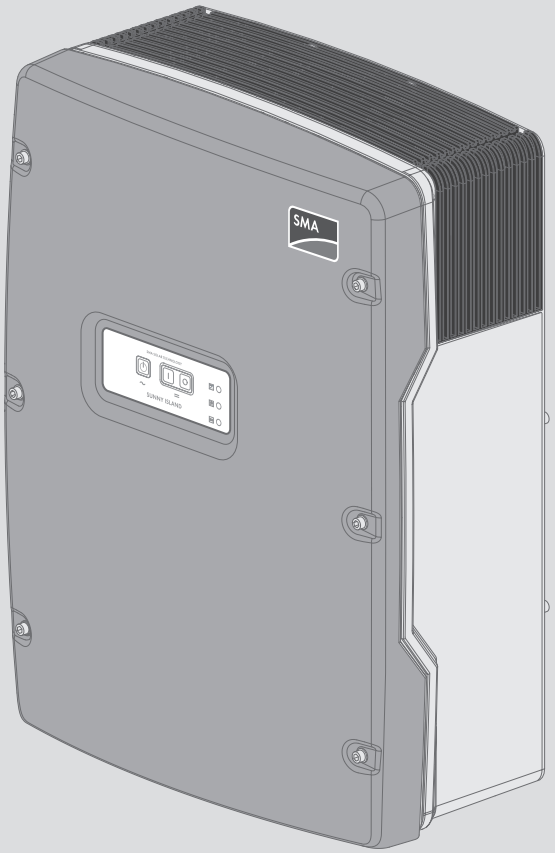
Installation Manual

SUNNY ISLAND 3.0M / 4.4M / 6.0H / 8.0H



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1 Information on this Document

1.1 Validity

This document is valid for the following device types:

- SI3.0M-11 (Sunny Island 3.0M) with firmware version 3.2
- SI4.4M-11 (Sunny Island 4.4M) with firmware version 3.2
- SI6.0H-11 (Sunny Island 6.0H) with firmware version 3.1
- SI8.0H-11 (Sunny Island 8.0H) with firmware version 3.1

1.2 Target group

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

- Training in how to deal with the dangers and risks associated with installing and using electrical devices and batteries
- Training in the installation and commissioning of electrical devices
- Knowledge of and adherence to the local standards and directives
- Knowledge of and compliance with the documentation of the Sunny Island inverter with all safety information

1.3 Additional Information

Links to additional information can be found at www.SMA-Solar.com:

Document title	Document type
"Battery Management in Off-Grid Systems"	Technology Brochure 6
"Battery Management"	Technical Information
"Grounding in Off-Grid Systems"	Technical Information
"External Energy Sources"	Technical Information
"PV Inverters in Off-Grid Systems"	Technical Information
"SMA Flexible Storage System with Battery Backup Function"	Planning Guidelines
"SMA Smart Home"	Planning Guidelines
"Multicluster Systems with Stand-Alone Grid or Increased Self-Consumption and Battery-Backup Function"	Installation – Quick Reference Guide

1.4 Symbols

Symbol	Explanation
⚠ DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury
⚠ WARNING	Indicates a hazardous situation which, if not avoided, can result in death or serious injury
⚠ CAUTION	Indicates a hazardous situation which, if not avoided, can result in minor or moderate injury
NOTICE	Indicates a situation which, if not avoided, can result in property damage

Symbol	Explanation
	This information is relevant for systems which are to be operated in parallel with utility grid. (e.g. SMA Flexible Storage System).
	Content is relevant for Off-Grid Systems.
i	Information that is important for a specific topic or goal, but is not safety-relevant.
□	Indicates a requirement for meeting a specific goal
☑	Desired result
✖	A problem that might occur

1.5 Typographies

Typography	Use	Example
bold	• Display messages • Parameter • Terminals • Slots • Elements to be selected • Elements to be entered	• Connect the grounding conductor to **AC2 Gen/ Grid**. • Select the parameter **235.01 GnAutoEna** and set to **Off**.
>	• Several elements that are to be selected	• Select **600# Direct Access > Select Number.**
[**Button**] [**Key**]	• Button that is to be selected or clicked on	• Select [**Enter**].

1.6 Nomenclature

Complete designation	Designation in this document
Off-grid system, battery-backup system, system for increased self-consumption	System
Sunny Boy, Sunny Mini Central, Sunny Tripower	PV inverter
Sunny Explorer, Sunny Portal, Sunny Home Manager	Communication product
Grid failure or deviation from the country-specific thresholds for voltage and frequency	Grid failure
Automatic transfer switch with battery-backup function	Automatic transfer switch
Grid-forming generators such as electric generators or utility grids	External energy sources

Menus are presented as follows: menu number, pound sign and menu name (e.g., **150# Compact Meters**).

Parameters are presented as follows: menu number, period, parameter number and parameter name (e.g., **150.01 GdRmgTm**). The term "parameter" includes parameters with configurable values as well as parameters for displaying values.

2 Safety

2.1 Intended Use

The Sunny Island is a battery inverter that controls the electrical energy balance in an off-grid system, in a battery-backup system or in a system for increased self-consumption. In a battery-backup system, you can also use the Sunny Island for increased self-consumption.

The product is for use in weather-protected outdoor areas and in indoor areas.

The product must only be used as stationary equipment.

The grid configuration of the generator or the utility grid must be a TN or TT system. Cables with copper conductors must be used for the installation.

Device types SI3.0M-11 and SI4.4M-11 do not support all off-grid system variants. Only the device types SI6.0H-11 and SI8.0H-11 are suitable for single-phase single cluster systems and three-phase multicluster systems (see quick reference guide "Off-Grid Systems").

The Sunny Island is not suitable for supplying life-sustaining medical devices. A power outage must not lead to personal injury.

AC sources (such as PV inverters) can be used in off-grid systems and battery-backup systems for energy supply. Too much power from the AC sources in the stand-alone grid or with battery-backup systems in a battery-backup grid can lead to system failures. The maximum output power of the AC sources must be observed in off-grid systems and battery-backup systems (see Section 10 "Technical Data", page 108). The powers of the individual Sunny Island inverters are added to yield the total maximum power.

The Sunny Island uses batteries for energy storage. The nominal voltage of the battery must correspond to the input voltage on the DC connection. A fuse switch-disconnector (e.g., BatFuse) must be installed between the battery and the Sunny Island. With lead-acid batteries, the battery room must be ventilated in accordance with the requirements of the battery manufacturer and with the locally applicable standards and directives (see documentation of the battery manufacturer).

If connecting a lithium-ion battery, the following must be observed:

- The lithium-ion battery must comply with the locally applicable standards and directives and be intrinsically safe.
- The battery management of the lithium-ion battery is compatible with the Sunny Island (see the technical information at "List of Approved Lithium-Ion Batteries").

In off-grid systems with lead-acid batteries only, a maximum of four Sunny Island Charger charge controllers can be connected per cluster. The battery management must record the DC current when charging and discharging the battery. A battery current sensor may be installed to allow precise measurement of the battery current. The Sunny Island is not suitable for establishing a DC distribution grid.

The Sunny Island can control various devices in the system (e.g., load-shedding contactors) via two multifunction relays. The multifunction relays are not suitable for controlling functions that may endanger persons in the event of a malfunction of the multifunction relays, e.g., if there is insufficient redundancy in the ventilation of the battery room.

Use this product only in accordance with the information provided in the enclosed documentation and with the locally applicable standards and directives. Any other application may cause personal injury or property damage.

Alterations to the product, e.g. changes or modifications, are only permitted with the express written permission of SMA Solar Technology AG. Unauthorized alterations will void guarantee and warranty claims and in most cases terminate the operating license. SMA Solar Technology AG shall not be held liable for any damage caused by such changes.

Any use of the product other than that described in the Intended Use section does not qualify as appropriate.

The enclosed documentation is an integral part of this product. Keep the documentation in a convenient place for future reference and observe all instructions contained therein.

The type label must remain permanently attached to the product.

2.2 Safety Information

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

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

⚠ DANGER

Danger to life from electric shocks due to live voltage and risk of injury from short-circuit currents

High voltages are present inside the Sunny Island inverter. When the enclosure lid is removed, live components can be touched that can result in death or serious injury due to electric shock. Short-circuit currents in the battery can cause heat build-up and electric arcs. Burns or eye injuries due to flashes may result.

- When carrying out any work on the electrical installation, wear suitable personal protective equipment.
- Switch off or disconnect the following components in the following order:
  - Sunny Island
  - The control and measurement voltages in the distribution board of the Sunny Island circuit breakers
  - Load-break switch of the battery
- Ensure that the system cannot be reconnected.
- Open the enclosure lid of the Sunny Island and ensure that no voltage is present.
- Ground and short-circuit the AC conductors outside the Sunny Island inverter.
- Cover or isolate any adjacent live components.

⚠ WARNING

Danger to life from electric shock due to damaged inverter

Operating a damaged inverter can lead to hazardous situations that can result in death or serious injuries due to electric shock.

- Only use inverter when it is technically faultless and in an operationally safe state.
- Check the inverter regularly for visible damage.
- Make sure that all external safety equipment is freely accessible at all times.
- Make sure that all safety equipment is in good working order.

⚠ WARNING

Risk of crushing injuries due to moving PV array parts

Moving parts in the PV array can crush or sever body parts. A generator can be started automatically by the Sunny Island.

- Operate the generator only with the safety equipment.
- Carry out work on the generator in accordance with the manufacturer's specifications.

⚠ CAUTION

Risk of burns due to short-circuit currents on the disconnected Sunny Island

The capacitors in the DC connection input area store energy. After the battery is isolated from the Sunny Island, battery voltage is still temporarily present at the DC connection. A short circuit at the DC terminal can lead to burns and may damage the Sunny Island inverter.

- Wait 15 minutes before performing any work at the DC terminal or on the DC cables. This allows the capacitors to discharge.

⚠ CAUTION

Risk of burns due to hot components

Some components of the inverter can become very hot during operation. Touching these components can cause burns. Heat build-up can cause burns.

- During operation, do not touch any parts other than the enclosure lid of the inverter.
- After opening the inverter, wait until the component parts have cooled down.

NOTICE

Damage to the inverter due to electrostatic discharge

Touching electronic components can cause damage to or destroy the inverter through electrostatic discharge.

- Ground yourself before touching any component.

2.3 Information on Handling Batteries

This section contains safety information that must be observed at all times when working on or with batteries.

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

⚠ WARNING

Danger to life due to explosive gases

Explosive gases may escape from the battery and cause an explosion. This can result in death or serious injury.

- Protect the battery environment from open flames, embers and sparks.
- Install, operate and maintain the battery in accordance with the manufacturer's specifications.
- Do not heat the battery above the temperature permitted or burn the battery.
- Ensure that the battery room is sufficiently ventilated.

⚠ WARNING

Chemical burns and poisoning due to battery electrolyte

If handled inappropriately, battery electrolyte can cause irritation to the eyes, respiratory system and skin, and it can be toxic. This may result in blindness or serious chemical burns.

- Protect the battery enclosure against destruction.
- Do not open or deform the battery.
- Whenever working on the battery, wear suitable personal protective equipment such as rubber gloves, apron, rubber boots and goggles.
- Rinse acid splashes thoroughly for a long time with clear water, and consult a doctor.
- If acid fumes have been inhaled, consult a doctor.
- Install, operate, maintain and dispose of the battery according to the manufacturer's specifications.

⚠ WARNING

Danger to life due to incompatible lithium-ion battery

An incompatible lithium-ion battery can lead to a fire or an explosion. With incompatible lithium-ion batteries, it is not ensured that battery management is intrinsically safe and will protect the battery.

- Verify that the battery complies with locally applicable standards and directives and is intrinsically safe.
- Ensure that the lithium-ion batteries are approved for use with the Sunny Island. The list of lithium-ion batteries approved for the Sunny Island is updated regularly (see the technical information "List of Approved Lithium-Ion Batteries" at www.SMA-Solar.com).
- If no lithium-ion batteries approved for the Sunny Island can be used, lead-acid batteries can be used.

⚠ WARNING

Risk of injury due to short-circuit currents

Short-circuit currents in the battery can cause heat build-up and electric arcs. Burns or eye injuries due to flashes may result.

- Remove watches, rings and other metal objects.
- Use insulated tools.
- Do not place tools or metal parts on the battery.

⚠ CAUTION

Risk of burns due to hot battery components

Improper battery connection may result in excessively high transition resistances. Excessive transition resistances give rise to localized heat build-up.

- Ensure that all pole connectors are connected with the connecting torque specified by the battery manufacturer.
- Ensure that all DC cables are connected with the connecting torque specified by the battery manufacturer.

NOTICE

Damage to the battery due to incorrect settings

The set battery parameters influence the charging behavior of the Sunny Island inverter. The battery can be damaged by incorrect settings of the battery type, nominal voltage and capacity parameters.

- Ensure that the values recommended by the manufacturer are set for the battery (refer to the technical data of the battery in the manufacturer documentation). Note that the battery charging behavior names used by SMA Solar Technology AG and the battery manufacturer may, in some cases, differ in meaning (for the battery charging behavior of the Sunny Island inverter, see technical information "List of Approved Lithium-Ion Batteries").
- Set the battery capacity for a ten-hour electric discharge (C10). The battery manufacturer specifies the battery capacity in relation to discharge time.

NOTICE

Permanent damage to the battery due to improper handling

Improper set-up and maintenance of the battery can cause it to become permanently damaged. Logs can help to determine the cause.

- Comply with all requirements of the battery manufacturer with regard to mounting location.
- Check and log the status of the battery before performing maintenance work.
  Useful hint: Many battery manufacturers provide suitable logs.
  - Check the battery for visible damage and log.
  - Measure and log the fill level and acid density of FLA batteries.
  - In the case of lead-acid batteries, measure and log the voltages of the individual cells.
  - Perform and log the test routines required by the battery manufacturer.

Prior damage to batteries

Batteries may have suffered prior damage due to production defects. Logs can help to determine the cause.

- Check and log the status of the battery before performing maintenance work.

Check and log the status of the battery before performing maintenance work.

Transition resistances can impair the performance of the batteries.

- Ensure that the torques at the battery connections are correct each time that maintenance is performed.

3 Scope of Delivery

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

Sunny Island

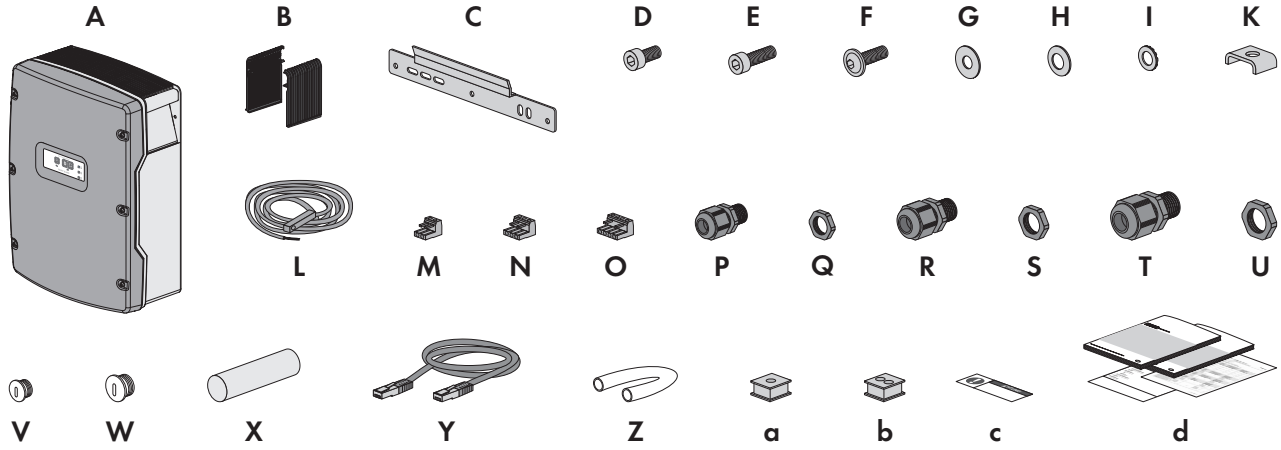


Figure 1: Components included in the scope of delivery

Position	Quantity	Designation	Position	Quantity	Designation
A	1	Sunny Island	S	2	Counter nut for cable gland M25
B	2	Ventilation grid	T	2	Cable gland M32
C	1	Wall mounting bracket	U	2	Counter nut for cable gland M32
D	2	Hexagon socket screw M6x10			
E	2	Hexagon socket screw M6x16*	V	1	Filler plug M20
F	2	Hexagon socket screw M8x20	W	1	Filler plug M25
G	2	Fender washer M8	X	1	Putty in a separate accessory kit
H	2	Spring washer M8			
I	2	Conical spring washer M6	Y	1	Black CAT5e data cable, 2 m
K	1	Clamping bracket	Z	2	Silicon tube 10 mm x 500 mm
L	1	Battery temperature sensor	a	1	Cable support sleeve for one cable
M	1	2-pole terminal	b	2	Cable support sleeve for two cables
N	2	3-pin terminal	c	1	Label “VDE 0126-1-1”
O	2	4-pin terminal		1	Warning label for battery-backup system

Position	Quantity	Designation	Position	Quantity	Designation
P	1	Cable gland M20	d	1	Installation manual, operating instructions, three quick reference guides: "SMA FLEXIBLE STORAGE SYSTEM", "SMA FLEXIBLE STORAGE SYSTEM with Battery-Backup Function", "Off-Grid Systems"
Q	1	Counter nut for cable gland M20			
R	2	Cable gland M25			

* One spare part for the enclosure lid included

Communication for RS485 Order Option

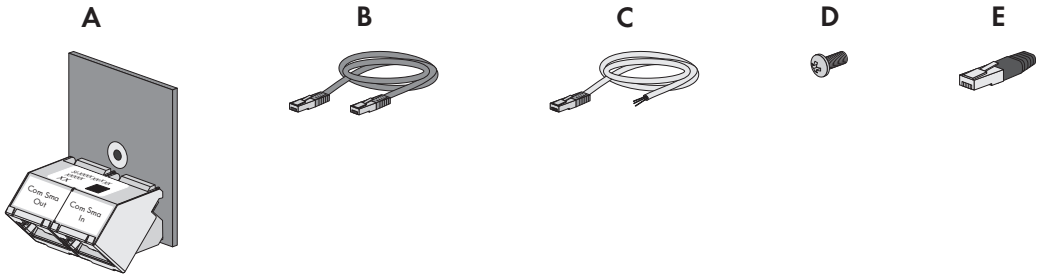


Figure 2: Components of the communication for RS485 order option

Position	Quantity	Designation
A	1	SI-COMSMA.BGx, installed in the Sunny Island at the factory*
B	1	Gray CAT5e data cable, 5 m
C	1	White CAT5e data cable with three conductors with stripped insulation
D	1	Screw, installed in the Sunny Island at the factory
E	1	Terminator, plugged into SI-COMSMA.BGx at the factory

* In the case of a cluster system, the communication interface is only installed in the master.

Communication for Multicluster System Order Option

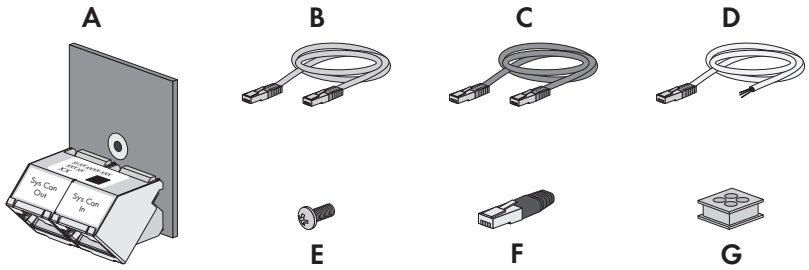


Figure 3: Components of the communication for multicluster system order option

Position	Quantity	Designation
A	1	SI-SYSCAN.BGx*, installed in the master at the factory

Position	Quantity	Designation
B	1	Yellow CAT5e data cable, 5 m
C	1	Gray CAT5e data cable, 5 m
D	1	White CAT5e data cable with three conductors with stripped insulation
E	2	Screw, installed in the Sunny Island at the factory
F	2	Terminator, plugged into SI-SYSCAN.BGx and SI-COMSMA.BGx at the factory
G	1	Cable support sleeve for four cables

* CAN communication interface

"Communication via Speedwire" Order Option (e.g., SMA Flexible Storage System)

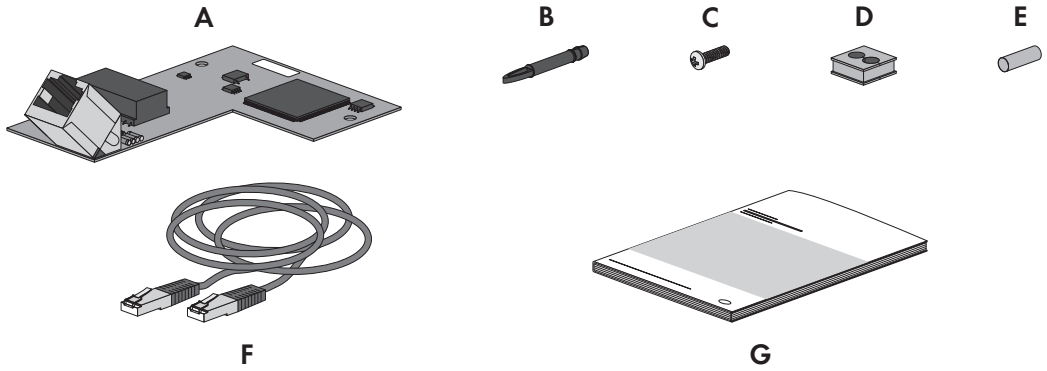


Figure 4: Components of the "Communication via Speedwire" order option

Position	Quantity	Designation
A	1	Speedwire data module, installed in the master at the factory
B	3	Spacer*
C	1	Screw
D	1	Cable support sleeve
E	1	Filler plug
F	1	Network cable, 5 m
G	1	Installation Manual

* Two spacers are required for installation of the Speedwire data module. One of the spacers is a spare part.

4 Additional Tools Required

Tools	Explanation
Drill	–
Drill bit	Mounting the wall mounting bracket
Allen key (AF 5)	–
Torque wrench	Attachment: AF 5 Measurement range: 4 Nm to 12 Nm
Crimping pliers	Crimping of the DC cable terminal lugs
Crimping tool	Crimping of the bootlace ferrules
Flat-blade screwdriver	Connection of the control and measuring cables to the terminals
Current clamp	Measuring of the battery current
Measuring device for voltage measurement	Measuring of the AC voltages in the system and measuring of the battery voltage

5 Product Description

5.1 Sunny Island

The Sunny Island is a battery inverter that controls the electrical energy balance in an off-grid system, in a battery-backup system or in a system for increased self-consumption. In a battery-backup system, you can also use the Sunny Island for increased self-consumption.

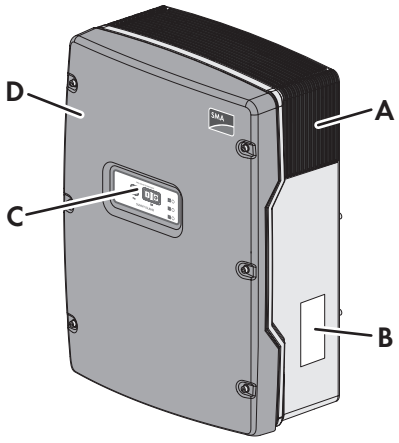


Figure 5: Design of the Sunny Island inverter

Position	Designation
A	Ventilation grid
B	Type label
C	Control panel
D	Enclosure lid

The Sunny Island supplies AC loads in the system from a battery or charges the battery with the energy provided by AC sources (e.g., PV inverter). AC sources supply loads and are used by the Sunny Island to recharge the battery. In order to be able to increase the availability of the off-grid system and reduce the battery capacity, the Sunny Island can use and control a generator as an energy reserve.

The loads may temporarily overload the Sunny Island. If there is a short circuit, the Sunny Island briefly feeds short-circuit currents into the utility grid. As a result, the Sunny Island may trip certain circuit breakers (see Section 10 "Technical Data", page 108).

Type label

The type label clearly identifies the product. The type label is located on the right-hand side of the enclosure (for a description of the type label, see the Sunny Island inverter operating manual).

You will require the information on the type label to use the product safely and when seeking customer support from Service (see Section 12 "Contact", page 118).

5.2 Scope of Functions of Device Types SI3.0M-11 and SI4.4M-11

The following functional restrictions apply for device types SI3.0M-11 and SI4.4M-11:

- All Sunny Island inverters in a cluster must be of the same device type.
- Device types SI3.0M-11 and SI4.4M-11 do not support all off-grid system variants.

  Single-phase systems can include a maximum of one Sunny Island SI3.0M-11 or SI4.4M-11.

  Three-phase systems can include a maximum of three Sunny Island SI3.0M-11 or SI4.4M-11 devices.

  Only the device types SI6.0H-11 and SI8.0H-11 are suitable for single-phase single-cluster systems and three-phase multicluster systems (see the quick reference guide"Off-Grid Systems" or the quick reference guide "Multicluster Systems with Stand-Alone Grid or Increased Self-Consumption and Battery-Backup Function").

5.3 Multifunction Relay

Using two multifunction relays, each Sunny Island can control various functions and can display operating states and warning messages.

In an SMA Flexible Storage System with battery-backup function, the multifunction relays of the master are set permanently.

In multicluster systems with Multicluster-Box 12 (MC-BOX-12.3-20), multifunction relays 1 and 2 in the master of the main cluster and multifunction relay 2 in slave 1 of the main cluster are set permanently.

Possible function or output	Explanation
Control of the tie switch and of the contactors for grounding	In the SMA Flexible Storage System with battery-backup function, the multifunction relays control the contactors for grid coupling and grounding.
Switch cycles in the multicluster system	In multicluster systems with Multicluster-Box 12, multifunction relays control different switch cycles in the multicluster system.
Controlling PV arrays	The multifunction relay activates if a PV array request is received from the Sunny Island inverter's generator management system. With the multifunction relay, you can control PV arrays with an electrical remote-start function or connect a signal generator for PV arrays with no autostart function (see Section 7.4.10, page 48).
Controlling load-shedding contactors	The multifunction relay is activated depending on the state of charge of the battery. Depending on the configuration, you can install a one-level load shedding with one multifunction relay or a two-level load shedding with two multifunction relays. You can also adjust the thresholds for the state of charge of the battery depending on the time of day (see Section 7.4.12, page 50).
Time control for external processes	The multifunction relays can be time-controlled (see Section 7.4.13, page 52).
Display of operating states and warning messages	Each multifunction relay can display either one event or one warning message (see Section 7.4.14, page 52).
Control of a battery-room fan	The multifunction relay is activated when the charging current causes the battery to emit gasses. A connected battery room fan is switched on for at least one hour (see Section 7.4.15, page 53).

Possible function or output	Explanation
Control of an electrolyte pump	Depending on the nominal energy throughput, the multifunction relay is activated at least once a day (see Section 7.4.16, page 54).
Use of excess energy	In off-grid systems during the constant voltage phase, a multifunction relay is activated and thus controls additional loads that can put any excess energy to good use (see Section 7.4.17, page 55).

5.4 Communication

5.4.1 Communication Interfaces

The Sunny Island is equipped with two interface slots for the connection of SMA communication interfaces.

Interface slot SICOMSMA

The interface slot **SICOMSMA** is for connecting the Speedwire data module SWDMSI-xx or the RS485 communication interface SI-COMSMA.BGx.

The Speedwire data module SWDMSI-xx allows the Sunny Island inverter to be integrated into a Speedwire network. Speedwire is a cable-based type of communication based on the Ethernet standard and the communication protocol SMA Data2+. This enables inverter-optimized 10/100 Mbit data transmission between Speedwire devices, e.g., between Sunny Island and Sunny Home Manager.

The SI-COMSMA.BGx communication interface allows the Sunny Island inverter to be integrated into an RS485 communication bus. You can connect the Sunny Island to the following products using RS485:

- PV inverter
- Wind power inverters
- Extension cluster masters

If the Sunny Island inverters are ordered with the RS485 communication interface SI-COMSMA.BGx or with the Speedwire data module SWDMSI-xx, the Sunny Island inverters are delivered with premounted communication interfaces (Components of the optional communication interface (see Section 3, page 15)).

Interface slot SISYSCAN

On Sunny Island device types SI6.0H-11 or SI8.0H-11, the interface slot **SISYSCAN** is for connecting the multicluster data module SI-SYSCAN.BGx.

In a multicluster system, the masters of the clusters must communicate with each other via a separate CAN bus. An SI-SYSCAN.BGx communication interface must be installed in each master for multicluster communication.

If the Sunny Island inverters are ordered with the communication interface SI-SYSCAN.BGx, the masters are delivered with premounted communication interfaces (components of the optional communication interface (see Section 3, page 15)).

5.4.2 Compatible Communication Products

Sunny Home Manager and Sunny Portal

The Sunny Home Manager is a device for PV system monitoring and for controlling loads in households with PV systems. The Sunny Home Manager and the Sunny Island inverter communicate via Speedwire and are a substantial part of the SMA Flexible Storage System (see quick reference guide of the Sunny Island inverter).

Sunny Portal is an Internet portal for visualization of the data of the PV system, of SMA radio-controlled sockets and of other components of the SMA Flexible Storage System. In addition, Sunny Portal serves as a user interface for configuring the Sunny Home Manager and SMA radio-controlled sockets (see user manual of the SUNNY HOME MANAGER).

Sunny Explorer

With the Sunny Explorer software, you can visualize and manage the data of your Sunny Island system. You can also use it to configure single devices or entire device classes in your system. To enable this, the Sunny Explorer software must be installed on a computer that is connected to the Sunny Island via Speedwire (see user manual of Sunny Explorer).

6 Mounting

6.1 Requirements for Mounting

Requirements for the mounting location:

⚠ WARNING

Danger to life due to fire or explosion

Despite careful construction, electrical devices can cause fires.

- Do not mount the inverter in areas containing highly flammable materials or gases.
- Do not mount the inverter in a potentially explosive atmosphere.

⚠ WARNING

Danger to life due to explosive gases

Explosive gases may escape from the battery and cause an explosion. This can result in death or serious injury.

- Protect the battery environment from open flames, embers and sparks.
- Install, operate and maintain the battery in accordance with the manufacturer's specifications.
- Do not heat the battery above the temperature permitted or burn the battery.
- Ensure that the battery room is sufficiently ventilated.

☐ The mounting location must be inaccessible to children.

☐ A solid support surface must be available for mounting, e.g. concrete or masonry. When mounted on drywall or similar materials, the inverter emits audible vibrations during operation which could be perceived as annoying.

☐ The mounting location must be suitable for the weight and dimensions of the inverter (see Section 10 "Technical Data", page 108).

☐ The mounting location must not be exposed to direct solar irradiation. Direct solar irradiation can result in the premature aging of the exterior plastic parts of the inverter and direct solar irradiation can cause the inverter to overheat. When becoming too hot, the inverter reduces its power output to avoid overheating.

☐ The mounting location must be less than 3000 m above MSL. From altitudes of 2000 m above MSL, the power decreases by 0.5% every 100 m.

☐ The mounting location must not hinder access to disconnection devices.

☐ The mounting location should be freely and safely accessible at all times without the need for any auxiliary equipment (such as scaffolding or lifting platforms). Non-fulfillment of these criteria may restrict servicing.

☐ The ambient temperature should be below 40°C to ensure optimum operation.

☐ Climatic conditions must be met (see Section 10 "Technical Data", page 108).

Permitted and prohibited mounting positions:

☐ The inverter must only be mounted in one of the permitted positions. This will ensure that no moisture can penetrate the inverter.

☐ The inverter should be mounted in such way that display messages or LED signals can be read without difficulty and buttons operated.

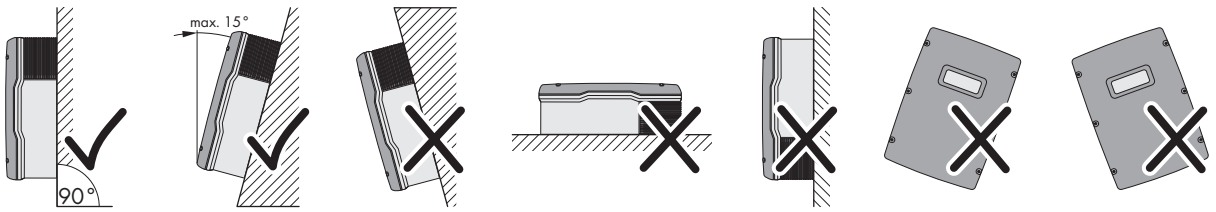


Figure 6: Permitted and prohibited mounting positions

Dimensions for mounting:

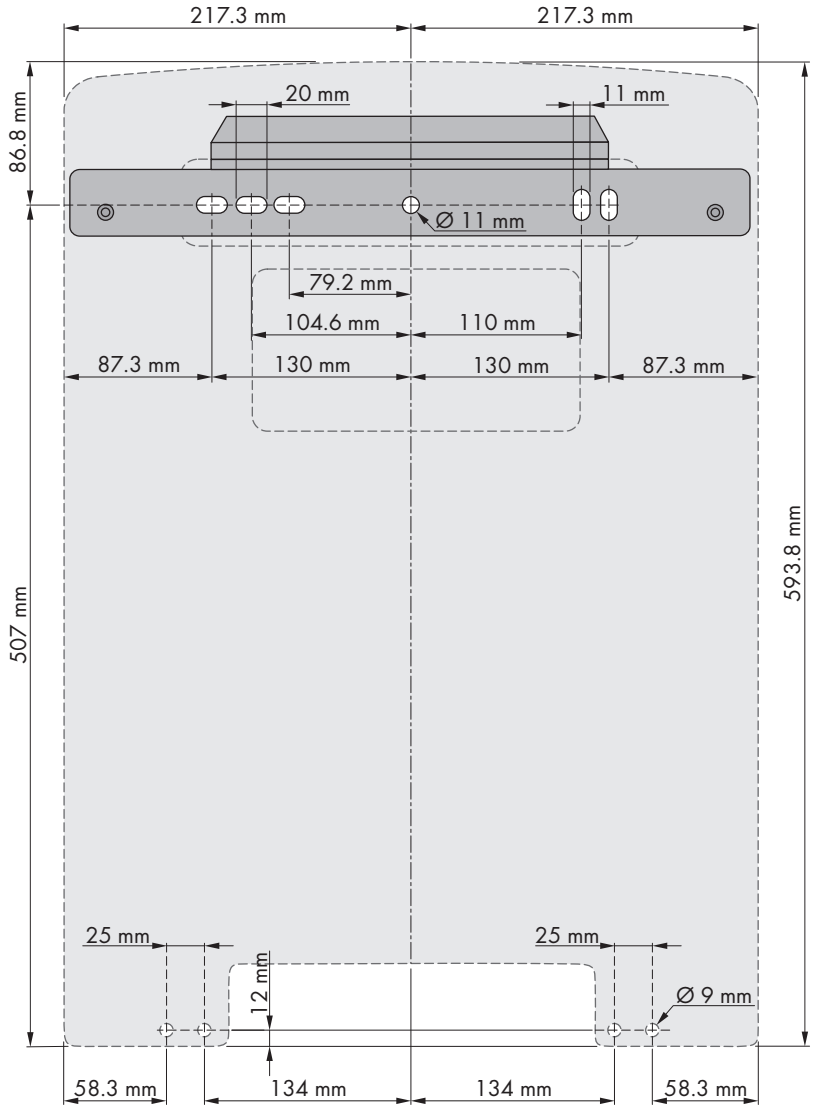


Figure 7: Position of the anchoring points

Recommended clearances:

If you maintain the recommended clearances, adequate heat dissipation will be ensured. Thus, you will prevent power reduction due to excessive temperature.

- ☐ Maintain the recommended clearances to walls as well as to other inverters or objects.
- ☐ If multiple inverters are mounted in areas with high ambient temperatures, increase the clearances between the inverters and ensure sufficient fresh-air supply.

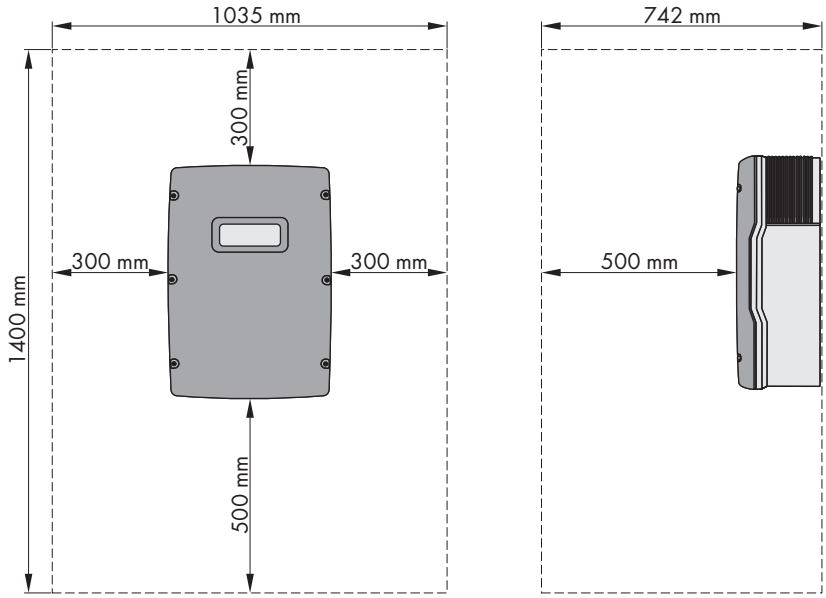


Figure 8: Recommended clearances

6.2 Mounting the Sunny Island

Sunny Island with order option "Communication via RS485" or "Communication in multicluster systems"

Any ordered communication interfaces are installed in the master at the factory. The master can be identified by the labeling on the packaging.

- For single-cluster systems and multicluster systems, mount the Sunny Island units with integrated communication interfaces at the planned mounting locations for masters.

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

- ☐ At least two screws that are suitable for the foundation
- ☐ At least two washers that are suitable for the screws
- ☐ At least two screw anchors that are suitable for the support surface and the screws
- ☐ If the inverter is to be secured against theft, two security screws that can only be unscrewed with a special tool.

Procedure:

⚠ CAUTION

Risk of injury when lifting the inverter, or if it is dropped

The Sunny Island inverter 3.0M / 4.4M weighs 44 kg, the Sunny Island inverter 6.0H / 8.0H weighs 63 kg. There is risk of injury if the inverter is lifted incorrectly or dropped while being transported or when attaching it to or removing it from the wall mounting bracket.

- Transport and lift the inverter carefully.

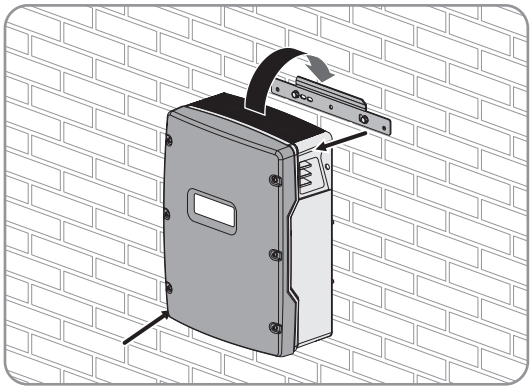
1. **⚠ CAUTION**

   Risk of injury due to damaged cables

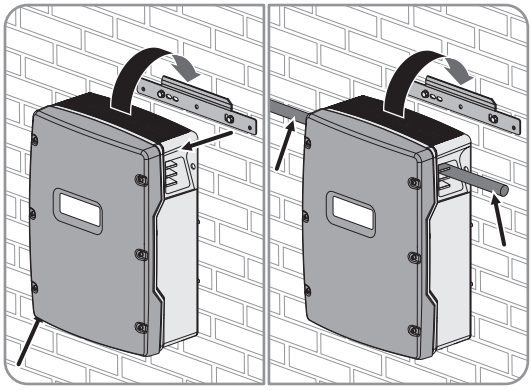
   There may be power cables or other supply lines (e.g. gas or water) routed in the wall.

   - Ensure that no lines are laid in the wall which could be damaged when drilling holes.
2. Mark the position of the drill holes using the wall mounting bracket. Use at least one hole on the right-hand and left-hand side in the wall mounting bracket.
3. Drill the holes and insert the screw anchors.

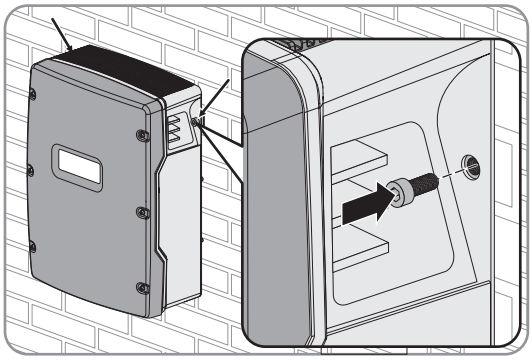
4. Secure the wall mounting bracket horizontally on the wall using screws and washers.
5. If the Sunny Island is to be secured against theft, mark the drill holes for the anti-theft device. Use at least one hole on the right and one on the left.
6. Mount the Sunny Island SI3.0M-11 and SI4.4M-11 to the wall mounting bracket. For this, use the side recess grips. Keep the Sunny Island in a horizontal position when moving it.



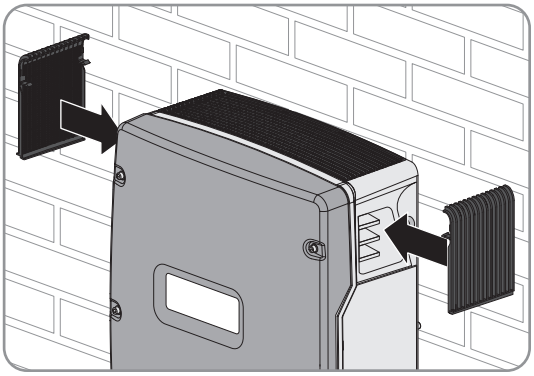
7. Mount the Sunny Island SI6.0H-11 and SI8.0H-11 to the wall mounting bracket. For this, use the side recess grips or a steel rod (diameter: maximum 30 mm). Keep the Sunny Island in a horizontal position when moving it.



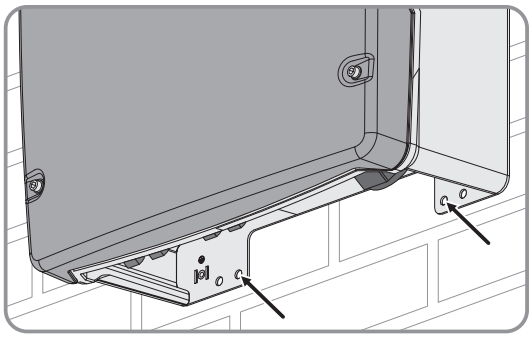
8. Use an Allen key (AF 5) to attach the Sunny Island to the wall mounting bracket on both sides with the M6x10 screws provided (torque: 4 Nm to 5.7 Nm). This will prevent the Sunny Island from being lifted off the bracket.



9. Close the recessed grips with the ventilation grids. Place the ventilation grid marked links/left on the left recessed grip and the ventilation grid marked rechts/right on the right recessed grip.



10. In order to protect the Sunny Island against theft, attach the bottom side to the wall with two security screws.



11. Ensure that the Sunny Island is firmly attached.

7 Electrical Connection

7.1 Content and Structure of the Section

The sub-sections differ in their structure. Some sub-sections refer to the correct connection of devices, others refer to basic procedures.

An overview detailing which contents the sub-sections describe and which contents should be read and adhered to can be found in the following table.

Section	Explanation
Section 7.2, page 29	Graphic overview of the connection area
Section 7.3, page 29	For systems with a grounded battery, this section must be read and observed.
Section 7.4, page 31	Information on the connection and circuitry of individual devices with specification of connections on the Sunny Island
Section 7.5, page 57	Correct connection of the cables to the respective connections You must read and observe the sections for the connections used.
Section 7.6, page 64	You must read and observe the section for the connections used.
Section 7.7, page 68	You must read and observe this section.
Section 7.8, page 69	You must read and observe this section.

7.2 Connection area

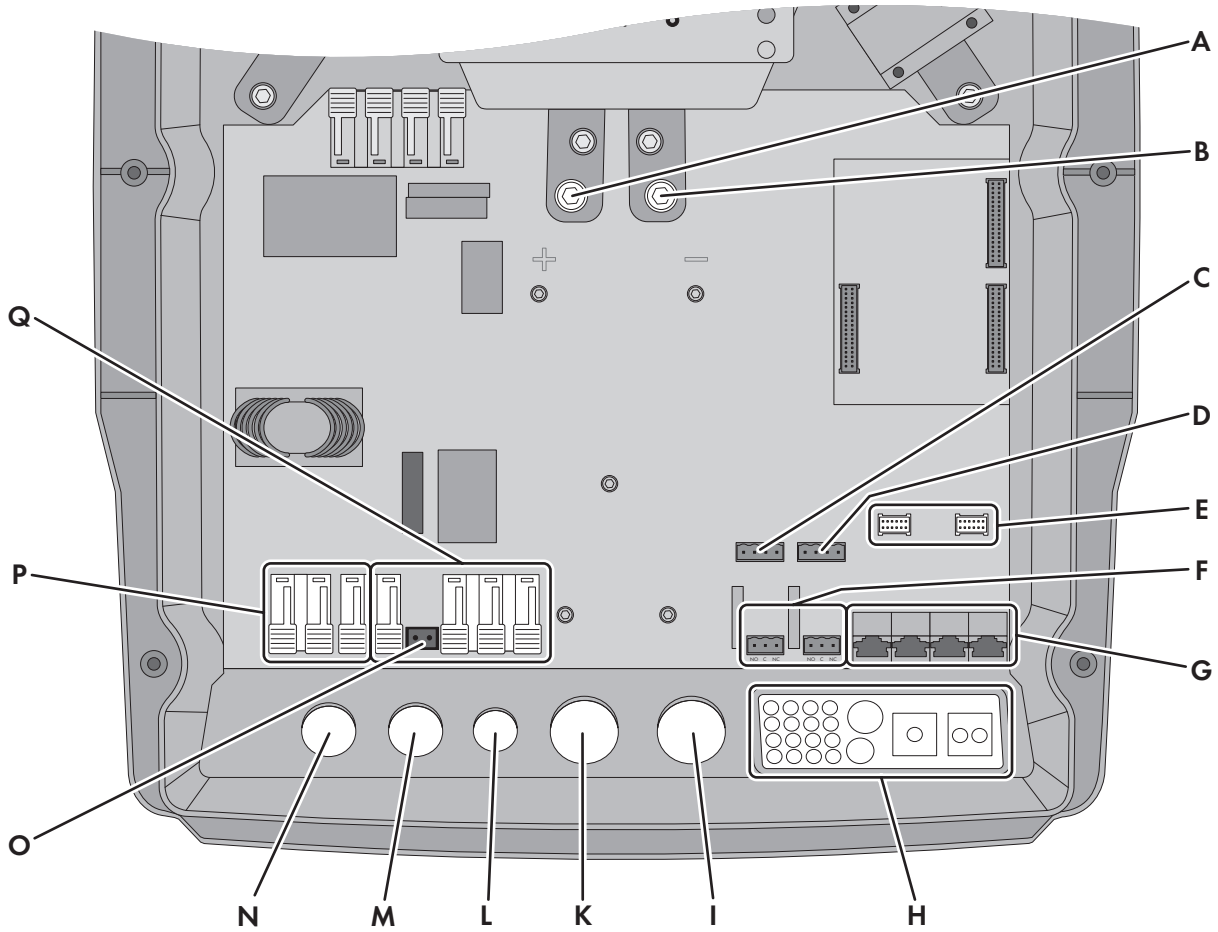


Figure 9: Connection area of the Sunny Island inverter

Position	Designation	Position	Designation
A	**DC+** connection	I	Enclosure opening for **DC-**
B	**DC-** connection	K	Enclosure opening for **DC+**
C	**BatTmp** and **BatCur** connections	L	Enclosure opening **PE/ExtVtg**
D	**BatVtgOut** and **DigIn** connections	M	Enclosure opening **AC2**
E	2 interface slots	N	Enclosure opening **AC1**
F	**Relay1** and **Relay2** connections	O	**ExtVtg** connection
G	Connecting the communication unit	P	**AC1** connection
H	Cable feed-through plate	Q	**AC2** connection

7.3 Connecting the Grounding Conductor in Systems with a Grounded Battery

If you ground the battery, you can ground it at the positive terminal or at the negative terminal with a grounding conductor. SMA Solar Technology AG does not recommend grounding the battery. If the battery is grounded, the enclosure of the Sunny Island must also be grounded. This additional grounding is no substitute for the grounding at connections **AC1** und **AC2**.

Conductor cross-section:

You must determine the required conductor cross-section of the grounding conductor, taking into account the applicable local standards and directives. The calculation of the grounding conductor cross-section depends on the type and size of the connected battery, the external fuse in the BatFuse and the material of the grounding conductor.

Example: Calculation of the grounding conductor cross-section

Grounding conductor made of copper. The required cross-section of the grounding conductor can be calculated using the following formula:

$$S_{Cu}(I, t) = \sqrt{\frac{I_{SC} \cdot t}{143}}$$

S_{Cu} = conductor cross-section in mm²

I_{SC} = short-circuit current in A

= interruption time in s

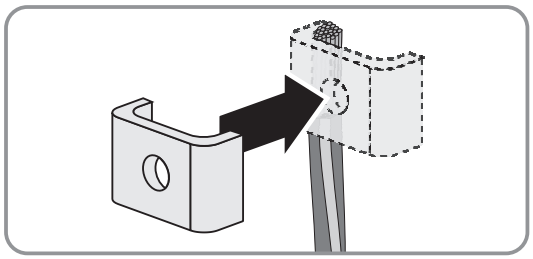
Typical tripping times for an LV/HRC fuse are around 25 ms for short-circuit currents between 2000 A and 10000 A. Grounding with a cross-section of 16 mm² is sufficient for short-circuit currents up to 10000 A.

Cable requirement:

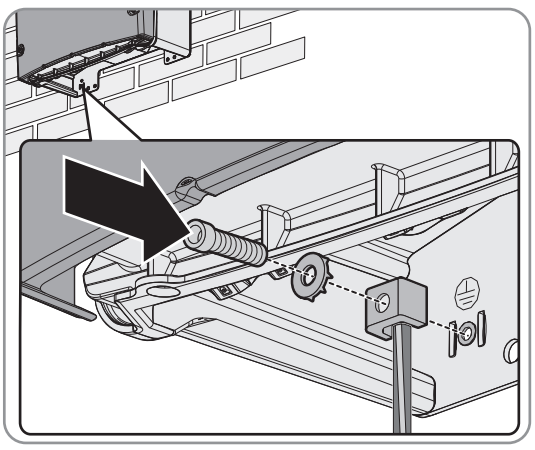
- ☐ Copper wire
- ☐ Conductor cross-section: maximum 16 mm²
- ☐ The cross-sections of the battery grounding conductor and Sunny Island inverter grounding conductor must be the same.

Procedure:

1. Calculate the cross-section of the grounding conductor.
2. Ground the battery at the positive terminal or negative terminal using a conductor with the calculated cross-section.
3. Also ground the Sunny Island enclosure using a conductor with the calculated cross-section, as follows:
   - Strip off the insulation of the grounding conductor.
   - Place the clamping bracket over the conductor. Position the conductor on the left.



   - Fasten the clamping bracket with the M6x16 hexagon socket screw and a conical spring washer (AF 5, torque: 4 Nm to 5.7 Nm). The teeth of the conical spring washer must face the clamping bracket.



7.4 Connecting the Components

7.4.1 Connecting the Fuse Switch-Disconnector BatFuse to the Sunny Island

Cables for DC connection

Long cables and insufficient conductor cross-sections reduce the efficiency of the system and the overload capacity of the Sunny Island inverter. The maximum cable length from the battery to the Sunny Island via the fuse switch-disconnector is 10 m. The recommended minimum conductor cross-section is dependent upon the battery voltage, power and cable length:

Sunny Island	Cable length *	Conductor cross-section	Cable diameter**	Terminal lug
SI 8.0H	≤ 5 m	70 mm²	14 mm to 21 mm	M8, 20 mm to 25 mm wide
	> 5 m	95 mm²	14 mm to 21 mm	M8, 20 mm to 25 mm wide
SI 6.0H	≤ 5 m	50 mm²	14 mm to 21 mm	M8, 20 mm to 25 mm wide
	> 5 m	70 mm²	14 mm to 21 mm	M8, 20 mm to 25 mm wide
SI 4.4M	≤ 5 m	50 mm²	14 mm to 21 mm	M8, 20 mm to 25 mm wide
	> 5 m	70 mm²	14 mm to 21 mm	M8, 20 mm to 25 mm wide
SI 3.0M	≤ 5 m	50 mm²	14 mm to 21 mm	M8, 20 mm to 25 mm wide
	> 5 m	70 mm²	14 mm to 21 mm	M8, 20 mm to 25 mm wide

* Cable length from the battery to the Sunny Island via the fuse switch-disconnector

** Maximum cable diameter on the Sunny Island: 25 mm
Maximum cable diameter on the BatFuse: 21 mm

⚠ WARNING

Danger to life due to incompatible lithium-ion battery

An incompatible lithium-ion battery can lead to a fire or an explosion. With incompatible lithium-ion batteries, it is not ensured that battery management is intrinsically safe and will protect the battery.

- Verify that the battery complies with locally applicable standards and directives and is intrinsically safe.
- Ensure that the lithium-ion batteries are approved for use with the Sunny Island. The list of lithium-ion batteries approved for the Sunny Island is updated regularly (see the technical information "List of Approved Lithium-Ion Batteries" at www.SMA-Solar.com).
- If no lithium-ion batteries approved for the Sunny Island can be used, lead-acid batteries can be used.

Procedure:

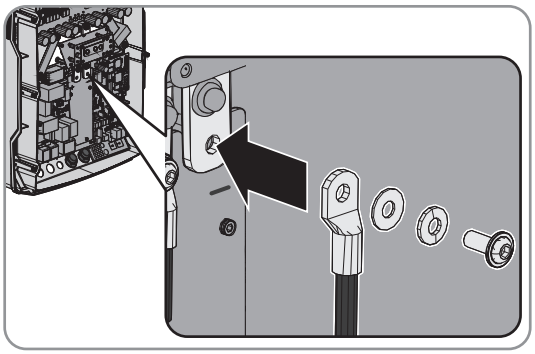
1. Ensure that the load-break switch of the BatFuse is open and secured against reconnection.
2. On the Sunny Island, remove all screws of the lower enclosure lid using an Allen key (AF 5) and remove the enclosure lid. Retain the screws and conical spring washers for later use.
3. Ethanol.Clean the contact surfaces of the **DC+** and **DC−** connections, for example, with ethanol. This reduces the transition resistance on the contact surfaces. A low transition resistance increases the system stability and minimizes the risk of damage to the Sunny Island.

4. **NOTICE**

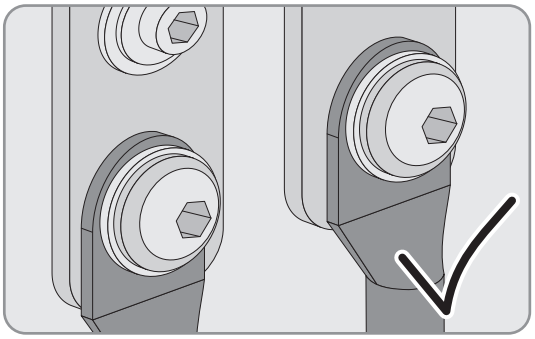
   Damage to Sunny Island inverter due to reverse polarity or incorrect terminal lug selection

   If the DC cables are swapped, high currents will flow after the load-break switch has closed and these can damage the Sunny Island.

   - Fasten the DC power cables to the DC connection with M8x20 screws, ensuring correct polarity (torque: 12 Nm). In doing so, ensure that the cable is connected correctly (see chapter 7.5.1 "Connecting the DC Power Cable", page 50) and adhere to the following screw assembly: screw head | spring washer | fender washer | terminal lug | DC connection.



☑ The contact surfaces of the fender washers have full contact with the terminal lugs.



7.4.2 Connecting the Utility Grid in the System for Increased Self-Consumption

Relevant for systems connected to the utility grid

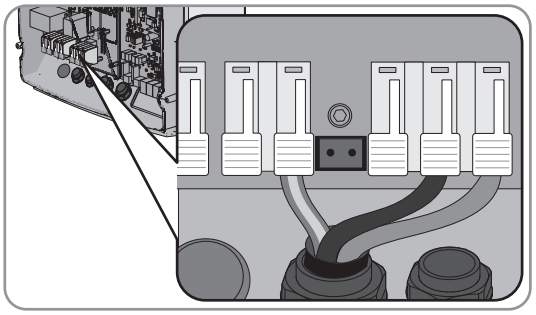
Requirements:

☐ The system is not a battery backup system

☐ For connection of the Sunny Island inverter to the utility grid, there must be a circuit breaker and a type A residual-current device on the distribution board (for circuitry overview, see the quick reference guide "SMA FLEXIBLE STORAGE SYSTEM")

Procedure:

1. On the Sunny Island, connect the power cable to the terminals **AC2 Gen/Grid**. Connect the line conductor to **AC2 Gen/Grid L**, neutral conductor to **AC2 Gen/Grid NTT** and grounding conductor to **AC2 Gen/Grid PE**.



2. Make sure that the cable is correctly connected. (see Section 7.5.2 "Connecting the AC Power Cable", page 59) .
3. Connect an additional grounding conductor to the **AC1 Loads/SunnyBoys PE** terminal if the power cable conductor cross-section is smaller than 10 mm² (see Section 7.5.3 "Connecting the Grounding Conductor", page 60).

7.4.3 Connecting an Automatic Transfer Switch in the Battery Backup System

7.4.3.1 Automatic Transfer Switch Function

Relevant for systems connected to the utility grid

The automatic transfer switch separates the utility grid from the battery backup grid in battery backup systems. The control cable, measuring cable, and power cable link the automatic transfer switch to the Sunny Island (for circuitry overview see quick reference guide "SMA FLEXIBLE STORAGE SYSTEM with Battery-Backup Function").

7.4.3.2 Connecting the AC Power Cables to the Automatic Transfer Switch

Relevant for systems connected to the utility grid

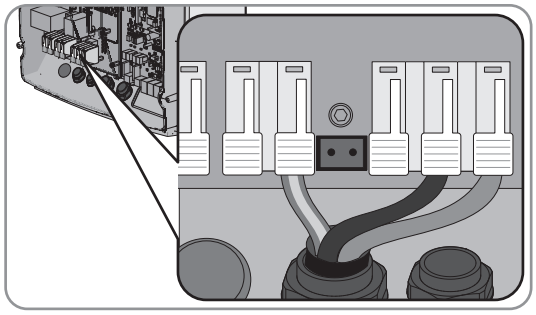
The AC power cables conduct the energy between the battery backup grid and the Sunny Island (for circuitry overview see Quick Reference Guide "SMA FLEXIBLE STORAGE SYSTEM").

Requirements:

☐ For a three-phase battery backup system, L1 must be assigned to the master, L2 to slave 1, and L3 to slave 2. This creates a right-hand rotating magnetic field.

☐ The power of the AC sources in the battery backup grid must not exceed the maximum connected power of the PV inverters in the battery backup systems (see Section 10.2 "AC2 Connection for Utility Grid and Generator (External Energy Source)", page 109). The powers of the individual Sunny Island inverters are added to yield the total maximum power.

Procedure:



- On the Sunny Island, connect the power cable from **X3** to the **AC2 Gen/Grid** terminals (for circuitry overview, see the quick reference guide "SMA Flexible Storage System with Battery Backup Function"). Ensure that the cable is correctly connected (see Section 7.5.2 "Connecting the AC Power Cable", page 59).
- Connect the line conductor to **AC2 Gen/Grid L**.
- Connect the neutral conductor to **AC2 Gen/Grid NTT**.
- Connect the grounding conductor to **AC2 Gen/Grid PE**.
- Connect the line conductor to **AC2 Gen/Grid L**.
- Connect the neutral conductor to **AC2 Gen/Grid NTT**.
- Connect the grounding conductor to **AC2 Gen/Grid PE**.

7.4.3.3 Connecting the Control Cables to the Automatic Transfer Switch

Relevant for systems connected to the utility grid

Control cables conduct the control signals of the multifunction relays to the contactors (for circuitry overview see Quick Reference Guide "SMA FLEXIBLE STORAGE SYSTEM with Battery-Backup Function").

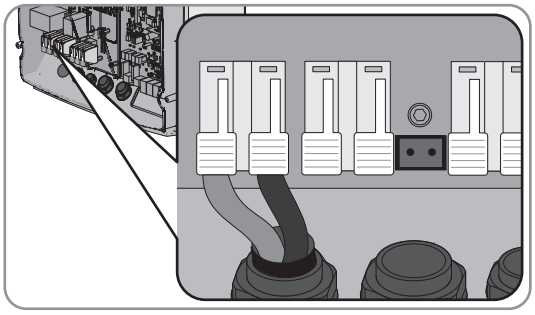
Cable route for control cables and measuring cables in the automatic transfer switch

An unfavorable cable route can lead to quality losses during the transmission of control signals and measured values Observe the following rules for cable routes:

- Lay the control and measuring cables at the greatest possible distance from the power cables or use shielded cables as control and measuring cables.
- Always connect the digital input **DigIn** of the Sunny Island inverter separately via a shielded cable.

Procedure:

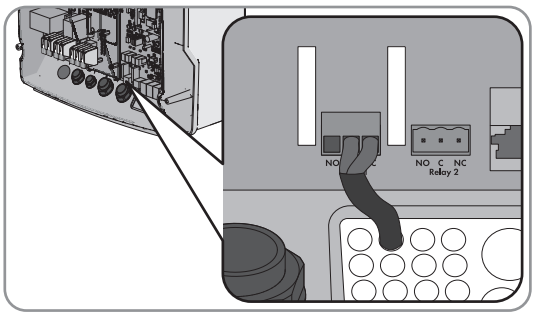
1. On the master, connect the cable from **X5 L** and **X5 N** (for the control voltage) to terminal **AC1 Loads/SunnyBoys**. Make sure that the cable is correctly connected (see Section 7.5.2 "Connecting the AC Power Cable", page 59).



2. **⚠ WARNING**

   Danger to life from electric shock due to incorrect insulation

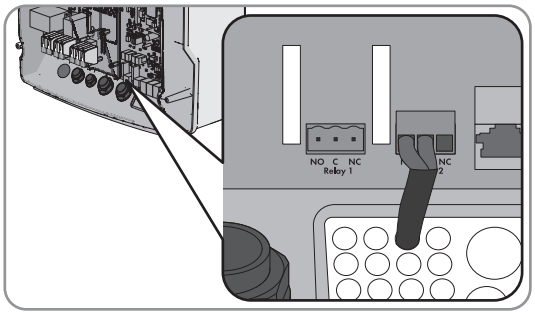
   - Connect the control cable of **X4 1** and **X4 2** to the **Relay1 C** and **Relay1 NC** terminals. Ensure that the cable is correctly connected .



3. **⚠ WARNING**

   Danger to life from electric shock due to incorrect insulation

   - Connect the control cable of **X5 1** and **X5 2** to the **Relay2 C** and **Relay2 NO** terminals. Ensure that the cable is correctly connected .



7.4.3.4 Connecting the Measuring Cables to the Automatic Transfer Switch

Relevant for systems connected to the utility grid

The Sunny Island measures the voltages of the respective line conductors via one measuring cable. In addition, the master measures whether the tie switch has activated or deactivated (for circuitry overview see Quick Reference Guide "SMA FLEXIBLE STORAGE SYSTEM with Battery-Backup Function").

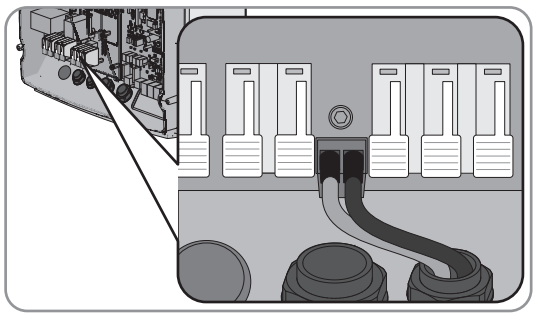
Cable route for control cables and measuring cables in the automatic transfer switch

An unfavorable cable route can lead to quality losses during the transmission of control signals and measured values Observe the following rules for cable routes:

- Lay the control and measuring cables at the greatest possible distance from the power cables or use shielded cables as control and measuring cables.
- Always connect the digital input **DigIn** of the Sunny Island inverter separately via a shielded cable.

Procedure:

1. On the Sunny Island, connect the measuring cable **X4 Ln** (Ln = L1 to L3) and **X4 N** for voltage monitoring to the **ExtVtg** terminal. Make sure that the cable is correctly connected (see Section 7.5.7 "Connecting ExtVtg", page 64).



2. At the master, connect the tie switch monitoring. Ensure that the cable from **X5 3** and **X5 4** is correctly connected (see Section 7.5.6 "Connecting BatVtgOut, DigIn, BatTMP and BatCur", page 63).
   - Connect **BatVtgOut−** with **DigIn−** within the master.
   - Connect the insulated conductor from **X5 3** to **DigIn+**.
   - Connect the insulated conductor from **X5 4** to **BatVtgOut+**.

7.4.4 Connecting the Stand-Alone Grid or Multicluster-Box 6 / 12 / 36

Relevant for off-grid systems

In the off-grid system, connect the AC loads and the grid-parallel AC sources (e.g., PV inverters) to connection **AC1** on the Sunny Island inverter via an AC distribution board. In the case of a multicluster system, the Multicluster-Box 6, Multicluster-Box 12 (MC-BOX-12.3) or Multicluster-Box 36 is the AC distribution board that is connected to connection **AC1** (connection of device type MC-BOX-12.3-20 Multicluster-Box 12 (see Section 7.4.5, page 36).

Requirements for connecting Sunny Island inverters in single-phase parallel single-cluster systems:

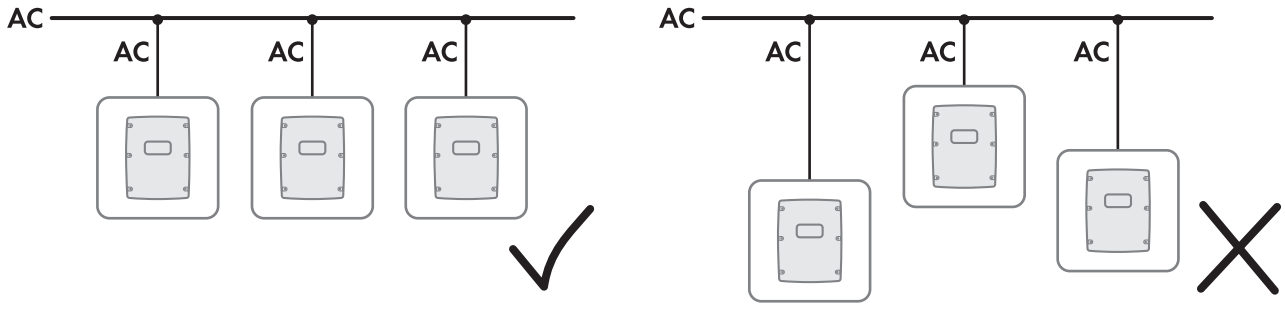


Figure 10: Correct, symmetric connection and incorrect, asymmetric connection of the Sunny Island inverters

☐ For a single-phase parallel single-cluster system, the cable length and conductor cross-section from each Sunny Island to the AC distribution board must be identical. This will allow for stable and symmetric operation.

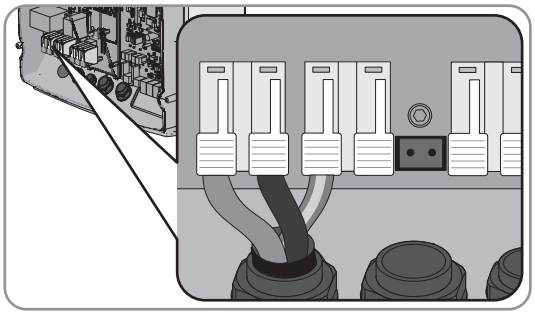
⚠ WARNING

Danger to life due to fire

In case of a short circuit, the short-circuit current driven by the generator flows over the unprotected cable between the Sunny Island and the AC distribution board. Short-circuit currents can cause fires.

- If the generator fuse is larger than the fuse on the AC distribution board, configure the cable for the generator fuse.

1. On the Sunny Island, connect the cable to the **AC1 Loads/ SunnyBoys** terminal. Ensure that the cable is correctly connected (see Section 7.5.2 "Connecting the AC Power Cable", page 59).



2. If the conductor cross-section of the grounding conductor is less than 10 mm², make sure that an additional grounding conductor is connected to terminal **AC1 Loads/SunnyBoys PE** (see Section 7.5.3 "Connecting the Grounding Conductor", page 60).

7.4.5 Connection of Multicluster-Box 12 (MC-Box-12.3-20)

7.4.5.1 Connecting the AC Power Cable to the Multicluster-Box 12

Always connect the AC power cable of the Multicluster-Box 12 (MC-Box-12.3-20) to the **AC2** terminal of the Sunny Island inverter.

⚠ WARNING

Danger to life due to fire

In case of a short circuit, the short-circuit current driven by the generator flows over the unprotected cable between the Sunny Island and the AC distribution board. Short-circuit currents can cause fires.

- If the generator fuse is larger than the fuse on the AC distribution board, configure the cable for the generator fuse.

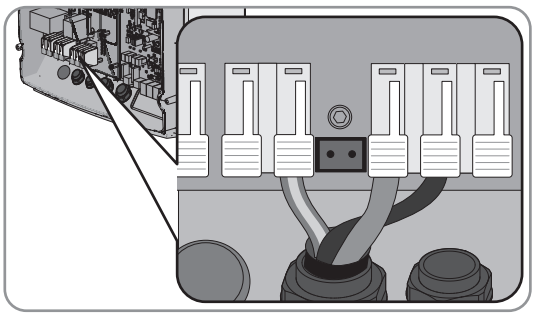
Requirements:

☐ The inverters to be connected must be Sunny Island 6.0H / 8.0H inverters.

☐ The PV inverters must be equipped with at least firmware version 3.5. Firmware version 3.5 of Sunny Island can only be used in multicluster systems with the Multicluster-Box 12 of device type MC-BOX-12.3-20.

Procedure:

1. Connect the power cable to the **AC2 Gen/Grid** terminal on all Sunny Island inverters. Connect the line conductor to **AC2 Gen/Grid L**, neutral conductor to **AC2 Gen/Grid N** and grounding conductor to **AC2 Gen/Grid PE**.



2. Make sure that the cable is correctly connected. (see Section 7.5.2 "Connecting the AC Power Cable", page 59) .

7.4.5.2 Connecting the Control Cable to the Multicluster-Box 12

Control cables conduct the control signals of the multifunction relays to the contactors of the Multicluster-Box 12 (MC-Box-12.3-20).

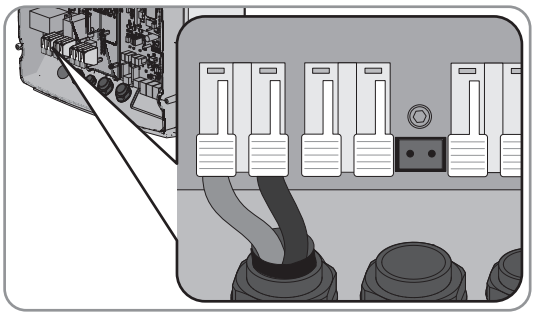
Requirements:

☐ The inverters to be connected must be Sunny Island 6.0H / 8.0H inverters.

☐ The PV inverters must be equipped with at least firmware version 3.5. Firmware version 3.5 of Sunny Island can only be used in multicluster systems with the Multicluster-Box 12 of device type MC-BOX-12.3-20.

Procedure:

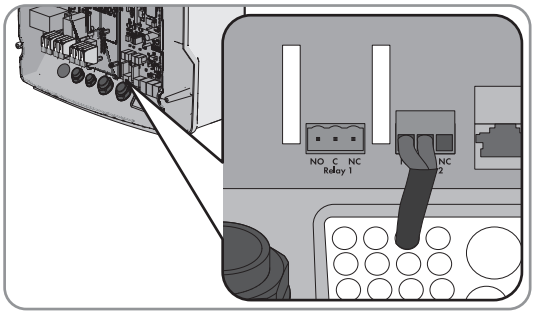
1. On the master of the main cluster, connect the **X106 1** line conductor and **X106 2** neutral conductor (for the control voltage) to terminal **AC1 Loads/SunnyBoys**. Make sure that the cable is correctly connected (see Section 7.5.2 "Connecting the AC Power Cable", page 59).



2. **⚠ WARNING**

   Danger to life from electric shock due to incorrect insulation

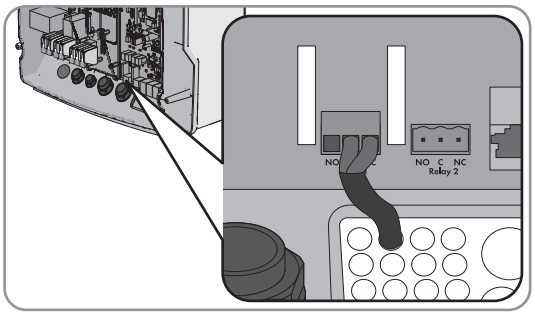
   - On the master of the main cluster, connect the control cable of **X113 1** and **X113 2** to the **Relay2 C** and **Relay2 NO**. Ensure that the cable is correctly connected (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62).



3. **⚠ WARNING**

   Danger to life from electric shock due to incorrect insulation

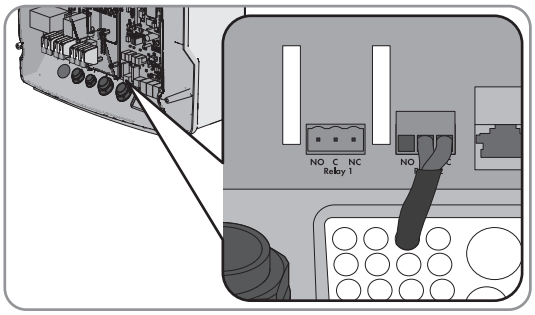
   - On the master of the main cluster, connect the control cable of **X112 1** and **X112 2** to the **Relay1 C** and **Relay1 NC** terminals when an NA-Box or Grid-Connect-Box is installed in addition to the Multicluster-Box 12. Ensure that the cable is correctly connected (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62).



4. **⚠ WARNING**

Danger to life from electric shock due to incorrect insulation

- On slave 1 of the main cluster, connect the control cable of **X112 5** and **X112 6** to the **Relay2 C** and **Relay2 NC** terminals when an NA-Box or Grid-Connect-Box is installed in addition to the Multicluster-Box 12. Ensure that the cable is correctly connected (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62).



7.4.5.3 Connecting the Measuring Cable to the Multicluster-Box 12

The Sunny Island inverters of the main cluster measure the voltages of the respective line conductors via one measuring cable each. In addition, the master measures whether the tie switch in the Multicluster-Box 12 (MC-Box-12.3-20) has activated or deactivated

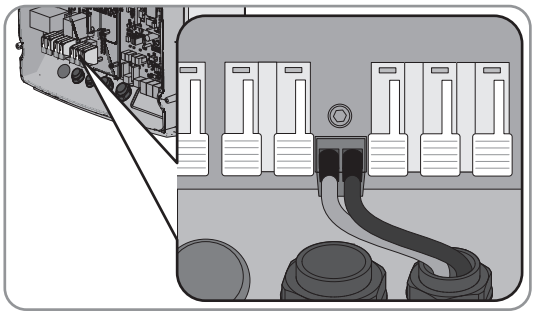
Requirements:

☐ The inverters to be connected must be Sunny Island 6.0H / 8.0H inverters.

☐ The PV inverters must be equipped with at least firmware version 3.5. Firmware version 3.5 of Sunny Island can only be used in multicluster systems with the Multicluster-Box 12 of device type MC-BOX-12.3-20.

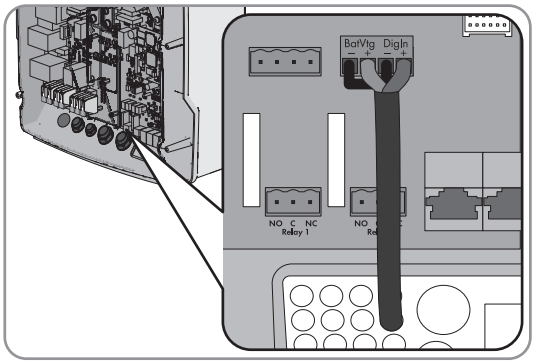
Procedure:

1. On every Sunny Island of the main cluster, connect the measuring cable for voltage monitoring of the Multicluster-Box 12 to the **ExtVtg** terminal. Ensure that the cable is correctly connected (see Section 7.5.7 "Connecting ExtVtg", page 64):



   - On the master, connect the **X112 3** and **X112 4** conductors to **ExtVtg**.
   - On slave 1, connect the **X112 7** and **X112 8** insulated conductors to **ExtVtg**.
   - On slave 2, connect the **X112 9** and **X112 10** insulated conductors to **ExtVtg**.

2. At the master, connect the AC contactor monitoring. Ensure that the cable is correctly connected (see Section 7.5.6 "Connecting BatVtgOut, DigIn, BatTMP and BatCur", page 63):



   - Connect the master **BatVtgOut** − with the **DigIn** −.
   - Connect the insulated conductor from **X113 3** to **BatVtgOut+**.
   - Connect the insulated conductor from **X113 4** to **DigIn+**.

7.4.6 Connecting the Generator in an Off-Grid System

Relevant for off-grid systems

In single systems and single-cluster systems, connect a generator to connection **AC2** of the Sunny Island inverter. For a multicluster system, connect the generator directly to the Multicluster-Box (see the Multicluster-Box documentation).

⚠ WARNING

Danger to life from electric shock due to incorrect connection of the neutral conductor

Connecting the neutral conductor incorrectly can cause failure of the protective functions in the system. This can result in death or serious injury.

- Connect the neutral conductor to terminal **AC2 Gen/Grid N**.

Requirements:

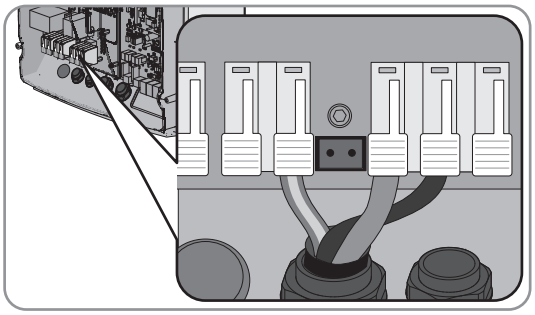
☐ A separate cable must be laid for each Sunny Island from the AC distribution board or directly from the generator.

☐ In single-phase parallel single-cluster systems, the cable lengths and conductor cross-sections from each Sunny Island to the AC distribution board or directly to the generator must be configured in the same way.

☐ For a 3-phase system, L1 must be assigned to the master, L2 to slave 1 and L3 to slave 2.

Procedure:

- Connect the power cable to the **AC2 Gen/Grid** terminal on the Sunny Island. Connect the neutral conductor to terminal **N** and ensure that the cable is correctly connected (see Section 7.5.2 "Connecting the AC Power Cable", page 59).



7.4.7 Communication Connection

7.4.7.1 Connecting the Sunny Remote Control

A data cable is included with the Sunny Remote Control for connection purposes. If the data cable is not long enough, you can replace it with a longer data cable.

Cable requirements:

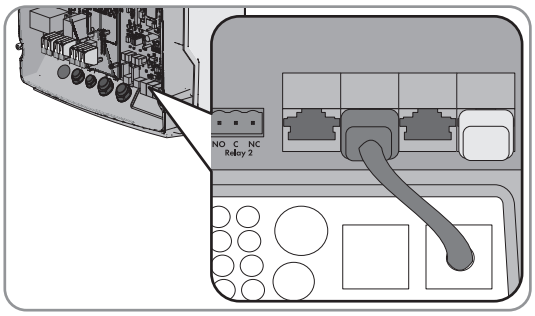
☐ Maximum cable length: 20 m

☐ Classification: CAT5e

☐ Type of plug: RJ45

Procedure:

1. Insert the data cable in the pin connector **Display** on the Sunny Island (see Section 7.5.4 "Connecting the Data Cable", page 61).



2. Connect the other end of the data cable to the Sunny Remote Control.

7.4.7.2 Connecting the Data Cable of the Lithium-Ion Batteries

Requirements:

☐ The total length of the communication bus must not exceed 30 m. Keep in mind that the communication bus possibly connects several nodes such as other Sunny Island Charger devices.

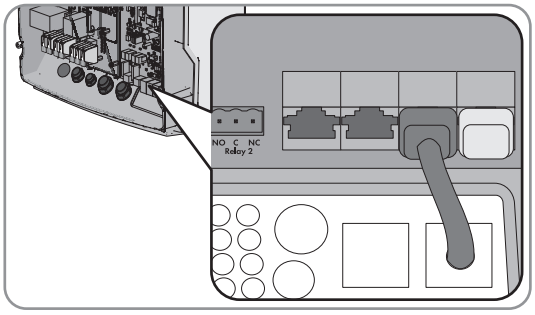
Cable requirements:

☐ Classification: CAT5e

☐ Type of plug: RJ45

Procedure:

1. Plug the data cable into a free pin connector **ComSync** on the Sunny Island. Ensure that the cable is correctly connected (see Section 7.5.4 "Connecting the Data Cable", page 61).



2. Connect the other end of the data cable to the battery management of the lithium-ion battery (see battery manufacturer documentation).
3. Ensure that the communication bus is closed at each end, e.g. with a terminator.

7.4.7.3 Connecting the Communication Product via Speedwire

Requirement:

☐ A Speedwire data module for Sunny Island must be installed (see the installation manual of the SMA Speedwire/ Webconnect data module).

Cable requirements:

☐ Cable length between two nodes:
Maximum 50 m with patch cable
Maximum 100 m with installation cable

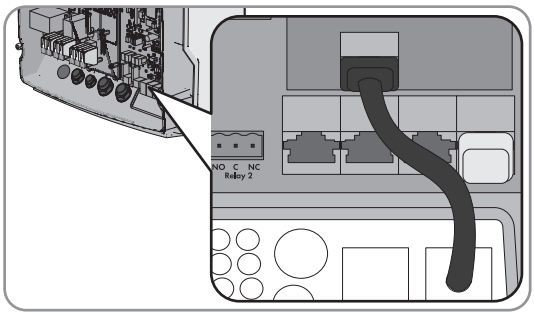
☐ Cross-section: at least 2 x 2 x 0.22 mm² or at least 2 x 2 x 24 AWG

☐ Cable type: 100BaseTx, CAT5 with S-UTP, F-UTP shielding or higher

☐ Type of plug: RJ45

Procedure:

1. On the Sunny Island, insert the data cable into the pin connector of the Speedwire data module (for electrical connection, see the installation manual of the Speedwire data module Sunny Island).



2. Connect the other end of the data cable to the router or network switch.

7.4.7.4 Connecting the Data Cable for the Internal Communication of the Cluster

In a cluster, the Sunny Island inverters communicate via a black data cable.

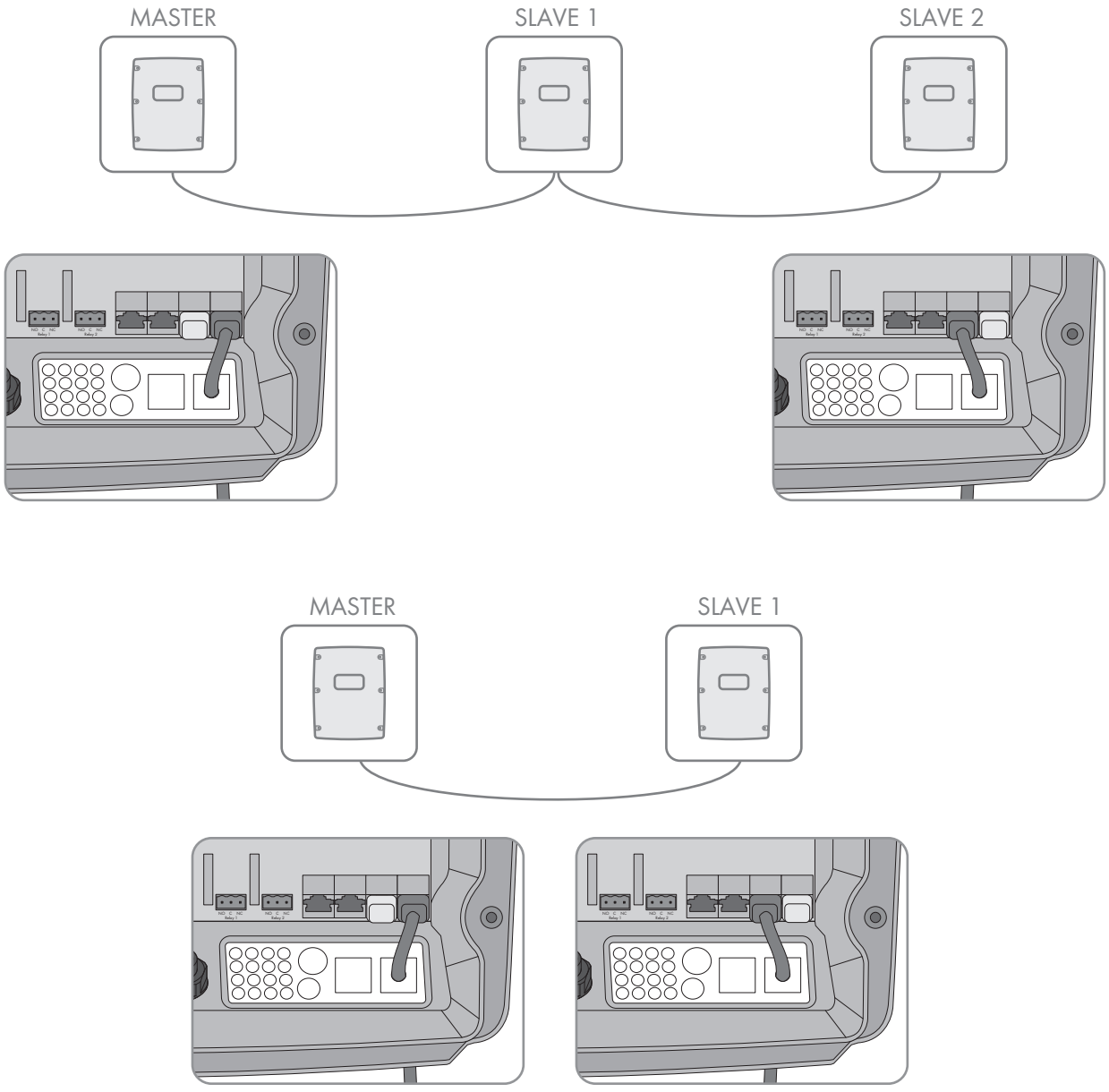
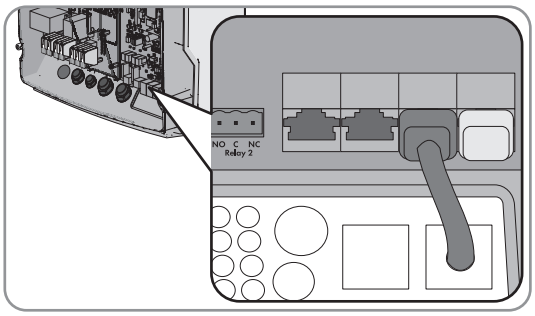


Figure 11: Internal communication cabling

Requirements:

☐ The total length of the communication bus must not exceed 30 m. Keep in mind that the communication bus possibly connects several nodes such as other Sunny Island Charger devices.

1. Plug the data cable into a free pin connector ComSync on the Sunny Island. Ensure that the cable is correctly connected (see Section 7.5.4 "Connecting the Data Cable", page 61).



2. Ensure that the communication bus is closed at each end, e.g. with a terminator.

7.4.7.5 Connecting the Data Cable of the Sunny Island Charger 50 Charge Controller

Relevant for off-grid systems

A maximum of four Sunny Island Charger 50 devices can be connected per cluster (see the quick reference guide "Off-Grid Systems").

Requirements:

☐ The total length of the communication bus must not exceed 30 m. Keep in mind that the communication bus possibly connects several nodes such as other Sunny Island Charger devices.

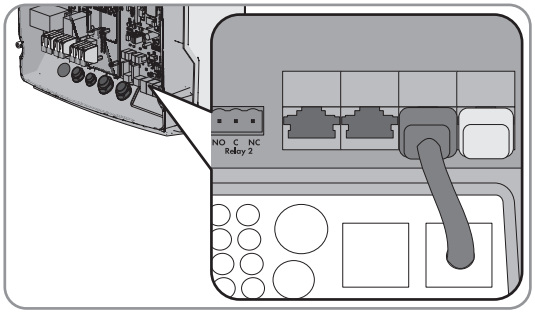
Cable requirements:

☐ Classification: CAT5e

☐ Type of plug: RJ45

Procedure:

1. Plug the data cable into a free pin connector **ComSync** on the Sunny Island. Ensure that the cable is correctly connected (see Section 7.5.4 "Connecting the Data Cable", page 61).



2. Connect the other end of the data cable to one Sunny Island Charger 50 and further Sunny Island Charger 50 devices to one another (see documentation for the Sunny Island Charger 50 charge controller).
3. Ensure that the communication bus is closed at each end, e.g. with a terminator.

7.4.7.6 Connecting the Data Cable of the Multicluster-Box

For a multicluster system, the Multicluster-Box communicates with the master of the main cluster via a black data cable (see Multicluster-Box documentation). The black data cable is part of the scope of delivery of the Multicluster-Box.

Requirements:

☐ The total length of the communication bus must not exceed 30 m. Keep in mind that the communication bus possibly connects several nodes such as other Sunny Island Charger devices.

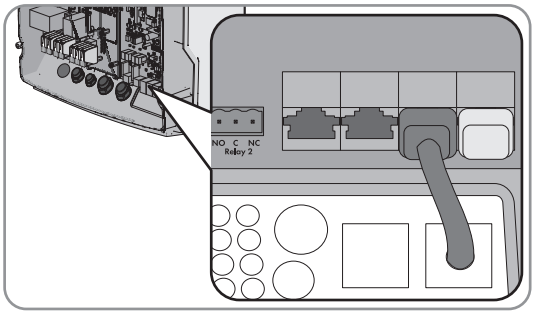
Cable requirements:

☐ Classification: CAT5e

☐ Type of plug: RJ45

Procedure:

1. Plug the data cable into a free pin connector **ComSync** on the Sunny Island. Ensure that the cable is correctly connected (see Section 7.5.4 "Connecting the Data Cable", page 61).



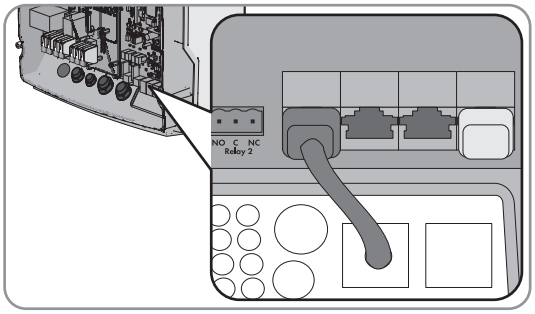
2. Connect the other end of the data cable to the Multicluster-Box (see Multicluster-Box documentation).
3. Ensure that the communication bus is closed at each end, e.g. with a terminator.

7.4.7.7 Connecting Control and Measuring Cables of the Multicluster-Box

For a multicluster system, the Multicluster-Box communicates control and measuring data with the three Sunny Island inverters of the main cluster via three red data cables (see Multicluster-Box documentation). The red data cables are part of the scope of delivery of the Multicluster-Box.

Procedure:

- Plug the red data cables into the pin connector **BackupVtgCur** on the Sunny Island units of the main cluster (see Section 7.5.4 "Connecting the Data Cable", page 61). Adhere to the following assignment when doing so:



- Connect the master with the **Mstr./L1** connection of the Multicluster-Box.
- Connect slave 1 with the **Slv1./L2** connection of the Multicluster-Box.
- Connect slave 2 with the **Slv2./L3** connection of the Multicluster-Box.
- Connect the master with the **Mstr./L1** connection of the Multicluster-Box.
- Connect slave 1 with the **Slv1./L2** connection of the Multicluster-Box.
- Connect slave 2 with the **Slv2./L3** connection of the Multicluster-Box.

7.4.7.8 Connecting the Data Cables for Multicluster Communication

In a multicluster system, the masters of the various clusters communicate with each other (see Multicluster-Box documentation). An SI-SYSCAN.BGx communication interface must be installed in each master for Multicluster communication. This communication is not necessary for a multicluster system with one cluster. If the Sunny Island was ordered with the **Communication for multicluster system** order option, SI-SYSCAN.BGx is installed in each master.

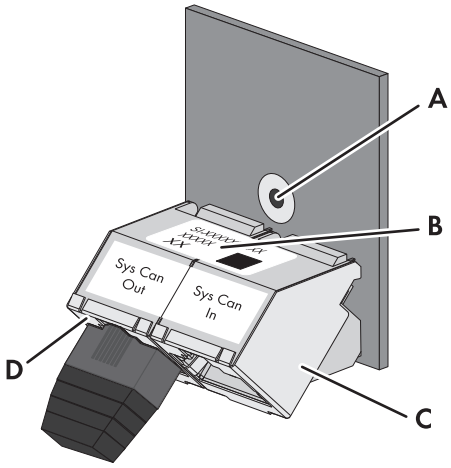


Figure 12: Design of the SI-SYSCAN.BGx

Position	Designation
A	Mounting hole
B	Type label
C	**SysCanIn** pin connector
D	Pin connector **SysCanOutPin**

Cable requirements:

☐ Classification: CAT5e

☐ Maximum cable length: 30 m

Procedure:

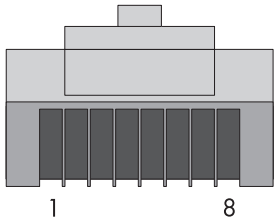
1. If no SI-SYSCAN.BGx communication interface is installed, install SI-SYSCAN.BGx in each master (see SI-SYSCAN-NR documentation).
2. Remove the terminator from the **SysCanOut** pin connector on the master of the main cluster and plug it into the SysCanIn pin connector.
3. Plug the yellow data cable into the **SysCanOut** pin connector on the main cluster master (see Section 7.5.4 "Connecting the Data Cable", page 61).
4. Plug the other end of the yellow data cable into the SysCanIn pin connector on the master of the extension cluster 1.
5. Connect the other extension clusters with each other as described in steps 3 and 4. Remove the terminators for this.
6. Leave the terminator plugged into the unused **SysCanOut** pin connector. This terminates the communication bus.

7.4.7.9 Connecting the Communication Device via RS485

Relevant for off-grid systems

The **SI-COMSMA.BGx** communication interface is required for RS485 communication with a communication device or other SMA products (e.g., PV inverter). If the Sunny Island was ordered with the **Communication for RS485** order option, the SI-COMSMA.BGx is installed on each master.

Plug assignment:



Pin	Signal	Color coding of the insulated conductors
2	GND	Orange with white stripes
3	Data+ (A)	White with green stripes
6	Data– (B)	Green with white stripes

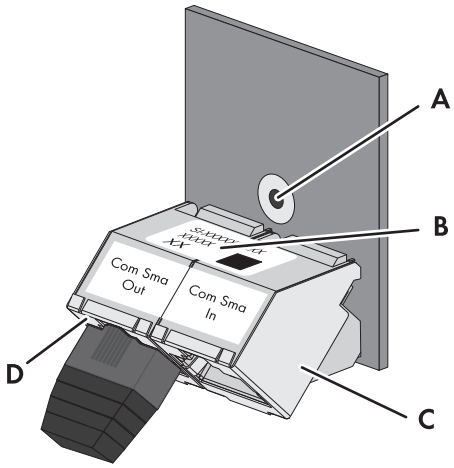


Figure 13: Design of the SI-COMSMA.BGx

Position	Designation
A	Mounting hole
B	Type label
C	**ComSmaIn** pin connector
D	**ComSmaOut** pin connector

Cable requirements:

☐ Classification: CAT5e

☐ Maximum cable length: 1200 m

Procedure:

1. If an SI-COMSMA.BGx is not installed in the Sunny Island, install an SI-COMSMA.BGx in the Sunny Island (see SI-COMSMA-NR mounting instructions):
   - In single systems, install an SI-COMSMA.BGx in the Sunny Island.
   - In a single-cluster system, install an SI-COMSMA.BGx in the master.

- In a multicluster system, install an SI-COMSMA.BGx in each master.

2. Plug the white data cable into the **ComSmaIn** pin connector on the communication device (see Section 7.5.4 "Connecting the Data Cable", page 61).
3. In a single-cluster system, plug the white data cable into the **ComSmaIn** pin connector on the master (see Section 7.5.4 "Connecting the Data Cable", page 61).
4. In a multicluster system, connect the masters to each other:
   - Remove the terminator from the **ComSmaOut** pin connector on the master of the main cluster.
   - Plug the gray data cable into the **ComSmaOut** pin connector on the master of the main cluster.
   - Plug the gray data cable into the **ComSmaIn** pin connector on the master of the extension cluster 1.
   - Connect the other extension clusters with each other as described.
5. Leave the terminator plugged into the unused **ComSmaOut** pin connector. This terminates the communication bus.

7.4.8 Connecting the Battery Temperature Sensor

With lead-acid batteries, the battery management of the Sunny Island inverter must record the temperature of the connected battery.

Battery temperature sensor in a cluster

Only the master measures the battery temperature in a cluster.

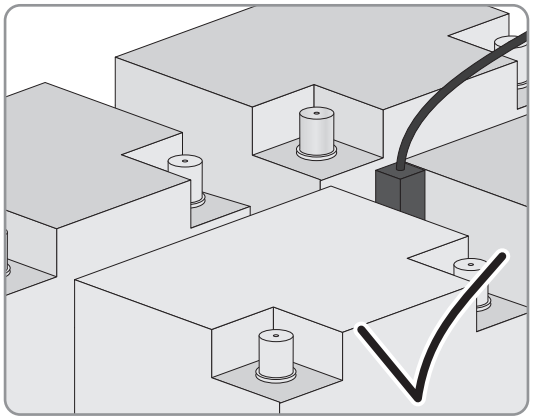
- Connect the battery temperature sensor only to the master.

NOTICE

Damage to the battery due to excessive charging voltage

Due to incorrect temperature measurements, the Sunny Island charges the battery with an incorrect charging voltage.

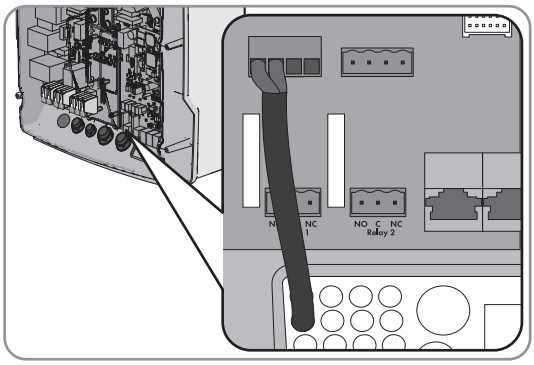
- Connect only the battery temperature sensor supplied.
- Attach the battery temperature sensor in the centre of the battery-storage system, in the upper third of the battery cell.



☑ The battery temperature sensor measures the warmest point of the battery-storage system.

Procedure:

- On the Sunny Island, connect both insulated conductors of the sensor to the **BatTmp** terminal (see Section 7.5.6 "Connecting BatVtgOut, DigIn, BatTMP and BatCur", page 63). In this case, the polarity is arbitrary.



7.4.9 Connecting the Battery Current Sensor in the Off-Grid System

Relevant for off-grid systems

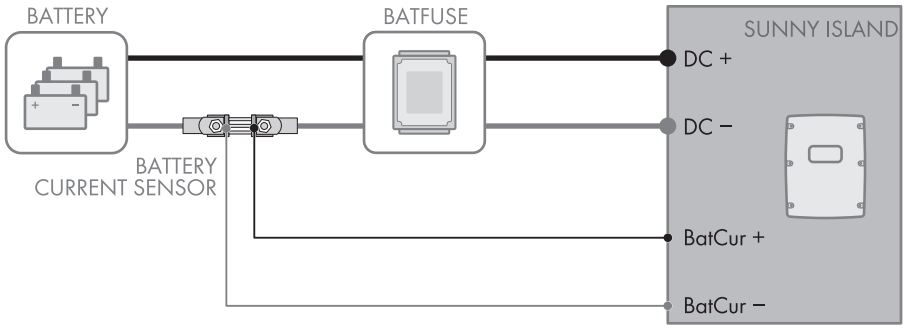


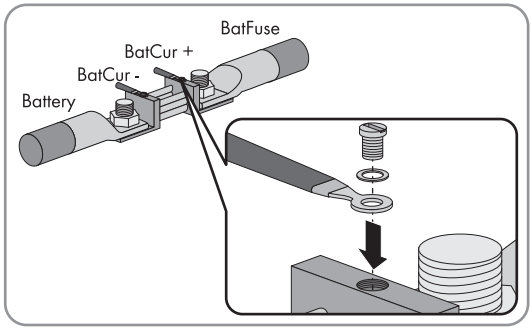
Figure 14: Connection of the battery current sensor to the Sunny Island.

Cable requirements:

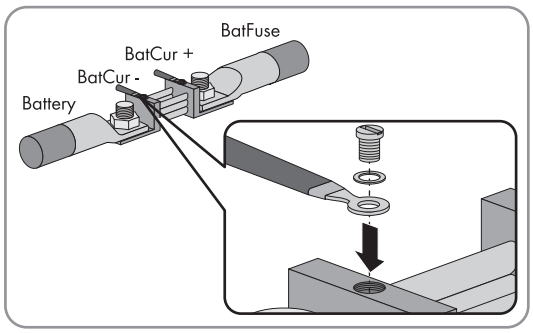
- ☐ Copper wire
- ☐ Maximum cable length: 3 m
- ☐ Conductor cross-section: 0.2 mm² to 2.5 mm²
- ☐ A measuring cable with intrinsically safe current circuits must be used. For this purpose, "intrinsically safe" means that the cable is double-insulated and that, in the event of a short circuit, the conductor melts but the insulation remains intact. In addition, the cable is not combustible.
- ☐ Insulated conductors in the measuring cable must be twisted.

Procedure:

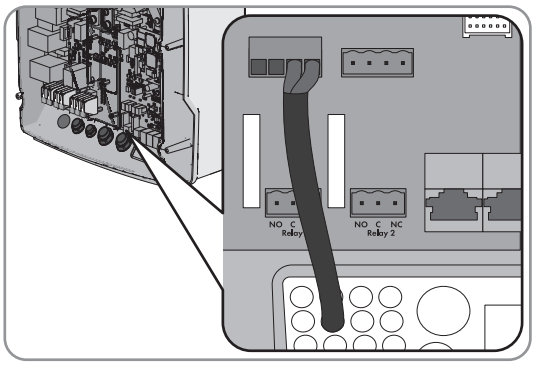
1. Install the battery current sensor on the **DC–** power cable between the battery and BatFuse.
2. Connect the **BatCur+** insulated measuring conductor to the side for connecting the BatFuse on the battery current sensor.



3. Connect the **BatCur–** insulated measuring conductor to the side for connecting the battery on the battery current sensor.



4. On the Sunny Island, connect the insulated conductors to the terminals **BatCur +** and **BatCur–**. Ensure that the cable is correctly connected (see Section 7.5.6 "Connecting BatVtgOut, DigIn, BatTMP and BatCur", page 63).



7.4.10 Connecting the Control Cable for Autostart Generators

Relevant for off-grid systems

Autostart generators are started and stopped with a contact.

Signal generator or generator control in a cluster

Slaves control the generator less reliably than masters do.

- Connect the generator control preferably to the master.
- In a multicluster system, always connect the signal generator to the master of the main cluster.

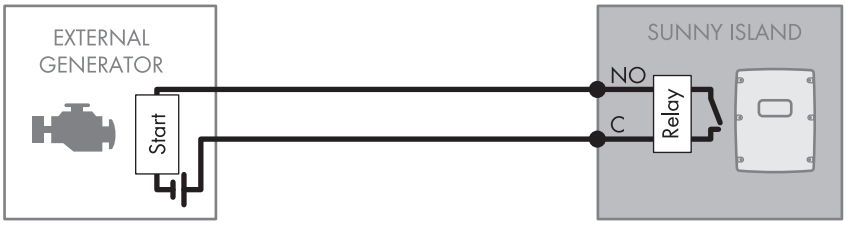


Figure 15: Connecting the Generator Control to Sunny Island

Requirements:

☐ The technical requirements of the multifunction relay must be met (see Section 10 "Technical Data", page 108).

Cable requirements:

☐ Copper wire

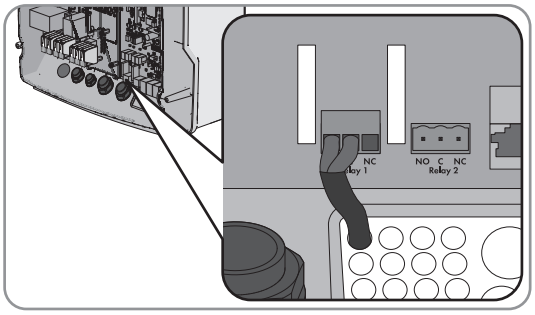
☐ Conductor cross-section: 0.2 mm² to 2.5 mm²

Procedure:

1. **⚠ WARNING**

   Danger to life from electric shock due to incorrect insulation

   - Connect the control cable to the multifunction relay **Relay1** on the Sunny Island (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62). Since the default setting of the Sunny Island uses the multifunction relay **Relay1** for generator request. Use the **C** and **NO** connections.



   - Connect the control cable to the multifunction relay **Relay2** on the Sunny Island (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62) if the multifunction relay **Relay1** for generator request is not available. Use the **C** and **NO** connections.

2. Enter the configuration **AutoGn** into the table of the settings (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).

7.4.11 Connecting a Signaler for Generators Without an Autostart Function

Relevant for off-grid systems

Generators without an autostart function do not have electric starting devices. If you install a generator without an autostart function, you can connect a signal generator (e.g., signal lamp) to the multifunction relay of the Sunny Island inverter. As a result, the Sunny Island can signal when the generator is to be manually started and stopped.

i Signal generator or generator control in a cluster

Slaves control the generator less reliably than masters do.

- Connect the generator control preferably to the master.
- In a multicluster system, always connect the signal generator to the master of the main cluster.

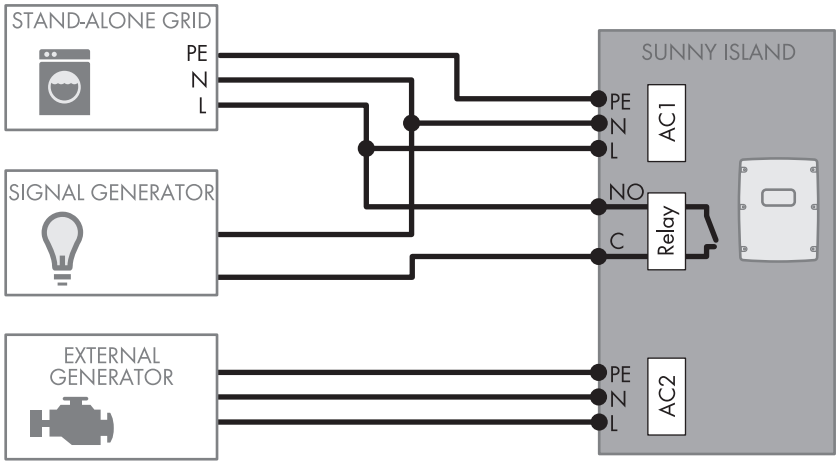


Figure 16: Connecting a Signal Generator to Signal a Generator Request (Example)

Requirements:

☐ The technical requirements of the multifunction relay must be met (see Section 10 "Technical Data", page 108).

Cable requirements:

☐ Copper wire

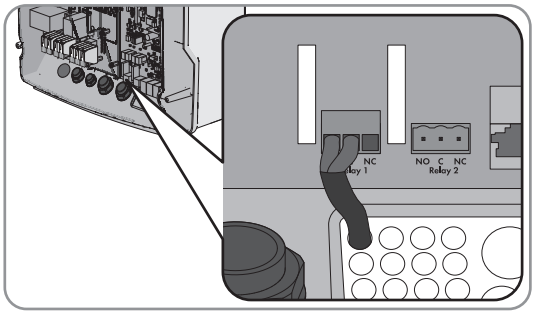
☐ Conductor cross-section: 0.2 mm² to 2.5 mm²

Procedure:

1. **⚠ WARNING**

   Danger to life from electric shock due to incorrect insulation

   - Connect the control cable to the multifunction relay **Relay1** on the Sunny Island (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62). Since the default setting of the Sunny Island uses the multifunction relay **Relay1** for generator request. Use the **C** and **NO** connections.



   - Connect the control cable to the multifunction relay **Relay2** on the Sunny Island (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62) if the multifunction relay **Relay1** for generator request is not available. Use the **C** and **NO** connections.

2. Enter the configuration **AutoGn** into the table of the settings (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).

7.4.12 Connecting Load-Shedding Contactors

Relevant for off-grid systems

Load shedding prevents the battery deep discharge and controls the power output to the loads. Load shedding provides the option of disconnecting specific loads from the system.

Load shedding is necessary for an off-grid system that is exclusively supplied with PV energy or wind energy.

The Sunny Island controls up to two load-shedding contactors depending on the state of charge of the battery. You can install two types of load shedding:

- One-level load shedding
  If the battery state of charge limit has been reached, one load-shedding contactor disconnects all loads at the same time. Depending on the configuration, the load-shedding contactor closes when the battery has been sufficiently charged or when the stand-alone grid has been switched to an external energy source.
- Two-level load shedding
  In two-level load shedding, there are two thresholds for the state of charge of the battery in order to control two load-shedding contactors. When the first threshold for the state of charge of the battery is reached, the first load-shedding contactor disconnects a group of loads. When the second threshold for the state of charge of the battery is reached, the second load-shedding contactor disconnects the remaining loads.

i Load shedding in a multicluster system

One-level load shedding is integrated into the Multicluster-Box. The load-shedding contactor is controlled directly by the master of the main cluster via communication with the Multicluster-Box. If you install an additional load-shedding contactor in a multicluster system, it is controlled with a multifunction relay in the master of extension cluster 1. Additional load-shedding contactors cannot be controlled by the main cluster.

i Load-shedding contactors in a cluster

If you connect load-shedding contactors to the master, limited operation is possible in the event of a disturbance. Slaves can control the load-shedding contactors less reliably in the event of a fault. In the event of a disturbance, the slave may wait for confirmation from the master.

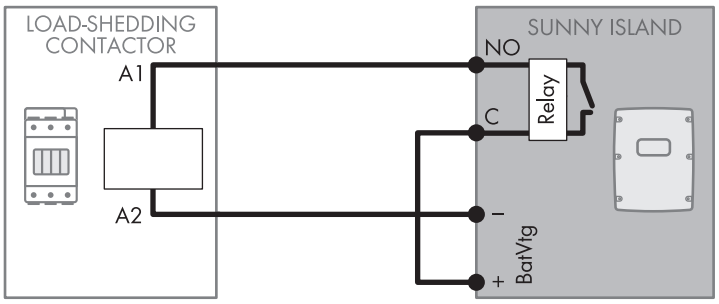


Figure 17: Connection of control cable for one-level load shedding (example)

Requirements:

☐ The technical requirements of the multifunction relay must be met (see Section 10 "Technical Data", page 108).

Cable requirements:

☐ Copper wire

☐ Conductor cross-section: 0.2 mm² to 2.5 mm²

Procedure:

1. Ensure that the load-shedding contactor only disconnects loads from the system. This ensures that the battery can be recharged from AC sources in the system.
2. When connecting the load shedding, preferably use the multifunction relay **Relay2**. Since the default setting of Sunny Island uses the multifunction relay **Relay2** for load shedding. Perform the following steps:
   - Connect the insulated conductor for coil connection **A1** of the load-shedding contactor on the Sunny Island to terminal **Relay2 NO** (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62).
   - Connect the insulated conductor for coil connection **A2** to terminal **BatVtgOut–** .
   - Connect terminal **BatVtgOut +** to terminal **Relay2 C**. Use the same conductor cross-section as that of the cable for the load-shedding contactor.
3. If the multifunction relay **Relay2** for load shedding is not available, use the multifunction relay **Relay1** when connecting the load shedding. Perform the following steps:
   - Connect the insulated conductor for coil connection **A1** of the load-shedding contactor on the Sunny Island to terminal **Relay1 NO** (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62).
   - Connect the insulated conductor for coil connection **A2** to terminal **BatVtgOut–** .
   - Connect terminal **BatVtgOut +** to terminal **Relay1 C**. Use the same conductor cross-section as that of the cable for the load-shedding contactor.
4. Enter the selected configuration into the table of the settings (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73):

Value	Explanation
AutoLodExt	Setting for one-level load shedding. When the Sunny Island switches to an external energy source, load shedding is stopped and the loads are supplied by the external energy source. The battery is only charged with the excess energy.
AutoLod1Soc	Setting for one-level load shedding or the first level of two-level load shedding. Load shedding is only stopped when the battery has been sufficiently charged.
AutoLod2Soc	Setting for the second level of two-level load shedding. Load shedding is only stopped when the battery has been sufficiently charged.
MccAutoLod	Setting for additional one-level load shedding in a multicluster system. Load shedding is only stopped when the batteries of the extension cluster have been sufficiently charged.

Value	Explanation

5. Repeat steps 1 to 5 for two-level load shedding. Connect the second load-shedding contactor to an unused multifunction relay.

7.4.13 Connecting the Time Control for External Processes

The Sunny Island has two timers for time-dependent control of external processes. For each timer, you can set the starting day and time that the multifunction relay is to be switched once, daily or weekly.

Requirements:

☐ The technical requirements of the multifunction relay must be met (see Section 10 "Technical Data", page 108).

Cable requirements:

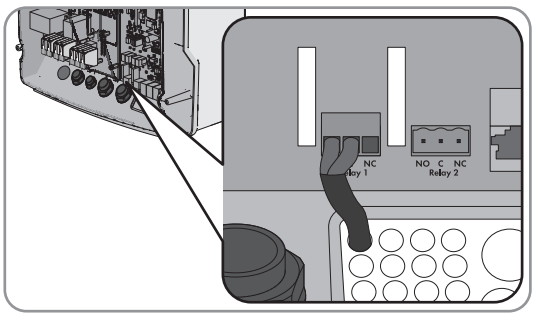
☐ Copper wire

☐ Conductor cross-section: 0.2 mm² to 2.5 mm²

1. **⚠ WARNING**

   Danger to life from electric shock due to incorrect insulation

   - Connect the control cable on the Sunny Island to either multifunction relay **Relay1** or **Relay2** (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62). Use the **C** and **NO** connections.



2. During configuration, enter the value **TM1** for timer 1 or the value **TM2** for timer 2 in the table of settings (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).

7.4.14 Connecting Message Devices for Operating States and Warning Messages

You can connect message devices to the multifunction relays to allow operating states and warning messages from the Sunny Island inverter to be output. One of the following operating states and warning messages can be displayed for each multifunction relay:

- The PV array is running and is connected.
- Voltage and frequency of the utility grid are within the range for connection.
- A Sunny Island displays an error message of level 2 or higher. Only the error messages within a cluster are evaluated here.

i Different control logic for error messages of level 2 or higher

A different control logic of level 2 ensures that the error message will also be displayed in the case of automatic shutdown.

- When an error message of level 2 is pending, the multifunction relay is deactivated.
- When no error message is pending, the multifunction relay is activated.

- A Sunny Island displays a warning. Only the warnings within a cluster are evaluated here.
- The Sunny Island is in operation in a single system.
- The respective cluster is in operation in a cluster system.
- The Sunny Island is in derating in a single system.
- The respective cluster is in derating in a cluster system.

Requirements:

☐ The technical requirements of the multifunction relay must be met (see Section 10 "Technical Data", page 108).

Cable requirements:

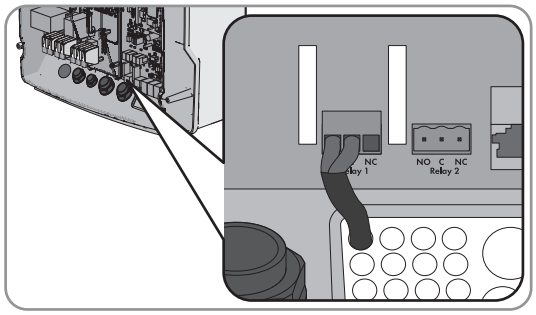
☐ Copper wire

☐ Conductor cross-section: 0.2 mm² to 2.5 mm²

1. **⚠ WARNING**

   Danger to life from electric shock due to incorrect insulation

   - Connect the control cable on the Sunny Island to either multifunction relay **Relay1** or **Relay2** (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62). Use the **C** and **NO** connections.



2. Enter the selected configuration into the table of the settings (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73):

Value	Version
GnRn	The PV array is running and is connected.
ExtVfOk	Voltage and frequency of the generator are within the range for connection.
GdOn	The utility grid is connected in the off-grid system.
Error	A Sunny Island displays an error message of level 2 or higher.
Warn	A Sunny Island displays a warning.
Run	In a single system, the Sunny Island is operating, or in a cluster system, the cluster is operating.
Overload	In a single system, a Sunny Island is in derating, or in a cluster system, the cluster is in derating.

7.4.15 Connecting the Battery Room Fan

If the charging current leads to the emission of gases from the battery, the battery room fan is switched on by the Sunny Island for at least one hour.

Requirements:

☐ The technical requirements of the multifunction relay must be met (see Section 10 "Technical Data", page 108).

Cable requirements:

☐ Copper wire

☐ Conductor cross-section: 0.2 mm² to 2.5 mm²

Procedure:

The battery management of the Sunny Island inverter is able to control one battery room fan for each battery. The following options result for the connection:

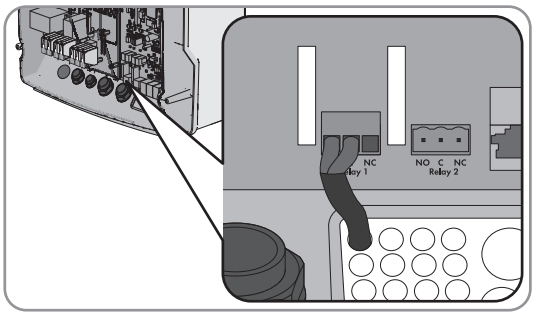
- Control a separate battery room fan for each battery.
- Control one battery room fan for all batteries. This is only an option with multicluster systems.

Controlling a separate battery room fan for each battery

1. Ensure that the battery room is sufficiently ventilated in the case of a malfunction of the multifunction relay.
2. **⚠ WARNING**

   Danger to life from electric shock due to incorrect insulation

   - With single systems or single-cluster systems, connect the battery room fan to a multifunction relay (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62) and enter the configuration **BatFan** into the table of settings (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).



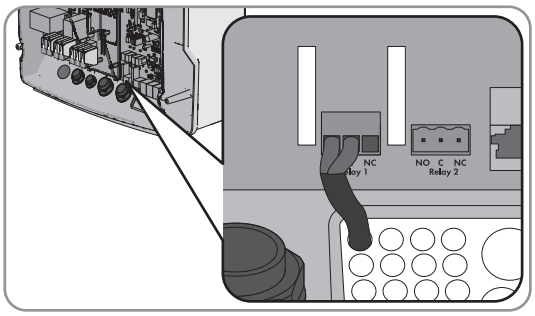
   - With a multicluster system, connect in each cluster a battery room fan to a multifunction relay on one of the Sunny Islands (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62) and enter the configuration **BatFan** into the table of settings (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).

Controlling One Battery Room Fan For All Batteries

1. Ensure that the battery room is sufficiently ventilated in the case of a malfunction of the multifunction relay.
2. **⚠ WARNING**

   Danger to life from electric shock due to incorrect insulation

   - Connect the battery room fan to one multifunction relay on a Sunny Island of the main cluster (see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62).



3. Enter the configuration **MccBatFan** into the table of the settings (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).

7.4.16 Connecting the Electrolyte Pump for the Battery

The Sunny Island controls the electrolyte pump for the battery as follows:

- The Sunny Island switches on the electrolyte pump at least once a day.
- The Sunny Island switches on the electrolyte pump a maximum of nine times each day.
- When the battery has been charged to 10% of its rated capacity, the Sunny Island switches the electrolyte pump on for five minutes.

Requirements:

☐ The technical requirements of the multifunction relay must be met (see Section 10 "Technical Data", page 108).

Cable requirements:

☐ Copper wire

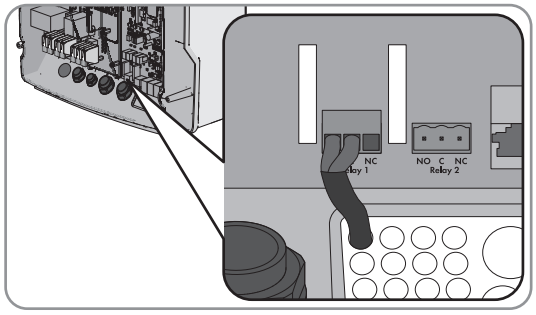
☐ Conductor cross-section: 0.2 mm² to 2.5 mm²

Procedure:

1. **⚠ WARNING**

   Danger to life from electric shock due to incorrect insulation

   - On the Sunny Island, connect the control cable of the acid circulation to a multifunction relay(see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62).



2. For a multicluster system, repeat step 1 for every cluster.
3. Enter the configuration **AcdCir** into the table of the settings (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).

7.4.17 Connecting the Control Cable for the Use of Excess Energy in an Off-Grid System

Relevant for off-grid systems

If the battery can no longer take up excess energy in an off-grid system, the power output of the AC sources in the stand-alone grid is limited by the Sunny Island. This means that the excess energy is not used. The Sunny Island allows for the use of excess energy by means of a multifunction relay.

During the constant voltage phase, a multifunction relay is activated and thus controls additional loads that can put any excess energy to good use. As a result of the utilization of excess energy, the Sunny Island has to limit the power output of the AC sources in the stand-alone grid to a lesser extent.

Example: Utilization of excess energy

The energy source of an off-grid system is PV energy. On days with high solar irradiation and low power consumption, the battery cannot take up all of the PV energy during the constant voltage phase. In order to utilize the excess energy, the Sunny Island activates the control of a pump that pumps water into a container for subsequent use.

Requirements:

☐ The technical requirements of the multifunction relay must be met (see Section 10 "Technical Data", page 108).

Cable requirements:

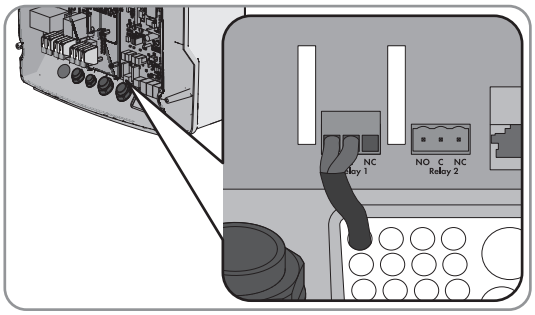
☐ Copper wire

☐ Conductor cross-section: 0.2 mm² to 2.5 mm²

1. **⚠ WARNING**

   Danger to life from electric shock due to incorrect insulation

   - On the Sunny Island, connect the control cable for the utilization of excess energy to the multifunction relay(see Section 7.5.5 "Connecting Relay 1 and Relay 2", page 62).



2. Enter the configuration **ExtPwrDer** into the table of the settings (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).
3. After performing basic system configuration, adjust the multifunction relay (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73) and function (see Section 8.3.6 "Setting Utilization of Excess Energy in Off-Grid Systems", page 92).

7.4.18 Connecting the Signal Cable of the External Generator Request

Relevant for off-grid systems

An external control signal can transmit a generator request to the generator management. If you have configured the generator management for the external generator request, the generator management starts the generator if there is a high level present. The generator management stops the generator if there is a low level. As a result, all generator run times are complied with.

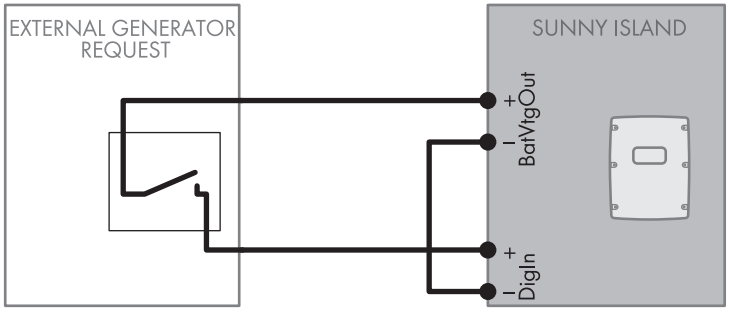


Figure 18: Connection of the control cable of an external generator request (example).

Requirements:

☐ The technical requirements of the multifunction relay must be met (see Section 10 "Technical Data", page 108).

Cable requirements:

☐ Copper wire

☐ Conductor cross-section: 0.2 mm² to 2.5 mm²

1. On the Sunny Island, connect one insulated conductor of the control cable to terminal **BatVtgOut+** (see Section 7.5.6 "Connecting BatVtgOut, DigIn, BatTMP and BatCur", page 63).
2. Connect one insulated conductor of the control cable to terminal **DigIn +**.
3. Connect terminal **BatVtgOut–** to terminal **DigIn –**. Use the same conductor as in the control cable.

7.5 Connecting the Cables

7.5.1 Connecting the DC Power Cable

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

- ☐ Ethanol
- ☐ 2 terminal lugs M8, 20 mm to 25 mm wide

Cable requirements:

- ☐ Conductor cross-section: 50 mm² to 95 mm²
- ☐ Cable diameters: 14 mm to 25 mm
  Cable diameter when using a BatFuse: 14 mm to 21 mm

⚠ WARNING

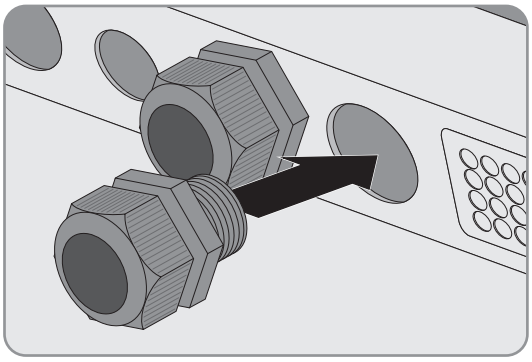
Danger to life due to incompatible lithium-ion battery

An incompatible lithium-ion battery can lead to a fire or an explosion. With incompatible lithium-ion batteries, it is not ensured that battery management is intrinsically safe and will protect the battery.

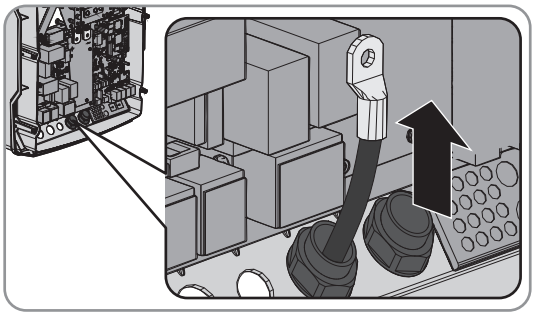
- Verify that the battery complies with locally applicable standards and directives and is intrinsically safe.
- Ensure that the lithium-ion batteries are approved for use with the Sunny Island. The list of lithium-ion batteries approved for the Sunny Island is updated regularly (see the technical information "List of Approved Lithium-Ion Batteries" at www.SMA-Solar.com).
- If no lithium-ion batteries approved for the Sunny Island can be used, lead-acid batteries can be used.

Procedure:

1. Ensure that the load-break switch of the BatFuse is open and secured against reconnection.
2. Loosen all screws of the enclosure lid and remove the enclosure lid. Retain the screws and conical spring washers for later use.
3. Clean the contact surfaces of the **DC+** and **DC-** connections, for example, with ethanol. This reduces the transition resistance on the contact surfaces. A low transition resistance increases the system stability and minimizes the risk of damage to the Sunny Island.
4. Strip off the insulation of the **DC+** cable and mount a terminal lug.
5. Attach two M32 cable glands with counter nuts to the **DC+** and **DC−** enclosure openings (torque: 12 Nm).



6. Lead the **DC+** cable through the **DC+** cable gland into the Sunny Island.

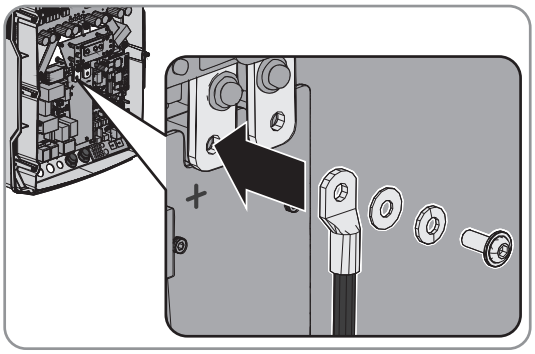


7. **NOTICE**

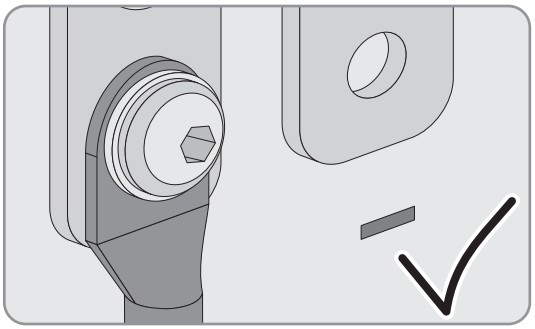
   Damage to Sunny Island inverter due to reverse polarity or incorrect terminal lug selection

   If the DC cables are swapped, high currents will flow after the load-break switch has closed and these can damage the Sunny Island.

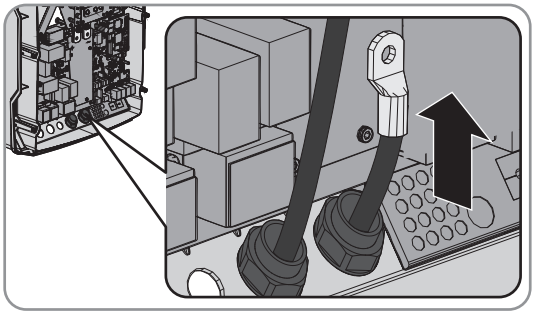
   - Route the **DC+** cable on the side of the protective cover marked with a + symbol.
   - Use an Allen key (AF 5) to fasten the **DC+** cable to the **DC+** connection with an M8x20 screw (torque: 12 Nm). Be sure to adhere to the following screw assembly: screw head | spring washer | fender washer | terminal lug | DC connection.



8. Ensure that the entire contact surface of the fender washer is in contact with the terminal lug.

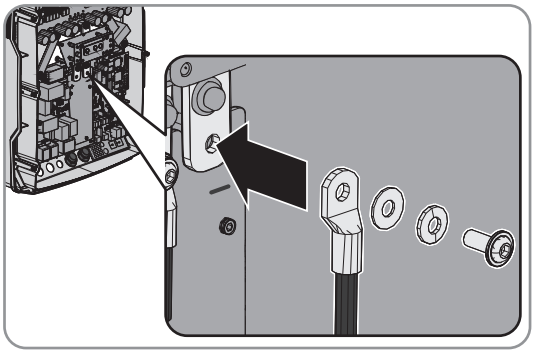


9. Strip off the insulation of the **DC–** cable and mount a terminal lug.
10. Lead the **DC–** cable through the **DC–** cable gland into the Sunny Island.

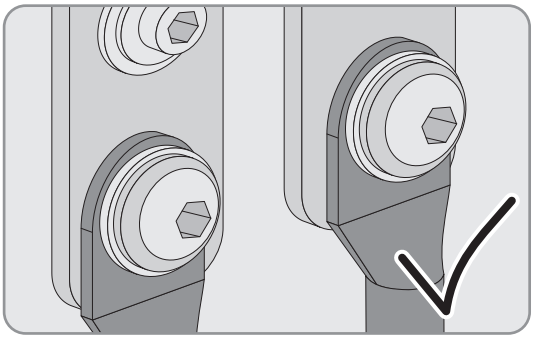


11. Route the **DC–** cable on the side of the protective cover marked with a – symbol.

12. Use an Allen key (AF 5) to fasten the **DC–** cable to the **DC–** connection with an M8x20 screw (torque: 12 Nm). Be sure to adhere to the following screw assembly: screw head | spring washer | fender washer | terminal lug | DC connection.



13. Ensure that the entire contact surface of the fender washer is in contact with the terminal lug.



14. Tighten the swivel nuts of the cable glands (torque 4.5 Nm).

7.5.2 Connecting the AC Power Cable

Always proceed as follows to connect the power cables.

Cable requirements:

- ☐ Copper wire
- ☐ Conductor cross-section: maximum 16 mm²
- ☐ Cable diameters: 9 mm to 18 mm

⚠ WARNING

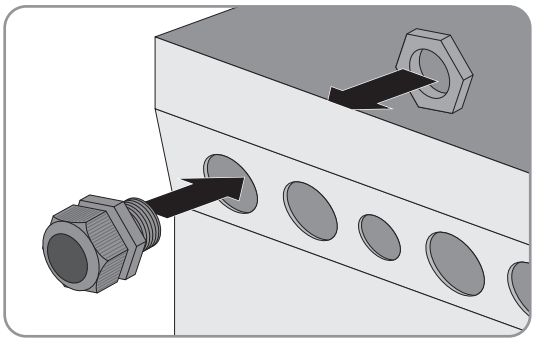
Danger to life from electric shock due to incorrect connection of the neutral conductor

The neutral conductor of the external energy source is firmly connected to the neutral conductor of the Sunny Island inverter on connection **AC2 Gen/Grid N**. Upon disconnection of the external energy source, the Sunny Island only disconnects the line conductor on connection **AC2 Gen/Grid N**. The Sunny Island disconnects all poles from the external energy source on connection **AC2 Gen/Grid N_{TT}**. If the neutral conductor is incorrectly connected on connection **AC2**, the protective functions in the system can fail. This can result in death or serious injury.

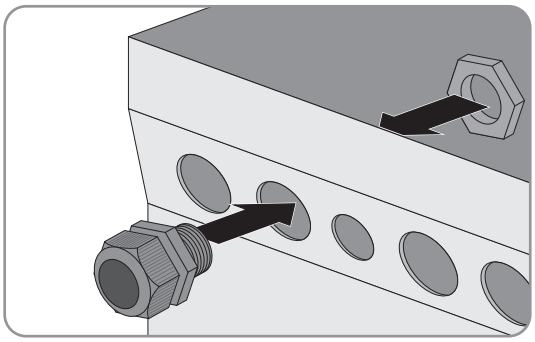
- Always connect the neutral conductor to the connection **AC2 Gen/Grid N_{TT}** in systems for increased self-consumption.
- Always connect the neutral conductor to the connection **AC2 Gen/Grid N_{TT}** in battery backup systems.
- Always connect the neutral conductor of the generator to the connection **AC2 Gen/Grid N** in off-grid systems.

Procedure:

1. Move the levers of the terminals upward at **AC1** or **AC2**.
2. When connecting the cable to connection **AC1**, attach the M25 cable gland to the **AC1** enclosure opening using the counter nut (torque: 7 Nm).



3. When connecting the cable to connection **AC2**, attach the M25 cable gland to the **AC2** enclosure opening using the counter nut (torque: 7 Nm).



4. Remove the cable jacket and strip off 13 mm of the the insulation of all conductors.
5. Lead the cable through the cable gland into the Sunny Island.
6. Connect the insulated conductors to the terminals **AC1 Loads/SunnyBoys** or **AC2 Gen/Grid:**
   - Insert the neutral conductor as far as it will go into terminal **N** or **NTT** and push the lever down.
   - Insert the line conductor as far as it will go into terminal **L** and push the lever down.
   - Insert the grounding conductor as far as it will go into terminal **PE** and push the lever down.
7. Tighten the swivel nut of the cable gland (torque: 4 Nm).

7.5.3 Connecting the Grounding Conductor

The Sunny Island must be connected via a grounding conductor on the terminal **AC1** or **AC2** to the ground potential. The conductor cross-section of the grounding conductor must be 10 mm² or larger. If the conductor cross-section is smaller, an additional grounding conductor must connect the Sunny Island with the ground potential.

Additional grounding is fulfilled if the Sunny Island is already grounded due to the grounded battery (see Section 7.3 "Connecting the Grounding Conductor in Systems with a Grounded Battery", page 29).

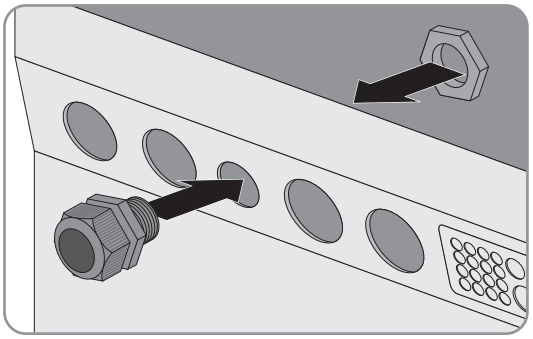
Cable requirements:

☐ Cross-section of the connected line conductor or (maximum 16 mm²)

☐ Cable diameters: 7 mm to 14 mm

Procedure:

1. Push the lever of terminal **AC1 Loads/SunnyBoys PE** or **AC2 Gen/Grid PE** upward.
2. Attach the M20 cable gland to the **PE/ExtVtg** enclosure opening with the counter nut (torque: 5 Nm).



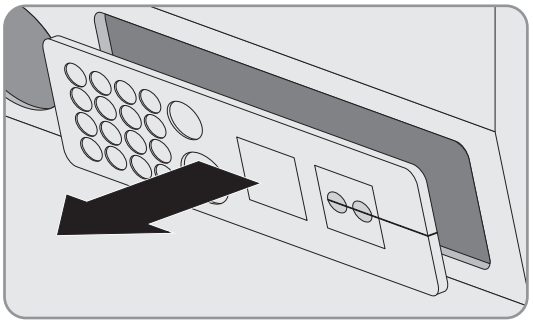
3. Strip off 13 mm of the insulation of the grounding conductor.
4. Lead the cable through the cable gland into the Sunny Island.
5. Insert the grounding conductor as far as it will go into terminal **AC1 Loads/SunnyBoys PE** or **AC2 Gen/Grid PE** and move the lever downward.
6. Tighten the swivel nut of the cable gland (torque: 2.6 Nm).

7.5.4 Connecting the Data Cable

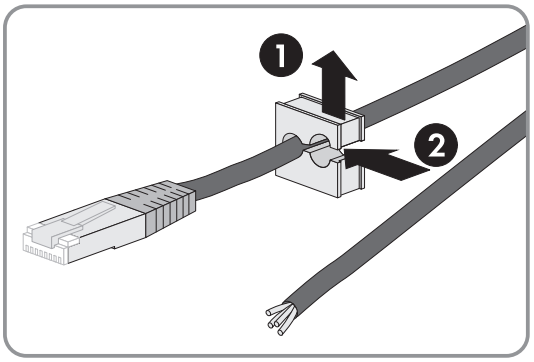
Always proceed as follows to connect data cables.

Procedure:

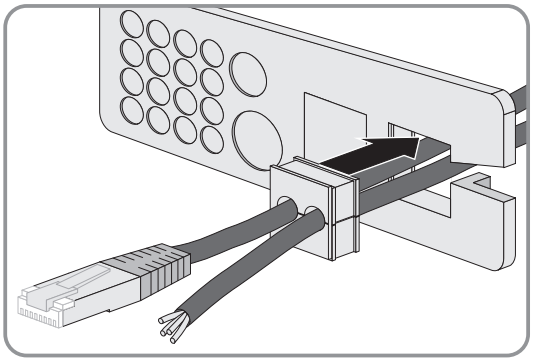
1. Push the cable feed-through plate out of the enclosure from outside.



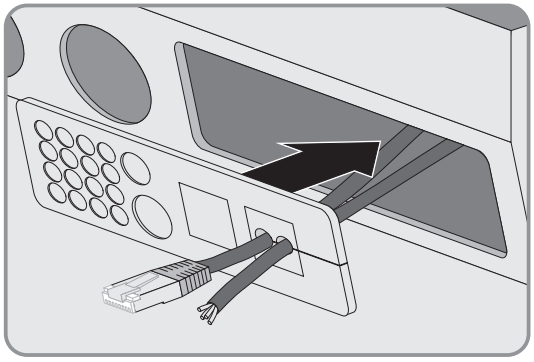
2. Retain the cable feed-through plate for later use.
3. Lead the data cable through the enclosure opening.
4. Connect the data cable.
5. When all data cables are connected, select two cable support sleeves with a suitable number of openings.
6. Open the cable support sleeves and place the cables in the cable support sleeves.



7. Open the cable feed-through plate and insert the cable support sleeves into the cable feed-through plate. Position the flat sides of each cable support sleeve on the flat side in the cable feed-through plate.



8. Hold the cables and push the cable feed-through plate to the enclosure opening of the cable feed-through plate.



9. Hook the cable feed-through plate into the enclosure opening of the cable feed-through plate and press into the enclosure opening.

7.5.5 Connecting Relay 1 and Relay 2

If you are using a multifunction relay, always connect it as follows:

i Switching Behavior of the Slaves

In case of a fault, the multifunction relays of the slaves switch less reliably than the multifunction relays of the masters. In case of a fault, the slaves wait for the master to confirm the fault.

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

☐ Suitable bootlace ferrules if using stranded wire

Requirements:

☐ The technical requirements of the multifunction relay must be met (see Section 10 "Technical Data", page 108).

Cable requirements:

☐ Copper wire

☐ Conductor cross-section: 0.2 mm² to 2.5 mm²

Procedure:

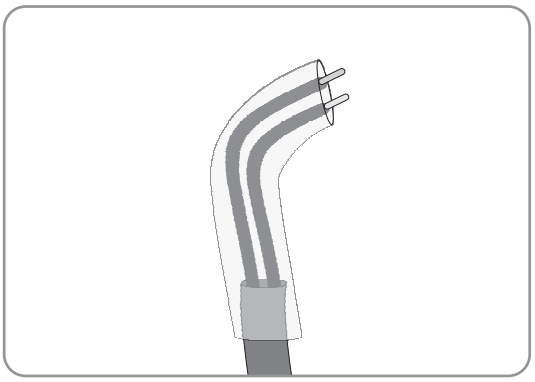
1. Break through a suitable location in the cable feed-through plate with a sharp object.
2. Strip off the insulation from the cable and press bootlace ferrules onto the insulated conductors.
3. Lead the cable through the hole in the cable feed-through plate into the Sunny Island.

4. ⚠ WARNING

Danger to life from electric shock due to incorrect insulation

High voltage can be present in the control cable. Faulty insulation can result in a conductive connection with other cables or components. Live components can be touched due to this connection. Touching can result in death or serious injury due to electric shock.

- Cut the silicon tube to the length of the cable in the Sunny Island.
- Pull the silicone tube over the cable.



☑ The cable is double-insulated.

- Lead the cable into the Sunny Island making sure that it does not touch any data cables.

5. Connect the insulated conductors to the **Relay1** or **Relay2** terminals using the 3-pole terminal (torque: 0.5 Nm to 0.6 Nm):

Terminal	Explanation
NC	Closed when idle
C	Change-over contact
NO	Open when idle

7.5.6 Connecting BatVtgOut, DigIn, BatTMP and BatCur

Always connect the cables to connections **BatVtgOut**, **DigIn**, **BatTMP** and **BatCur** as follows.

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

☐ Suitable bootlace ferrules if using stranded wire

Cable requirements:

☐ Copper wire

☐ Conductor cross-section: 0.2 mm² to 2.5 mm²

Procedure:

1. Break through a suitable location in the cable feed-through plate with a sharp object.
2. Strip the cable.
3. For stranded wires: press the bootlace ferrules onto the insulated conductors.
4. Lead the insulated conductors through the hole in the cable feed-through plate into the Sunny Island.
5. Connect the insulated conductors to the 4-pole terminal (torque: 0.5 Nm to 0.6 Nm).

7.5.7 Connecting ExtVtg

Always connect the cable to the ExtVtg connection as follows.

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

☐ Suitable bootlace ferrules if using stranded wire

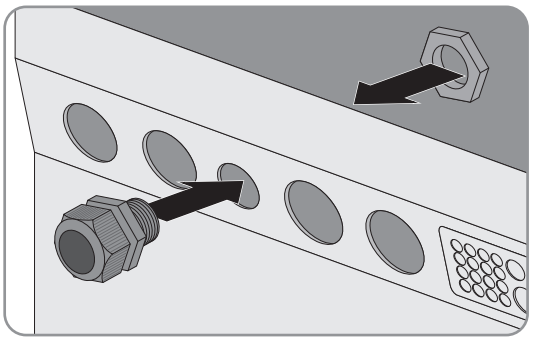
Cable requirements:

☐ Copper wire

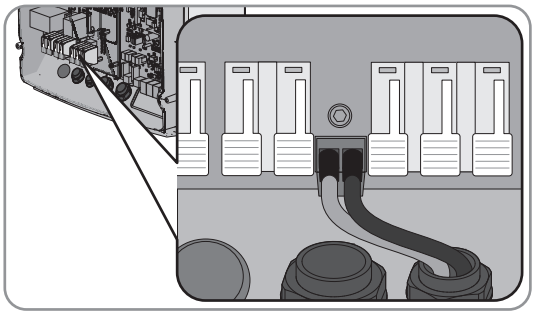
☐ Conductor cross-section: 0.2 mm² to 2.5 mm²

Procedure:

1. On the Sunny Island, attach the M20 cable gland to the **PE/ ExtVtg** enclosure opening with the counter nut (torque: 5 Nm).



2. Strip the cable.
3. For stranded wires: press the bootlace ferrules onto the insulated conductors.
4. Lead the cable through the cable gland into the Sunny Island.
5. Connect the insulated conductors to the **ExtVtg** terminal using the 2-pin terminal (torque: 0.5 Nm to 0.6 Nm) (circuitry overview see Quick Reference Guide "SMA FLEXIBLE STORAGE SYSTEM with Battery-Backup Function"):



   - Connect the line conductor to terminal **ExtVtg L**.
   - Connect the neutral conductor to terminal **ExtVtg N**.
6. Tighten the swivel nut of the cable gland (torque: 2.6 Nm).

7.6 Checking the Wiring

Ensure that you carry out all tests relevant to the system and rectify all detected problems.
Useful hint: Tests can be documented directly in the tables. Cross out all tests not applicable.

Requirement:

☐ All Sunny Island inverters must be voltage-free (see the Sunny Island inverter operating manual).

Checking the Grounding

Test point	Test criterion	OK
Enclosure opening, PE/ExtVtg	Enclosure opening is sealed with a filler plug or M20 cable gland.	☐ ☐
	The cable diameter of the cable must be 7 mm to 14 mm for an M20 cable gland.	☐
Conductor cross-section of the grounding conductor at the **AC1** and **AC2** connections	If one grounding conductor is connected, the conductor cross-section must be at least 10 mm². If two grounding conductors are connected, the cross-section of each conductor must be at least 4 mm².	☐
Grounding conductor connection to ground	The grounding conductor must be grounded, e.g., by connection to a grounding busbar or a foundation ground electrode.	☐
With a TN system, neutral conductor and grounding conductor connection	Ensure by measuring that there is a conductive connection between the neutral conductor and the grounding conductor.	☐
Grounding of the battery	Ensure that the battery is not grounded unintentionally. If the battery has been grounded intentionally, ensure that the conductor cross-section is sufficient (see Section 7.3 "Connecting the Grounding Conductor in Systems with a Grounded Battery", page 29).	☐

Checking the Additional Grounding

If the battery is grounded, you must check the additional grounding on the Sunny Island.

Test point	Test criterion	OK
Conductor cross-section for the additional grounding	The conductor cross-section must correspond to the grounding of the battery.	☐ ☐
Connection of additional grounding	Hexagon socket screw is screwed tight (torque: 4 Nm to 5.7 Nm).	☐
Grounding conductor connection to ground	The grounding conductors must be grounded, e.g., by connection to a grounding busbar or foundation ground electrode.	☐

Connecting the Sunny Island Inverter

Test point	Test criterion	OK
Enclosure opening for DC	In the cable gland M32, the diameter of the DC power cable must be 14 mm to 25 mm.	☐
DC connection	Terminal lugs are pressed on firmly.	☐
	The bolted connection for fitting terminal lugs to the DC connection is assembled as follows: head of M8x20 screw | spring washer | fender washer | terminal lug | DC connection.	☐
	Terminal lugs are firmly fastened on the Sunny Island (torque: 12 Nm).	☐

Test point	Test criterion	OK
DC power cable	The maximum length of cables from the battery via the BatFuse to the Sunny Island is 10 m.	☐
	The conductor cross-section meets the cable requirements of 50 mm² to 95 mm² (for the recommended conductor cross-section, see Section 7.4.1).	☐
BatFuse	Fuse links are matched to the Sunny Island. • SI3.0M-11: 80 A • SI4.4M-11: 100 A • SI6.0H-11: 160 A • SI8.0H-11: 200 A	☐
	The cables are attached to the BatFuse with the required torque (see BatFuse installation manual).	☐
If installed, charge controllers and DC loads	All charge controllers and DC loads are installed in accordance with the manufacturer's specifications.	☐
If installed, battery current sensor	The battery current sensor can be loaded with the maximum DC current (see technical data of the battery current sensor).	☐

Checking Connections AC1 and AC2 of the Sunny Island Inverter

Test point	Test criterion	OK
Enclosure openings AC1 and AC2	All enclosure openings are sealed with M25 cable glands or filler plugs.	☐
	For an M25 cable gland, the cable diameter must be 9 mm to 18 mm.	☐
AC1 and AC2 terminals	All contact areas are not insulated.	☐
	All terminal levers are in the downward position.	☐
	All cables are securely clamped.	☐
AC power cable at connection AC1	The cables are sufficiently protected by circuit breakers.	☐
	Trip-capable circuit breakers are installed and additional type A residual-current devices have been installed. Maximum trip-capable circuit breakers: • SI3.0M-11: Tripping characteristics B6 • SI4.4M-11: Tripping characteristics B6 • SI6.0H-11: Tripping characteristics B16 or C6 • SI8.0H-11: Tripping characteristics B16 or C6	☐
With a three-phase system, allocation of the Sunny Island inverters	The allocation of the Sunny Island inverters to the line conductors of the stand-alone grid or the Multicluster-Box results in a right-hand rotating magnetic field. The master must be assigned to L1, slave 1 must be assigned to L2, slave 2 must be assigned to L3.	☐

Checking the Generator Connection

Test point	Test criterion	OK
The connection cables	The conductor cross-section is sufficient for the maximum generator current.	☐
	The cables are sufficiently protected by circuit breakers.	☐
With a three-phase off-grid system, allocation of the line conductors	The allocation of the Sunny Island inverters to the line conductors of the generator results in a right-hand rotating magnetic field. The master must be assigned to L1, slave 1 must be assigned to L2, slave 2 must be assigned to L3.	☐
Grounding	The exposed conductive part of the generator is grounded.	☐

Checking the Control and Measuring Cables

Test point	Test criterion	OK
Battery temperature sensor if installed	The battery temperature sensor is connected to the terminal **BatTmp**.	☐
	The battery temperature sensor is secured in the middle of the battery-storage system, in the upper third of the battery cell.	☐
If installed, the control and measuring cables of the Multicluster-Box	The control and measuring cables are correctly connected (see Multicluster-Box manual).	☐
If installed, the measuring cable of the battery current sensor	The measuring cable of the battery current sensor is connected to the terminal **BatCur** with the correct polarity (see Section 7.4.9 "Connecting the Battery Current Sensor in the Off-Grid System", page 47).	☐
Control cable of the load shedding, if installed	The multifunction relay and the load-shedding contactors are correctly wired to each other (see Section 7.4.12 "Connecting Load-Shedding Contactors", page 50).	☐
Communication with Sunny Island Charger 50, if installed	The data cable between the Sunny Island Charger 50 and the Sunny Island is connected correctly (see manual for Sunny Island Charger 50 charge controller).	☐

Checking the Wiring of the Communication Products

Test point	Test criterion	OK
Electricity supply to communication products	The plug-in power supply units are plugged in.	☐
	The communication products are connected to an electricity supply.	☐
Termination of the communication buses	The communication buses are connected to the first and last device in the bus.	☐

Checking the System Devices

Test point	Test criterion	OK
System components	All system devices are correctly connected (see the manuals for the devices).	☐
	Ensure by measuring that all system devices are connected with the same ground potential.	☐
AC1 connection	After the system-specific connection, the required components are connected at terminal **AC1** (see Installation - Quick Reference Guide of the System Used).	☐
AC2 connection	After the system-specific connection, the required components are connected at terminal **AC2** (see Installation - Quick Reference Guide of the System Used).	☐

7.7 Sealing and Closing the Sunny Island

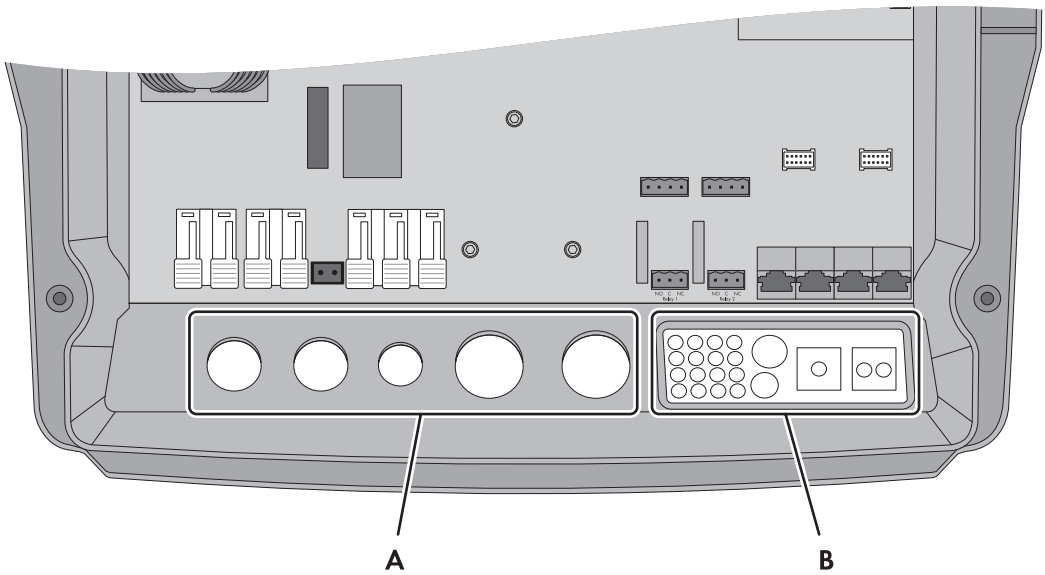
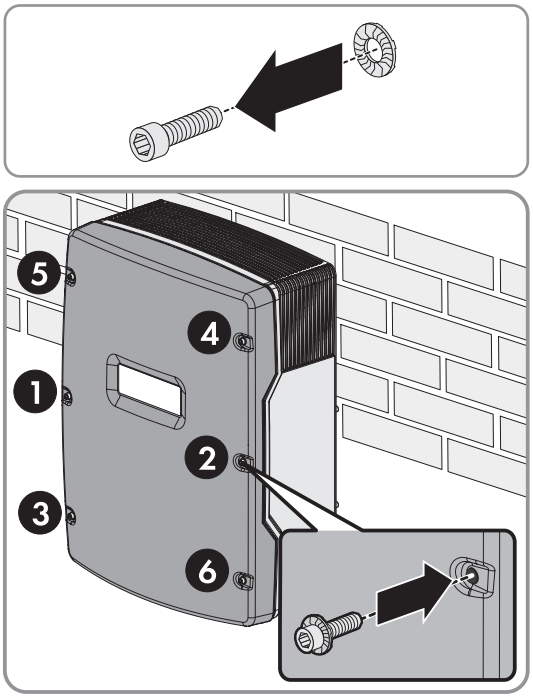


Figure 19: Position of the cable glands and the cable feed-through plate.

Position	Designation
A	Cable glands
B	Cable feed-through plate

1. Protect the interior of the Sunny Island from dust and moisture:
   - Ensure that the cable glands (A) completely seal the enclosure openings.
   - Seal unused enclosure openings with filler plugs on the cable feed-through plate (B).
   - Seal the cable feed-through plate (B) using the provided sealing compound. The sealing compound must completely seal the cable feed-through plate and the gap between the cable feed-through plate and enclosure.

2. Attach one conical spring washer to each screw. Ensure that the grooved side of the conical spring washer points to the screw head. Tip: The scope of delivery of the Sunny Island inverter includes one additional replacement screw with a conical spring washer.
3. On the Sunny Island, fasten the enclosure lid following the sequence 1 to 6 using an Allen key (AF 5) (torque: 6 Nm).



☑ The teeth of the conical spring washer press into the enclosure lid. This ensures that the enclosure lid is grounded.

7.8 Inserting the Fuse Links in the Fuse Switch-Disconnector BatFuse

1. Ensure that the NH1 fuse link for the BatFuse is correct:

Sunny Island	Fuse link
SI3.0M-11	80 A
SI4.4M-11	100 A
SI6.0H-11	160 A
SI8.0H-11	200 A

2. Insert the fuse link and close the BatFuse (see BatFuse documentation).

8 Commissioning

8.1 Basic Configuration

8.1.1 Start the Quick Configuration Guide

With the Quick Configuration Guide (QCG), you can configure the settings required for operation.

Step by step, the QCG requests the required settings for the system. Parameter setting for a cluster takes place centrally at the master. All slaves adopt the configuration automatically.

Configuration of the system using the QCG

The Sunny Island, which is connected to a Sunny Remote Control when starting to configure a new system, automatically becomes the master.

- During configuration, only the master may be connected to a Sunny Remote Control.
- For a multicluster system, each cluster must be configured individually at the master.

Requirements:

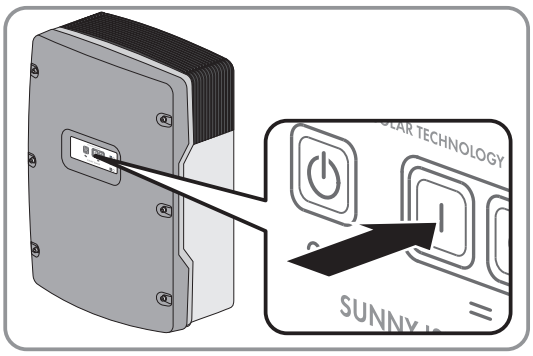
☐ All circuit breakers in the AC distribution board must be open.

☐ All Sunny Island inverters must be closed.

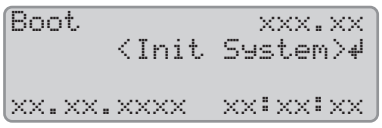
☐ All Sunny Island inverters must be switched off.

Procedure:

1. Quickly close the load-break switch of the BatFuse and close the BatFuse (see BatFuse installation manual).
2. Switching on the Sunny Island:



   - In single systems, press the activation button on the Sunny Island.
   - In a cluster, press and hold down the activation button on the master until an acoustic signal sounds. As a result, all Sunny Island inverters in the cluster are switched on.
3. When the Sunny Remote Control displays **<Init System>**, press and hold the button on the Sunny Remote Control (for operation of the Sunny Remote Control inverter, see the Sunny Island inverter operating manual).



   ☑ An acoustic signal sounds three times and the Sunny Remote Control displays the QCG.

   ✖ The Sunny Remote Control does not display the QCG?

   You have either pressed the button too late or not long enough.

   - Press the off button.
   - Repeat steps 2 and 3.

8.1.2 Starting Basic Configuration of the Sunny Island

Requirements:

☐ The Sunny Remote Control must be connected to the master.

☐ All Sunny Island inverters must be switched on but not in operation (for how to switch on the Sunny Island inverter, see the Sunny Island inverter operating manual).

☐ The Quick Configuration Guide (QCG) is started.

Procedure:

1. Turn the button on the Sunny Remote Control to the right and select **New System**.

2. Press the button.
3. Turn the button to the right until **Y** flashes and press the button. This confirms your selection of **New System**.
4. Set the parameters of the QCG (carry out basic configuration in accordance with the installed system, see quick reference guide of the installed system).

8.1.3 Setting Sunny Island for Charge Controller / Sunny Island Charger in Off-Grid Systems

Relevant for off-grid systems

Requirements:

☐ For systems with a maximum of four Sunny Island Charger devices, all Sunny Island Charger devices must be connected to the master via a communication bus.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Type: other DC sources** / **250.28 ChrgCtlOp** and adjust as follows:

Value	Explanation
Auto	System with AC sources (e.g., PV inverter) The Sunny Island Charger or charge controller can also be present in the system.
SMA	System with Sunny Island Charger and without AC sources A maximum of four Sunny Island Charger devices is installed.
NoFrq	System with charge controllers and without AC sources The charge controllers are not Sunny Island Charger devices or the number is greater than four Sunny Island Chargers.

8.1.4 Commissioning the Battery Current Sensor in Off-Grid Systems

Relevant for off-grid systems

To operate the battery current sensor, you must set the type of the battery current sensor and start the adjustments of the battery current sensor.

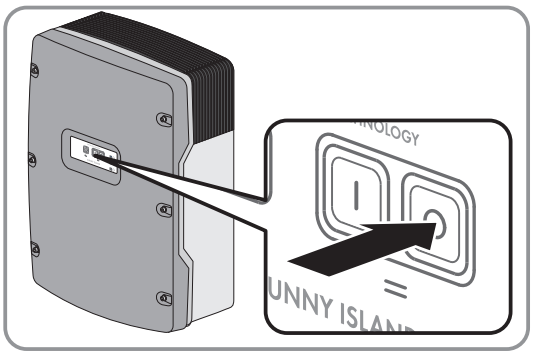
The Sunny Island distinguishes between battery current sensors of the types 50 mV and 60 mV. The types reflect the amplification factor of the battery current sensor. The amplification factors are given in amperes per 50 mV or in amperes per 60 mV, e.g., 400 A/60 mV.

Requirement:

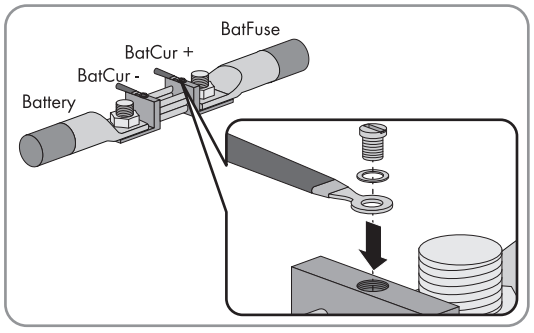
☐ The Sunny Remote Control must be connected to the master.

Procedure:

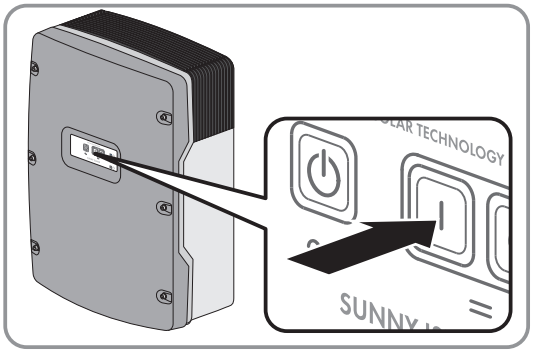
1. Switch off the Sunny Island and open the BatFuse load-break switch quickly.



2. Short-circuit the measuring cable at the battery current sensor. Connect the **BatCur–** and **BatCur+** insulated measuring conductors to the connection for **BatCur+**.



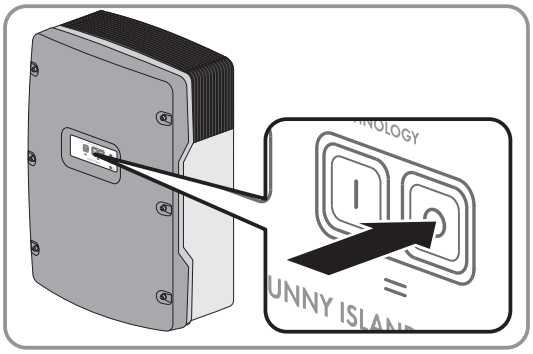
3. Close the BatFuse load-break switch quickly and switch on the Sunny Island.



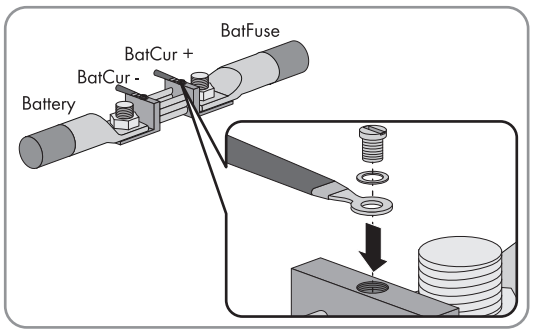
4. Switch to installer mode on the Sunny Remote Control (see Sunny Island operating manual).
5. Select the parameter **225.01 BatCurSnsTyp** and set to the type of the battery current sensor used.
6. For a 60 mV model, select the parameter **225.02 BatCurGain60** and set it according to the gain factor of the battery current sensor.
7. For a 50 mV model, select the parameter **225.03 BatCurGain50** and set it according to the gain factor of the battery current sensor.
8. Select the parameter **225.04 BatCurAutoCal** and set to Start.
   ☑ The Sunny Island starts the adjustment.
9. After ten seconds, select the parameter **120.06 TotBatCur** and read off the value.
   ☑ The parameter value is between 0 A and 1 A.
   ✖ The parameter value is not between 0 A and 1 A.
   The measuring cables are not correctly connected or not short-circuited.
   - Check whether the measuring cables are correctly connected and whether they are short-circuited.

- Repeat steps 8 and 9.

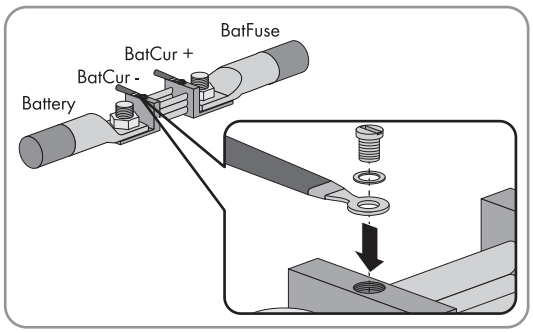
10. Switch off the Sunny Island and open the BatFuse load-break switch quickly.



11. Connect the **BatCur+** insulated measuring conductor on the side for connecting the BatFuse.



12. Connect the **BatCur–** insulated measuring conductor on the side for connecting the battery.



13. Close the BatFuse load-break switch quickly and switch on the Sunny Island.

8.1.5 Setting the Functions of the Multifunction Relays

The multifunction relays of the master are preset in an SMA Flexible Storage System and cannot be changed.

In multicluster systems with Multicluster-Box 12 (MC-BOX-12.3-20), multifunction relays 1 and 2 in the master of the main cluster and multifunction relay 1 in slave 1 of the main cluster are set permanently.

Note the function of the multifunction relays in the following table during the electrical connection (see Section 7.4 "Connecting the Components", page 31).

Table for configuring the operating modes of the multifunction relay (for your own notes):

Multifunction relay	Value	Function/output
Relay 1 of Sunny Island inverter/master	241.01 Rly1Op	
Relay 2 of Sunny Island inverter/master	241.02 Rly2Op	
Relay 1 of Slave 1	244.01 Rly1OpSlv1	
Relay 2 of Slave 1	244.02 Rly2OpSlv1	

Multifunction relay		Value	Function/output
Relay 1 of Slave 2	245.01 Rly1OpSlv2		
Relay 2 of Slave 2	245.02 Rly2OpSlv2		

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Set the parameter for the multifunction relay functions as shown in the table above.

8.2 "Battery Management"

8.2.1 Safety When Setting the Battery Management Parameters

This section contains safety information to be observed when configuring the battery management. To prevent property damage and to ensure the long-term operation of the product, read this section carefully and observe all safety information.

NOTICE

Damage to the battery due to incorrect settings

The set battery parameters influence the charging behavior of the Sunny Island inverter. The battery can be damaged by incorrect settings of the battery type, nominal voltage and capacity parameters.

- Ensure that the values recommended by the manufacturer are set for the battery (refer to the technical data of the battery in the manufacturer documentation). Note that the battery charging behavior names used by SMA Solar Technology AG and the battery manufacturer may, in some cases, differ in meaning (for the battery charging behavior of the Sunny Island inverter, see technical information "List of Approved Lithium-Ion Batteries").
- Set the battery capacity for a ten-hour electric discharge (C10). The battery manufacturer specifies the battery capacity in relation to discharge time.

8.2.2 Adjusting the Battery Management to the Battery

For further information relating to the battery management and the charging behavior of the Sunny Island inverter, see the technical information "Battery Management" on the supplied CD.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. To set the parameters for battery management on the Sunny Explorer, click on the tab **Settings** on the Sunny Explorer and select the group **Battery > Charge**.
3. Select the parameter **Maximum battery charging current** / **222.01 BatChrgCurMax** and set it to the maximum battery charging current recommended by the battery manufacturer.
4. Set the parameters for boost charge.
   - Select the parameter **Time for boost charge of battery** / **222.02 AptTmBoost** and set to the boost-charge absorption time recommended by the battery manufacturer.
   - Select the parameter **Cell charge setpoint voltage for boost charge** / **222.07 ChrgVtgBoost** and set it to the cell-voltage setpoint recommended by the battery manufacturer for boost charge.
5. Set the parameters for full charge.

- Select the parameter Time for **full charge of battery** / **222.03 AptTmFul** and set to the full-charge absorption time recommended by the battery manufacturer.
- Select the parameter **Full charge cycle time** / **222.05 CycTmFul** and set to the full-charge cycle time recommended by the battery manufacturer.
- Select the parameter **Cell charge setpoint voltage for full charge** / **222.08 ChrgVtgFul** and set it to the cell-voltage setpoint recommended by the battery manufacturer for full charge.

6. Set the parameters for equalization charge.
   - Select the parameter **Time for equalization charge of battery** / **222.04 AptTmEqu** and set it to the equalization-charge absorption time recommended by the battery manufacturer.
   - Select the parameter **Equalization charge cycle time** / **222.06 CycTmEqu** and set it to the equalization-charge cycle time recommended by the battery manufacturer.
   - Select the parameter **Cell charge setpoint voltage for equalization charge** / **222.09 ChrgVtgEqu** and set it to the cell-voltage setpoint recommended by the battery manufacturer for equalization charge.

8.2.3 Changing the Battery Usage Through Battery-Backup Systems without Increased Self-Consumption

Relevant for systems connected to the utility grid

Adjusting the default values

The parameters for battery usage are set automatically to reasonable values during basic configuration for the respective system. The parameter values can be adjusted if there are special requirements for the system or the battery.

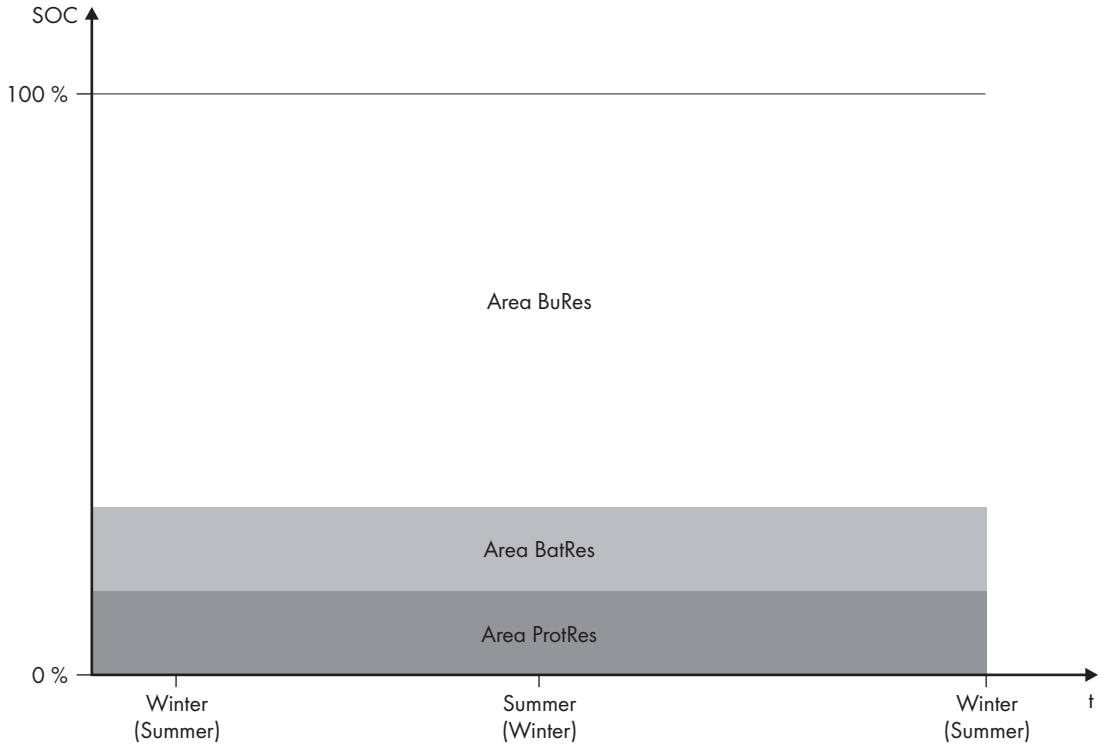


Figure 20: State of charge ranges of the battery according to the time of year (example)

Range	Explanation of the range and parameters	Behavior of the Sunny Island inverter
BuRes	Range for the battery backup system function **Minimum width of the battery-backup range / 262.03 BUResSOC**	The Sunny Island uses this range for supplying the battery-backup grid when the utility grid fails. When the utility grid is available again, the battery is charged by the Sunny Island with nominal power from the utility grid.
BatRes	Range for protection against deep discharge This range can only be reached when the utility grid fails. **Minimum width of the deep-discharge protection range / 262.02 BatResSOC**	The Sunny Island switches into standby mode. The Sunny Island starts up every two hours and attempts to charge the battery with PV energy. If the battery cannot be charged, the Sunny Island switches back to standby mode. When the utility grid is available again, the battery is charged by the Sunny Island with nominal power from the utility grid.
ProtRes	Range for protection in the event of deep discharge This range can only be reached when the utility grid fails. **Lower limit of the deep-discharge protection range before disconnection / 262.01 ProtResSOC**	When this range is reached, the Sunny Island switches off in order to protect the battery. When the utility grid is available again, the system must be charged manually (see Sunny Island operating manual).

The following ranges result from the parameter default values:

Range	Lead-acid battery	Lithium-ion battery
BuRes	15% to 100%	13% to 100%

Range	Lead-acid battery	Lithium-ion battery
BatRes	10% to 15%	3% to 13%
ProtRes	0% to 10%	0% to 3%

Procedure for multicluster systems with battery-backup grid

With the Multicluster-Box 12 (MC-Box-12.3-20) and the NA-Box or Grid-Connect-Box, multicluster systems with battery-backup grid can be installed (see Multicluster-Box and NA-Box / Grid-Connect-Box documentation).

- In a multicluster system with battery-backup grid, set the ranges of battery state of charge for each cluster to the same values.

You can change the battery usage through battery-backup systems without increased self-consumption on the communication product or Sunny Remote Control.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Set the following parameters for increased self-consumption:

Parameter	Value
Increased self-consumption switched on / 261.01 SlfCsmpIncEna	**Disable**
Lower limit of the deep-discharge protection range before disconnection / 262.01 ProtResSOC	Range for protection during deep discharge as a percentage of the battery capacity
Minimum width of the deep-discharge protection range / 262.02 BatResSOC	Range for protection against deep discharge as a percentage of the battery capacity
Minimum width of the battery-backup range / 262.03 BUResSOC	Range for battery-backup function If all ranges combined do not amount to 100%, the **BuRes** range will be increased automatically.
Seasonal operation active / 261.03 Saisonenable	**No**

8.2.4 Battery Usage through Systems for Increased Self-Consumption

8.2.4.1 Seasonal Adjustment of the Battery Usage

Relevant for systems connected to the utility grid

The options for increased self-consumption depend to a large extent on the battery and on the availability of PV energy. In order to use the battery optimally, you can adjust the depth of discharge of the battery to the application.

In many regions, the PV energy available largely depends on the season and the hours of sunshine. On short days with few hours of sunlight, the Sunny Island cannot charge the battery fully. Lead-acid batteries in particular age faster due to low charging over a long period. Therefore, it is better if the battery is not discharged too much by the Sunny Island on short days. On short days, there is insufficient PV energy to charge the battery. On long days with many hours of sunlight, the Sunny Island can usually charge the battery fully. On such days, it is better to use as much of the battery capacity as possible for increasing self-consumption.

The discharge behavior can be adjusted to the location and time by the Sunny Island. You can activate seasonal adjustment for this (parameter **Seasonal operation active / 261.03 Saisonenable**). The Sunny Island only uses a small portion of battery capacity for increased self-consumption on short days when adjustment is activated. The Sunny Island uses a large portion of the battery capacity for the increased self-consumption on long days. The seasonal adjustment prolongs the electrical endurance of the battery in regions where the available PV energy is largely dependent on the season.

8.2.4.2 Changing the Battery Usage Through Systems for Increased Self-Consumption Without a Battery Backup Grid

Relevant for systems connected to the utility grid

Adjusting the default values

The parameters for battery usage are set automatically to reasonable values during basic configuration for the respective system. The parameter values can be adjusted if there are special requirements for the system or the battery.

In systems for increased self-consumption, one range can be adjusted seasonally:

- Increased self-consumption range (SlfCsmp)

  You determine the percentage of the battery capacity that is to be used for increased self-consumption on the shortest day of the year.

The longer the days become, the more the SlfCsmp range increases automatically and the range for protection against deep discharge (BatRes) decreases. The range for increased self-consumption reaches its maximum on the longest day:

$SlfCsmp_{max}$ = 100%−262.04 PVResSOC−262.02 BatResSOC−262.01 ProtResSOC

This results in the seasonal progression of the ranges.

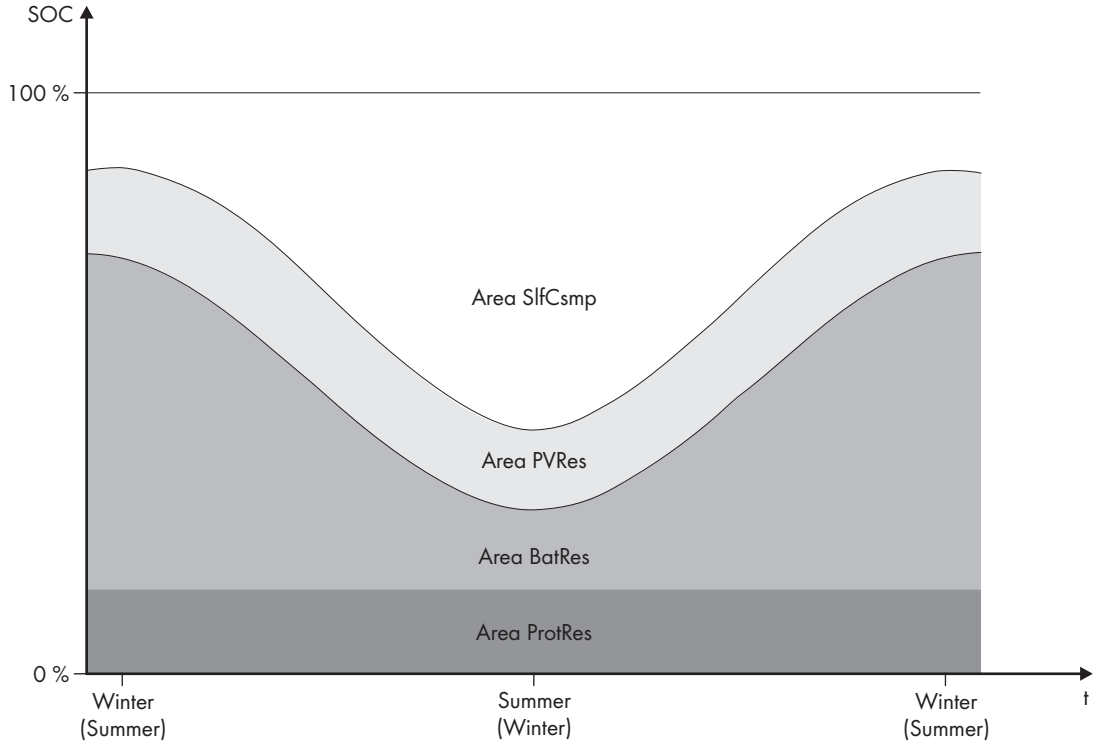


Figure 21: State of charge ranges of the battery according to the time of year (example)

Range	Explanation of the range and parameters	Behavior of the Sunny Island inverter
SlfCsmp	Range for increased self-consumption The **SlfCsmp** range applies to the shortest day of the year with seasonal adjustment (see Section 8.2.4.1, page 77). When seasonal adjustment is deactivated, only the **SlfCsmp** range is used and the **BatRes** range increased accordingly.	The Sunny Island uses the battery for increased self-consumption.
	Minimum width of the self-consumption range / 262.05 MinSlfCsmpSOC	
PVRes	Range for maintaining the state of charge of the battery The range size is constant year-round.	Excess PV energy is used for conserving the battery charge. If no excess PV energy is available, the Sunny Island switches to energy saving mode. When the state of charge reaches the BatRes range limit, the Sunny Island charges the battery up to half of the PVRes range from the utility grid. To do so, the Sunny Island charges the battery with maximum efficiency at 25% of the nominal power of the Sunny Island inverter.
	Width of the range for the maintenance of the battery state of charge / 262.04 PVResSOC	

Range	Explanation of the range and parameters	Behavior of the Sunny Island inverter
BatRes	262.02 BatResSOC Range for protection against deep discharge This range can only be reached when the utility grid fails. The **BatRes** range applies to the longest day of the year with seasonal adjustment (see Section 8.2.4.1, page 77) . If seasonal adjustment is deactivated, the **BatRes** range is increased accordingly.	If a utility grid is available, the Sunny Island charges the battery using nominal power from the utility grid.
	Minimum width of the deep-discharge protection range / 262.02 BatResSOC	
ProtRes	Range for protection in the event of deep discharge This range can only be reached when the utility grid fails.	When this range is reached, the Sunny Island switches off in order to protect the battery. When the utility grid is available again, the system must be charged manually (see Sunny Island operating manual).
	Lower limit of the deep-discharge protection range before disconnection / 262.01 ProtResSOC	

The following ranges result from the parameter default values:

Range	Lead-acid battery		Lithium-ion battery	
	Shortest day*	**Longest day****	**Shortest day***	**Longest day****
MinSlfCsmp	65% to 100%	40% to 100%	30% to 100%	10% to 100%
PVRes	60% to 65%	40% to 45%	25% to 30%	5% to 10%
BatRes	10% to 60%	10% to 40%	3% to 13%	3% to 5%
ProtRes	0% to 10%	0% to 10%	0% to 3%	0% to 3%

* December 21 (northern hemisphere) or June 21 (southern hemisphere)
** June 21 (northern hemisphere) or December 21 (southern hemisphere)

The following ranges result from deactivating seasonal adjustment with the default values of the parameters:

Range	Lead-acid battery	Lithium-ion battery
MinSlfCsmp	65% to 100%	30% to 100%
PVRes	60% to 65%	25% to 30%
BatRes	10% to 60%	3% to 25%
ProtRes	0% to 10%	0% to 3%

Requirement:

☐ The system is not a battery backup system

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Set the following parameters for the battery usage:

Parameter	Value
Increased self-consumption switched on / 261.01 SlfCsmpIncEna	Enable
Lower limit of the deep-discharge protection range before disconnection / 262.01 ProtResSOC	Range for protection during deep discharge as a percentage of the battery capacity
Minimum width of the deep-discharge protection range / 262.02 BatResSOC	Range for protection against deep discharge on the longest day of the year as a percentage of the battery capacity The range remains constant year-round when seasonal adjustment is deactivated.
Width of the range for the maintenance of the battery state of charge / 262.04 PVResSOC	Range for maintaining the state of charge of the battery as a percentage of the battery capacity
Minimum width of the self-consumption range / 262.05 MinSlfCsmpSOC	Range for increasing self-consumption on the shortest day of the year as a percentage of the battery capacity When seasonal adjustment is deactivated, this value is used year-round for increased self-consumption.
Highest yielding month for battery utilization range / 261.02 SlfCsmpPosSel	**North** for northern hemisphere*
	South for southern hemisphere**
Seasonal operation active / 261.03 Saisonenable	**No** for no seasonal adjustment or **Yes** for seasonal adjustment

* Set the value to **North** when June is the month with the highest yield.
** Set the value to **South** when December is the month with the highest yield.

☑ The following parameters for the battery usage is set.

✖ A parameter cannot be adjusted?

All ranges combined result in a value greater than 100%.

- Ensure that all ranges have been set correctly.

8.2.4.3 Changing the Battery Usage through Battery-Backup Systems with Increased Self-Consumption

Relevant for systems connected to the utility grid

Adjusting the default values

The parameters for battery usage are set automatically to reasonable values during basic configuration for the respective system. The parameter values can be adjusted if there are special requirements for the system or the battery.

Two ranges can be adjusted seasonally in battery-backup systems with increased self-consumption:

- Range for increased self-consumption (MinSlfCsmp)

  You determine the percentage of the battery capacity that is to be used for increased self-consumption on the shortest day of the year.

- Range for the battery backup system function (BURes)

  You specify the percentage of the battery capacity that is to be used for the battery backup system function on the longest day.

The longer the days become, the more the SlfCsmp range automatically increases and the BURes range decreases. The range for increased self-consumption reaches its maximum on the longest day:

$SlfCsmp_{max}$ = 100%−262.04 PVResSOC−262.03 BUResSOC−262.02 BatResSOC−262.01 ProtResSOC

This results in the seasonal progression of the ranges.

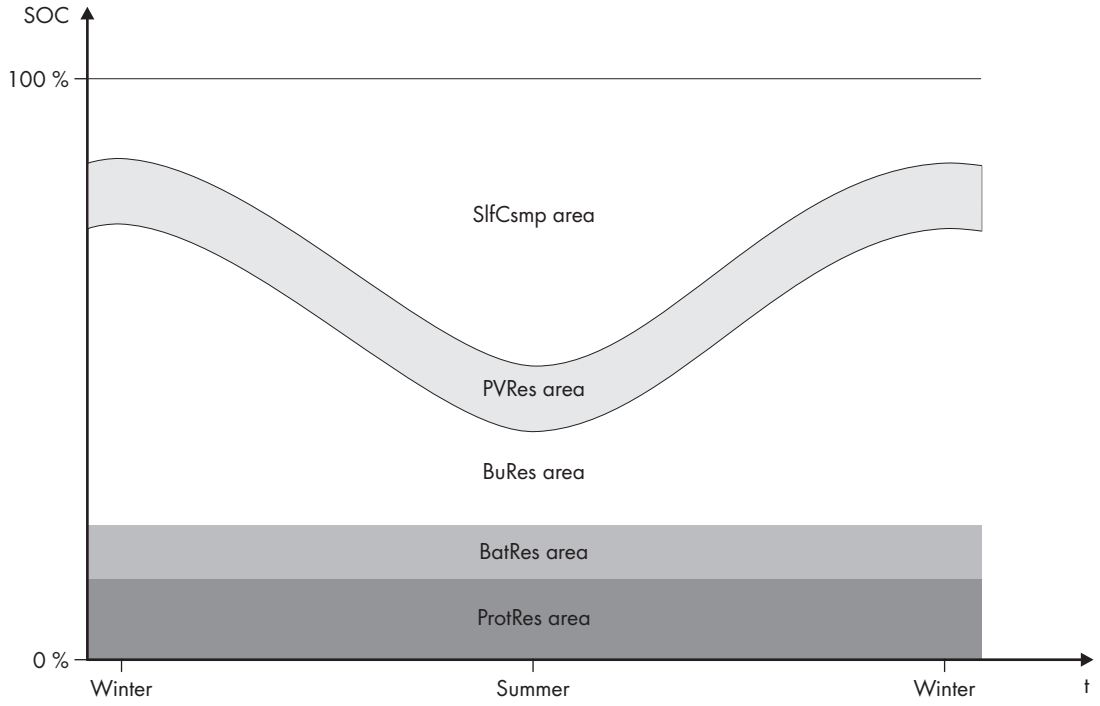


Figure 22: State of charge ranges of the battery according to the time of year (example)

Range	Explanation of the range and parameters	Behavior of the Sunny Island inverter
SlfCsmp	Range for increased self-consumption The **SlfCsmp** range applies to the shortest day of the year with seasonal adjustment (see Section 8.2.4.1, page 77). When seasonal adjustment is deactivated, only the **SlfCsmp** range is used and the **BURes** range increased accordingly.	The Sunny Island uses the battery for increased self-consumption.
	Minimum width of the self-consumption range / 262.05 MinSlfCsmpSOC	

Range	Explanation of the range and parameters	Behavior of the Sunny Island inverter
PVRes	Range for maintaining the state of charge of the battery The range size is constant year-round. **Width of the range for the maintenance of the battery state of charge / 262.04 PVResSOC**	Excess PV energy is used for conserving the battery charge. If no excess PV energy is available, the Sunny Island switches to energy saving mode. When the state of charge reaches the BatRes range limit, the Sunny Island charges the battery up to half of the PVRes range from the utility grid. To do so, the Sunny Island charges the battery with maximum efficiency at 25% of the nominal power of the Sunny Island inverter.
BuRes	Range for the battery backup system function The **BURes** range applies to the longest day of the year with seasonal adjustment (see Section 8.2.4.1, page 77) . When seasonal adjustment is deactivated, only the minimum range is used and the **SlfCsmp** range increased accordingly. **Minimum width of the battery-backup range / 262.03 BUResSOC**	The Sunny Island uses this range for supplying the battery-backup grid when the utility grid fails. When the utility grid is available again, the battery is charged by the Sunny Island with nominal power from the utility grid.
BatRes	Range for protection against deep discharge This range can only be reached when the utility grid fails. **Minimum width of the deep-discharge protection range / 262.02 BatResSOC**	The Sunny Island switches into standby mode. The Sunny Island starts up every two hours and attempts to charge the battery with PV energy. If the battery cannot be charged, the Sunny Island switches back to standby mode. When the utility grid is available, the Sunny Island charges the battery with nominal power from the utility grid.
ProtRes	Range for protection in the event of deep discharge This range can only be reached when the utility grid fails. **Lower limit of the deep-discharge protection range before disconnection / 262.02 ProtResSOC**	When this range is reached, the Sunny Island switches off in order to protect the battery. When the utility grid is available again, the system must be charged manually (see Sunny Island operating manual).

Range	Lead-acid battery		Lithium-ion battery	
	Shortest day*	Longest day**	Shortest day*	Longest day**
SlfCsmp	65% to 100%	40% to 100%	30% to 100%	28% to 100%
PVRes	60% to 65%	40% to 45%	25% to 30%	23% to 28%
BURes	15% to 60%	15% to 40%	13% to 25%	13% to 23%
BatRes	10% to 15%	10% to 15%	3% to 13%	3% to 13%
ProtRes	0% to 10%	0% to 10%	0% to 3%	0% to 3%

* December 21 (northern hemisphere) or June 21 (southern hemisphere)
** June 21 (northern hemisphere) or December 21 (southern hemisphere)

The following ranges result from deactivating seasonal adjustment with the default values of the parameters:

Range	Lead-acid battery	Lithium-ion battery
SlfCsmp	65% to 100%	30% to 100%
PVRes	60% to 65%	25% to 30%
BURes	10% to 60%	13% to 25%
BatRes	10% to 15%	3% to 13%
ProtRes	0% to 10%	0% to 3%

Procedure for multicluster systems with battery-backup grid

With the Multicluster-Box 12 (MC-Box-12.3-20) and the NA-Box or Grid-Connect-Box, multicluster systems with battery-backup grid can be installed (see Multicluster-Box and NA-Box / Grid-Connect-Box documentation).

- In a multicluster system with battery-backup grid, set the ranges of battery state of charge for each cluster to the same values.

You can change the battery usage through battery-backup systems with increased self-consumption on the communication product or Sunny Remote Control.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Set the following parameters for the battery usage:

Parameter	Value
Increased self-consumption switched on / **261.01 SlfCsmpIncEna**	Enable
Lower limit of the deep-discharge protection range before disconnection / **262.01 ProtResSOC**	
Minimum width of the deep-discharge protection range / **262.02 BatResSOC**	Range for protection against deep discharge as a percentage of the battery capacity
Minimum width of the battery-backup range / **262.03 BUResSOC**	Range for the battery backup system function on the longest day of the year as a percentage of the battery capacity The range remains constant year-round when seasonal adjustment is deactivated.
Width of the range for the maintenance of the battery state of charge / **262.04 PVResSOC**	Range for maintaining the state of charge of the battery as a percentage of the battery capacity
Minimum width of the self-consumption range / **262.05 MinSlfCsmpSOC**	Range for increasing self-consumption on the shortest day of the year as a percentage of the battery capacity When seasonal adjustment is deactivated, this value is used year-round for increased self-consumption.

Parameter	Value
Highest yielding month for battery utilization range / 261.02 SlfCsmpPosSel	**North** for northern hemisphere*
	South for southern hemisphere**
Highest-yielding month for battery utilization range: / 261.03 Saisonenable	**No** for no seasonal adjustment or **Yes** for seasonal adjustment

* Set the value to **North** when June is the month with the highest yield.
** Set the value to **South** when December is the month with the highest yield.

☑ The following parameters for the battery usage is set.

✖ A parameter cannot be adjusted?

All ranges combined result in a value greater than 100%.

- Ensure that all ranges have been set correctly.

8.2.5 Changing the Battery Protection Mode in Off-Grid Systems

Relevant for off-grid systems

Function of the battery protection mode:

The battery protection mode protects the battery.

If the state of charge (SOC) of the battery falls below the thresholds, battery protection mode is activated. In battery protection mode, the Sunny Island switches to standby mode or switches itself off. The battery protection mode has three levels. One state of charge threshold can be set for each level. Levels 1 and 2 of the battery protection mode have specific start and end times and are therefore dependent on the time of day (see Section 9.3 "Setting Time-Dependent Functions", page 107).

- Level 1

  If the state of charge falls below the threshold for level 1, the Sunny Island switches to standby between the start time and end time. This way you can specify preferred times for the Sunny Island to be switched off if an energy deficit occurs.

- Level 2

  If the SOC drops below the threshold for level 2, the Sunny Island switches to standby. Use the start time and end time to define the time window in which no energy is anticipated from AC sources. Outside this time window, the Sunny Island starts up every two hours to charge the battery. If no energy is available to charge the battery, the Sunny Island remains on standby.

  This means that, for example, in stand-alone grids with PV inverters, you can specify that the Sunny Island does not start up at night, preventing it from consuming energy from the battery.

- Level 3

  If the state of charge falls below the threshold for level 3, the Sunny Island switches itself off. This protects the battery against deep discharge and severe damage. To charge the battery again, the Sunny Island must be switched on and started manually.

At all three levels, the Sunny Island will only switch to standby mode or switch itself off if no charging current has flowed in the battery for at least five minutes.

Recharging the battery with an external energy source:

In levels 1 and 2 of battery protection mode, you can charge the battery at any time with an external energy source. If a voltage is present on connection **AC2**, the Sunny Island exits standby mode.

If the Sunny Island has switched to level 3 of battery protection mode by itself, you must charge the battery in emergency charge mode (see the Sunny Island inverter operating manual).

Time settings:

The start time and the end time can be configured for battery protection mode levels 1 and 2.

If the state of charge falls below the threshold for level 1, the Sunny Island switches to standby between the start time and end time.

If the state of charge drops below the SOC threshold for level 2, the Sunny Island switches to standby between the start time and the end time. The Sunny Island attempts to charge the battery in the remaining time.

You can change the battery protection mode on the communication product or on the Sunny Remote Control. The parameters for the battery protection mode are created as a data field in the communication product. Data fields enable the summary of parameters. Therefore, the parameters in the Sunny Explorer are shown in a table.

Requirement:

☐ In a cluster, the communication product or Sunny Remote Control must be connected to the master.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. To change battery protection mode in level 1, set the desired times and SOC thresholds:
   - Select the parameter **Start time battery protection mode** / **223.01 BatPro1TmStr** and set to the desired start time for level 1.
   - Select the parameter **End time battery protection mode** / **223.02 BatPro1TmStp** and set to the desired end time for level 1.
   - Select the parameter **Battery state of charge for protection mode** / **223.05 BatPro1Soc** and set to the desired SOC threshold for level 1.
3. To change battery protection mode in level 2, set the desired times and SOC thresholds:
   - Select the parameter **Start time battery protection mode** / **223.03 BatPro2TmStr** and set to the desired start time for level 1.
   - Select the parameter **End time battery protection mode** / **223.04 BatPro2TmStp** and set to the desired end time.
   - Select the parameter **Battery state of charge for protection mode** / **223.06 BatPro2Soc** and set to the desired SOC threshold.
4. To change the battery protection mode in level 3, select the parameter **Battery state of charge for protection mode** / **223.07 BatPro3Soc** and set to the desired SOC threshold.

8.2.6 Configuring the Resistance of the Battery Cable

You can optimize the battery management if you set the resistance of the battery cable in expert mode.

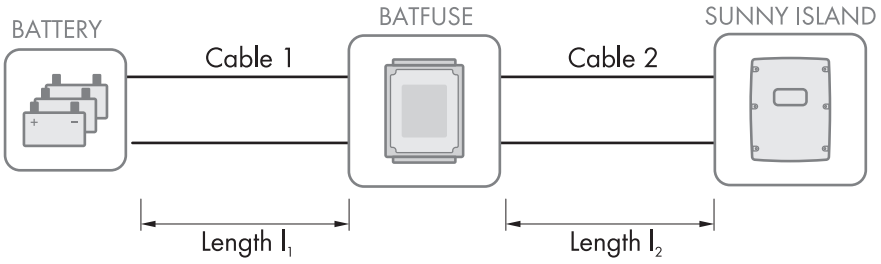


Figure 23: Designation of the cable

The resistance of the battery cable is composed of the resistance of cable 1, the BatFuse and the resistance of cable 2.

Requirement:

☐ In a cluster, the communication product or Sunny Remote Control must be connected to the master.

Procedure:

1. Calculate the individual cable resistances. Use the following formula:

   $R_{Cu}(l,A)$ = resistance of the cable

   ρ = specific resistance for copper ($\rho = 0.018^{\Omega\ mm^2/m}$)

   l = total length of the conductor (outward conductor + return conductor = twice the cable length) in m

   A = conductor cross-section in mm^2

2. Calculate the total resistance of the battery cable. Use the following formula:

   $R_{BatRes} = R_{(cable\ 1)} + R_{(BatFuse)} + R_{(cable\ 2)}$

   R_{BatRes} = total resistance of the battery cable

   $R_{Cable\ 1}$ = Calculated resistance of cable 1

   $R_{Cable\ 2}$ = Calculated resistance of cable 2

   $R_{(BatFuse)}$ = Total resistance of the BatFuse = 2 mΩ

3. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
4. Select the parameter **Cable resistance of the battery connection** / **221.06 BatWirRes** and set to the resistance of the battery cable.

8.2.7 Setting the Control of the Battery Room Fan

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Temperature limit for multifunction relay with battery room fan** / **221.07 BatFanTmpStr** and set it to the battery temperature at which the fan is to be switched on.
3. Ensure that the multifunction relay used for control is set to **BatFan** or **MccBatFan** (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).
4. Ensure that the battery room is sufficiently ventilated in the case of malfunctions – for example, on failure of the multifunction relay.

8.3 Energy management

8.3.1 Setting Load Shedding in a Multicluster System

Relevant for off-grid systems

The load contactor in the Multicluster-Box is a load-shedding contactor and is controlled depending on the state of charge of the batteries.

Significance of the SOC thresholds:

When the state of charge of a battery reaches the lower SOC threshold, the load contactor is opened. The state of charge of the battery of the main cluster and the states of charge of the batteries of the extension clusters are evaluated. The load contactor disconnects the loads from the stand-alone grid. When the state of charge of all batteries reaches the upper SOC threshold during recharging, the load contactor closes. The load-shedding contactor connects the loads to the stand-alone grid.

Requirement:

☐ In a cluster, the communication product or Sunny Remote Control must be connected to the master.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Battery state of charge limit for load shedding 1 start / 242.01 Lod1SocTm1Str** and set it to the lower SOC threshold.
3. Select the parameter **Battery state of charge limit for load shedding 1 stop / 242.02 Lod1SocTm1Stp** and set it to the upper SOC threshold. The upper SOC threshold must be at least 10 percentage points above the lower SOC threshold.
4. Set the parameter **Time load shedding 1 / 242.05 Lod1Tm1Str** and the parameter **Start time for the additional time period of load shedding 1 / 242.06 Lod1Tm2Str** each to the same value, e.g., to **00:00:00**. This will switch the time-dependent load shedding off.
5. If the off-grid system is a multicluster system, ensure that the parameter of the multifunction relay is set to **MccAutoLod** (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).

8.3.2 Setting One-Level Load Shedding

One multifunction relay controls the load-shedding contactor depending on the state of charge of the battery.

Significance of the SOC thresholds:

When the state of charge of the battery reaches the lower SOC threshold, the multifunction relay opens the connected load-shedding contactor. The load-shedding contactor disconnects the loads from the stand-alone grid. When the state of charge of the battery reaches the upper SOC threshold during recharging, the multifunction relay closes the connected load-shedding contactor. The load-shedding contactor connects the loads to the stand-alone grid.

Requirement:

☐ In a cluster, the communication product or Sunny Remote Control must be connected to the master.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Battery state of charge limit for load shedding 1 start / 242.01 Lod1SocTm1Str** and set it to the lower SOC threshold.
3. Select the parameter **Battery state of charge limit for load shedding 1 stop / 242.02 Lod1SocTm1Stp** and set it to the upper SOC threshold. The upper SOC threshold must be at least 10 percentage points above the lower SOC threshold.
4. Set the parameter **Time load shedding 1 / 242.05 Lod1Tm1Str** and the parameter **Start time for the additional time period of load shedding 1 / 242.06 Lod1Tm2Str** each to the same value, e.g., to 00:00:00. This will switch the time-dependent load shedding off.
5. If the loads are only to be reconnected when the set SOC threshold is reached, ensure that the parameter of the multifunction relay has been set to **AutoLod1Soc** (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).

6. If the loads are to be supplied by an external energy source during recharging of the battery, perform the following steps:
   - Ensure that the parameter of the multifunction relay is set to **AutoLodExt** (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).
   - Ensure that the external energy source can supply the loads with sufficient power.
7. If the off-grid system is a multicluster system, ensure that the parameter of the multifunction relay is set to **MccAutoLod** (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).

8.3.3 Setting Two-Level Load Shedding

Two multifunction relays control two load-shedding contactors depending on the state of charge of the battery.

Significance of the SOC thresholds:

Two lower and two upper SOC thresholds are available for each interval for controlling the load-shedding contactors. The load-shedding contactors disconnect the loads from the utility grid if the states of charge are as follows:

- When the state of charge of the battery reaches the first lower SOC threshold, the multifunction relay opens the connected load-shedding contactor for the first level of load shedding. The load-shedding contactor disconnects those loads from the utility grid that are to be disconnected for the first level.
- When the state of charge of the battery reaches the second lower SOC threshold, the multifunction relay opens the connected load-shedding contactor for the second level of load shedding. The load-shedding contactor disconnects the remaining loads from the utility grid.
- When the state of charge of the battery reaches the second upper SOC threshold during recharging, the multifunction relay closes the connected load-shedding contactor for the second level of load shedding. The load-shedding contactor connects those loads to the utility grid that were disconnected for the second level.
- When the state of charge of the battery reaches the first upper SOC threshold during recharging, the multifunction relay closes the connected load-shedding contactor for the first level of load shedding. The load-shedding contactor connects those loads, which were disconnected for the first level, to the utility grid. All loads are connected to the utility grid.

Requirement:

☐ In a cluster, the communication product or Sunny Remote Control must be connected to the master.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Setting the First Level of Load Shedding:
   - Select the parameter **Battery state of charge limit for load shedding 1 start / 242.01 Lod1SocTm1Str** and set it to the lower SOC threshold.
   - Select the parameter **Battery state of charge limit for load shedding 1 stop / 242.02 Lod1SocTm1Stp** and set it to the upper SOC threshold.
   - Set the parameter **Time load shedding 1 / 242.05 Lod1Tm1Str** and the parameter **Start time for the additional time period of load shedding 1 / 242.06 Lod1Tm2Str** each to the same value, e.g., to **00:00:00**. This will switch the time-dependent load shedding off.
   - Ensure that the parameter of the multifunction relay has been set to **AutoLod1Soc** (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).
3. Setting the second level of load shedding:
   - Select the parameter **Battery state of charge limit for load shedding 2 start / 242.07 Lod2SocTm1Str** and set it to the lower SOC threshold.

- Select the parameter **Battery state of charge limit for load shedding 2 stop in the additional time period / 242.08 Lod2SocTm1Stp** and set it to the upper SOC threshold.
- Set the parameter **Time load shedding 2 / 242.11 Lod2Tm1Str** and the parameter **Start time for the additional time period of load shedding 2 / 242.12 Lod2Tm2Str** each to the same value, e.g., to **00:00:00**. This will switch the time-dependent load shedding off.
- Ensure that the parameter of the multifunction relay has been set to **AutoLod2Soc** (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).

8.3.4 Setting Time-Dependent One-Level Load Shedding

The time-dependent load shedding divides the day into two intervals (see Section 9.3 "Setting Time-Dependent Functions", page 107). You set the SOC thresholds that apply for each interval. For example, you can set that no loads are to be disconnected from the utility grid during the night where possible.

Significance of the SOC thresholds:

When the state of charge of the battery reaches the lower SOC threshold, the multifunction relay opens the connected load-shedding contactor. The load-shedding contactor disconnects the loads from the utility grid. When the state of charge of the battery reaches the upper SOC threshold during recharging, the multifunction relay closes the connected load-shedding contactor. The load-shedding contactor connects the loads to the utility grid.

Example: from 10:00 p.m. to 6:00 a.m., the load-shedding contactor is not to disconnect the loads from the utility grid where possible.

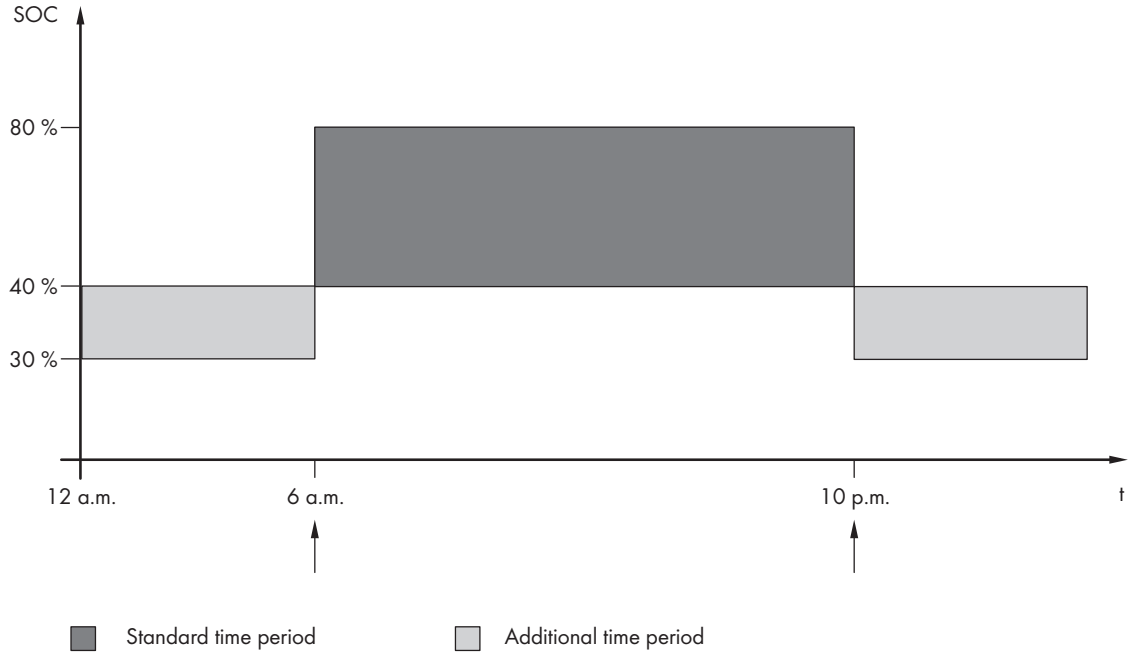


Figure 24: Profile of the SOC thresholds for controlling the load-shedding contactor and the start times for the intervals

The start time for the first interval is set to 6:00 a.m. The lower SOC threshold is set to 40% and the upper SOC threshold is set to 80% in this time interval.

The start time for the second interval is set to 10:00 p.m. The lower SOC threshold is set to 30% and the upper SOC threshold is set to 40% in this time interval.

Requirement:

☐ In a cluster, the communication product or Sunny Remote Control must be connected to the master.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Set the parameters for the standard time period:
   - Select the parameter **Time load shedding 1 / 242.05 Lod1Tm1Str** and set to the start time for the standard time period.
   - Select the parameter **Battery state of charge limit for load shedding 1 start / 242.01 Lod1SocTm1Str** and set it to the lower SOC threshold for the standard time period.
   - Select the parameter **Battery state of charge limit for load shedding 1 stop / 242.02 Lod1SocTm1Stp** and set it to the upper SOC threshold for the standard time period.
3. Set the parameters for the additional time period:
   - Select the parameter **Start time for the additional time period of load shedding 1 / 242.06 Lod1Tm2Str** and set to the start time for the additional time period.
   - Select the parameter **Battery state of charge limit for load shedding 1 start in the additional time period / 242.03 Lod1SocTm2Str** and set it to the lower SOC threshold for the additional time period.
   - Select the parameter **Battery state of charge limit for load shedding 1 stop in the additional time period / 242.04 Lod1SocTm2Stp** and set it to the upper SOC threshold for the additional time period.
4. Ensure that the parameter of the multifunction relay is set to **AutoLod1Soc** (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).

8.3.5 Setting Time-Dependent Two-Level Load Shedding

The time-dependent load shedding divides the day into two intervals (see Section 9.3 "Setting Time-Dependent Functions", page 107). You set the SOC thresholds that apply for each interval for two-level load shedding. For example, you can set that as far as possible no loads are to be disconnected from the utility grid during the day.

Significance of the SOC thresholds:

Two lower and two upper SOC thresholds are available for each interval for controlling the load-shedding contactors. The load-shedding contactors disconnect the loads from the utility grid if the states of charge are as follows:

- When the state of charge of the battery reaches the first lower SOC threshold, the multifunction relay opens the connected load-shedding contactor for the first level of load shedding. The load-shedding contactor disconnects those loads from the utility grid that are to be disconnected for the first level.
- When the state of charge of the battery reaches the second lower SOC threshold, the multifunction relay opens the connected load-shedding contactor for the second level of load shedding. The load-shedding contactor disconnects the remaining loads from the utility grid.
- When the state of charge of the battery reaches the second upper SOC threshold during recharging, the multifunction relay closes the connected load-shedding contactor for the second level of load shedding. The load-shedding contactor connects those loads to the utility grid that were disconnected for the second level.
- When the state of charge of the battery reaches the first upper SOC threshold during recharging, the multifunction relay closes the connected load-shedding contactor for the first level of load shedding. The load-shedding contactor connects those loads, which were disconnected for the first level, to the utility grid. All loads are connected to the utility grid.

Requirement:

☐ In a cluster, the communication product or Sunny Remote Control must be connected to the master.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Time load shedding 1 / 242.05 Lod1Tm1Str** and set to the start time for the first interval.
3. Select the parameter **Start time for the additional time period of load shedding 1 / 242.06 Lod1Tm2Str** and set to the start time for the second interval.
4. Set the SOC threshold for the standard time period:
   - Select the parameter **Battery state of charge limit for load shedding 1 start / 242.01 Lod1SocTm1Str** and set it to the lower SOC threshold for the first level of load shedding.
   - Select the parameter **Battery state of charge limit for load shedding 1 stop / 242.02 Lod1SocTm1Stp** and set it to the upper SOC threshold for the first level of load shedding.
   - Select the parameter **Battery state of charge limit for load shedding 2 start / 242.07 Lod2SocTm1Str** and set it to the lower SOC threshold for the second level of load shedding.
   - Select the parameter **Battery state of charge limit for load shedding 2 stop in the additional time period / 242.08 Lod2SocTm1Stp** and set it to the upper SOC threshold for the second level of load shedding.
5. Set the SOC threshold for the additional time period:
   - Select the parameter **Battery state of charge limit for load shedding 1 start in the additional time period / 242.03 Lod1SocTm2Str** and set it to the lower SOC threshold for the first level of load shedding.
   - Select the parameter **Battery state of charge limit for load shedding 1 stop in the additional time period / 242.04 Lod1SocTm2Stp** and set it to the upper SOC threshold for the second level of load shedding.
   - Select the parameter **Battery state of charge limit for load shedding 2 start in the additional time period / 242.09 Lod2SocTm2Str** and set it to the lower SOC threshold for the second level of load shedding.
   - Select the parameter **Battery state of charge limit for load shedding 2 stop in the additional time period / 242.10 Lod2SocTm2Stp** and set it to the upper SOC threshold for the second level of load shedding.
6. Ensure that the multifunction relay used for controlling the first level of load shedding is set to **AutoLod1Soc** (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).
7. Ensure that the multifunction relay used for controlling the second level of load shedding is set to **AutoLod2Soc**.

8.3.6 Setting Utilization of Excess Energy in Off-Grid Systems

Relevant for off-grid systems

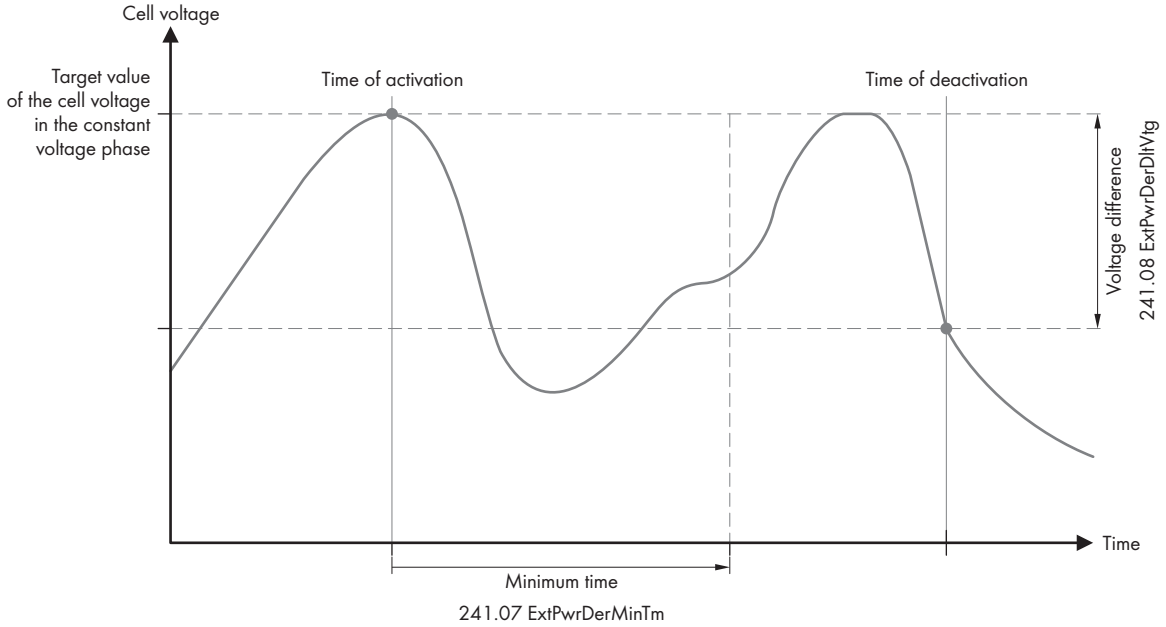


Figure 25: Switching-on time and switching-off time for utilization of excess energy during constant voltage phase

The Sunny Island controls the utilization of excess energy during the constant voltage phase depending on the cell voltage of the battery. During the constant voltage phase, the battery is charged with a constant charging voltage. When the setpoint of the cell voltage in the constant voltage phase is reached, the multifunction relay is activated. The multifunction relay remains in this position for the minimum time **241.07 ExtPwrDerMinTm**. If the cell voltage differs by more than **241.08 ExtPwrDerDltVtg** from the setpoint of the cell voltage, the multifunction relay is deactivated. The setpoint of the cell voltage depends on the charging process during the constant voltage phase.

Charging Process	Parameter	Default value
Boost charge	**Cell charge setpoint voltage for boost charge / 222.07 ChrgVtgBoost**	2.40 V
Full charge	**Cell charge setpoint voltage for full charge / 222.08 ChrgVtgFul**	2.45 V
Equalization charge	**Cell charge target voltage for equalization charge / 222.09 ChrgVtgEqu**	2.45 V

To control the utilization of excess energy, set the multifunction relay as follows:

Procedure:

1. Switch to installer mode on the Sunny Remote Control.
2. Select the parameter **241.07 ExtPwrDerMinTm** and set it to the minimum time that the multifunction relay remains activated.
3. Select the parameter **241.08 ExtPwrDerDltVtg** and set it to the voltage difference relative to the setpoint of the cell voltage during the constant voltage phase.
4. **Recording of the measured values of the cell voltage reacts to changes with time-lag**

   The Sunny Island calculates the cell voltage from the measured battery voltage. The Sunny Island calculates an average from the measured values of the battery voltage. As a result of the calculation of an average, the cell voltage that is recorded reacts to changes with a time-lag.

5. Ensure that the multifunction relay used for control is set to **ExtPwrDer** (see Section 8.1.5 "Setting the Functions of the Multifunction Relays", page 73).

8.4 Generator Management

8.4.1 Configuration of the Thresholds for Generator Connection

8.4.1.1 Changing the Current Thresholds for the Generator

Relevant for off-grid systems

Significance of the current limits:

The generator management limits the consumption of generator current to the maximum set value.

In three-phase systems, the generator current is limited for each line conductor individually. The set value applies to each line conductor.

For Sunny Island inverters that are operated in parallel, the generator management only limits the total generator current. The generator current may be unequally distributed to the Sunny Island inverters. If a Sunny Island fails, for example, more current flows through the remaining Sunny Island inverters.

Enhanced generator management:

If the set generator current is not sufficient for supplying the loads, the generator management requests additional current from the battery. The system then supplies the loads with the generator current and the battery current.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Nominal generator current** / **234.03 GnCurNom** and set to the desired value.
   Useful hint: A suitable value for the parameter **234.03 GnCurNom** is 80% of the maximum generator current per line conductor.

8.4.1.2 Changing the Voltage Thresholds for the Generator

Relevant for off-grid systems

The voltage thresholds determine the range within which the generator voltage is allowed to fluctuate. When the Sunny Island switches to the generator, the stand-alone grid will also fluctuate within this range.

A breach of the set voltage thresholds leads to disconnection of the line conductor from the stand-alone grid or the generator not being switched on.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Voltage monitoring generator lower minimum threshold** / **234.01 GNVtgMin** and set to the minimum generator voltage.
3. Select the parameter **Voltage monitoring generator upper maximum threshold** / **234.02 GnVtgMax** and set to the maximum generator voltage.

8.4.1.3 Changing the Frequency Thresholds of the Generator Voltage

Relevant for off-grid systems

The frequency thresholds determine the range within which the frequency of the generator voltage is allowed to fluctuate. When the Sunny Island switches to the generator, the stand-alone grid will also fluctuate within this range.

A breach of the set frequency thresholds leads to disconnection of the line conductor from the stand-alone grid or to the generator not being switched on.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Nominal generator frequency** / **234.04 GnFrqNom** and set to the rated frequency of the generator voltage.
3. Select the parameter **Frequency monitoring generator lower minimum threshold** / **234.05 GnFrqMin** and set to the minimum frequency of the generator voltage.
4. Select the parameter **Frequency monitoring generator upper maximum threshold** / **234.06 GnFrqMin** and set to the maximum frequency of the generator voltage.

8.4.1.4 Changing the Permitted Reverse Power in the Generator

Relevant for off-grid systems

If the reverse power for the set time is exceeded, all Sunny Island inverters disconnect the generator from the stand-alone grid and block the connection of the generator to the stand-alone grid for the minimum stop time.

NOTICE

Generator damage

In the event of reverse power, the AC sources in the stand-alone grid drive the generator. The generator can be damaged as a result.

- Observe the manufacturer's information on reverse power protection of the generator.
- Set the generator reverse power and permitted time for reverse power according to the manufacturer's specifications.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Voltage monitoring generator maximum reverse power** / **234.13 GnRvPwr** and set to the active power of the generator reverse power.
3. Select the parameter **Voltage monitoring generator maximum reverse power tripping time** / **234.14 GnRvTm** and set to time period of the generator reverse power.

8.4.1.5 Configuring the Current Limit for the Generator Depending on the Frequency

Relevant for off-grid systems

The higher the generator current, the higher the torque for the generator. With unregulated generators, the speed of rotation decreases with increasing torque. If the speed of rotation decreases, the frequency of the generator voltage is reduced.

If the frequency of the generator voltage falls below the rated frequency, the generator management can place additional limits on the generator current. The lower the frequency, the more the generator current is limited by the generator management. This setting is useful if the generator is supplying other loads parallel to the Sunny Island. This setting allows the maximum load to be placed on the generator without overloading it.

Requirement:

☐ The generator must not be an inverter generator. The output frequency of the inverter generator is fixed.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Nominal generator current** / **234.03 GnCurNom** and set to the desired value.
   Useful hint: A suitable value for the parameter **234.03 GnCurNom** is 80% of the maximum generator current per line conductor.
3. Select the parameter **Type of generator current limitation** / **234.15 GnCtlMod** and set to **CurFrq**. This will activate the frequency-dependent current limiting.

8.4.2 Changing the Type of the Generator Interface

Relevant for off-grid systems

If you have installed a generator in the system, the type of generator interface determines how the generator is controlled.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. If the generator has an autostart function, select the parameter **Generator request** / **234.07 GnStrMod** and set to **Autostart**.
3. If the generator does not have an autostart function, select the parameter **Generator request** / **234.07 GnStrMod** and set to **Manual**.

8.4.3 Configuring Generator Run Times

8.4.3.1 Changing the Warm-Up Time for the Generator

Relevant for off-grid systems

Relation between warm-up time and termination of generator start:

The generator management measures the time between the generator start and the beginning of the warm-up time. If a maximum time is exceeded, the generator management terminates the generator start. The maximum time to start termination is double the warm-up time plus an additional two minutes.

With some generator types, the generator only switches the voltage to the output of the generator after the internal warm-up time has expired. During this time, the generator management is unable to recognize a valid generator voltage. If the warm-up time is set too low, the generator management terminates the generator start before the internal warm-up time has expired.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Generator warm-up time** / **234.12 GnWarmTm**.
3. Set the selected parameter according to the generator properties.

Generator properties		Setting Parameters
Without internal warm-up time		• Set the desired warm-up time.
With internal warm-up time	Autostart compatible	• Set the warm-up time to be at least half the internal warm-up time of the generator.
	Without an autostart function	

☑ The generator start is not terminated prematurely.

8.4.3.2 Changing the Minimum Run Time for the Generator

Relevant for off-grid systems

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Minimum run time of the generator** / **234.08 GnOpTmMin** and set to the desired value.

8.4.3.3 Changing the Power-Down Time for the Generator

Relevant for off-grid systems

Internal shut-off delay of the generator

Generators may have an internal shut-off delay which is activated only once the generator request has been removed. Note that this internal shut-off delay increases the actual power-down time.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Cool-down time of the generator** / **234.10 GnCoolTm** and set to the desired value.

8.4.3.4 Changing the Minimum Stop Time for the Generator

Relevant for off-grid systems

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Minimum idle time of the generator** / **234.09 GnStpTmMin** and set to the desired value.

8.4.4 Configuring the Generator Request

8.4.4.1 Changing the Automatic Generator Operation

Relevant for off-grid systems

In automatic generator operation, the generator management specifies when and for how long the generator runs, depending on the configuration.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. To deactivate automatic generator mode, select the parameter **Automatic generator start** / **235.01 GnAutoEna** and set it to **Disable**.
3. To activate automatic generator mode, select the parameter **Automatic generator start** / **235.01 GnAutoEna** and set it to **Enable**.

8.4.4.2 Changing a State-Of-Charge-Dependent Generator Request

Relevant for off-grid systems

If the battery reaches the lower SOC threshold, the generator management requests the generator. If the battery reaches the upper SOC threshold during recharging, the generator management resets this generator request.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Battery state of charge limit for generator start / 235.03 GnSocTm1Str** and set it to the lower SOC threshold.
3. Select the parameter **Battery state of charge limit for generator disconnection / 235.04 GnSocTm1Stp** and set it to the upper SOC threshold.
4. Set the parameter **End time additional time period generator request / 235.07 GnTm1Str** and **Start time additional time period generator request / 235.08 GnTm2Str** to the same value, e.g., to **00:00:00**. This deactivates the time-dependent generator request.

8.4.4.3 Setting a Time-Dependent Generator Request

Relevant for off-grid systems

The time-dependent generator request divides the day into two intervals. For each interval, you set which conditions there are for the generator request (see Section 9.3 "Setting Time-Dependent Functions", page 107). In this way, you can, for example, set the generator not to start at night. This ensures that the noise pollution produced by the generator takes place during the day whenever possible. Both intervals each have a lower and an upper SOC threshold. If the battery reaches the lower SOC threshold, the generator management requests the generator. When the battery reaches the upper SOC threshold during recharging, generator management resets this generator request. The following settings are possible for the SOC thresholds:

- The lower SOC threshold is lower than the upper SOC threshold.

  The generator is requested during this interval depending on the state of charge.
- The lower SOC threshold is higher than or equal to the upper SOC threshold.

  The generator is not started depending on the state of charge. In this interval, the other settings for the generator request, e.g. the time-dependent generator request, apply.

Example: from 10:00 p.m. to 6:00 a.m., the generator is not to start where possible.

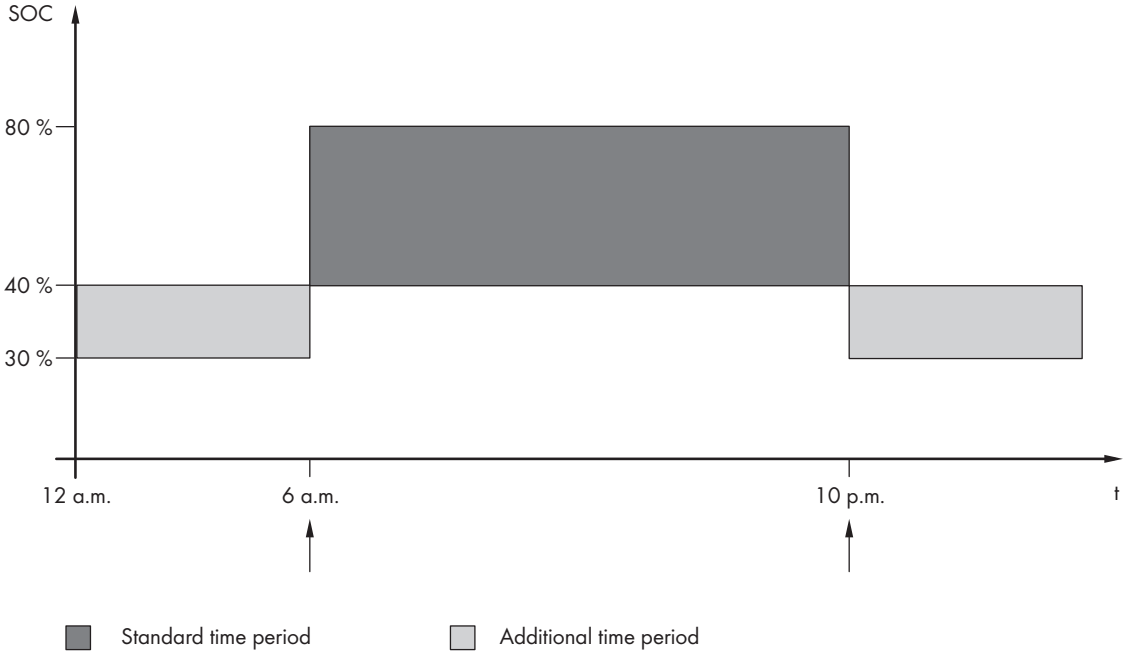


Figure 26: Profile of the SOC and the times for generator requests

For the standard time period, the start time is set to 6:00 a.m. and the end time to 10:00 p.m. The lower SOC threshold is set to 40% and the upper SOC threshold is set to 80% in this time period.

For the additional time period, the start time is set to 10:00 p.m. and the end time to 6:00 a.m. The lower SOC threshold is set to 30% SOC and the upper SOC threshold is set to 40% SOC in this time period.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Set the parameters for the standard time period:
   - Select the parameter **End time additional time period generator request** / **235.07 GnTm1Str** and set it to the start time for the standard time period.
   - Select the parameter **Battery state of charge limit for generator start** / **235.03 GnSocTm1Str** and set it to the lower SOC threshold during the standard time period.
   - Select the parameter **Battery state of charge limit for generator disconnection** / **235.04 GnSocTm1Stp** and set it to the upper SOC threshold during the standard time period.
3. Set the parameters for the additional time period:
   - Select the parameter **Start time for the additional time period of generator request** / **235.08 GnTm2Str** and set to the start time for the additional time period.
   - Select the parameter **Battery state of charge limit for generator start in the additional time period** / **235.05 GnSocTm2Str** and set it to the lower SOC threshold during the additional time period.
   - Select the parameter **Battery state of charge limit for generator disconnection in the additional time period** / **235.06 GnSocTm2Stp** and set it to the upper SOC threshold during the additional time period.

8.4.4.4 Configuring the Load-Dependent Generator Request

Relevant for off-grid systems

Significance of the load-dependent generator request:

If you activate the load-dependent generator request, the Sunny Island requests the generator in the event of a high load. This prevents the battery from deep electric discharging and cycling and extends its service life. The performance of the off-grid system for supplying loads increases to the sum of the generator power and the power of the Sunny Island inverter. This improves the system stability. The load is the average output power of the Sunny Island inverter.

Loads in a three-phase system:

The generator management considers the total load of all phases. It does not monitor single phases in three-phase systems. If the switch-on power limit is exceeded, the generator management requests the generator.

Time-based procedure of the load-dependent generator request:

If the switch-on power limit is reached, the generator management requests the generator. If the load then drops to the switch-off power limit, the generator management resets the generator request after the minimum run time. The generator management does not record the load as an instantaneous value. The generator management calculates the load during the averaging time **235.12 GnPwrAvgTm**. The greater the averaging time that you set, the less the generator management reacts to load peaks.

Generator run times:

The warm-up, minimum and power-down times are adhered to after the generator start. The power of the generator is not immediately available in the stand-alone grid. Each start also means that the generator runs for at least the warm-up time, minimum run time and power-down time.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Generator request via power on** / **235.09 GnPwrEna** and set to **Enable**. This will activate the load-dependent generator request.
3. Select the parameter **Generator start load limit** / **235.10 GnPwrStr** and set to the switch-on power limit.
4. Select the parameter **Generator shutdown load limit** / **235.11 GnPwrStp** and set to the switch-off power limit.
5. Select the parameter **Averaging time for generator request based on power** / **235.12 GnPwrAvgTm** and set to the averaging time with which the generator management calculates the average power.

8.4.4.5 Time-Controlled Generator Requesting

Relevant for off-grid systems

If the generator is requested dependent on time, it is requested on certain days for a set duration (see Section 9.4 "Setting Time-Controlled Functions", page 107).

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Time-controlled generator operation** / **235.13 GnTmOpEna** and set it to **Enable**.
3. To set start date and start time on the Sunny Remote Control, set the parameter **235.14 GnTmOpStrDt** to the desired start date and the parameter **235.15 GnTmOpStrTm** the desired start time.

4. To set the start date and start time on the communication product, select the parameter **Start time for time-controlled generator operation** and set the desired start date and time of the generator.
5. Select the parameter **Run time for time-controlled generator operation** / **235.16 GnTmOpRnDur** and set it to the desired duration.
6. Select the parameter **Repetition cycle for time-controlled inverter operation** / **235.17 GnTmOpCyc** and set it to the desired repetition cycle.

Value	Explanation
Single	Single generator request on the start date
Daily	Daily generator request starting on the start date
Weekly	Weekly generator request starting on the start date The start date determines the weekday.

8.4.4.6 Changing the Generator Request via the Charging Process of the Battery

Relevant for off-grid systems

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. Select the parameter **Generator request in configured charge mode** / **235.18 GnStrChrgMod** and set to the desired generator request:

Value	Explanation
Equal	Generator request during equalization charge
Full	Generator request during full charge
Both	Generator request during equalization and full charge
Off	Deactivation of the generator request via the charging process of the battery

8.4.4.7 Setting an External Generator Request

Relevant for off-grid systems

An external control signal can transmit a generator request to the generator management.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. In order to activate the external generator request, select the parameter **Reaction to digital input of the generator request** / **235.19 GnStrDigIn** and set to **Enable**.
3. In order to deactivate the external generator request, select the parameter **Reaction to digital input of the generator request** / **235.19 GnStrDigIn** and set to **Disable**.

8.4.5 Configuring the Procedure in the Event of a Generator False Start

Relevant for off-grid systems

Operating procedure if a generator false start is detected:

If the Sunny Island detects a generator false start (e.g., voltage too high), the Sunny Island does not connect the stand-alone grid to the generator. If there is another request for the generator after the minimum stop time, the Sunny Island attempts to start the generator. If the Sunny Island detects a false start on numerous occasions and the number of failed attempts exceeds the maximum value, the Sunny Island switches into error status. After the stop time **234.11 GnErrStpTm** has expired, the Sunny Island attempts to restart the generator.

Single cluster systems:

The generator management classes a line conductor fault on the master as a generator failure. All Sunny Island inverters disconnect the stand-alone grid from the generator. The generator management treats a fault on the slave line conductor as a line conductor fault. The slave disconnects only the affected line conductor from the stand-alone grid. The slave switches the stand-alone grid to the generator again if the faulty line conductor is in the valid range.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. In order to change the maximum number of failed attempts on the Sunny Remote Control:
   - Select the parameter **235.01 GnAutoEna** and set it to **Enable**.
   - Select the parameter **235.02 GnAutoStr** and set to the desired number of start attempts.
3. In order to change the maximum number of failed attempts on the communication product:
   - Select the parameter **Automatic generator start**.
   - Activate the automatic generator start and set the desired number of start attempts (see user manual of the communication product).
4. In order to change the stop time of the generator after the maximum number of start attempts has been exceeded, select the parameter **Idle time after generator error** / **234.11 GnErrStpTm** and set to the desired stop time.

8.5 Setting the Time Control

The time control controls up to two multifunction relays according to the set times.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. To set the start date, select and set the following parameters:

Possible settings	Parameter	
Start time for timer 1, date	**Start date relay control for timer**	**243.01 RlyTmr1StrDt**
Start time for timer 1, time		**243.02 RlyTmr1StrTm**
Start time for timer 2, date		**243.05 RlyTmr2StrDt**
Start time for timer 2, time		**243.06 RlyTmr2StrTm**

3. To set the desired running time, select and set the following parameters:

Possible settings	Parameter	
Running time for timer 1	**Duration for which the multi-function relay remains activated for timer**	**243.03 RlyTmr1Dur**
Running time for timer 2		**243.07 RlyTmr2Dur**

Possible settings	Parameter

4. To set the desired repetition cycle, select and set the following parameters:

Possible settings	Parameter	
Repetition cycle time for timer 1	**Repetition cycle time relay control for timer**	**243.04 RlyTmr1Cyc**
Repetition cycle time for timer 2		**243.08 RlyTmr2Cyc**

8.6 Changing Thresholds for Systems for Increased Self-Consumption

Relevant for systems connected to the utility grid

The Sunny Island meets the requirements of the application rule "VDE-AR-N 4105:2011-08 - Power generation systems connected to the low-voltage distribution network - Technical minimum requirements for the connection to and parallel operation with low-voltage distribution networks". In the Sunny Island, the application rule is defined as standard country data set **VDE-AR-4105**.

In certain countries, the settings may need to be modified for connection of the Sunny Island inverter to the utility grid.

Procedure:

- If the operation of the Sunny Island connected to the utility grid is allowed and an adjustment is necessary, change the Sunny Island according to the documentation (see www.SMA-Solar.com).

8.7 Changing the Automatic Frequency Synchronization in Off-Grid Systems

Relevant for off-grid systems

Automatic frequency synchronization enables the use of clocks which use the power frequency as a timer. The power frequency determines the accuracy of the clock. For power frequencies with constant frequency deviations from the rated frequency, the time indications will become more and more inaccurate. Continuous frequency deviations occur in off-grid systems with generators, for example. If the automatic frequency synchronization is activated, the Sunny Island regulates the frequency deviations over time. As a result, the accuracy of clocks that use the power frequency as timers is increased.

Procedure:

1. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
2. To deactivate automatic frequency synchronization, select the parameter **Automatic frequency synchronization** / **250.11 AfraEna** and set it to **Disable**.
3. To activate automatic frequency synchronization, select the parameter **Automatic frequency synchronization** / **250.11 AfraEna** and set it to **Enable**.

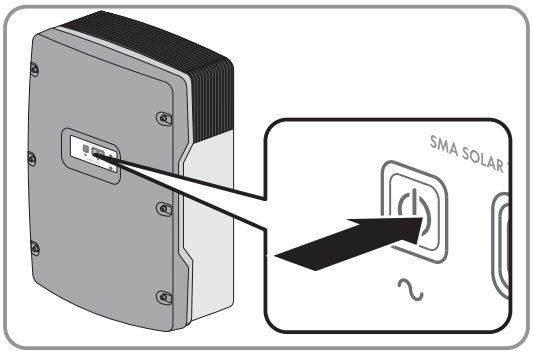
8.8 Complete Commissioning.

Load shedding in the first two operating hours

The state of charge (SOC) recorded by battery management and the available battery capacity (SOH) will deviate strongly from the actual values of SOC and SOH for a newly connected battery. During operation, the values recorded by battery management will gradually approach the real values. In the first two operating hours with the new battery, these deviations can lead to load shedding and corresponding messages. These messages are shown on the Sunny Remote Control or communication product (see the Sunny Island operating manual or the user manual of the communication product).

Procedure:

1. Make sure that the wiring is correct (see Section 7.6, page 64).
2. Ensure that the system-specific preparations for commissioning have been implemented correctly (see "Installation - Quick Reference Guide" of the System Used).
3. Connect or close the circuit breakers and fuse switch-disconnectors for energy sources.
4. With off-grid systems only, disconnect or open all loads, the circuit breakers of the loads and the fuse switch-disconnector. As a result, only the energy sources are connected to the Sunny Island.
5. Press the start-stop button on the Sunny Island and hold it until an acoustic signal sounds.



   ☑ The Sunny Island starts charging the battery automatically.
6. With off-grid systems only, when full charge is complete, switch on all circuit breakers and load-break switches. Tip: The state of charge of the battery is displayed on the Sunny Remote Control in standard mode.
7. In order to receive service assignments for the Sunny Island system, all system data must be recorded in the information sheet for Sunny Island systems and made available to Service (for information sheet see www.SMA-Solar.com).

9 Supplementary Information

9.1 Enter the SMA Grid Guard code.

Depending on the configuration, safety-relevant parameters are protected by the SMA Grid Guard code from unauthorized changes. You can unlock the parameters by entering the SMA Grid Guard code.

Procedure:

1. Contact the SMA Service Line and apply for a personal SMA Grid Guard code.
2. Log in to Sunny Explorer as **Installer** (see the user manual of the Sunny Explorer) or switch to expert mode on the Sunny Remote Control (see the Sunny Island operating manual).
3. To enter the SMA Grid Guard code on the Sunny Remote Control, select the parameter **270.01 Auth.Code** and set the SMA Grid Guard code.
4. To enter the SMA Grid Guard code in the Sunny Explorer, select **Options > SMA Grid Guard** in the menu bar and set the SMA Grid Guard code (see Sunny Explorer user manual).

☑ Grid-relevant parameters can be changed.

9.2 Determining the Battery Capacity

Manufacturers state the battery capacity depending on the discharge time. In the configuration of the off-grid system and in the QCG, you always enter the battery capacity for a 10-hour electric discharge (C10).

Procedure:

- Determine the battery capacity C10 specified by the battery manufacturer.
  - ☑ You could determine the battery capacity C10.

✖ You could not determine the battery capacity C10?

- Estimate the battery capacity C10 from other discharge times. This will provide a value that is probably sufficient for commissioning.

Discharging time	Estimation
120 h (C120)	$C10 = {}^{C120}/_{1.28}$
100 h (C100)	$C10 = {}^{C100}/_{1.25}$
20 h (C20)	$C10 = {}^{C20}/_{1.09}$
10 h (C10)	C10 = C10
5 h (C5)	$C10 = {}^{C5}/_{0.88}$
1 h (C1)	$C10 = {}^{C1}/_{0.61}$

- Contact the battery manufacturer, request the C10 battery capacity and set the correct battery capacity in the QCG as soon as possible. Proceed as if you were replacing the battery (replacing the battery, see Sunny Island operating manual).

9.3 Setting Time-Dependent Functions

Time-dependent functions, such as time-dependent load shedding, split the day into two time periods. You specify the time periods using two points in time. The standard time period starts with time 1 and ends with time 2. The additional time period starts with time 2 and ends with time 1.

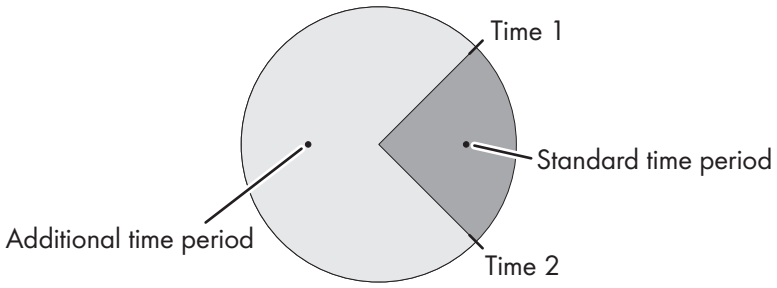


Figure 27: Division of the time of day into two time periods

9.4 Setting Time-Controlled Functions

For time-controlled functions, you set the start time, duration and repetition type.

Example: Time-controlled operation of a generator

If you want the generator to run every Monday from 07:00 a.m. to 08:00 a.m., Set the generator as follows:

- **Time-controlled generator operation** / **235.13 GnTmOpEna**: Enable (activation of the function)
- **Start time for time-controlled generator operation** / **235.14 GnTmOpStrDt**: January 5, 2015 (Monday)
- **Start time for time-controlled generator operation** / **235.15 GnTmOpStrTm**: 07:00:00 (starting time)
- **Runtime for time-controlled generator operation** / **235.16 GnTmOpRnDur**: 01:00:00 (duration)

  Repeat cycle for time-controlled generator operation / **235.17 GnTmOpCyc**: Weekly (repetition type)

10 Technical Data

10.1 AC1 Connection for Stand-Alone Grid

	Sunny Island 3.0M	Sunny Island 4.4M	Sunny Island 6.0H	Sunny Island 8.0H
Rated power	2300 W	3300 W	4600 W	6000 W
Power for 30 minutes at 25°C	3000 W	4400 W	6000 W	8000 W
Power for 5 minute at 25°C	3500 W	4600 W	6800 W	9100 W
Power for 1 minute at 25°C	4200 W	4800 W	7500 W	9600 W
Maximum AC power for 3 s at 25°C	5500 W	5500 W	11000 W	11000 W
Maximum connectable power of the PV inverters in off-grid systems	4600 W	4600 W	9200 W	12000 W
Rated grid voltage	230 V	230 V	230 V	230 V
Voltage range	202 V to 253 V	202 V to 253 V	202 V to 253 V	202 V to 253 V
Rated frequency	50 Hz	50 Hz	50 Hz	50 Hz
Frequency range	45 Hz to 65 Hz	45 Hz to 65 Hz	45 Hz to 65 Hz	45 Hz to 65 Hz
Frequency range of the set range	±10 Hz	±10 Hz	±10 Hz	±10 Hz
Rated Current	10 A	14.5 A	20.0 A	26.1 A
Maximum output current as a peak value for 60 milliseconds	60 A	60 A	120 A	120 A
Total harmonic distortion of the output voltage (THD)	<4.5 %	<4.5 %	<4 %	<4 %
Displacement power factor cos φ	−1 to +1	−1 to +1	−1 to +1	−1 to +1
Recommended conductor cross-section	10 mm²	10 mm²	10 mm²	10 mm²
Maximum connectable conductor cross-section	16 mm²	16 mm²	16 mm²	16 mm²
Cable diameter	9 mm to 18 mm	9 mm to 18 mm	9 mm to 18 mm	9 mm to 18 mm
Terminal	Lever terminal	Lever terminal	Lever terminal	Lever terminal
Circuit breakers than can be tripped	Tripping characteristics B6	Tripping characteristics B6	Tripping characteristics B16 or C6	Tripping characteristics B16 or C6
Short circuit power of the device	13.8 kW	13.8 kW	27.6 kW	27.6 kW

10.2 AC2 Connection for Utility Grid and Generator (External Energy Source)

	Sunny Island 3.0M	Sunny Island 4.4M	Sunny Island 6.0H	Sunny Island 8.0H
Maximum power in an off-grid system	11500 W	11500 W	11500 W	11500 W
Rated voltage	230 V	230 V	230 V	230 V
Voltage range	172.5 V to 264.5 V	172.5 V to 264.5 V	172.5 V to 264.5 V	172.5 V to 264.5 V
Rated frequency	50 Hz	50 Hz	50 Hz	50 Hz
Permitted frequency range	40 Hz to 70 Hz	40 Hz to 70 Hz	40 Hz to 70 Hz	40 Hz to 70 Hz
Maximum current in off-grid systems	50 A	50 A	50 A	50 A
Maximum current in SMA Flexible Storage System without battery backup function with one Sunny Island in Germany	10.0 A	13.3 A	20.0 A	20.0 A
Maximum power in systems for increased self-consumption with one Sunny Island in Germany	2300 W	3300 W	4600 W	4600 W
Maximum inrush current for 10 ms	±3 A	±3 A	±1.5 A	±1.5 A
Maximum connectable power of the PV inverters in battery-backup systems	5000 W	5000 W	9200 W	12000 W
Recommended conductor cross-section	10 mm²	10 mm²	10 mm²	10 mm²
Maximum connectable conductor cross-section	16 mm²	16 mm²	16 mm²	16 mm²
Cable diameter	9 mm to 18 mm	9 mm to 18 mm	9 mm to 18 mm	9 mm to 18 mm
Terminal	Lever terminal	Lever terminal	Lever terminal	Lever terminal
Maximum back-up fuse	50 A	50 A	50 A	50 A

10.3 DC Connection for Battery

	Sunny Island 3.0M	Sunny Island 4.4M	Sunny Island 6.0H	Sunny Island 8.0H
Rated input voltage	48 V	48 V	48 V	48 V
Voltage range	41 V to 63 V	41 V to 63 V	41 V to 63 V	41 V to 63 V
Rated charging current	45 A	63 A	90 A	115 A
Rated discharging current	51 A	75 A	103 A	136 A
Maximum battery charging current	51 A	75 A	110 A	140 A

	Sunny Island 3.0M	Sunny Island 4.4M	Sunny Island 6.0H	Sunny Island 8.0H
Battery type	Lead-acid battery: FLA, VRLA lithium-ion battery *	Lead-acid battery: FLA, VRLA lithium-ion battery *	Lead-acid battery: FLA, VRLA lithium-ion battery *	Lead-acid battery: FLA, VRLA lithium-ion battery *
Battery capacity range of lead-acid batteries	100 Ah to 10000 Ah	100 Ah to 10000 Ah	100 Ah to 10000 Ah	100 Ah to 10000 Ah
Battery capacity range of lithium-ion batteries	50 Ah to 10000 Ah	50 Ah to 10000 Ah	50 Ah to 10000 Ah	50 Ah to 10000 Ah
Recommended minimum battery capacity C10 in systems for increased self-consumption	100 Ah	100 Ah	100 Ah	100 Ah
Recommended minimum battery capacity C10 in battery-backup systems	100 Ah	100 Ah	120 Ah	160 Ah
Recommended minimum battery capacity C10 in off-grid systems	100 Ah	150 Ah	190 Ah	250 Ah
Recommended minimum battery capacity C10 per 1,000 Wp power of PV systems in off-grid systems	100 Ah	100 Ah	100 Ah	100 Ah
Charge control for lead-acid batteries	IUoU charging behavior with automatic full charge and equalization charge	IUoU charging behavior with automatic full charge and equalization charge	IUoU charging behavior with automatic full charge and equalization charge	IUoU charging behavior with automatic full charge and equalization charge
DC connection	Terminal lug M8, 20 mm to 25 mm wide	Terminal lug M8, 20 mm to 25 mm wide	Terminal lug M8, 20 mm to 25 mm wide	Terminal lug M8, 20 mm to 25 mm wide
Permitted conductor cross-section:	50 mm^2 to 95 mm^2	50 mm^2 to 95 mm^2**	50 mm^2 to 95 mm^2**	50 mm^2 to 95 mm^2**
Maximum connectable conductor cross-section	95 mm^2**	95 mm^2**	95 mm^2**	95 mm^2**
Cable diameter	14 mm to 25 mm	14 mm to 25 mm	14 mm to 25 mm	14 mm to 25 mm
Torque	12 Nm	12 Nm	12 Nm	12 Nm

* The lithium-ion battery must be approved for use with the Sunny Island (see technical information at "List of Approved Lithium-Ion Batteries").

** In the event of a cross-section of 95 mm^2, observe the maximum cable diameter.

10.4 Efficiency

	Sunny Island 3.0M	Sunny Island 4.4M	Sunny Island 6.0H	Sunny Island 8.0H
Maximum efficiency	95.3 %	95.3 %	95.8 %	95.8 %
European weighted efficiency	94.0 %	94.0 %	94.3 %	94.1 %

10.5 Sunny Island 3.0M Efficiency Profile

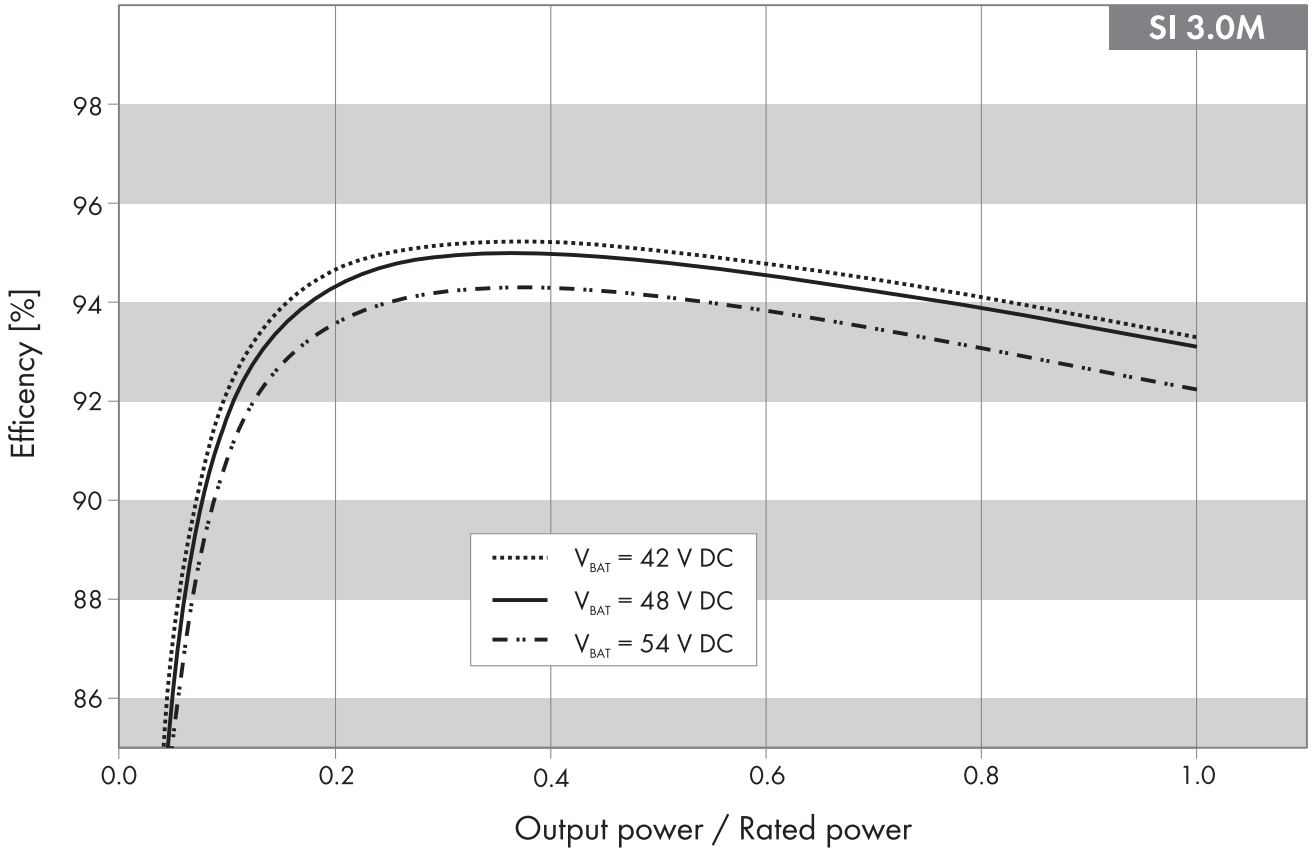


Figure 28: Characteristic efficiency curve

10.6 Sunny Island 4.4M Efficiency Profile

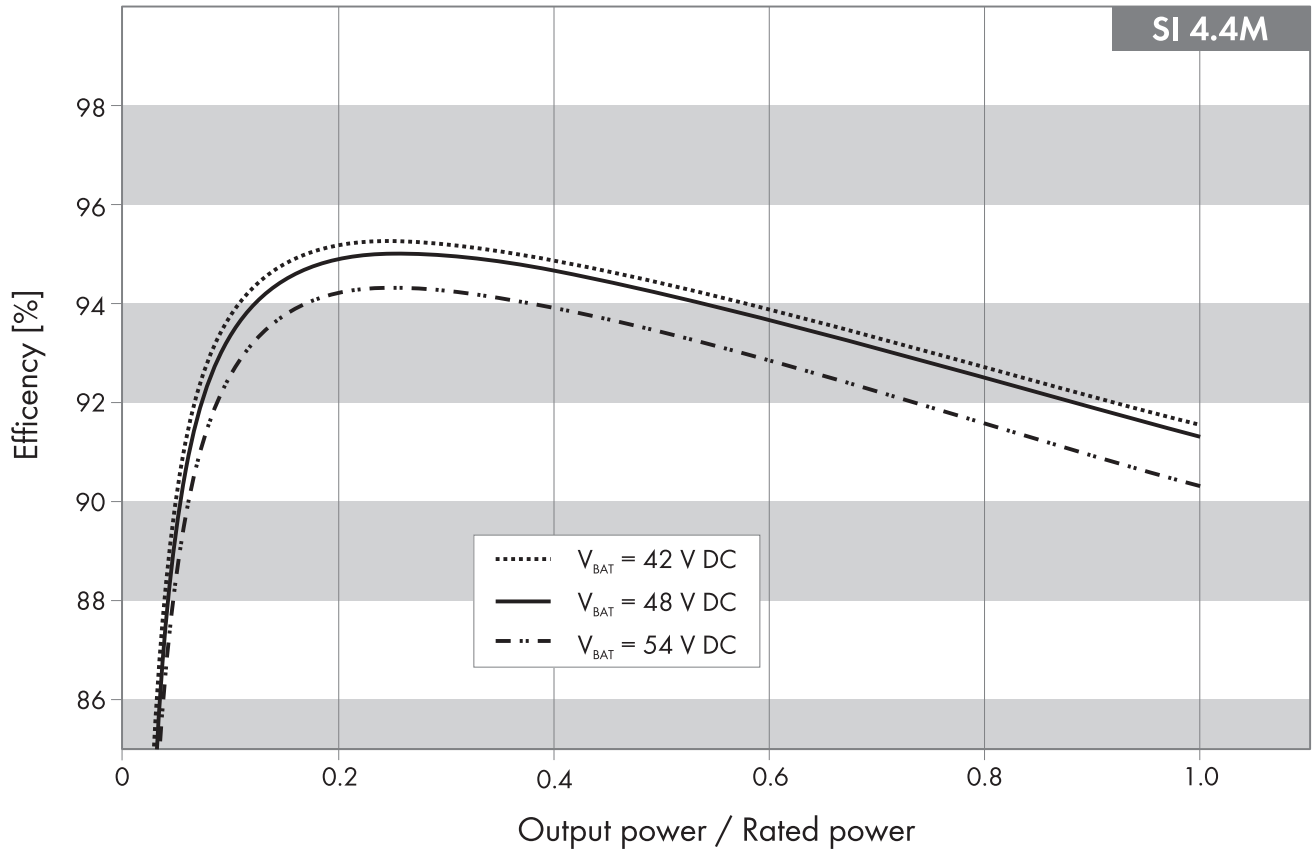


Figure 29: Characteristic efficiency curve

10.7 Sunny Island 6.0H Efficiency Profile

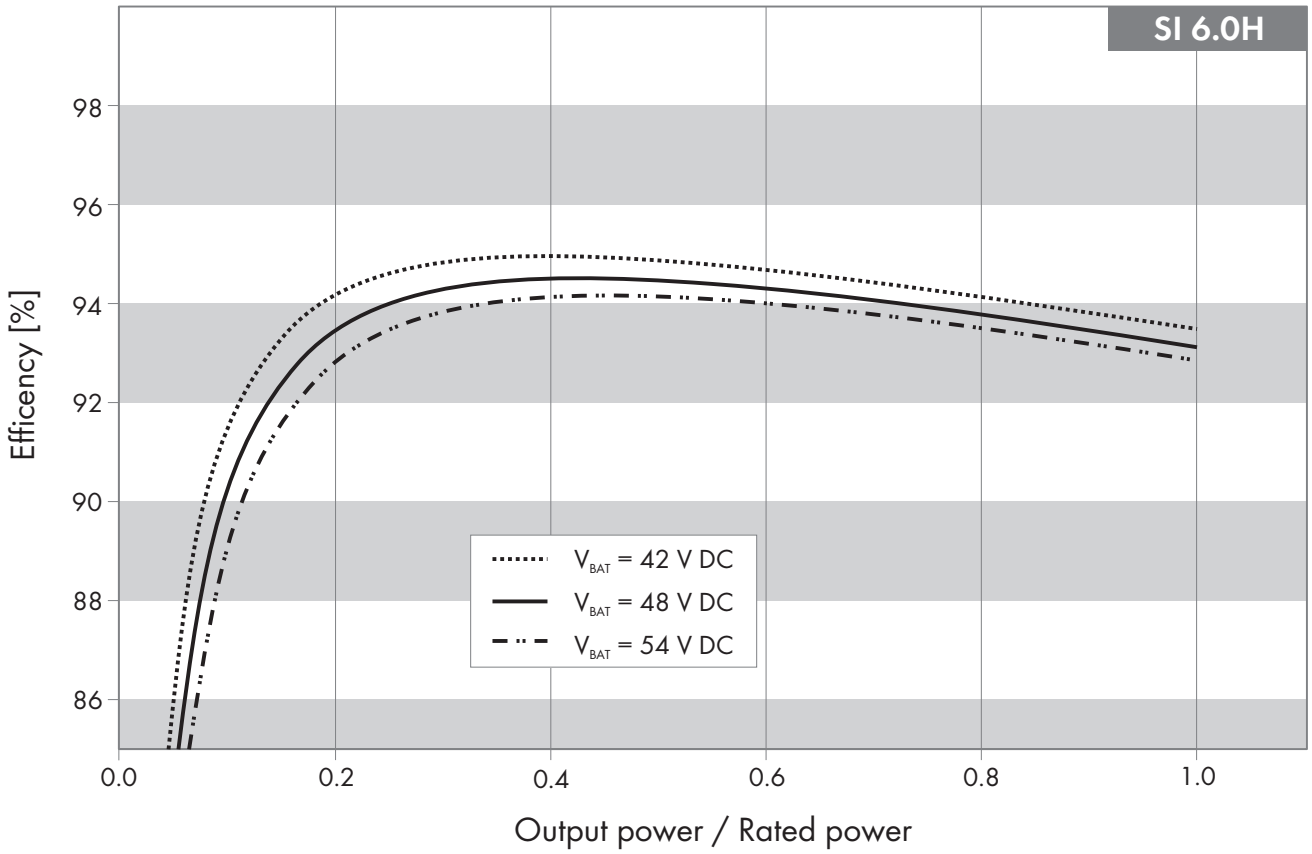


Figure 30: Characteristic efficiency curve

10.8 Sunny Island 8.0H Efficiency Profile

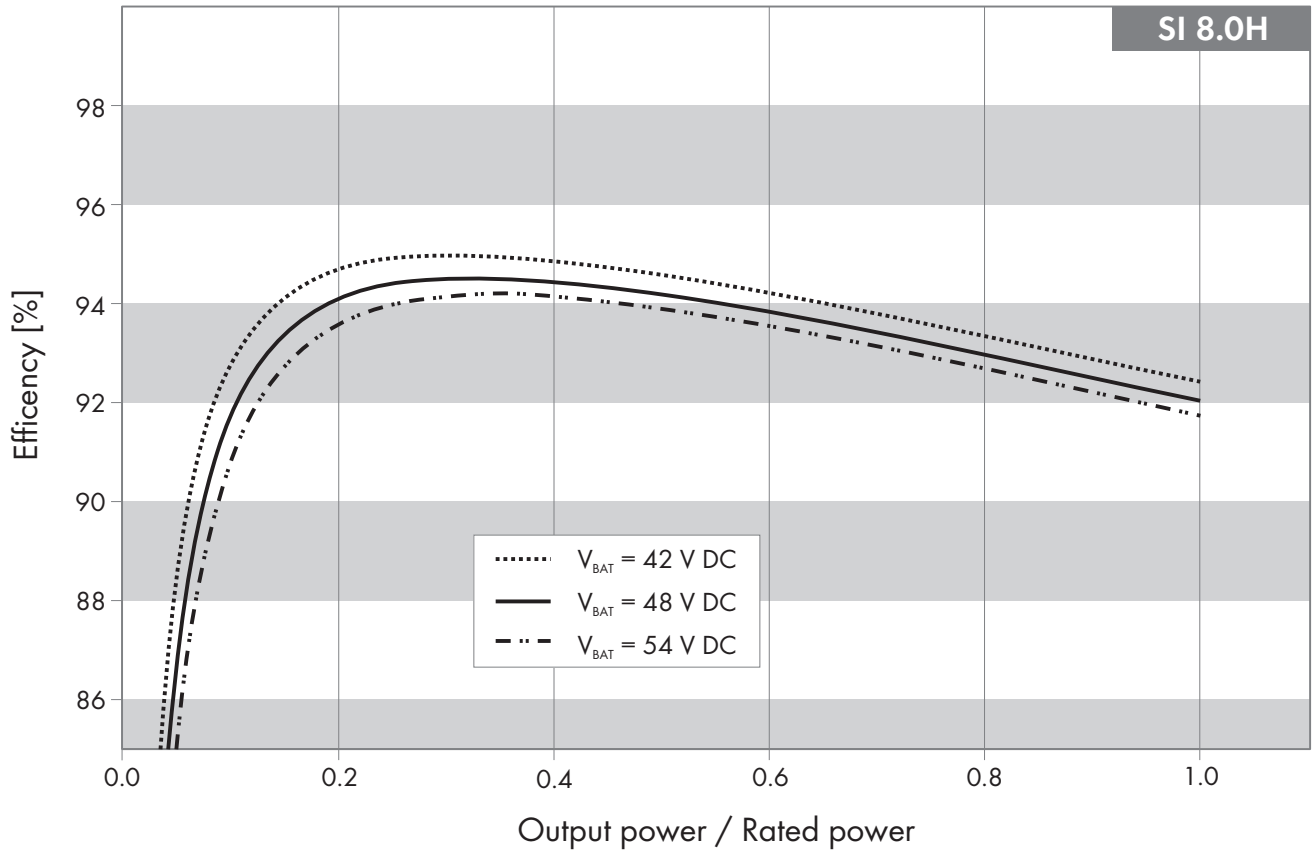


Figure 31: Characteristic efficiency curve

10.9 Energy Consumption in No-Load Operation and Standby

	Sunny Island 3.0M	Sunny Island 4.4M	Sunny Island 6.0H	Sunny Island 8.0H
Standby consumption	6.8 W	6.8 W	6.5 W	6.5 W
Consumption in no-load operation and in discharge mode without SRC-20	18.0 W	18.0 W	25.8 W	25.8 W
Consumption in no-load operation and in discharge mode with SRC-20	18.8 W	18.8 W	26.6 W	26.6 W

10.10 Noise Emission

Noise emission, typical	49 dB(A)

10.11 Grid Configuration

TN-S grid configuration	Suitable
TN-C-S grid configuration	Suitable
TT grid configuration	Suitable

10.12 Protective Devices

AC short-circuit	yes
AC overload	yes
DC reverse polarity protection	not available
Battery deep discharge	yes
Overtemperature	yes
Overvoltage category in accordance with IEC 60664-1	III

10.13 Equipment

Number of buttons	3
Number of LEDs	3 two-color LEDs
Display	External display SRC-20
Number of interface slots	2
SWDMSI-xx	required in systems for increased self-consumption
SI-COMSMA.BGx	optional
COM SYNC	for internal communication only
SI-SYSCAN.BGx	optional for Sunny Island 6.0H/8.0H
Number of digital control inputs	1
High level digital input	9 V to 63 V
Low level digital input	0 V to 3 V
Potential-free control contacts	Two multifunction relays
Number of connections for battery current sensors	1
Measuring accuracy with connected battery current sensor	± 10 %
Maximum length of measuring cable on battery current sensor	3 m
AC load switching limit for multifunction relays 1 and 2	1 A at 250 V
DC load switching limit for multifunction relays 1 and 2	(see Section 10.14, page 116)

10.14 DC Load Limitation Curve of the Multifunction Relays

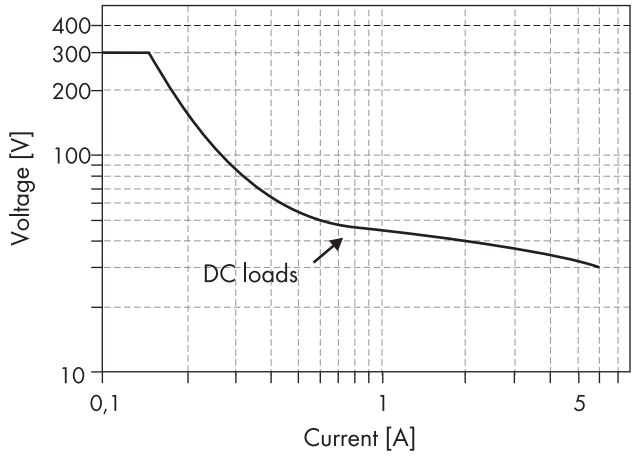


Figure 32: DC load limitation curve of multifunction relays 1 and 2

10.15 General Data

	Sunny Island 3.0M/4.4M	Sunny Island 6.0H / 8.0H
Width x height x depth	467 mm x 612 mm x 242 mm	467 mm x 612 mm x 242 mm
Weight	44 kg	63 kg
Operating temperature range	−25°C to +60°C	−25°C to +60°C
Storage temperature range	−25°C to +70°C	−25°C to +70°C
Humidity	0% to 100%	0% to 100%
Maximum installation height above MSL	3000 m	3000 m
Topology	LF transformer	LF transformer
Cooling method	SMA OptiCool	SMA OptiCool
Protection class in accordance with IEC 62103	I	I
Climatic category in accordance with IEC 60721	3K6	3K6
Degree of protection in accordance with IEC 60529	IP54	IP54

11 Accessories

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

Designation	Brief description	SMA order number
Batfuse-B.01 (80 A, 100 A, 160 A, 200 A, 250 A)	2-pole LV/HRC battery fuse-switch-disconnector, size 1 for 1 Sunny Island, 3 DC inputs (1 x battery and 2 x Sunny Island Charger 50), 1 x auxiliary voltage output 8 A	BATFUSE-B.01*
Batfuse-B.03 (80 A, 100 A, 160 A, 200 A, 250 A)	2-pole LV/HRC battery fuse-switch-disconnector, size 1 for up to three Sunny Island units, 6 DC inputs (2 x battery and 4 x Sunny Island Charger 50), 1 x auxiliary voltage output 8 A	BATFUSE-B.03*
SI-COMSMA.BGx	Communication interface RS485	SI-COMSMA-NR
SI-SYSCAN.BGx	Communication interface for communication between clusters in a multicluster system	SI-SYSCAN-NR
SWDMSI	SMA Speedwire data module for Sunny Island	SWDMSI

* When ordering, additional details on the intended use are required.

12 Contact

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

- Sunny Island inverter type
- Sunny Island inverter serial number
- Sunny Island inverter firmware version
- Error message displayed
- Type of battery connected
- Nominal battery capacity
- Nominal battery voltage
- Type of the communication products connected
- Type and size of additional energy sources

In order to receive service assignments for the Sunny Island system, all system data must be recorded in the information sheet for Sunny Island systems during commissioning and made available to Service (for information sheet see www.SMA-Solar.com).

Danmark Deutschland Österreich Schweiz	SMA Solar Technology AG Niestetal SMA Online Service Center: www.SMA-Service.com Sunny Boy, Sunny Mini Central, Sunny Tripower: +49 561 9522-1499 Monitoring Systems (Kommunikationsprodukte): +49 561 9522-2499 Fuel Save Controller (PV-Diesel-Hybridsysteme): +49 561 9522-3199 Sunny Island, Sunny Backup, Hydro Boy: +49 561 9522-399 Sunny Central: +49 561 9522-299	Belgien Belgique België Luxemburg Luxembourg Nederland	SMA Benelux BVBA/SPRL Mechelen +32 15 286 730
		Česko Magyarország Slovensko	SMA Service Partner TERMS a.s. +420 387 6 85 111
		Polska	SMA Polska +48 12 283 06 66
France	SMA France S.A.S. Lyon +33 472 22 97 00	Ελλάδα Κύπρος	SMA Hellas AE Αθήνα +30 210 9856666
España Portugal	SMA Ibérica Tecnología Solar, S.L.U. Barcelona +34 935 63 50 99	United Kingdom	SMA Solar UK Ltd. Milton Keynes +44 1908 304899
Bulgaria Italia România	SMA Italia S.r.l. Milano +39 02 8934-7299		
United Arab Emirates	SMA Middle East LLC Abu Dhabi +971 2234 6177	India	SMA Solar India Pvt. Ltd. Mumbai +91 22 61713888

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