Sunny Central Accessories

SUNNY CENTRAL STRING-MONITOR US

Technical Description

SSMUS-TUS094511 | 98-4001411 | Version 1.1

US

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IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for Models Sunny Central String-Monitor U DC COMBINER BOX, that shall be followed during installation and maintenance of the DC combiner box.

The Sunny Central String-Monitor 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 Sunny Central String-Monitor. To reduce the risk of personal injury and to ensure the safe installation and operation of the Sunny Central String-Monitor, you must carefully read and follow all instructions, cautions and warnings in this Installation Guide.

Warnings

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

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

WARNING

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

CAUTION

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

NOTICE

NOTICE indicates a situation that can result in property damage if not avoided.

Other Symbols

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 should know and use to ensure optimal operation of the system.

Markings on this Product

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

Warning regarding dangerous voltage

The product works with high voltages. All work on the product may only be done as described in its documentation.

Beware of hot surface

The product can become hot during operation. Avoid coming into contact with the product during operation.

Observe the operating instructions

Read the product's documentation before working on it. Follow all safety precautions and instructions as described in the documentation.

DC current

Earth Ground

General Warnings

General Warnings

All electrical installations must be done in accordance with the local and National Electrical Code ANSI/NFPA 70. In Canada, wiring methods shall be per the Canadian Electrical Code Part II.

The Sunny Central String-Monitor contains no user-serviceable parts. For all repair and maintenance always contact an authorized SMA Service Center.

Before installing or using the Sunny Central String-Monitor, read all of the instructions, cautions, and warnings on the Sunny Central String-Monitor, the PV array, in this Installation Guide and in User Manual.

PV arrays produce electrical energy when exposed to light and thus can create an electrical shock hazard. Wiring of the PV-arrays shall only be performed by qualified personnel.

This product is intended for operation in an environment having a maximum ambient temperature of 113 °F (45 °C).

The DC ouput terminals shall be connected using the following wire types: Copper an copper clad conductors only - use No. 350 kcmil, copper wire.

The DC input wires (Fuse holder)shall be connected using the following wire types: Rigid wire 10 - 6 AWG; Multistrand wire: 10 - 8 AWG.

The Input wire (Busbar) shall be connected using the following wire types: 10 - 4 AWG

Table of Contents

1 About this Manual

The manual describes how to install and commission the Sunny Central String-Monitor US. For the purposes of this manual, the Sunny Central String-Monitor US is referred to as Sunny Central String-Monitor.

1.1 Target Group

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

1.2 Area of Validity

This manual is valid for the Sunny Central String-Monitor US starting with fabrication version A. The Sunny Central String-Monitor US will be referred to as Sunny Central String-Monitor in this manual.

This manual does not cover any details concerning PV modules. Information concerning the PV modules is available from the manufacturer of the PV modules.

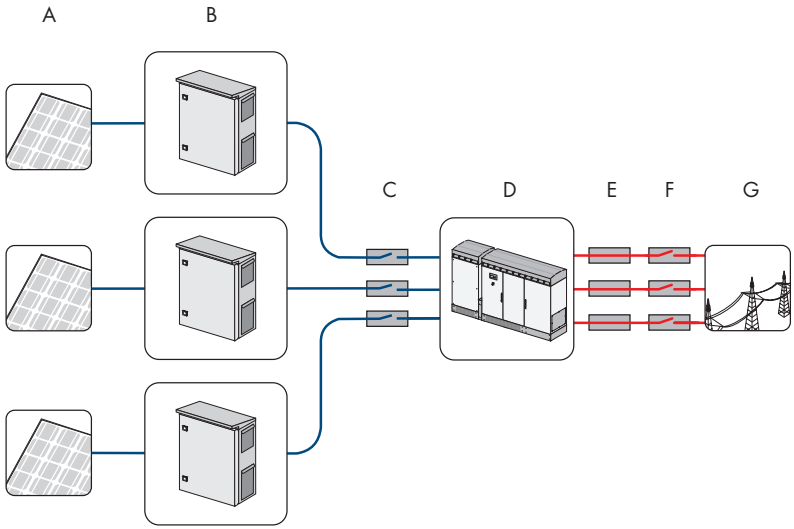
2 Security

2.1 Appropriate Usage

The Sunny Central String-Monitor is a Smart-Combiner. Depending on the versions, the box provides the possibility to directly connect 24, 32 or 64 strings and to link them with the Sunny Central inverter. All inputs are fused in compliance with NEC.

Additionally, a high-resolution string monitoring is integrated in the device. It permanently measures and monitors the string current of all inputs and detects partial and total dropouts. In case of failures and dropouts, the responsible person is immediately informed via the WebBox.

Principle of a PV Power System with Sunny Central String-Monitor



Position	Description
A	PV modules
B	Sunny Central String-Monitor
C	DC disconnect
D	Sunny Central
E	AC fuse
F	AC disconnect
G	Public grid

Any other application of the Sunny Central String-Monitor, installation of components and modifications, that are not explicitly allowed, endanger the safety and void the warranty as well as the operation permission.

It is prohibited:

- to use the Sunny Central String-Monitor for purposes other than those indicated in this installation guide,
- to connect voltage sources to the Sunny Central String-Monitor other than those consisting of PV modules,
- to modify the Sunny Central String-Monitor or to install components that are not explicitly recommended by SMA or sold by SMA for this purpose!

2.2 Safety Precautions

DANGER

Improper performance of the tasks described in this manual.

Death or serious injuries.

- All work on the Sunny Central String-Monitor must only be carried out by a qualified personnel.
- All work on the Sunny Central String-Monitor may only be done as described in this manual.
- Pay attention to all safety precautions.

WARNING

Risk of electric shock during operation of a damaged Sunny Central String-Monitor.

Death or serious injuries.

- The Sunny Central String-Monitor may only be used when it is technically faultless and safe to operate!
- Operate the Sunny Central String-Monitor only if no damage is visibly evident!
- Visually check the Sunny Central String-Monitor for damage on a regular basis!
- Ensure that all external safety features are freely accessible at all times, and that they are regularly tested for correct functionality!

NOTICE

Electrostatic discharges possible when components are touched.

Damage to components.

- Follow ESD protective provisions.
- Remove existing electrostatic charges by touching a grounded metal surface (e.g. housing).

Storage of the Documentation

The documentation must be kept in the immediate vicinity of the Sunny Central String-Monitor. They must be available to operators and maintenance staff at all times.

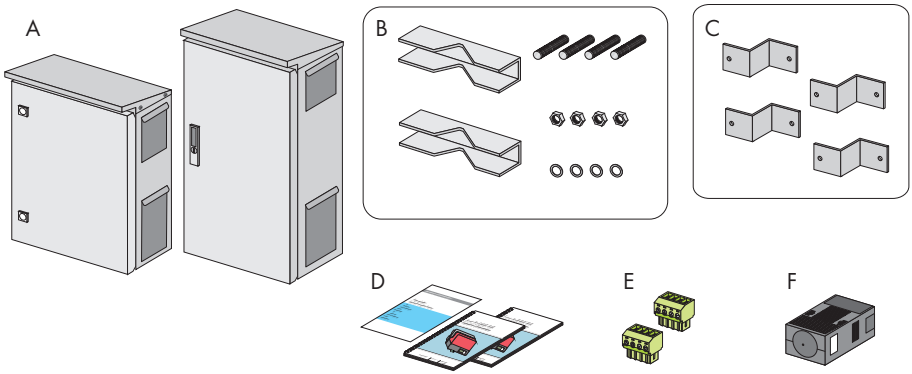
3 Unpacking

3.1 Unpacking and Inspection

All SMA Sunny Central String-Monitors 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 to the shipping company that delivered the unit. If it becomes necessary to return the Sunny Central String-Monitor USA, use the original packing material.

If you need assistance with a damaged Sunny Central String-Monitor, contact your SMA dealer or SMA America. Contact information for SMA America is provided in chapter 14 "Contact" (page 80).

3.2 Packing List



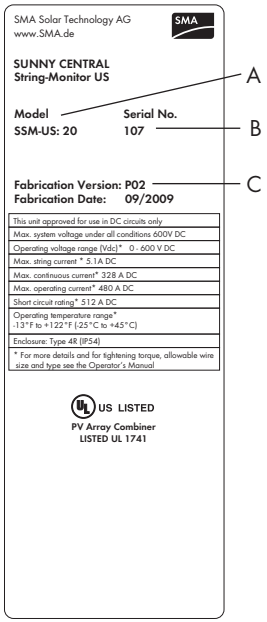
Position	Description
A	Sunny Central String-Monitor US (left: version 24 and 32, right: version 64)
B	Installation kit for pole mounting
C	Installation kit for wall mounting
D	Installation Guide: mounting and installation of the Sunny Central String-Monitor Circuit Diagrams: circuit diagrams of the Sunny Central String-Monitor
E	2x plug for communication cable
F	Termination resistor plug

3.3 Identifying the Sunny Central String-Monitor

The Sunny Central String-Monitor can be identified with the type label (see image on the right). The type label is located on the inside of the Sunny Central String-Monitor door.

Specified on the type plate:

Position	Name	Description
A	Model	The Sunny Central String-Monitor type name with version code (optional).
B	Serial No.	Serial number of the Sunny Central String-Monitor.
C	Manufacturing Version	Manufacturing version of the Sunny Central String-Monitor.



4 Mounting

This section provides guidelines to help you select the best mounting location, suggestions to insure optimum performance, cautions and warnings that you should follow to avoid injury and/or equipment damage, and step-by-step instructions for mounting a Sunny Central String-Monitor.

CAUTION

Risk of injury during transport of the Sunny Central String-Monitor.

Injuries and contusion of body parts.

- Transport the Sunny Central String-Monitor with two people or with a cart.
- Wear personal protective equipment.

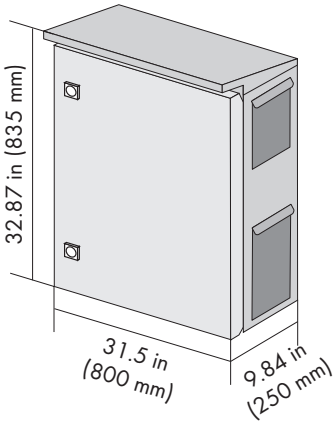
4.1 Selection of Mounting Location

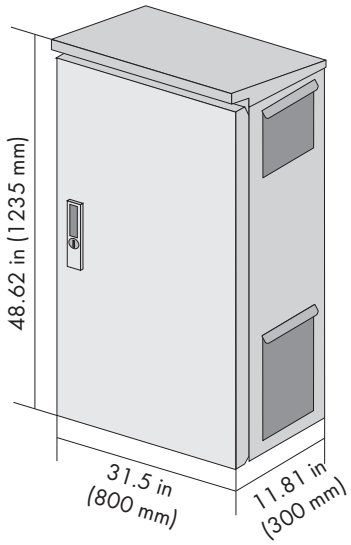
4.1.1 Ambient Conditions

- The installation method and mounting location must be suitable for the weight and dimensions.
- Mounting on a solid surface.
- The mounting location must be accessible at all times.
- The ambient temperature must be between -13 ... 113 °F (-25 °C and +45 °C).
- Do not mount the Sunny Central String-Monitor in a location where it is exposed to direct sunlight.

4.1.2 Dimensions and Weight

The Sunny Central String-Monitor version 24 weighs 143 lbs. (65 kg) version 32 weighs 146 lbs. (66 kg), version 64 weighs 194 lbs. (88 kg). The mounting location must be suitable for the weight of the Sunny Central String-Monitor. The Sunny Central String-Monitor may not be mounted to plasterboard walls or similar.





4.1.3 Minimum Clearance

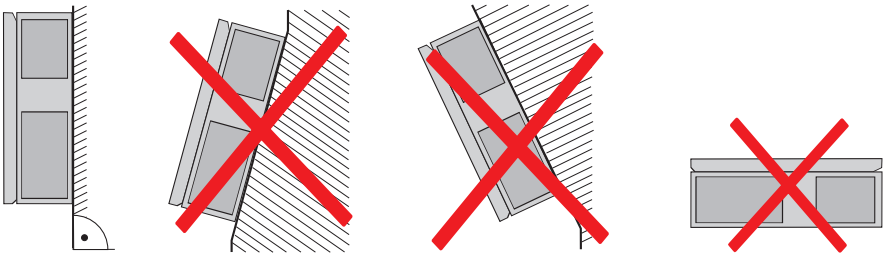
Keep a clearance of at least 60 in. (1,500 mm) to walls, other devices or similar. This clearance is necessary in order to allow to insert the cables to the Sunny Central String-Monitor and open the Sunny Central String-Monitor.

Clearances

The National Electrical Code may require significantly larger working clearances (see NEC Section 110.26).

4.1.4 Permissible Slanting

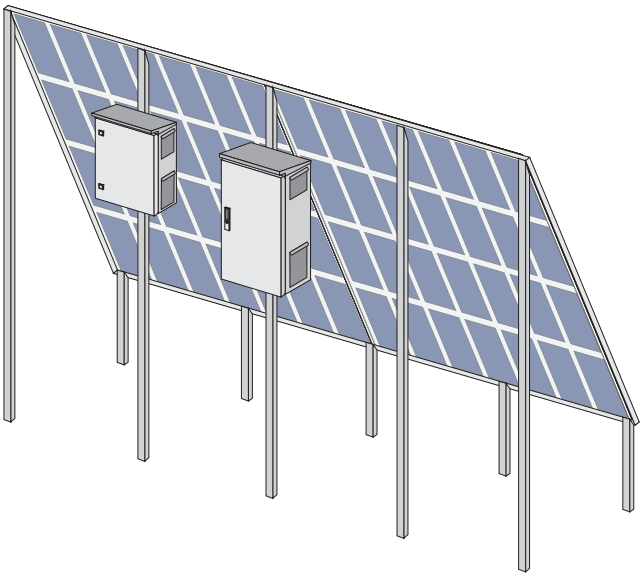
The Sunny Central String-Monitor must be mounted vertically.



- Never install the device with a backward tilt.
- Never install the device with a forward tilt.
- Do not install horizontally.

4.1.5 Mounting to PV Module Racks

The Sunny Central String-Monitor can be mounted to the back of module racks. It is not permitted to be mounted in a location where rainwater will flow over the Sunny Central String-Monitor. The image below schematically illustrates how the Sunny Central String-Monitor can be mounted to a PV module rack.

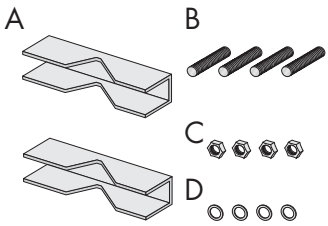


4.2 Mounting to a Pole

4.2.1 Mounting the Sunny Central String-Monitor to a pole (square)

The Sunny Central String-Monitor can be mounted to a square or round pole. An installation kit for pole mounting is included in the Sunny Central String-Monitor accessories kit. This section describes mounting to a square pole.

A Pole mount
B Threaded bolt
C Nuts
D Washers

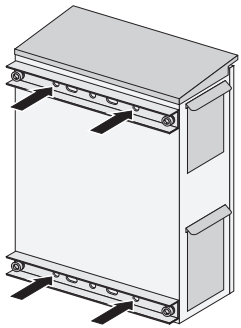


Dimensions of the square pole

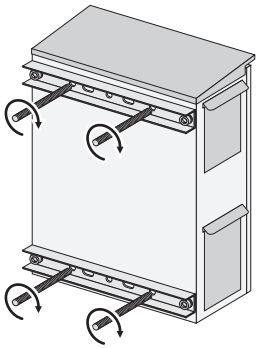
The Sunny Central String-Monitor can be mounted on square poles with the following dimensions:

- minimum: 3.94 in. (100 mm)
- maximum: 7.48 in. (190 mm)

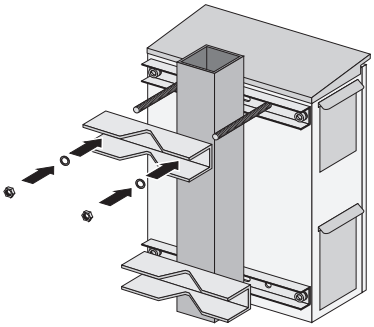
Two mounting rails are attached to the rear side of the Sunny Central String-Monitor. In the middle of the mounting rails there are 2 internal threads for attaching the pole mount.



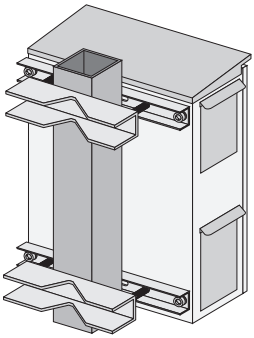
1. Securely screw the 4 threaded bolts into the internal threads of the mounting rail in a clockwise direction.
2. Lift the Sunny Central String-Monitor to the mounting position on the pole.



3. Slide pole mounts at top and bottom with the closed side to the threaded bolts. The required torque is 89 lb-in.
4. Slide washers onto the threaded bolts.
5. Screw the nuts onto the threaded bolts and tighten in a clockwise direction.



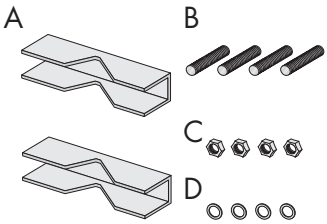
☑ The Sunny Central String-Monitor is mounted on a (square) pole.



4.2.2 Mounting the Sunny Central String-Monitor to a pole (round)

The Sunny Central String-Monitor can be mounted to a square or round pole. An installation kit for pole mounting is included in the Sunny Central String-Monitor accessories kit. This section describes mounting to a round pole.

A Pole mount
B Threaded bolt
C Nuts
D Washers

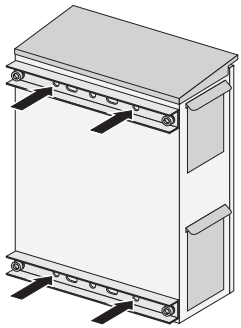


Dimensions of the round pole

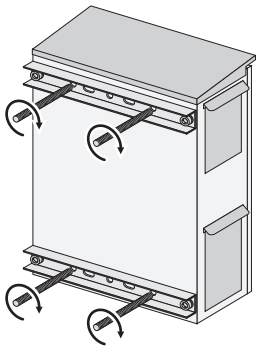
The Sunny Central String-Monitor can be mounted on round poles with the following dimensions:

- minimum: 3.94 in. (100 mm)
- maximum: 7.48 in. (190 mm)

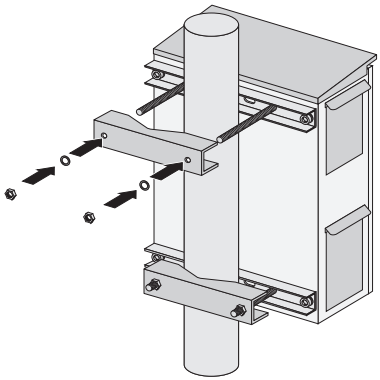
Two mounting rails are attached to the rear side of the Sunny Central String-Monitor. In the middle of the mounting rails there are 2 internal threads for attaching the pole mount.



1. Securely screw the 4 threaded bolts into the internal threads of the mounting rail in a clockwise direction.
2. Lift the Sunny Central String-Monitor to the mounting position on the pole.



3. Slide pole mounts top and bottom with the V opening on the threaded bolts.
4. Slide washers onto the threaded bolts.
5. Screw the nuts onto the threaded bolts.
6. Tighten the nuts in a clockwise direction with a torque of 89 in-lb.



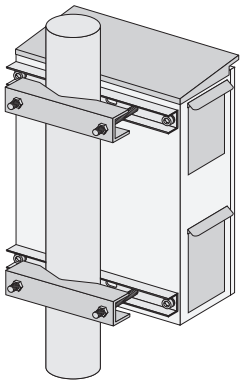
CAUTION

Protruding bolts may occur during the mounting of the Sunny Central String-Monitor to a small-diameter pole.

Abrasions caused by contact with protruding bolts.

7. Shorten the bolts.
8. Remove the sharp edges on the bolts using a deburring tool.

☑ The Sunny Central String-Monitor is mounted to a pole (round).



4.3 Mounting to a Wall

Make sure that the wall you choose to mount the Sunny Central String-Monitor on is sturdy enough to support its weight (143 lbs. (65 kg), 146 lbs. (66 kg) or 194 lbs. (88 kg)) over a long period of time and that the wall is plump. The Sunny Central String-Monitor may also be mounted on stone, brick, solid walls or wooden stud walls. Use the mounting brackets for mounting on walls. Be sure to use appropriate type of mounting hardware for the wall material and ensure that the hardware is no smaller than 1/4 in.

DANGER

Risk of electric shock by drilling into power cables.

Death or serious injuries.

- Check installation location for power cables.

CAUTION

Falling of the Sunny Central String-Monitor may cause injuries.

Crushing of body parts possible.

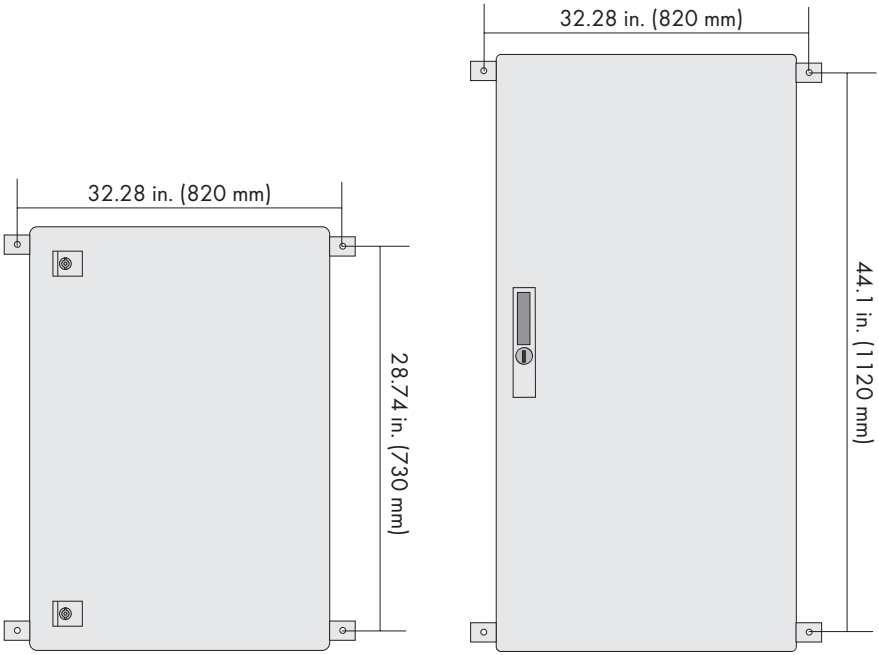
- Ensure that there are studs in the wall at the places where you intend to drill the mounting-holes.
- Do not use molly or toggle bolts to mount the Sunny Central String-Monitor to sheet rock or panelling.

Information for mounting

The diameter of the holes you drill must match the hardware you are using to mount the Sunny Central String-Monitor.

For example, if you are mounting the Sunny Central String-Monitor to a concrete wall, the hole diameter should be approximately the same as the outside diameter of the concrete anchors you intend to use. If you are mounting the Sunny Central String-Monitor on a wall that has wooden studs inside it, the hole diameter should be the correct size for the lag screws you intend to use to mount the bracket. It is recommended that the lag screws be made of stainless steel, and the diameter of the screws closely match the diameter of the holes in the wall-mounting bracket. Make sure that the screws are long enough to penetrate the wall to a depth of 1.5 in.

Distance of the holes



Used mounting material

Attaching to the Sunny Central String-Monitor

Screws: 1/4" stainless steel screws

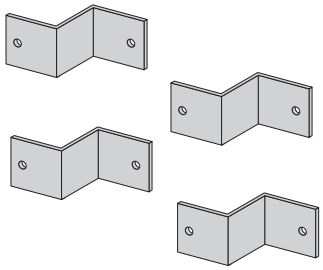
Attaching to the wall

Screws 5/16" wood screw, length 2"

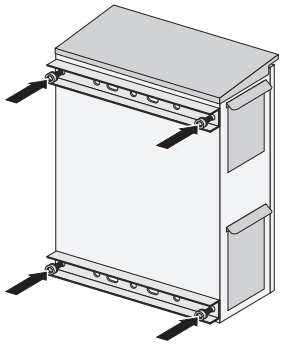
Wall anchor: 3/8“

4.3.1 Mounting the Sunny Central String-Monitor to a wall

A Mounting bracket

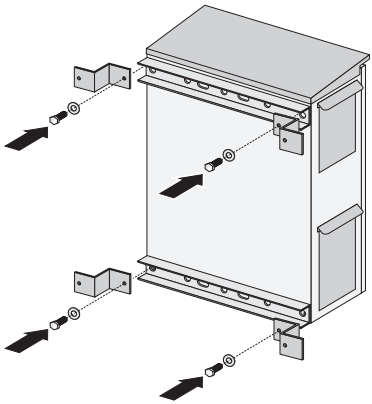


Two mounting rails are attached to the rear side of the Sunny Central String-Monitor. The mounting rail is attached to the Sunny Central String-Monitor right and left with nuts.



1. Loosen the 4 nuts counterclockwise. Remove nuts and washers, they will be needed later.

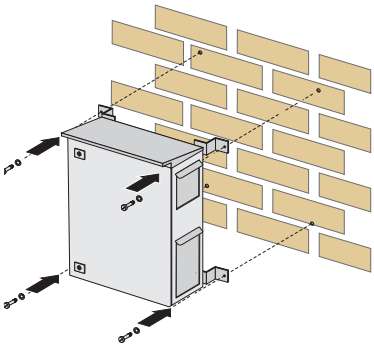
2. Lay the 4 mounting brackets on the threads of the mounting rails.
3. Slide the washers on the threads.
4. Screw the nuts onto the threads and tighten clockwise with a torque of 89 in-lb (10 Nm).



5. Measure the distance for the holes.
6. Mark the position of the drill holes.
7. Drill holes at the marked positions.

8. Insert wall anchors into the drill holes.
9. Attach the Sunny Central String-Monitor to the wall using screws and washers.
10. Tighten the screws clockwise using a torque of 133 in-lb (15 Nm).

☑ The Sunny Central String-Monitor is now mounted to the wall.



5 Attaching the Cable Conduits

NOTICE

Infiltration of water during the mounting and installation of the product.

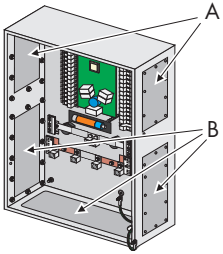
Damage to the product.

- Do not open the Sunny Central String-Monitor when it is raining or when there is very high humidity (>95 %).
- For conduit hubs, use only UL Listed rainproof, or wet location hubs complying with UL 514B for entry into the enclosure.

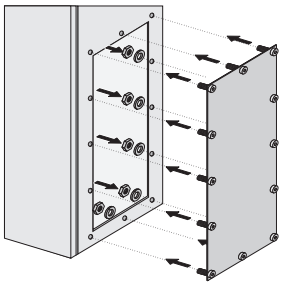
The cables of the Sunny Central and the PV generator can be routed into the Sunny Central String-Monitor from left, right or bottom. The communication cables can be routed into the Sunny Central String-Monitor from left or right. Metal plates are attached to the Sunny Central String-Monitor for this purpose. The plates can be removed in order to punch the holes for the cable conduits.

A Cable gland for:
- Communication

B Cable gland for:
- Cable of the PV generator
- Cables of the Sunny Central

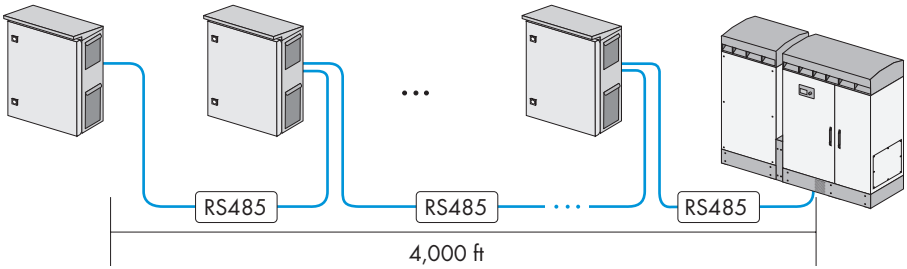


1. Check which position is the best for routing the cable (example: The Sunny Central is on the right side of the Sunny Central String-Monitor. The right side of the Sunny Central String-Monitor can be used for routing the cables).
2. Loosen nuts at the metal plates to be used.
3. Put the nuts aside.
4. Punch holes for the cable conduits into the plates.
5. Attach plates to the Sunny Central String-Monitor.
6. Tighten the screws with a torque of 22 in-lb (2.5 Nm).
7. Insert the conduits into the openings.
8. Attach the cable conduits with the appropriate screws.



6 Communication connector

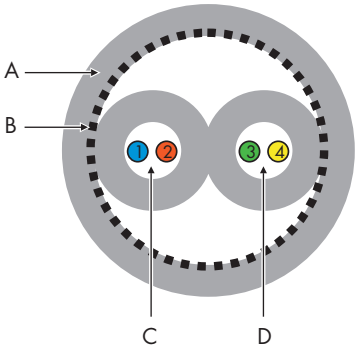
- The communication between the Sunny Central String-Monitors and the Sunny Central is provided using a RS485.
- The Sunny Central String-Monitors are connected to the Sunny Central within a bus (in series).
- The bus may not be longer than 4,000 ft (1,200 m) in total.
- Connection of up to 4 hubs for the connection of 4 buses possible (see section 11.2 "Communication Overview" (page 61)).
- The last Sunny Central String-Monitor in the bus and the Sunny Central must be terminated (see section 6.2.3 "Terminate the RS485 bus in the Sunny Central String-Monitor" (page 34) and section 7 "Electrical Connection" (page 37)).



Data cable

Use a shielded twisted pair data cable with a cross-section of 2 x 2 x AWG 24.

A	Flexible PVC insulation
B	Shielding (copper shielding braid)
C	Twisted Pair 1 (2 x AWG 24)
D	Twisted Pair 2 (2 x AWG 24)

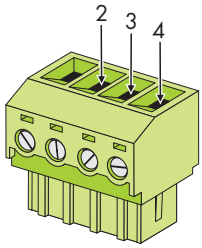


Recommendation data cable

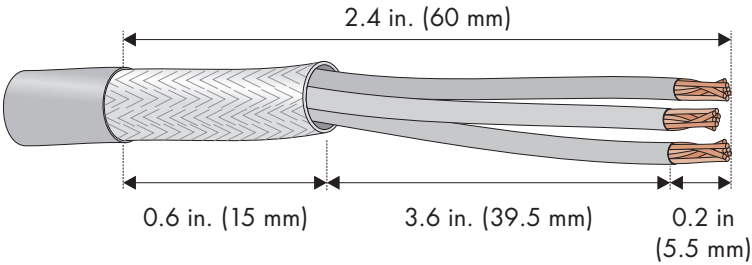
SMA also provides communication cables. Please contact your installer or wholesaler.

6.1 Preparing the Data Cable

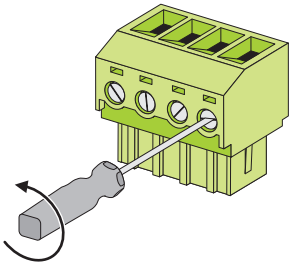
Three wires of the data cable, GND (2), Data+ (3), and Data– (4), are required for the connection. Data+ and Data– must be a twisted pair.



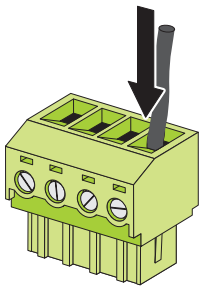
1. Remove the insulation of the data cable by approx. 2.4 in. (60 mm) and uncover the shield.
2. Uncover the wires by approx. 1.8 in. (45 mm).
3. Strip the wires by approx. 0.2 in. (1.8 mm).



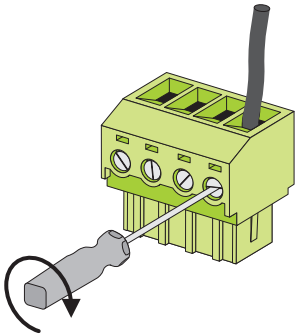
4. Open the screw terminal completely.



5. Insert wires into the terminal.

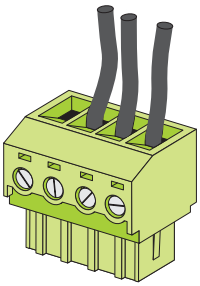


6. Tighten the screw terminal using a screwdriver. The required torque is 2.2 in-lb (0.25 Nm).
7. Pull the wires to check that it is securely in place.



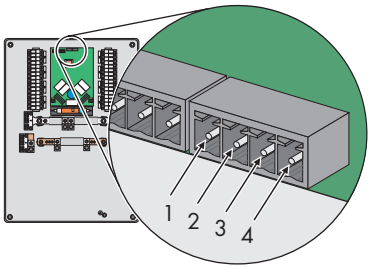
8. Note down the wire color:
   GND _____
   Data+ _____
   Data– _____
9. Shorten the fourth wire which is unused.

☑ The data cable is prepared.



6.2 Communication Connector Sunny Central String-Monitor

The data cable of the communication bus is attached with a plug at the top of the Sunny Central String-Monitor. Two sockets are present in the Sunny Central String-Monitor for this purpose.



Position	Description
1	NC
2	GND
3	DATA+
4	DATA–

Sunny Central String-Monitor at the end of the communication bus

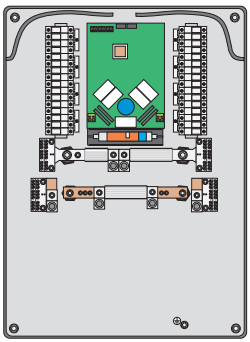
If the Sunny Central String-Monitor is at the end of the communication bus, you only require one socket. To ensure sufficient signal quality of the RS485 communication bus, it must be terminated on both ends. For this, connect the termination resistor plug to the second socket. Follow section 6.2.3 "Terminate the RS485 bus in the Sunny Central String-Monitor" (page 34).

Sunny Central String-Monitor within the communication bus

If the Sunny Central String-Monitor is within the communication bus, two communication cables must be attached to the the Sunny Central String-Monitor. Two sockets are present in the Sunny Central String-Monitor for this purpose.

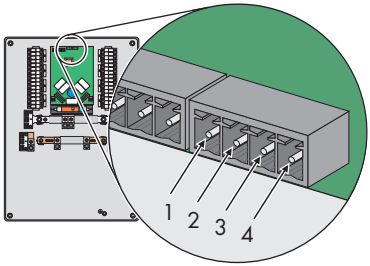
6.2.1 Connecting the Data Cable in the Sunny Central String-Monitor

1. Open the Sunny Central String-Monitor
2. Prepare the data cable as described in section 6.1 "Preparing the Data Cable" (page 30).
3. Draw the data cable into the Sunny Central String-Monitor (see section 5 "Attaching the Cable Conduits" (page 28)).



4. Connect the plug with one of the sockets of the Sunny Central String-Monitor.
5. Repeat the procedure for all data cables. GND (2), Data+ (3) and Data– (4) must be connected to the same wire.

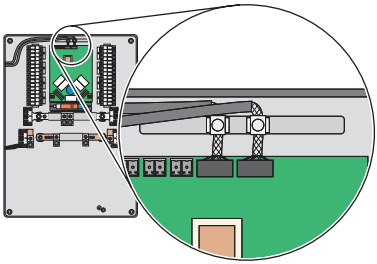
☑ The data cables are attached in the Sunny Central String-Monitor.



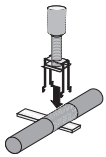
6.2.2 Grounding the Shield of the Data Cable

The shield of the data cable is placed on the shield rail (F) in the Sunny Central String-Monitor.

1. Put the cable shield onto the shield rail.



2. Put the shield clamp (G) on the shield of the data cable and connect it with the shield rail (H).



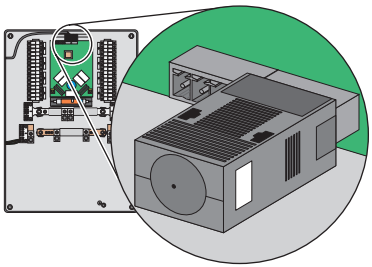
3. Hand-tighten the screw at the shield clamp (4.4 in-lb (0.5 Nm)).
4. Close the Sunny Central String-Monitor.

☑ The data cable is grounded.

6.2.3 Terminate the RS485 bus in the Sunny Central String-Monitor

Only set the termination if the Sunny Central String-Monitor is at the end of the RS485 communication bus. The termination is made using a termination resistor plug. The termination resistor plug is included in delivery.

1. Opening the Sunny Central String-Monitor
2. Set the termination resistor plug in the free socket in the Sunny Central String-Monitor.
3. Close the Sunny Central String-Monitor.



6.3 Communication Connector Sunny Central

NOTICE

Disregarding the proper order when connecting the communication bus.

Damage to the communication bus.

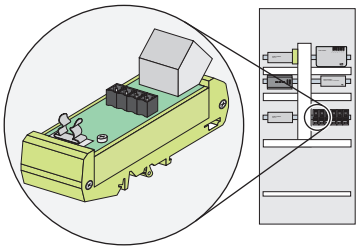
- Only connect the data cable in the Sunny Central after all Sunny Central String-Monitors are connected to the communication bus (see section 6.2 "Communication Connector Sunny Central String-Monitor" (page 32)).

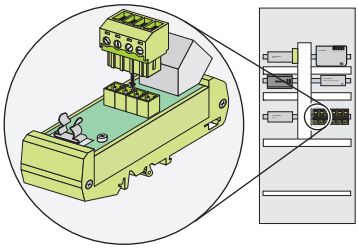
6.3.1 Connecting the Data Cable in the Sunny Central

The data cable is attached with a plug to the 485 RJ45 clamp in the Sunny Central.

1. Open the Sunny Central as described in the Sunny Central installation guide.
2. Prepare the data cable as described in section 6.1 "Preparing the Data Cable" (page 30). Data+, Data– and GND must be connected to the same wire as the last Sunny Central String-Montior in the communication bus.
3. Draw the data cable into the Sunny Central as described in the Sunny Central installation guide.
4. Plug the plug to the 485 RJ45 clamp.

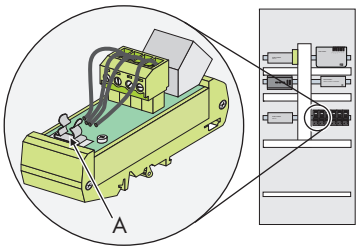
☑ The data cables are attached in the Sunny Central.





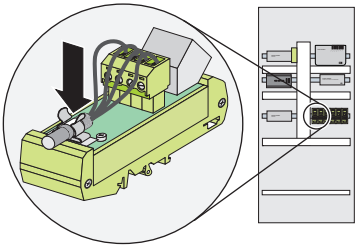
6.3.2 Grounding the Shield of the Data Cable

The data cable shielding is fitted into the shielding clamp (A) of the 485 RJ45 clamp in the Sunny Central.



1. Shorten the shielding to 0.6 in., fold it back, and attach it with conductive adhesive foil.
2. Push the two cables' portions of shielding reattached in this way into the shielding clamp.

☑ The shielding of the data cable is grounded.



7 Electrical Connection

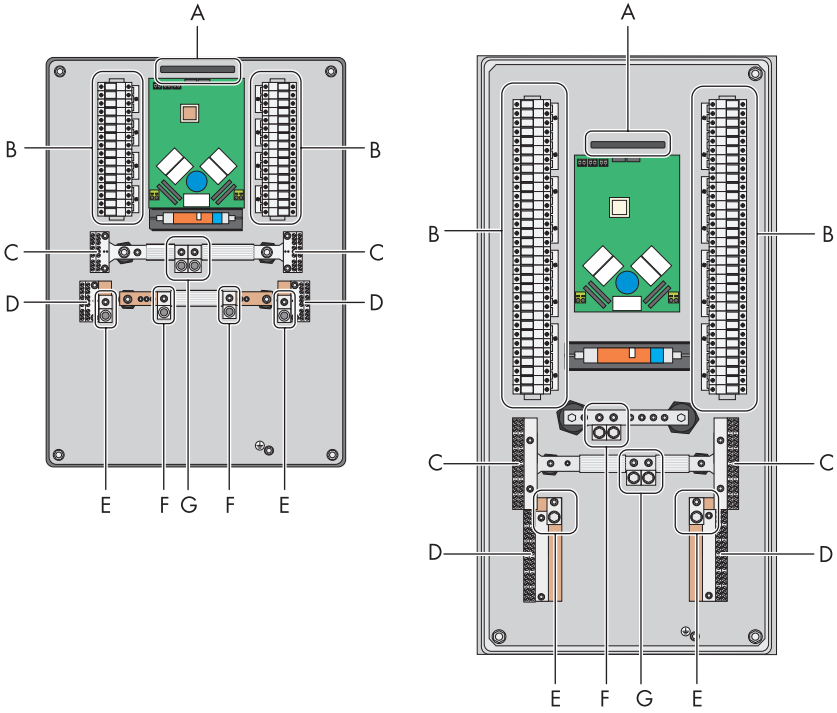
NOTICE

Electrostatic discharges possible when components are touched.

Damage to components.

- Follow ESD protective provisions.
- Remove existing electrostatic charges by touching a grounded metal surface (e.g. housing).

7.1 Connection area



Position	Description
A	Rail for grounding the cable shield of the communication cable

Position	Description
B	Negative grounding: Screw terminals for DC+ of the PV generator Positive grounding: Screw terminals for DC– of the PV generator Use 90 °C (194 °F) copper wire for all DC wiring connections to the fuse holders.
C	Negative grounding: Screw terminals for DC– of the PV generator Positive grounding: Screw terminals for DC+ of the PV generator
D	Screw terminals for grounding the PV generator
E	Terminal for grounding the DC cable of the Sunny Central
F	Negative grounding: Terminal for DC+ of the Sunny Central Positive grounding: Terminal for DC– of the Sunny Central
G	Negative grounding: Terminal for DC– of the Sunny Central Positive grounding: Terminal for DC+ of the Sunny Central

7.2 Connecting ground

The PV modules may not be connected until the communication cables have been connected (see section 6 "Communication connector" (page 29)).

The Photovoltaic System Grounding shall be installed per the requirements of sections 690.41 through 690.47 of the National Electrical Code, ANSI/NFPA 70 and is the responsibility of the installer. In Canada, wiring methods shall be per the Canadian Electrical Code Part II.

Use 90 °C (194 °F), copper wire for all wiring connections to the Sunny Central String-Monitor.

DANGER

Risk of electric shock when touching the DC cable attached to the PV module.

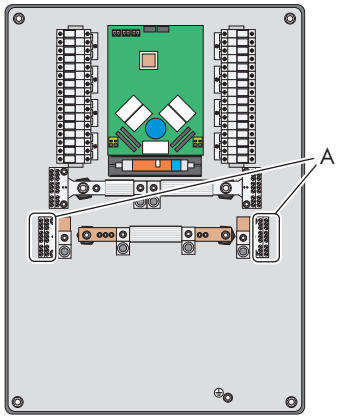
Death or serious injuries.

Voltage is present in PV modules exposed to light.

- Cover the PV modules.
- Follow all safety precautions of the module manufacturer.

7.2.1 PV modules: Connecting ground

The PV modules are grounded at the lower screw terminals (A) in the Sunny Central String-Monitor.



1. Strip the cable by approx. 0.3 in. (8 mm).
2. Open the screw terminal with a screwdriver counterclockwise.
3. Plug the copper inner conductor of the cable into the screw terminal.

4. Tighten the screw terminal with a screwdriver clockwise. Required torques:

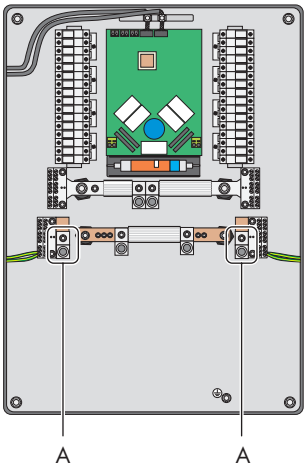
Wire size	Torque
6 - 4 AWG	45 in-lb (5 Nm)
8 AWG	40 in-lb (4.5 Nm)
10 AWG	35 in-lb (4 Nm)

5. Connect all grounding cables of the modules as described above.

☑ The PV modules are grounded.

7.2.2 Sunny Central: Connecting ground

The grounding cable of the Sunny Central is connected to the terminals (A) in the Sunny Central String-Monitor.



1. Strip the cable by approx. 1.1 in. (28 mm).
2. Loosen the nut with a wrench counterclockwise.
3. Put the nut and the washer aside.
4. Pull the screw terminal from the threaded bolt.
5. Open the screw terminal with a hexagon (allen) key counterclockwise.
6. Insert the cable into the Sunny Central String-Monitor as described in chapter 5 "Attaching the Cable Conduits" (page 28).
7. Plug the copper inner conductor of the cable into the screw terminal.
8. Tighten the screw terminal using a hexagon (allen) key clockwise. The required torque is 325 in-lb.

Wire size	Torque
350 kcmil	325 in-lb

9. Put the screw terminal on the threaded bolt.
10. Put the washer and the nut on the threaded bolt.
11. Tighten the nut using a wrench clockwise. The required torque is 222 in-lb.
12. Connect the second grounding cable of the Sunny Central as described above.

☑ The ground cable of the Sunny Central is connected.

7.3 Connecting PV modules - negative grounding

The PV modules may not be connected until the communication cables have been connected (see section 6 "Communication connector" (page 29)).

The Photovoltaic System Grounding shall be installed per the requirements of sections 690.41 through 690.47 of the National Electrical Code, ANSI/NFPA 70 and is the responsibility of the installer. In Canada, wiring methods shall be per the Canadian Electrical Code Part II.

DANGER

Risk of electric shock when touching the DC cable attached to the PV module.

Death or serious injuries.

Voltage is present in PV modules exposed to light.

- Cover the PV modules.
- Follow all safety precautions of the module manufacturer.

Technical Data for the Connection of the PV Modules

	Version 24	Version 32	Version 64
Max. number of strings	24	32	64
Max. string short-circuit current	12.82 A	9.62 A	5.13 A

Technical Data for the Cables of the PV Modules

Use 90 °C (194 °F), copper wire for all DC wiring connections to the screw terminals between

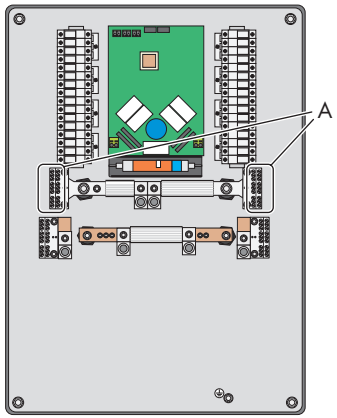
- PV-modules and Sunny Central String Monitor
- Sunny Central String-Monitor and Sunny Central

Use 90 °C (194 °F) copper wire for all DC wiring connections to the fuse holders.

Cables of PV Modules	Cable Size	Torque
DC +	Rigid wire: 10 - 6 AWG Multistrand wire: 10 - 8 AWG	19 in-lb (2.2 Nm)
DC -	6 - 4 AWG	45 in-lb (5 Nm)
	8 AWG	40 in-lb (4.5 Nm)
	10 AWG	35 in-lb (4 Nm)

7.3.1 PV modules: Connecting DC–

The DC– cables of the PV modules are connected at the medium screw terminals (A) in the Sunny Central String-Monitor.



1. Strip the cable by approx. 0.3 in. (8 mm).

2. Open the screw terminal with a screwdriver counterclockwise.
3. Plug the copper inner conductor of the cable into the screw terminal.
4. Tighten the screw terminal with a screwdriver clockwise. Required torques:

Wire size	Torque
6 - 4 AWG	45 in-lb (5 Nm)
8 AWG	40 in-lb (4.5 Nm)
10 AWG	35 in-lb (4 Nm)

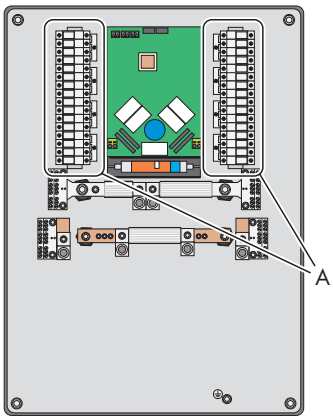
5. Connect all DC– cables of the modules as described above.

☑ The DC– cables of the PV modules are connected.

7.3.2 PV modules: Connecting DC+

The DC+ cables of the PV modules are connected at the fuse holders (A) in the Sunny Central String-Monitor.

Use 90 °C (194 °F) copper wire for all DC wiring connections to the fuse holders.



1. Open the screw terminal with a screwdriver counterclockwise.
2. Strip the cable by approx. 0.47 in. (12 mm).

3. Plug the copper inner conductor of the cable into the fuse holder.
4. Tighten the screw in the fuse holder with a screwdriver clockwise. The required torque is 19 in-lb (2.2 Nm).

Wire size	Torque
Rigid wire: 10 - 6 AWG Multistrand wire: 10 - 8 AWG	19 in-lb (2.2 Nm)

5. Connect all DC+ cables of the modules as described above.

☑ The DC+ cables of the PV modules are connected.

DANGER

Risk of electric shock when working on the Sunny Central String-Monitor with fuses closed.

Death or serious injuries.

- DO NOT close the fuse holders.
- Do not close the fuse-holder until the PV system is put into operation.

7.4 Connecting the PV modules - positive grounding

The PV modules may not be connected until the communication cables have been connected (see section 6 "Communication connector" (page 29)).

The Photovoltaic System Grounding shall be installed per the requirements of sections 690.41 through 690.47 of the National Electrical Code, ANSI/NFPA 70 and is the responsibility of the installer. In Canada, wiring methods shall be per the Canadian Electrical Code Part II.

DANGER

Risk of electric shock when touching the DC cable attached to the PV module.

Death or serious injuries.

Voltage is present in PV modules exposed to light.

- Cover the PV modules.
- Follow all safety precautions of the module manufacturer.

Technical Data for the Connection of the PV Modules

	Version 24	Version 32	Version 64
Max. number of strings	24	32	64
Max. string short-circuit current	12.82 A	9.62 A	5.12 A

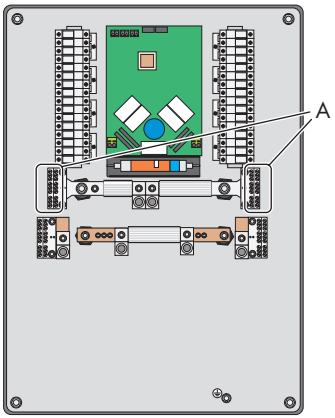
Technical Data for the Cables of the PV Modules

Use 90 °C (194 °F), copper wire for all DC wiring connections to the Sunny Central String-Monitor.

Cables of PV Modules	Cable Size	Torque
DC+	6 - 4 AWG	45 in-lb (5 Nm)
	8 AWG	40 in-lb (4.5 Nm)
	10 AWG	35 in-lb (4 Nm)
DC–	Rigid wire: 10 - 6 AWG Multistrand wire: 10 - 8 AWG	19 in-lb (2.2 Nm)

7.4.1 PV modules: Connecting DC+

The DC+ cables of the PV modules are connected at the medium screw terminals (A) in the Sunny Central String-Monitor.



1. Strip the cable by approx. 0.3 in. (8 mm).
2. Open the screw terminal with a screwdriver counterclockwise.
3. Plug the copper inner conductor of the cable into the screw terminal.
4. Tighten the screw terminal with a screwdriver clockwise. Required torques:

Wire size	Torque
6 - 4 AWG	45 in-lb
8 AWG	40 in-lb
10 AWG	35 in-lb

5. Connect all DC+ cables of the modules as described above.

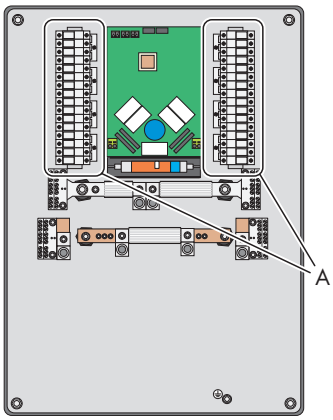
☑ The DC+ cables of the PV modules are connected.

7.4.2 PV modules: Connecting DC–

The DC– cables of the PV modules are connected at the fuse holders (A) in the Sunny Central String-Monitor.

Use 90 °C (194 °F) copper wire for all DC wiring connections to the fuse holders.

1. Open the fuses with a screwdriver counterclockwise.



1. Strip the cable by approx. 0.47 in. (12 mm).
2. Plug the copper inner conductor of the cable into the fuse holder.
3. Tighten the fuse holder with a screwdriver. The required torque is 19 in-lb.

Wire size	Torque
Rigid wire: 10 - 6 AWG Multistrand wire: 10 - 8 AWG	19 in-lb (2.2 Nm)

4. Connect all DC– cables of the modules as described above.

☑ The DC– cables of the PV modules are connected.

DANGER

Risk of electric shock when working on the Sunny Central String-Monitor with fuses closed.

Death or serious injuries.

- DO NOT close the fuse holders.
- Do not close the fuse-holder until the PV system is put into operation.

7.5 Connecting Sunny Central - negative grounding

The Sunny Central may not be connected until the communication and the PV modules have been connected (see section 6 "Communication connector" (page 29), section 7.2 "Connecting ground" (page 38) and 7.4 "Connecting the PV modules - positive grounding" (page 44)).

DANGER

Risk of electric shock through reverse voltage from Sunny Central.

Death or serious injuries.

- Disconnect the AC side from the Sunny Central as described in the installation guide of the Sunny Central.

Technical Data for the Connection to the Sunny Central

	Version 24	Version 32	Version 64
Max. number of output lines per potential	2	2	2
DC Short Circuit Current	480 A	480 A	512 A
DC Max Continuous Current	308 A	308 A	328 A

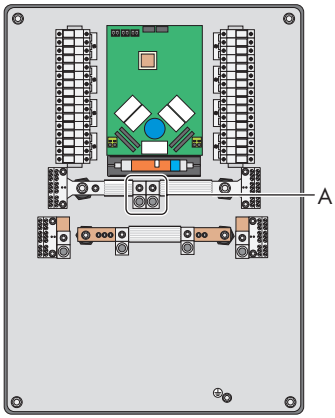
Technical Data for the Cables to the Sunny Central

Use 90 °C (194 °F), copper wire for all DC wiring connections to the Sunny Central String-Monitor.

Cables to the Sunny Central	Cable Size	Torque
DC+	350 kcmil	325 in-lb
DC–	350 kcmil	325 in-lb

7.5.1 Sunny Central: Connecting DC–

The DC– cable of the Sunny Central is connected to the terminals (A) in the Sunny Central String-Monitor.



1. Strip the cable by approx. 1.1 in. (28 mm).
2. Loosen the hexagon screw with a wrench counterclockwise.
3. Put the hexagon screw and the washer aside.
4. Pull the screw terminal from the rail.
5. Open the screw terminal using a hexagon (allen) key counterclockwise.
6. Insert the cable into the Sunny Central String-Monitor as described in chapter 5 "Attaching the Cable Conduits" (page 28).
7. Plug the copper inner conductor of the cable into the screw terminal.
8. Tighten the screw terminal using an Allen key clockwise. The required torque is 325 in-lb.

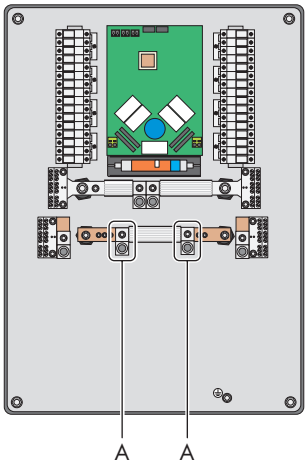
Wire size	Torque
350 kcmil	325 in-lb

9. Put the screw terminal on the rail.
10. Put the washer on the screw terminal and the hexagon screw in the hole of the screw terminal.
11. Tighten the hexagon screw using a wrench clockwise. The required torque is 222 in-lb.
12. Connect the second DC– cable of the Sunny Central as described above.

☑ The DC– cable of the Sunny Central is connected.

7.5.2 Sunny Central: Connecting DC+

The DC+ cable of the Sunny Central is connected to the terminals (A) in the Sunny Central String-Monitor.



1. Strip the cable by approx. 1.1 in. (28 mm).
2. Open the screw terminal using an Allen key counterclockwise.
3. Plug the copper inner conductor of the cable into the screw terminal.
4. Tighten the screw terminal using an Allen key. The required torque is 325 in-lb.

Wire size	Torque
350 kcmil	325 in-lb

5. Connect the second DC+ cable of the Sunny Central as described above, if required.

☑ The DC+ cable of the Sunny Central is connected.

7.6 Connecting Sunny Central - positive grounding

The Sunny Central may not be connected until the communication and the PV modules have been connected (see section 6 "Communication connector" (page 29), section 7.2 "Connecting ground" (page 38)and section 7.4 "Connecting the PV modules - positive grounding" (page 44)).

DANGER

Risk of electric shock through reverse voltage from Sunny Central.

Death or serious injuries.

- Disconnect the Sunny Central.

Technical Data for the Connection to the Sunny Central

	Version 24	Version 32	Version 64
Max. number of output lines per potential	2	2	2
DC Short Circuit Current	480 A	480 A	512 A
DC Max Continuous Current	308 A	308 A	328 A

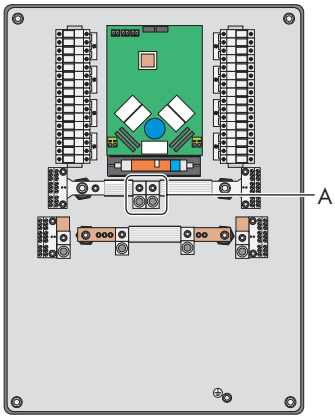
Technical Data for the Cables to the Sunny Central

Use 90 °C (194 °F), copper wire for all DC wiring connections to the Sunny Central String-Monitor.

Cables to the Sunny Central	Cable Size	Torque
DC+	350 kcmil	325 in-lb
DC–	350 kcmil	325 in-lb

7.6.1 Sunny Central: Connecting DC+

The DC+ cable of the Sunny Central is connected to the terminals (A) in the Sunny Central String-Monitor.



1. Strip the cable by approx. 1.1 in. (28 mm).
2. Loosen the hexagon screw with a wrench counterclockwise.
3. Put the hexagon screw and the washer aside.
4. Pull the screw terminal from the rail.
5. Open the screw terminal using a hexagon (allen) key counterclockwise.
6. Insert the cable into the Sunny Central String-Monitor as described in chapter 5 "Attaching the Cable Conduits" (page 28).
7. Plug the copper inner conductor of the cable into the screw terminal.
8. Tighten the screw terminal using an Allen key clockwise. The required torque is 325 in-lb.

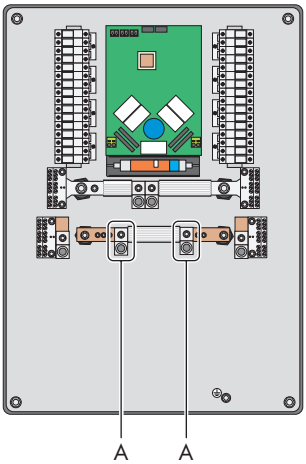
Wire size	Torque
350 kcmil	325 in-lb

9. Put the screw terminal on the rail.
10. Put the washer on the screw terminal and the hexagon screw in the hole of the screw terminal.
11. Tighten the hexagon screw using a wrench clockwise. The required torque is 222 in-lb.
12. Connect the second DC+ cable of the Sunny Central as described above.

☑ The DC+ cable of the Sunny Central is connected.

7.6.2 Sunny Central: Connecting DC–

The DC– cable of the Sunny Central is connected to the terminals (C) in the Sunny Central String-Monitor.



1. Strip the cable by approx. 1.1 in. (28 mm).
2. Open the screw terminal with an Allen key counterclockwise.
3. Plug the copper inner conductor of the cable into the screw terminal.
4. Tighten the screw terminal using an Allen key. The required torque is 325 in-lb.

Wire size	Torque
350 kcmil	325 in-lb

5. Connect the second DC– cable of the Sunny Central as described above, if required.

☑ The DC– cable of the Sunny Central is connected.

8 Commissioning

DANGER

Risk of electric shock when closing the fuses under load.

Death or serious injuries.

- Cover the PV modules with an opaque (dark) material.
- Follow all safety precautions of the module manufacturer.

The Sunny Central String-Monitor is only one part of the PV power system. The commissioning of the Sunny Central String-Monitor may 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.

9 Maintenance and Cleaning

The Sunny Central String-Monitor must be maintained at regular intervals. Maintenance includes:

- Inspection of wearing parts, and replacement thereof if necessary
- Functionality test of components
- Inspection of contact joints
- Cleaning of housing and interior if necessary

The maintenance intervals depend on the location and the ambient conditions. A device installed in an environment with very dusty ambient air requires more frequent maintenance than indicated in the following table.

Maintenance electrical connections

Maintenance work	Maintenance interval (recommended)
Check all power cable connections for looseness and tighten them if necessary. Check the connectors and insulation for discoloration or degradation. Replace any damaged connectors or corroded contacts.	12 months
Check all string cable connections for looseness and replace them if necessary. Check the connectors and insulation on the assembly and busbars for discoloration or degradation.	12 months
Checking the shield connection	24 months
Checking the ground connection	12 months

Maintenance housing

Maintenance work	Maintenance interval (recommended)
Check that the Sunny Central String-Monitor is mounted correctly	24 months
Check the screw fitting seals and that they are tightly fastened and replace them if necessary	12 months
Check whether there is condensation water in the device	12 months
Check the installation location for accessibility, combustible materials, and that the device is securely positioned	12 months
Check the adhesive warning labels and replace them if necessary.	24 months
Visual inspection of the housing for damage	12 months

9.1 Replace fuses

9.1.1 Replace string fuses

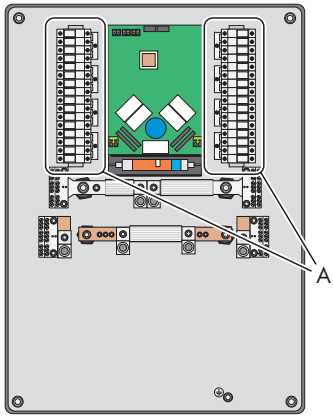
NOTICE

Risk of fire due to incorrectly dimensioned fuse.

Injuries due to fire.

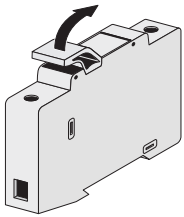
- For continuous protection, only replace with a fuse of the same type and size.
- Only use 10x 38 Class CC fuses from the company Ferraz (Type ATMR) with the following dimensions:
  - Version 24: max. 20 A rated current
  - Version 32: max. 15 A rated current
  - Version 64: max. 8 A rated current

The fuse holders are positioned at the right and left side (C) of the Sunny Central String-Monitor.

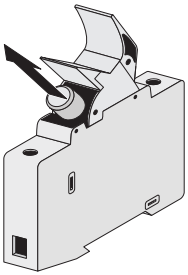


1. Open the Sunny Central String-Monitor as described in section 10.1 "Opening Sunny Central String-Monitor" (page 58).

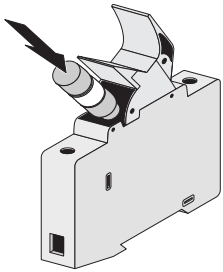
2. Open the fuse holder.



3. Pull the fuse out of the fuse holder.

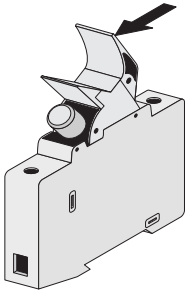


4. Insert the new fuse into the fuse holder.



5. Close the fuse holder.
6. Close the Sunny Central String-Monitor as described in section 10.2 "Closing the Sunny Central String-Monitor" (page 59).

☑ The fuse is replaced.



9.1.2 Replace Fuse from Electronic Board

NOTICE

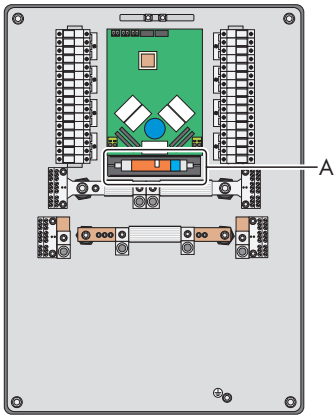
Risk of fire due to incorrectly dimensioned fuse.

Injuries due to fire.

- For continuous protection, only replace with a fuse of the same type and size.
- Only use a 127 x 21 fuse from the company Ferraz (Type Amp-trap 2000 SmartSpot A6D) with the following current rating:
  - 1/10 A

1. Open the Sunny Central String-Monitor as described in section 10.1 "Opening Sunny Central String-Monitor" (page 58).
2. Remove the fuse from the holder (A) by pulling it forwards.
3. Insert the new fuse into the holder.
4. Close the Sunny Central String-Monitor as described in section 10.2 "Closing the Sunny Central String-Monitor" (page 59).

☑ The fuse is replaced.



10 Opening and Closing

10.1 Opening Sunny Central String-Monitor

DANGER

Risk of electric shock when opening the Sunny Central String-Monitor under load.

Death or serious injuries.

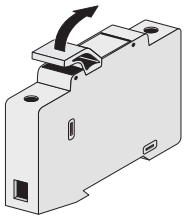
- Cover the PV modules with an opaque (dark) material.

1. Switch off the Sunny Central as described in the Sunny Central installation guide.

DANGER

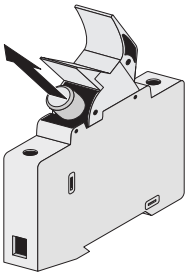
High voltages are present in the Sunny Central String-Monitor. Death or serious injury due to electric shock.

2. Wait 5 minutes before opening the Sunny Central String-Monitor.
3. Open the Sunny Central String-Monitor.
4. Ensure that no voltage is present in the system.
5. Open the fuse holders.



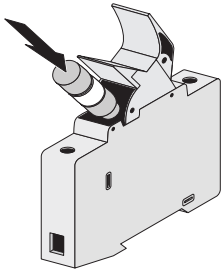
6. Pull the fuses out of the fuse holders and lay them aside.

☑ The Sunny Central String-Monitor is opened.



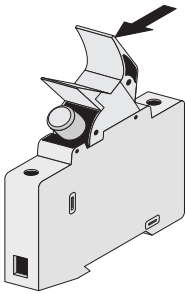
10.2 Closing the Sunny Central String-Monitor

1. Reinsert the fuses into the fuse holders.



1. Close the fuse holders.
2. Close the Sunny Central String-Monitor.
3. Commission the Sunny Central as described in the Sunny Central Installation Guide.
4. Remove the cover of the PV modules.

☑ The Sunny Central String-Monitor is closed.



11 Operation of the Sunny Central String-Monitor

The Sunny Central String-Monitor cannot be operated unless there is a Sunny WebBox connected to the Sunny Central.

You will find operating instructions for the Sunny WebBox in the technical description of the Sunny WebBox.

11.1 Terms and Definitions

Accuracy

Adjusting sensitivity by varying the triggering threshold:

- sensitiv
- regular
- insensitiv

Creating Groups

A group is made up of several PV strings. For instance, you can create a group of PV strings connected to inverters which are shaded during the morning. This will result in similar measurements for the whole group.

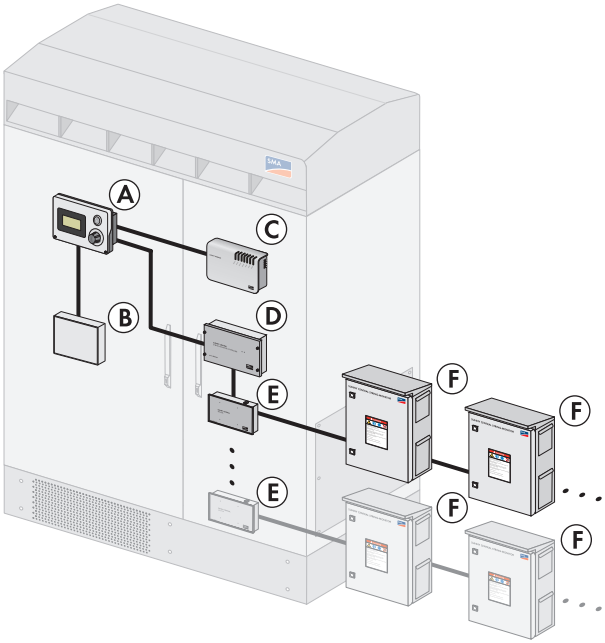
Communication Period

Time period during which the Sunny Central String-Monitor Controller communicates with the Sunny Central String-Monitors. Upon leaving our factory, the default communication period is set from 10:00 hours (10:00 a.m.) to 15:00 hours (3:00 p.m.). The Sunny Central String-Monitors are supplied with energy from the PV panel. If, for example, the Sunny Central String-Monitor Controller tries to communicate with the Sunny Central String-Monitors during the night, they will be unable to respond. The Sunny Central String-Monitor Controller will generate an error report.

Monitoring Period

Time period during which the Sunny Central String-Monitor Controller monitors the Sunny Central String-Monitors. Upon leaving our factory, the default monitoring period is set from 10:00 hours (10:00 a.m.) to 15:00 hours (3:00 p.m.). At night, when the PV plant is not producing any power, the Sunny Central String-Monitor Controller and the Sunny Central String-Monitors are unable to communicate with each other.

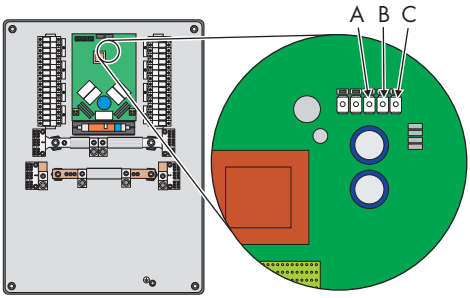
11.2 Communication Overview



Position	Description
A	Sunny Display
B	Sunny Central Control Unit
C	Sunny WebBox
D	Sunny Central String-Monitor Controller (SCSMC)
E	Sunny Central 485Hub
F	Sunny Central String-Monitor (SSM-US)

11.2.1 Status Display Sunny Central String-Monitor

LED Overview



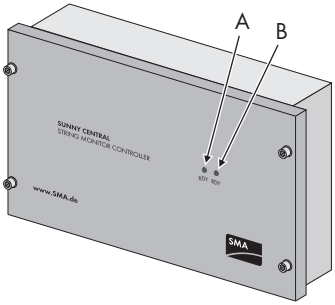
Position	Description
A	Green LED "Ready"
B	Green LED "Receive Data"
C	Orange LED "Activity"

Explanation of the LEDs

Green LED "Ready"	Green LED "Receive Data"	Orange LED "Activity"	Description
permanently on			Sunny Central String-Monitor is in operation.
flashing	flashing		Internal error Please contact the SMA Serviceline (see Section 14 "Contact" (page 80)).
	permanently on		Internal error Please contact the SMA Serviceline (see Section 14 "Contact" (page 80)).
	flashing		Sunny Central String-Monitor is communicating with the Sunny Central String-Monitor Controller.
		flashing	Communication on RS485 bus

11.2.2 Status Display Sunny Central String-Monitor Controller

LED Overview



Position	Description
A	Green LED "RDY"
B	Orange LED "ACT"

Explanation of the LEDs

Green LED "RDY"	Orange LED "ACT"	Description
permanently on		Sunny Central String-Monitor Controller is in operation.
	flashing	Communication is taking place with at least one Sunny Central String-Monitor.
	off	• There is no communication taking place with any Sunny Central String-Monitors. **or** • The Sunny Central String-Monitor Controller is no longer within the monitoring period.

11.3 Spot Values

Recalling spot values

1. Log into the Sunny WebBox as an installer.
2. Go to "System > Devices" on the web interface.
3. Select Sunny Central String-Monitor Controller "SCSMC" or Sunny Central String-Monitor "SSM-US" from the list.
4. Click the "spot values" tab.

11.3.1 Spot values Sunny Central String-Monitor Controller

Name	Description
Error	Warning indicator Sunny Central String-Monitor Controller (see Section 12.2 "Confirm warning" (page 75)).
h-On	Total hours in operation.
MeanCurGr1 – MeanCurGr6	Mean value of electricity generated by the respective group.
Mode	Operating mode of the Sunny Central String-Monitor Controller: • Operation • Warning • Disturbance • Error
ParaCfg	Ok: The configuration is in order. WrnMoniTmCom: end time of the communication period is before the start time. WrnMoniTmGr: at least one end time in a given group is before the respective start time.
SSMUIntDatTm	Display of the time duration for one complete communication cycle between the Sunny Central String-Monitor Controller and the connected Sunny Central String-Monitors.
SSMUNoOf	Number of Sunny Central String-Monitors found.
SSMUWrnCode	If a string failure is recognized, the following values are indicated: • Identification number of the Sunny Central String-Monitor. • First position after the decimal point: the number of the current measurement input (1 - 8).

Name	Description
SSMUWrnTxt	Error message in text format. **Display format** SMU (SSMUId) Chan (x) (SSMUId): identification number of the Sunny Central String-Monitor. (x): number of the faulty string current channel 1 to 8.
SysDt	Current system date Display format: mm-dd-yy mm: month, dd: day, yy: year
SysTm	Current system time System time is displayed in 24-hour format. Display format: hh:mm:ss hh: hours, mm: minutes, ss: seconds

11.3.2 Spot values Sunny Central String-Monitor

Name	Description
ComQ	Communication quality Low: bad quality of communication. Good: good quality of communication. Excellent: very good quality of communication.
CurCh1 – CurCh8	Mean value of electricity present in the respective canal.
Error	Warning on Sunny Central String-Monitor (see Section 12 "Troubleshooting" (page 74)).
Mode	Operating mode of the Sunny Central String-Monitor.

11.4 Parameters

Recalling parameters

1. Log into the Sunny WebBox.
2. Go to "System > Devices" on the web interface.
3. Select Sunny Central String-Monitor Controller "SCSMC" or Sunny Central String-Monitor "SSM-US" from the list.
4. Select the "Parameters" tab.

11.4.1 Parameters for Sunny Central String-Monitor Controller

The following table lists the parameters displayed in the user and installer modes. The parameters with a grey background are only visible in the installer mode.

Name	Adjustment range	Default setting	Description
Ackn	quit		Confirm errors and warnings manually. Confirmation of a warning or error which has occurred in the Sunny Central String-Monitor or the Sunny Central String-Monitor Controller.
ComBaud	---, 1200Baud, 4800Baud, 9600Baud, 19200Baud, 38400Baud, 57600Baud	19200	Speed of data transfer via the communication bus.
DevFunc	---, AutoDetect_SSMU, DetectSSMURetry, DelAll_SSMU, Factory		AutoDetect_SSMU: Deletion of all detected and registered Sunny Central String-Monitors and subsequent search for the Sunny Central String-Monitors. DetectSSMURetry: Continue search for further Sunny Central String-Monitors which have so far remained undetected. DelAll_SSMU: Deletion of all Sunny Central String-Monitors registered in the Sunny Central String-Monitor Controller. Factory: Set all the parameters visible in the installer mode back to default settings.
Dt	yymmdd		Current date of the Sunny Central String-Monitor Controller. yy: year, mm: month, dd: day E.g., for July 4, 2009, enter "070409".

Name	Adjustment range	Default setting	Description
ErrLevGr1 – ErrLevGr6	Sensitive, Regular, Insensitive, Customer	Regular	Adjusting the string current monitoring system. Here you can set the monitoring parameters for each individual group.
Firmware			Firmware version of the Sunny Central String-Monitor Controller. This parameter cannot be adjusted.
Firmware2			Kernel version of the Sunny Central String-Monitor Controller. This parameter cannot be adjusted.
MoniTmComOff	6.00 – 20.00	15.00	Time at which the daily communication with the Sunny Central String-Monitors stops. The time is entered in 24-hour format. Hours and minutes are separated by a dot. E.g., for 6:30 p.m. enter "18.30".
MoniTmComOn	6.00 – 20.00	10.00	Time at which the daily communication with the Sunny Central String-Monitors starts. The time is entered in 24-hour format. Hours and minutes are separated by a dot. E.g., for 10:30 a.m. enter "10.30".
MoniTmGr1Off – MoniTmGr6Off	7.00 – 19.00	15.00	End of monitoring for the Sunny Central String-Monitor groups 1 to 6. These parameters will enable you to set the monitoring end times for each separate group. The time is entered in 24-hour format. Hours and minutes are separated by a dot. E.g., for 3:00 p.m. enter "15.00".

Name	Adjustment range	Default setting	Description
MoniTmGr1On – MoniTmGr6On	7.00 – 19.00	10.00	Start of monitoring for the Sunny Central String-Monitor groups 1 to 6. These parameters will enable you to set the monitoring start times for each separate group. The time is entered in 24-hour format. Hours and minutes are separated by a dot. E.g., for 10:30 a.m. enter "10.30".
MoniTmGrAllOff	7.00 – 19.00	15.00	End of monitoring time for all the Sunny Central String-Monitor groups. This parameter will enable you to set the monitoring end time simultaneously for the parameters MoniTmGr1Off thru MoniTmGr6Off. The time is entered in 24-hour format. Hours and minutes are separated by a dot. E.g., for 3:00 p.m. enter "15.00".
MoniTmGrAllOn	7.00 – 19.00	10.00	Start of monitoring time for all the Sunny Central String-Monitor groups. This parameter will enable you to set the monitoring start time simultaneously for the parameters MoniTmGr1On thru MoniTmGr6On. The time is entered in 24-hour format. Hours and minutes are separated by a dot. E.g., for 10:30 a.m. enter "10.30".
Serial			Serial number of the Sunny Central String-Monitor Controller. This parameter cannot be adjusted.

Name	Adjustment range	Default setting	Description
Tm	hhmmss		Current time of the Sunny Central String-Monitor Controller. The time is displayed in 24-hour format. hh: hours, mm: minutes, ss: seconds E.g. for 4:30:22 p.m. enter "163022".

11.4.2 Parameters for Sunny Central String-Monitor

The following table lists the parameters displayed in the user and installer modes. The parameters with a grey background are only visible in the installer mode.

Name	Adjustment range	Default setting	Description
Firmware			Firmware version of the Sunny Central String-Monitor. This parameter cannot be adjusted.
GrCh	0 - 6	1	This parameter enables you to allocate all the strings connected to the Sunny Central String-Monitor to a group.
GrCh1 – GrCh8	0 - 6	1	Group to which a string of the Sunny Central String-Monitor has been allocated. Please allocate all the strings connected to the Sunny Central String-Monitor to a group. The Sunny Central String-Monitor does not monitor groups of less than 4 strings. GrCh0 is not monitored.
Serial Number			Serial number of the Sunny Central String-Monitor. This parameter cannot be adjusted.
SSMId			Identification number of the Sunny Central String-Monitor. The Sunny Central String-Monitor Controller displays errors on the basis of this Sunny Central String-Monitor identification number.

11.5 Setting the PV Plant Monitoring System

To set the PV plant monitoring system, all actions described here must be carried out in the given order.

Setting the Communication Type of the PV System

To enable individual components to communicate with each other, you must set the communication type as follows:

1. Log into the Sunny WebBox as an installer.
2. Set the communication type of the PV plant as described in the instructions for the Sunny WebBox. Set the following values:
   - "Interface": SMA-COM
   - "Baudrate": 19200

   ☑ Setting the communication type of the PV system is now complete.

Detecting the Sunny Central String-Monitor Controller

In order to fulfill the preconditions for communication, it is necessary for the Sunny WebBox to detect the Sunny Central and the Sunny Central String-Monitor Controller. Do not yet detect the Sunny Central String-Monitors.

3. Detect the Sunny Central String-Monitor Controller and the Sunny Central, as described in the instructions to the Sunny WebBox. Set the following values:
   - "Total number of devices to be detected": 2 (1 Sunny Central and 1 Sunny Central String-Monitor Controller)

   ☑ Detection of the Sunny Central String-Monitor Controller and the Sunny Central is now complete.

Check Date and Time

4. Go to "System > Devices" on the web interface.
5. Select Sunny Central String-Monitor Controller "SCSMC" in the device view.
6. Select the tab "Spot values".
7. Check date and time of the Sunny Central String-Monitor Controller.
   - Spot value of current date: SysDt
   - Spot value of current time: SysTm
8. If the spot values for "SysDt" and "SysTm" are incorrect, change the parameters "Dt" and "Tm" (see following Section).

Adjusting the parameters of the Sunny Central String-Monitor Controller

9. Select the "Parameters" tab.
10. If the spot value for "SysDt" is incorrect, alter the "Dt" parameter to the current date.
11. If the spot value for "SysTm" is incorrect, alter the "Tm" parameter to the current time.
12. Select [Save].

☑ Adjustment of the parameters of the Sunny Central String-Monitor Controller is now complete.

Detecting the Sunny Central String-Monitors via the Sunny Central String-Monitor Controller

13. Set parameter "DevFunc" to "AutoDetect_SSMU".
14. Select [Save].
    ☑ The Sunny Central String-Monitor Controller starts with the detection of all the Sunny Central String-Monitors.

Detecting the Sunny Central String-Monitors can take several minutes.

Depending on the number and distance of devices from each other, the duration of the detection process can differ.

15. Select the tab "Spot values".
16. Check the number of Sunny Central String-Monitors detected in the spot value for "SSMUNoOf".
    ☑ Detection of the Sunny Central String-Monitors by the Sunny Central String-Monitor Controller is now complete.

    or

    If the Sunny Central String-Monitor Controller has not detected all the Sunny Central String-Monitors, restart the detection process.
17. Set parameter "DevFunc" to "DetectSSMURetry".
18. Select [Save].
    ☑ The Sunny Central String-Monitor Controller starts over with the detection of all the Sunny Central String-Monitors.

Detection of the entire system by the Sunny WebBox

The Sunny WebBox must detect the entire system, i.e., the Sunny Central, the Sunny Central String-Monitor Controller and the Sunny Central String-Monitors.

19. Detect the Sunny Central String-Monitor Controller and the Sunny Central, as described in the instructions to the Sunny WebBox. Set the following values:
    – "Total number of communication units": spot value reading "SSMUNoOf" + 2 more devices (Sunny Central and Sunny Central String-Monitor Controller).
    ☑ Detection of the Sunny Central String-Monitors, the Sunny Central and the Sunny Central String-Monitor Controller is now complete. The Sunny WebBox now displays the Sunny Central String-Monitors in the device view.

Adjusting the group allocation of the Sunny Central String-Monitors

20. Select the Sunny Central String-Monitor "SSM-US" in the device view.
21. Select the "Parameters" tab.

22. Via the parameter "SSMId" allocate a unique identification number to each Sunny Central String-Monitor. Each Sunny Central String-Monitor must have its own individual identification number.
23. Make a note of the identification numbers allocated to the serial numbers of the Sunny Central String-Monitors.

☑ Adjustment of the group allocation of the Sunny Central String-Monitors is now complete.

11.6 Optional Settings for the PV plant Monitoring System

11.6.1 Setting the communication period of Sunny Central String-Monitors

The communication period is the time period during which the Sunny Central String-Monitor Controller communicates with the Sunny Central String-Monitors. Upon leaving our factory, the default communication period is set from 10:00 hours (10:00 a.m.) to 15:00 hours (3:00 p.m.). If you want to change the communication period follow the instructions below.

Setting the communication period of all Sunny Central String-Monitors

1. Set the parameter "MoniTmComOn" to the monitoring start time.
2. Set the parameter "MoniTmComOff" to the monitoring end time.
3. Select [Save].

☑ Setting the communication period of all Sunny Central String-Monitors is now complete. Check the monitoring period settings according to the instructions below.

11.6.2 Setting the monitoring period of Sunny Central String-Monitors

You can set the monitoring period of the Sunny Central String-Monitors via the parameters of the Sunny Central String-Monitor Controller. You can set the monitoring period for all the Sunny Central String-Monitors or allocate a separate monitoring period to each group of Sunny Central String-Monitors.

Selecting the monitoring period

The monitoring period must never be outside the time period set for the Sunny Central String-Monitors to communicate with the Sunny Central String-Monitor Controller. This time period can be set via the parameter "MoniTmComOn" and "MoniTmComOff".

Setting the monitoring period of all Sunny Central String-Monitors

1. Set parameter "MoniTmGrAllOn" to the monitoring start time.
2. Set parameter "MoniTmComOff" to the monitoring end time.
3. Select [Save].

☑ Setting the monitoring period of all Sunny Central String-Monitors is now complete. Check the monitoring period settings according to the instructions below.

Setting the monitoring period for individual groups of Sunny Central String-Monitors

1. Set parameter "MoniTmGr1On" thru "MoniTmGr6On" to the monitoring start time.
2. Set parameter "MoniTmGr1Off" thru "MoniTmGr6Off" to the monitoring end time.
3. Select [Save].

   ☑ Setting the monitoring period for the groups of Sunny Central String-Monitors is now complete. Check the monitoring period settings according to the instructions below.

Checking the monitoring period

1. Select the tab "Spot values".
2. Check spot value "ParaCfg".
   - If parameter "ParaCfg" displays the message "WrnMoniTmGr", this means that the end of the monitoring period of the particular group is before the beginning of the monitoring period.
   - If parameter "ParaCfg" displays the message "WrnMoniTmCom", this means that the times for "MoniTmComOn" or "MoniTmComOff" have been set incorrectly (see Section "Adjusting the parameters of the Sunny Central String-Monitor Controller" (page 70)).

   ☑ Setting of the monitoring period is now complete.

☑ Setting the PV plant monitoring system is now complete.

11.6.3 Allocation of PV strings to groups

1. Log into the Sunny WebBox as an installer.
2. Go to "System > Devices" on the web interface.
3. Select the Sunny Central String-Monitor "SSM-US" in the list.
4. Select the "Parameters" tab.
5. Using parameter "GrCh0 – GrCh6" allocate all strings of the Sunny Central String-Monitors to a group. The Sunny Central String-Monitor does not monitor groups of less than 4 strings.

☑ The allocation of PV strings to groups is now complete.

12 Troubleshooting

12.1 Detection and Elimination of Faults

By means of the Sunny WebBox you can look at the spot value "Error" for the Sunny Central String-Monitor Controller or the Sunny Central String-Monitor. These spot values indicate that errors have occurred.

12.1.1 Detecting errors with the Sunny Central String-Monitor Controller

1. Log into the Sunny WebBox as an installer.
2. Go to "System > Devices" on the web interface.
3. Select the Sunny Central String-Monitor Controller "SCSMC" in the list.
4. Select the tab "Spot values".
5. Select the spot value "Error".

   ☑ If the spot value "Error" displays an alert, compare the message with the following table and eliminate the error. If the spot value "Error" does not display any warning, go on to next point.

Display	Meaning	Corrective measures
> Warning 380 < Warning 380	A string is not reaching the normal current. String failure or error trigger >: Incoming warning <: Outgoing warning	• Check which Sunny Central String-Monitor is faulty (see spot value "SSMUWrnCode"in Section 11.3.1 "Spot values Sunny Central String-Monitor Controller" (page 64)). • Check string current values in the Sunny Central String-Monitor ☑ If the string current values are correct: – Adjust parameter "ErrLevGr" in the Sunny Central String-Monitor Controller. ☑ If the string current values are incorrect: – Check the hardware of the Sunny Central String-Monitor. – Use clamp meter to test the PV field/ panel.

Display	Meaning	Corrective measures
> Warning 381 < Warning 381	Communication with the Sunny Central String-Monitor has failed. >: Incoming warning <: Outgoing warning	• Check under spot value "SSMUWrnCode" to establish which Sunny Central String-Monitor is faulty (see Section 11.3.1 "Spot values Sunny Central String-Monitor Controller" (page 64)). • Check communication wiring. • Check operating mode of the Sunny Central String-Monitor. If the Sunny Central String-Monitor is switched off, no communication can take place. • Check monitoring period.

12.1.2 Detecting errors with the Sunny Central String-Monitor

1. Go to "System > Devices" on the web interface.
2. Select the Sunny Central String-Monitor "SSM-US" in the list.
3. Select the tab "Spot values".
4. Select the spot value "Error".
5. Compare the spot value "Error" message with the following table and eliminate the warning.

Display	Meaning
EvtEe Error	The Sunny Central String-Monitor does not display the measured values correctly. Please contact the SMA Serviceline (see Section 14 "Contact" (page 80)).

12.2 Confirm warning

Confirm the warning message via the Sunny WebBox. You will find detailed operating instructions for the Sunny WebBox in the technical description of the Sunny WebBox.

1. Eliminating errors in the PV system (see Section 12 "Troubleshooting" (page 74)).
2. Log into the Sunny WebBox as an installer.
3. Select Sunny Central String-Monitor Controller „SCSMC“ in the device list.
4. Select the "Parameters" tab.
   ☑ The browser displays the list of parameters for the Sunny Central String-Monitor Controller.
5. Select parameter „Ackn“.
6. Select „quit“ in the drop-down menu.
7. Select [Save].

☑ The warning is now confirmed.

13 Technical Data

PV generator connection data

	Version 24	Version 32	Version 64
Input voltage range	0 ... 600 V DC	0 ... 600 V DC	0 ... 600 V DC
Maximum array system voltage (DC)	600 V DC	600 V DC	600 V DC
Maximum operating input current per string	20 A [1]	15 A [1]	8 A [1]
Maximum input short circuit current (Isc) – per string (A DC)	12.8 A [2]	9.6 A [2]	5.1 A [2]
Maximum input short circuit current (Isc) – total (A DC)	308 A DC [2]	308 A DC [2]	328 A DC [2]
Maximum fuse rating	20 A 600 V DC	15 A 600 V DC	8 A 600 V DC
Number of input circuits	24	32	64
Fused inputs per measuring channel	3	4	8
Configuration PV array	negative or positive grounded	negative or positive grounded	negative or positive grounded
Measuring Channels	8	8	8
Operating Consumption	20 W	20 W	20 W

1) These values indicate input current without the derating factors of NEC articles 690.8(A)(1) and 690.8(B)(1) applied.

2) These values indicate input current with the derating factors of NEC articles 690.8(A)(1) and 690.8(B)(1) applied.

Sunny Central connection data

	Version 24	Version 32	Version 64
DC short-circuit current	480 A	480 A	512 A
Maximum operating output current, continous (DC)	308 A	308 A	328 A
Maximum number of output lines per potential	2	2	2

Supply voltage assembly

Operational voltage	250 ... 600 V DC
Maximum fuse size	1/10 A , 600 V DC

Mechanical Data

	Version 24	Version 32	Version 64
Dimensions (W x H x D)			
inch	31.5 x 31.5 x 9.84	31.5 x 31.5 x 9.84	31.5 x 47.24 x 11.81
mm	800 x 800 x 250	800 x 800 x 250	800 x 1.200 x 300
Weight	143 lbs. (65 kg)	146 lbs. (66 kg)	194 lbs. (88 kg)
Enclosure rating	NEMA 3R	NEMA 3R	NEMA 3R
Type of housing	Steel or stainless steel	Steel or stainless steel	Steel or stainless steel

Ambient Conditions

Ambient temperature	-13 ... 113 °F (-25 ... +45 °C)
Maximum air ambient	113 °F (45 °C)
Rel. humidity	up to 95 %, condensation possible
Maximum height above sea level (NHN)	3.280 ft. (1000 m)

Communication

RS485 interface	as standard
Maximum diameter for the shield of the communication cable	0.315 in. (8 mm)
Dimensions of the communication cable	2 x 2 AWG 24

General

Certified in accordance with UL 1741
EMC compliant according to FCC

13.1 Torques and Cable sizes

Use 90 °C (194 °F), copper wire for all DC wiring connections to the screw terminals between

- PV-modules and Sunny Central String Monitor
- Sunny Central String-Monitor and Sunny Central

Use 90 °C (194 °F) copper wire for all DC wiring connections to the fuse holders.

13.1.1 Negative Grounding

PV module connections

Cables of the PV modules	Cable Size	Torque
DC+	Rigid wire: 10 - 6 AWG Multistrand wire: 10 - 8 AWG	19.5 in-lb (2.2 Nm)
DC–	6 - 4 AWG	45 in-lb (5 Nm)
	8 AWG	40 in-lb (4.5 Nm)
	10 AWG	35 in-lb (4 Nm)
Ground	6 - 4 AWG	45 in-lb (5 Nm)
	8 AWG	40 in-lb (4.5 Nm)
	10 AWG	35 in-lb (4 Nm)

Connection - Sunny Central

Cables to the Sunny Central	Cable Size	Torque
DC+	350 kcmil	325 in-lb
DC–	350 kcmil	325 in-lb
Ground	350 kcmil	325 in-lb

13.1.2 Positive grounding

PV module connections

Cables of the PV modules	Cable Size	Torque
DC+	6 - 4 AWG	45 in-lb (5 Nm)
	8 AWG	40 in-lb (4.5 Nm)
	10 AWG	35 in-lb (4 Nm)
DC–	Rigid wire: 10 - 6 AWG Multistrand wire: 10 - 8 AWG	19.5 in-lb (2.2 Nm)
Ground	6 - 4 AWG	45 in-lb (5 Nm)
	8 AWG	40 in-lb (4.5 Nm)
	10 AWG	35 in-lb (4 Nm)

Connection - Sunny Central

Cables to the Sunny Central	Cable Size	Torque
DC+	350 kcmil	325 in-lb
DC–	350 kcmil	325 in-lb
Ground	350 kcmil	325 in-lb

14 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:

- Inverter type
- Type and number of modules connected
- Communication method
- Serial number of the Sunny Central String-Monitor
- Sunny Central failure or warning number
- Display message of the Sunny Central

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