

US

Accessories for Sunny Central

# Disconnect Unit for Sunny Central 250U/500U/500HE-US/CA and Sunny Central CP

Installation Guide



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### **IMPORTANT SAFETY INSTRUCTIONS**

### SAVE THESE INSTRUCTIONS

This manual contains important instructions for the Disconnect Unit for Sunny Central 250U / 500U / 500HE-US/CA and Sunny Central CP accessory, that must be followed during installation and maintenance of the accessory.

The Disconnect Unit for Sunny Central 250U / 500U / 500HE-US/CA and Sunny Central CP are 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 Disconnect Unit for Sunny Central 250U / 500U / 500HE-US/CA and Sunny Central CP. To reduce the risk of personal injury and to ensure the safe installation and operation of the Disconnect Unit for Sunny Central 250U / 500HE-US and Sunny Central CP, you must carefully read and follow all instructions, cautions and warnings in this installation guide.

#### 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.

### 

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

### 

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

### **A** CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

#### NOTICE

NOTICE is used to address practices not related to personal injury.

#### Other symbols in this document

In addition to the safety and hazard symbols described on the previous pages, the following symbol is also used in this installation guide:

#### Information

This symbol accompanies notes that call attention to supplementary information that you must know and use to ensure optimal operation of the system.

#### Markings on this product

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



Warning regarding dangerous voltage

The product works with high voltages. All work on the product must only be performed as described in it's documentation.



Electric arc hazards

The product has large electrical potential differences between its conductors. Arc flashes can occur through air when high-voltage current flows. Do not work on the product during operation.



Beware of hot surface

The product can become hot during operation. Do not touch the product during operation.



Observe the operating instructions

Read the documentation of the product before performing any work. Follow all safety precautions and instructions as described in the documentation.



UL1741 is the standard applied by Underwriters Laboratories to the AC/DC-Disconnect Unit for Sunny Central 250U / 500U / 500HE-US/CA to certify that it meets the requirements of the National Electrical Code<sup>®</sup>, the Canadian Electrical Code<sup>®</sup> 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.

#### **General warnings**

#### **WARNING**

All electrical installations must be done in accordance with the local codes and National Electrical Code  $^{\mbox{\scriptsize @}}$  ANSI/NFPA 70 or the Canadian Electrical Code  $^{\mbox{\scriptsize @}}$  CSA C22.1.

Before installing or using the Disconnect Unit for Sunny Central 250U / 500U / 500HE-US/CA and Sunny Central CP, read all of the instructions, cautions, and warnings on the AC/DC-Disconnect Unit for Sunny Central 250U / 500U / 500HE-US/CA and Sunny Central CP in this installation guide.

Before connecting the Disconnect Unit for Sunny Central 250U / 500U / 500HE-US/CA and Sunny Central CP to the power distribution grid, contact the local power distribution grid company. This connection must be made only by qualified personnel.

Wiring of the Disconnect Unit for Sunny Central 250U / 500U / 500HE-US/CA and Sunny Central CP must be made by qualified personnel only.

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# 1 Notes on this manual

This manual describes the installation and the commissioning of the Disconnect Unit for Sunny Central 250U / 500U / 500HE-US/CA and Sunny Central CP. This manual does not cover any details concerning PV modules. Information concerning the PV modules is available from the manufacturer of the PV modules.

You can install the Disconnect Unit both right and left from the Sunny Central. All instructions in this manual are explained for a right system. That means, that the Disconnect Unit will be installed on the right side of the Sunny Central. A right system is recommended by SMA due to much shorter cable lengths. If an installation of the Disconnect Unit is required on a left system, observe that all connections are arranged opposite and that all instructions are carried out accordingly.

Keep this manual in a convenient place for future reference.

### 1.1 Target group

This manual is for qualified personnel only. Qualified personnel have received training and have demonstrated skills and knowledge in the construction and operation of the device. Qualified personnel are trained to deal with the dangers and hazards involved in installing electric devices.

### 1.2 Validity

This manual is valid for the Disconnect Unit for Sunny Central 250U / 500U / 500HE-US/CA and Sunny Central CP.

### 1.3 Nomenclature

In this technical writing the Sunny Central 250U / 500U / 500HE-US/CA and Sunny Central CP are referred to as "Sunny Central".

In this technical writing the Disconnect Unit for Sunny Central 250U / 500U / 500HE-US/CA and Sunny Central CP is referred to as "Disconnect Unit".

In this technical writing SMA America Production, LLC and SMA Solar Technology Canada Inc. are referred to in the following as SMA.

### 1.4 Differences between variants of the Disconnect Unit

The dimensions of the Disconnect Unit are adopted to the specific inverter. A Disconnect Unit for the Sunny Central 250U/500U has a lower height than the Disconnect Unit for the Sunny Central 500HE-US/CA and for Sunny Central CP. Furthermore, you can order the Disconnect Unit in different technical variants. These differences between the variants of the Disconnect Unit are described explicitly in the relevant technical writing chapters.

# 2 Safety

This section describes general safety regulations which must be observed throughout the entire installation process. Pay attention to this section to avoid personal injury and material damages.

### 2.1 Appropriate usage

The Disconnect Unit for Sunny Central inverter is a AC/DC disconnect that extends the range of functions of the inverter. You can use the Disconnect Unit to disconnect the inverter from PV modules and from the power distribution grid as requested by the National Electrical Code<sup>®</sup> ANSI/NFPA 70.



Figure 1: Principle of a PV plant with a inverter with Disconnect Unit

Position	Description
Α	PV modules
В	DC distribution with DC fuses (e.g., Sunny Central String-Monitor)
с	Sunny Central
D	Disconnect Unit
E	Transformer
F	Power distribution grid

Any other application of the inverter, of the Disconnect Unit or installation of components and modifications which are not allowed explicitly endanger the safety and void the warranty as well as the operation permit.

- It is prohibited to use the inverter and the Disconnect Unit for purposes other than those described here.
- It is prohibited to modify the inverter or the Disconnect Unit or to install components that are not explicitly recommended or sold by SMA.

• It is prohibited to connect the Sunny Central 500HE-US/CA or Sunny Central CP without transformer to the grid. Operating the inverter without transformer causes a short-circuit and can destroy the inverter.

### 2.2 Safety instructions

#### 

High voltages are present in the live components of the low-voltage grid.

Death from burning and electric shock will result.

- Do not touch the live components of the inverter or of the Disconnect Unit or low-voltage grid.
- Pay close attention to all safety precaution measures regarding the low-voltage grid.

#### **A** DANGER

During operation, high voltages are present in the inverter and in the Disconnect Unit.

Death resulting from electric shock will result.

• If the Disconnect Unit has got doors: Do not operate the inverter and the Disconnect Unit with doors open.

Before commencing work on the inverter and the Disconnect Unit:

- Disconnect completely.
- Ensure that the device cannot be reconnected.
- Ensure that no voltage is present.
- Ground and short-circuit.
- Cover any nearby live parts.

#### **A** DANGER

Normally grounded conductors may be ungrounded and energized when a ground-fault is indicated by the inverter.

Risk of electric shock.

- Test before touching.
- Work on the inverter and on the Disconnect Unit must be carried out by qualified personnel.

#### **WARNING**

Failure to follow the manual, the operating instructions and the safety precautions may lead to severe injury from electric shock.

- All work on the inverter and on the Disconnect Unit must be done as described in this manual.
- Pay attention to all safety instructions.
- Follow all operating instructions.
- If problems occur when performing the work described here, contact SMA.

### 

Operating a damaged inverter or Disconnect Unit can cause severe injury from electric shock.

- The inverter and the Disconnect Unit must only be used when it is technically faultless and safe to operate.
- Do not operate the inverter or the Disconnect Unit if there are visible damages.
- Check the inverter and the Disconnect Unit on a regular basis for visible damage.
- Ensure that all safety features are accessible at all times and that their correct operation is tested regularly.

### 

Cuts and scratches due to sharp edges inside the inverter and inside the Disconnect Unit can result.

• Wear protective gloves when working on the inverter and the Disconnect Unit.

#### NOTICE

The components in the inverter and in the Disconnect Unit can be damaged by electrostatic discharge.

- Observe all ESD safety regulations when working on and when handling the components of the inverter and the Disconnect Unit.
- Discharge electrostatic charge by touching the grounded inverter enclosure.
- Only then it is safe to touch any electronic components.

### i Storage of technical writing

Keep this installation guide in the immediate vicinity of the Disconnect Unit. It must be accessible to service and maintenance personnel at any time.

Do not store the installation guide or any other papers in the inverter or in the Disconnect Unit.

# 3 The Disconnect Unit for Sunny Central

### 3.1 Operating principles

The PV modules convert a portion of sunlight into electrical energy (direct current). The inverter then converts the direct current into alternating current and feeds it into the power distribution grid. This current can be used directly, or it can be sold to your energy provider. The Disconnect Unit is for disconnecting the inverter from the PV modules and from the power distribution grid for service and maintenance issues and in case of emergency as demanded by National Electrical Code<sup>®</sup> 2008.

### 3.2 Identifying the Disconnect Unit

You can identify the Disconnect Unit by its type label. The type label is located at the top right of the rear wall.

www.SMA-America.com	SMA	
DISCONNECT-UNIT		
Engineered in Germany - Assem	bled in Denver/Colorado	
	US80	
Model:	Serial No.:	
DC-SC-US	XXXXXXXXXX	
Fabrication Version Date of manufacture	xx/xxxx	
Allowed Inverter Type	хохохох - хх/хх	
DC Rating:		
Maximum Array system voltage	xxx Vdc	
AC Pering current	xxxx Adc	
AC Katings:	Min. xxx	
(Vac 3-Phase)	Nominal xxx	
Operating frequency range	Max. xxx Min. xx.x	
(Hz)	Max. xx.x	
Max. continous output current	хххх Аас	
Max. continous output Power	xxxx kWac	
For more electrical	ratings see in the	
Other Ratings*		
Operating temperature range	(-25 °F +50 °C)	
Maximum Air ambient without De-Ratings (°C)	50 °C	
ENCLOSURE	Type 3R (IP54)	
* For more details and tightening	torge, allowable wire size	
and type see Disconnect unit G	perators's manual.	
C U US LISTED		

Figure 2: Type label Disconnect Unit

# 4 Scope of delivery and storage

### 4.1 Unpacking and inspection

All Disconnect Units are thoroughly checked before they are packaged and shipped. Although they are shipped in sturdy packaging, damage can still occur during shipping and delivery.

- It is important to carefully inspect the shipping container and contents prior to installation.
- If you detect any external damage after unpacking, report the damage immediately to your SMA dealer and shipping company that delivered the unit.
- If it becomes necessary to return the Disconnect Unit, use the original packing material.
- For further details about unpacking and transport of the Disconnect Unit see the technical description "Unpacking AC/DC Disconnect Unit for Sunny Central 250U / 500U / 500HE-US/CA and Sunny Central CP".
- If you need assistance with a damaged Disconnect Unit, contact your dealer or SMA (see chapter 9 "Contact", page 70).

### 4.2 Scope of delivery



Figure 3: Scope of delivery Disconnect Unit

Position	Quantity	Description
Α	1	Disconnect Unit for Sunny Central
В	1	Installation guide
С	1	TX 25 screw driver
D	1	TX 30 screw driver
E	18*	Screw terminals for AC connections
F	18*	Screw terminals for DC connections
G	2*	Screw terminals for PE connection
н	1	Label

optional

### 4.3 Storage

#### NOTICE

Improper storage can cause moisture to seep into the Disconnect Unit.

Damage to the Disconnect Unit will result.

- The Disconnect Unit must be closed during storage.
- If stored for 6 months or longer, make sure the storage area is dry.

#### NOTICE

Uneven underground can damage the frame construction.

- The underground must be suitable for the weight of the disconnect of approximately 1,464 lb. (664 kg).
- The underground may only deviate from a level of 0.25 %.
- Storage temperature: -40 °F ... +140 °F (-40 °C ... +60 °C).

## 5 Installation of the Disconnect Unit

### 5.1 Choosing the installation site

### 5.1.1 Ambient conditions

- □ The installation location must be accessible at all times.
- □ Ambient temperature: -13 °F ... +122 °F (-25 °C ... +50 °C).
- □ Humidity 15 % ... 95 %.
- □ The Disconnect Unit is not protected from salt fog pariculars, it can not be operated in chemically aggressive environments. Operate the Disconnect Unit in a minimal distance of 19 miles (30 km) from sea.

For more information, see section 8 "Technical data", page 66.

### 5.1.2 Characteristics of the base

- $\Box$  The mounting surface is leveled and strong enough to support the weight of the Disconnect Unit. The evenness of the foundation must be less than 0.25 % (1 in. per 3  $\frac{5}{16}$  ft.).
- □ The width and depth of the base is at least the same size as the Disconnect Unit including mounting anchors.



Figure 4: Dimension Base for Disconnect Unit



### 5.1.3 Position of the mounting holes and bottom entry sleeves

Figure 5: Position mounting holes

### 5.1.4 Minimum clearances



Figure 6: Minimum clearance between inverter and Disconnect Unit side-by-side

The minimum clearance between Sunny Central and Disconnect Unit side-by-side is required for bending radii for inserting cables through side-entry (see section 5.4 and section 5.5). Minimum clearance can be reduced down to 3 in. (75 mm) by inserting the cables through bottom entry.



Figure 7: Minimum clearance between inverter and Disconnect Unit face-to-face

The minimum between Sunny Central and Disconnect Unit face-to-face has to be 4 ft. (1,220 mm) if one cabin shall be opened at the same time. Refer to National Electrical Code<sup>®</sup> ANSI/NFPA 70 for detailed information about the requirements.

#### NOTICE

#### Increased clearance

The clearance has to be raised if both cabinets shall be opened at the same time. Refer to National Electrical Code<sup>®</sup> ANSI/NFPA 70 for detailed requirements.

### 5.1.5 Dimensions and weight

#### Disconnect Unit for Sunny Central 250U / Sunny Central 500U

The Sunny Central with Disconnect Unit has a total weight of approximately 1,356 lb. (615 kg).



Figure 8: Dimensions Disconnect Unit for Sunny Central 250U / Sunny Central 500U with roof



Figure 9: Dimensions Disconnect Unit for Sunny Central 250U / Sunny Central 500U without roof

#### Disconnect Unit for Sunny Central 500HE-US/CA and Sunny Central CP

The Sunny Central with Disconnect Unit has a total weight of approximately 1,356 lb. (615 kg).



Figure 10: Dimensions Disconnect Unit for Sunny Central 500HE-US/CA and Sunny Central CP with roof





### 5.2 Installing the Disconnect Unit onto the base

#### 1. NOTICE

#### Danger of crushing

Regard the heavy weight of the Disconnect Unit.

- Use a cran to move the Disconnect Unit. Refer to technical description "Unpacking Disconnect Unit for Sunny Central 250U/500U/500HE-US/CA" for further information.
- Move the Disconnect Unit to its position onto the base.
- 2. Mark the position of the holes for connecting the Disconnect Unit with the basement.
- 3. Drill the holes into the basement on marked positions.
- 4. Put dowels into the drill holes.
- 5. Fasten the Disconnect Unit to the basement using appropriate screws.

### 5.3 Opening the Disconnect Unit

- □ The front consists of a single front plate fixed by screws. Regard the heavy weight of the front plate. Two persons are needed to move the front plate of this variant of the Disconnect Unit.
- 1. Shutdown the Sunny Central as descibed in the user manual of the Sunny Central.
- 2. Unscrew the 3 screws at the handles on the left side of the front plate.



 Turn all switches of the Disconnect Unit to the left into "Off" position. You need to push/pull sharply in order to move the switches.



- 4. For Disconnect Unit for Sunny Central 500HE-US and Sunny Central CP:
  - Push the red button of the AC disconnect.

#### 5. **A DANGER**

#### High voltages are present in the inverter.

Death resulting from electric shock will result.

Even after switching all switches to the "Off" position, there could be high voltages from the Sunny Central and the power distribution grid at the busbars and at the switches and their connection points.

- If the inverter has already been in operation, wait for at least 8 minutes for all internal power supplies to discharge.
- Disconnect the unit from power distribution grid.
- Make sure that there is no voltage at the busbars and at the connection points of the switches.

#### 6. NOTICE

#### Danger of crushing

Regard the heavy weight and the measures of the front plate.

- Two persons are needed to move the front plate of the Disconnect Unit.
- Make sure that one person always hold the front plate of the enclosure while the other person performs work at it.
- 7. Loosen all screws except for the 4 screws at the corners of the front plate.

8. Hold the front plate of the Disconnect Unit and loosen the 4 screws at the corners of the front plate.

 Pull the bottom edge of the front plate of the enclosure approximately 6 in. (150 mm) to the front.



Unhook the front plate of the enclosure by pulling it 10. upwards.

11. Move the front plate for approximately 8 in. (200 mm) and hold it with 2 hands.

- 12. Remove the ground strap from the bottom left corner of the front plate.

Remove the front plate. 13.

### 5.4 Preparation of the cable entries

Figure 12: Position of the cable entries for both AC cables and DC cables





- 1. Determine the entering side of the cables. There are plates for cable entries on both sides and at the bottom of the Disconnect Unit.
- 2. For every plate which is used for cable input proceed as follows:
  - Loosen all screws of the plate and remove the plate.



#### 3. NOTICE

#### Danger of fire

In order to avoid high temperatures you must distribute the cables through a sufficient number of openings.

Refer to National Electrical Code<sup>®</sup> ANSI/NFPA 70 requirements for further information. Regard the AC cable arrangement requirements mentioned in section 6.4.2 for sufficient number of openings.

- Cut openings into the plate.
- The opening must be large enough so that all cables can be pulled through.
- The opening must not be too large so that they can be sealed up easily.
- 4. Cut 1 additional opening for the PE cable on the side that points to the inverter.
  - The openings must be large enough so that all cables can be pulled through.
  - The openings must not be too large so that they can be sealed up easily.
- Install the plates with openings at the Disconnect Unit. Tighten the screws with a torque of 31 in-lb. (3.5 Nm).



### 5.5 Inserting cables into the Disconnect Unit

#### NOTICE

#### Ingressing moisture caused by insufficient sealing.

Water and moisture can ingress through unsealed openings.

- Use fittings and conduits to seal all openings as required by the National Electrical Code<sup>®</sup> ANSI/NFPA 70.
- If you want to lead the grounded DC cables through the Disconnect Unit: insert the grounded DC cables through rear openings of the plates and pull them through the Disconnect Unit to the inverter.



- 2. Insert the ungrounded DC cables through rear openings and connect them to the DC load breaker switches (see section 6.3 "Connecting DC cables to the Disconnect Unit", page 33).
- 3. Insert the AC cables through forward openings and connect them to the AC busbars (see section 6.4 "Connecting AC cables to the Disconnect Unit", page 40).

# 6 Electrical connection

### 6.1 Overview electrical connections

### 6.1.1 Disconnect Unit for Sunny Central 250U/500U

The following illustration gives an overview of a Disconnect Unit for Sunny Central 250U and Sunny Central 500U.



Position	Description
Α	Connection for ungrounded DC to inverter
В	PE busbar
С	Connection for ungrounded DC from PV-plant
D	Connection for AC to power distribution grid
E	Connection for AC from inverter

### 6.1.2 Disconnect Unit for Sunny Central 500HE-US/CA and Sunny Central CP



Figure 13: Overview electrical connection

Position	Description
Α	Connection for ungrounded DC to inverter
В	PE busbar
с	Connection for ungrounded DC from PV-plant
D	Busbars for AC to power distribution grid
E	Busbars for AC from inverter

### 6.2 Cable requirements

#### **WARNING**

#### **Risk of fire**

#### Caused by mix-up of DC and AC cables during installation.

• To reduce the risk of fire, flag all DC cables with home run numbers and AC cables with phase designations by appropriate labels prior to installation to avoid the risk of mix-up.

### 6.2.1 Cable requirements for DC, AC and PE connection

- Connect all cable to the Disconnect Unit using copper or aluminium conductors that are suitable for temperatures of +194 °F (+90 °C) and in accordiance with National Electrical Code<sup>®</sup> ANSI/NFPA 70.
- Use the screw terminal or the screws included in scope of delivery for mounting cable lugs only. Cable lugs have to be UL listed compression lugs with two securement holes (1/2) in. (13 mm) in diameter) and a distance between the holes of  $1^{3}/_{4}$  in. (44 mm). Both holes have to be utilized in installation. The width of the lugs has to exceed the washer diameter of  $1^{1}/_{4}$  in. (32 mm) to ensure defined torque values listed below.

The screw terminals can be connected with 1 or 2 conductors each.

Connection method	Cable size	Torque
Cable fixing in screw terminal	4 AWG 600 kcmil	41.5 ftlb. (56.5 Nm)
	(25 mm² 304 mm²)	
Cable lug, aluminum on copper	4 AWG 800 kcmil	27.5 ftlb. (37 Nm)
busbar	(25 mm² 405 mm²)	
Cable lug, copper on copper	4 AWG 800 kcmil	44 ftlb. (60 Nm)
busbar	(25 mm² 405 mm²)	

 $\hfill\square$  For individual cable sizing refer to article National Electrical Code  $\ensuremath{^{\textcircled{@}}}\xspace$  310.

Screw terminals are pre-mounted upon delivery. If they have to be fixed again on the copper busbar, use a torque of 27.5 ft.-lb. (37 Nm).

### 6.2.2 Additional cable requirements for DC connection

- Use the screw terminals or cable lugs to connect DC cables to the DC load break switch as described in section 6.3.2 and 6.3.3.
- Connect 2 conductors per input terminal maximum.
- The DC inputs are isolated from the enclosure and the system grounding. If required by section 250 of the National Electrical Code<sup>®</sup>, ANSI/NFPA 70, the installer is responsible for this grounding.

#### Maximum numbers of DC inputs

Maximum number of DC inputs for Sunny Central 250U	6
Maximum number of DC inputs for Sunny Central 500U / 500HE-US / CA and Sunny Central CP $$	9

### 6.3 Connecting DC cables to the Disconnect Unit

### 6.3.1 Connection sequence DC switches

Depending on your order the Disconnect Unit contains up to five DC switches. There are up to 3 DC switches in the back row and up to 2 in the front row. The location of the DC home runs contacts are depicted in figure 14 and 15 shown below.

#### Connection sequence to inverter:

For good access to all DC homerun terminals always contact from the back row to the front row and always from the bottom to the top contact within each row.

The connection sequence in terms of home run numbers is shown in figure 14 and listed below.



Figure 14: DC home run numbers to inverter

Row	Home run number
1	4 and 2
2	9, 3 and 1
3	8 and 6
4	7 and 5

#### **Connection sequence from PV-plant:**

For good access to all DC home run terminals always contact from the back row to the front row and always from the bottom to the top contact within each row.

The connection sequence in terms of home run numbers is shown in figure 15 and listed below.



Figure 15: DC home run numbers from PV-plant

Row	Home run number
1	4 and 2
2	9, 3 and 1
3	8 and 6
4	7 and 5

# 6.3.2 Connecting DC cables to DC load break switch by screw terminals

#### **A** DANGER

Voltage is present in PV modules exposed to light. Death resulting from electric shock.

- Cover the PV modules.
- Switch off the fuses in the DC distribution boxes (e.g. Sunny Central String-Monitor) and secure them against reconnection.
- Follow all safety precautions of the module manufacturer.

#### **A** DANGER

Normally grounded conductors may be ungrounded and energized when a groundfault is indicated. Risk of electric shock.

- Test before touching.
- Work on the Disconnect Unit must be carried out by qualified personnel.





Figure 16: Connection of DC cables to busbar with screw terminals
Position	Description
Α	Nut - size: M 12
В	Spring washer
с	Washer
D	Screw terminal
E	Busbar
F	Screw head - size: M12



Figure 17: Mounted screw terminal

- 1. Strip the cable by about  $1 \frac{1}{5}$  in. (30 mm).
- 2. Open the set screw of the terminal completely.
- 3. Plug the conductor of the cable into the screw terminal and tighten it with the specified torque (see section 6.2 "Cable requirements", page 32).
- 4. **İ** Torque at pre-mounted screw terminals

The screw terminals are pre-mounted upon delivery.

If necessary, tighten the screw terminal to the busbar again using a torque wrench with a torque of 27 ft-lb. (37 Nm).

# 6.3.3 Connecting DC cables to DC load break switch by cable lugs

# **A** DANGER

#### Voltage is present in PV modules exposed to light. Death resulting from electric shock.

- Cover the PV modules.
- Switch off the fuses in the DC distribution boxes (e.g. Sunny Central String-Monitor) and secure them against reconnection.
- Follow all safety precautions of the module manufacturer.

# 

Normally grounded conductors may be ungrounded and energized when a groundfault is indicated. Risk of electric shock.

- Test before touching.
- Work on the Disconnect Unit must be carried out by qualified personnel.



Figure 18: Connection of DC cables to busbar with cable lug

Position	Description
Α	Screw head - size: M 12
В	Spring washer
С	Washer
D	Cable lug
E	Busbar
F	Nut - size: M 12



Figure 19: Mounted cable lugs

#### Procedure of connecting

# 1. NOTICE

#### Oxide layers on contact surfaces after transport and storing of the Disconnect Unit.

Yield loss resulting due to poor electrical conductivity.

- Before connecting the cables, clean the contact surfaces.
- Use only the non-woven abrasive delivered with the Sunny Central.
- Do not clean the surfaces with sandpaper.
- Do not damage the tin coating.
- Do not touch the contact surfaces after they have been cleaned.
- 2. Position the cable lug or lugs on the busbar.
- 3. Tighten the screw with a nut in a clockwise direction. For torques refer to the table (see section 6.2 "Cable requirements", page 32).
- 4. Connect all DC cables as illustrated above.

# 6.4 Connecting AC cables to the Disconnect Unit

#### NOTICE

The AC outputs are isolated from the enclosure and the system grounding. If required by section 250 of the National Electrical Code<sup>®</sup>, ANSI/NFPA 70, the installer is responsible for this grounding.

Refer to section 6.2 "Cable requirements", page 32 for general requirements for DC, AC and PE connection of the Disconnect Unit.

# 6.4.1 Additional cable requirements for AC connection

• Use the screw terminals or cable lugs to connect the AC cables to the AC breakers (see section 6.4.5 "Connecting AC cables to busbars", page 51).

#### Maximum number of AC outputs

Maximum number of AC outputs per phase for Sunny Central 250U/500U		
Maximum number of AC outputs per phase for Sunny Central 500HE-US/CA and Sunny Central CP	6	

# NOTICE

#### **External AC fuses**

The Disconnect Unit for Sunny Central 500HE-US/CA and Sunny Central CP is provided with UL listed circuit breaker on output rated 1,600 A for branch circuit protection.

The AC output of the Disconnect Unit with Sunny Central 250U/500U must be fused externally by the installer.

# **A**CAUTION

- Over-current protection for AC output circuit of the Disconnect Unit must be provided by others when used with Sunny Central 250U/500U.
- To reduce the risk of fire, connect only to a circuit provided with over-current protection in accordance with National Electrical Code<sup>®</sup>, ANSI/NFPA 70.

AC fuses Disconnect Unit with Sunny Central 250U	High speed US fuses (Class J), maximum 400 A each.
AC fuses Disconnect Unit with Sunny Central 500U	Class L fuses, maximum 800 A each.

# 6.4.2 Arranging AC cables

This section explains how to arrange the AC cables to minimize the interferences between the different phases. Make sure that the cables of the different phases have got the same length.

# Cable arragement for AC cables shorter than 6 $\frac{1}{2}$ ft. (2 m)

Arrange the cables as shown in the following figure for all number of cables with length shorter than 6 1/2 ft. (2 m). The description is exemplary for an arrangement with 4 cables per phase. The distance between the cables should be twice the diameter of a single cable.



Figure 20: Cable arragement for AC cables shorter than 6  $\frac{1}{2}$  ft. (2 m)

# Cable arragement for AC cables longer than 6 $\frac{1}{2}$ ft. (2 m)

Arrange the cables as shown in the following figure for all number of cables with length shorter than 6 1/2 ft. (2 m). The description is exemplary for an arrangement with 4 cables per phase.

For AC cable arrangement 1: the distance between the cables should be twice the diameter of a single cable.

# NOTICE

The AC cable length between Disconnect Unit and transformer must be lower than 49 ft (15 m).

Number of cables per phase	3	4	5	6
	AC cable arrangement 1.	If possible: AC cable arrangement 2. else: AC cable arrangement 1	AC cable arrangement 1.	If possible: AC cable arrangement 3. else: AC cable arrangement 1.



Figure 21: AC cable arrangement 1



Figure 22: AC cable arrangement 2



Figure 23: AC cable arrangement 3

# 6.4.3 Overview AC connection to power distribution grid

AC connection Disconnect Unit for Sunny Central 250U/Sunny Central 500U

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Figure 24: Overview AC connection to power distribution grid with AC switch 400 A

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Figure 25: Overview AC connection to power distribution grid with AC switch 800 A



Figure 26: Overview AC connection to power distribution grid with cable lugs



Figure 27: Overview AC connection to power distribution grid with screw terminals

# AC connection Disconnect Unit for Sunny Central 500HE-US/CA/Sunny Central CP



Figure 28: Overview AC connection to power distribution grid - phases

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Figure 29: Overview connection sequence AC switch to power distribution grid

# **i** Arrangement of elements AC connection

To make sure that you can reach all nuts and screws with a torque-wrench, arrange all screw terminals, screws, nuts, washers and spring washers as shown in the figures below.



Figure 30: Overview AC connection to power distribution grid with cable lugs - phases B and C



Figure 31: Overview AC connection to power distribution grid with cable lugs - phase A



Figure 32: Overview AC connection to power distribution grid with screw terminals - phases C



Figure 33: Overview AC connection to power distribution grid with screw terminals - phases B



Figure 34: Arrangement of elements AC connection to power distribution grid with screw terminals - phase A

# 6.4.4 Overview AC connection to the inverter

## AC connection Disconnect Unit for Sunny Central 250U/Sunny Central 500U



Figure 35: Overview AC connection to inverter with AC switch 400 A - phases



Figure 36: Overview AC connection to inverter with AC switch 800 A - phases



# AC connection Disconnect Unit for Sunny Central 500HE-US/CA/Sunny Central CP

Figure 37: Overview AC connection to inverter - phases



Figure 38: Overview connection sequence AC switch to inverter

# **i** Arrangement of elements AC connection

To make sure that you can reach all nuts and screws with a torque-wrench, arrange all screw terminals, screws, nuts, washers and spring washers as shown in the figures below.



Figure 39: Arrangement of elements AC connection to inverter with cable lugs



Figure 40: Arrangement of elements AC connection to inverter with screw terminals

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# 6.4.5 Connecting AC cables to busbars

#### **A** DANGER

#### High voltages are present in the live components of the low voltage grid.

#### Death resulting from burning and electric shock.

- Pay close attention to all safety precaution measures regarding the low-voltage grid.
- Switch off the AC and DC circuit breaker/load break switches and secure it against accidental switching on.
- Ensure that no voltage is present.

# **A** CAUTION

#### Danger of fire caused by wrong arrangement of AC cables.

Wrong arrangement of AC cables can result overheating of the cables and causes the danger of fire.

• Arrange the cables as described in 6.4.2 "Arranging AC cables", page 41.

# **A** CAUTION

#### Danger of fire caused by improper connection to the power distribution grid.

 To reduce the risk of fire, do not connect to an AC load center (circuit breaker panel) having multi-wire branch circuits connected.

A B

C<sub>C</sub>B<sub>F</sub>



#### Connecting AC cables to busbars with screw terminals

Figure 41: Connection of AC cables to busbar with screw terminals

Position	Description
Α	Nut - size: M 12
В	Spring washer
с	Washer
D	Screw terminal
E	Busbar
F	Screw head - size: M12

- 1. Strip the cable by about  $1\frac{1}{5}$  in. (30 mm).
- 2. Open the set screw of the terminal completely.
- 3. Plug the copper conductor of the cable into the screw terminal and tighten it with the specified torque (see section 6.2 "Cable requirements", page 32).

If necessary, tighten the screw terminal to the busbar again using a torque wrench with a torque of 27 ft-lb. (37 Nm).







Figure 42: Connection of AC cables to busbar with copper cable lug

Position	Description
Α	Screw head - size: M 12
В	Spring washer
с	Washer
D	Cable lug
E	Busbar
F	Nut - size: M 12

#### Connecting procedure

# 1. NOTICE

#### Oxide layers on contact surfaces after transport and storing of the Disconnect Unit.

Yield loss resulting due to poor electrical conductivity.

- Before connecting the cables, clean the contact surfaces.
- Use only the non-woven abrasive delivered with the Sunny Central.
- Do not clean the surfaces with sandpaper.
- Do not damage the tin coating.
- Do not touch the contact surfaces after they have been cleaned.
- 2. Position the cable lug or lugs on the busbar.
- 3. Tighten the screw with a nut in a clockwise direction. For torques refer to the table (see section 6.2 "Cable requirements", page 32).
- 4. Connect all AC cables as illustrated above.

# 6.5 Connecting protective earth

#### NOTICE

The AC outputs are isolated from the enclosure and the system grounding. If required by section 250 of the National Electrical Code<sup>®</sup>, ANSI/NFPA 70, the installer is responsible for this grounding.

Refer to section 6.2.1 "Cable requirements for DC, AC and PE connection", page 32 for general requirements for DC, AC and PE connection of the Disconnect Unit.

# 6.5.1 Additional cable requirements for PE connection

- □ Use the screw terminals or cable lugs to connect the AC cables to the AC breakers as described in section 6.4.5 "Connecting AC cables to busbars", page 51.
- □ The conductor size of the PE connection is depending on the installed over-current protection device. For determination see National Electrical Code<sup>®</sup>, ANSI/NFPA 70 article 250.122.
- □ The Photovoltaic System Grounding must be installed per the requirements of sections 690.41 through 690.47 of the National Electrical Code<sup>®</sup>, ANSI/NFPA 70 and is the responsibility of the installer.



Figure 43: Overview bus	bar protective earth
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Position	Description
Α	Neutral busbar <sup>*</sup>
В	PE busbar

\* only for Sunny Central 250U/500U

# 6.5.2 Connecting protective earth to busbar

You can connect up to 4 PE cables to the busbar(s). For every PE cable carry out the following instruction.

- 1. Strip the PE cable by about  $1 \frac{1}{5}$  in. (30 mm).
- 2. Open the screw terminal completely.
- 3. Plug the copper inner conductor of the PE cable into the screw terminal.

4. Tighten the screw terminal with a torque wrench and a torque of 41 ft-lb. (56 Nm).





# 6.6 Closing the Disconnect Unit

- □ The handles on the front plate of the enclosure must be set to "Off", so that the shafts can snap in.
- □ The 2 mounting clamps for the front plate of the enclosure must be set to the correct position (see figure below). The 2 mounting clamps are moveable and must be arranged  $11\frac{3}{4}$  in. ... 1 ft.  $3\frac{3}{4}$  in. (300 mm ... 400 mm) from the sides.



Figure 44: Position of the mounting clamps.

#### 

#### Danger of crushing

Take into account the heavy weight of the front plate of the enclosure.

- Two persons are needed to move the front plate of the enclosure to the Disconnect Unit.
- Make sure that one person always holds the front plate of the enclosure while the other person performs work at it.
- Hold the front plate of the enclosure with 2 hands and move it to the front of the Disconnect Unit. The distance between the Disconnect Unit and its front plate must be approximately 8 in. (200 mm).
- Connect the ground strap from the bottom left corner of the Disconnect Unit to the front plate of the enclosure. Fasten the screw with a torque of 70 in-lb. (8 Nm).



- Tip the front plate of the enclosure with two persons 3. in such way, that the upper edge of it points towards the Disconnect Unit. Hook the front plate of the enclosure into the two mounting clamps at the front of the Disconnect Unit.
- 4. Push the bottom edge of the front plate of the enclosure to the Disconnect Unit.

- For every handle of the switches in front of the front plate of the enclosure: slightly shake the 5. handle a few times so that the shaft of the switch snaps into the handle.
- 6. Attach the front plate of the enclosure to the Disconnect Unit at its 4 corners with 4 screws and 4 seal washers. Fasten the screws hand-tight so that the front plate of the enclosure can be moved.

- 7. Insert 1 screw with seal washer in every hole and fasten the screws hand-tight. The 3 holes behind the left handles are not reachable yet.
- Make sure that the front plate of the enclosure is 8. aligned to the edges of the Disconnect Unit. Fasten all screws with a torque of 44 in-lbs (5 Nm).





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9. Make sure that all switches function properly by switching them into position "On" and back to position "Off".

The switches function properly if there is no backlash of the shafts and the switches make a clear sound. Re-adjust if necessary.

 When all switches function properly: switch all switches into position "On" and insert 3 screws with seal washers into the holes at the handles at the left side. Tighten the screws with a torque of 44 in-lbs (5 Nm).



- 11. Switch all switches into position "Off"
- 12. For Disconnect Unit for Sunny Central 500HE-US/ CA/CP: make sure that the ground strap at the clamp of the AC switch is correctly connected to the flap and that it is not jammed between enclosure and flap. Close the flap after check.



# 6.7 Affixing information about grounded path

1. Determine if the PV plant is positive or negative grounded:

In a PV plant only the cables of the ungrounded path are disconnected by breakers, DC load break switches and fuses.

To determine if the PV system is positively or negatively grounded, check the routing of the DC cables for disconnectors and fuses. DC cables without any disconnection belong to the grounded DC path.

If the DC cable without disconnectors is positive: the PV plant is positively grounded.

If the DC cable without disconnectors is negative: the PV plant is negatively grounded.

 Affix the label that indicates the grounded path of the DC system to the front plate of the Disconnect Unit.

There are 2 labels included in the scope of delivery for indicating the grounded path of the DC system. Depending on which path of the DC system is grounded affix label for positive or negative grounding to the front plate of the Disconnect Unit.



# 7 Operating the Disconnect Unit

# 7.1 Arrangement of the switches



Figure 45: Arrangement of the switches

Number	Switch	Function	
1	DC-Switch 1	open/close DC home run 1 and 2	
2	DC-Switch 2	open/close DC home run 3 and 4	
3	DC-Switch 3	open/close DC home run 5 and 6	
4	DC-Switch 4	open/close DC home run 7 and 8	
5	DC-Switch 5	open/close DC home run 9	
6	AC-Switch	open/close AC output	

# 7.2 Switching on the Disconnect Unit

#### NOTICE

Only switch on the Disconnect Unit after all parts of the PV power system are set up.

The Disconnect Unit is only one part of the PV power system. The commissioning of the Disconnect Unit must not be performed until all parts of the PV power system are set up. A complete description of commissioning can be found in the commissioning protocol of the Sunny Central.

 Turn all switches of the DC load break switch to the right into position "On". You need to push/pull sharply in order to move the switches.

- 2. For Disconnect Unit for Sunny Central 250U/500U:
  - Turn the AC breaker to the right into position "On". You need to push/pull sharply in order to move the switch.





- 3. For Disconnect Unit for Sunny Central 500HE-US/ CA and Sunny Central CP:
  - Operate the lever of the circuit-breaker a few times.
  - ☑ The mechanical indicator below the red button changes its color to yellow.
  - Push the green button.



# 7.3 Switching off the Disconnect Unit

- 1. For Disconnect Unit for Sunny Central 250U/500U:
  - Turn the AC breaker to the left into position "Off". You need to push/pull sharply in order to move the switch.

- 2. For Disconnect Unit for Sunny Central 500HE-US/ CA and Sunny Central CP:
  - Push the red button.





 Turn all switches of the DC load break switch to the left into position "Off". You need to push/pull sharply in order to move the switches.



# 7.4 Securing against reconnection – Lock-Off function



Figure 46: Dimensions of padlock for securing against reconnection

Position	Description
Α	Diameter padlock: <sup>3</sup> / <sub>16</sub> in <sup>5</sup> / <sub>16</sub> in. (5 mm 8 mm)

- 1. For all DC switches:
  - Strongly turn the switch to the left into position "Off".

• Pull the lock holder out of the switch handle and attach up to 3 padlocks to the handle of the switch.



- 2. For Disconnect Unit for Sunny Central 500HE-US/ CA and Sunny Central CP:
  - Close the cover of the AC breaker.

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3. Attach a suitable padlock to the cover of the circuit-breaker.





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# 8 Technical data

For more electrical ratings than the shown here refer to the manual of the inverter.

# 8.1 Disconnect Unit for Sunny Central 250U/500U

#### DC connection data

## DC operating current

Maximum operating current Sunny Central 250U	800 A
Maximum operating current Sunny Central 500U	1,600 A
Maximum input short circuit current (lsc) - per home run SC-250U with 350 A fuses*	224.4 A
Maximum input short circuit current (Isc) - per home run SC-500U with 450 A fuses*	288.4 A

\* Input current with the derating factors of NEC articles 690.8(A)(1) and 690.8(B)(1) applied.

#### General AC connection data

Minimum operating voltage	422 V
Nominal operating voltage	480 V
Maximum operating voltage	528 V
Minimum operating frequency	59.3 Hz
Nominal operating frequency	60 Hz
Maximum operating frequency	60.5 Hz

#### AC connection data with Sunny Central 250U connected

Maximum continuous output current	300.7 A
Maximum continuous output power	250 kVA

#### AC connection data with Sunny Central 500U connected

Maximum continuous output current	601.4 A
Maximum continuous output power	500 kVA

# General data

W x H x D including mounting lug for Sunny	4 ft. 11 in. x 6 ft. 7 <sup>3</sup> / <sub>4</sub> in. x 3 ft. 1 <sup>1</sup> / <sub>4</sub> in.
Central 250U / Sunny Central 500U	(1,500 mm x 2,025 mm x 960 mm)
Weight	1,151 lb. (522 kg)

# Front plate of the enclosure

Width	5 ft. 7 in. (1,700 mm)
Height	4 ft. 7 <sup>1</sup> / <sub>8</sub> in. (1,400 mm)
Weight	88 lb. (40 kg)

#### **Ambient conditions**

Maximum operating altitude above sea level for nominal operation.	6,500 ft. (2,000 m)
Operating temperature range	– 13 °F +122 °F
	( – 25 °C +50 °C)
Temperature range for storage and transport	– 40 °F +122 °F
	( – 40 °C + 60 °C)
Maximum air humidity (condensation allowed)	95 %

# 8.2 Disconnect Unit for Sunny Central 500HE-US/CA

# DC connection data

Maximum array system voltage	600 V
Maximum operating current	1,600 A
Maximum input short circuit current (Isc) - per home run with 450 A fuses*	288.4 A

\* Input current with the derating factors of NEC articles 690.8(A)(1) and 690.8(B)(1) applied.

# AC connection data

Minimum operating voltage	180 V
Nominal operating voltage	200 V
Maximum operating voltage	220 V
Minimum operating frequency	59.3 Hz

Nominal operating frequency	60 Hz
Maximum operating frequency	60.5 Hz
Maximum continuous output current	1,470 A
Maximum continuous output power	500 kVA

# General data

W x H x D including mounting lug for Sunny	4 ft. 11 in. x 7 ft. 3 $\frac{1}{2}$ in. x 3 $\frac{1}{8}$ ft.
Central 500HE-US / Sunny Central xxxCP	(1,500 mm x 2,225 mm x 960 mm)
Maximum weight	1,464 lb. (664 kg)

# Front plate of the enclosure

Width	6 ft. 2 $^{3}\!\!\!/_{4}$ in. (1,900 mm)
Height	4 ft. 7 <sup>1</sup> / <sub>8</sub> in. (1,400 mm)
Weight	110 lb. (50 kg)

# Ambient conditions

Maximum operating altitude above sea level for nominal operation.	6,500 ft. (2,000 m)
Operating temperature range	– 13 °F +122 °F
	( – 25 °C +50 °C)
Temperature range for storage and transport	– 40 °F +122 °F
	( – 40 °C + 60 °C)
Maximum air humidity (condensation allowed)	95 %

# 8.3 Disconnect Unit for Sunny Central CP

# DC connection data

Maximum array system voltage	1000 V
Maximum operating current	1,400 A
Maximum input short circuit current (Isc) - per home run with 400 A fuses*	256.4 A

\* Input current with the derating factors of NEC articles 690.8(A)(1) and 690.8(B)(1) applied.

# AC connection data

Operating voltage	324 V 396 V
Operating frequency	50/60 Hz
Maximum continuous output current at 77 °F (25 °C)	1411 A
Maximum continuous output current at 122 °F (50 °C)	1283 A
Maximum continuous output power at 77 °F (25 °C)	880 kVA
Maximum continuous output power at 122 °F (50 °C)	800 kVA

# General data

W x H x D including mounting lug for Sunny	4 ft. 11 in. x 7 ft. 3 <sup>1</sup> / <sub>2</sub> in. x 3 <sup>1</sup> / <sub>8</sub> ft.
Central 500HE-US / Sunny Central xxxCP	(1,500 mm x 2,225 mm x 960 mm)
Weight	1,464 lb. (664 kg)

# Front plate of the enclosure

Width	6 ft. 2 <sup>3</sup> / <sub>4</sub> in. (1,900 mm)
Height	4 ft. 7 <sup>1</sup> / <sub>8</sub> in. (1,400 mm)
Weight	110 lb. (50 kg)

# Ambient conditions

Maximum operating altitude above sea level for nominal operation.	6,500 ft. (2,000 m)
Operating temperature range	– 13 °F +122 °F
	( – 25 °C +50 °C)
Temperature range for storage and transport	– 40 °F +122 °F
	( – 40 °C + 60 °C)
Maximum air humidity (condensation allowed)	95 %

# 9 Contact

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

- Disconnect Unit device type
- Disconnect Unit serial number
- Type and number of modules connected

SMA America, LLC 6020 West Oaks Blvd Rocklin, CA 95765 Tel. +1 916 625 0870 Tel. +1 877-MY SMA TECH Tel. +1 877 697 6283 (Toll free, available for USA, Canada and Puerto Rico) Fax +1 916 625 0871 Service@SMA-America.com www.SMA-America.com

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