Solar Systems
Installation / Operating Manual

Attachment of Standard PV Modules to Schüco SolarEZ™ Mounting System

SCHÜCO

Installation/Operating Manual: Art. No. 232 085. We reserve the right to make changes; 05.2006

Preface / Installer Responsibilities

Thank you for choosing Schüco Solar products. Should these installation and operating instructions not answer all your questions, please contact your Schüco specialist.

PLEASE REVIEW THIS MANUAL THOROUGHLY BEFORE INSTALLATION.

YOU, THE INSTALLER, ASSUME COMPLETE AND ABSOLUTE LIABILITY AND RESPONSIBILITY FOR FOLLOWING THE SPECIFIC PROCEDURES SET FORTH IN THIS INSTALLATION MANUAL.

MAKE SURE YOU UTILIZE ALL NECESSARY SAFETY EQUIPMENT, AS REQUIRED BY APPLICABLE RULES AND REGULATIONS, OR AS REQUIRED BY COMMON SENSE.

Schüco is not responsible for your failure to follow these approved procedures, or to use professional standards of care and common sense in handling Schüco products or following these procedures. Schüco is not responsible for any unauthorized changes, additions or alterations you make to the design of a product or to the installation method for any product, or the results from such unauthorized changes.

Incorrect usage can result in serious injury or death to the user or a third-party and damage the product. Schüco shall not be liable for any damage arising from incorrect usage.

Any work you perform must be adapted to suit conditions on site and must be in accordance with technical and local regulations, as well as all applicable state, and federal laws and regulations. Installation must be carried out only by technically qualified and authorized professional personnel who possesses the required licensing, if applicable.

Be advised that the installation of solar units may require increased rain resistance measures with regard to skylights, walls and sealing technology and this must be taken into account accordingly.

When installing PV modules on SolarEZ™ please note:
- Solar modules are live electrical power sources when ex- posed to light.
- Arrays of many modules can cause lethal shock and burn hazards.
- Solar modules should be covered with an opaque material during installation to avoid shocks or burns.
- Do not touch live terminals with bare hands.
- Use insulated tools for electrical connections.

You should be familiar with construction standards established by the Occupational Safety and Health Administration (OSHA).
The following is a partial list of relevant national codes. Schüco makes no warranty as to the completeness of this list:

- 2001 Code of Federal Regulations, Chapter 29, Part 1926: Safety and Health Regulations for Construction. U.S. Department of Labor / OSHA, www.osha.gov

The OSHA rules most relevant to solar installations include:

Subpart D - Occupational Health and Environmental Controls
Subpart E - Personal Protective and Life Saving Equipment
Subpart P - Tools, Hand, and Portable Power Tools
Subpart Q - Welding, Cutting, Brazing

In addition you should have knowledge of national codes related to solar system installation. Various codes that are used throughout the United States are:

- 2003 International Plumbing Code
  International Code Council Inc., www.iccsafe.org
- 2003 Uniform Plumbing Code
  International Association of Plumbing & Mechanical Officials (IAPMO), www.iapmo.org
- 2000 Uniform Solar Energy Code
  International Association of Plumbing & Mechanical Officials (IAPMO), www.iapmo.org
- 2002 National Electrical Code, NFPA 70 or 2002 National Electrical Code Handbook National Fire Protection Association, www.nfpa.org
- The NRCA Roofing and Waterproofing Manual, 5th Edition
  National Roofing Contractors Association, www.nrca.org

The installer is solely responsible for:
- **Complying** with all applicable local or national building codes, including any that may supersede this manual
- **Ensuring** that this product is appropriate for the particular installations and is designed for the installation environment
- **Ensuring** that the roof, its rafters, connections, and other structural support members can support the array under live load conditions
- **Ensuring** that lag screws have adequate pullout strength and shear capacities
- **Maintaining** the waterproof integrity of the roof including selection of appropriate flashing
- **Ensuring** safe installation of all electrical aspects or all plumbing aspects of the solar thermal system

Use SolarEZ™ Installation Manual to attach ezRails on pitched roofs.
Afterwards follow instructions given in this manual on how to install Standard PV modules.

This manual may be amended at any time by SCHÜCO. Please check with us on a regular basis for any updates or amendments to this document.

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General Information And Safety

The installation of PV modules requires a great degree of skill and should only be performed by a qualified licensed professional, including (without limitations) licensed contractors and licensed electricians. The installer assumes risk of all injury that might occur during installation, including (again without limitation) the risk of electric shock.

- Module installation should be performed by qualified personnel, being familiar with electricity and electric appliances. Children should not be allowed near the solar electric installation.
- It is recommended that the module remain packed in the box until time of installation.
- A module generates DC current when exposed to sunlight or other light sources.
- Before installing a module contact the appropriate authorities to determine permit, installation and inspection requirements which should be followed.
- Refer to national and Local Codes (US: National Electric Code, NEC) for installation of the PV module.
- Electrically ground module(s) for all systems of any voltage.
- DO NOT use modules of different configurations in the same system.
- DO NOT use the PV module where failure would result in death or fatal injury or damage to property.
- Confirm that PV module conforms to the requirements for the equipment used in the total system.
- Follow all safety precautions of other used components.

General Handling / Cautions During Installation

- Always handle the PV module with care.
- DO NOT disassemble the PV module or remove any part or label installed by the manufacturer.
- DO NOT bend the PV module.
- DO NOT walk on the PV module.
- DO NOT impact on front or rear surface of the PV module.
- Rear surface may be damaged by sharp objects.
- DO NOT treat the back of the module with paint or adhesives.
- DO NOT throw and drop the PV module or allow objects to fall on it.
- Never leave a module unsupported or unsecured. If a module should fall, the glass may break.
- DO NOT use damaged PV modules. The damaged PV module may cause a fire and/or an electrical shock that result in death of users or installers.
- Avoid electrical hazards when installing, wiring, operating and maintaining the PV module.
- DO NOT touch live parts of cables or connectors. Use appropriate safety equipment (insulated tools, insulating gloves, etc.), when touching them.
- DO NOT expose artificially concentrated sunlight on the PV module.
- Cover the front surface of the PV module by an opaque cloth or other material when installing.
- The PV module exposed to sunlight generates high voltage and current. Contact with the module output wiring may cause a fire or an electrical shock.
- Ground securely the PV modules and the mounting structures respectively.
- Install the PV modules so as not to cause accidents that result in death, injury or any damage to property by accumulated snow falling from the PV module.
- Work only under dry conditions, with a dry module and dry tools.
- Fasten the PV modules to the mounting structures firmly so that they are not affected by wind gusts and meet relevant structural standards.

Installation

Note: Refer to Local Code (US: National Electric Code, NEC) for installation of the PV module.

Climate Conditions

Install the PV module within the following conditions:

- Ambient temperature: -4°F to 122°F (-20°C to 50°C)
- Operating temperature: -40°F to 181°F (-40°C to 83°C)
- Water resistance: DO NOT install the PV module in a location where it would be immersed in water or continually exposed to water from a sprinkler or fountain etc.
- Corrosion resistance: except for corrosive salt area and sulphurous area. Corrosive salt area:
  area within 1600 ft. (~ 500 m) from sea and salty wind exposure. Sulphurous area: areas near sulphurous volcano and sulphurous spring.

Orientation and Mounting

- Install the PV modules facing South (in Northern Hemisphere). Modules facing West or East can generate a smaller amount of electricity than facing South (in Northern Hemisphere). Incorrect orientation will result in loss of power output.
- PV modules connected in series should be installed at same orientation and angle. Different orientation or angle may cause loss of output power due to difference of amount of sunlight exposed to the module.
- For grid-connected systems a tilt angle of 5 to 15 degrees will result in maximum power output during the summer and respectively less in winter. For off-grid systems (battery charging) a consistent energy output through the year will be achieved by calculating the optimal winter tilt angle: Use the building site's latitude and add 20 degrees maximum. (Note: All angles are above the horizon)
- The location for a PV module should be selected to have direct access to shade-free sunlight. Shading causes loss of output even though the factory fitted bypass diode of the PV module will minimize any such loss.
- Many types of mounting systems are used to install Schüco PV modules. Only use mounting structures that can withstand forces from wind and snowfall pressure specific to the installation area.
- The use of proper mounting hardware is recommended to minimize the possibility of corrosion of the module frame and mounting structure itself. Module mounting holes are provided for easy installation and correct mechanical loading.
- Use lock washers and flat washers to mount the PV module. These mounting bolts are not to be used for electrically grounding the module frame. The use of stainless-steel hardware is recommended.
- Use appropriate methods to fasten the module when installing at high place from which fall of the module causes death, injury or damage of property.
- Install the PV module with a space for draft behind the module to radiate heat. Sufficient clearance between the module frame and the surface is required to allow cooling air to circulate behind the back of the module, also allowing any condensation or moisture to dissipate.

Wiring and Grounding

- Connect required number of PV modules to meet the voltage specification of equipment used in system.
- Wire the output cable connectors so that they do not exert strain on the PV module's junction box.

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- Attach the cable to the mounting structure using approved fixings.
- Modules can be wired in series to increase voltage or parallel to increase current.
  Series wiring (for more voltage):
  Connect wires from the positive (+) connector of one module to the negative (-) connector of the next module.
  Parallel wiring (for more current):
  Connect wires from the positive (+) connector of one module to the positive (+) connector of the next module.
- DO NOT short the positive (+) and negative (-) cables.
- Make sure connectors are fully engaged without a gap between the insulators. In case there is a gap, a fire and/or electrical shock may occur.
- Connect the output cable correctly to the equipment. Schüco PV modules employ wiring leads and UL recognized connectors for the output wiring. The use of conduit connected to the modules is not possible with these modules.
- To extend the cable always use proper commercial cables and connectors that can withstand outdoor use for long periods (the lifetime of the PV system). Select an appropriate cable diameter according to its lengths to avoid voltage drop after first meeting the basic ampacity requirements required by electrical codes.
- Final output field wiring should be done with commercially available wiring product that meet requirements of the National Electric Code (NEC).
- The electrical characteristics stated on the PV module's factory label are within +/- 10% of the indicated values of Isc, Voc (Uoc) and Pmax under standard test conditions (STC). STC: irradiance of 100 mW/cm², AM 1.5 spectrum, and a cell temperature of 25°C (77°F).
- Cable sizing and overcurrent protection: Under normal conditions, the PV module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions (STC). Accordingly, the values of Isc and Voc marked on this module should be multiplied by a correction factor in order to calculate the maximum photovoltaic system voltage (to determine voltage ratings of cables, disconnects, overcurrent devices, and other equipment).
  a) for circuits carrying currents from PV modules, multiply the Isc by 1.25 (80% derating) and use this value for following calculations as the CONTINOUS CURRENT. This requirement has been included in Section 690-8 of the NEC, but also remains in UL 1703. **DO NOT apply this multiplier twice, just because it is mentioned in UL 1703 and the NEC separately.**
  b) NEC Section 690.9 will require a second multiplication of Isc by 1.25 for a total of two factors of 1.25 (1.25 x 1.25 = 1.56).
  c) The multiplication of Voc by a factor of 1.25 required above is duplicated by a temperature variant factor in Section 690.7 of the NEC (see following Note). **DO NOT apply both factors, only use the voltage correction factor according to the following table:**

Ambient Temperature:			Correction Factor:
77 to 50°F	(25 to 10°C)	-	1.06
49 to 32°F	(9 to 0°C)	-	1.10
31 to 14°F	(–1 to –10°C)	-	1.13
13 to –4°F	(–11 to –20°C)	-	1.17
–5 to –40°F	(–21 to –40°C)	-	1.25

- **NOTE:** The maximum permissible system voltage is **600 V for the US** due to restrictions by the NEC and UL 1703, even though the module is capable of more voltage as indicated on the label. **DO NOT exceed the 600V rating.**
- The method of solidly grounding the PV module shall meet the NEC and/or UL 1703 in accordance with a specification of system. Ground the system properly in accordance with mounting structure and the environment:

Each individual PV module shall be grounded at one of the points marked ⏚ on the PV module using a thread-cutting (UNF) stainless steel screw and a stainless steel isolating washer. The washer shall be placed between the copper equipment-grounding conductor and the module frame – normally, the copper grounding conductor (not larger than 10 AWG) shall not come into contact with the aluminium frame of the module. The thread-cutting stainless steel screw shall be used in the marked predrilled grounding hole to attach the copper conductor to the module frame, cutting at least two threads into the aluminium frame of the module (general UL requirement).

- Module mounting holes and module mounting hardware shall not be used to ground the module.

- If required by local codes, an outdoor-rated (usually direct-burial rated) lug (not provided) may be used with the provided hardware to connect a larger (than 10 AWG) conductor to the module for grounding purposes.

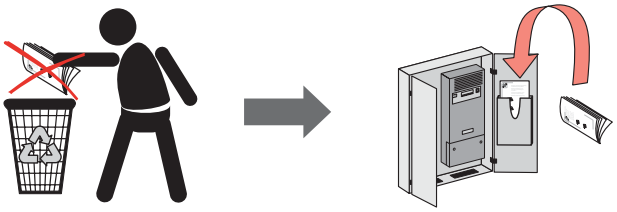
Maintenance and Annual Inspection

- DO NOT touch live parts or connectors. Use appropriate safety equipment (insulated tools, insulating gloves, etc.) when touching them.
- Cover the front surface by an opaque cloth or other material when repairing. A module generates DC current when exposed to sunlight or other light sources.
- Check if nuts and bolts of mounting structure are secure and not loose. Tighten loose components if necessary.
- Check the connections of cables, grounding cables and connectors.
- Check all electrical and mechanical connections for absence of corrosion.
- Check the ground resistance of metal parts such as the module frames and the mounting structures. ---

General Information, Hazard Warnings And Safety Advices

As you work, be constantly alert for circumstances that may cause an accident!

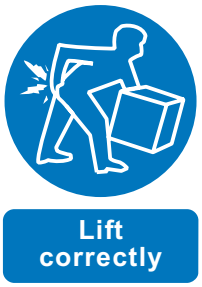
Do not throw away this manual after installation!



First steps:

- Check delivery regarding transport damages.
- Check for completeness! If incomplete, please call: 1-877-4 SCHUCO
- If necessary, protect delivery against weather influences.
- Use caution when unpacking.

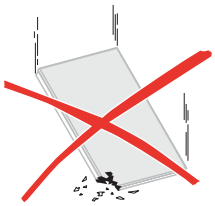
Carry carefully!
Never handle heavy loads alone!
If available use tools like elevating truck platform, etc.
Pay attention to sharp edges!



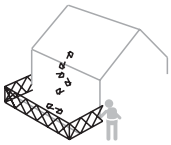
Caution, do not damage connecting wire

1. Follow the protection regulations by the Occupational Safety and Health Administration (OSHA).
2. Pay attention to safety precautions.
3. Wear proper clothing.
4. Use shoes with soft rubber soles.
5. Wear eye protection.
6. Wear a hardhat.
7. Do not concentrate heavy loads in one area of the roof, always spread them out. The deck could give way under the load.
8. Roofs with a greater than 4:12 slope that are 16 feet or more above the ground should have a catch platform at the edge of the roof while working.
9. Some roof conditions require that the installer wears a harness and lifeline to protect against falls.
10. Ladder safety:
    Make sure you are aware of all OSHA requirements.
    Always check the ladder for defects; never use a damaged ladder.
    The feet of the ladder must be on a firm, non-slippery surface. On soft earth, place 3/4-inch plywood squares below each leg.
    If neccessary, nail pieces of wood onto ground, behind ladder, to keep from slipping.
    Use fiberglass ladders; ladders made of wood deteriorate with age.
    An aluminium ladder is dangerous if used around electric extension cords or overhead wiring.

General Information, Hazard Warnings And Safety Advices



Use caution while carrying.
Fragile item!



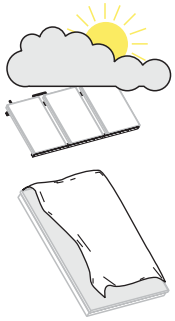
Section-off site and secure against falling parts.

Apply Safety Guard Strap.

Safety Guard Strap.

Do not attach Safety Guard Straps to the mounting system.

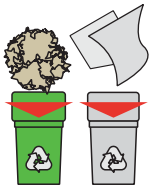
Warning: Danger of burning.



Cover the front surface of PV modules by an opaque cloth or other material when installing!

Keep First Aid Box ready and place in range.

Extreme danger! Before working with electrical devices, always disconnect the device from the mains power supply.



Dispose all packaging.

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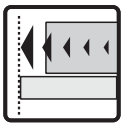
Explanation Of Symbols Used

(232 000) 6-figure numbers in brackets are always Schüco article numbers


Warning: Danger to life, environment and product


Flush


Parallel


Hand-tight


Tighten firmly

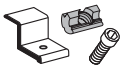
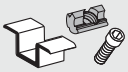

See page


Connection


Important note


Materials to be provided by installer

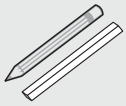
Required Material

	PV-Module	2	3	4	5
	ezClamp END	4	4	4	4
	ezClamp MID Type	2	4	6	8
	ezClip 2 (232 081)	4	6	8	10
	Installation Manual SolarEZ™ Mounting System (232 101)	1	1	1	1
	Installation Manual: Attachment of Standard PV Modules to Schüco SolarEZ™ Mounting System (232 085)	1	1	1	1

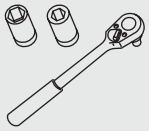
Also Required

	String cable
	Module connecting cable
	Safety guard strap (221 522)

Tools Required:



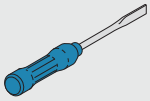
Pencil / Chalk



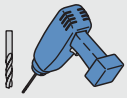
Torque wrench

Tape measure

Spirit level



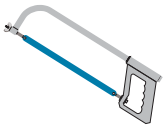
Screw driver



Electric Screwdriver / drill and bit

Hexhead Screwdriver

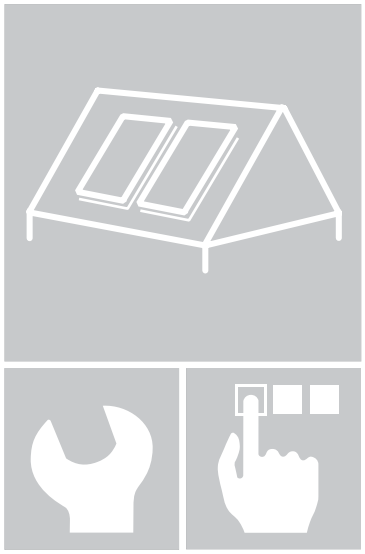
0,24 inch



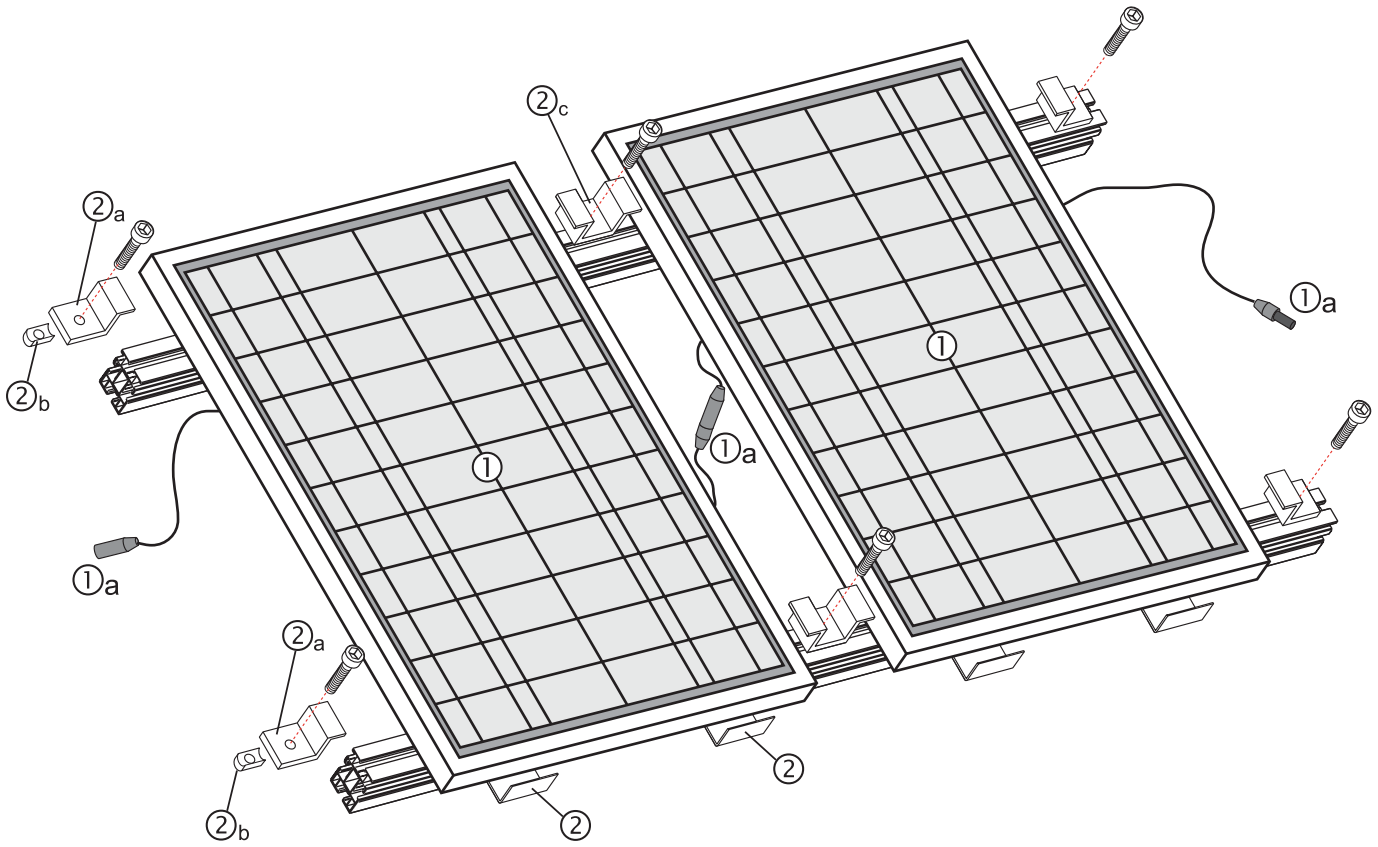
Metal saw

PV-Modules Onto SolarEZ™

On-Roof Installation



Overview: Installation Of Standard PV-Modules



① Standard PV Module

①a MC connector cable

② Module clip

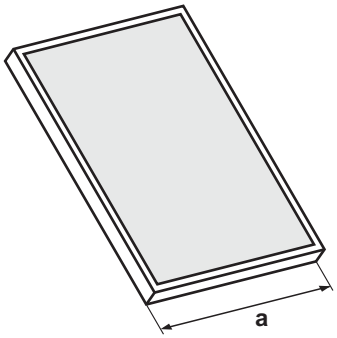
②a ezClamp END

②b ezClamp MID

②c ezUniversal screw

②d ezAnchor Block

Standard PV-Module Portrait, Adjacent Installation



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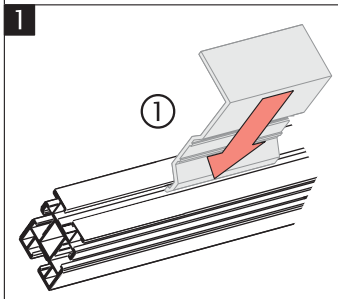

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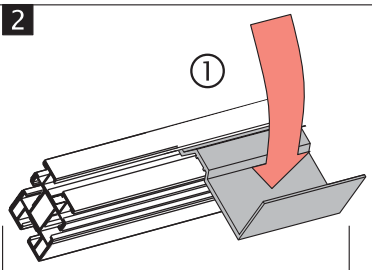

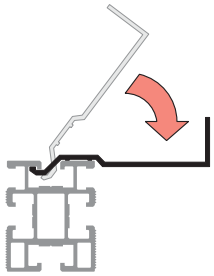

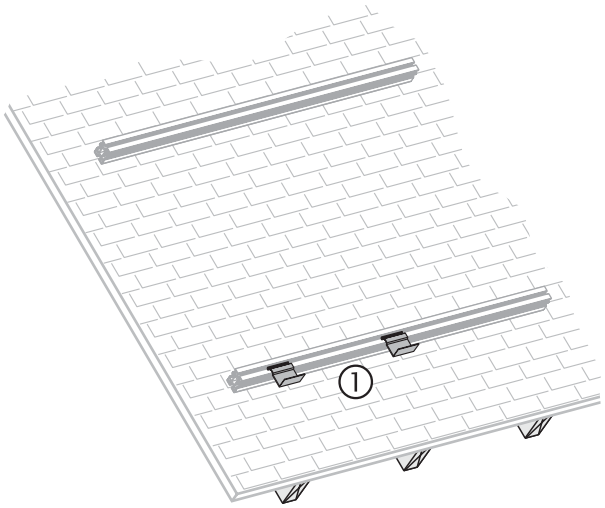

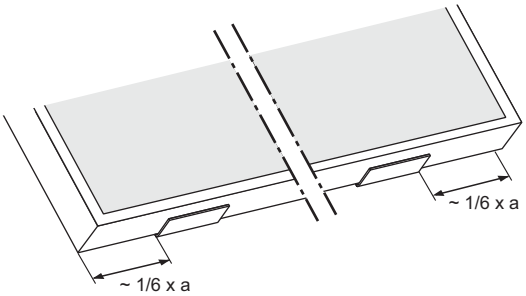

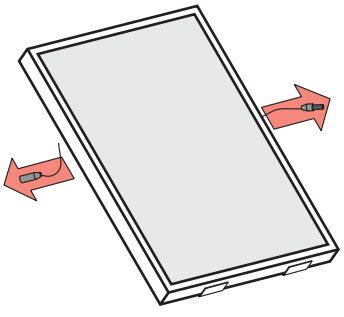

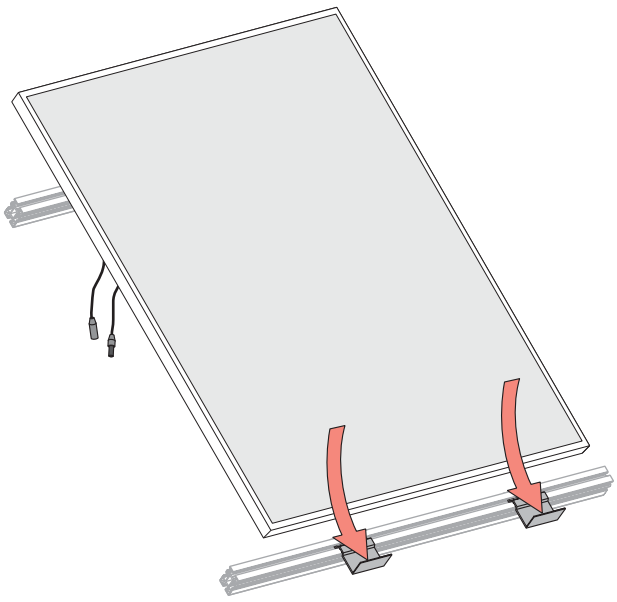

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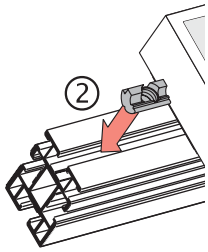

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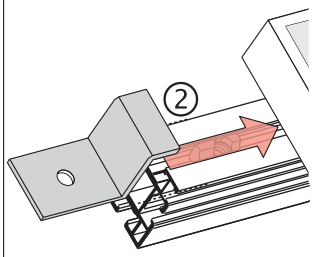
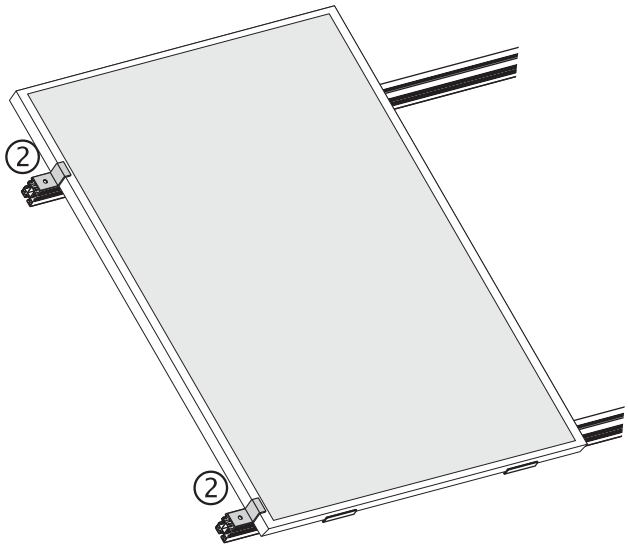
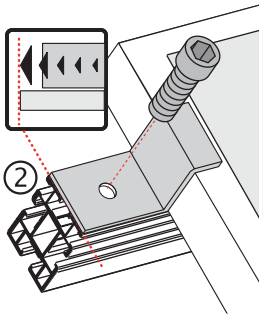




3



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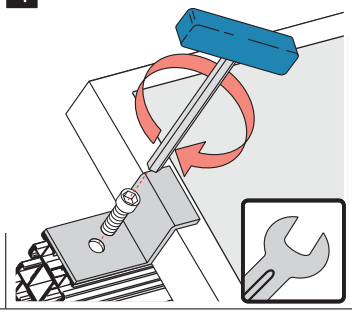
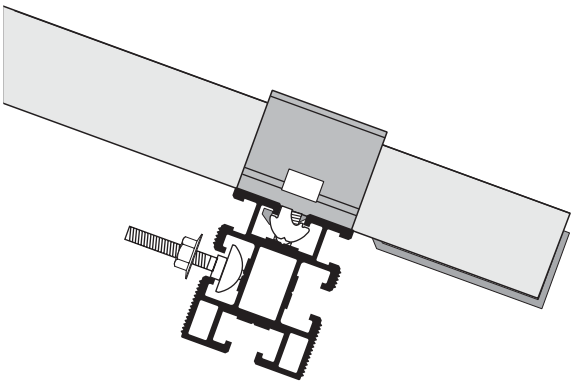
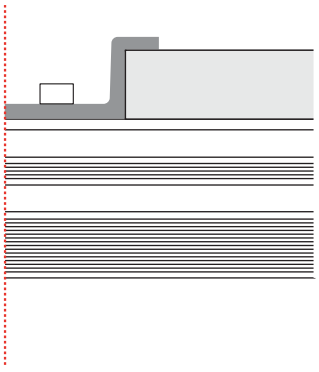
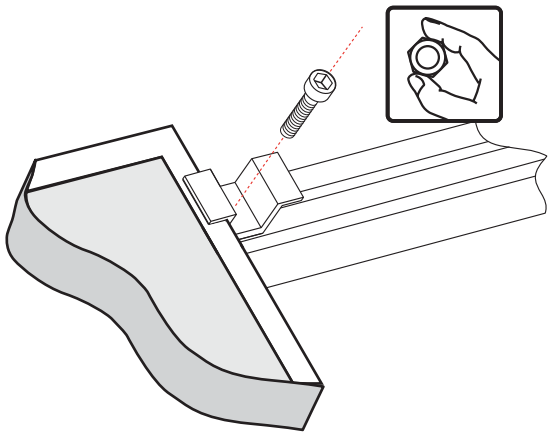
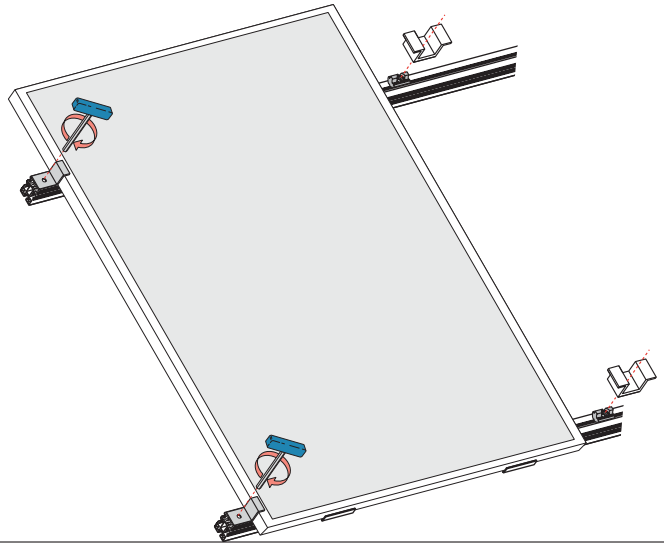






Installing The Next Module





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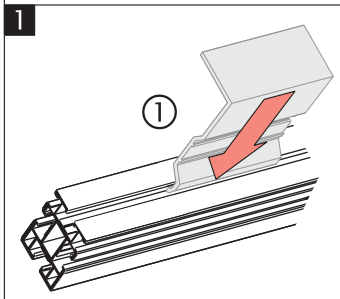

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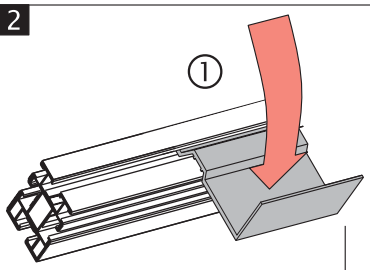
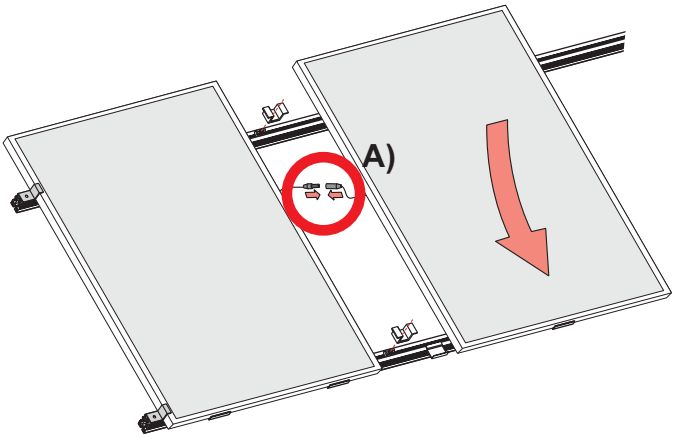
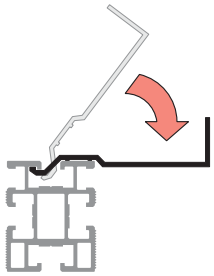
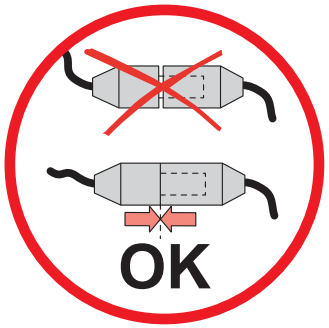
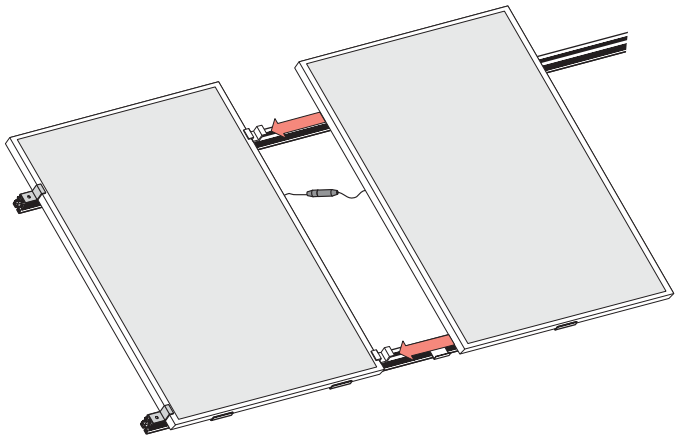


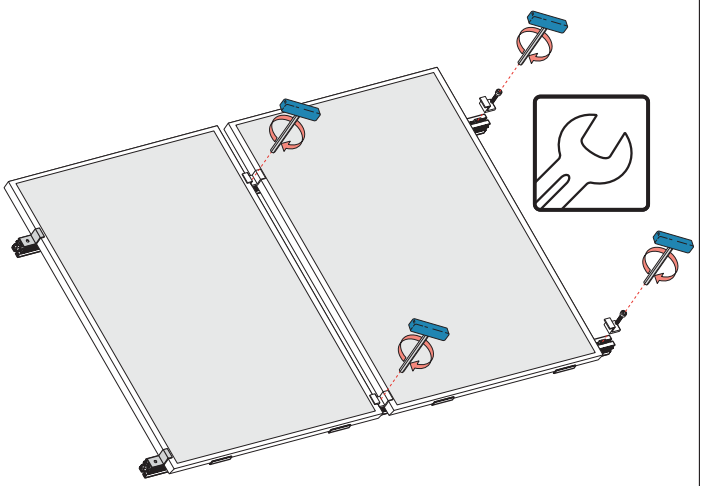




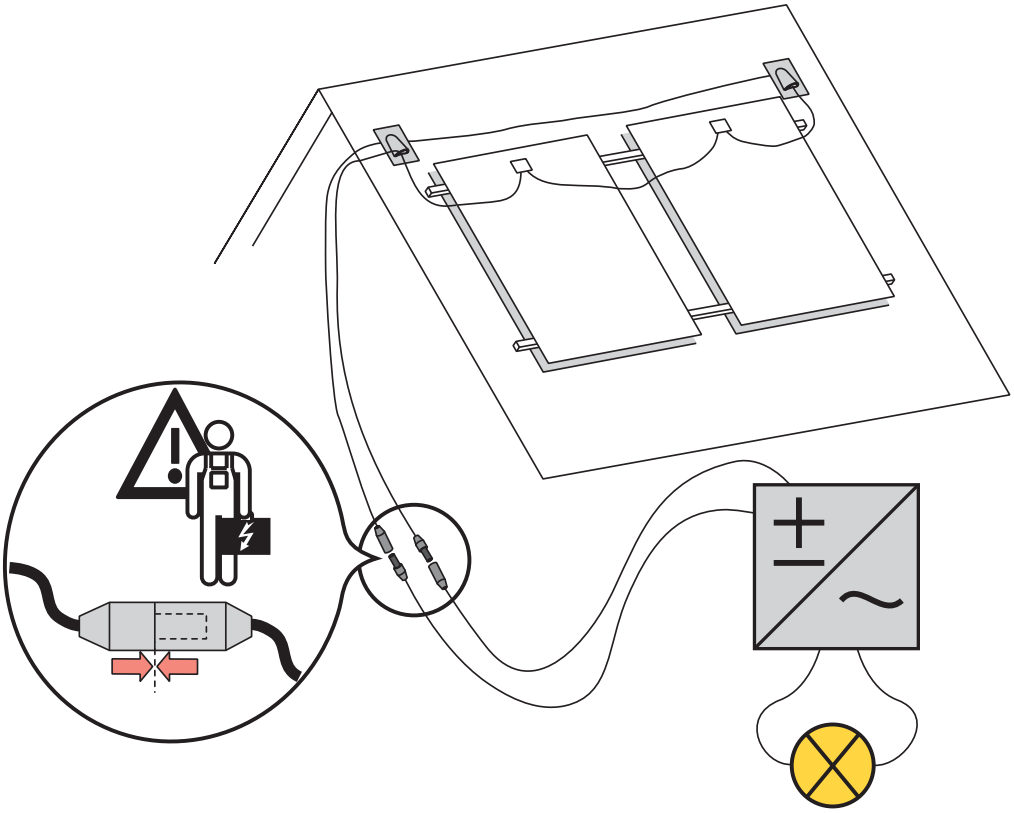
A)







Electrical Connections



Always use cable-conduit if required by code!

Ground modules / array if required by code!

Authorized personnel required

Inverter

Electrical consumer

Schüco USA L.P. • 240 Pane Road • Newington, CT 06111
Phone: 1-877 4 SCHUCO • Fax 1-860-666 2359 • solar@schuco-usa.com --- www.schuco-usa.com