Central Inverter

SUNNY CENTRAL 400LV / 400HE / 500HE / 630HE

Installation Guide

SC400_500_630-IUS090830 | 98-4018730 | Version 3.0

US

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IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for Models Sunny Central 400LV, 400HE-11, 500HE-11 and 630HE-11, that shall be followed during installation and maintenance of the Sunny Central.

The Sunny Central 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. To reduce the risk of personal injury and to ensure the safe installation and operation of the Sunny Central, 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.

You will find information on maintaining the Sunny Central in the Sunny Central Maintenance Manual.

Before installing or using the Sunny Central, read all of the instructions, cautions, and warnings on the Sunny Central String, 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 122°F (50 °C).

Table of Contents

1 Notes on this Manual

1.1 Validity

This manual describes the transport, installation and commissioning of SMA central inverters of the following types:

- Sunny Central 400LV (SC 400LV-11)
- Sunny Central 400HE (SC 400HE-11)
- Sunny Central 500HE (SC 500HE-11)
- Sunny Central 630HE (SC 630HE-11)

This manual does not cover any details concerning equipment connected to the „device" (e. g. solar modules). Information concerning the connected equipment is available from the manufacturer of the equipment.

1.2 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.

1.3 Additional Information

All manuals for the Sunny Central as well as for the installed components must be stored together with the system documentation and must be accessible at all times. The documents listed below are included in the delivery of your Sunny Central. The following information is contained in these documents.

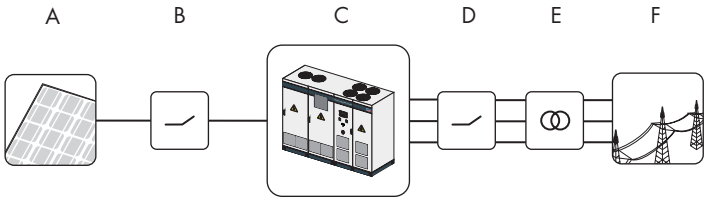
- Installation guide: Setup and installation of the Sunny Central
- User manual: Operation of the Sunny Central and the Sunny Central Control
- Wiring diagrams: Variant wiring diagram of the Sunny Central
- Commissioning report: Checklist for commissioning. After successful commissioning, the commissioning report has to be sent to SMA Solar Technology AG.
- Accessory documentation: The documentation for optional accessories or optional equipment for the Sunny Central (e.g. setup in chemically aggressive environments, for example near the sea) can be found at www.SMA.de/en.

2 Safety

2.1 Appropriate Usage

The Sunny Central is a PV inverter. It allows photovoltaic solar energy from solar modules to be converted and fed into a medium-voltage grid.

Principle of a grid-connected solar power system with a Sunny Central



Position	Description
A	PV modules
B	DC-Disconnect
C	Sunny Central
D	AC-Disconnect
E	Transformator
F	Public grid

Sunny Central HE

The Sunny Central HE is a high efficiency PV inverter. High efficiency means that the Sunny Central has not its own transformer. You can connect up to 2 Sunny Central HE of the same type to a transformer. For connecting one or two Sunny Central devices to a transformer, you require the following transformers of the following type:

- 1 Sunny Central: double-wound transformer
- 2 Sunny Central: triple-wound transformer

It is prohibited to connect the Sunny Central without transformer to the grid. Operating the Sunny Central HE without transformer causes a short-circuit and can destroy the Sunny Central.

Sunny Central LV

The Sunny Central LV is suitable for the connection of low-voltage modules.

2.2 Safety Precautions

Failures that affect or limit the safety of the device must be rectified immediately. Unauthorized modifications and the use of spare parts not recommended by SMA Solar Technology may cause fire, material damage and electrical shock. Unauthorized personnel must not have access to the equipment.

Warning signs must always be clearly legible and immediately replaced if damaged.

2.2.1 Personnel

Only qualified personnel may perform any and all work on the Sunny Central. "Qualified" means that the personnel must possess training relevant to the activity performed.

The personnel must be familiar with the content of the Sunny Central installation guide and user manual in order to commission and / or operate the Sunny Central. In particular, the safety instructions must be followed at all times.

2.2.2 Installation

The installation requirements described in the installation guide must be satisfied. In order to guarantee optimum noise and fire protection, installation must occur in an electrical operating room.

The Sunny Central product line has been type-tested and approved for installation in industrial environments with regard to the industry-standard EMC limits (EMC = Electromagnetic Compatibility). Devices suitable for installation in domestic areas are available upon request.

The following points must be observed for the installation.

- The intake and exhaust ventilation systems for the Sunny Central must be separate to any other ventilation so as to minimize smoke distribution in the case of fire.
- It is mandatory to ensure an appropriate escape route.
- Appropriate sound insulation must be provided.
- The EMC specifications must be observed (see technical data)

WARNING!

Smoke emission in electrical operating rooms.

We recommend the installation of a smoke detector inside the electrical operating room which controls the external emergency shutdown switch of the device and switches off the Sunny Central in the event of smoke.

2.2.3 Special Hazards of Photovoltaic Systems

Photovoltaic systems have special characteristics representing special hazards that are described here:

- An active power source is connected. Depending on the operating mode, there may be voltage present from the photovoltaic generator and / or the Sunny Central. This is especially important to note when disconnecting particular parts of the system.
- Very high DC voltages are present (no zero-crossing) that, in the case of a fault or inappropriate use of fuses or plugs, may lead to arcing.
- The short-circuit current of the photovoltaic generator is only slightly higher than the maximum operating current and is also dependent on the level of solar radiation. In the event of a short-circuit in the system, the available fuses are not guaranteed to switch off.
- The grid structure of the PV generator is generally an IT grid, i.e. a non-grounded grid that could become unintentionally earthed if a ground fault occurs.
- A highly branched generator array may be difficult to disconnect if a fault develops (e.g. short circuit). We recommend the extra use of external DC circuit breakers for disconnecting the inverter and / or the DC main cables / Sunny String Monitors (DC circuit breakers optionally available). At every DC input, an easily accessible DC circuit breaker should be installed.

2.2.4 Electrical Connection

The electrical connection must be performed according to this installation guide, the variant wiring diagram and the technical data of the device.

Ensure the grid connection cable for grid feeding is fused at the nominal current indicated on the type plate. If the specified nominal current differs from the nominal current of the fuse plug, the fuse plug having the next highest nominal current may be used.

Power supply cord

The power supply cord for the internal power supply must be fused with the circuit breaker specified in the technical data.

Lightning protection

The devices have internal surge voltage protection on the AC and DC sides. However, the desired protection level can only be achieved if a lightning protection area concept exists for the installation building as defined in the country-specific provisions, i.e. lightning conductors or combined surge and lightning conductors (not included in delivery) are available at, among other locations, the building's entrance (transfer lightning protection area LPZ 1).

Combined overvoltage and lightning protection for the signal inputs are optional and can be ordered separately.

Emergency shut-off

In systems having more than one device, the respective emergency shutdown switches must be connected together and checked for correct operation as described in this installation guide. The emergency shut-off circuit may only be supplied with voltage from a single device.

Emergency shut-off circuit

- The emergency shut-off circuit may only be supplied with power from a single Sunny Central.
- Ensure correct mounting of the jumpers on the emergency shut-off terminal strip of the device.

2.2.5 Power Supplies

WARNING!

Risk of lethal electric shock!

High voltages are present in the device.

- The protective earth connection must be made before the external voltage is switched on.
- Maintain the nominal voltage, frequency and the right-hand rotary field on the AC grid connection terminal.
- The correct polarity and ungroundedness must be ensured before inserting the DC input fuses (internal or external). The fuses may only be inserted and / or removed under load-free conditions and using the appropriate personal protective equipment and fuse carriers.
- When the DC fuses (internal or external) have been inserted, reverse voltage exists, via the Sunny Central busbars, on all externally connected DC main distribution boxes and DC sub-distribution boxes (Sunny String Box).
- The doors must remain closed when connecting the supplies!

Requirements for the use of external power supplies

- All connections have been made according to the installation guide and the wiring diagram.
- The protective earth connection for grid feed-in and for internal power supply has been made.
- The device is switched off. The key switch is in the “Stop” position and the main switches are off.
- The DC input fuses (internal or external) are inserted and the touch protection (Plexiglas cover) is mounted.
- The nominal voltage, frequency and the right-hand rotating field are maintained.
- The polarity of the DC voltage at the inputs / fuse inputs (device dependent) has been checked.
- The polarity of the DC voltage at the inverter input (device dependent) has been checked.
- The photovoltaic generator has been checked with an insulation test to ensure that there is no ground fault.

Sequence for switching on the external power supplies

1. Grid voltage for the grid feed-in
2. Grid voltage for internal power supply
3. DC voltage from the photovoltaic generator

2.2.6 Disconnecting the Device

External isolation of the device must always occur under load-free conditions. The device must be switched off in order to do this, i.e. the key switch must be in the "Stop" position.

DANGER!

Risk of lethal electric shock!

Work on the Sunny Central may be performed only after switching off the power to the unit and in observance of the following steps:

- Disconnect the device
- Protect against reactivation
- Ensure that no voltage is present
- Ground and short the unit if necessary (not on the DC side)
- If necessary, cover or protect against accidental contact with any voltage carrying components

The following power supplies must be isolated:

- Grid voltage for the grid feed-in
- Grid voltage for internal power supply (optional)
- DC voltage from the photovoltaic generator
- Additional external voltage if necessary (e.g. emergency shut-off)

Simply switching off the main AC and DC switches is not sufficient to ensure proper isolation of the device. The main switches only separate the power circuit from the grid and the photovoltaic generator.

DANGER!

Risk of lethal electric shock!

Dangerous accidental-contact voltages can be present in the Sunny Central even when the main AC and DC switches are switched off!

- Wait at least 5 minutes after switching off the Sunny Central.

The DC voltage is isolated using the internal or external DC input fuses, or using an external circuit breaker if present. Isolation by removing the DC input fuses must occur under load-free conditions.

The device contains capacitors on the AC and DC sides which discharge once the device has been switched off. After switching off, dangerous accidental-contact voltages remain within the device for several minutes. If there is a fault in the device, these voltages may also be present for a longer period of time. Wait at least 5 minutes after switching off the device before opening the device.

WARNING!

Risk of lethal electric shock!

- To avoid arcing, the load-free status of the device must be checked with a current probe (using a clamp-on ammeter) before removing the DC input fuses. The fuses may only be inserted or removed using the appropriate personal protective equipment and fuse carriers.
- When the DC fuses (internal or external) have been inserted, reverse voltage exists, via the Sunny Central busbars, on all externally connected DC main distribution boxes and DC sub-distribution boxes (Sunny String Monitor).
- In case of a failure, the DC contactor may carry a life-threatening DC voltage!
- The discharge time of the capacitors is longer than 5 minutes.

The Plexiglas cover must be removed in order to pull the fuses. The covers must never be removed from both poles at the same time. Immediately reinstall the cover after the cover has been removed from one pole and the fuse has been extracted. The covers must always remain in place when fuses are not being removed.

Safely disconnecting system components

We recommend the extra use of external DC circuit breakers for disconnecting the Sunny Central, the DC main cables and Sunny String Monitors (DC circuit breakers optionally available). This allows system components to be safely isolated, even in the case of faults or fire.

2.2.7 General Information

Ear protection

The device fans and the power unit create significant levels of operating noise. Additionally, a fault in the device can lead to very high sound levels. For these reasons we recommend the use of ear protection when remaining in the device area.

High noise levels in electrical operating rooms

We recommend the use of ear protection when in the vicinity of the Sunny Central electrical operating room for extended periods.

Burns

Immediately after isolating the device, depending on the operating conditions, certain components can be very hot (e.g. fuses, transformer core, sine wave filter, heatsinks etc.).

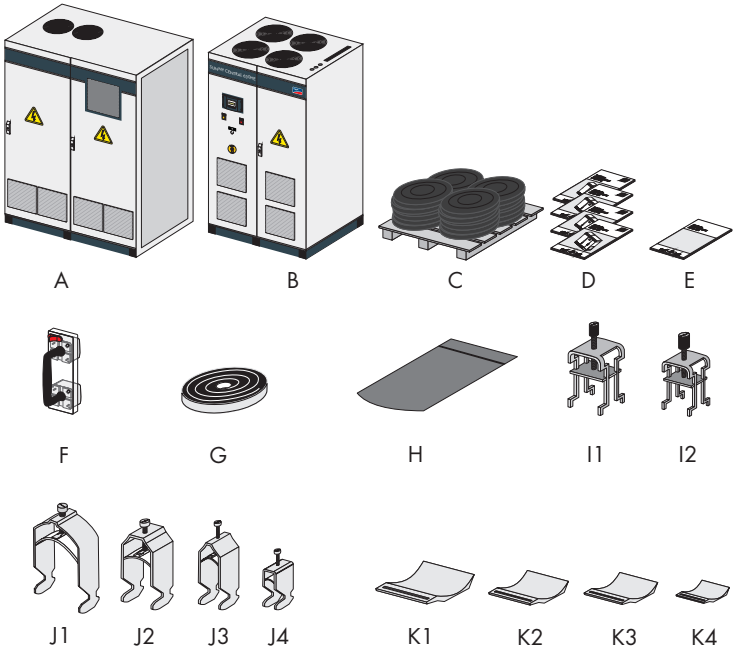
Safety gloves should always be worn when working near components that can be expected to be very hot.

High temperatures on device components

We recommend that safety gloves be worn during all work on the device.

3 Delivery

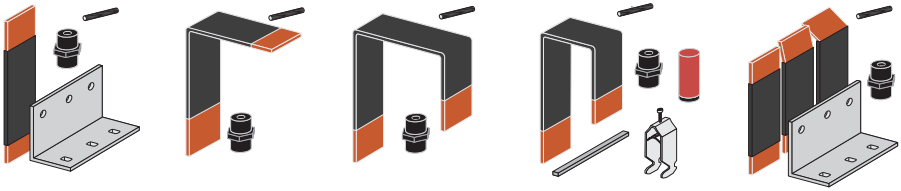
3.1 Standard Scope of Delivery



Position	Quantity	Description
A	1	DC / inverter cabinet
B	1	AC cabinet
C	1	Power cabling
D	1	SMA documentation: • Installation guide • User manual • Variant wiring diagram • Commissioning report
E	1	Documentation for insulation monitoring (Bender), optional
F	1	Low-voltage HRC fuse carrier: optional
G	2	Terminal profile, 8.84 ft. Rittal SZ 2573.000

Position	Quantity	Description
H	1	Rittal mounting set • Dispatch bag, dual opening TS8 1200 x 2000 • Angle bracket TS corner TS8800.430 • Quick angle connector TS TS8800.500 • Rittal angle plate PS 4582.500 • Sealing tape
I1	4	Shield clamp 0.28 in. – 0.63 in. Wago 790-116
I2	5	Shield clamp 0 – 0.31 in. mm Wago 790-108
J1	6	OBO cable clip 0.47 in. – 0.63 in.
J2	17	OBO cable clip 0.87 in. – 1.1 in.
J3	21	OBO cable clip 1.1 in. – 1.34 in.
J4	14	OBO cable clip 1.34 in. – 1.57 in.
K1	6	OBO counter trough 1197169 2058 FW/16
K2	17	OBO counter trough 1197282 2058 FW/28
K3	21	OBO counter trough 1197347 2058 FW/34
K4	14	OBO counter trough 1197401 2058 FW/40

3.2 Model-Dependent Scope of Delivery

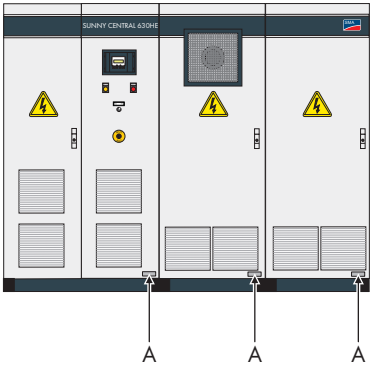


Position	Quantity	Description
A	1	AC connection model 13 / 0: • 3 x straight copper bar (same length) • 3 x insulator • 1 x angle bracket • 3 x insulator and setscrew
B	1	AC connection model 13 / 1: • 3 x L-shaped copper bar • 3 x insulator • 3 x insulator and setscrew
C	1	AC connection model 13 / 2: • 3 x U-formed copper bar • 3 x insulator • 3 x insulator and setscrew
D	1	AC connection model 13 / 3: • 3 x U-formed copper bar • 3 x support • 3 x insulator and setscrew • 24 x cable clip and counter trough • 4 x cable rail for side panels
E	1	AC connection model 13 / 4: • 3 x copper bar (varying angles) • 3 x insulator • 1 x angle bracket • 3 x insulator and setscrew

3.3 Identifying the Sunny Central

You can identify the Sunny Central by its type label. The type label is located on the inside of the Sunny Central's door.

In addition, the series number (A) is located on the front side of the device.



Selecting the switch cabinet units

The Sunny Central is delivered in the form of two switch cabinet units. In the event a greater number of Sunny Centrals are delivered and installed, the cabinet units with the same series number must be set up contiguously.

3.3.1 Checking for Transport Damages

Upon receipt of the equipment, check the packaging and the device for any possible damage and compare the contents of the delivery with the delivery documentation. Immediately contact SMA Solar Technology if any damages are found or if there are any ambiguities about the contents of the delivery.

Transport safety

The inverters are delivered as two separate switch cabinet units. They do not satisfy the protection class requirements as specified in the technical data. The transport packaging provides sufficient protection against moisture and damages.

3.3.2 Storage

The cabinet units do not satisfy the protection class requirements as specified in the technical data during transport and storage. The transport packaging provides sufficient protection against moisture and damages during shipping. The cabinet units may not be stored outdoors.

Notice!

Improper storage may cause damages to the Sunny Central.

Improper storage can cause moisture or dust to seep into the Sunny Central.

- Only store your Sunny Central in rooms which will protect it from dust and moisture.
- The conditions under which the Sunny Central is stored must correspond to the intended operating conditions.
- Do not store the Sunny Central outdoors.

4 Installation and Internal Cabling

Sunny Central installation requirements

Each Sunny Central has individual installation requirements. These can be ordered at any time from SMA Solar Technology and have to be observed for project planning and preparation of the installation site.

Selecting the switch cabinet units

During installation and internal cabling, make sure the cabinet units have the same series number.

4.1 Installation Site Requirements

Sunny Central installation location

The Sunny Central should be set up in an electrical operating room.

Foundation

The foundation must guarantee solid and safe positioning of the inverter. The foundation must provide the load-carrying capacity necessary to cope with the weight of the inverter. The inverter cabinet must be installed on a level surface. Any existing unevenness, depression or slope must be corrected prior to installation.

Wall clearances

Appropriate wall clearances for minimum passages, escape routes and ventilation requirements must be maintained when installing the inverter. Appropriate specifications for each type of inverter are contained in the Sunny Central Installation Requirements (separate document).

Inverter protection rating / EMC / sound levels

The Sunny Central is suitable for a dry, dust-reduced environment as per an IP20 protection rating. With regard to the electromagnetic emissions and the noise level, the Sunny Central inverter is conceived for setup in an industrial environment.

4.2 Electrical Operating Room

For the installation and connection of the Sunny Central central inverters, observe the country-specific provisions. The requirements for the electrical operating room for the installation of high-voltage systems up to 1000 V as well as the requirements for passageways and escape routes are included therein.

Minimum passageway in electrical operating rooms

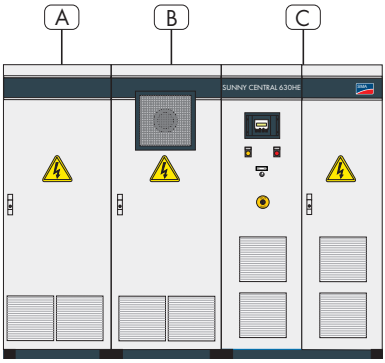
Observe the following points for a minimum passageway:

- With fully opened cabinet doors, a minimum passage width of 19.69 in. (escape routes) must be maintained.
- To maintain the minimum passageway requirements, the cabinet doors in an inverter system with two rows of opposing cabinets (e.g. in a station building) may only be opened on one side at a time.

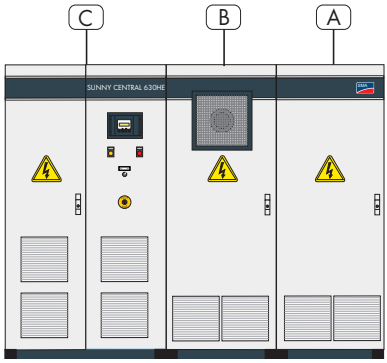
4.2.1 MV Stations

Inverters in the HE series are normally set up in a compact concrete substation, opposite to each other as a "left-hand system" and a "right-hand system". The installation must be carried out in accordance with the country-specific provisions for closed electrical operating rooms. A left-hand and a right-hand system are both illustrated in the figure below.

Left-hand system



Right-hand system



A DC cabinet

B Inverter cabinet

C AC cabinet

The AC cabinets should always stand next to the dividing wall to the transformer room so as to allow the AC power cables to be connected to the transformer over the shortest possible route.

WARNING!

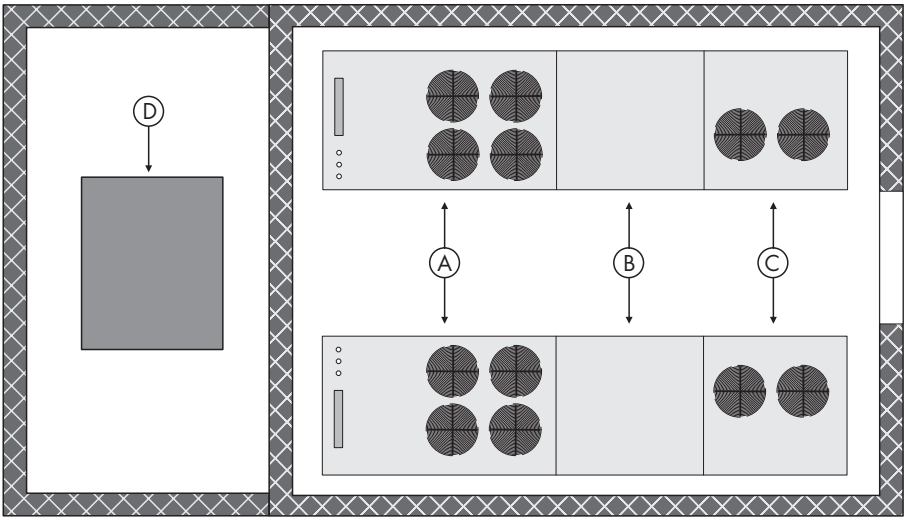
Smoke emission in electrical operating rooms.

SMA Solar Technology recommends the installation of a smoke detector inside the operating room which controls the external emergency shut-off connection of the device and which switches off the Sunny Central in the event of smoke.

Sunny Centrals in a station

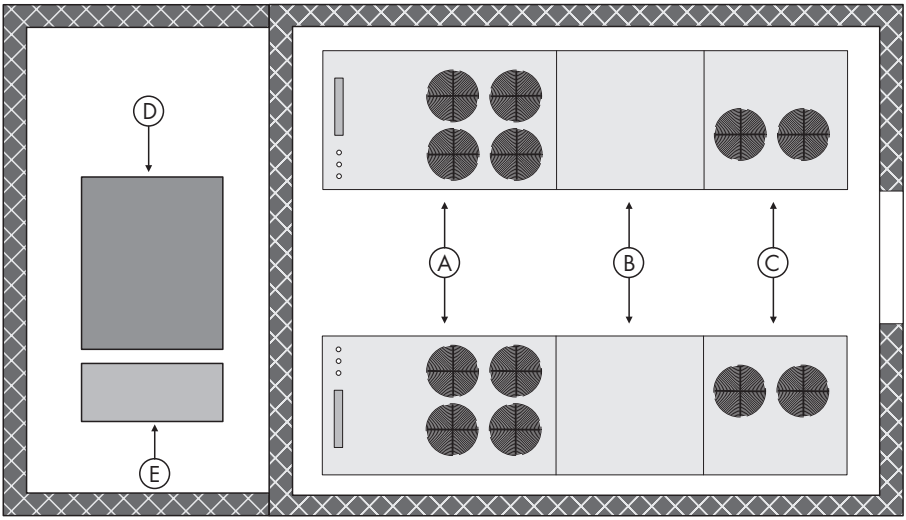
In the following section, a selection of schematic overviews will be shown which illustrate Sunny Centrals and the transformer room within a station. The inverter has been installed as a "right-hand system" (above) and a "left-hand system" (below). Stations may also be equipped with only one Sunny Central. In addition to a transformer, the option exists to also include a medium-voltage switchgear in a transformer room.

MV station with two Sunny Centrals without medium-voltage switchgear



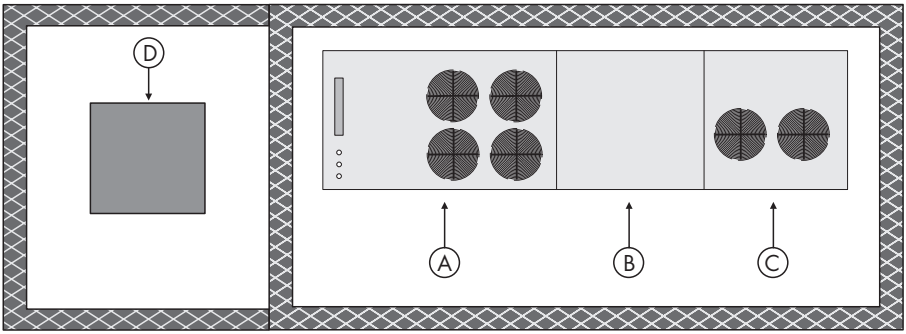
A AC cabinet
B Inverter cabinet
C DC cabinet
D Transformer

MV station with two Sunny Centrals and medium-voltage switchgear



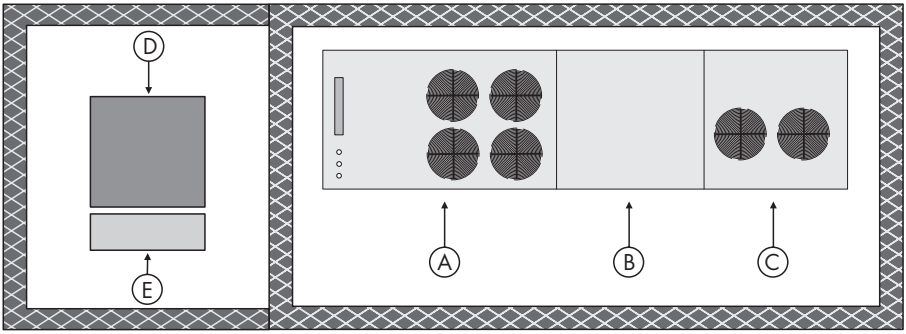
A AC cabinet
B Inverter cabinet
C DC cabinet
D Transformer
E Medium-voltage switchgear

MV station with one Sunny Central without medium-voltage switchgear



A AC cabinet
B Inverter cabinet
C DC cabinet
D Transformer

MV station with one Sunny Central and medium-voltage switchgear



A	AC cabinet
B	Inverter cabinet
C	DC cabinet
D	Transformer
E	Medium-voltage switchgear

4.3 Ventilation

Appropriate inlet ventilation is required for cooling the inverter. The permissible ambient temperature must be observed in order to guarantee secure operation and the maximum feed-in power.

Depending on the Sunny Central model, the required air is drawn through the switch cabinet doors and is blown out via the roof or the back wall of the cabinet unit. This allows the devices to be installed directly next to each other. Air requirements as well as appropriate wall clearances are to be taken from the Sunny Central Installation Requirements (special document). Filters for cleaning the inlet air are installed in the inlet vents.

If the required volume of air at the installation site of the Sunny Central is too small, then on-site measures must be taken to provide greater quantities of air (ventilation grilles, blowers, fans, etc.).

The inlet air must satisfy the requirements of classification 3S2 (see table). Classification 3C2 must be met if installation is to occur in chemically aggressive environments (e.g. installation near the sea). The operation of the inverter is suited to a relative humidity of 15 ... 95 %.

Air quality, classification for mechanically active substances

Environmental requirements for stationary use	Class			
	3S1	3S2	3S3	3S4
a) Sand in the air [mg / m³]	-	30	300	3000
b) Dust (suspended matter) [mg / m³]	0.01	0.2	0.4	4.0
c) Dust (fallout) [mg / m³]	0.4	1.5	15	40
Sites where dust fallout is kept to a minimum through appropriate measures.	x	x	x	x
Sites where no special measures have been taken to reduce the sand or dust levels and which are far from sand and dust sources.		x	x	x
Sites near sand and dust sources.			x	x
Sites in production halls where sand or dust is present, or sites in geographical locations in which the air can contain high quantities of sand and dust.				x

Air quality, classification for chemically active substances

Environmental requirements for stationary use	Class					
	3C1R	3C1L	3C1	3C2	3C3	3C4
a) Marine salt	-	-	-	Occurrence of marine salt		
b) Sulfur dioxide, mg / m³	0.01	0.1	0.1	1.0	10	40
c) Hydrogen sulfide, mg / m³	0.0015	0.01	0.01	0.5	10	70
c) Chlorine, mg / m³	0.001	0.01	0.1	0.3	1.0	3.0
d) Hydrogen chloride, mg / m³	0.001	0.01	0.1	0.5	5.0	5.0
e) Hydrogen fluoride, mg / m³	0.001	0.003	0.003	0.03	2.0	2.0
f) Ammonia, mg / m³	0.03	0.3	0.3	3.0	35	175
g) Ozone, mg / m³	0.004	0.01	0.01	0.1	0.3	2.0
h) Nitrogen oxides, mg / m³	0.01	0.1	0.1	1.0	9.0	20
Installation sites with carefully monitored and regulated atmosphere (category clean spaces).	x	x	x	x	x	x
Installation sites with carefully a regulated atmosphere.		x	x	x	x	x
Installation sites in rural or densely populated areas with little industry and moderate traffic volume.			x	x	x	x
Installation sites in densely populated areas with industry and high traffic volume.				x	x	x
Installation sites in the direct vicinity of industrial plants with chemical emissions.					x	x
Installation sites directly inside of industrial plants, with emission of high concentrations of chemical pollutants.						x

Environmental conditions

The following points must be observed in relation to environmental conditions:

- Required amount of fresh air
- Stipulated air quality
- Relative humidity
- Permissible ambient temperature

4.3.1 Exhaust airflow

The heated exhaust air generated by the inverter must be ducted away from the device so that the maximum permissible environmental temperature is not exceeded and / or the warm exhaust air does not unnecessarily heat the installation room.

CAUTION!

Risk of crushing from metal parts.

- Remove the finger protection from the fan openings of the Sunny Central before installing the exhaust airflow.

The exhaust airflow of the DC and AC cabinets occurs upwards. This is achieved through the on-site installation of an exhaust airflow (e.g. air channel).

The exhaust airflow of the inverter cabinet occurs on the rear-side. The Sunny Central can then be set up with the rear of the cabinet directly against the opening in the building wall. An on-site seal or a frame-like air box with seals is to be installed for this purpose. The air box must be fastened onto the building wall.

NOTICE!

Excessive temperatures can impair the operational capacity of the Sunny Central!

The following points must be observed in order to ensure an appropriate cooling of the inverter:

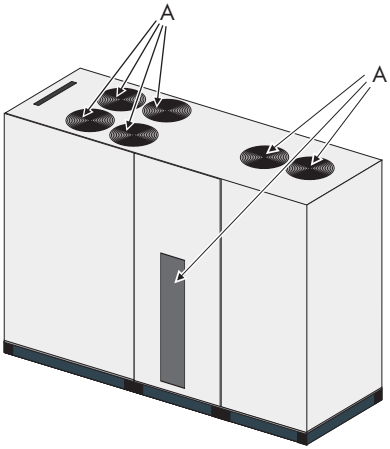
- Obey the indicated amount of air.
- Clean the ventilation openings (filter pads) and the exhaust air bars at regular intervals.
- Expel the exhaust air separately from the individual cabinet components in order to avoid thermal short circuits.

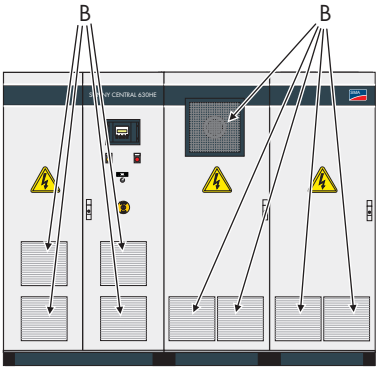
Information regarding the inverter

The specific configuration of the ventilation systems for each inverter is to be taken from the Sunny Central Installation Requirements (separate document).

Overview of ventilation openings

Examples are used below to illustrate the exact position and size of the single air grills as well as for the supply air on the front side and the exhaust air on the roof or at the rear side of the switch cabinets.





A Exhaust air

B Air inlet

4.4 Transport Possibilities

The inverter consists of two cabinet units, the DC / inverter cabinet and the AC cabinet, which are separately transported and assembled together on site.

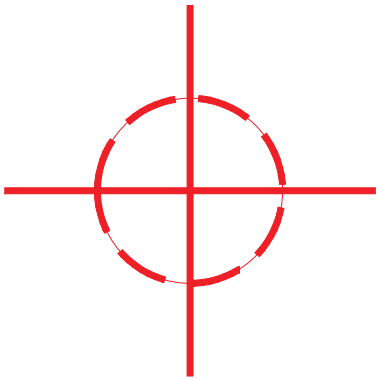
The inverters and cabinet units are delivered on pallets. A forklift or crane is then used to transport the equipment to the final installation site.

WARNING!

Heavy weight of the cabinet units!

Danger of tipping during transport!

- The cabinet units must always be transported in an upright position.
- When unloading, the heavy-load markings must be observed at all times.
  - The center of gravity of the Sunny Central is marked on the outside of the packaging and on the cabinet units.
  - The labeling on the cabinet units can be removed residue-free following installation.



NOTICE!

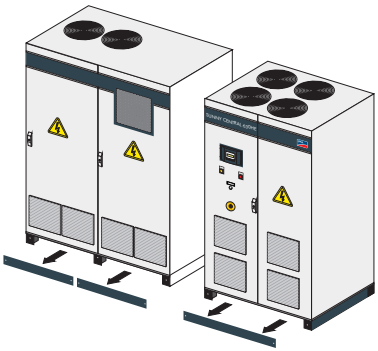
Missing plinth panels could damage the Sunny Central.

- The plinth panels are essential for stable positioning of the switch cabinet.
- In the case of transport on a pallet, it is necessary to install the plinth panels. Otherwise, there is the danger that the base will collapse under the weight of the switch cabinet.

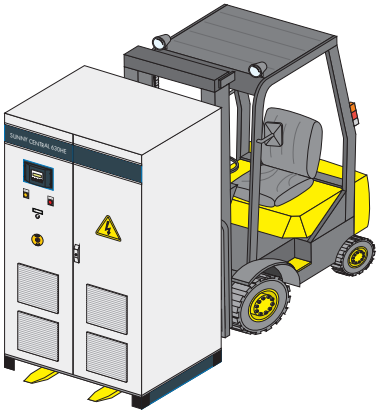
4.4.1 Transporting Using a Pallet Truck or Forklift

1. Unscrew the plinth panels on the front and back.

- The two screws per plinth panel can be unscrewed using a Torx TX30 screwdriver.



2. Insert the fork of a pallet truck or forklift under the cabinet.



4.4.2 Transport Using a Crane

Transport using crane eyelets

The heavy weight of the individual cabinet units means that transport using crane eyelets is not permitted. An appropriate crane fork should be used instead.

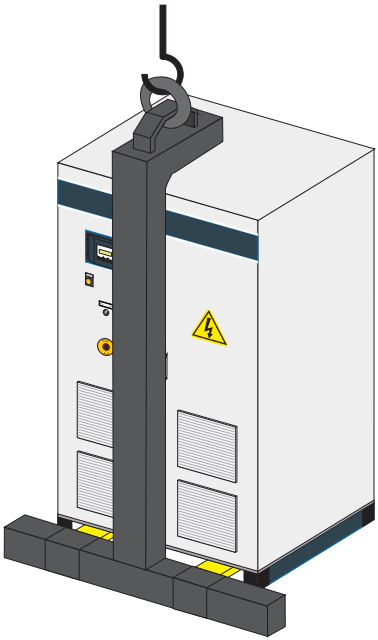
NOTICE!

Inappropriate transport could cause damages to the Sunny Central.

Observe the following points when transporting with a crane:

- Asymmetric weight distribution
- Heavy duty
- The weight of the cabinet units is mainly distributed to the rear of the cabinet.

1. Unscrew the plinth panels on the front and back; see 4.4.1 "Transporting Using a Pallet Truck or Forklift" (page 34).
2. Insert the fork of a crane under the cabinet.



4.5 On-Site Inverter Installation

Once the two switch cabinet units have been installed next to each other, carry out the following steps for final mounting:

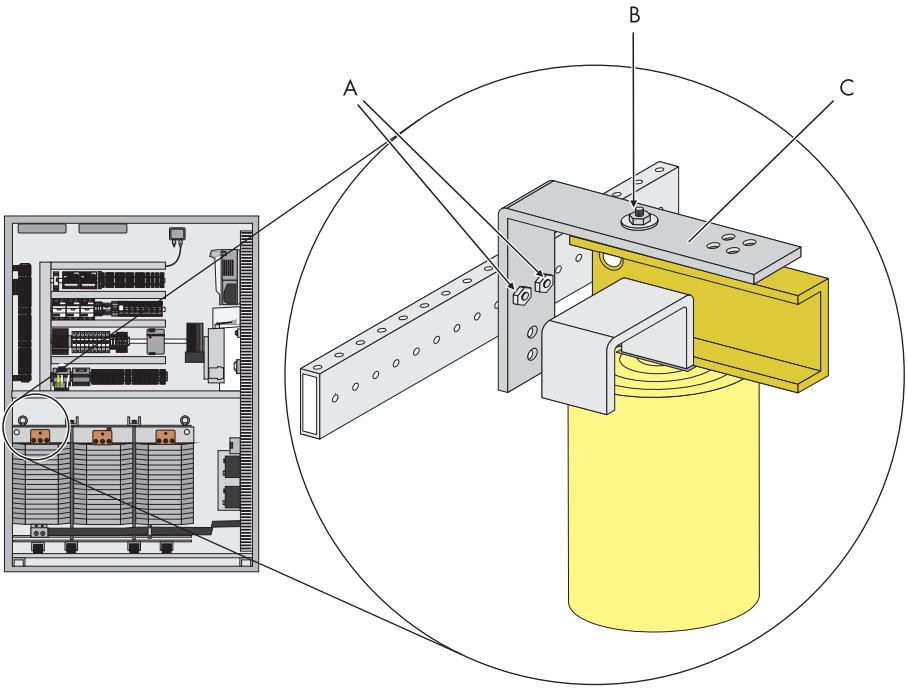
- Remove the transport locks of the sine filter (see 4.5.1 "Removing the Transport Locks" (page 37)).
- Mount the seals (see 4.5.2 "Mechanical Coupling" (page 38)).
- Mechanically connect the switch cabinets (see 4.5.2 "Mechanical Coupling" (page 38)).
- For Sunny Central devices that are installed and transported in an MV station: attach the Sunny Central to the base or to a wall (see 4.5.3 "Anchorage to the Ground or Wall" (page 38)).
- Electrically connect the switch cabinets from the inside (see 5 "Internal Electrical Connections" (page 39)).

All necessary materials required for connecting the cabinets are included in the delivery.

4.5.1 Removing the Transport Locks

The sine wave filter must be secured with a transport lock on the AC cabinet of the Sunny Central. The transport lock is a metal bracket which is to be fastened on the side of the cabinet.

1. Remove the fastening screws (A) on the cabinet.
2. Remove the fastening screws (B) on the sine wave filter.
3. Remove the fastening bracket (C).



4.5.2 Mechanical Coupling

NOTICE!

Moisture ingress due to lack of sealing!

- Before the two cabinets can be mechanically joined together, the seals provided must be glued into the appropriate recesses in the cabinets, if this has not already been done by default.

The mechanical connection of the two cabinets is done using baying clamps. They consist of terminals and brackets with which the cabinets can be screwed together in several places. In order to do this, both cabinets have to be at the same level.

Adhere to the installation guide of the cabinet manufacturer.

The installation of the seals and baying clamps is described in the installation guide from the Rittal company annexed to this document.

4.5.3 Anchorage to the Ground or Wall

The weight of the Sunny Centrals is heavy, and for this reason additional anchorage to the ground or wall is not necessary.

Anchorage in an MV station

Sunny Centrals which are housed and transported within an MV station are anchored to the wall and floor of the station so that they do not slide and become damaged during transport.

5 Internal Electrical Connections

Once both cabinet units have been installed alongside each other and are mechanically connected, the individual cabinets must be electrically joined together.

Performing an electrical connection

The wiring diagram provided must be used for establishing the electrical connections and connectors!

To prepare the inverter for the external AC and DC connections, all internal connections must be installed first.

For internal electrical connection of the two cabinets, the following internal connections must be established:

- Power cable connection between the sine wave filter and power unit
- Grounding connection between AC cabinet and DC / inverter cabinet
- Control cables on the transfer terminal strip
- Communication between the Sunny Central Control and the power unit in the inverter cabinet
- Communication between the Sunny Central Control and the insulation monitoring system

Installing the internal connections

In large part, the internal connections are pre-assembled and must be plugged or screwed in when joining the cabinets together.

5.1 Connecting the Power Cable Connection

The power cable connection of the power units in the inverter cabinet to the sine filter choke in the AC cabinet is to be established using the Radox cables (W131 to W139) included in the delivery.

Observe the cable length

The Radox cables included in the delivery have different lengths for left-hand and right-hand systems. Array the cables pursuant to the wiring diagram of the respective Sunny Central.

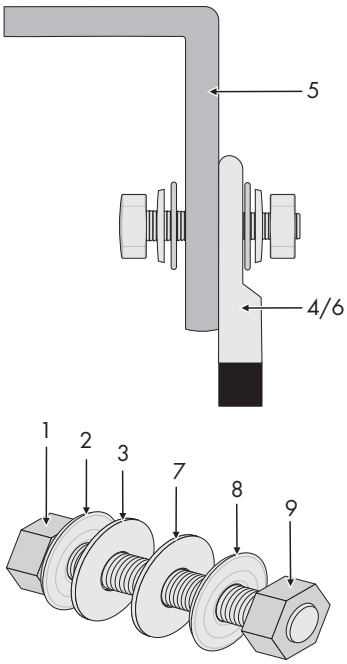
According to the wiring diagram included in the delivery, one power unit per phase is connected to the sine filter choke, each measuring 3 x 1 x 350 kcmil. The corresponding terminal screws are located on the connection points.

NOTICE!

A faulty connection can impair the operational capacity of the Sunny Central!

The following connection sequence must be observed when connecting the power cables to the sine filter choke:

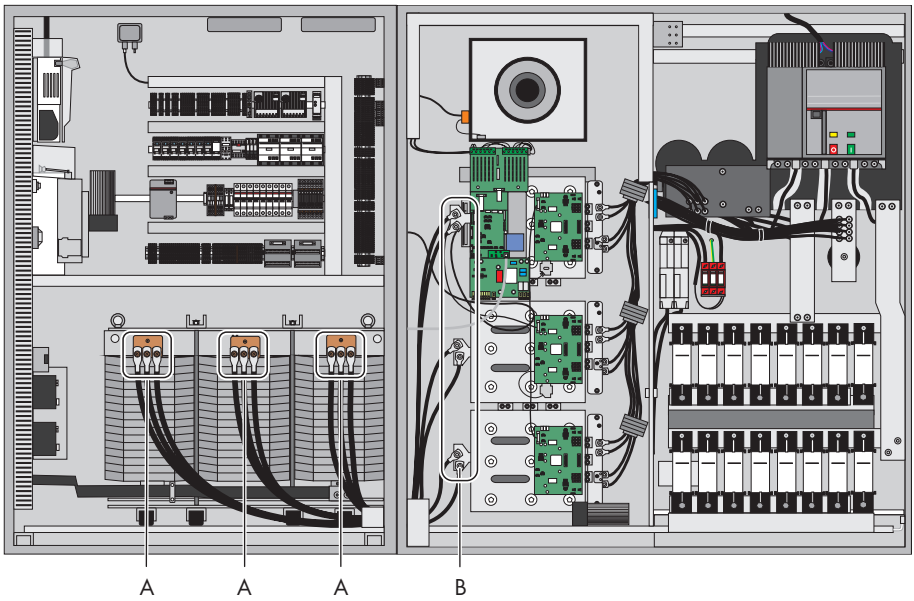
1. Screw
2. Spring washer
3. Washer
4. Cable lug
   - Only in the case of a middle power cable; this will be installed on the rear-side of the connection point.
5. Connection point sine wave filter or power unit
6. Cable lug
   - Only in the case of the two exterior power cables; these will be installed on the front-side of the connection point.
7. Washer
8. Spring washer
9. Nut



Procedure for power cabling:

1. First connect the lower power unit followed by the middle unit and then the upper unit.
2. Use cable clips to catch the three power cables of one phase.
3. Feed the cable through the opening in the side wall above the floor section of the cabinet and feed it back in at the area of the AC cabinet.
4. Use cable clips to bind the cables in the floor section of the cabinet.
5. Connect the power cables of one phase to the sine wave filter choke.

The following figure shows the terminal lugs at the three power units in the inverter cabinet and the connection of the power cables to the sine filter in the AC cabinet of the Sunny Central.



A Terminal lugs of the sine wave filter choke

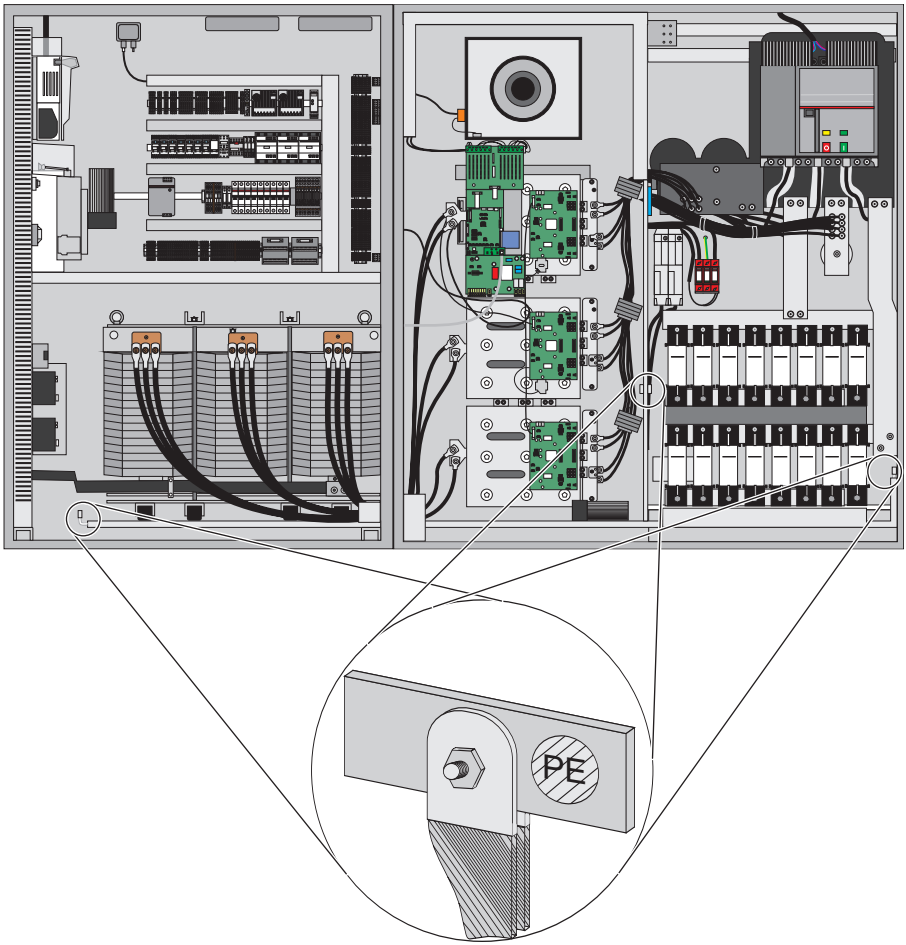
B Terminal lugs of the power unit

5.2 Connecting the Internal PE Connection

The individual cabinets are equipped with PE rails which must be connected together at the time of installation. A pre-assembled PE cable can be found in the AC cabinet. The PE rails are located at the bottom of the AC cabinet, behind the sine wave filter choke. A PE rail is located in the DC / inverter cabinet at the bottom of the exterior wall of the DC cabinet, and an additional rail can be found in the connecting point between the DC and inverter cabinet units.

1. Feed the cable behind the sine wave filter choke in the AC cabinet and the power units in the inverter cabinet into the DC cabinet.
2. Connect the cable to the PE rail in the DC cabinet.

Example PE connection between the switch cabinets of the Sunny Central



Checking the grounding connection

When connecting the grounding connection, make sure that the screws are securely positioned.

Position of the PE rail

Due to the design, the exact position of the PE rails is next to the fuse strip in the DC cabinet and behind the sine wave filter choke in the AC cabinet. The exact position of the PE rail can be determined with the help of the equipment identifier and the provided wiring diagram.

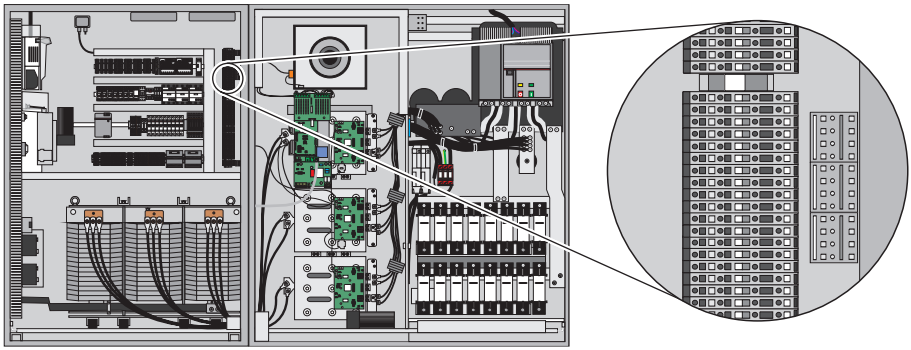
5.3 Connecting the Control Cables on the Transfer Terminal Strip

Checking the cabling

When connecting the control cables, the correct sequence and the appropriate colors of the wires have to be observed. The plugs are sequentially numbered.

Most control cables, which have to be connected between the switch cabinets, are connected to the transfer terminal strips via plugs. The transfer terminal strip is located in the AC cabinet on the mounting plate that is oriented towards the inverter cabinet. The cable bundles to be plugged in are labeled with their destination.

Example transfer terminal strip between the switch cabinets of the Sunny Central



Position of the transfer terminal strips

The exact position of the transfer terminal strips can be determined with the help of the equipment identifier and the wiring diagram included in the delivery.

5.4 Connecting the Sunny Central Control to the Power Unit

Notice!

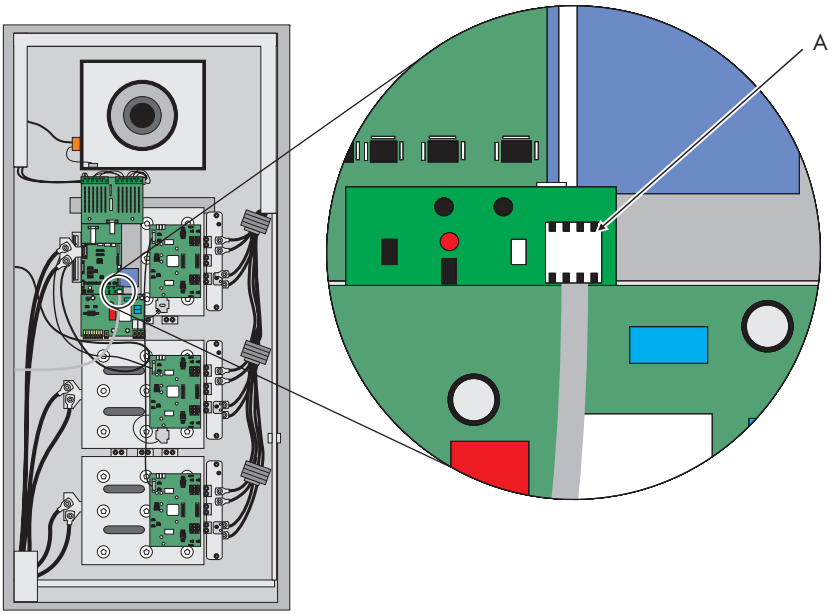
Faulty installation could damage the cabling

- Do not lay the cables in the cable channel or parallel to the power cables (EMC).
- Place the cables freely in the switching cabinet.
- Carefully connect the plug contact to the board.

Connect the data line of the Sunny Central Control to the controller board at the power unit. The cable possesses a 4-pole white plug that is to be plugged into the controller board. The ADAPBFS (control board) and controller board are located in the inverter cabinet on the topmost power unit.

The controller board communicates with the ADAPBFS board via a ribbon cable. The slot for the plug of the data line is located on the right side of the board directly at the communication interface (Piggy-Back).

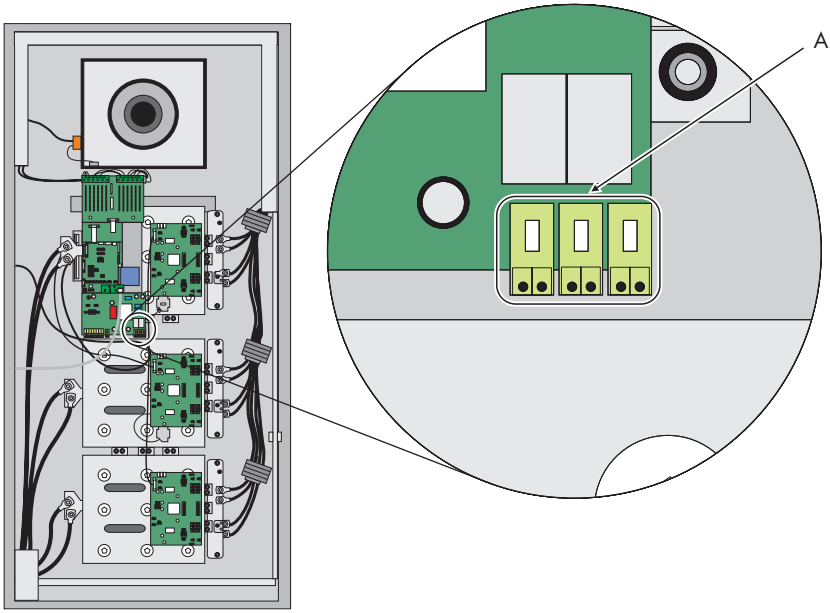
Connection terminal (A) for the data cable in the Sunny Central



5.5 Connecting the Internal Control Cables of the Power Unit

The control cable coming from the AC cabinet is already plugged in upon delivery. Plug in the X31 / 32 control cable via the terminal strip.

Connection (A) of the internal control cable for the Sunny Central



Connecting the control cable

Adhere to the wiring diagram included in the delivery when connecting the internal control cable.

5.6 Connecting the Communication Unit for Insulation Monitoring

Insulation monitors from Bender

An insulation monitoring device from Bender can optionally be built into the Sunny Central. A user manual is included with the device.

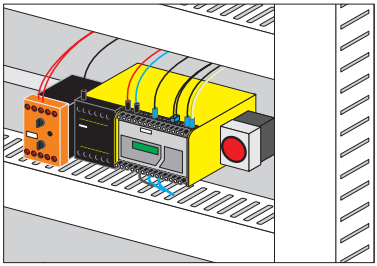
Notice!

A faulty installation could damage the cabling.

- Lay the connection cables in the cable channel.

The insulation monitoring system is located in the DC cabinet. A 2-conductor data cable connects the Sunny Central Control to the insulation monitoring system and is delivered pre-cabled. The connection is made via the transfer terminal strip.

Insulation monitor with connected data cable in the Sunny Central.



Position of the connection terminal of the insulation monitoring

The exact position of the connection terminals of the insulation monitoring can be determined with the help of the equipment identifier and the wiring diagram included in the delivery.

5.7 Sunny Central for Chemically Aggressive Environments

Optional Sunny Central package for installation in chemically aggressive environments (near the sea).

With this optional package, the Sunny Centrals are protected from salt fog particulars and fulfill the requirements as set out in DIN EN 60721-3-3, class 3C2: "Classification of Environmental Conditions – Stationary Use at Weatherprotected Locations".

Additional Information

Further instructions can be found in the installation manual contained in the optional package.

6 External Connections

The following connections have to be made in order to connect the Sunny Central externally:

- AC grid connection
- PE rail connection
- AC control voltage
- DC connection
- External messages and signals
- Sensors and digital outputs
- Communication terminal
- Emergency shut-off cabling
- Lightning and surge voltage protection

Installing the external connections

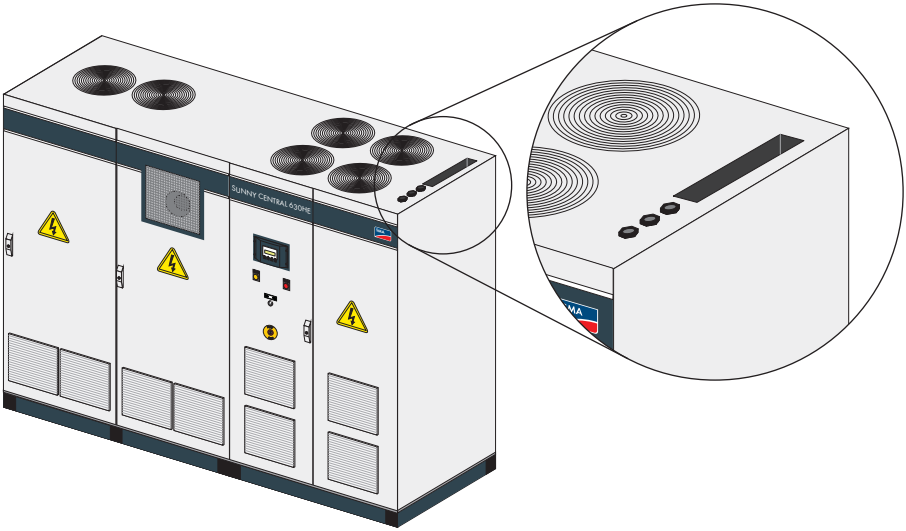
Adhere to the wiring diagram included in the delivery when realizing external connections.

Dimensioning the connections

The implementation of the AC grid connection point as well as the maximum inverter-specific connection cross-section and cable lugs are included in the installation requirements of the relevant Sunny Central.

6.1 Connecting the AC Grid

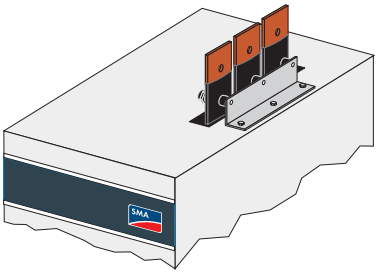
The AC connection is made on the copper bars located on the outside on top of the Sunny Central roof.



The connection can be made in five different manners:

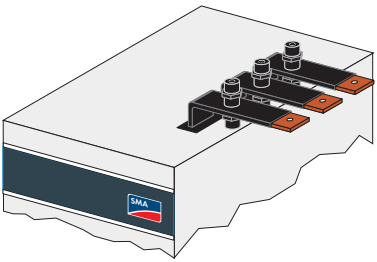
Model 13 / 0

In this case, the connection is made to three straight copper bars.



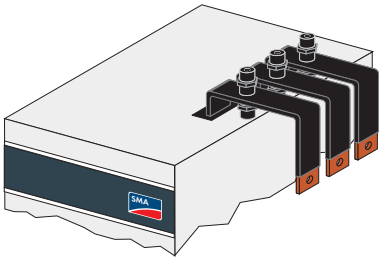
Model 13 / 1

In this case, the connection is made to three L-shaped copper bars.



Model 13 / 2

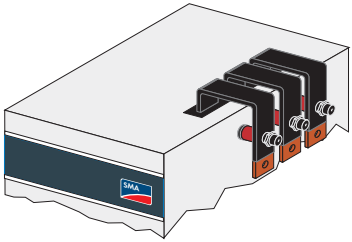
In this case, the connection is made to three U-shaped copper bars.



Model 13 / 3

In this case, the connection is made to three U-shaped copper bars.

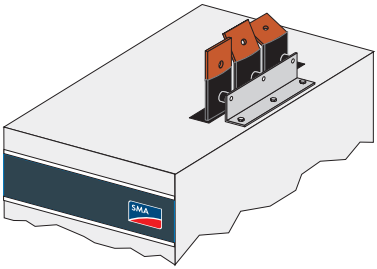
The particularity of this connection is the so-called side outlet; here the AC cabling is fed downwards directly along the side of the Sunny Central.



Model 13 / 4

In this case, the connection is made to three copper bars, each of which is angled differently. Seen from the front, the first will not be angled, and the second and third will be angled at 15° and 30°, respectively.

These models are only offered for left-handed switching cabinets.



Diverse installation models.

Depending on the specific model, the different copper bars or insulators as well as other add-on parts included in the accessories must be installed.

Damaged insulators.

If an insulator becomes damaged it must be replaced with an insulator of the same type or model.

Observe the internal power supply connection.

If the Sunny Central power supply is picked up internally at the AC connection, the internal power supply must be connected prior to the installation of the AC copper bars (see6.4.2 "Connecting the Internal Power Supply" (page 65)).

6.1.1 Mounting and Dismounting the Plexiglas Cover and Sliding Plate

WARNING!

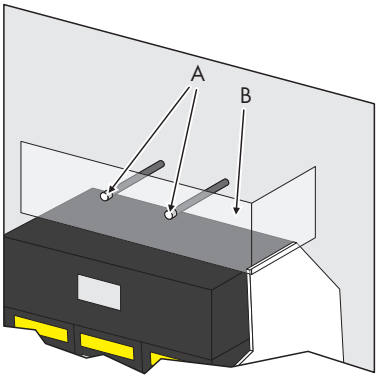
Risk of death due to burns and electric shock when live parts are touched!

- Do not touch the live components of the Sunny Central, the public grid or the low-voltage grid.
- All safety precaution measures regarding the public grid must be observed.
- Only work on this device when it is switched off and under voltage-free conditions.

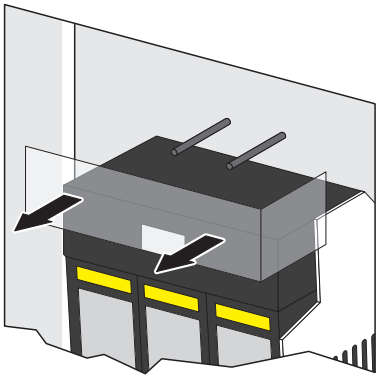
Removing and mounting the Plexiglas cover

The Sunny Central is delivered with a Plexiglas cover mounted above the load disconnector. The cover must be dismounted prior to the installation of the copper bars.

1. Unscrew the two knurled screws (A) of the Plexiglas cover (B) located above the load disconnector.

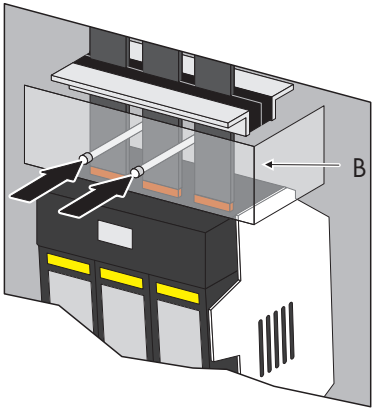


2. Remove the Plexiglas cover.



The Plexiglas cover must be put back on once the copper bars have been installed.

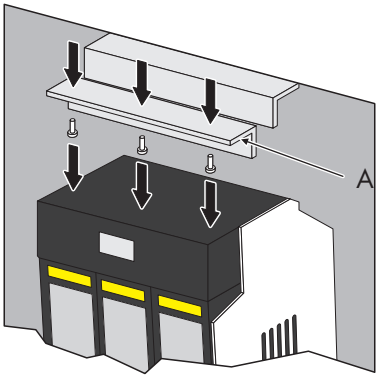
1. Remove the Plexiglas cover (B). For this purpose, tightly screw in the two knurled screws.



Mounting and dismounting the sliding plate

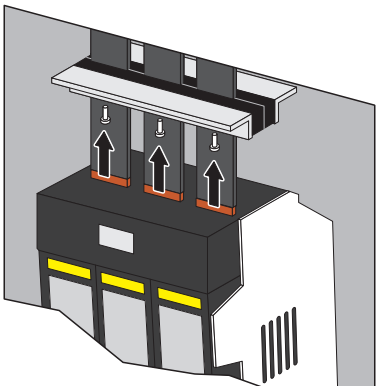
Sliding plates are included in the delivery of the Sunny Central. The front sliding plate must be dismounted prior to the installation of the copper bars.

1. Remove the front sliding plate (A) from the roof of the Sunny Central. For this purpose, remove the three screws on the underside.



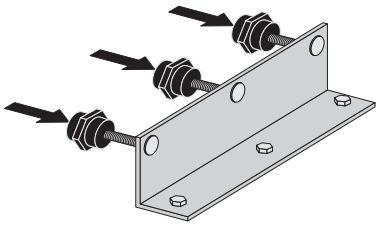
The sliding plate must be put back on once the copper bars have been installed.

1. Mount the front sliding plate (A) into the roof of the Sunny Central. For this purpose, tightly fasten the three screws on the underside.

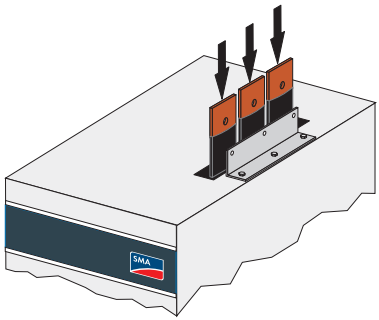


6.1.2 Procedure for Models 13 / 0 and 13 / 4

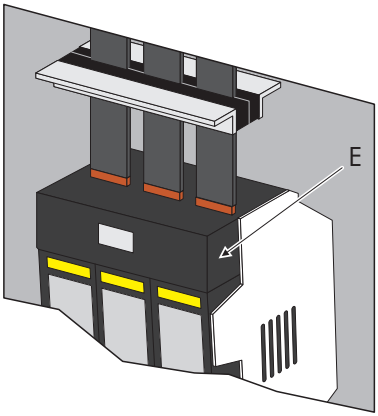
1. Remove the Plexiglas cover and sliding plate, see 6.1.1 "Mounting and Dismounting the Plexiglas Cover and Sliding Plate" (page 50).
2. Mount the three insulators to the angle section. For this purpose, tightly fasten the three insulators to the press-fitted stud bolts.



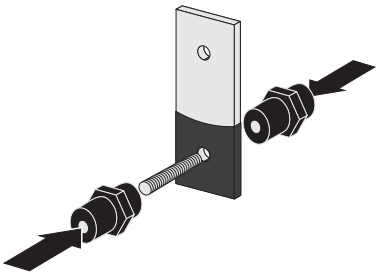
3. Feed the copper bars into the AC cabinet from above.



4. Connect the copper bars to the load disconnecting switch (E) in the AC cabinet.



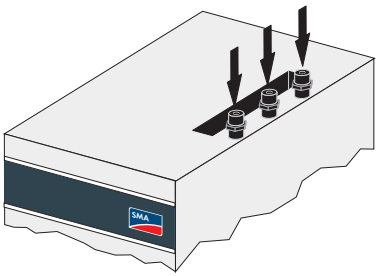
5. Mount the copper bars to the insulators. For this purpose, screw the setscrews included in the delivery into the still unused insulators and fasten them to the other insulators through the copper bars. In this manner, the two insulators function like locknuts.



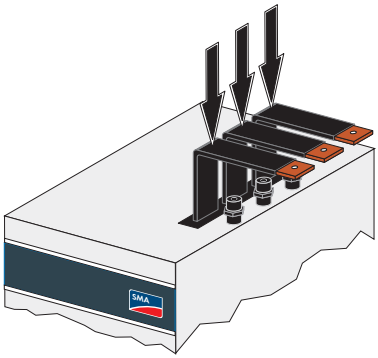
6. Mount the Plexiglas cover and front sliding plate, see 6.1.1 "Mounting and Dismounting the Plexiglas Cover and Sliding Plate" (page 50)
7. Connect the AC cable to the copper bars from the outside.

6.1.3 Procedure for model 13 / 1

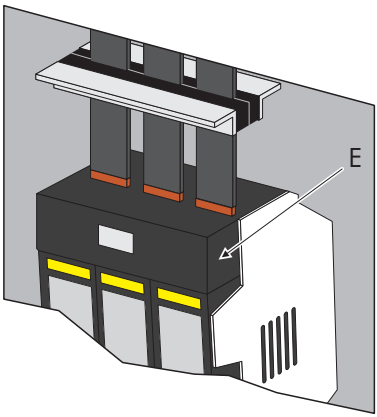
1. Remove the Plexiglas cover and sliding plate, see 6.1.1 "Mounting and Dismounting the Plexiglas Cover and Sliding Plate" (page 50).
2. Mount the three insulators next to the opening in the roof of the switching cabinet for the copper bars.



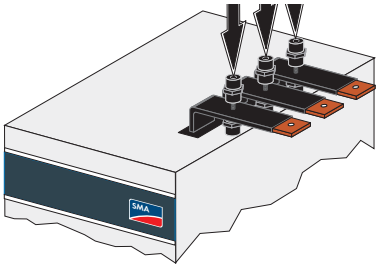
3. Feed the copper bars into the AC cabinet from above.



4. Connect the copper bars to the load disconnecting switch (E) in the AC cabinet.



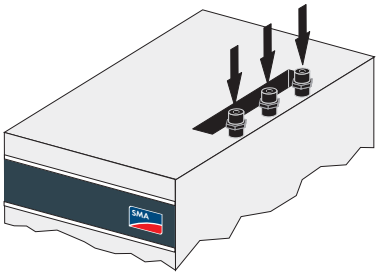
5. Mount the copper bars to the insulators. For this purpose, screw the setscrews included in the delivery into the still unused insulators and fasten them to the other insulators through the copper bars. In this manner, the two insulators function like locknuts.



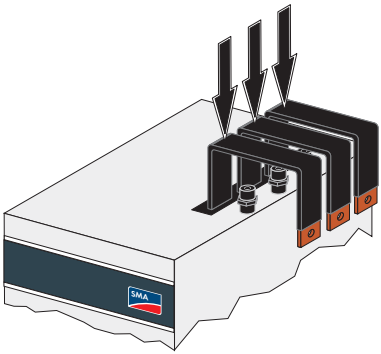
6. Mount the Plexiglas cover and front sliding plate, see 6.1.1 "Mounting and Dismounting the Plexiglas Cover and Sliding Plate" (page 50)
7. Connect the AC cable to the copper bars from the outside.

6.1.4 Procedure for model 13 / 2

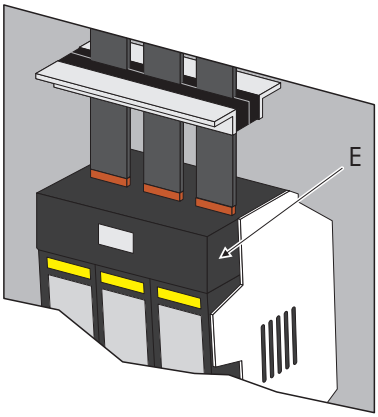
1. Remove the Plexiglas cover and front sliding plate, see 6.1.1 "Mounting and Dismounting the Plexiglas Cover and Sliding Plate" (page 50).
2. Mount the three insulators next to the opening in the roof of the switching cabinet for the copper bars.



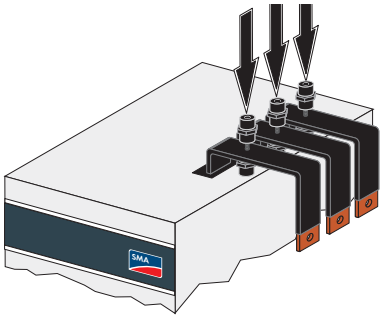
3. Feed the copper bars into the AC cabinet from above.



4. Connect the copper bars to the load disconnecting switch (E) in the AC cabinet.



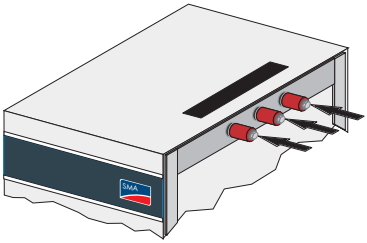
5. Mount the copper bars to the insulators. For this purpose, screw the setscrews included in the delivery into the still unused insulators and fasten them to the other insulators through the copper bars. In this manner, the two insulators function like locknuts.



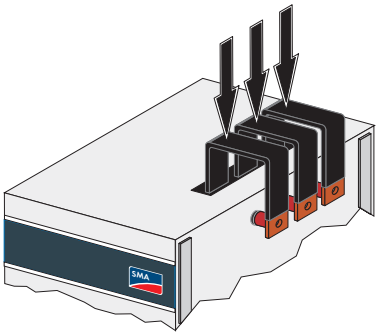
6. Mount the Plexiglas cover and front sliding plate, see 6.1.1 "Mounting and Dismounting the Plexiglas Cover and Sliding Plate" (page 50)
7. Connect the AC cable to the copper bars from the outside.

6.1.5 Procedure for model 13 / 3

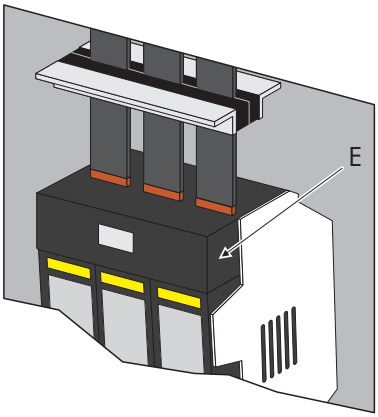
1. Remove the Plexiglas cover and front sliding plate, see 6.1.1 "Mounting and Dismounting the Plexiglas Cover and Sliding Plate" (page 50).
2. Mount the three insulators to the angle bracket on the side wall of the Sunny Central.



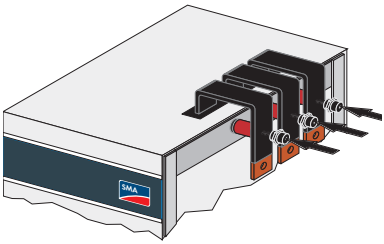
3. Feed the copper bars into the AC cabinet from above.



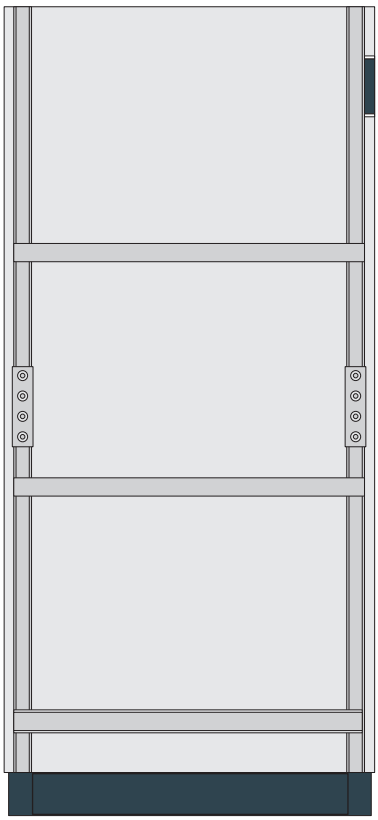
4. Connect the copper bars to the load disconnecting switch (E) in the AC cabinet.



5. Mount the copper bars to the insulators. For this purpose, screw the setscrews included in the delivery into the still unused insulators and fasten them to the other insulators through the copper bars. In this manner, the two insulators function like locknuts.



6. Mount the cable rails to the pre-assembled rails on the side wall of the Sunny Central.



7. Mount the Plexiglas cover and front sliding plate, see 6.1.1 "Mounting and Dismounting the Plexiglas Cover and Sliding Plate" (page 50)
8. Connect the AC cable to the copper bars from the outside. Feed the cables along the rails located on the side of the Sunny Central and fasten them with cable clips.

6.1.6 Connecting the AC Cable

Selection of the medium-voltage transformer.

The Sunny Centrals of the HE series are inverters without a low-voltage transformer. Special transformers are required for connecting the Sunny Central to the medium-voltage grid. Connecting several Sunny Centrals in parallel to one transformer coil is not permitted. If requested, SMA Solar Technology offers support in specifying and selecting a suitable medium-voltage transformer.

The mains grid type for the inverter is an IT grid. This signifies that the grid between the inverter and the medium-voltage transformer is not grounded. The connection must be 3-phase with the following operating voltages:

- U, nominal voltage between the phases
  - for SC 400LV-11 = 200 V
  - for SC 400HE-11 = 270 V
  - for SC 500HE-11 = 270 V
  - for SC 630HE-11 = 315 V
- Vo, nominal voltage between external conductor and ground: 1200 V (depending on the current operating point of the device)

NOTICE!

High voltages in the IT grid.

A faulty AC connection could cause damage to the Sunny Central.

Due to the IT grid, during inverter operation there are nominal voltages of up to 1200 V between phase and ground. Pay attention to the dimensioning of the AC cables to be connected.

- When choosing the AC cables, take into account the increased demands on the nominal voltage Vo against grounding.
- Dimension the AC cables with a voltage resistance of at least 1200 V.
- Lay the AC cables ground- and short-circuit proof.
- Only use aluminum cable clips for the cable inlet of the AC connection.

The connection of one load disconnecting switch in the AC cabinet of the inverter to the low-voltage winding of a medium-voltage transformer is 3-phase.

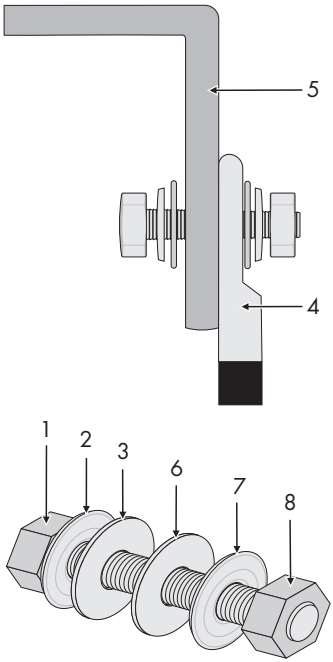
AC grid connection for IT grid on the copper bars on the outside of the AC cabinet of the Sunny Central.

NOTICE!

A faulty connection can impair the operational capacity of the Sunny Central!

The following connection sequence must be observed when connecting the power cables:

1. Screw
2. Spring washer
3. Washer
4. Cable lug
5. Connection point copper bar
6. Washer
7. Spring washer
8. Nut



The AC grid connection cable is dimensioned on site and fed into the Sunny Central. Additional mountings, cable clips or other equipment must be provided by the customer.

Cable inlet

An appropriate clamp is required for the AC cables in the operating room. This must be provided by the customer.

For the model 13 / 3, the AC grid connection cable is fed directly downwards on the side wall of the Sunny Central. A device has been pre-assembled on the Sunny Central for this purpose.

6.2 AC Grid Connection for MV Stations

WARNING!

Risk of death due to burns and electric shock when live parts of the public grid are touched!

- Do not touch the live components of the Sunny Central, the public grid or the low-voltage grid.
- All safety precaution measures regarding the public grid must be observed.
- Only work on this device when it is switched off and under voltage-free conditions.

The connection concept for two Sunny Central HE inverters is factory provided in the Sunny Central MV station. In the MV-Station, the AC mains grid connection is made 3-phase to the high-voltage winding of a three-phase current-rectifying medium-voltage transformer. Connection is made using cone-shaped contact plugs provided for by the customer.

Earths and short-circuits of the high-voltage side of the medium-voltage transformer

- Grounding and short-circuiting of the MS transformer high-voltage side is made in the customer side upstream MS switching station.
- The grounding and short-circuiting of the medium-voltage transformer occurs on the Sunny Central at the AC load disconnecting switch. For this purpose, a respective grounding and short-circuiting device can be delivered upon request.
- The set is connected to the grounding cable, then set into the load disconnecting switch and closed.
- The grounding cable is located in the labeled cable channel of the AC cabinet.

Optional grounding and short-circuiting device

A grounding and short-circuit device can be ordered as an optional accessory.

6.3 Connecting the PE Rail

WARNING!

Risk of death due to burns and electric shock when live parts are touched!

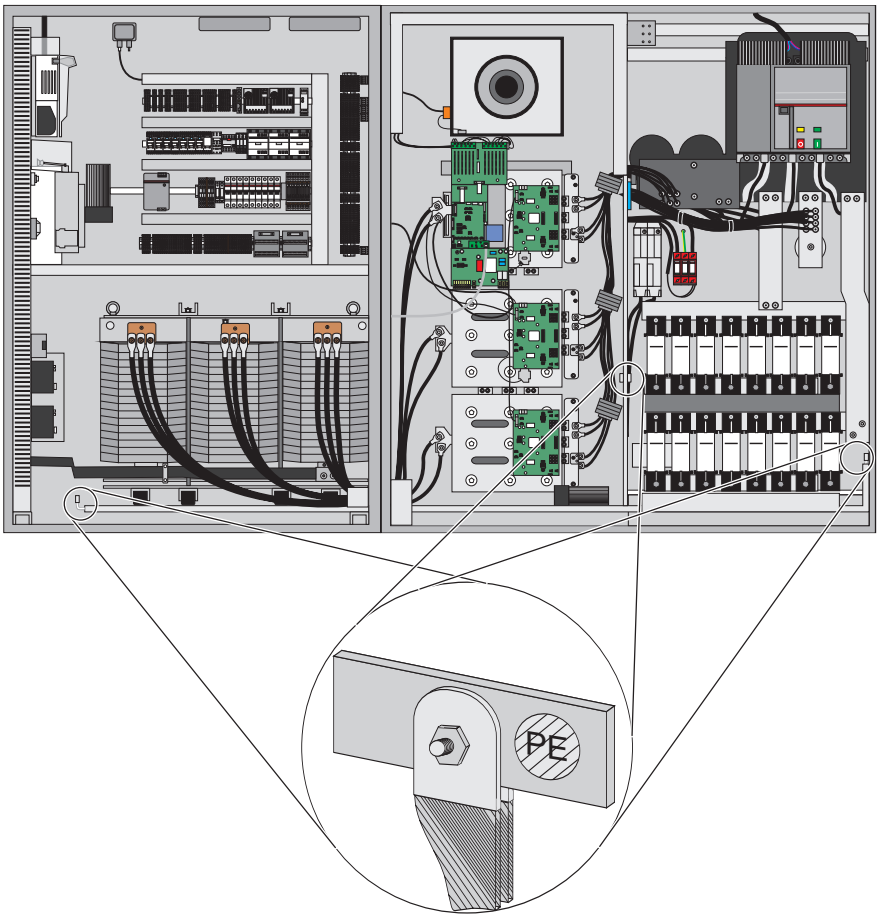
- Do not touch the live components of the Sunny Central, the public grid or the low-voltage grid.
- Observe all applicable safety precautions.
- Only work on this device when it is switched off and under voltage-free conditions.

1. Connect the equipotential bonding or ground electrode to the PE rail in the DC / inverter cabinet.
   The cable entry is located at the opening in the floor of the DC cabinet.

Position of the PE rail

The exact position of the PE rail is located behind the fuse strip in the DC cabinet. The exact position of the PE rail can be determined with the help of the equipment identifier and the provided wiring diagram.

Connection point for equipotential bonding in the Sunny Central



Cable dimensioning of the PE connection

Provide at least 1 x 1 AWG for the PE connection to the equipotential bonding.

6.4 Connecting the Internal Power Supply

The energy required for operating the Sunny Central is either provided for through an external voltage supply or internally, directly at the AC outlet of the Sunny Central via an internal energy supply transformer. The grid connection for internal power supply is, as standard, a TN-S grid.

6.4.1 Connecting the External Voltage Supply

The external voltage supply of the internal power supply is 3-phase.

It is obligatory to follow the wiring diagram provided when connecting the internal power supply!

Cable entry of the internal power supply

The cable entry is fed in together with the communication unit throuhg the opening in the floor of the AC cabinet.

Minimum connected load

The minimum connected load per phase is 1500 W.

WARNING!

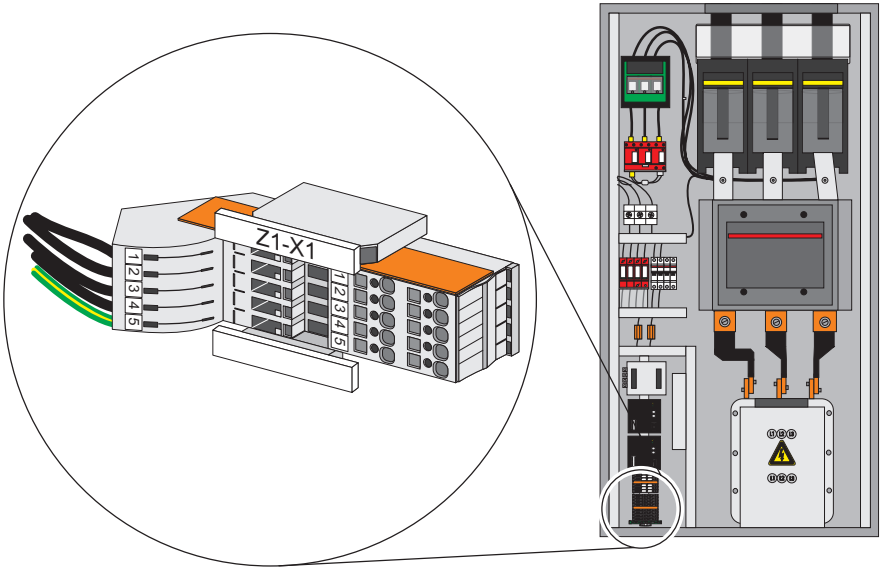
Risk of death due to burns and electric shock when live parts are touched!

- Do not touch the live components of the Sunny Central, the public grid or the low-voltage grid.
- Observe all applicable safety precautions.
- Only work on this device when it is switched off and under voltage-free conditions.

Internal surge voltage protector

An internal surge voltage protector is provided for in the Sunny Central for the internal power supply of the inverter.

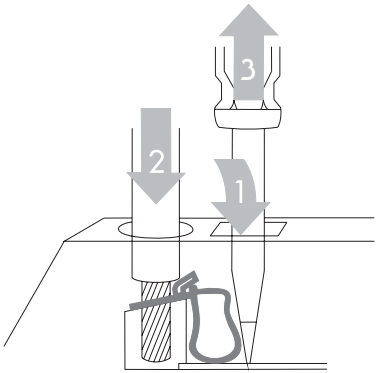
The 3-phase connection is made to the control circuit terminals.



Handling the connection terminals for the internal power supply

The following figure shows the correct method for handling the terminals used for connecting external cables to the control terminal strip of the control voltage. The connection terminals are designed as maintenance-free spring-loaded terminals that can be operated using a screwdriver of the correct size.

Handling the connection terminals (source: Wago)



6.4.2 Connecting the Internal Power Supply

Necessary components

For the internal power supply you will need an internal power supply transformer, proper cables and the right screw set. You can order these components directly from SMA Solar Technology.

Implementing the internal power supply

It is obligatory to follow the wiring diagram contained in the delivery when connecting the internal power supply.

WARNING!

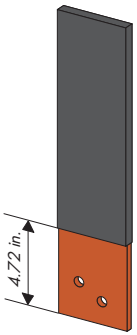
Risk of death due to burns and electric shock when live parts are touched!

- Do not touch the live components of the Sunny Central, the public grid or the low-voltage grid.
- Observe all applicable safety precautions.
- Only work on this device when it is switched off and under voltage-free conditions.

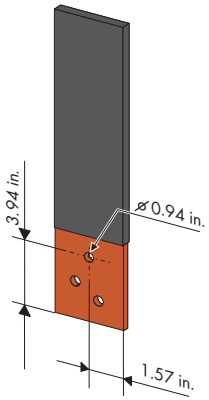
Cable routing of the internal power supply

Connect the internal energy supply transformer on the primary side to the copper bars which are included in delivery and located directly behind the load disconnecting switch. Connect and prepare the copper bars as described below.

1. Strip the lower ends of the three copper bars, which are intended for the AC connection and to be fed into the load disconnector, to a length of 4.72 in.



2. Drill a hole in the copper bar as illustrated in the figure to the right.



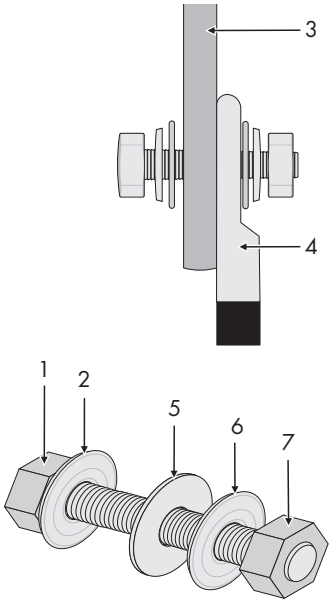
3. Use a ring cable lug (4 AWG – M8) to connect the internal power supply to the copper bars.

NOTICE!

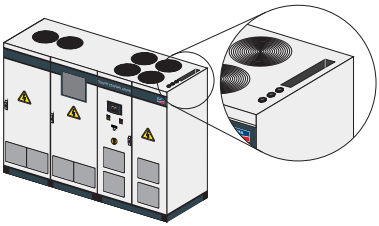
A faulty connection can impair the operational capacity of the Sunny Central!

Configuration of the components for connection (from back to front):

1. Screw, M8 x 25
2. Washer, M8
3. Copper bar
4. Ring cable lug
5. Washer, M8
6. Locking washer, M8
7. Nut, M8



4. Feed the cable through the screwed cable glands in the roof of the AC cabinet to the internal power supply transformer.
5. The voltage supply to the terminals in the Sunny Central is fed in on the secondary side of the internal energy supply transformer;
see 6.4.1 "Connecting the External Voltage Supply" (page 63)



6.5 Connecting the DC Cable

Optional low-voltage HRC fuses are located in the DC cabinet of the Sunny Central, allowing the connection of string distribution boxes. As standard, all Sunny Centrals are equipped with one busbar per potential.

DANGER!

Death or serious injuries can occur. Risk of electric shock when touching the DC cable attached to the PV generator.

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

NOTICE!

Faulty DC cabling can cause damages to the Sunny Central or PV generator.

- When connecting the DC cables, it is obligatory to follow the wiring diagram provided with delivery.

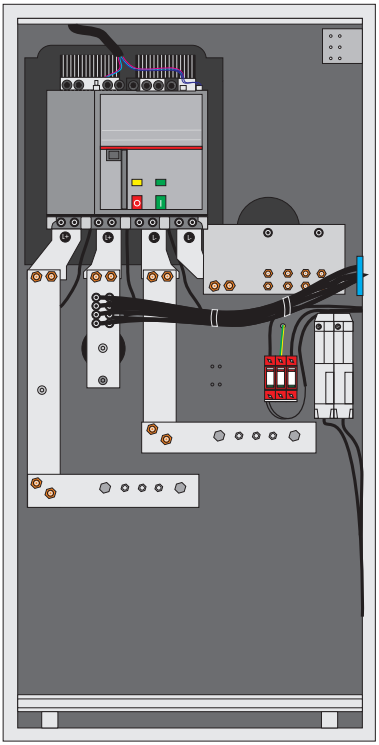
NOTICE!

Weak voltage resistance or poor sealing could impair operational capacity.

- Ensure that the DC cables are appropriately voltage-resistant!
- Lay the DC cables so that they are ground- and short-circuit-proof.
- All cable feeds must be sealed airtight with respect to the local environment. This prevents cooling air from bypassing the inlet filters and being sucked into the system.

6.5.1 Connecting the DC Cable to the Busbar

The cables are fed through the base and floor of the DC cabinet. The DC cables should have a maximum terminal cross-section of 600 kcmil and can be connected at three connection points in the busbars located in the lower part of the Sunny Central.



Mounting material for the connection

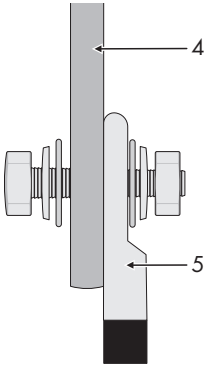
The mounting material is installed to the bar at the factory. A M12 ring cable lug is used for the connection to the bar and must be provided for by the customer.

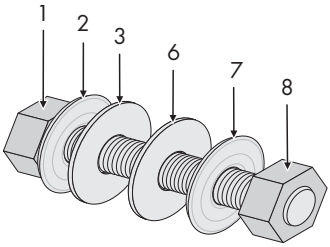
1. Remove the narrow sliding plate located at the back of the DC cabinet.
2. Tape sealing tape to the back frame of the base.
3. Pull the DC cables into the interior of the switching cabinet and cut them to length up to the busbars.
4. For strain relief, use cable clips to fasten the cables to the cable rail.
5. Tape sealing tape to the front side of the narrow sliding plate.
6. Insert the narrow sliding plate in against the mounted DC cables.
7. Use polyurethrane foam to seal up any possible spaces remaining at the point of cable entry.

8. Fasten the DC cables to the busbars.

NOTICE!

A faulty connection can impair the operational capacity of the Sunny Central!





Configuration of the components for connection (from back to front):

1. Screw
2. Spring washer
3. Washer
4. Busbar
5. Cable lug
6. Washer
7. Spring washer
8. Nut

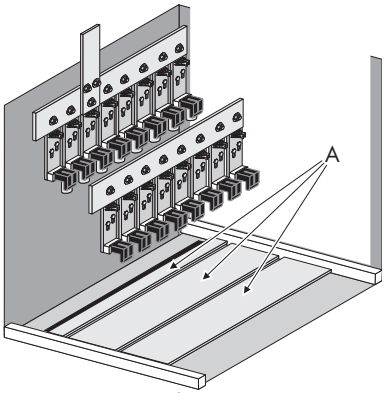
6.5.2 Connecting the DC Cable to the Low-Voltage HRC Fuses

Single- and multi-strand Cu and Al cables with round or sectoral cross section can be connected to the clamps. The following table gives the cross sections which can be connected with the various cable types.

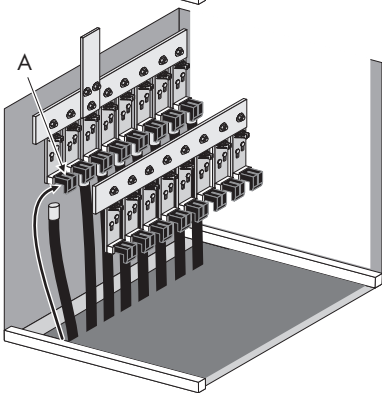
Round single-strand	Round multi-strand	Sectoral single-strand	Sectoral multi-strand
4 AWG – 300 kcmil	4 AWG – 600 kcmil	4 AWG – 500 kcmil	4 AWG – 500 kcmil

The cables are fed through the base and floor of the DC cabinet.

1. Remove the sliding plate (A) located in the DC cabinet.
2. Tape sealing tape to the back frame of the base.



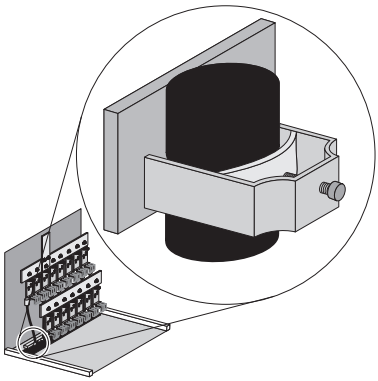
3. Pull the DC cables of the back row of fuses into the interior of the switching cabinet and cut them to length up to the fuse holders (A).



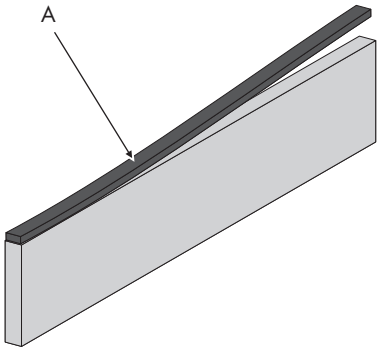
Dismounting the front fuse holder

The front fuse holders can be removed thus making it easier to mount the DC cables to the back row of fuses.

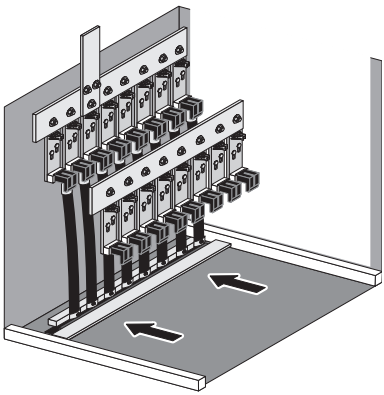
4. For strain relief, use cable clips to fasten the cables to the cable rail.



5. Tape sealing tape (A) to the front side of the narrow sliding plate.



6. Insert the narrow sliding plate in behind the mounted DC cables.



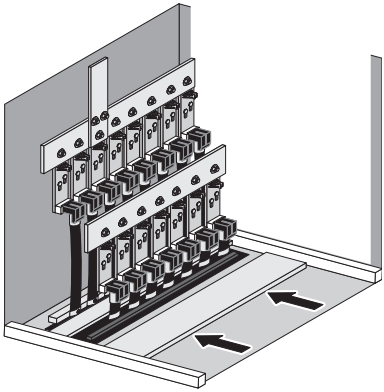
7. Pull the DC cables of the front row of fuses into the interior of the switching cabinet and cut them to length up to the fuse holders (A).
8. For strain relief, use cable clips to fasten the cables to the cable rail.

NOTICE!

Improper handling can cause faulty terminal connection.

- Do **not** use any grease for the connection of the DC cables to the terminals.
- The cable endings and terminal points must be free of grease and dirt.

9. Connect the DC cables on the terminals directly to the low-voltage HRC fuse holders.
10. Tape sealing tape to the front side of the remaining sliding plates.
11. Insert the sliding plate into the DC cabinet.



12. Use polyurethrane foam to seal up any possible spaces remaining at the point of cable entry.

6.5.3 Additional Connections of DC Main Distributors

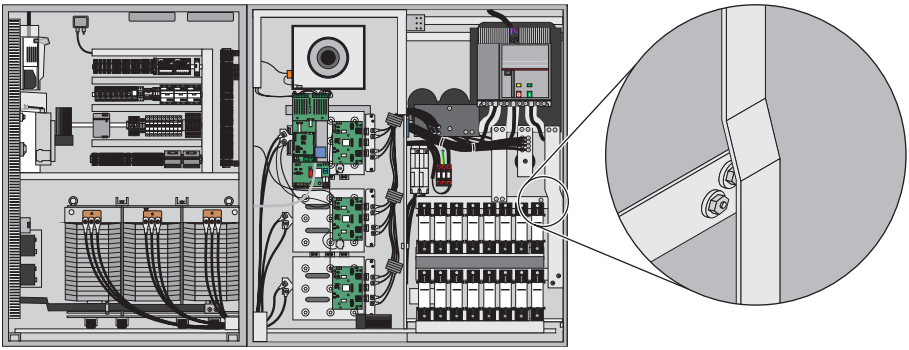
In the event that the quantity of optional low-voltage HRC fuses in the Sunny Central prove to be insufficient, the possibility exists to connect additional DC strings to the Sunny Central. To this end, up to two more DC main distribution boxes (Sunny Main Boxes) can be connected in the DC terminal area of the Sunny Central.

Number of Sunny Main Boxes and their corresponding connection cross-sections

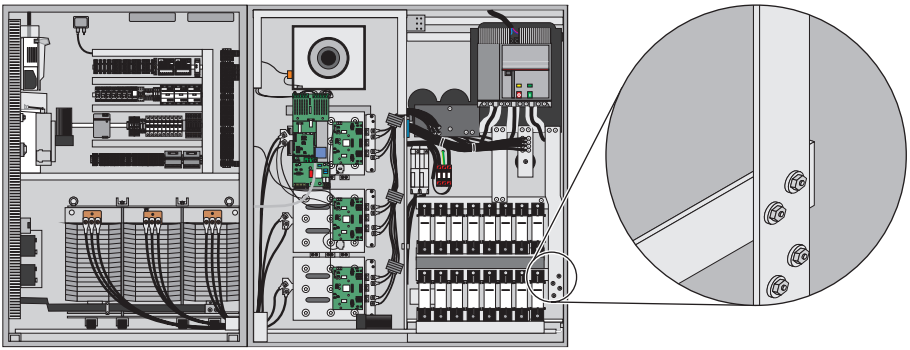
- Two additional external Sunny Main Boxes with a maximum connection cross-section of 1 x 600 kcmil per potential
- One additional external Sunny Main Box with a maximum connection cross-section of 2 x 600 kcmil per potential

The following two figures illustrate the connection points for the Sunny Main Boxes. Two bore holes for M 12 have been drilled into the output rails.

The bore holes for the minus pole are housed in the busbar on the DC side.



The bore holes for the plus pole are housed on the lower edge of the rail which is connected to the busbar of DC+ and the EMC filter.



Connecting the Sunny Main Boxes

DANGER!

Death or serious injuries can occur. Risk of electric shock when touching the DC cable attached to the PV generator.

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

NOTICE!

Faulty DC cabling can cause damages to the Sunny Central or PV generator.

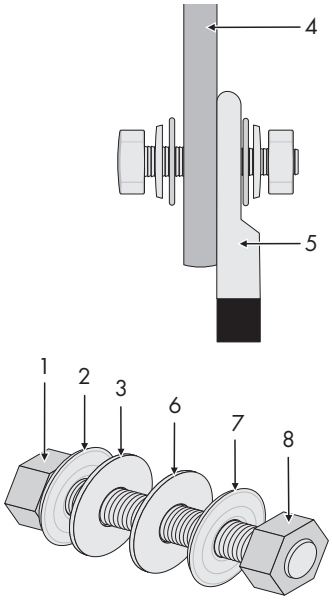
- It is obligatory to follow the wiring diagram provided when connecting the additional Sunny Main Boxes.

Mounting material for the connection

The mounting material is installed to the bar at the factory. A M12 ring cable lug is used for the connection of the Sunny Main Boxes to the bar and must be provided for by the customer.

NOTICE!

Due to spatial considerations, connect the ring cable lug to the front of the busbar.



Configuration of the components for connection (from back to front):

1.Screw
2.Spring washer
3.Washer
4.Busbar
5.Cable lug
6.Washer
7.Spring washer
8.Nut

6.6 Analog Inputs

6.6.1 Analog Sensors

In the Sunny Central it is possible to install a temperature sensor PT 100 and two additional sensors (pre-assembled as ExtSollrr, ExtGlolrr) on the Sunny Central Control panel via the customer's terminal strip. See the table below for the respective connection possibilities of the customer. The sensors can be configured by the customer.

Connecting the sensors

The connection of the sensors to the terminal strip in the Sunny Central Control is described in the documentation contained in the delivery.

Configuring the sensors

Further information on this topic can be found in the Sunny Central user manual.

6.6.2 External Signals

Alongside the analog sensors, three further signals can be connected: ExtAlarm, ExtSolP, ExtSolQ. These signals have a direct effect on the operation of the Sunny Central.

A voltage supply of 24 V_{DC} must be provided if an ExtAlarm sensor is to be connected. The voltage supply is made available internally within the Sunny Central but can also be tapped externally.

The other analog inputs (ExtSolP, ExtSolQ) help to regulate the effective and reactive power of the Sunny Central. These sensors are also connected to the customer's terminal strip.

6.6.3 Overview of the Analog Inputs

Assignment of the analog inputs on the Sunny Central Control

When connecting the analog inputs and for the digital signals, it is obligatory to follow the wiring diagram included with delivery.

The connection is made at the connection terminals. For this purpose, the connections for four-conductor and two-conductor sensors should be noted and any required measuring converters should be made available.

Analog inputs	Ain	Name	Meaning
Customer	Ain1	ExtSolP	External nominal value specification for effective power
Customer	Ain3	ExtSollrr	External irradiation sensor
Customer	Ain4	ExtGlolrr	Pyranometer (measurement of global solar irradiation)
Customer	Ain5	ExtAlarm	External alarm input, e.g. for monitoring the functioning of the medium-voltage transformer
Customer	Ain6	ExtSolQ	External nominal value specification for reactive power
Customer	Ain8	TmpExt C	External temperature sensor / PT 100

6.6.4 Handling the Shield Contact

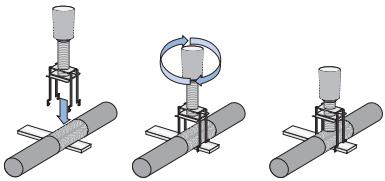
1. The external signal and bus cables must be shielded.
   The shield must contact the shield bus, provided for this purpose, along a large surface area.
   The contact is made with the shield clamps included in the delivery.

NOTICE!

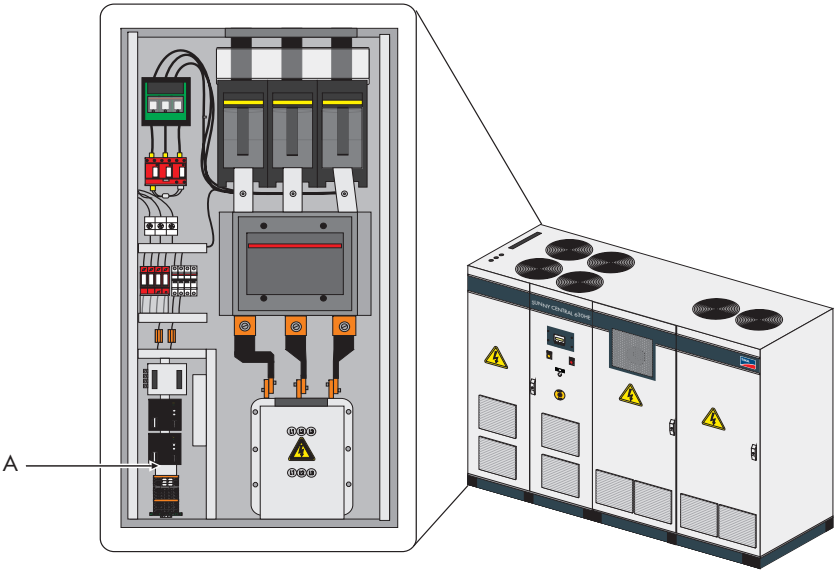
The shield clamps could become damaged through improper handling.

- The shield clamps must only be hand-tightened. Never use a screwdriver.
- Tightening the clamps with the use of a screwdriver can damage the insulation.

The correct handling of the shield clamps is shown in the figure on the right.



Shield bus (A) in the area of the external connection terminals in the Sunny Central



6.7 Remote Deactivation Unit

An additional shut down device can be applied in parallel to the key switch. This unit should be attached to the terminals in the Sunny Central. A 230 V voltage supply must be connected with the internal terminal for this purpose.

Remote deactivation unit

For special project-dependent requirements, the Sunny Central can be operated with a remote deactivation unit in combination with the monitoring of the on-position. In this manner, the Sunny Central can be controlled from a control room without having to activate the key switch on the Sunny Central.

When connecting the remote deactivation unit, it is obligatory to follow the wiring diagram included in the delivery.

6.8 Serial Interfaces

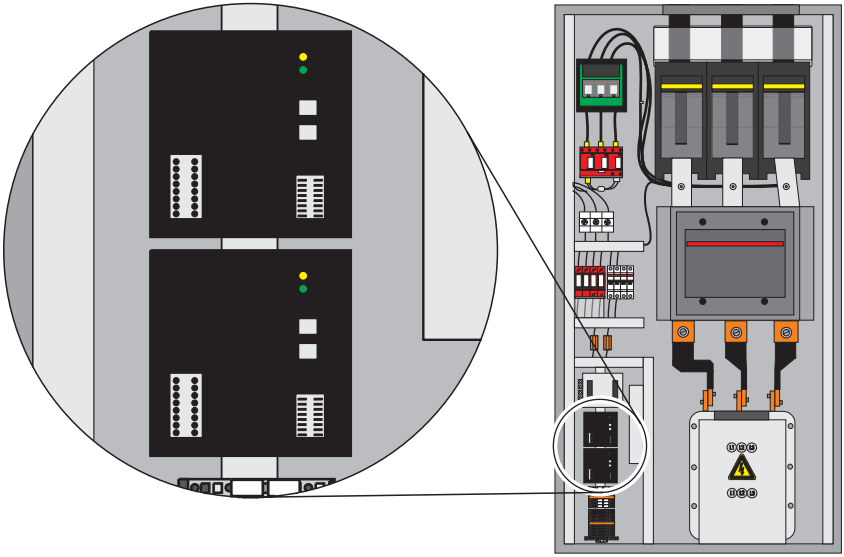
NET interface

For communication of the Sunny Central Control for data transmission to a PC, modem or Sunny WebBox,c use the NET interface.

RS485 data line

Communication between the Sunny Central Control and the optional Sunny String Monitors (DC distributor with integrated string current monitoring) occurs over an RS485 data line using the COM1 Port of the Sunny Central Control. The RS485 data line of the string current monitoring of the Sunny String Monitor is connected to the HUB components in the Sunny Central.

Connection of the RS485 data line in the Sunny Central



Position of the HUB components

The exact position of the HUB components varies according to the Sunny Central. The exact position of the HUB as well as of the NET interface can be determined with the help of the equipment identifier and the wiring diagram included with delivery.

Technical description of the Sunny String Monitor

The documentation of the Sunny String Monitors contained in the delivery provides a detailed description of the installation of the integrated string current monitoring.

6.9 Emergency Shut-Off Cabling

The Sunny Central is equipped ex-works with an internal emergency shutdown switch. If an external emergency shut-off is desired, this can be connected to terminals 2 and 3 of terminal strip Z3-X3. Otherwise, these terminals must be bridged.

Emergency shutdown circuit

NOTICE!

Damage to the Sunny Central through missing emergency- shut-off function.

- In installations with more than one inverter, the emergency shut-off circuits of the existing devices have to be connected with each other and tested for correct functionality.
- The emergency shutdown circuit may only be supplied with voltage from a single Sunny Central.

In the case that several Sunny Centrals are in operation in one installation, all of them have to be switched off when the emergency shutdown switch is activated by one inverter (creation of an emergency shutdown circuit). For this purpose, all Sunny Central emergency shutdown switches are connected in series.

The necessary 24 V supply voltage for the emergency shutdown circuit can be tapped internally by up to two Sunny Centrals which, for example, are built into one station. The voltage supply must be provided externally if more than two Sunny Centrals are built into one station.

Connecting the external emergency shut-off cabling

When connecting the external emergency shut-off cabling, it is obligatory to follow the wiring diagram included in the delivery. The connection is made at the connection terminals.

6.10 Surge Voltage Protection

Position of the surge voltage protectors

The exact position of the surge voltage protectors varies according to the Sunny Central. The exact position of the surge voltage protector can be determined with the help of the equipment identifier and the wiring diagram included with delivery.

7 Commissioning

Warranty or guaranty claims

Warranty or guaranty claims may only be asserted when the first commissioning has been performed by SMA Solar Technology or when the provided Commissioning Report for Sunny Central Systems has previously been completed, signed and returned to SMA Solar Technology.

1. All work performed on the device should be thoroughly checked prior to the first commissioning.
2. In particular, the voltages on the DC and AC sides should be checked for conformance to the limits allowed on the inverter and polarity.

7.1 Commissioning Requirements

The following requirements for proper commissioning of the Sunny Central must be met prior to the actual commissioning.

- The PV generator must be constructed and tested in compliance with the country-specific provisions. The grounding resistance is decisive for the safety of the complete system and must therefore be determined before the system is started for the first time.

Circuit breakers and motor overload switches

When delivered, all circuit beakers and motor overload switches in the Sunny Central are switched off.

7.2 Checking the Cabling

When performing the cabling checks, first check the connections between the switch cabinet units for correctness and proper installation.

In particular, the following aspects must be checked:

- Correct order and tight mounting of the plugs of the transfer terminal strip
- Tight fit and correct phase sequence of the transformer and sine wave filter connections
- Correct connection of the data and control cables on the power unit
- Correct connection of the data line to the insulation monitoring
- Installation site of the internal temperature sensor
- Are the PE rails of the cabinet units connected to each other?

7.2.1 Checking the AC Grid Connection

The connection made to the feed-in cable is 3-phase.

1. A right-hand rotary field must be connected to L1(A), L2 (B) and L3 (C).
2. Measure and record the amount of the AC voltage.
3. Finally, check the connections to ensure that they are securely positioned.

Equipotential bonding

4. The Sunny Central HE inverter must be connected to the equipotential bonding of the installation site / operating room. Make sure that the terminals are securely positioned.

AC internal power supply

5. Test the connection for the separate cable of the external AC internal power supply.
   If the device's internal power is provided using an external 3-phase supply, then a right-hand rotating field must be used here as well.

7.2.2 Checking the DC Cabling

The power connections are made via the main DC cables to the inverter.

1. The voltage on the individual DC main cables should be identical and must never exceed the maximum DC voltage of the inverter.
2. Make sure that the terminals are securely positioned.

NOTICE!

Excessive DC voltage can cause damage to the central inverter.

The DC voltage of the PV generator must never exceed the maximum permissible inverter input voltage.

- UPV ≤ 1000 V for SC 400 / 500 / 630HE
- UPV ≤ 600 V for SC 400LV

Checking the polarity of the individual DC main cables

The wrong polarity in one of the DC main cables can also damage the PV generator.

7.2.3 Checking the Connection of the Serial Interfaces

Checking the external communication and the string current monitoring

1. Check the cabling of the connection of the data lines to the Sunny String Monitor HUB.
2. Check the NET interface connection.

7.2.4 Checking the Emergency Shut-Off Cabling

1. Check the external emergency shutdown switch and the emergency shutdown circuit.

7.2.5 Checking the Thermostat and Hygrostat Settings

The device contains adjustable thermostats for controlling the cabinet ventilators and the over-temperature shut-off system. The heating system is controlled by an adjustable hygrostat. All thermostats and hygrostats are pre-adjusted before delivery.

Checking the thermostat and hygrostat settings

Compare the settings to the information provided in the wiring diagram. In the case of deviations, adjust the values as determined in the wiring diagram.

7.3 Switching on the Device

If all tests and measurements have been performed, and all measured values lie within the acceptable range, then the device can be switched on for the first time.

1. Use the fuse carrier contained in the delivery to press the DC fuses into the fuse holder.
2. Switch on all circuit breakers and motor overload switches in the Sunny Central.
   ☑ Now the inverter is completely connected on the AC and DC sides and can be switched on using the key switch.
3. To switch on the inverter, first close all cabinet doors and turn the key switch to the right to the "Start" position.

☑ The Sunny Central will now start automatically. First, the grid voltage and frequency parameters are checked. After approx. 20 seconds, the motorized DC breaker is activated automatically and connects the PV generator.

8 Technical Data

8.1 Technical Data SC 500HE-11, SC 630HE-11

PV generator connection data	SC 500HE-11	SC 630HE-11
Max. PV power (recommended)[a], P_{PV}	580 kWp	730 kWp
Max. input voltage, $U_{DC\ max}$	1000 V	1000 V
DC voltage range, MPPT, U_{DC}	450 V – 820 V	500 V – 820 V
Max. input current, $I_{DC\ max}$	1200 A	1350 A
DC voltage ripple, Upp	< 3 %	
Max. number of non-fused connection points / max. number of fused DC inputs	2 ports for external DC main distributions (Sunny Main Box) / 8 per potential	

[a] Specifications apply to irradiation values below STC

Grid connection data	SC 500HE-11	SC 630HE-11
Nominal output power, P_{ACNom}	500 kW	630 kW
Operational voltage ± 10 %, U_{ACNom}	270 V	315 V
Nominal output current, I_{ACNom}	1070 A	1155 A
Nominal operating frequency, f_{ACNom}	50 Hz / 60 Hz	
Harmonic distortion of output current, K_{IAC}	< 3 % (at nominal output power)	
Power factor, cos ϕ	95 leading / 95 lagging	

Efficiency	SC 500HE-11	SC 630HE-11
Max. efficiency, η_{max}	98.6 %	98.6 %
European standard efficiency, η_{euro}	98.4 %	98.4 %

Mechanical data	SC 500HE-11	SC 630HE-11
Dimensions (width x height x depth)	62.99 in. + 47.24 in. x 83.46 in. x 33.46 in.	
Weight	Approx. 4189 lb.	

Power absorbed	SC 500HE-11	SC 630HE-11
Internal consumption in operation[b] , P_{day}	< 2900 W	3000 W
Internal consumption in night mode, P_{night}	< 100 W	
Internal power supply / grid structure	3 x 400 V, 50 / 60 Hz, TN-S / TT grid / TNC grid	
External back-up fuses for internal energy supply	B 20 A, 3-pole	

[b] Internal consumption measured in clock-rate operation with activated AC fans, activaed DC fans and power unit cooling unit at 100 %

Minimum connected load per phase < 1500 W

Sunny Central Control interfaces	SC 500HE-11	SC 630HE-11
Communication unit (NET Piggy Back, optional)	Analog, Ethernet	
Analog inputs	1 x PT 100, 5 x A_{in} [c]	
Surge voltage protection for analog inputs	Optional	
Sunny String Monitor interface (COM1)	RS485	
PC connection (COM 2)	RS232	
Electrically separated relay contact (signaling)	1	

[c] Connection for analog sensor in two-wire and four-wire versions

General data	SC 500HE-11	SC 630HE-11
Protection rating as per EN 60529	NEMA 1 (IP20)	
Protection rating as per EN 60721-3-3 Environmental conditions: Stationary location, with protection against wind and weather	Classification of • chemically active substances: 3C1L • mechanically active substances: 3S2	
Permissible ambient temperature, T	– 4°F ... + 122°F	
Relative humidity, non-condensing, U_{air}	15 % ... 95 %	
Max. altitude above sea level, NHN	3300 ft.	
Fresh air consumption, V_{air}	2030 ft.³ / h	
EMC	EN 61000-6-2, EN 61000-6-4	

8.2 Technical Data SC 400LV-11, SC 400HE-11

PV generator connection data	SC 400LV-11	SC 400HE-11
Max. PV power (recommended)[d], P_{PV}	450 kWp	450 kWp
Max. input voltage, $U_{DC\ max}$	600 V	1000 V
DC voltage range, MPPT, U_{DC}	300 V – 600 V	450 V – 820 V
Max. input current, $I_{DC\ max}$	1400 A	1000 A
DC voltage ripple, Upp	< 3 %	
Max. number of non-fused connection points / max. number of fused DC inputs	2 ports for external DC main distributions (Sunny Main Box) / 8 per potential	

[d] Specifications apply to irradiation values below STC

Grid connection data	SC 400LV-11	SC 400HE-11
Nominal output power, P_{ACNom}	409 kW	400 kW
Operational voltage ± 10 %, U_{ACNom}	200 V	270 V
Nominal output current, I_{ACNom}	1155 A	855 A
Nominal operating frequency, f_{ACNom}	50 Hz / 60 Hz	
Harmonic distortion of output current, K_{IAC}	< 3 % (at nominal output power)	
Power factor, cos ϕ	95 leading / 95 lagging	

Efficiency	SC 400LV-11	SC 400HE-11
Max. efficiency, η_{max}	98.2 %	98.6 %
European standard efficiency, η_{euro}	98.0 %	98.4 %

Mechanical data	SC 400LV-11	SC 400HE-11
Dimensions (width x height x depth)	62.99 in. + 47.24 in. x 83,46 in. x 33.46 in.	
Weight	Approx. 4189 lb.	

Power consumption	SC 400LV-11	SC 400HE-11
Internal consumption in operation[e] , P_{day}	< 2800 W	
Internal consumption in night mode, P_{night}	< 100 W	
Internal power supply / grid structure	3 x 400 V, 50 / 60 Hz, TN-S / TNC / TT grid	
External back-up fuses for internal energy supply	B 20 A, 3-pole	

[e] Internal consumption measured in clock-rate operation with activated AC fans, activated DC fans and power unit cooling unit at 100 %

Minimum connected load per phase < 1500 W

Sunny Central Control interfaces	SC 400LV-11	SC 400HE-11
Communication unit (NET Piggy Back, optional)	Analog, Ethernet	
Analog inputs	1 x PT 100, 5 x A_{in} [f]	
Surge voltage protection for analog inputs	Optional	
Sunny String Monitor interface (COM1)	RS485	
PC connection (COM 2)	RS232	
Electrically separated relay contact (signaling)	1	

[f] Connection for analog sensor in two-wire and four-wire versions

General data	SC 400LV-11	SC 400HE-11
Protection rating as per EN 60529	NEMA 1 (IP20)	
Protection rating as per EN 60721-3-3 Environmental conditions: Stationary location, with protection against wind and weather	Classification of • chemically active substances: 3C1L • mechanically active substances: 3S2	
Permissible ambient temperature, T	– 4°F ... + 122°F	
Relative humidity, non-condensing, U_{air}	15 % ... 95 %	
Max. altitude above sea level, NHN	3300 ft.	
Fresh air consumption, V_{air}	2030 ft.³ / h	
EMC	EN 61000-6-2, EN 61000-6-4	

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:

- Sunny Central device type
- Sunny Central serial number
- Type and number of modules connected
- Communication method
- Sunny Central failure or warning numbers
- Display message of the Sunny Central

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