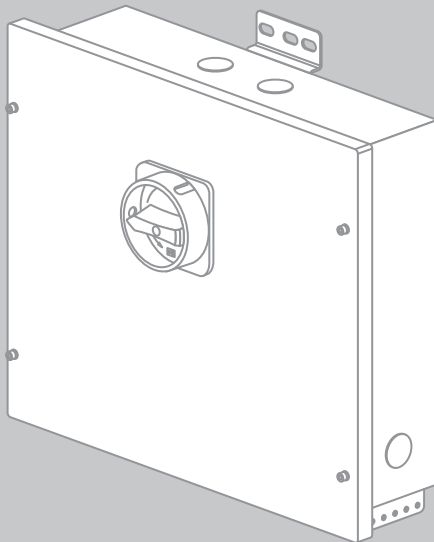




Accessories for PV Inverters

## **SMA CONNECTION UNIT 600-US / 1000-US**

**Installation Manual**





## Legal Provisions

Copyright © 2013 SMA America, LLC. All rights reserved.

No part of this document may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photographic, magnetic or otherwise, without the prior written permission of SMA America, LLC.

Neither SMA America, LLC nor SMA Solar Technology Canada Inc. makes representations, express or implied, with respect to this documentation or any of the equipment and/or software it may describe, including (with no limitation) any implied warranties of utility, merchantability, or fitness for any particular purpose. All such warranties are expressly disclaimed. Neither SMA America, LLC nor its distributors or dealers nor SMA Solar Technology Canada Inc. nor its distributors or dealers shall be liable for any indirect, incidental, or consequential damages under any circumstances.

(The exclusion of implied warranties may not apply in all cases under some statutes, and thus the above exclusion may not apply.)

Specifications are subject to change without notice. Every attempt has been made to make this document complete, accurate and up-to-date. Readers are cautioned, however, that SMA America, LLC and SMA Solar Technology Canada Inc. reserve the right to make changes without notice and shall not be responsible for any damages, including indirect, incidental or consequential damages, caused by reliance on the material presented, including, but not limited to, omissions, typographical errors, arithmetical errors or listing errors in the content material.

All trademarks are recognized even if these are not marked separately. Missing designations do not mean that a product or brand is not a registered trademark.

The *Bluetooth*<sup>®</sup> word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. and any use of such marks by SMA America, LLC and SMA Solar Technology Canada Inc. is under license.

### **SMA America, LLC**

3801 N. Havana Street  
Denver, CO 80239 U.S.A.

### **SMA Solar Technology Canada Inc.**

2425 Matheson Blvd. E  
7th Floor  
Mississauga, ON L4W 5K4  
Canada

# IMPORTANT SAFETY INSTRUCTIONS

## SAVE THESE INSTRUCTIONS

This manual contains important instructions for the following products:




- CU 600-US-10 (SMA Connection Unit 600-US)
- CU 1000-US-10 (SMA Connection Unit 1000-US)

This manual must be followed during installation and maintenance.

The product is designed and tested according to international safety requirements, but as with all electrical and electronic equipment, certain precautions must be observed when installing and/or operating the product. To reduce the risk of personal injury and to ensure the safe installation and operation of the product, you must carefully read and follow all instructions, cautions and warnings in this manual.





## Warnings in this document

A warning describes a hazard to equipment or personnel. It calls attention to a procedure or practice, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the SMA equipment and/or other equipment connected to the SMA equipment or personal injury.

Symbol	Description
 <b>DANGER</b>	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
 <b>WARNING</b>	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
 <b>CAUTION</b>	CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
<b>NOTICE</b>	NOTICE is used to address practices not related to personal injury.

## Warnings on this product

The following symbols are used as product markings with the following meanings.

Symbol	Description
	<b>Warning regarding dangerous voltage</b> The product works with high voltages. All work on the product must only be performed as described in the documentation of the product.
	<b>Beware of hot surface</b> The product can become hot during operation. Do not touch the product during operation.
	<b>Risk of Fire</b> Improper installation of the product may cause a fire.
	<b>Observe the operating instructions</b> Read the documentation of the product before working on it. Follow all safety precautions and instructions as described in the documentation.

## General Warnings

### **⚠ WARNING**

All electrical installations must be made in accordance with the local and *National Electrical Code*® ANSI/NFPA 70 or the *Canadian Electrical Code*® CSA C22.1. This document does not and is not intended to replace any local, state, provincial, federal or national laws, regulation or codes applicable to the installation and use of the product, including without limitation applicable electrical safety codes. All installations must conform with the laws, regulations, codes and standards applicable in the jurisdiction of installation. SMA assumes no responsibility for the compliance or noncompliance with such laws or codes in connection with the installation of the product.

The product contains no user-serviceable parts.

For all repair and maintenance, always return the unit to an authorized SMA Service Center.

Before installing or using the product, read all of the instructions, cautions, and warnings in this manual.

Wiring of the product must be made by qualified personnel only.

# Table of Contents

<b>1</b>	<b>Information on this Document</b>	<b>9</b>
<b>2</b>	<b>Safety</b>	<b>10</b>
2.1	Intended Use	10
2.2	Skills of Qualified Persons	11
2.3	Safety Precautions	12
<b>3</b>	<b>Scope of Delivery</b>	<b>13</b>
<b>4</b>	<b>Product Description</b>	<b>14</b>
4.1	Connection Unit	14
4.2	Type Label	15
4.3	DC Switch-Disconnecter	16
4.4	String Fuses	16
4.5	Reverse Polarity Detection	17
<b>5</b>	<b>Mounting</b>	<b>18</b>
5.1	Requirements for Mounting	18
5.2	Mounting the Connection Unit on a Wall	23
5.3	Mounting the Connection Unit to a Post	25
<b>6</b>	<b>Electrical Connection</b>	<b>26</b>
6.1	Safety during Electrical Connection	26
6.2	Overview of the Connection Area	27
6.2.1	Enclosure Openings	27
6.2.2	Interior View of the Connection Unit 600-US	28
6.2.3	Interior View Connection Unit 1000-US	29
6.3	Connecting Conduits to the Connection Unit	30
6.4	Connecting the Grounding Conductor	31
6.5	Connecting the PV Array to the Connection Unit 600-US	33
6.6	Connecting the PV Array to the Connection Unit 1000-US	35
6.7	Operating the Reverse Polarity Detection	36
6.8	Connecting the DC Output Cable for the Inverter to the Connection Unit	38

<b>7</b>	<b>Commissioning</b>	<b>40</b>
7.1	Inserting the String Fuses	40
7.2	Commissioning the Connection Unit	42
<b>8</b>	<b>Disconnecting the Connection Unit from Voltage Sources</b>	<b>43</b>
<b>9</b>	<b>Troubleshooting</b>	<b>44</b>
9.1	LED Signals	44
9.2	Replacing the String Fuses	45
<b>10</b>	<b>Decommissioning</b>	<b>47</b>
10.1	Disassembling the Connection Unit	47
10.2	Packing the Connection Unit	47
10.3	Disposing of the Connection Unit	47
<b>11</b>	<b>Technical Data</b>	<b>48</b>
<b>12</b>	<b>Accessories</b>	<b>50</b>
<b>13</b>	<b>Contact</b>	<b>51</b>



# 1 Information on this Document

## Validity

This document is valid for the following device types:

- CU 600-US-10 (SMA Connection Unit 600-US)
- CU 1000-US-10 (SMA Connection Unit 1000-US)

## Target Group





This document is intended for qualified persons. Only qualified personnel with the appropriate skills are allowed to perform the tasks described in this document (see Section 2.2 "Skills of Qualified Persons", page 11).

## Additional Information

Links to additional information can be found at [www.SMA-Solar.com](http://www.SMA-Solar.com):

Document title	Document type
Sunny Tripower 12000TL-US / 15000TL-US / 20000TL-US / 24000TL-US	Installation manual
Sunny Boy 6000TLUS / 7000TLUS / 8000TLUS / 9000TLUS / 10000TLUS / 11000TLUS	Installation manual

## Symbols

Symbol	Explanation
	Information that is important for a specific topic or goal, but is not safety-relevant
	Indicates an essential requirement for achieving a specific goal
	Desired result
	A problem that could occur

## Nomenclature

Complete designation	Designation in this document
SMA America Production, LLC	SMA
SMA Solar Technology Canada Inc.	SMA
SMA Connection Unit 600-US / 1000-US	Connection Unit, product

## 2 Safety

### 2.1 Intended Use

The Connection Unit is a String-Combiner to which up to eight strings can be connected.

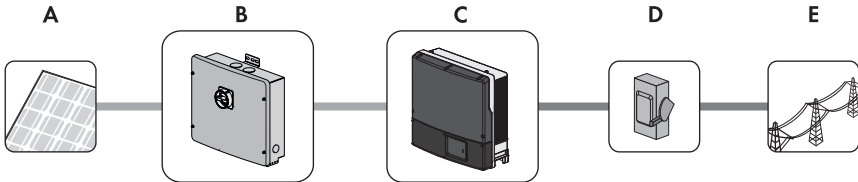


Figure 1: Example design of a PV system with Connection Unit

Item	Designation
A	PV modules
B	Connection Unit
C	Sunny Tripower
D	Circuit breaker
E	Utility grid

The Connection Unit is suitable for indoor and outdoor use.

The Connection Unit must only be used in ungrounded PV systems. Do not use grounded PV modules with the Connection Unit. Only ground the mounting frame of the PV modules.

All DC inputs of an ungrounded PV system must be equipped with an overcurrent protection according to the *National Electrical Code*® NEC 690. The Connection Unit shall be installed per the requirements contained in Section 690.35 of the *National Electrical Code*®, ANSI/NFPA 70. The Connection Unit must only be used with the following transformerless SMA inverters:

- SB 6000TLUS-12 / 7000TLUS-12 / 8000TLUS-12 / 9000TLUS-12 / 10000TLUS-12 / 11000TLUS-12
- STP 12000TL-US-10 / 15000TL-US-10 / 20000TL-US-10 / 24000TL-US-10

For safety reasons, it is forbidden to modify the product or install components that are not explicitly recommended for this product or distributed by SMA.

Use this product only in accordance with the enclosed documentation and with the local standards and directives. Any other use can result in personal injury or property damage.

- Do not mount the product in areas where flammable gases may occur.
- Do not mount the product in areas where highly flammable materials are stored.
- Do not install the product in potentially explosive atmospheres.

The enclosed documentation is an integral part of this product.

- Read and observe the documentation.
- Keep the documentation in a convenient place for future reference.

## **2.2 Skills of Qualified Persons**

The tasks described in this document must be performed by qualified persons only. Qualified persons must have the following skills:

- Knowledge of how electrical devices and plants work and are operated
- Training in how to deal with the dangers and risks associated with installing and using electrical devices and plants
- Training in the installation and commissioning of electrical devices and plants
- Knowledge of all applicable standards and directives
- Knowledge of and adherence to this document and all safety precautions

## 2.3 Safety Precautions

This section contains safety precautions that must be observed at all times when working on or with the product.

To prevent personal injury or property damage and to ensure long-term operation of the product, read this section carefully and follow all safety precautions at all times.

### **⚠ DANGER**

#### **Danger to life due to high voltages in the Connection Unit**

High voltages that can cause fatal electric shocks when touched are present in the live components of the Connection Unit.

- All work on the Connection Unit must be carried out by qualified persons only.
- Before working on the Connection Unit carry out the following steps:
  - Switch off all devices that are connected to the Connection Unit (e.g. inverter) and protect against reconnection.
  - Cover the PV modules.
  - Turn the DC switch-disconnector of the Connection Unit counterclockwise by 90° and set to **OFF**.
- While operating the Connection Unit, do not remove the sealing plugs.
- All work on the Connection Unit should only be carried out as described in this document.

### **⚠ WARNING**

#### **Danger to life due to operating a damaged Connection Unit**

Using a damaged Connection Unit can lead to serious or lethal injuries through electric shock.

- Only operate the Connection Unit when it is functioning properly and safely.
- Regularly check the Connection Unit for visible damage.
- Ensure that all safety equipment is freely accessible at all times.

### **NOTICE**

#### **Damage to the Connection Unit due to electrostatic discharges**

By touching electronic components you can damage or destroy the Connection Unit through electrostatic discharge.

- Ground yourself before touching any components.

### 3 Scope of Delivery

Check the scope of delivery for completeness and any externally visible damage. Contact your distributor if the scope of delivery is incomplete or damaged.

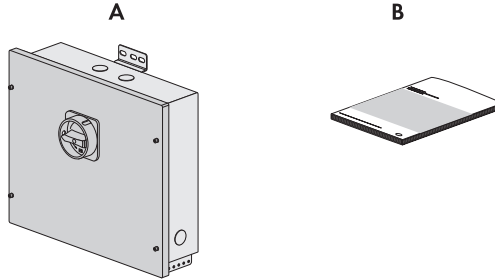


Figure 2: Components included in the scope of delivery

Item	Quantity	Designation
A	1	Connection Unit
B	1	Installation manual, Production Test Report

## 4 Product Description

### 4.1 Connection Unit

The Connection Unit is a String-Combiner to which up to eight strings can be connected.

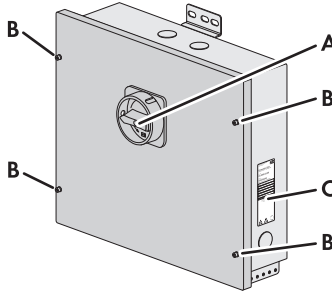


Figure 3: Design of the Connection Unit

Item	Designation
A	DC switch-disconnector
B	Captive screws of the lid
C	Type label

In the Connection Unit the PV array strings are combined and routed into the inverter via cables. The integrated fuse holders are designed to be used with string fuses for overcurrent protection. The Connection Unit is equipped with a DC switch-disconnector and therefore serves as a DC disconnection unit.

#### Symbols on the Connection Unit

Symbol	Explanation
	Equipment grounding
	No galvanic isolation





## 4.2 Type Label

The type label clearly identifies the Connection Unit. The type label is located on the right-hand side of the enclosure. You will find the following information on the type label:

- Device type (Item No.)
- Serial number (Serial No.)
- Date of manufacture,
- Device-specific characteristics

You will require the information on the type label to use the Connection Unit safely and when seeking customer support from the SMA Service Line. The type label must be permanently attached to the Connection Unit.

### Symbols on the Type Label

Symbol	Explanation
	<p><b>Danger to life due to high voltages</b></p> <p>The product operates at high voltages. All work on the product must be carried out by qualified persons only.</p>
	<p><b>Risk of burns from hot surfaces</b></p> <p>The product can get hot during operation. Avoid contact during operation. Allow the product to cool down sufficiently before carrying out any work. Wear personal protective equipment such as safety gloves.</p>
	<p><b>Observe the documentation</b></p> <p>Observe all documentation that is supplied with the product.</p>
	<p><b>UL certification mark</b></p> <p>UL1741 is the standard applied by Underwriters Laboratories to the product to certify that it meets the requirements of the <i>National Electrical Code</i>®, the <i>Canadian Electrical Code</i>® CSA C22.1 and IEEE-929-2000. IEEE 929-2000 provides recommendations regarding the proper equipment and functionality necessary to ensure compatible operation when power generation is connected to the utility grid.</p>

### 4.3 DC Switch-Disconnecter

The Connection Unit is equipped with a DC switch-disconnector. The DC switch-disconnector enables disconnection of the inverter from the PV array. The disconnection takes place at all poles.

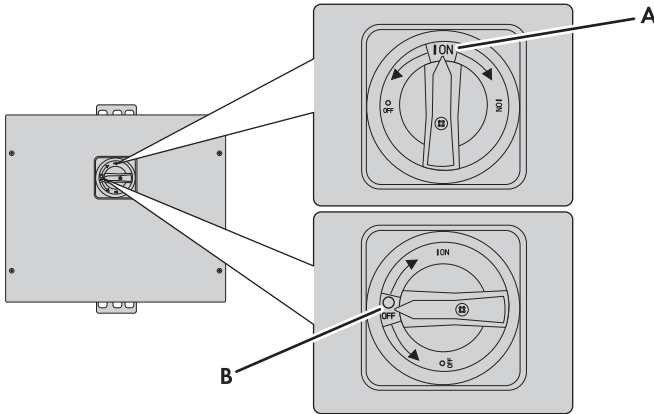


Figure 4: DC switch-disconnector of the Connection Unit

Item	Designation
A	Switch position <b>ON</b>
B	Switch position <b>OFF</b> Opening for padlock to protect against restarting

When the DC switch-disconnector is switched **OFF**, it can be protected against restarting with a padlock via one of the three openings.

### 4.4 String Fuses

String fuses are used to protect wiring and equipment from excessive currents that can cause damage, heating, or in extreme cases, even fire.

If the string fuses are designed too small, they may open too early and cause interference. If the string fuses are designed too large, they do not provide the required protection as they open too late.

In PV systems, the minimum and maximum size of the string fuse is determined by the electrical nominal sizes of the PV module as well as by UL and *National Electrical Code*® requirements. Contact the manufacturer of the PV modules in order to obtain the corresponding nominal sizes of the string fuses.

The maximum nominal size for string fuses in the Connection Unit is 20 A.



The minimum size of the string fuses and cables is calculated by means of the short-circuit current rating ( $I_{SC}$ ) of the PV module. The *National Electrical Code*® stipulates that all string fuses and cables are designed to be at least 1.56 times as large as the  $I_{SC}$  of the PV module being used. The correct size of the string fuse is determined by calculating the minimum size and then rounding it up to the nearest standard size for string fuses.

---

### Example: calculating the minimum size of the string fuses

For example, if the  $I_{SC}$  of the PV module equals 6.9 A, then the size of the string fuses is determined as follows:  $1.56 \times 6.9 = 10.76$

The nearest standard size for string fuses would be a 12 A fuse.

---

## 4.5 Reverse Polarity Detection

The SMA Connection Unit 1000-US is equipped with reverse polarity detection.

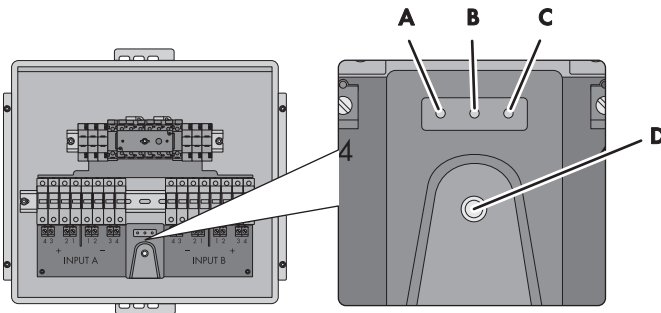


Figure 5: Reverse polarity detection in the SMA Connection Unit 1000-US

Item	Designation
A	LED for visualizing a polarity-reversed string at <b>INPUT A</b>
B	LED for visualizing a correct connection for <b>INPUT A</b> and <b>INPUT B</b>
C	LED for visualizing a polarity-reversed string at <b>INPUT B</b>
D	Button for activating the reverse polarity detection

The reverse polarity detection will test if the polarity of the connected conductors is correct once a string has been newly connected. Testing occurs by operating the integrated button. As long as there is sufficient DC voltage, the test result is visualized by the LEDs flashing.

## 5 Mounting

### 5.1 Requirements for Mounting

Requirements for the mounting location:

#### **⚠ WARNING**

##### **Danger to life due to fire or explosion**

Despite careful construction, electrical devices can cause fires.

- Do not mount the Connection Unit in areas where flammable gases may occur.
- Do not mount the Connection Unit near highly flammable materials.
- Do not mount the Connection Unit in potentially explosive atmospheres.

#### **⚠ CAUTION**

##### **Risk of burns due to hot enclosure parts**

Some parts of the enclosure can get hot during operation.

- Mount the Connection Unit in such a way that it cannot be touched inadvertently.

- A solid building ground is required for installation, e.g. a concrete wall, brick work, a post.
- Studs must be present behind the mounting points on plasterboard sheets or panels.
- The mounting location must be suitable for the weight and dimensions of the Connection Unit (see Section 11 "Technical Data", page 48).
- When mounting directly below the inverter, the minimum clearances to the inverter must be observed (see the inverter installation manual).
- The mounting location should be freely and safely accessible at all times without the necessity for any auxiliary equipment, such as scaffolding or lifting platforms. Non-fulfillment of these criteria may restrict servicing.
- The mounting location should not be exposed to direct solar irradiation. Direct solar irradiation can cause the Connection Unit to overheat.
- The ambient temperature must be within a permissible range (see Section 11 "Technical Data", page 48). This will ensure optimal operation of the Connection Unit.

**Dimensions for mounting:**

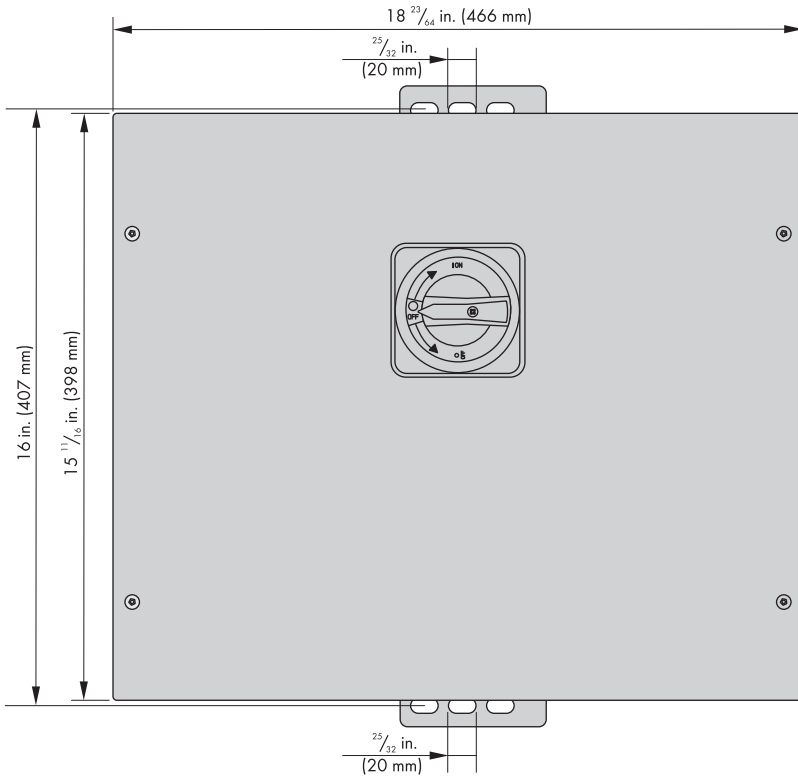
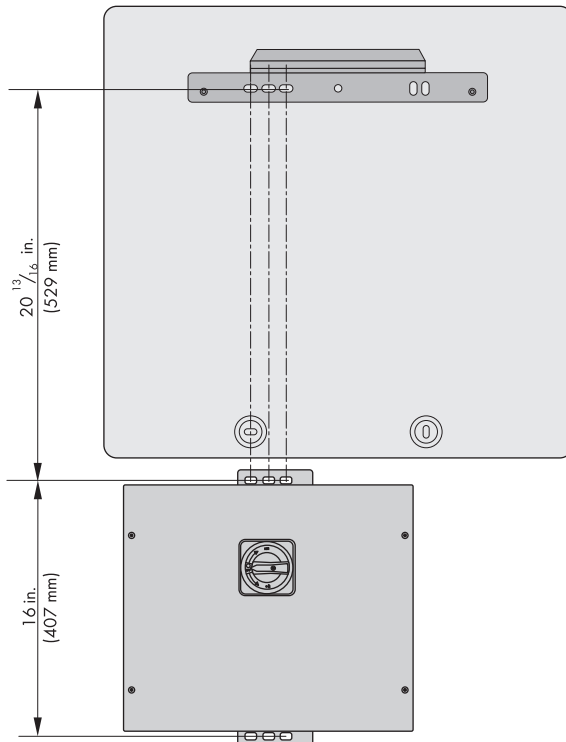


Figure 6: Dimensions of the mounting points

**i** Information on mounting the Connection Unit below a Sunny Tripower

- You can mount the Connection Unit directly below the Sunny Tripower. The output openings of the Connection Unit must be exactly below the openings for the DC connection of the Sunny Tripower.
- Align the oblong holes of the mounting straps of the Connection Unit, the oblong holes of the wall mounting brackets of the Sunny Tripower, and the drill holes for the screw in the rear panel of the Sunny Tripower to each other.
- In order to have the conduits at the Sunny Tripower and at the Connection Unit correctly positioned, the left oblong hole of the wall mounting bracket of the Sunny Tripower and the left oblong hole of the Connection Unit must be flush one below the other.

**Example:**

**Recommended clearances:**

- Observe recommended clearances to the walls or other objects. Thus, you can read the following data from the type label at all times.
- The clearances to the front must be chosen in such a way that the DC switch-disconnector is accessible at all times. Thus, you can operate the DC switch-disconnector anytime and read out the switch position.

**NOTICE****Damage to the Connection Unit by mounting it in regions with a high probability of snow**

Position the Connection Unit in such way that it will not be covered entirely with snow when mounting it in regions with a high probability of snow drifts. Snow drifts can damage the seals of the conduits and moisture can get into the Connection Unit.

- To protect the Connection Unit from freezing, provide sufficient clearance to the ground.

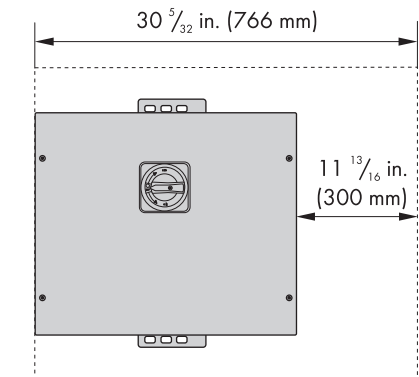


Figure 7: Recommended clearances

**Permitted mounting positions:**

- The Connection Unit must be mounted in a permitted position. That prevents moisture from entering the Connection Unit.

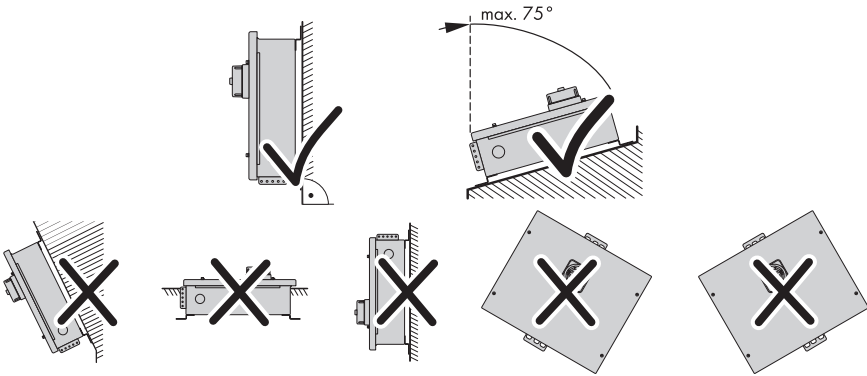


Figure 8: Permitted and prohibited mounting positions

## 5.2 Mounting the Connection Unit on a Wall

### NOTICE

#### Damage to the Connection Unit due to moisture and dust intrusion

Dust or moisture intrusion can damage the Connection Unit.

- Only mount the Connection Unit with its lid closed and with inserted filler plugs.

#### Additionally required mounting material (not included in the scope of delivery):

- At least two screws that are suitable for the foundation
- At least two washers that are suitable for the screws
- At least two screw anchors that are suitable for the foundation and for the screws

### CAUTION

#### Risk of burns due to hot enclosure parts

Some parts of the enclosure can get hot during operation.

- Mount the Connection Unit in such a way that it cannot be touched inadvertently.

#### Risk of injury when lifting the Connection Unit, or if it is dropped

There is a risk of injury if the Connection Unit is lifted incorrectly or dropped during transport or mounting

- Keep in mind that the Connection Unit weighs 22 lbs. (10 kg) when mounting it.
- Use suitable mounting material for the mounting location of the Connection Unit.
  - Do not use hollow-wall anchors or toggle bolts for mounting on drywall.

#### Procedure:

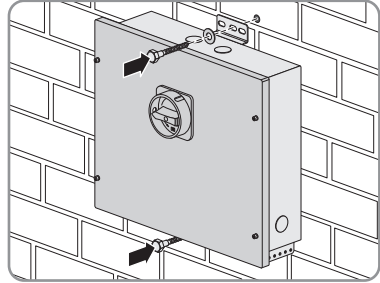
1. Position the Connection Unit on the wall.

### WARNING

#### Danger of electric shock if electric cables and other supply lines are damaged by drilling

- Before drilling, ensure that there are no electric cables and supply lines in the wall that could be damaged.
3. Mark the drill hole positions by means of the oblong holes in the brackets of the Connection Unit. Use at least one of the oblong holes at the top and at the bottom.
  4. Remove the Connection Unit from the wall.
  5. Drill holes at the markings.
  6. Insert suitable screw anchors into the drill holes.

7. Insert screws with washers through the oblong holes of the Connection Unit into the drill holes.



8. Tighten the screws. Ensure that no screws are loose.
9. Ensure that the Connection Unit is firmly positioned.



### 5.3 Mounting the Connection Unit to a Post

#### NOTICE

#### Damage to the Connection Unit due to moisture and dust intrusion

Dust or moisture intrusion can damage the Connection Unit.

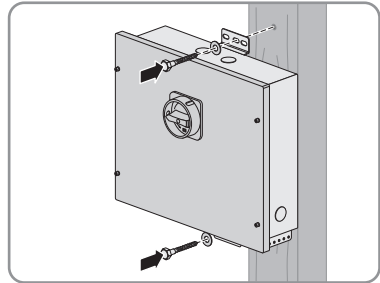
- Only mount the Connection Unit with its lid closed and with inserted filler plugs.

#### Additionally required mounting material (not included in the scope of delivery):

- 2 screws suitable for the building ground
- 2 washers to match the screws
- 2 screw anchors suitable for the building ground and the screws.

#### Procedure:

1. Position the Connection Unit on the post.
2. Mark the drill hole positions by means of the oblong holes in the brackets of the Connection Unit. Use at least one of the oblong holes at the top and at the bottom.
3. Remove the Connection Unit from the post.
4. Drill holes at the markings.
5. Insert suitable screw anchors into the drill holes.
6. Insert screws with washers through the oblong holes of the Connection Unit into the drill holes.



7. Tighten the screws. Ensure that no screws are loose.
8. Ensure that the Connection Unit is firmly positioned.

## 6 Electrical Connection

### 6.1 Safety during Electrical Connection

#### **⚠ DANGER**

##### **Danger to life due to high voltages in the Connection Unit**

High voltages that can cause fatal electric shocks when touched are present in the live components of the Connection Unit.

- All work on the Connection Unit must be carried out by qualified persons only.
- Prior to performing any work on the Connection Unit, disconnect it from any voltage source as described in this document (see Section 8).
- All work on the Connection Unit should only be carried out as described in this document.

#### **NOTICE**

##### **Damage to the seal of the enclosure lid during frost**

When opening the Connection Unit during frost, the seal of the enclosure lid can be damaged. There may be an ingress of moisture damaging the Connection Unit.

- Do not open the Connection Unit when the ambient temperature is below 23 °F ( - 5 °C). There might be ice on the seal of the lid when there is frost or the temperatures are below freezing. Remove it prior to opening the Connection Unit (e.g. by melting the ice with warm air). Adhere to the corresponding safety precautions.

##### **Damage to the Connection Unit due to moisture ingress during electrical installation**

- Do not open the Connection Unit in the event of rain or a high level of humidity (> 95%).
- For attaching the conduits to the enclosure, only use UL-listed rainproof or wet location conduit fittings in accordance with UL514B.
- Close all unused openings tightly.

##### **Electrostatic discharge**

By touching electronic components you can damage or destroy the Connection Unit through electrostatic discharge.

- Ground yourself before touching any components.

##### **Ground faults, unreliable and highly resistive connections due to Wire Nuts®**

Potential damage to or failure of the Connection Unit.

- Do not use *Wire Nuts*®.

**i** **Electrical installations**

All electrical installations must be made in accordance with the local electrical standards and the *National Electrical Code*® ANSI/NFPA70 or the *Canadian Electrical Code*® CSA C22.1.

- Use only +194 °F (+90 °C) copper wire for all DC wiring connections to the screw terminals between the PV modules and the Connection Unit and between the Connection Unit and the inverter.
- The DC input and output circuits are isolated from the enclosure and that system grounding, if required by Section 250 of the *National Electrical Code*®, ANSI/NFPA 70, is the responsibility of the installer.
- Make sure that no damaged cables are being used.

## 6.2 Overview of the Connection Area

### 6.2.1 Enclosure Openings

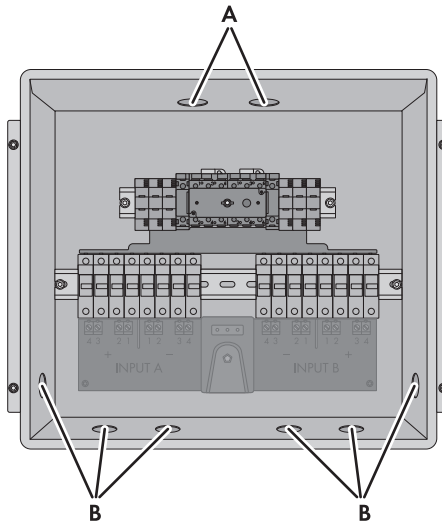


Figure 9: Enclosure openings of the Connection Unit

Item	Designation
A	Output opening in the enclosure for connecting the conduits (diameter: 1 <sup>23</sup> / <sub>64</sub> in. (34.5 mm) to 1 <sup>3</sup> / <sub>8</sub> in. (34.7 mm))
B	Input opening in the enclosure with filler plugs for connecting the conduits (diameter: 1 <sup>3</sup> / <sub>32</sub> in. (27.8 mm) to 1 <sup>7</sup> / <sub>64</sub> in. (28.0 mm))

## 6.2.2 Interior View of the Connection Unit 600-US

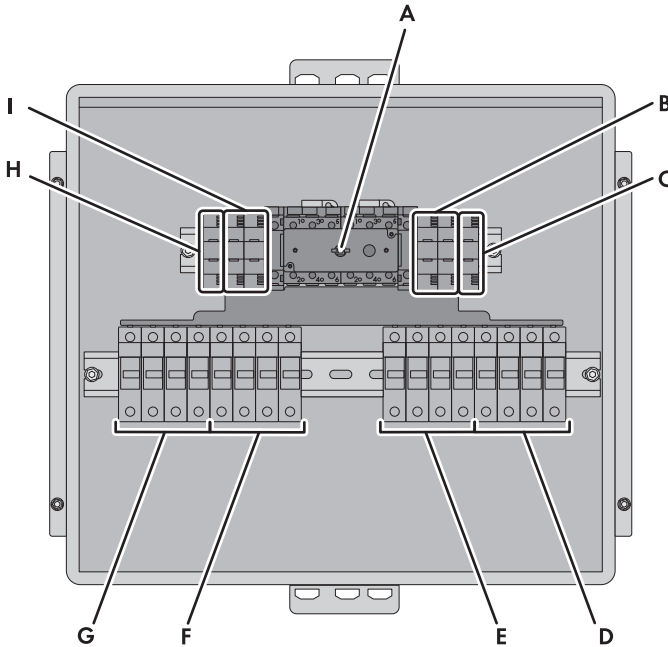


Figure 10: Components and connection areas in the interior of the Connection Unit 600-US

Item	Designation
A	Shaft of the DC switch-disconnector
B	Terminals for connecting the DC output cables (INPUT B)
C	Equipment grounding terminal
D	Fuse holders for string fuses and terminals for connecting the negative DC cables of the PV array (-) (INPUT B)
E	Fuse holders for string fuses and terminals for connecting the positive DC cables of the PV array (+) (INPUT B)
F	Fuse holders for string fuses and terminals for connecting the negative DC cables of the PV array (-) (INPUT A)
G	Fuse holders for string fuses and terminals for connecting the positive DC cables of the PV array (+) (INPUT A)
H	Equipment grounding terminal
I	Terminals for connecting the DC output cables (INPUT A)

### 6.2.3 Interior View Connection Unit 1000-US

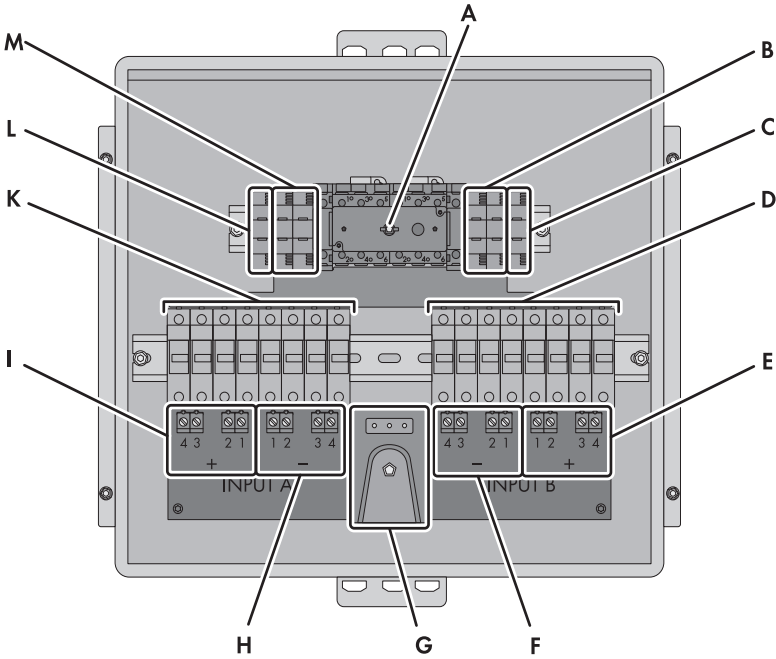


Figure 11: Components and connection areas in the interior of the Connection Unit 1000-US

Item	Designation
A	Shaft of the DC switch-disconnector
B	Terminals for connecting the DC output cables (INPUT B)
C	Equipment grounding terminal
D	Fuse holders for string fuses (INPUT B)
E	Terminals for connecting the positive DC cables of the PV array (+) (INPUT B)
F	Terminals for connecting the negative DC cables of the PV array (-) (INPUT B)
G	Reverse polarity detection
H	Terminals for connecting the negative DC cables of the PV array (-) (INPUT A)
I	Terminals for connecting the positive DC cables of the PV array (+) (INPUT A)
K	Fuse extractor for string fuses (INPUT A)
L	Equipment grounding terminal
M	Terminals for connecting the DC output cables (INPUT A)

## 6.3 Connecting Conduits to the Connection Unit

**Additionally required material (not included in the scope of delivery):**

- Conduits made out of metal that match the openings of the Connection Unit
- UL-listed rainproof or wet location conduit fittings complying with UL514B that match the openings of the Connection Unit
- UL-listed type 3R filler plugs for closing unused output openings in the enclosure at the top of the Connection Unit

**Procedure:**

1. **⚠ DANGER**

**Danger to life due to electric shock**

- Make sure that all devices (e.g. inverter) connected to the Connection Unit are switched off and protected against reconnection (see manual of the respective device).

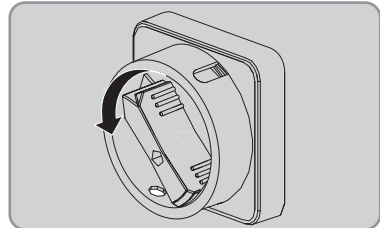
2. **NOTICE**

**Damage to the Connection Unit due to moisture ingress**

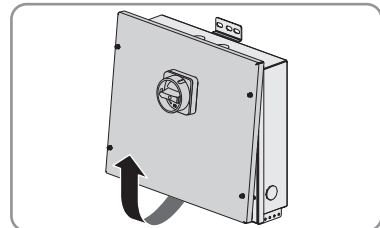
Electronic components in the Connection Unit can be destroyed or damaged as a result of moisture ingress.

- Do not enlarge enclosure openings.

3. Switch the DC switch-disconnector **OFF**. Turn the DC switch-disconnector counterclockwise by 90°.



4. Disassemble the lid of the Connection Unit. Loosen all captive screws with an Allen key (AF 4) and remove the lid by lifting it from below.



5. Remove the adhesive tape from both output openings on top of the Connection Unit.

## 6. **⚠ CAUTION**

### Risk of injury when pressing out the filler plugs

- To connect the conduits to the input openings of the Connection Unit, gently press out one filler plug for each conduit from the inside with a blunt object (e.g. screwdriver handle). Make sure not to damage components of the Connection Unit or of the filler plugs.
7. Insert one conduit fitting each into the corresponding enclosure opening and tighten from within using the counter nut.
  8. Attach the conduit to the enclosure opening.
  9. Close an unused output opening on top of the Connection Unit with UL-listed type 3R filler plugs.
  10. Close unused input openings of the Connection Unit with the factory-mounted filler plugs.

## 6.4 Connecting the Grounding Conductor

The Connection Unit is equipped with two terminals for connecting the grounding conductors. Each terminal has two connection points.

### Overview

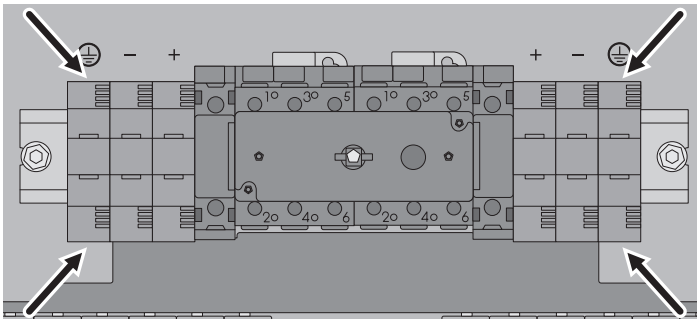


Figure 12: Terminals for connecting the grounding conductors


### Cable requirements:

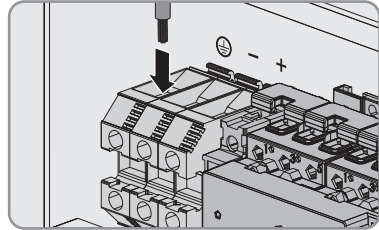
- The cable must be designed in accordance with the local installation requirements and for temperatures of over +194 °F (+90 °C).
- Cable type: copper wire
- Use only solid wire or rough wire strands.
- Conductor cross-section: AWG 8 to AWG 2 (10 mm<sup>2</sup> to 35 mm<sup>2</sup>)

**Requirements:**

- All conduits must be correctly connected to the Connection Unit (see Section 6.3).
- The DC switch-disconnector must be turned **OFF** and the lid of the Connection Unit must be dismantled.

**Procedure:**1. **⚠ DANGER****Danger to life due to electric shock**

- Make sure all devices connected to the Connection Unit (e.g inverter) are switched off and protected against reconnection (see manual of the respective device).
  - Ensure that no DC voltage is present.
2. Lead the grounding conductors through the conduit into the interior of the Connection Unit.
  3. Strip the insulation of the grounding conductor  $2\frac{3}{32}$  in. (18 mm).
  4. Connect the grounding conductor to one of the termination points of the terminal with the symbol  and tighten with a screwdriver (blade width: 6 mm) (torque: at least 44.3 in-lb. (5 Nm)).



5. Ensure that the grounding conductor is firmly positioned.



## 6.5 Connecting the PV Array to the Connection Unit 600-US

### Cable requirements:

- The DC cables of the PV array must be designed in accordance with the installation requirements applicable on site and for temperatures of +194°F (+90°C).
- The DC input and output circuits are isolated from the enclosure and that system grounding, if required by Section 250 of the *National Electrical Code*®, ANSI/NFPA 70, is the responsibility of the installer.
- The maximum cable length, which is dependent on the conductor cross-section, must be adhered to.
- Cable type: copper wire
- Conductor cross-section: AWG 12 to AWG 8 (4 mm<sup>2</sup> to 8 mm<sup>2</sup>)

### Requirements:

- The conduits must be correctly connected to the Connection Unit (see Section 6.3).
- The DC switch-disconnector must be switched **OFF** and the lid must be dismantled.

### Procedure:

Connect the DC cables of the PV array to each **INPUT A** and **INPUT B** as follows:

#### 1. **⚠ DANGER**

##### Danger to life due to electric shock

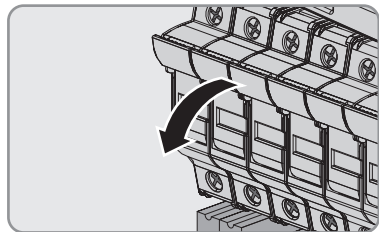
- Make sure that all devices (e.g. inverter) connected to the Connection Unit are switched off and protected against reconnection (see manual of the respective device).
- Cover the PV modules.

#### 2. **⚠ DANGER**

##### Danger to life due to electric shock

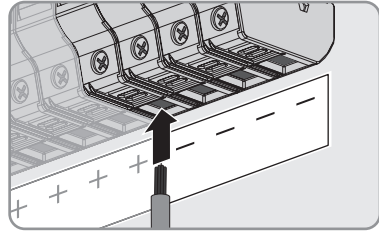
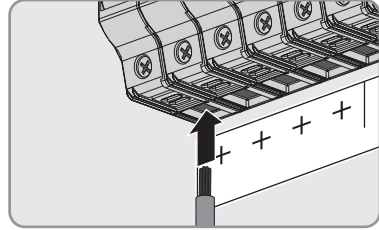
The strings in the Connection Unit are combined to one main string. If there is reverse polarity of a PV string, there can be short-circuit current flowing when string fuses are inserted, string safety levers are closed, and the DC switch-disconnector is open.

- Open all safety levers all the way.



3. Lead the DC cables of the PV array through the connected conduits into the interior of the Connection Unit.
4. Strip the insulation of all cables  $\frac{23}{64}$  in. (9 mm).

5. Check the positive DC cables for correct polarity and insert them all the way into the square opening with the plus sign (+) on the bottom of the fuse holder.
6. Tighten the fuse holder screws with a Philips screwdriver (Philips size: 2) (torque: 30 in-lb. (3.4 Nm)).
7. Check the negative DC cables for correct polarity and insert them all the way into the square opening with the minus sign ( - ) on the bottom of the fuse holder.
8. Tighten the fuse holder screws with a Philips screwdriver (Philips size: 2) (torque: 30 in-lb. (3.4 Nm)).



9. Ensure that all conductors are securely in place and cannot be detached by pulling.

## 6.6 Connecting the PV Array to the Connection Unit 1000-US

### Cable requirements:

- The DC cables of the PV array must be designed in accordance with the installation requirements applicable on site and for temperatures of +194°F (+90°C).
- The DC input and output circuits are isolated from the enclosure and that system grounding, if required by Section 250 of the *National Electrical Code*®, ANSI/NFPA 70, is the responsibility of the installer.
- The maximum cable length, which is dependent on the conductor cross-section, must be adhered to.
- Cable type: copper wire
- Conductor cross-section: AWG 12 to AWG 6 (4 mm<sup>2</sup> to 16 mm<sup>2</sup>)

### Requirements:

- The conduits must be correctly connected to the Connection Unit (see Section 6.3).
- The DC switch-disconnector must be switched **OFF** and the lid must be dismantled.

### Procedure:

Connect the DC cables of the PV array to INPUT A and B as follows:

#### 1. **⚠ DANGER**

##### **Danger to life due to electric shock**

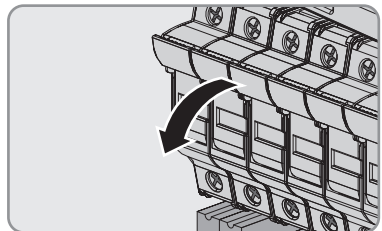
- Make sure that all devices (e.g. inverter) connected to the Connection Unit are switched off and protected against reconnection (see manual of the respective device).
- Cover the PV modules.

#### 2. **⚠ DANGER**

##### **Danger to life due to electric shock**

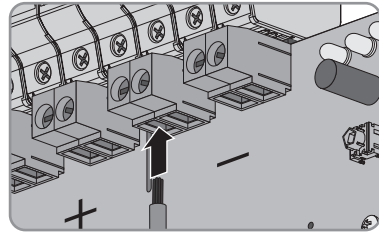
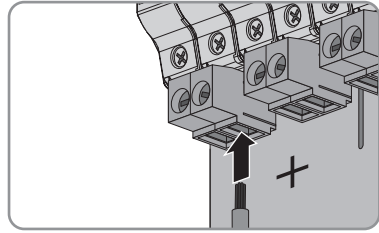
The strings in the Connection Unit are combined to one main string. If there is reverse polarity of a PV string, there can be short-circuit current flowing when string fuses are inserted, string safety levers are closed, and the DC switch-disconnector is open.

- Open all safety levers all the way.



3. Lead the DC cables of the PV array through the connected conduits into the interior of the Connection Unit.

4. Strip the insulation of all cables by  $1\frac{3}{32}$  in. (10 mm).
5. Check the positive DC cables for correct polarity and connect them to the terminals with the plus sign (+). Tip: the reverse polarity detection can be carried out after connecting each string (see Section 6.7 "Operating the Reverse Polarity Detection", page 36).
6. Tighten the screw terminals with a screwdriver (blade width: 4) (torque: 15 in-lb. (1.7 Nm)).
7. Check the negative DC cables for correct polarity and connect them to the terminals with the minus sign (-). Tip: the reverse polarity detection can be carried out after connecting each string (see Section 6.7 "Operating the Reverse Polarity Detection", page 36).
8. Tighten the screw terminals with a screwdriver (blade width: 4) (torque: 15 in-lb. (1.7 Nm)).
9. Ensure that all cables are connected with the right polarity using the reverse polarity detection (see Section 6.7 "Operating the Reverse Polarity Detection", page 36).



## 6.7 Operating the Reverse Polarity Detection

The reverse polarity detection of the Connection Unit 1000-US allows you to test if all cables have been connected with the correct polarity.

### Requirements:

- The DC cables of the PV array must be connected to the terminals.
- The DC switch-disconnector must be turned **OFF** and the lid dismantled.
- For the reverse polarity detection to function, the DC voltage must be at least 100 V.

### **⚠ WARNING**

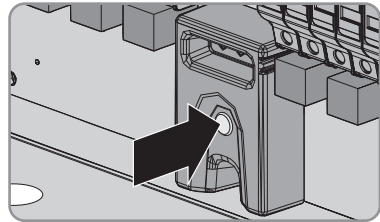
#### **Danger to life due to electric shock**

The strings in the Connection Unit are combined to one main string. If there is reverse polarity of a PV string, there can be short-circuit current flowing when string fuses are inserted, string safety levers are closed, and the DC switch-disconnector is open.

- All safety levers must be opened all the way before you can use the reverse polarity detection.

**Procedure:**

1. Establish the DC voltage supply.
2. Press the button for reverse polarity detection once.



- The middle LED glows green for a few seconds.  
All DC cables are correctly connected. How long the LED glows depends on the level of the applied DC voltage.
- The left LED glows red for a few seconds? How long the LED glows depends on the level of the applied DC voltage.  
At least two of the connected cables at INPUT B are connected with reversed polarity.

  - Check polarity and connect the cable to the correct terminal.
- The red LED glows red for a few seconds? How long the LED glows depends on the level of the applied DC voltage.  
At least two of the connected cables at INPUT B are connected with reversed polarity.

  - Check polarity and connect the cable to the correct terminal.
- All LEDs are off?  
The polarity test could not be carried out.

  - Make sure that the DC voltage is at least 100 V and wait for about 1 minute. Then press the button again.
  - If there is sufficient DC voltage and the problem still persists, check the polarity at each terminal with a suitable multimeter. In case of reverse polarity, connect the respective cable to the correct terminal.

## 6.8 Connecting the DC Output Cable for the Inverter to the Connection Unit

**Additionally required mounting material (not included in the scope of delivery):**

- Two cables for connecting the Connection Unit to the inverter.
- If the DC switch-disconnector should be protected against restarting, a padlock can be used.

**Cable requirements:**

- The DC output cables must be designed in accordance with the installation requirements applicable on site and for temperatures of +194°F (+90°C).
- Cable type: copper wire
- Use only solid wire or rough wire strands.
- Conductor cross-section: AWG 8 to AWG 2 (10 mm<sup>2</sup> to 35 mm<sup>2</sup>)

**Padlock requirements:**

- The material must be non-corrosive and weather-proof.
- The shackle of the padlock must be hardened.
- The lock cylinder must be secured.

**Requirements:**

- The conduits must be correctly connected to the Connection Unit (see Section 6.3).
- The DC switch-disconnector must be switched **OFF** and the lid must be dismantled.

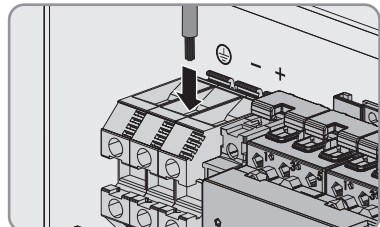
**Procedure:**

Connect the DC output cables for connecting the Connection Unit to the inverter for **INPUT A** and **INPUT B** as follows:

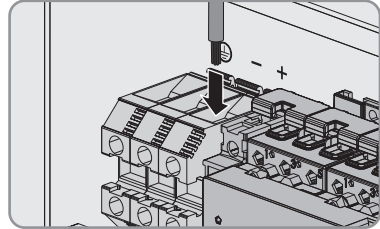
1. ** DANGER**

**Danger to life due to electric shock**

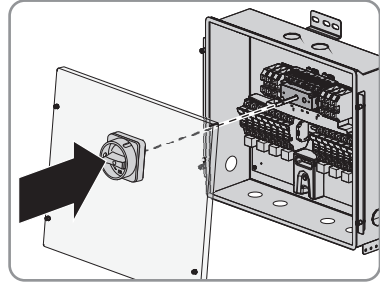
- Make sure all devices connected to the Connection Unit (e.g inverter) are switched off and protected against reconnection (see manual of the respective device).
  - Cover the PV modules.
2. Strip the insulation of the cable ends of the two cables for connecting the Connection Unit to the inverter by  $\frac{5}{16}$  in. (18 mm).
  3. Connect a cable to the screw terminal with the minus sign for connecting the Connection Unit to the inverter.
  4. Tighten the screw terminals with a screwdriver (blade width: 6 mm) (torque 51 in-lb. (5.8 Nm)).



5. Connect a cable to the screw terminal with the plus sign for connecting the Connection Unit to the inverter
6. Tighten the screw terminals with a screwdriver (blade width: 6 mm) (torque 51 in-lb. (5.8 Nm)).



7. Mount the lid of the Connection Unit:
  - Position the lid in such a way that the protruding shaft in the Connection Unit snaps into the provided opening of the DC switch-disconnector.
  - Tighten all lid screws with an Allen key (AF 4) (torque: 35 in-lb. (4 Nm)).



8. In order to protect the DC switch-disconnector against restarting, lead the shackle of the padlock through the opening in the switch and lock it.
9. Lead the connected DC output cables through the conduit of the Connection Unit and connect to the inverter (see inverter installation manual).

## 7 Commissioning

### 7.1 Inserting the String Fuses

Insert the string fuses before commissioning the Connection Unit.

#### Requirements:

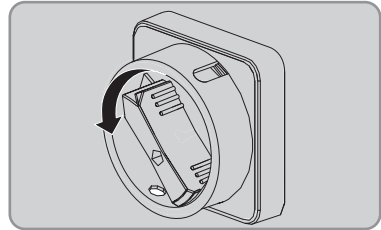
- Only UL-listed string fuses according to UL 2579 are permitted.
- 600 V string fuses must be inserted for the Connection Unit 600-US.
- 1,000 V string fuses must be inserted for the Connection Unit 1000-US.
- The fuse size must be 10 mm x 38 mm (midget format).
- Only maximum 20 A string fuses are permitted.

#### Procedure:

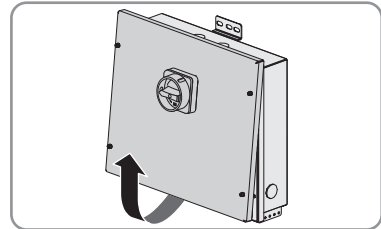
1. **⚠ DANGER**

#### Danger to life due to electric shock

- Make sure that all devices (e.g. inverter) connected to the Connection Unit are switched off and protected against reconnection (see manual of the respective device).
  - Ensure that no DC voltage is present.
2. Turn the DC switch-disconnector **OFF**. Turn the DC switch-disconnector counterclockwise by 90°.

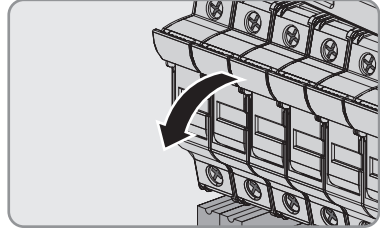


3. Remove the lid of the Connection Unit. Loosen all captive screws with an Allen key (AF 4) and remove the lid by lifting it from below.

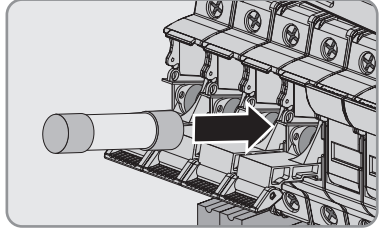




4. Open all safety levers needed all the way.

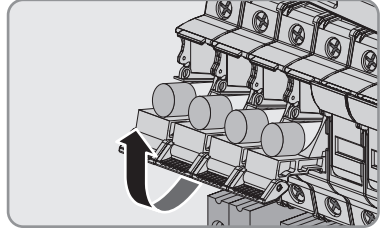


5. Insert 1 string fuse into each fuse holder.



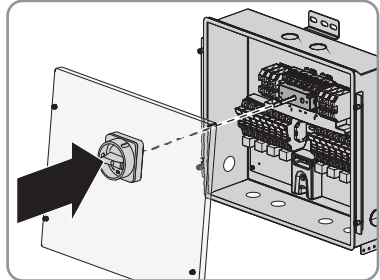
6. Close all safety levers all the way.

☑ The safety levers audibly click into place.



7. Mount the lid of the Connection Unit:

- Position the lid in such a way that the protruding shaft in the Connection Unit snaps into the provided opening of the DC switch-disconnector.
- Tighten all screws of the lid with an Allen Key (AF 4) (torque: 35 in-lb. (4 Nm)).



8. In order to protect the DC switch-disconnector against restarting, lead the shackle of the padlock through the opening in the switch and lock it.

9. Commission the Connection Unit (see Section 7.2).

## 7.2 Commissioning the Connection Unit

The Connection Unit is part of the PV system. All parts of the PV system must be mounted and set up prior to commissioning the Connection Unit.

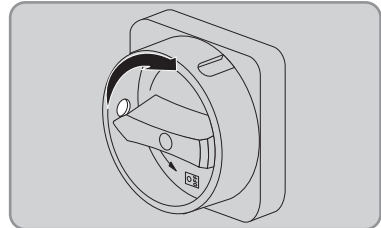
Commissioning occurs via the three-pole circuit breaker (see inverter installation manual).

### Requirements:

- The Connection Unit must be correctly mounted.
- All DC cables must be correctly connected.
- String fuses must be inserted in the Connection Unit.
- Unused output openings on top of the Connection Unit must be closed with UL-listed type 3R filler plugs.
- Unused input openings of the Connection Unit must be closed tightly. The factory-mounted filler plugs can be used for that purpose.
- Connection Unit must be connected to the inverter.
- The Connection Unit and the inverter must be connected by a grounding conductor.
- The lid of the Connection Unit must be installed.
- The three-pole circuit breaker must be correctly rated.

### Procedure:

1. Commission the inverter (see inverter installation manual).
2. If the DC switch-disconnector has been protected against restarting, open and detach the padlock.
3. Turn the DC switch-disconnector of the Connection Unit counterclockwise by 90° and set to **ON**.



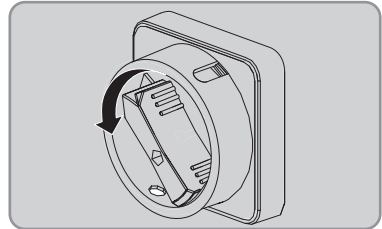
## 8 Disconnecting the Connection Unit from Voltage Sources

### 1. **⚠ DANGER**

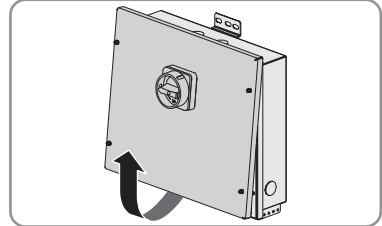
#### Danger to life due to electric shock

- Make sure that all devices (e.g. inverter) connected to the Connection Unit are switched off and protected against reconnection (see manual of the respective device).
- Cover the PV modules.

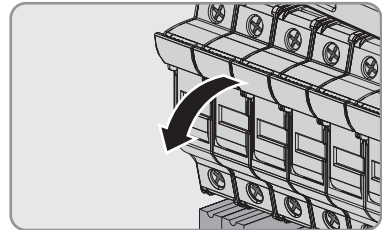
2. Turn the DC switch-disconnector of the Connection Unit counterclockwise by 90° and set to **OFF**.



3. Disassemble the lid of the Connection Unit. Loosen all captive screws with an Allen key (AF 4) and remove the lid by lifting it from below.



4. Open all safety levers all the way.



### 5. **⚠ DANGER**

#### Danger to life due to electric shock

The DC cables are still live if there is sufficient irradiation. Detaching the live DC cables from the terminals can cause life-threatening electric shocks.

- Ensure that the terminals are voltage-free using a suitable multimeter.

6. Detach all DC cables from the terminals using a screwdriver.

## 9 Troubleshooting

### 9.1 LED Signals

The LEDs are part of the reverse polarity detection of the Connection Unit 1000-US and signalize if a string has been connected correctly or with the wrong polarity.

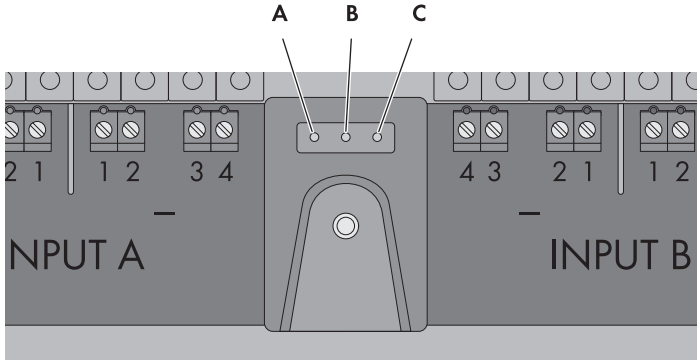


Figure 13: LED signals of the reverse polarity detection for the SMA Connection Unit 1000-US

Item	LED	Status	Explanation
A	LED <b>INPUT A</b>	glowing red	String at <b>INPUT A</b> is connected with the wrong polarity.
B	LED middle	glowing green	String at <b>INPUT A</b> and/or <b>INPUT B</b> is connected correctly
C	LED <b>INPUT B</b>	glowing red	String at <b>INPUT B</b> is connected with the wrong polarity

## 9.2 Replacing the String Fuses

Each string fuse is assigned to one string. If one or several string fuses are blown or defective, you have to replace the respective string fuses.

### Requirements:

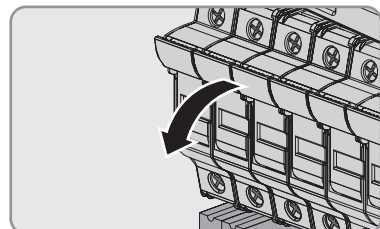
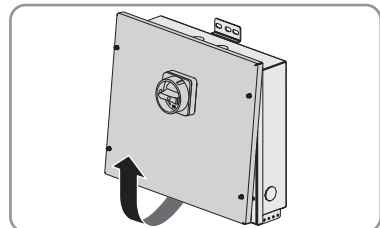
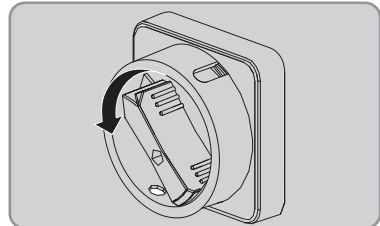
- Only UL-listed string fuses according to UL 2579 are permitted.
- 600 V string fuses must be inserted for the Connection Unit 600-US.
- 1,000 V string fuses must be inserted for the Connection Unit 1000-US.
- The fuse size must be 10 mm x 38 mm (midget format).
- Only maximum 20 A string fuses are permitted.

### Procedure:

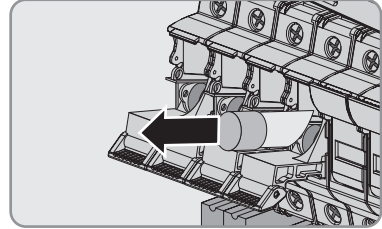
#### 1. **DANGER**

#### Danger to life due to electric shock

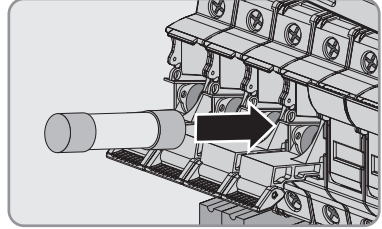
- Make sure that all devices (e.g. inverter) connected to the Connection Unit are switched off and protected against reconnection (see manual of the respective device).
  - Ensure that no DC voltage is present.
2. Turn the DC switch-disconnector **OFF**. Turn the DC switch-disconnector counterclockwise by 90°.
  3. Remove the lid of the Connection Unit. Loosen all captive screws with an Allen key (AF 4) and remove the lid by lifting it from below.
  4. Open all safety levers needed all the way.



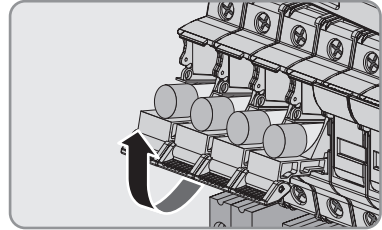
5. Remove blown or defective string fuses from the fuse holders.



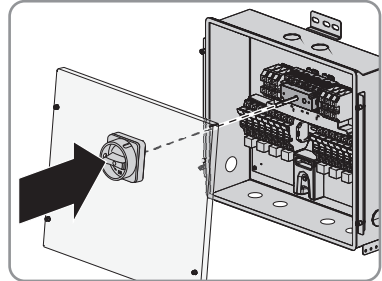
6. Insert one new string fuse into each fuse holder.



7. Close all safety levers all the way.  
 The safety levers audibly click into place.



8. Mounting the lid of the Connection Unit:
- Position the lid in such a way that the protruding shaft in the Connection Unit snaps into the provided opening of the DC switch-disconnector.
  - Tighten all screws of the lid with an Allen Key (AF 4) (torque: 35 in-lb. (4 Nm)).



9. Commission the Connection Unit (see Section 7.2).

# 10 Decommissioning

## 10.1 Disassembling the Connection Unit

1. Disconnect the PV system from voltage sources (see inverter installation manual).
2. Remove all cables from the Connection Unit:
  - Disconnect the Connection Unit from voltage sources (see Section 8).
  - Release all cables from the terminals using a screwdriver and pull the cables out of the Connection Unit.
  - Unscrew the counter nut of the conduit fittings from the inside.
  - Remove the conduit fittings and conduits with cables.
3. Mount the lid of the Connection Unit:
  - Position the lid in such a way that the protruding shaft in the Connection Unit snaps into the provided opening of the DC switch-disconnector.
  - Attach all screws of the lid (torque: 35.4 in-lb. (4 Nm)).
4. Detach the screws from the mounting straps.
5. Remove the Connection Unit from the building ground.
6. To seal the Connection Unit, insert the original filler plugs or type 3R filler plugs into the enclosure openings.

## 10.2 Packing the Connection Unit

- Pack the Connection Unit. Use the original packaging or packaging that is suitable for the weight and dimensions of the Connection Unit.

## 10.3 Disposing of the Connection Unit

- Dispose of the Connection Unit in accordance with the applicable local disposal regulations for electronic waste.

# 11 Technical Data

## DC Input

	CU 600-US-10	CU 1000-US-10
Maximum number of incoming strings	8	8
Strings for INPUT A	4	4
Strings for INPUT B	4	4
Maximum input voltage	600 V	1,000 V

## DC Output

	CU 600-US-10	CU 1000-US-10
Maximum number of outgoing strings	2	2

## Protective Devices

	CU 600-US-10	CU 1000-US-10
DC reverse polarity detection	Not available	available
Overcurrent protection	String fuses	String fuses

## Torques

	CU 600-US-10	CU 1000-US-10
Fuse holder / terminals for connecting the DC input cables	30 in-lb. (3.4 Nm)	15 in-lb. (1.7 Nm)
Terminals for connecting the DC output cables	51 in-lb. (5.8 Nm)	51 in-lb. (5.8 Nm)
Grounding terminals	51 in-lb. (5.8 Nm)	51 in-lb. (5.8 Nm)
Lid screws	35.4 in-lb. (4.0 Nm)	35.4 in-lb. (4.0 Nm)



## General Data

Width x height x depth	18 $\frac{23}{64}$ in. x 15 $\frac{11}{16}$ in. x 5 $\frac{11}{32}$ in. (466 mm x 398 mm x 136 mm)
Weight	22 lb. (10 kg)
Length x width x height of packaging	22 $\frac{11}{64}$ in. x 21 $\frac{3}{8}$ in. 5 $\frac{11}{32}$ in. (563 mm x 543 mm x 240 mm)
Transport weight	24 lb. (11 kg)
Operating temperature range	- 40°F to +140°F (- 40°C to +60°C)
Storage temperature range	- 40°F to +140°F (- 40°C to +60°C)
Maximum permissible value for relative humidity, non-condensing	100%
Maximum operating altitude above MSL	6,561 ft. (2,000 m)
Enclosure Type Rating	Type 3R
Approvals and national standards, as per 05/2013	UL1741 CAN/CSA C22.2 No. 107.1-01

## 12 Accessories

You will find the corresponding accessories and spare parts for your product in the following overview. If required, these can be ordered from SMA or your specialty retailer.

<b>Designation</b>	<b>Brief Description</b>	<b>SMA order number</b>
String fuses	Retrofit kit with ten fuses, listed according to UL2579	-

## 13 Contact

If you have technical problems concerning our products, contact the SMA Service Line. We require the following information in order to provide you with the necessary assistance:

- Device type of the Connection Unit
- Serial number of the Connection Unit
- Type and number of the PV modules connected
- Mounting location and mounting height of the Connection Unit
- LED signal and error message of the inverter if applicable

Country	Company name	SMA Service Line
United States/ Estados Unidos	SMA America, LLC Rocklin, CA	+1 877-MY-SMATech (+1 877-697-6283)* +1 916 625-0870**
Canada/ Canadá	SMA Canada, Inc. Toronto	+1 877-MY-SMATech (+1 877-697-6283)***

\* toll free for USA, Canada and Puerto Rico / Llamada gratuita en EE. UU., Canadá y Puerto Rico

\*\* international / Internacional

\*\*\* toll free for Canada / gratuit pour le Canada

**SMA Solar Technology**

**www.SMA-Solar.com**

**SMA America, LLC**

[www.SMA-America.com](http://www.SMA-America.com)

