WARNING	Potentially dangerous situation	Death or serious injuries
 CAUTION	Potentially dangerous situation	Minor injuries or property damage
 INFORMATION	Potentially damaging situation	Material damage to the product or the surrounding area

3.2 GENERAL AND PERSONAL SAFETY INSTRUCTIONS

Please note that our general installation regulations must be adhered to. Generally the following applies:

CAUTION

- Systems may only be installed and put into operation by experts who can ensure proper implementation due to their professional qualifications (e.g. training or activity) or experience.
- Before installation, it must be checked whether the product meets the static requirements on site. For roof systems, the on-site load-bearing capacity of the roof must always be checked.
- National and site-specific building regulations, standards and environmental protection regulations must be adhered to.
- Occupational safety and accident prevention regulations, corresponding standards and regulations of the professional association must be adhered to! In particular, please note:
 - a. Safety clothing must be worn (especially a protective helmet, work shoes and gloves).
 - b. When working on the roof, the regulations for work on the roof must be observed (e.g. use of: fall protection, scaffolding with safety gear from an eaves height of 3 m, etc.).
 - c. The presence of two people is mandatory for the entire assembly process in order to ensure quick help in the event of an accident.
- The SmartSolarBox is constantly being further developed. Assembly processes might change.
- The potential equalization between the individual parts of the system must be carried out in accordance with the respective country-specific regulations.
- If our installation instructions and installation instructions are not followed and not all system components are used, as well as when installing and removing components that were not purchased from us, we assume no liability for any resulting defects or damage. The warranty is excluded in this respect.

- Smartvolt AG reserves the right to exclude liability if our general safety instructions are ignored or if components from other suppliers are installed or attached.
- The system dismantling shall be executed in the reverse order.

3.3 ELECTRICAL SECURITY

A PV-module generates electrical current and voltage even at low levels of illumination. Disconnecting a closed circuit can cause sparks and arcs. These can cause life-threatening injuries. This risk increases when several modules are connected in series.

DANGER

- PV-modules are always under electrical voltage when there is light.
- Danger to life due to electric shock and arcing.
- Risk of fire and injury from electric shock.
- The PV-modules can only be protected at the DC switch; in the event of an error (short circuit, ground fault) the DC side will still be live.
- When connectors are disconnected under load, non-extinguishing arcs can occur.
- Do not insert any (electrically conductive) parts into plugs or sockets of the PV-modules.
- Do not mount PV-modules and cables with wet connectors.
- Tools and working conditions must be dry.
- All work on the lines should only be carried out by qualified personnel.
- Improper installation can lead to fire.
- Keep children away from PV-modules, inverters and other live components of the system.

3.4 SAFE HANDLING OF THE SMARTSOLARBOX

The packaging is designed to ensure safe transport and installation. The intended and certified lifting aids must always be used for installation. Please read the manual «Operational Manual LAM-SSB5» carefully before using the lifting aids.

CAUTION

- Do not disassemble PV-modules or the SSB units.
- Do not treat PV-modules with paint, adhesives or sharp objects.
- Do not clean PV-modules with cleaners containing solvents.
- greatest care when handling the SSB units .
- Always transport the SSB units in the intended transport-box.
- Always move the SSB units using a crane.

- Do not use the junction box and the connection cables as a handle.
- Do not put pressure on, step on or drop PV-modules.
- Do not handle PV-modules with sharp objects, for example when unpacking them.
- Always keep all electrical contacts clean and dry.
- Intermediate storage only in dry rooms.

3.5 BUILDINGS AND REGULATIONS

It is the responsibility of the installer to observe the general conditions of the building.

⚠ CAUTION

- Before installing the system, check the static stability of the building and the roof structure on which the PV-system is to be erected.
- Before installing the system, check the general condition of the intended compartment roof.

3.6 INFORMATION FROM OTHER SUPPLIERS

The instructions and assembly instructions from other suppliers must also be observed.

⚠ CAUTION

- The manufacturer's safety instructions, such as those of the inverter manufacturer and other system components, must be followed.
- Observe the respective assembly instructions.

4 LAYOUT AND FUNCTION

4.1 OVERVIEW

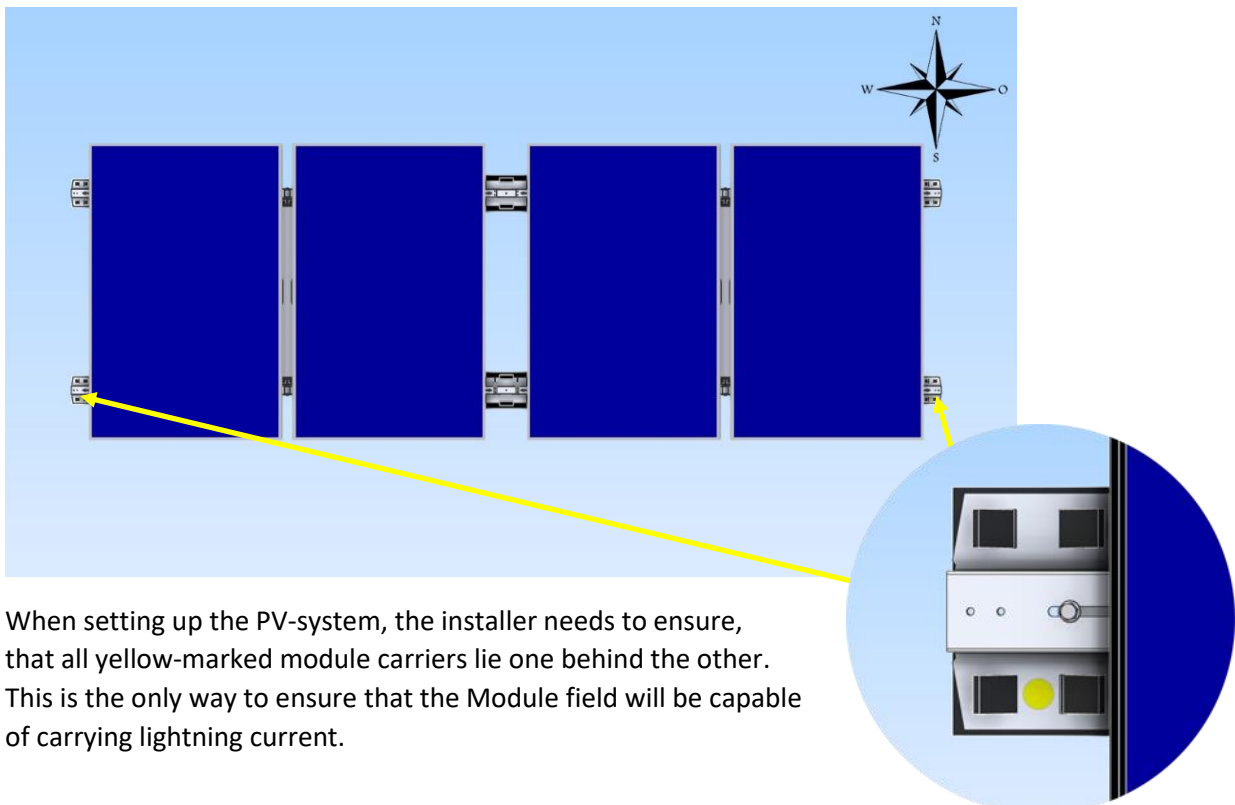
A SmartSolarBox basically consists of photovoltaic modules, a substructure with building protection mats and ballast stones. The photovoltaic modules are pre-wired and the ballast stones are already integrated.



Figure 1: SSB unit with 4 PV-modules (SSB4)

Depending on the roof conditions, SSB units with only 2 PV-modules may also be used (SSB2).

The SmartSolarBox is delivered either in a standard or lightning current capable version. The variant lightning current version is capable of carrying the lightning current along a module carrier in east-west direction. The module carrier, which is designed to carry lightning current, is marked with a **yellow dot** during production.



When setting up the PV-system, the installer needs to ensure, that all yellow-marked module carriers lie one behind the other. This is the only way to ensure that the Module field will be capable of carrying lightning current.

4.2 PACKAGING AND TRANSPORT



The folded SSB units are delivered in special transport boxes. A transport box usually holds four SSB4 units or eight SSB2 units.

Figure 2: Transport box for four SSB4 units

INFORMATION

Note : The SmartSolarBox units may only be transported in the transport boxes provided. The boxes are designed for this purpose and protect the goods and people from damage or accidents.

4.3 COMPONENTS

The following section describes the various components that have to be connected to the SmartSolarBoxes during system installation on the roof. The M6 locking screws required to assemble the system will be delivered with every project.

4.3.1 Ballast stone outside

Depending on the system design and wind loads, the outside ballast stone is usually installed at the end of the SSB rows between the two outer feet. The exact location in the system can be found on the assembly plan.

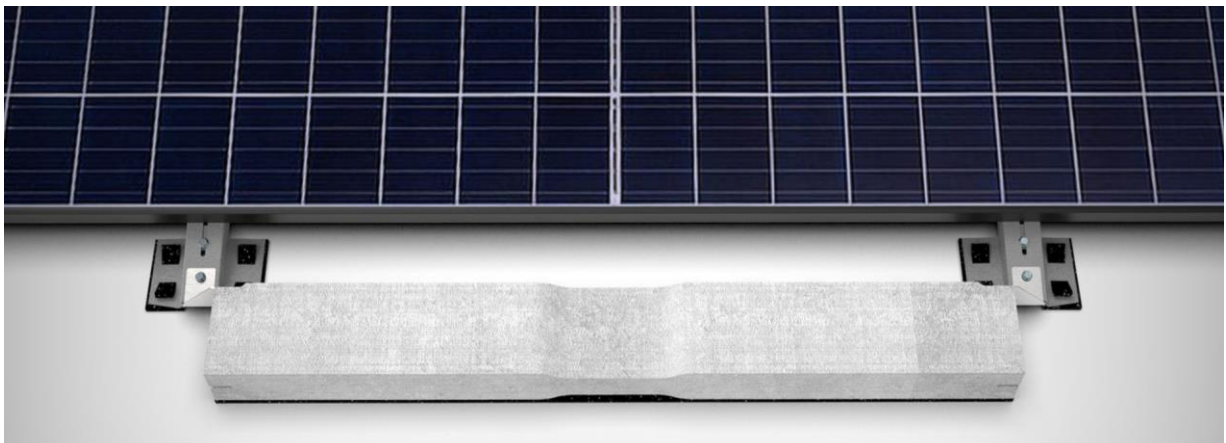


Figure 3: Ballast stone outside including mounting plates

4.3.2 Horizontal connection set

Mechanical and electrical connections are made possible via connecting plates.



Figure 4: Universal connector

The horizontal connecting plate is used to connect adjacent SSB rows to one another. The position of the connectors can be seen in the layout plan and must be strictly adhered to.

4.3.3 Connecting plate SSB set

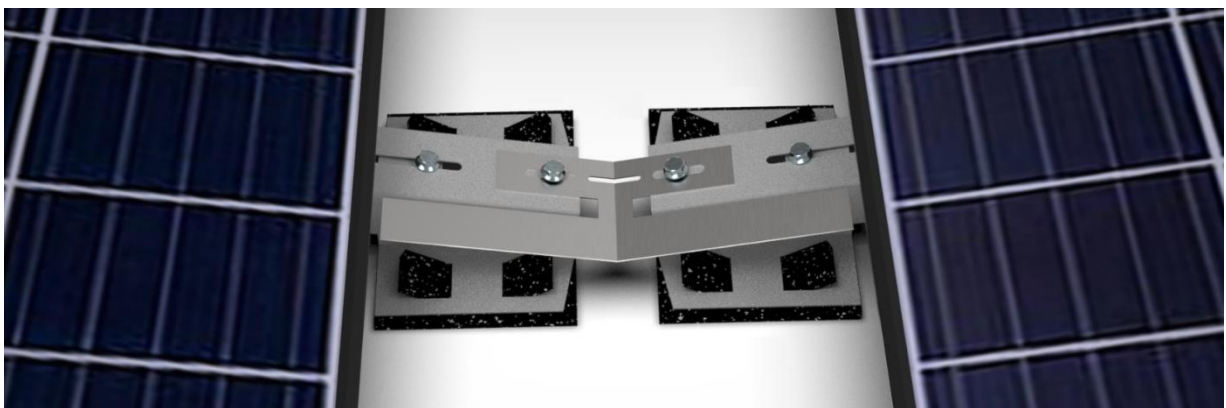


Figure 5: SSB connecting plate

SSBs standing one behind the other are connected to one another using the SSB connecting plate. The DC cables are attached to the protruding tab using a cable clip and are thus protected from direct UV radiation.

⚠ WARNING

The connecting plates are for safety and must be installed . They form a coherent module field so that together with the ballast stones they can withstand the wind loads. The mounting plates must be installed in the system according to the plan. If these have not been installed or have been installed incorrectly, there is a risk that the system will be damaged by high wind loads or that parts of the system will be carried away by the wind.

4.3.4 Jumper cable

The supplied pre-assembled jumper cables are used to electrically connect adjacent SSBs at the end of the row.

4.4 ASSEMBLY AIDS

Installation is always carried out using a crane and the LAM-SSB5-F load handling device. The LAM-SSB5-F has been tested and certified by TÜV and can therefore be used for this load. The assembly aids are delivered to the construction site in a separate transport box together with a print-version of the operation manual and will be provided for the assembly of the system. Once the assembly has been completed, these will be sent back together with the empty transport boxes of the SSBs.



Figure 6: Transport box assembly aids

4.4.1 Crane beam LAM-SSB5-F for the installation of PV-systems



Figure 7: LAM-SSB5-F load handling device

The LAM-SSB5-F has a return spring, which ensures that spontaneous opening is prevented while the SSB is being lifted by crane.

⚠ CAUTION

Caution : The LAM-SSB5-F may only be used to lift a single SSB unit at a time. It is not permitted to attach other loads to it - other suitable slinging devices, such as a tested loop lifting strap, must be used. Before attaching an SSB for the first time with the LAM-SSB5-F load handling device, the supplied operating manual must be studied to prevent incorrect operation.

⚠ WARNING

Warning : The LAM-SSB5-F is approved and certified for a maximum load of **175 kg** at a time.

4.4.2 Distance gauge

During installation, the distance gauge can be used to maintain the 4cm distance between two units. This simplifies the assembly of the connecting plates.



Figure 8: Distance gauge

5 ASSEMBLY

5.1 PREPARATION OF THE ROOF

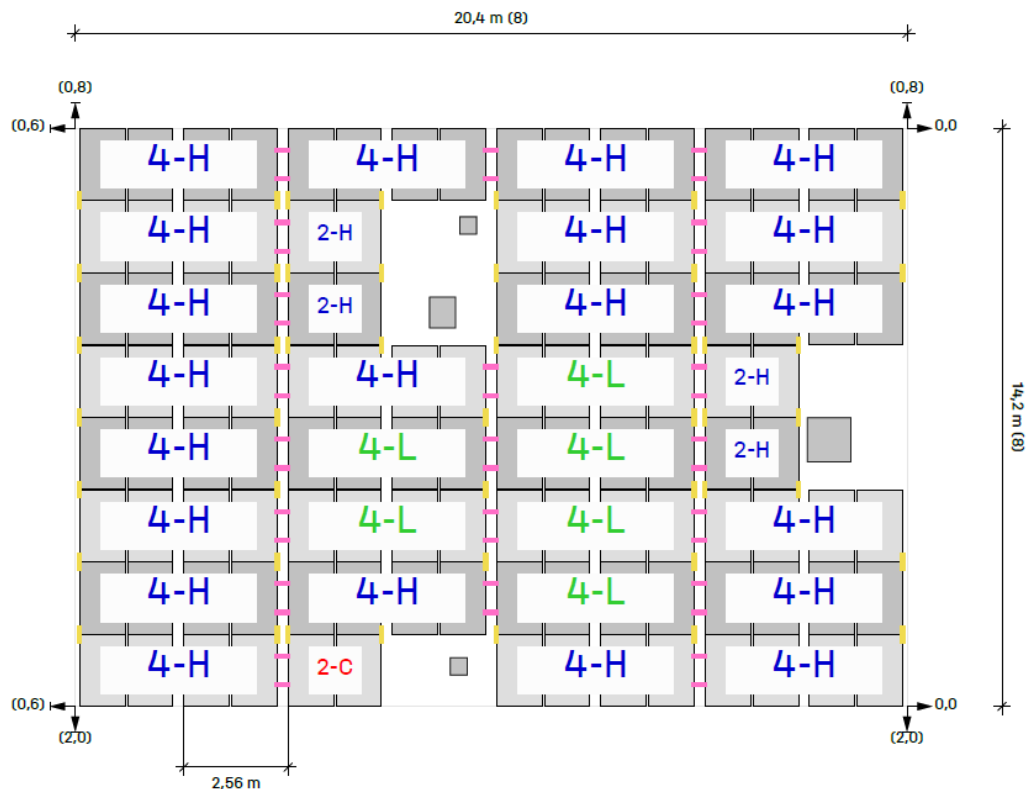
- The SSB units should be mounted on a surface that is as flat as possible.
- Plants and other disturbing objects must be permanently removed before installation.
- Depending on the respective substrate and the roof structure, parts of the substrate may have to be removed.

INFORMATION

Note : We always recommend the use of a floor fabric to be placed underneath the system in order to minimize maintenance work on the solar system in the long term.

5.2 OCCUPANCY PLAN

Planning a PV-system with the SmartSolarBox is carried out by using the K2-Base planning tool (<https://base.k2-systems.com/>). The system can be installed on the roof according to the assembly plan in the PDF report from K2-Base. The edge distances and the position of the differently ballasted SSB systems must be strictly adhered to:



The ballast variants **Light** and **Heavy** and **Corner** are marked in color each as a 2 or 4 element. The horizontal connection sets (section 4.3.2, page 10) are shown in **pink**, the connecting plate set SSB (section 4.3.3, page 10) be found in **yellow** on the plan.

5.3 TRANSPORTING THE SYSTEMS TO THE ROOF

The installation of the SSB units is explained in the following steps.

The position of roof objects must be considered and, if necessary, these should be selected as the starting point. Basically, the procedure should be chosen in such a way that the field position is determined first.

5.3.1 Delivery

The installation is carried out according to the k2-Base assembly plan. It is important to ensure that the units are delivered in the desired order and can be lifted by crane.

Delivery takes place in the designated transport boxes, which must be returned after installation.



Figure 9: Delivery in SmartSolarBox transport boxes

5.3.2 Lifting an SSB unit

Only trained persons are allowed to work with the LAM-SSB5-F. Further information about the load handling device can be found in the operating manual provided.

The SmartSolarBox4 is attached using two LAM-SSB5-F. One unit is then lifted vertically out of the packaging per crane lift.

CAUTION

Caution : When transporting SmartSolarBox2 systems that are attached with a single LAM-SSB5-F, the second load handling device must be removed from the crane hook. Unused load handling equipment hanging on the crane can cause mechanical damage to the PV-modules.

5.3.3 Procedure on the roof

1. Determine the starting corner and edge distance - mark the longitudinal and transverse directions with a guideline (green) - then mark the middle of the SSB for the first SSB at a distance of 2.54m from the edge (red).

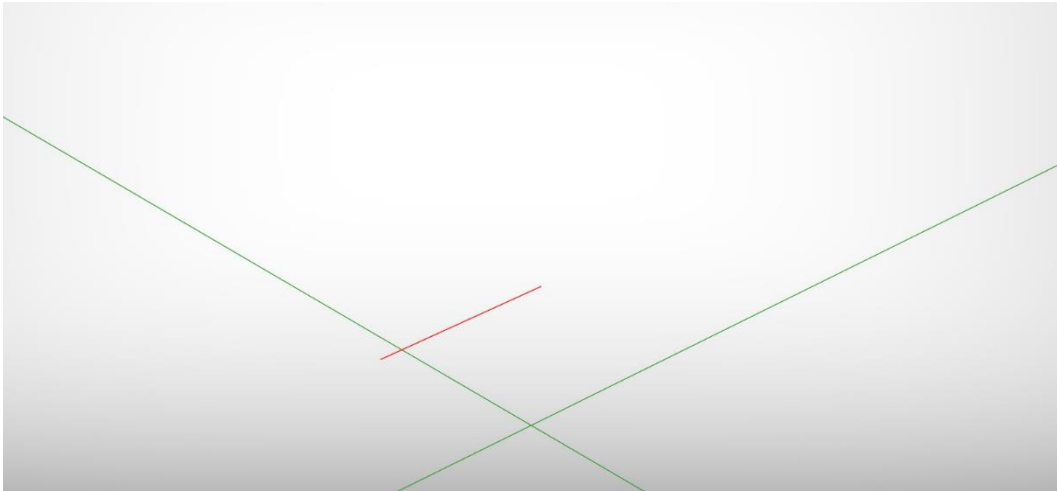


Figure 10: Starting corner with guideline

The correct angle of the guidelines across can be tested with the diagonal.

INFORMATION

Note : Before setting the first SSB, study the occupancy plan again and, if necessary, measure individual obstacles once more. For a SmartSolarBox capable of carrying lightning current, align the SSB so that the module carrier capable of carrying lightning current lies on the desired side (marked with a yellow dot on the outer feet). It is important that each additional SSB is aligned identically in the longitudinal and transverse rows, as 4.1

2. Place the first SSB with the central feet on the red marking and unfold it.



Figure 11: First SSB unit placed

3. Set up the first row; The distance of 4cm must be maintained using the distance gauge (see Figure 8, page 12).

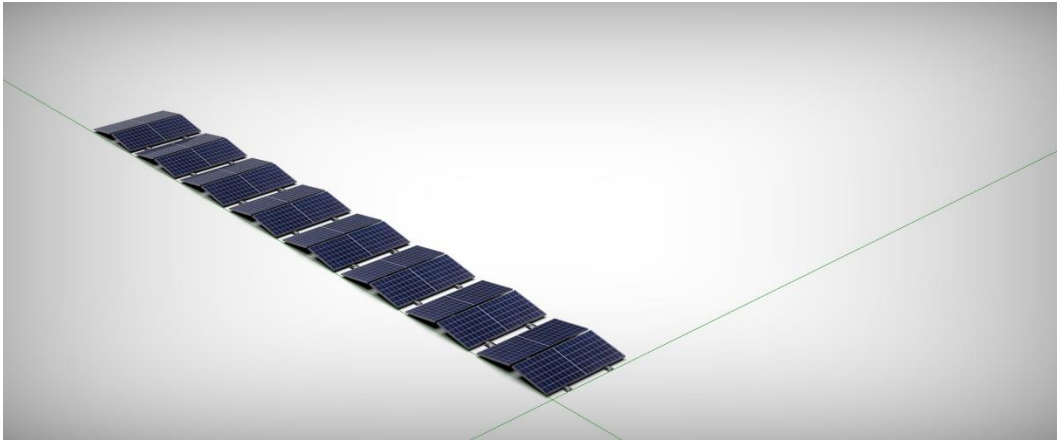


Figure 12: First longitudinal row constructed

4. Fill the field across the cross row. Distance between the PV-modules 1 cm.

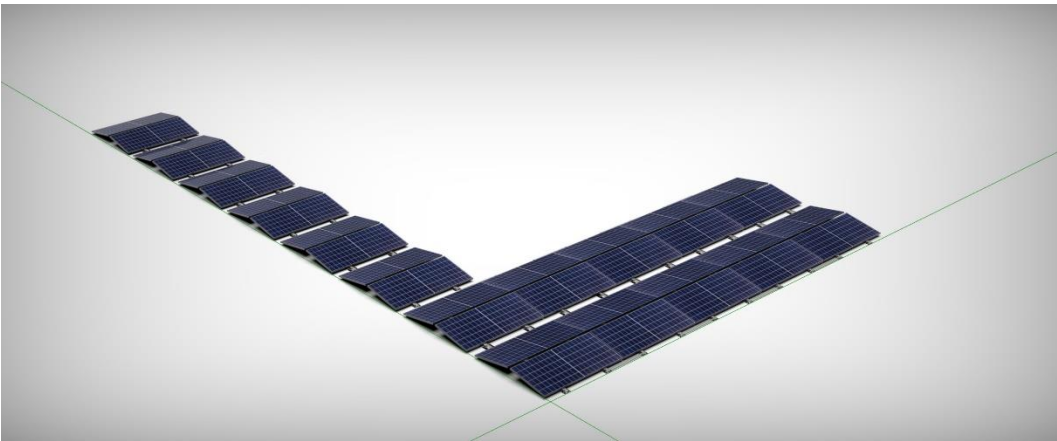


Figure 13: Fill transverse rows

5. Fill field

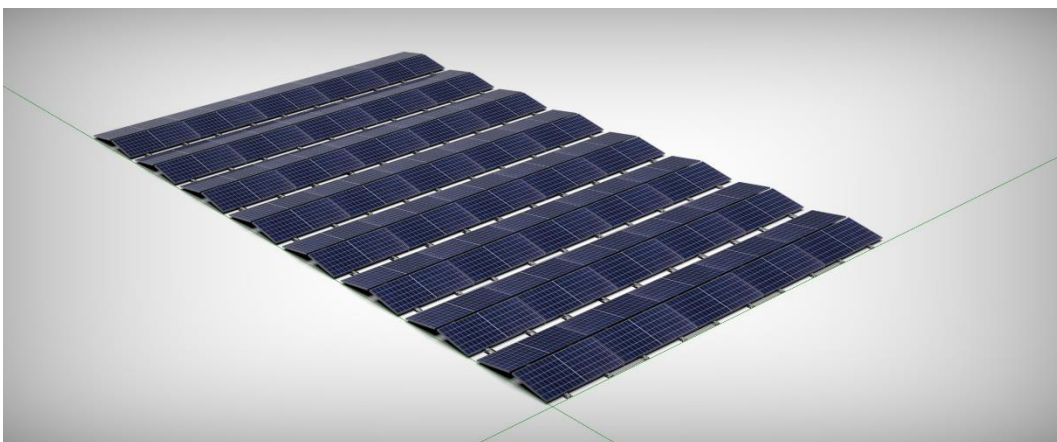


Figure 14: PV field filled

6. The SSB units are released from the load handling device after being set down. While the crane brings the next unit for installation, the electrical and mechanical connections can already be installed. More about this in Chapter 5.5, page 17.

5.4 BALLASTING

The ballasting was determined in advance. The exact location is therefore specified for each unit. It is important to ensure that the assembly plan is adhered to. Smartvolt AG declines any liability in the event of incorrect placement.

5.5 CONNECTING THE SSB UNITS – ELECTRICALLY AND MECHANICALLY

After the SSB units have been placed on the roof, the units are connected to each other mechanically and electrically. To do this, the DC cables fixed under the modules with metal clips are detached from the module and connected to the respective cables of the next SSB. Since the connection cables are of different lengths, only one plug connection is located on the right and left of the connecting plate SSB under the PV-modules.

As soon as the electrical connection has been established, the SSB connecting plate and, if necessary, also the connecting plate horizontally (the positions are marked in the assignment plan) can be fixed with the M6 locking screws provided.

Finally, the DC cables on the left and right are fixed with the metal clips underneath the wing of the connecting plate SSB. The connection is now established and the cables are protected from UV radiation.



Figure 15: Correctly attached DC cabling

The M6 thread inserts for the fastenings are attached to the feet of the module carriers.

At the beginning of the string, the connection cables are not connected to the next SSB, as the supply lines to the inverters will be connected there in the next step. At the string end, the two DC cables on each side are plugged together, thus closing the return line. The cables are then attached under the module frame using the metal clip. In this case, the connecting plate SSB remains empty.

INFORMATION

Note : During stringing, be sure to pay attention to the string plan (to be created by the installer or planner) to prevent errors. As soon as the SSB connecting plates are installed, it is almost impossible to get underneath the modules in order to close or release the plug connections there.

⚠ CAUTION

Caution : In larger systems, thermal separation lines must be maintained at certain intervals. The horizontal and SSB connecting plates may not be installed on these dividing lines. It is important that if there are thermal separation lines, the DC cables should still be protected from UV radiation!

5.6 CONNECTION OF THE SYSTEM TO AN EXTERNAL LIGHTNING PROTECTION SYSTEM

The SmartSolarBox is delivered either in a standard or lightning current version. The variant capable of carrying lightning current can handle lightning-current along a module carrier in an east-west direction. The module carrier, which is capable of carry lightning current, is marked with a **yellow dot** at the factory .

The connection to the external lightning protection system is described in a separate document and can be found on the page <http://smartsolarbox.com/en/downloads> .

6 MAINTENANCE

⚠ WARNING

Warning : We would like to point out that all manipulations, including dismantling the photovoltaic system, may only be carried out by trained personnel.

⚠ WARNING

Warning: When working on the inverters, the DC connections to the inverter must be disconnected. **There are life-threatening voltages of up to 1500 volts DC or 400 volts AC** at the inverter terminals! Wait until the capacitors have discharged. It is mandatory to follow the instructions in the inverter manual! In the event of discrepancies, instructions from the inverter manufacturer take precedence!

⚠ WARNING

Warning: Before disconnecting any DC connections in the solar cell field, the inverter of the corresponding string must always be switched off!

6.1 MAINTENANCE AREAS AND WORK

- The SmartSolarBox substructure is maintenance-free.
- Maintenance work on the PV-modules should only be carried out by qualified personnel.
- Maintenance work on the electrical system should only be carried out by qualified personnel.
- The cleaning of the PV-modules may only be carried out by trained personnel who are secured in accordance with current regulations.

7 STRING-PLANNING

The internal wiring of the modules within the SmartSolarBox enables easy connection of the SSBs in the system:

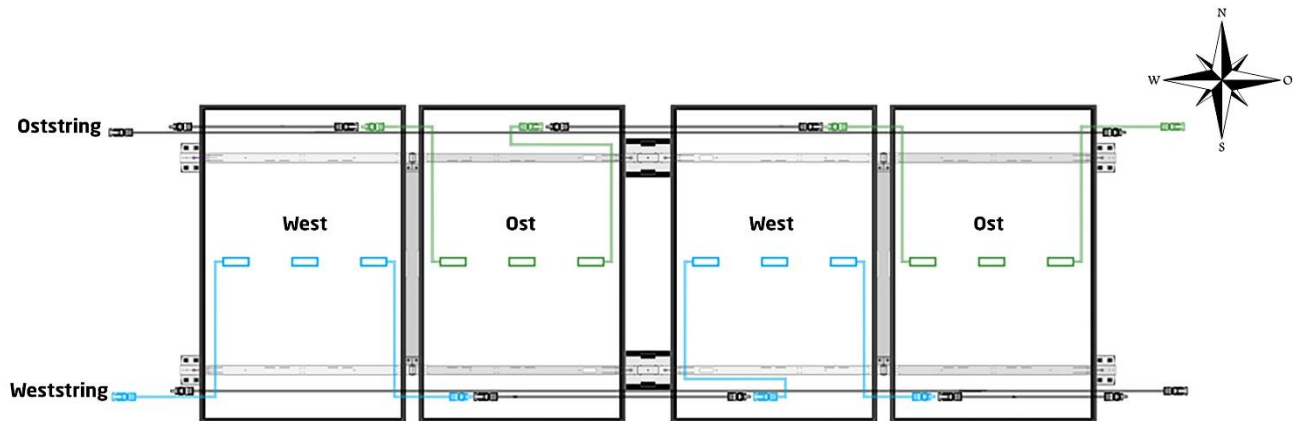


Figure 16: SSB4 – internal connection

The integrated return-cable ensures that no loops can arise within the string. The start of the string is connected to the inverter using the + and - lines. Within the string, the SSBs in a row are simply connected to the next SSB using 4 plug connections each. At the end of the string, the two plugs of a string are then simply connected to each other, thus closing the string.

INFORMATION

Note : Terminating a string is only possible at the end of a SSB - separating a string in the middle of a SSB4 is impossible. If, during string planning, a string end ends up in the middle of a SSB4, this SSB4 must be replaced by 2 pieces SSB2 with the same ballasting.

8 DISPOSAL

INFORMATION

Note : Recycling (<http://www.erecycling.ch/>) in Switzerland is organized simple and efficient. You can return all of your old large and small electrical and electronic appliances, toys, lamps and lights to over 450 collection points in your area and to retail sales points at any time and, of course, free of charge.

INFORMATION

Note : Where is recycling done? You can find the nearest return point in two steps via <http://www.erecycling.ch/wo-wird-recycelt> :

Nächste Rückgabestelle finden

Schritt 1: Wählen Sie die Gerätekategorie an, aus welcher Sie Geräte zurückbringen möchten (gleichzeitig maximal 3 Gerätekategorien möglich).



Schritt 2: Geben Sie den Ort oder die Postleitzahl ein, um die nächsten Rückgabemöglichkeiten anzuzeigen.

- All components collected during disassembly of the system must be disposed of in accordance with local disposal guidelines.
- Disposal at the end of its useful life must be carried out by qualified personnel or an external service provider. To do this, the locally applicable regulations on environmental protection, recycling and disposal must be observed.

9 REGISTER OF ILLUSTRATIONS

Figure 1 : SSB unit with 4 PV-modules (SSB4)	8
Figure 2 : Transport box for four SSB4 units	9
Figure 3 : Ballast stone outside including mounting plates	10
Figure 4 : Universal connector	10
Figure 5 : SSB connecting plate	10
Figure 6 : Transport box assembly aids	11
Figure 7 : LAM-SSB5-F load handling device	11
Figure 8 : Distance gauge	12
Figure 9 : Delivery in SmartSolarBox transport boxes.....	14
Figure 10 : Starting corner with guideline.....	15
Figure 11 : First SSB unit placed	15
Figure 12 : First longitudinal row constructed	16
Figure 13 : Fill transverse rows.....	16
Figure 14 : PV field filled.....	16
Figure 15 : Correctly attached DC cabling	17
Figure 16 : SSB4 – internal connection.....	20