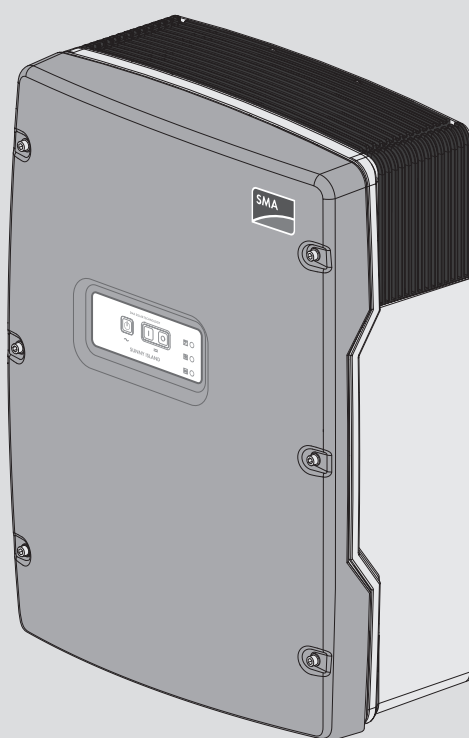


Operating manual

# SUNNY ISLAND 4.4M / 6.0H / 8.0H



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As of: 12/4/2020

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# 1 Information on this Document

## 1.1 Validity

This document is valid for:

- SI4.4M-13 (Sunny Island 4.4M)
- SI6.0H-13 (Sunny Island 6.0H)
- SI8.0H-13 (Sunny Island 8.0H)

## 1.2 Target Group

This document is intended for qualified persons and operators. Only qualified persons are allowed to perform the activities marked in this document with a warning symbol and the caption "Qualified person". Tasks that do not require any particular qualification are not marked and can also be performed by operators. Qualified persons must have the following skills:

- Knowledge of how an inverter works and is operated
- Knowledge of how batteries work and are operated
- Training in how to deal with the dangers and risks associated with installing, repairing and using electrical devices, batteries and installations
- Training in the installation and commissioning of electrical devices and installations
- Knowledge of all applicable laws, standards and directives
- Knowledge of and compliance with this document and all safety information
- Knowledge of and compliance with the documents of the battery manufacturer with all safety information

## 1.3 Levels of Warning Messages

The following levels of warning messages may occur when handling the product.

### DANGER

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

### WARNING

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



### CAUTION

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








### NOTICE

Indicates a situation which, if not avoided, can result in property damage.

## 1.4 Symbols in the Document

Symbol	Explanation
	Information that is important for a specific topic or goal, but is not safety-relevant
	Indicates a requirement for meeting a specific goal



Symbol	Explanation
	Desired result
	A problem that might occur
	Example
 	This information is relevant for systems which are to be operated in parallel with utility grid: <ul style="list-style-type: none"> <li>• System for increased self-consumption (battery-storage system)</li> <li>• Battery-backup system</li> </ul>
	Content is relevant for off-grid systems.
 <b>QUALIFIED PERSON</b>	Sections describing activities to be performed by qualified persons only

## 1.5 Typographical Elements in the Document

Typography	Use	Example
<b>bold</b>	<ul style="list-style-type: none"> <li>• Messages</li> <li>• Terminals</li> <li>• Elements on a user interface</li> <li>• Elements to be selected</li> <li>• Elements to be entered</li> </ul>	<ul style="list-style-type: none"> <li>• Connect the insulated conductors to the terminals <b>X703:1</b> to <b>X703:6</b>.</li> <li>• Enter <b>10</b> in the field <b>Minutes</b>.</li> </ul>
>	<ul style="list-style-type: none"> <li>• Connects several elements to be selected</li> </ul>	<ul style="list-style-type: none"> <li>• Select <b>Settings &gt; Date</b>.</li> </ul>
[Button] [Key]	<ul style="list-style-type: none"> <li>• Button or key to be selected or pressed</li> </ul>	<ul style="list-style-type: none"> <li>• Select <b>[Enter]</b>.</li> </ul>
#	<ul style="list-style-type: none"> <li>• Placeholder for variable components (e.g., parameter names)</li> </ul>	<ul style="list-style-type: none"> <li>• Parameter <b>WCtHz.Hz#</b></li> </ul>

## 1.6 Designations in the Document

Complete designation	Designation in this document
SMA Flexible Storage System	Battery storage system
SMA Flexible Storage System with Battery-Backup Function	Battery-backup system
Sunny Boy, Sunny Tripower	PV inverter
Sunny Places, Sunny Portal, Sunny Home Manager, SMA Data Manager M	Communication product

## 1.7 Explanation of Used Terms

Term	Explanation
Battery-storage system	In a battery-storage system, the Sunny Island uses the connected battery for the intermediate storage of excess PV energy.
Battery-backup system	In the event of grid failure, a battery-backup system supplies loads with energy and a PV system disconnected from the utility grid with voltage.
External energy source	Grid-forming generators such as electric generators or utility grids
Off-grid system	All components belonging to the stand-alone grid (e.g., Sunny Island)
Grid failure	Utility grid failure or deviation from the country-specific thresholds for voltage and frequency
Automatic transfer switch with battery-backup function	disconnects the battery-backup grid from the utility grid in the event of grid failure.

## 1.8 Additional Information

For more information, please go to [www.SMA-Solar.com](http://www.SMA-Solar.com).

Title and information content	Type of information
"Parameters and Measured Values" Overview of all inverter operating parameters and their configuration options	Technical Information
"Grounding in Off-Grid Systems"	Technical Information
"SMA GRID GUARD 10.0 - Grid management services through SMA Inverter"	Technical Information
"Off-Grid Systems" Detailed system information, connection overviews and information on commissioning	System description
"SMA FLEXIBLE STORAGE SYSTEM" (Battery-storage system) Detailed system information, connection overviews and information on commissioning	System description
"SMA FLEXIBLE STORAGE SYSTEM with Battery-Backup Function" (Battery-backup system) Detailed system information, connection overviews and information on commissioning	System description
"Multicluster Systems with Stand-Alone Grid or Increased Self-Consumption and Battery-Backup Function" Detailed system information, connection overviews and information on commissioning	System description
MULTICLUSTER-BOX 6.3-11	Installation - Connection overview

Title and information content	Type of information
MULTICLUSTER-BOX 12	Installation – Connection overview
MULTICLUSTER-BOX 36	Installation – Connection overview

## 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 system for increased self-consumption or in a battery-backup system.

The product is for use in weather-protected outdoor areas and in indoor areas. The ambient conditions prescribed for the product must be observed at all times.

The product must only be used as stationary equipment.

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

Loads connected to the Sunny Island must have an CE, RCM or UL identification label.

Device type SI4.4M-13 must not be used for single-phase single-cluster systems and not for three-phase multicluster systems (see planning guidelines "Design of Off-Grid Systems with Sunny Island Devices").

The entire battery voltage range must be completely within the permissible DC input voltage range of the Sunny Island. The maximum permissible DC input voltage of the Sunny Island must not be exceeded. The battery must be protected against short circuits. The locally applicable standards and directives must be complied with.

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).

The following conditions must be satisfied for lithium-ion batteries:

- The lithium-ion battery must comply with the locally applicable standards and directives and must be intrinsically safe.
- The battery management of the lithium-ion battery used must be compatible with the Sunny Island (see the technical information at "List of Approved Batteries").
- Applicable for off-grid systems and battery-backup systems: the lithium-ion battery must be able to supply sufficient current at the maximum output power of the Sunny Island (see Section 16 "Technical Data", page 178).

The DC terminal of the inverter is exclusively intended for the connection of a battery with external battery fuse. Only DC loads or DC energy sources that are immune to electromagnetic interference must be used.

The maximum output power of the AC sources must be observed in off-grid systems and battery-backup systems (see Section 16 "Technical Data", page 178). The powers of the individual Sunny Island inverters are added to yield the maximum total power.

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

The multifunction relays of the inverter are not suitable for controlling safety-relevant functions which can endanger persons in the event of a malfunction in the multifunction relays.

Use SMA products only in accordance with the information provided in the enclosed documentation and with the locally applicable laws, regulations, standards and directives. Any other application may cause personal injury or property damage.

Alterations to the SMA products, 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 the intended use.

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

This document does not replace and is not intended to replace any local, state, provincial, federal or national laws, regulations or codes applicable to the installation, electrical safety and use of the product. SMA Solar Technology AG assumes no responsibility for the compliance or non-compliance with such laws or codes in connection with the installation of the product.

The type label must remain permanently attached to the product.

## 2.2 IMPORTANT SAFETY INSTRUCTIONS

Keep the manual for future reference.

This section contains safety information that must be observed at all times when working.

The product has been designed and tested in accordance with international safety requirements. As with all electrical or electronical devices, there are residual risks despite careful construction. 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 due to electric shock when live components or cables are touched**

High voltages are present in the conductive components or cables of the product. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Disconnect the product from voltage sources and make sure it cannot be reconnected before working on the device.
- After disconnection, wait 15 minutes until the capacitors have discharged.
- Observe all safety information on components associated with the product.
- Wear suitable personal protective equipment for all work on the product.

### DANGER

#### **Danger to life due to electric shock in case of overvoltages and if surge protection is missing**

Overvoltages (e. g. in the event of a flash of lightning) can be further conducted into the building and to other connected devices in the same network via the network cables or other data cables if there is no surge protection. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Ensure that all devices in the same network and the battery are integrated into the existing surge protection.
- When laying the network cables or other data cables outdoors, it must be ensured that a suitable surge protection device is provided at the transition point of the cable from the product or the battery outdoors to the inside of a building.

**⚠ DANGER****Danger to life due to electric shock when live components are touched because the battery grounding is connected to grounding conductor terminals**

Due to the connection of the battery grounding to the grounding conductor terminals, high voltages might be present on the enclosure of the inverter. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Only the grounding conductors of the AC power cables may be connected to the grounding conductor terminals of the inverter.
- Observe all safety information of the battery manufacturer.
- Ground the battery according to the battery manufacturer's requirements.
- If the locally applicable standards and directives require battery grounding, connect the battery grounding to the grounding busbar in the distributor.

**⚠ DANGER****Danger to life due to electric shock in case of overvoltages and unsuitable loads**

Overvoltages of up to 1500 V can occur in the stand-alone grid and in the battery-backup grid. If the loads are not suitable for these overvoltages or are not safe to operate, a voltage that poses a danger to life may be present on accessible parts or cables. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Only connect loads that have a CE, RCM or UL designation. These loads are suitable for overvoltages of up to 1500 V.
- Operate the loads only when they are technically faultless and in an operationally safe state.
- Check the loads regularly for visible damage.

**⚠ DANGER****Danger to life due to electric shock when operating a damaged product**

Operating a damaged product can lead to hazardous situations since high voltages can be present on accessible product parts. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Only operate the product when it is in a flawless technical condition and safe to operate.
- Check the product 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.
- Wear suitable personal protective equipment for all work on the product.

**⚠ WARNING****Danger to life due to fire or explosion**

In rare cases, an explosive gas mixture can be generated inside the inverter under fault conditions. In this state, switching operations can cause a fire inside the inverter or explosion. Death or lethal injuries due to hot or flying debris can result.

- In the event of a fault, do not perform any direct actions on the product.
- Ensure that unauthorized persons have no access to the product.
- Disconnect the battery from the product via an external disconnection device.
- Disconnect the AC circuit breaker, or keep it disconnected in case it has already tripped, and secure it against reconnection.
- Only perform work on the product (e.g., troubleshooting, repair work) when wearing personal protective equipment for handling of hazardous substances (e.g., safety gloves, eye and face protection, respiratory protection).

**⚠ WARNING****Risk of injury due to toxic substances, gases and dusts.**

In rare cases, damages to electronic components can result in the formation of toxic substances, gases or dusts inside the inverter. Touching toxic substances and inhaling toxic gases and dusts can cause skin irritation, burns or poisoning, trouble breathing and nausea.

- Only perform work on the product (e.g., troubleshooting, repair work) when wearing personal protective equipment for handling of hazardous substances (e.g., safety gloves, eye and face protection, respiratory protection).
- Ensure that unauthorized persons have no access to the product.

**⚠ WARNING****Danger to life from electric shock due to circuit breakers that cannot be tripped**

In off-grid systems and battery-backup systems, the Sunny Island can only trip circuit breakers up to a certain tripping characteristic. Circuit breakers with a higher operating current cannot be tripped. Under fault conditions, a voltage that poses a danger to life may be present on accessible parts for several seconds. Touching live components can result in death or serious injury due to electric shock.

- SI4.4M-13: Check whether a circuit breaker has a higher trip characteristic than B6 (B6A).
- SI6.0H-13 and SI8.0H-13: Check whether a circuit breaker has a higher trip characteristic than B16 (B16A) or C6 (C6A).
- If a circuit breaker has a higher trip characteristic than the specified circuit breakers that can be tripped, you should also install a residual-current device of type A.

**⚠ WARNING****Risk of crushing injuries due to moving PV array parts**

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

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

**⚠ CAUTION****Risk of burns due to short-circuit currents on the disconnected inverter**

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

Some parts of the enclosure can get hot during operation.

- Mount the inverter in such a way that it cannot be touched inadvertently during operation.

**NOTICE****Damage to the product due to sand, dust and moisture ingress**

Sand, dust and moisture penetration can damage the product and impair its functionality.

- Only open the product if the humidity is within the thresholds and the environment is free of sand and dust.
- Do not open the product during a dust storm or precipitation.
- Close the product in case of interruption of work or after finishing work.

**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.

**NOTICE****Damage to the enclosure seal in subfreezing conditions**

If you open the product when temperatures are below freezing, the enclosure seals can be damaged. Moisture can penetrate the product and damage it.

- Only open the product if the ambient temperature is not below  $-5^{\circ}\text{C}$ .
- If a layer of ice has formed on the enclosure seal when temperatures are below freezing, remove it prior to opening the product (e.g. by melting the ice with warm air).

**NOTICE****High costs due to inappropriate Internet tariff**

Depending on use, the data volume of the product transferred via the Internet may vary in size. The data volume depends, for example, on the number of devices in the system, the frequency of device updates, the frequency of data transfer to Sunny Portal or the use of FTP push. High costs for the Internet connection can be the result.

- SMA Solar Technology AG recommends using an Internet flat rate.



- i** **The inverter supports different firmware versions that are suitable for different systems.**
- SI4.4M-13 as of firmware version 3.20.09.R:** suitable in off-grid, battery-storage and battery-backup systems.
- SI6.0H-13 / SI8.0H-13 as of firmware version 3.20.09.R:** suitable in all off-grid systems (single systems, single-cluster and multicluster systems) as well as in battery-storage and battery-backup systems without MC-BOX-12.3-20 (only single systems and single-cluster systems).
- SI6.0H-13 / SI8.0H-13 with firmware version 1.04.00.R:** intended for battery-storage and battery-backup systems with MC-BOX-12.3-20 (multicluster systems with parallel grid operation).
- Ensure that the inverter is equipped with a firmware version that are suitable for the respective system.

- i** **Change to the names and units of grid parameters to comply with the grid-connection requirements in accordance with Regulation (EU) 2016/631 (valid from April 27, 2019)**
- To comply with the EU grid-connection requirements (valid from April 27, 2019) the names and units of grid parameters were changed. The change is valid from firmware version  $\geq 3.00.00.R$ . Names and units of grid parameters for inverters with firmware version  $\leq 2.99.99.R$  are not affected by this change and remain valid.

## 2.3 Battery Safety Information

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 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.

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

### **⚠ WARNING**

#### **Danger to life due to explosive gases**

Explosive gases may escape from the battery and cause an explosion.

- 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 burn the battery and do not heat it beyond the permitted temperature.
- Additional measures for lead-acid batteries: Ensure that the battery room is sufficiently ventilated.

**⚠ WARNING****Chemical burns due to battery electrolyte**

If handled inappropriately, battery electrolyte can leak from the battery and cause irritation to the eyes, respiratory system and skin.

- Install, operate, maintain and dispose of the battery according to the manufacturer's specifications.
- Whenever working on the battery, wear suitable personal protective equipment such as rubber gloves, an apron, rubber boots and goggles.
- Rinse acid splashes thoroughly for a long time with clear water, and consult a doctor immediately.
- If acid fumes have been inhaled, consult a doctor immediately.

**⚠ WARNING****Danger to life due to burns caused by electric arcs through short-circuit currents**

Short-circuit currents in the battery can cause heat build-up and electric arcs. Heat build-up and electric arcs may result in lethal injuries due to burns.

- Remove watches, rings and other metal objects prior to carrying out any work on the battery.
- Use insulated tools for all work on the battery.
- Do not place tools or metal parts on the battery.
- Observe all safety information of the battery manufacturer.

**⚠ 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 inverter. The battery can be damaged by incorrect settings of the battery type, nominal voltage and capacity parameters.

- Set the correct battery type as well as the correct values for nominal voltage and battery capacity when configuring.
- 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).

### 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

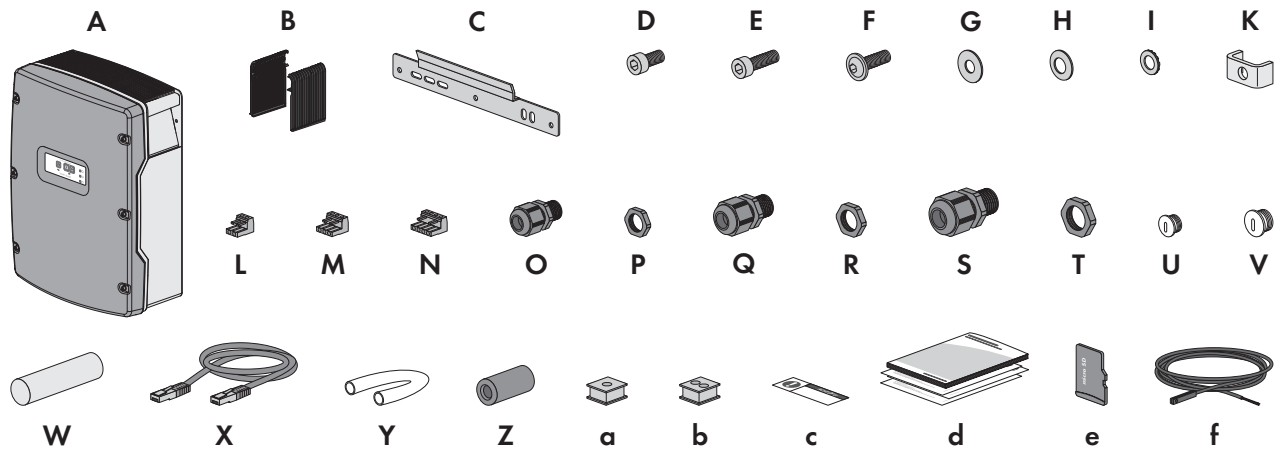
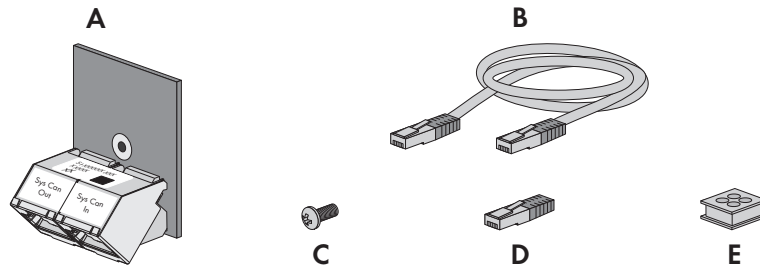


Figure 1: Components included in the scope of delivery

Position	Quantity	Designation	Position	Quantity	Designation
A	1	Sunny Island	S	2	Cable gland M32
B	2	Ventilation grid	T	2	Counter nut for cable gland M32
C	1	Wall mounting bracket	U	1	Filler plug M20
D	2	Hexagon socket screw M6x10	V	1	Filler plug M25
E	2	Hexagon socket screw M6x16	W	1	Putty in a separate accessory kit
F	2	Pan head screw with hex socket M8x20	X	1	Black CAT5e data cable, 2 m
G	2	Fender washer M8	Y	2	Silicon tube 10 mm x 500 mm
H	2	Spring washer M8	Z	2	Ferrite
I	2	Conical spring washer M6	a	1	Cable support sleeve for one cable
K	1	Clamping bracket	b	2	Cable support sleeve for two cables
L	1	2-pole terminal block	c	1	Label "VDE 0126-1-1"
M	2	3-pole terminal block	d	1	Quick Reference Guide
N	2	4-pole terminal block			
O	1	Cable gland M20			
P	1	Counter nut for cable gland M20			

Position	Quantity	Designation	Position	Quantity	Designation
Q	2	Cable gland M25	e	1	Micro SD card (optional)
R	2	Counter nut for cable gland M25	f	1	Battery temperature sensor (optional)

### Communication for Multicluster System Order Option



Position	Quantity	Designation
A	1	SI-SYSCAN.BGx*, installed in the master at the factory
B	1	Yellow CAT5e data cable, 5 m
C	1	Screw, installed in the Sunny Island at the factory
D	1	Terminator, plugged into SI-SYSCAN.BGx at the factory
E	1	Cable support sleeve for four cables

\* CAN communication interface

## 4 Product Overview

### 4.1 Product Description

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

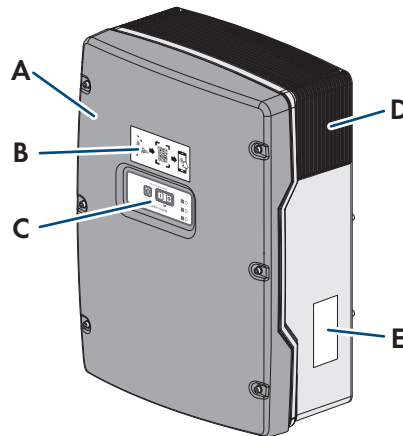

















Figure 2: Design of the Sunny Island inverter

Position	Designation
A	Enclosure lid
B	Label with QR Code for scanning via the SMA 360° App and easy connection to the inverter's user interface via WLAN
C	Control panel with LED signals
D	Ventilation grid
E	Type label The type label uniquely identifies the inverter. You will require the information on the type label to use the product safely and when seeking customer support from Service. The type label must remain permanently attached to the product. You will find the following information on the type label: <ul style="list-style-type: none"> <li>• Address of SMA Solar Technology AG</li> <li>• Device type (Model)</li> <li>• Serial number (Serial No.)</li> <li>• Device-specific characteristics</li> <li>• Identification key (PIC) for registration in Sunny Portal</li> <li>• Registration ID (RID) for registration in Sunny Portal</li> <li>• WLAN password WPA2-PSK (WiFi Protected Access 2 - Preshared Key) for direct connection to the inverter via WLAN</li> </ul>

### 4.2 Symbols on the Product

Symbol	Explanation
	Beware of electrical voltage The product operates at high voltages.

Symbol	Explanation
	Beware of hot surface The product can get hot during operation.
	Danger to life due to high voltages in the inverter; observe a waiting time of 15 minutes High voltages that can cause lethal electric shocks are present in the live components of the inverter. Prior to performing any work on the inverter, disconnect it from all voltage sources as described in this document.
	Observe the documentation Observe all documentation supplied with the product.
	Grounding conductor This symbol indicates the position for connecting a grounding conductor.
	Alternating current
	Direct current
	Transformer The product has a transformer.
	WEEE designation Do not dispose of the product together with the household waste but in accordance with the disposal regulations for electronic waste applicable at the installation site.
	Degree of protection IP54 The product is protected against interior dust deposits and against water splashing from all angles against the enclosure.
	CE marking The product complies with the requirements of the applicable EU directives.
	RoHS labeling The product complies with the requirements of the applicable EU directives.
	RCM (Regulatory Compliance Mark) The product complies with the requirements of the applicable Australian standards.
	ICASA The product complies with the requirements of the South African standards for telecommunication.
	The product complies with the Moroccan safety and EMC requirements for electronic products.

### 4.3 Interfaces and Functions

The inverter can be equipped or retrofitted with the following interfaces and functions:

## User interface for configuration and monitoring

The product is equipped as standard with an integrated webserver, which provides a user interface for configuring and monitoring the product.

The product user interface can be called up via the web browser if there is an existing connection to an end device (e.g. computer, tablet PC or smartphone).

## Smart Inverter Screen

The Smart Inverter Screen enables you to view the status display and to display the nominal energy throughput and state of charge of the battery on the user interface login page. You therefore have an overview of the most important inverter and battery data without having to log into the user interface.

The Smart Inverter Screen is deactivated by default. The Smart Inverter Screen can be activated via the user interface once the inverter has been commissioned.

## SMA Speedwire

The product is equipped with SMA Speedwire as standard. SMA Speedwire is a type of communication based on the Ethernet standard. SMA Speedwire is designed for a data transfer rate of 100 Mbps and enables optimum communication between Speedwire devices within systems.

The products supports the encrypted system communication with SMA Speedwire Encrypted Communication. In order to be able to use the Speedwire encryption in the system, all Speedwire devices, except for the SMA Energy Meter, must support the function SMA Speedwire Encrypted Communication.

## SMA Webconnect

The product is equipped with a Webconnect function as standard. The Webconnect function enables direct data transmission between the product and Internet portals Sunny Portal and Sunny Places without any additional communication device and for a maximum of 4 products per visualized system. In PV systems with more than 4 products, there is the option of establishing data transmission between the products and Sunny Portal via the data logger (e.g., SMA Data Manager) or distributing the inverters over several systems. If there is an existing WLAN or Ethernet connection, you can directly access your visualized system via the web browser on your end device.

## WLAN connection to SMA 360° app

The product has a QR code. By scanning the QR Code attached to the product via the SMA 360° app, access to the product is established via WLAN and the connection to the user interface is made automatically.

## WLAN

The product is equipped with a WLAN interface as standard. The inverter is delivered with the WLAN interface activated as standard. If you do not want to use WLAN, you can deactivate the WLAN interface.

In addition, the product has a WPS function. The WPS function is for automatically connecting the product to a network (e.g. via router) and establish a direct connection between the product and an end device.

### Limited radio range

The WLAN interface integrated in the inverter has a limited range of 5 m.

- Take this range into consideration when establishing the WLAN connection.

### Limited function in the event of frost

The integrated WLAN interface of the product is only designed for temperatures down to -20°C.

- Deactivate the WLAN interface at low temperatures (see Section 8.9, page 117).

## Multicluster Communication

In a multicluster system, the masters of the clusters must communicate with each other via a separate CAN bus. The Multicluster data module SI-SYSCAN.BGx must be installed in each master for this multicluster communication. The interface slot SISYSCAN is for connecting the Multicluster data module SI-SYSCAN.BGx.

If the Sunny Islands are ordered with the communication interface multicluster CAN, the masters are delivered with multicluster data modules.

Multicluster communication only functions with the device types SI6.0H-13 und SI8.0H-13.

## Data Storage

Event messages and instantaneous values are saved in the Sunny Island. This data can be evaluated and thus the operating processes in the Sunny Island system can be traced. From this, for example, parameter settings can be derived that will e.g. increase the self-consumption of PV energy or the service life of the battery. For SMA Service, this data simplifies the analysis of any errors present and the identification of possible solutions.

The storage capacity of the inverter can be extended with the optional micro SD card. Thus, for example, data can be recorded over longer time periods, enabling extended diagnostics possibilities to be used (see Section 16.14, page 185).

## Grid management services

The product is equipped with service functions for grid management.

Depending on the requirements of the grid operator, you can activate and configure the functions (e.g. active power limitation) via operating parameters.

## 4.4 Control panel with LED signals

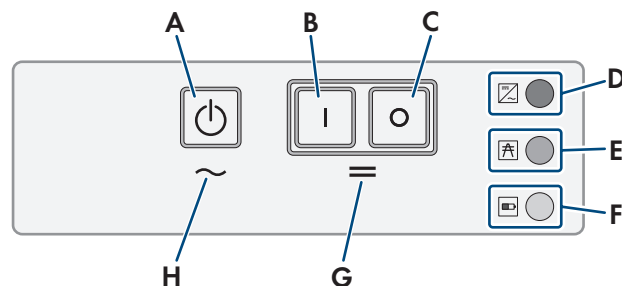









Figure 3: Layout of the control panel

Position	Symbol	Designation	LED signal	Explanation
A		Start-stop button	–	By pressing the start-stop button, you can start or stop the system.
B		"On" button	–	Pressing the "On" button will switch the Sunny Island on. The Sunny Island is in standby mode after being switched on.
C		"Off" button	–	Pressing the "Off" button will switch off the Sunny Island.



Position	Symbol	Designation	LED signal	Explanation
D		Inverter LED	Not glowing	The Sunny Island is switched off.
			Glowing green	The Sunny Island is in operation.
			Glowing orange	The Sunny Island is in standby or energy-saving mode.
			Glowing red	The Sunny Island switched off due to an error.
			Flashing	The Sunny Island is not configured.
E		Grid LED	Not glowing	There is no voltage present from the generator or the utility grid.
			Glowing green	Generator or utility grid is connected.
			Glowing orange	The Sunny Island is synchronizing the stand-alone grid with the generator or the utility grid.
			Glowing red	Error at the connection of the generator or the utility grid.
F		Battery LED	Glowing green	The state of charge is more than 50%.
			Glowing orange	The state of charge is between 50% and 20%.
			Glowing red	The state of charge is less than 20%.
G		Standby	–	Position of the buttons for switching on and off
H		AC operation	–	Position of the button for starting and stopping operation

## 4.5 Multifunction Relay

Using 2 multifunction relays, each Sunny Island can control various functions and can display operating states and warning messages. Within a cluster, the master can also access the multifunction relays of the slaves.

In a single-cluster 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. Furthermore, free multifunctional relays can be used for additional functions.

Possible function or output	Explanation
Control of the tie switch and of the contactors for grounding	In the battery-backup system, 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 6.5.10, page 47).

Possible function or output	Explanation
Controlling load-shedding contactors	Depending on the state of charge of the battery, the multifunction relay picks up and thus controls up to 2 load-shedding contactors. Basically, you can install a one-stage or a two-stage load-shedding scheme. Note the restrictions that depend on the selected system (see Section 6.5.12, page 49).  You can adjust the thresholds for the state of charge of the battery depending on the time of day.
Time control for external processes	The multifunction relays can be time-controlled (see Section 6.5.13, page 51).
Display of operating states and warning messages	Each multifunction relay can display either 1 event or 1 warning message (see Section 6.5.14, page 51).
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 1 hour (see Section 6.5.15, page 53).
Control of an electrolyte pump	Depending on the nominal energy throughput, the multifunction relay is activated at least once a day (see Section 6.5.16, page 54).
Use of excess energy	In off-grid systems with lead-acid batteries, a multifunction relay is activated during the constant voltage phase. It thus controls additional loads that can put any excess energy to good use (see Section 6.5.17, page 54).

## 4.6 Information on Battery-Backup Systems

### **i** Wiring and connection of automatic transfer switches for single-phase or three-phase battery-backup systems

- Do not bridge the neutral conductors of connections **X1** to **X5** in the automatic transfer switch. If the neutral conductor connections are bridged, residual-current devices could trip accidentally.
- Label the equipment and devices of the automatic transfer switch in accordance with the schematic diagrams. This will facilitate installation, commissioning and assistance in case servicing is required.

### **i** Connection of automatic transfer switches for single-phase battery-backup systems

In single-phase battery-backup systems, only the line conductor of the Sunny Island that is connected to the circuit breaker **F1** of the automatic transfer switch is monitored for grid failure. If terminal **AC2 Gen/Grid L** is connected to another line conductor, the battery-backup system is not able to synchronize with the utility grid following a grid failure.

- With single-phase battery-backup systems, connect circuit breaker **F1** and terminal **AC2 Gen/Grid L** of the Sunny Island to the same line conductor, e.g. to L1 (for a single-phase battery-backup system with an all-pole disconnection function).
- Connect the PV inverter and the Sunny Island to the same line conductor if possible. This way, in the event of grid failure, the PV inverters are supplied with voltage directly and then can feed in even if phase coupling is deactivated.

## 5 Mounting

### 5.1 Requirements for Mounting

Requirements for mounting location:

#### **⚠ WARNING**

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

Despite careful construction, electrical devices can cause fires. This can result in death or serious injury.

- Do not mount the product in areas containing highly flammable materials or gases.
- Do not mount the product in potentially explosive atmospheres.

#### **⚠ WARNING**

##### **Danger to life due to explosive gases**

Explosive gases may escape from the battery and cause an explosion.

- 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 burn the battery and do not heat it beyond the permitted temperature.
- Additional measures for lead-acid batteries: Ensure that the battery room is sufficiently ventilated.

- A solid support surface must be available (e.g., concrete or masonry). When mounted on drywall or similar materials, the product emits audible vibrations during operation which could be perceived as annoying.
- The mounting location must be inaccessible to children.
- The mounting location must be suitable for the weight and dimensions of the product (see Section 1.6, page 178).
- The mounting location must not be exposed to direct solar irradiation. If the product is exposed to direct solar irradiation, the exterior plastic parts might age prematurely and overheating might occur. When becoming too hot, the product reduces its power output to avoid overheating.
- The mounting location must be less than 10 m above Mean Sea Level (MSL). From altitudes of 10 m above MSL, the power decreases by 10%.
- 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.
- All ambient conditions must be met (see Section 1.6, page 178).
- The ambient temperature should be below 40°C to ensure optimum operation.
- The mounting location of the battery must meet all requirements of the battery manufacturer.

**Permitted and prohibited mounting positions:**

- The product may only be mounted in a permitted position. This will ensure that no moisture can penetrate the product.
- The product should be mounted in such way that display messages or LED signals can be read without difficulty and buttons operated.

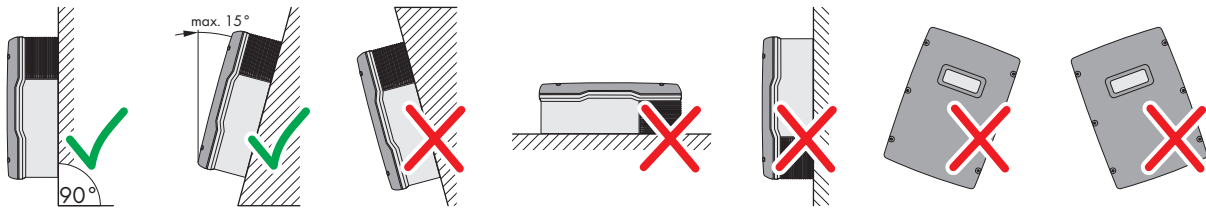


Figure 4: Permitted and prohibited mounting positions

**Dimensions for mounting:**

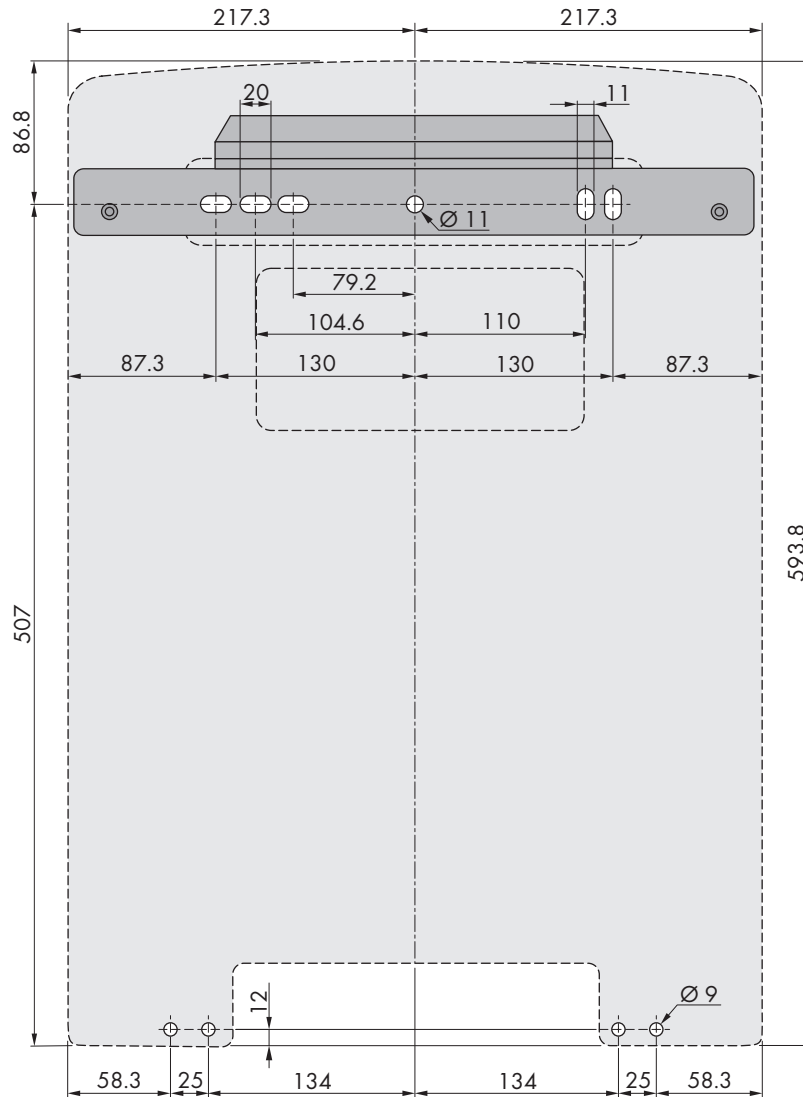


Figure 5: Position of the anchoring points(Dimensions in mm)

**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 products are mounted in areas with high ambient temperatures, increase the clearances between the products and ensure sufficient fresh-air supply.

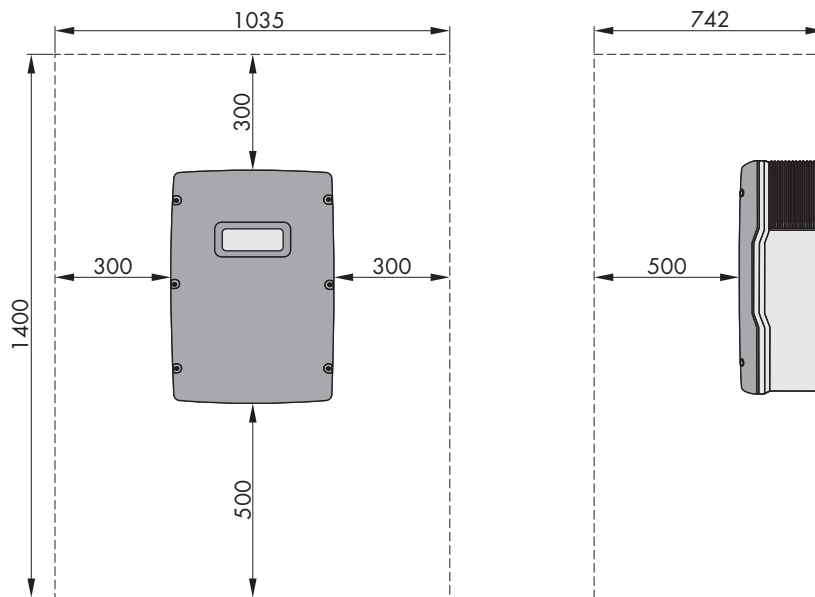


Figure 6: Recommended clearances (Dimensions in mm)

## 5.2 Mounting the Sunny Island

### ⚠ QUALIFIED PERSON

#### ⚠ CAUTION

##### Risk of injury due to weight of product

Injuries may result if the product is lifted incorrectly or dropped while being transported or mounted.

- Transport and lift the product carefully. Take the weight of the product into account.
- Wear suitable personal protective equipment for all work on the product.

#### **i** Mounting Sunny Island devices with multicluster communication

The multicluster data modules are installed in the master at the factory if multicluster communication has been ordered. The master can be identified by the labeling on the packaging.

- With multicluster systems, mount the Sunny Island devices with installed multicluster data modules at the mounting location planned for master devices.

#### 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:

1.

#### ⚠ CAUTION

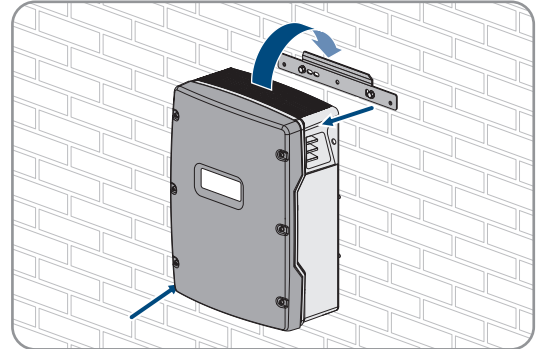
##### Risk of injury due to damaged cables

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

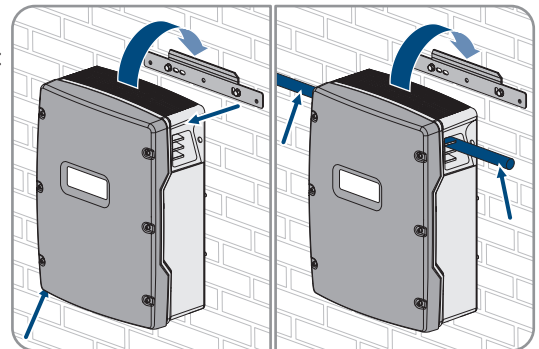
- Ensure that no lines are laid in the wall which could be damaged when drilling holes.

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.

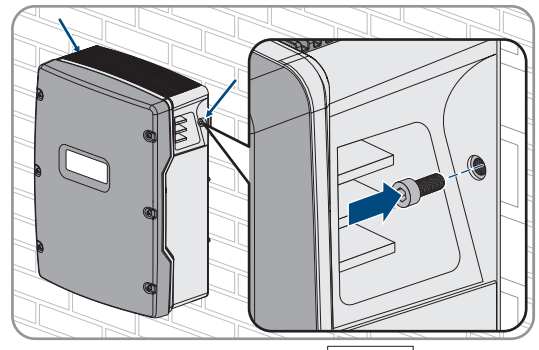
3. Drill the holes and insert the screw anchors.
4. Secure the wall mounting bracket horizontally on the wall using screws and washers.
5. If the Sunny Island is to be secured against theft, mark the drill holes for the anti-theft device. Use at least one hole on the right and one on the left.
6. Mount the SI4.4M-13 to the wall mounting bracket. For this, use the side recess grips. Keep the Sunny Island in a horizontal position when moving it.



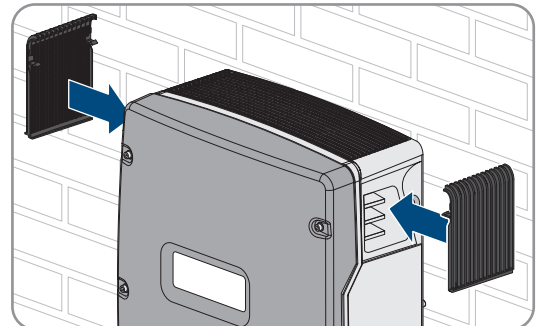
7. Mount the SI6.0H-13 and SI8.0H-13 to the wall mounting bracket. For this, use the side recess grips or a steel rod (diameter: maximum 30 mm). Keep the Sunny Island in a horizontal position when moving it.



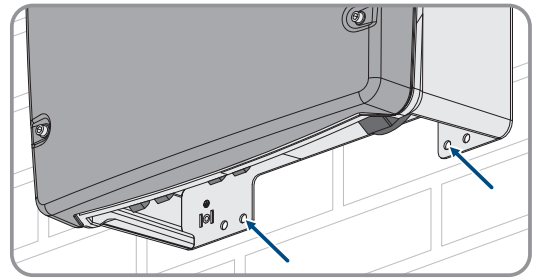
8. Use an Allen key (AF 5) to attach the Sunny Island to the wall mounting bracket on both sides with the M6x10 screws provided (torque: 4 Nm to 5.7 Nm). This will prevent the Sunny Island from being lifted off the bracket.



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.

## 6 Electrical Connection

### 6.1 Content and Structure of the Section

Some of the following sub-sections relate to the physical connection of components or the use of physical connections on the Sunny Island. Other sub-sections describe actions that must always be performed.

An overview detailing which contents the sub-sections describe can be found in the following table.

Section	Explanation
Section 6.2, page 33	Graphic overview of the connection area
Section 6.3, page 34	The section must be read and observed if the optional micro SD card is to be inserted.
Section 6.4, page 34	For systems with a grounded battery, this section must be read and observed.
Section 6.5, page 35	Information on the connection and circuitry of individual devices with specification of connections on the Sunny Island You must read and observe the sub-sections for the components connected to the Sunny Island.
Section 6.6, page 56	Correct connection of the cables to the respective connections on the Sunny Island You must read and observe the sub-sections for the connections on the Sunny Island used.
Section 6.7, page 64	You must read and observe the section for the connections used.
Section 6.8, page 68	You must always read and observe this section.
Section 6.9, page 69	You must always read and observe this section.



## 6.2 Overview of the Connection Area

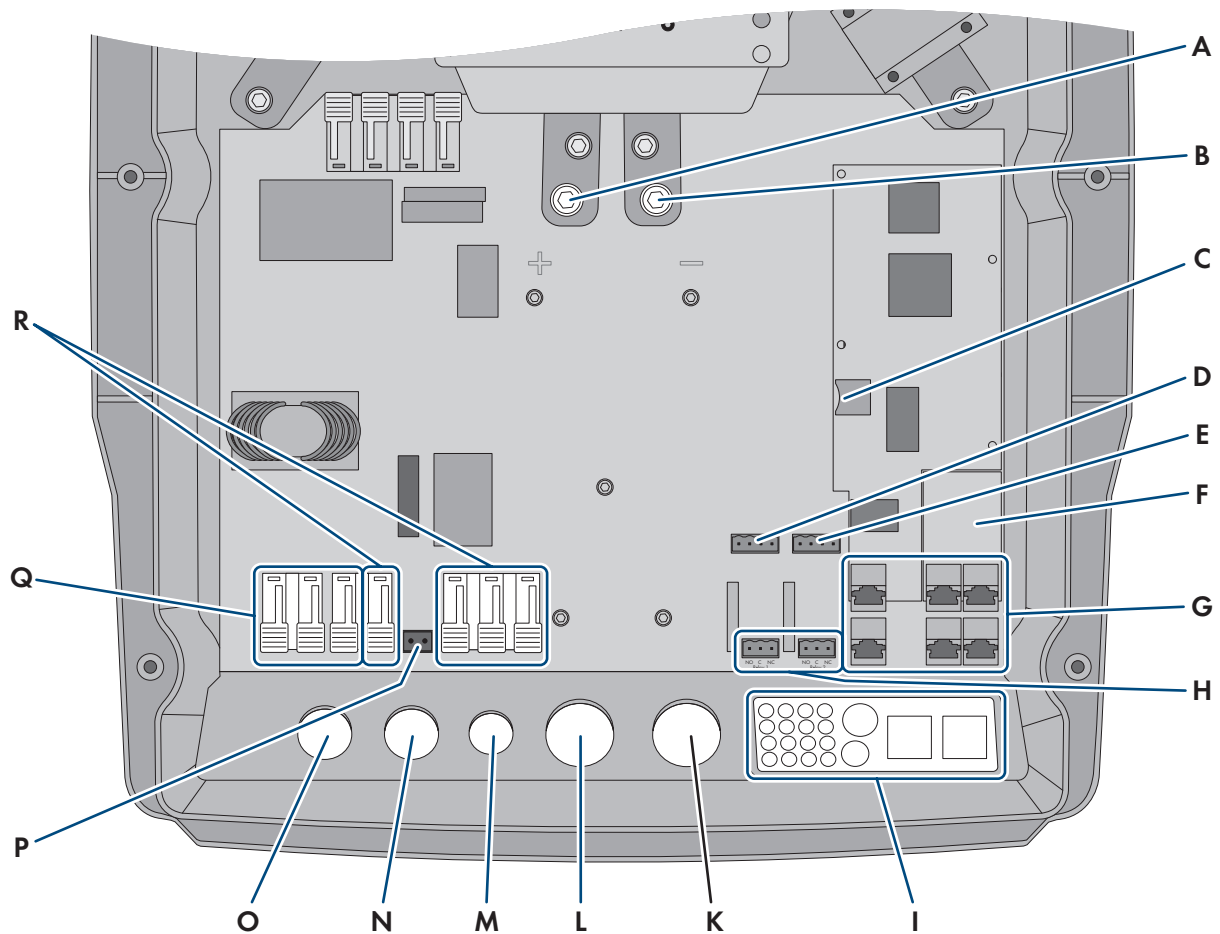


Figure 7: Connection area of the Sunny Island inverter

Position	Designation	Position	Designation
A	<b>DC+</b> connection	K	Enclosure opening for <b>DC-</b>
B	<b>DC-</b> connection	L	Enclosure opening for <b>DC+</b>
C	Slot for optional micro SD card	M	Enclosure opening <b>ExtVtg</b>
D	<b>BatTmp</b> and <b>BatCur</b> connections	N	Enclosure opening <b>AC2</b>
E	<b>BatVtgOut</b> and <b>DigIn</b> connections	O	Enclosure opening <b>AC1</b>
F	Slot for optional communication interface SI-SYSCAN.BGx*	P	<b>ExtVtg</b> connection
G	Connecting the communication unit	Q	<b>AC1</b> connection
H	<b>Relay1</b> and <b>Relay2</b> connections	R	<b>AC2</b> connection
I	Cable feed-through plate		

\* If the inverter was ordered with the **Communication for multicluster system** order option, SI-SYSCAN.BGx is installed in each master.

## 6.3 Inserting the Micro SD Card

### **⚠ QUALIFIED PERSON**

The optional micro SD card extends the data storage capacity of the inverter (see Section 16.14, page 185). The micro SD card can be ordered as an optional accessory from SMA Solar Technology AG or purchased via specialist retailers. Perform the following steps to insert the micro SD card.

### 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.

#### **Requirements on the micro SD card:**

- A micro SD card must be used. Other memory cards (e.g. MMC cards) may not be used.
- Data storage in the FAT16/32 file format must be possible.
- Minimum storage capacity: 1 GB
- Maximum storage capacity: 64 GB
- Quality: industry standard

#### **Requirements:**

- The microSD card must be available.
- The inverter must be disconnected from all voltage sources Disconnecting the Sunny Island from Voltage Sources.

#### **Procedure:**

1. 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.
2. Insert the micro SD card into the slot up to the stop. Do not jam the micro SD card when doing so.
3. Ensure that the micro SD card is correctly plugged in.

## 6.4 Connecting the Grounding Conductor with a Grounded Battery

### **⚠ QUALIFIED PERSON**

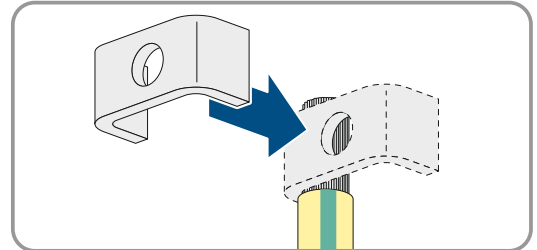
If you ground the battery, you can ground it at the positive terminal or at the negative terminal with a grounding conductor. SMA Solar Technology AG does not recommend grounding the battery. If the battery is grounded, the enclosure of the Sunny Island must also be grounded. This additional grounding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

#### **Cable requirements:**

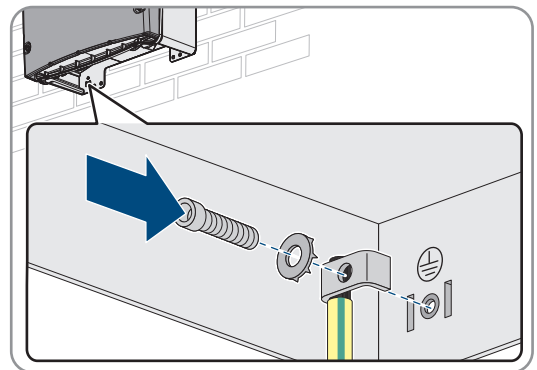
- Material: Copper wire
- Minimum conductor cross-section: 10 mm<sup>2</sup> (or 2x 4 mm<sup>2</sup>)
- Maximum conductor cross-section: 16 mm<sup>2</sup>
- The cross-section of the grounding conductor must comply with the locally applicable standards and directives.
- The cross-section of the grounding conductor must be sized in accordance with the requirements of the external battery fuse.
- 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. Observe all locally applicable standards and directives when doing so.
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 serrated conical spring washer (AF 5, torque: 4 Nm to 5.7 Nm). The teeth of the serrated conical spring washer must face the clamping bracket.



## 6.5 Connecting the Components

### 6.5.1 Connecting the Battery Fuse to the Sunny Island

#### **⚠ QUALIFIED PERSON**

#### **i** Selecting the battery fuse

The battery fuse protects the DC cables and the battery against a short circuit. The battery fuse must be designed according to the maximum short-circuit current of the battery, the conductor cross section of the DC cables and the technical data of the Sunny Island (see Section 16.3, page 179). The locally applicable standards and directives must be complied with.

If a battery fuse is already available, no further fuse is necessary.

Tip: Install a battery fuse of the type enwitec BAT FUSE HERITAGE 01 or enwitec BAT FUSE HERITAGE 03.

#### **i** Maximum cable length for the DC connection

Long cables and insufficient conductor cross-sections reduce the efficiency of the system and the overload capacity of the inverter.

- The length of all DC cables from the battery via the battery fuse to the Sunny Island must be smaller than 10 m.

### **i** Connection of DC loads or DC energy sources

The DC connection of the inverter is primarily intended for connecting a battery. When DC loads or DC energy sources are connected, electromagnetic interference may temporarily interfere with operation. Therefore, DC loads or DC energy sources that are immune to electromagnetic interference should be used. This is the case if DC loads and DC energy sources have interference immunity for industrial environments (e.g. according to EN 61000-6-2).

SMA recommends the Sunny Island Charger of MSTE SOLAR GmbH as DC charge controller.

The recommended minimum conductor cross-section depends on the battery voltage, the power and the length of the cable:

#### **Cable requirements when using the inverter with an enwitec BAT FUSE HERITAGE 01 or enwitec BAT FUSE HERITAGE 03 battery fuse:**

Sunny Island	Cable length*	Conductor cross-section	Cable diameter	Terminal lug
SI8.0H	≤ 5 m	70 mm <sup>2</sup>	14 mm to 25 mm	M8, 20 mm to 25 mm wide
	> 5 m	95 mm <sup>2</sup>	14 mm to 25 mm	M8, 20 mm to 25 mm wide
SI6.0H	≤ 5 m	50 mm <sup>2</sup>	14 mm to 25 mm	M8, 20 mm to 25 mm wide
	> 5 m	70 mm <sup>2</sup>	14 mm to 25 mm	M8, 20 mm to 25 mm wide
SI4.4M	≤ 5 m	50 mm <sup>2</sup>	14 mm to 25 mm	M8, 20 mm to 25 mm wide
	> 5 m	70 mm <sup>2</sup>	14 mm to 25 mm	M8, 20 mm to 25 mm wide

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

### **⚠ 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.

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

#### **Procedure:**

1. Ensure that the load-break switch of the battery fuse 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. Connect the DC power cable of the battery fuse with the correct polarity (see Section 6.6.1 "Connecting the DC Power Cable", page 56).

## **6.5.2 Connecting the Utility Grid in the System for Increased Self-Consumption**

### **⚠ QUALIFIED PERSON**



Relevant for systems connected to the utility grid

**Requirements:**

- The system may not be a battery-backup system or an off-grid 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 (see circuitry overview in the quick reference guide "SMA FLEXIBLE STORAGE SYSTEM")

**Procedure:**

1. On the Sunny Island, connect the power cable to the terminals **AC2 Gen/Grid** (see Section 6.6.2, page 58):
  - Connect the line conductor to **AC2 Gen/Grid L**.
  - Connect the neutral conductor to **AC2 Gen/Grid NTT**.
2. Thread the grounding conductor through a ferrite included in the scope of delivery and connect to **AC2 Gen/Grid PE** (see Section 6.6.3, page 60).
3. If the power cable conductor cross-section is less than 10 mm<sup>2</sup>, thread an additional grounding conductor through the provided ferrite and connect it to the **AC1 Loads/SunnyBoys PE** terminal (see Section 6.6.3, page 60).

### 6.5.3 Connecting an Automatic Transfer Switch in the Battery Backup System

#### 6.5.3.1 Connecting the AC Power Cables of the Automatic Transfer Switch

##### QUALIFIED PERSON

 Relevant for systems connected to the utility grid

The AC power cables conduct the energy between the battery-backup grid and the Sunny Island (see circuitry overview in the quick reference guide "SMA FLEXIBLE STORAGE SYSTEM with Battery-Backup Function").

**Requirements:**

- With each three-phase cluster, the connection of the line conductor must be prepared as follows: L1 to the master, L2 to slave 1 and L3 to slave 2. This results in 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 16.2, page 179). The powers of the individual Sunny Island inverters are added to yield the total maximum power.

**Procedure:**

- Connect the power cable from **X3** on the automatic transfer switch to the terminals **AC2 Gen/Grid** on the Sunny Island. When doing so, connect the line conductor to **AC2 Gen/Grid L** and the neutral conductor to **AC2 Gen/Grid NTT** (see Section 6.6.2, page 58). Thread the grounding conductor through a ferrite included in the scope of delivery and connect to **AC2 Gen/Grid PE** (see Section 6.6.3, page 60).

#### 6.5.3.2 Connecting the Control Cables of the Automatic Transfer Switch

##### QUALIFIED PERSON

 Relevant for systems connected to the utility grid

Control cables conduct the control signals of the multifunction relays to the contactors (see circuitry overview in the quick reference guide "SMA FLEXIBLE STORAGE SYSTEM with Battery-Backup Function").

### **i** 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.
- Use shielded cables for the control and measuring cables.
- Always connect the digital input **DigIn** of the Sunny Island 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** (see Section 6.6.2 "Connecting the AC Power Cable", page 58).

#### 2. **⚠ WARNING**

##### **Danger to life from electric shock due to incorrect insulation**

In the case of faulty insulation, supposedly de-energized parts or cables may be live. Touching live components or cables can result in death or serious injury due to electric shock.

- When making the following connections, always insert a silicone tube (see Section 6.6.5, page 61).

3. Connect the control cable from **X4 1** and **X4 2** to the connections **Relay1 C** and **Relay1 NC**.
4. Connect the control cable from **X5 1** and **X5 2** to the connections **Relay2 C** and **Relay1 NO**.

### 6.5.3.3 Connecting the Measuring Cables of the Automatic Transfer Switch

#### **⚠ QUALIFIED PERSON**



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 (see circuitry overview in the quick reference guide "SMA FLEXIBLE STORAGE SYSTEM with Battery-Backup Function").

### **i** 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.
- Use shielded cables for the control and measuring cables.
- Always connect the digital input **DigIn** of the Sunny Island separately via a shielded cable.

#### Procedure:

1. On the Sunny Island, connect the measuring cable **X4 Ln** ( $L_n = L1$  to  $L3$ ) and **X4 N** for voltage monitoring to the **ExtVtg** terminal (see Section 6.6.7 "Connecting ExtVtg", page 63).
2. At the master, connect the tie switch monitoring (see Section 6.6.6 "Connecting BatVtgOut, DigIn, BatTMP and BatCur", page 63).
  - Connect the master **BatVtgOut-** with the **DigIn-**.
  - Thread both insulated conductors through a ferrite included in the scope of delivery.
  - Connect the insulated conductor from **X5 3** to **DigIn+**.
  - Connect the insulated conductor from **X5 4** to **BatVtgOut+**.

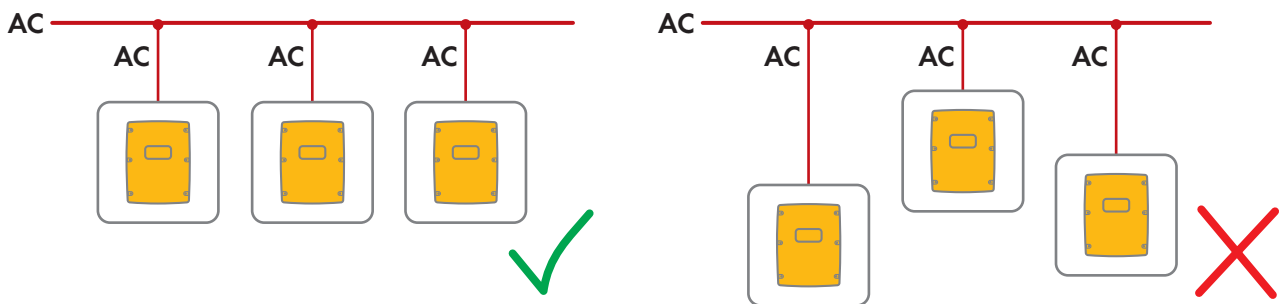
## 6.5.4 Connecting the Stand-Alone Grid or Multicluster-Box 6 / 36

### ⚠ QUALIFIED PERSON

#### 🔌 Relevant for off-grid systems

In off-grid systems you connect AC loads and the grid-parallel AC sources (e.g. PV inverters) using an AC sub-distribution board to the **AC1** terminal of the Sunny Island. In the case of a multicluster system, the Multicluster-Box 6 or Multicluster-Box 36 is the AC distribution board that is connected to connection **AC1** (for the connection of device type MC-BOX-12.3-20 Multicluster-Box 12 (see Section 6.5.5, page 40).

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



- 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 fuse on the generator has a higher operating current than the fuse in the AC distribution board, size the cable between the generator and AC distribution board in accordance with the operating current of the fuse on the generator.

1. On the Sunny Island, connect the cable to the **AC1 Loads/SunnyBoys** terminal (see Section 6.6.2 "Connecting the AC Power Cable", page 58).
  - Connect the line conductor to **AC1 Loads/SunnyBoys L**.
  - Connect the neutral conductor to **AC1 Loads/SunnyBoys N**.
2. In addition, thread the grounding conductor through a ferrite included in the scope of delivery and connect to **AC1 Loads/SunnyBoys PE** (see Section 6.6.3 "Connecting the Grounding Conductor", page 60).
3. If the power cable conductor cross-section is less than 10 mm<sup>2</sup>, thread an additional grounding conductor through the provided ferrite and connect it to the **AC1 Loads/SunnyBoys PE** terminal (see Section 6.6.3 "Connecting the Grounding Conductor", page 60).

## 6.5.5 Connection of Multicluster-Box 12 (MC-Box-12.3-20)

### 6.5.5.1 Connecting the AC Power Cable of the Multicluster-Box 12

#### **⚠ QUALIFIED PERSON**

#### **⚠ 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 fuse on the generator has a higher operating current than the fuse in the AC distribution board, size the cable between the generator and AC distribution board in accordance with the operating current of the fuse on the generator.

#### **Requirement:**

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

#### **Procedure:**

1. Connect the power cable to the **AC2 Gen/Grid** terminal on all Sunny Island (see Section 6.6.2 "Connecting the AC Power Cable", page 58):
  - Connect the line conductor to **AC2 Gen/Grid L**.
  - Connect the neutral conductor to **AC2 Gen/Grid N**.
2. Thread the grounding conductor through a ferrite included in the scope of delivery and connect to **AC2 Gen/Grid PE** (see Section 6.6.3, page 60).

### 6.5.5.2 Connecting the Control Cable of the Multicluster-Box 12

#### **⚠ QUALIFIED PERSON**

#### **Requirements:**

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

#### **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** (see Section 6.6.2 "Connecting the AC Power Cable", page 58).

2.

#### **⚠ WARNING**

##### **Danger to life from electric shock due to incorrect insulation**

In the case of faulty insulation, supposedly de-energized parts or cables may be live. Touching live components or cables can result in death or serious injury due to electric shock.

- When making the following connections, always insert a silicone tube (see Section 6.6.5, page 61).

3. On the master of the main cluster, connect the control cable of **X113 1** and **X113 2** to the **Relay2 C** and **Relay2 NO** (see Section 6.6.5 "Connecting Relay 1 and Relay 2", page 61).
4. On the main cluster's master, connect the control cable of **X112 1** and **X112 2** to the **Relay1 C** and **Relay1 NC** terminals when a Grid-Connect-Box is installed in addition to the Multicluster-Box 12.



### 6.5.5.3 Connecting the Measuring Cable of the Multicluster-Box 12

#### QUALIFIED PERSON

##### Requirements:

- The inverters to be connected must be Sunny Island 6.0H / 8.0H inverters.
- The utility grid must be connected to the multicluster system (see Multicluster-Box 12 operating manual).

##### 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 (see Section 6.6.7 "Connecting ExtVtg", page 63):
  - 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 (see Section 6.6.6 "Connecting BatVtgOut, DigIn, BatTMP and BatCur", page 63):
  - Connect the master **BatVtgOut-** with the **DigIn-**.
  - Thread both insulated conductors through a ferrite included in the scope of delivery.
  - Connect the insulated conductor from **X113 3** to **BatVtgOut+**.
  - Connect the insulated conductor from **X113 4** to **DigIn+**.

### 6.5.6 Connecting the Generator in an Off-Grid System

#### QUALIFIED PERSON

#### Relevant for off-grid systems

For a single system and single-cluster system, connect the generator to the **AC2** terminal of the Sunny Island. 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.
- For a single-phase parallel cluster, the cable length and the conductor cross-section must be identical from each Sunny Island to the AC distribution board or directly to the generator.
- With each three-phase cluster, the connection of the line conductor must be prepared as follows: L1 to the master, L2 to slave 1 and L3 to slave 2. This results in a right-hand rotating magnetic field.

##### Procedure:

1. Connect the power cable to the **AC2 Gen/Grid** terminal on the Sunny Island. To do this, connect the neutral conductor to terminal **N** (see Section 6.6.2 "Connecting the AC Power Cable", page 58).
  - Connect the line conductor to **AC2 Gen/Grid L**.

- Connect the neutral conductor to **AC2 Gen/Grid N**.
2. Thread the grounding conductor through a ferrite included in the scope of delivery and connect to **AC2 Gen/Grid PE** (see Section 6.6.3, page 60).

## 6.5.7 Communication Connection

### 6.5.7.1 Connecting the Data Cable for Speedwire Network

#### QUALIFIED PERSON

The Sunny Island and one communication product (e.g. Sunny Home Manager 2.0) can be directly interconnected via Speedwire. If more than two devices are to communicate via Speedwire or the Sunny Home Manager 2.0 is to establish an internet connection to the Sunny Portal, a Speedwire network is required.

#### Requirements:

- All Speedwire devices must be connected to the same router.
- The router and the optional network switch must fully support Multicast.
- The router must support "Internet Enabled Devices" with the SIP and STUN interfaces.

Most common routers and network switches support Multicast and "Internet Enabled Devices".

#### 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 mm<sup>2</sup> 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. Insert the data cable in the pin connector **ComETH** on the Sunny Island (see Section 6.6.4 "Connecting the Data Cable", page 60).
2. Connect the other end of the data cable to the router or network switch.

### 6.5.7.2 Connecting the Data Cable of the Lithium-Ion Batteries

#### QUALIFIED PERSON

#### Requirements:

- The total length of the communication bus must not exceed 30 m. Keep in mind that the communication bus possibly connects several nodes.

#### Cable requirements:

- Classification: CAT5e
- Type of plug: RJ45

#### Procedure:

1. Plug the data cable into a free pin connector **ComSync** on the Sunny Island (see Section 6.6.4 "Connecting the Data Cable", page 60).
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.

### 6.5.7.3 Connecting the Data Cable for the Internal Communication of the Cluster

#### ⚠ QUALIFIED PERSON

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

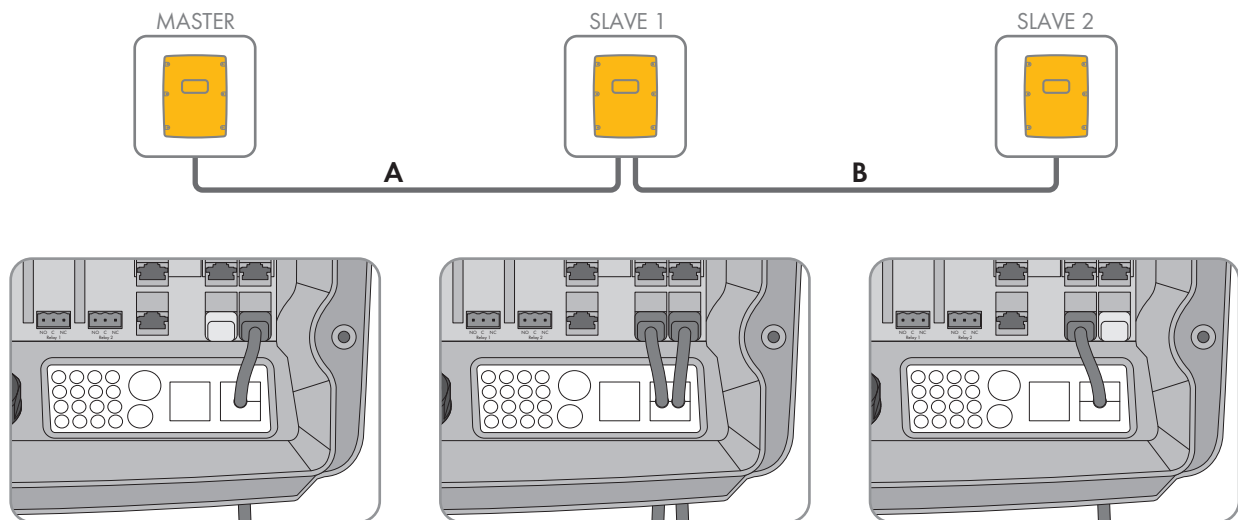


Figure 8: Internal communication cabling (example)

#### Requirements:

- The total length of the communication bus (A+B) must be less than 30 m. Keep in mind that the communication bus possibly connects several nodes.

#### Procedure:

1. Plug the data cable into a free pin connector **ComSync** on the Sunny Island (see Section 6.6.4 "Connecting the Data Cable", page 60).
2. Ensure that the communication bus is closed at each end, e.g. with a terminator.

### 6.5.7.4 Connecting the Data Cable of the Multicluster-Box

#### ⚠ QUALIFIED PERSON

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.

#### Cable requirements:

- Classification: CAT5e
- Type of plug: RJ45

#### Procedure:

1. Plug the data cable into a free pin connector **ComSync** on the Sunny Island (see Section 6.6.4 "Connecting the Data Cable", page 60).
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.

### 6.5.7.5 Connecting Control and Measuring Cables of the Multicluster-Box

#### ⚠ QUALIFIED PERSON

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.

#### Cable requirements:

- Cable length for BatVtgOut, DigIn and BatTemp: less than 30 m

#### Procedure:

- Plug the red data cables into the pin connector **BackupVtgCur** on the Sunny Island units of the main cluster (see Section 6.6.4 "Connecting the Data Cable", page 60). Connect the master with the connection **Mstr./L1**, slave 1 with the connection **Slv1./L2** and slave 2 with the connection **Slv2./L3** on the Multicluster-Box.

### 6.5.7.6 Connecting the Data Cables for Multicluster Communication

#### ⚠ QUALIFIED PERSON

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 when using a Multicluster-Box. If the Sunny Island was ordered with the **Communication for multicluster system** order option, SI-SYSCAN.BGx is installed in each master.

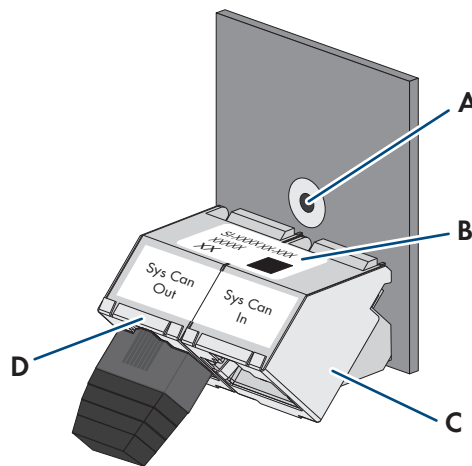


Figure 9: Design of the SI-SYSCAN.BGx

Position	Designation
A	Mounting hole
B	Type label
C	<b>SysCanIn</b> pin connector
D	<b>SysCanOut</b> jack

#### Cable requirements:

- Classification: CAT5e
- Maximum cable length: 30 m

**Procedure:**

1. Ensure that the communication interface SI-SYSCAN.BGx is installed 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 6.6.4 "Connecting the Data Cable", page 60).
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.

## 6.5.8 Connecting the Battery Temperature Sensor

### ⚠ QUALIFIED PERSON

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

#### **i** 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.

**Requirement:**

- Cable length for BatVtgOut, DigIn and BatTemp: less than 30 m

**Procedure:**

1.

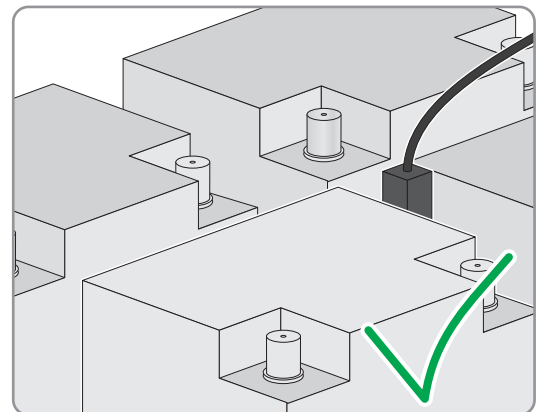
#### NOTICE

#### Damage to the battery due to excessive charging voltage due to incorrectly measured battery temperature

Due to incorrect battery temperature measurement, the battery inverter charges the battery with an incorrect amount of charging voltage. Excessive charging voltage can damage the battery.

- Connect only the battery temperature sensor supplied.
- Attach the battery temperature sensor as described in the following step.

2. Attach the battery temperature sensor in the center of the battery-storage system, in the upper third of the battery cell. As a result, the battery temperature sensor measures the temperature at the warmest point in the battery-storage system.



3. Thread both insulated conductors of the sensor through a ferrite included in the scope of delivery and connect to the terminals **BatTmp** on the Sunny Island (see Section 6.6.6 "Connecting BatVtgOut, DigIn, BatTMP and BatCur", page 63). In this case, the polarity is arbitrary.

## 6.5.9 Connecting the Battery Current Sensor in the Off-Grid System

### ⚠ QUALIFIED PERSON

When using lead-acid batteries, a battery current sensor can be installed for precise measurement of the battery current.

#### ⚠ Relevant for off-grid systems

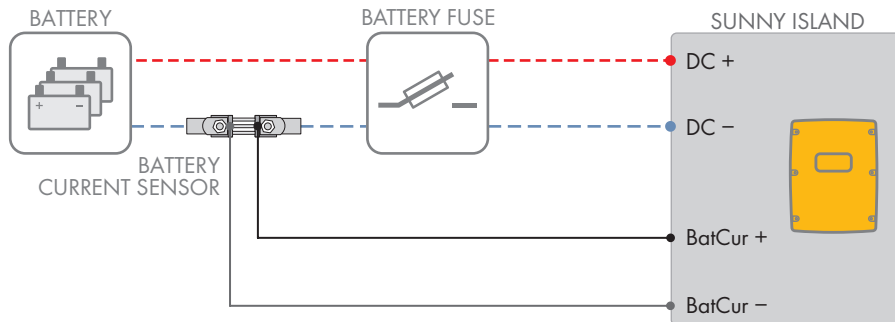


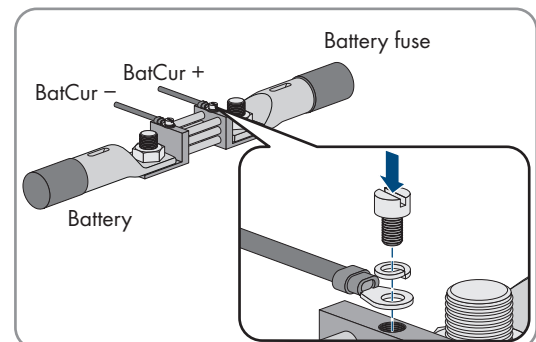
Figure 10: Connection of the battery current sensor to the Sunny Island.

#### Cable requirements:

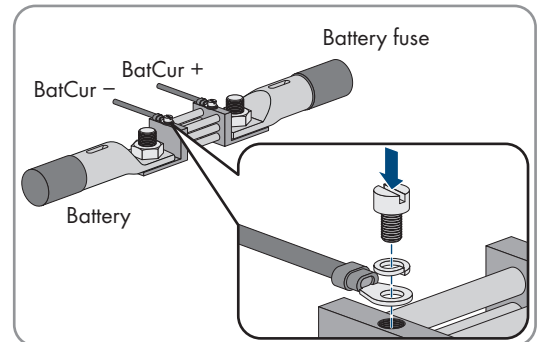
- Copper wire
- Maximum cable length: 3 m
- Conductor cross-section: 0.2 mm<sup>2</sup> to 2.5 mm<sup>2</sup>
- A measuring cable with intrinsically safe current circuits must be used. For this purpose, "intrinsically safe" means that the cable is double-insulated and that, in the event of a short circuit, 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 in the **DC** power cable between the battery and the battery fuse.
2. Connect the **BatCur+** insulated measuring conductor to the side for connecting the battery fuse 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. Thread both insulated conductors through a ferrite included in the scope of delivery and connect to the terminals **BatCur+** und **BatCur-** on the Sunny Island (see Section 6.6.6 "Connecting BatVtgOut, DigIn, BatTMP and BatCur", page 63).

### 6.5.10 Connecting the Control Cable for Autostart Generators

#### ⚠ QUALIFIED PERSON

#### 🔌 Relevant for off-grid systems

Autostart generators are started and stopped with a contact.

#### **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.

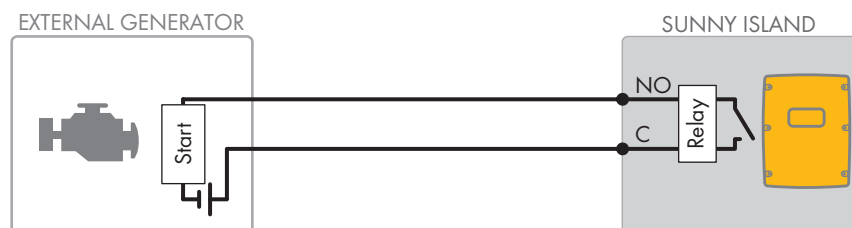


Figure 11: Connecting the Generator Control to Sunny Island

#### Requirements:

- The technical requirements of the multifunction relay must be met (see Section 16 "Technical Data", page 178).

#### Cable requirements:

- Copper wire
- Conductor cross-section: 0.2 mm<sup>2</sup> to 2.5 mm<sup>2</sup>

#### Procedure:

1.

#### ⚠ WARNING

#### Danger to life from electric shock due to incorrect insulation

In the case of faulty insulation, supposedly de-energized parts or cables may be live. Touching live components or cables can result in death or serious injury due to electric shock.

- When making the following connections, always insert a silicone tube (see Section 6.6.5, page 61).

2. The default setting of the Sunny Island uses the multifunction relay **Relay1** for generator requests. Therefore, connect the control cable to the multifunction relay **Relay1** on the Sunny Island. Use the **C** and **NO** connections.

3. If the multifunction relay **Relay1** for generator requests is not available, connect the control cable to the multifunction relay **Relay2** on the Sunny Island. Use the **C** and **NO** connections.
4. If, with more than one Sunny Island, the multifunction relay **Relay1** and **Relay2** for generator requests are not available on the Master, connect the control cable to a free multifunction relay on slave 1 or slave 2. Use the **C** and **NO** connections.
5. Enter the configuration **Automatic generator request** in the table of settings (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).

### 6.5.11 Connecting a Signaler for Generators Without an Autostart Function

#### **⚠ QUALIFIED PERSON**

#### **🔌 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.

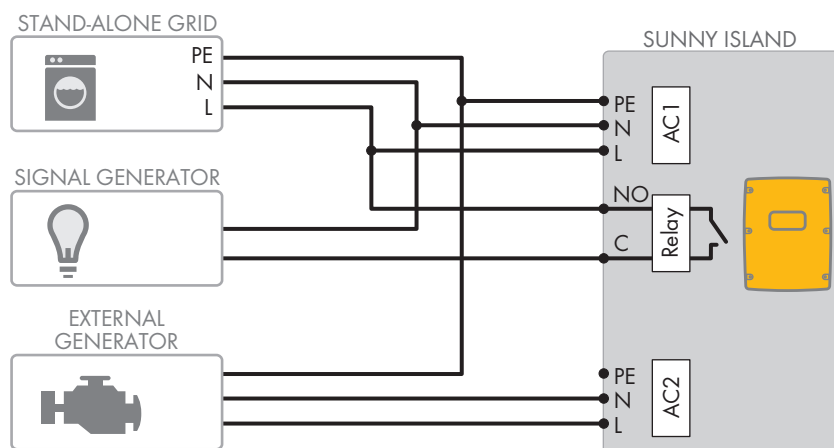


Figure 12: Connecting a Signal Generator to Signal a Generator Request (Example)

#### Requirements:

- The technical requirements of the multifunction relay must be met (see Section 16 "Technical Data", page 178).

#### Cable requirements:

- Copper wire
- Conductor cross-section: 0.2 mm<sup>2</sup> to 2.5 mm<sup>2</sup>

#### Procedure:

1.

#### **⚠ WARNING**

#### **Danger to life from electric shock due to incorrect insulation**

In the case of faulty insulation, supposedly de-energized parts or cables may be live. Touching live components or cables can result in death or serious injury due to electric shock.

- When making the following connections, always insert a silicone tube (see Section 6.6.5, page 61).



- The default setting of the Sunny Island uses the multifunction relay **Relay1** for generator requests. Therefore, connect the control cable to the multifunction relay **Relay1** on the Sunny Island. Use the **C** and **NO** connections.
- If the multifunction relay **Relay1** for generator requests is not available, connect the control cable to the multifunction relay **Relay2** on the Sunny Island. Use the **C** and **NO** connections.
- If, with more than one Sunny Island, the multifunction relay **Relay1** and **Relay2** for generator requests are not available on the Master, connect the control cable to a free multifunction relay on slave 1 or slave 2. Use the **C** and **NO** connections.
- Enter the configuration **Automatic generator request** in the table of settings (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).

## 6.5.12 Connecting Load-Shedding Contactors

### ⚠ QUALIFIED PERSON

#### 🔌 Relevant for off-grid systems

Load shedding prevents battery deep discharge and controls the supply of energy 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.

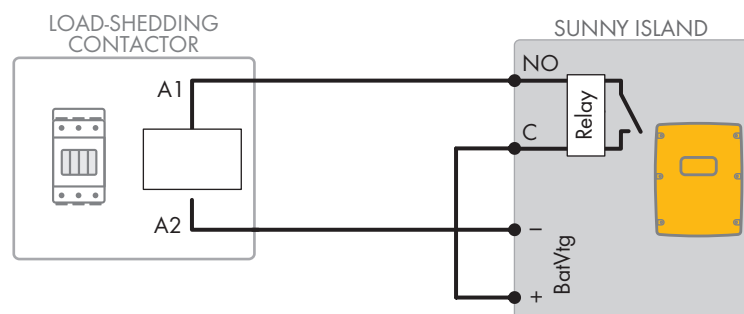


Figure 13: Connection of control cable for one-stage load shedding (example)

### **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.

### Specifications for load-shedding configuration:

The following values are stored in the user interface of the Sunny Island for setting the load-shedding system. If you connect load-shedding contactors, consider the effects in the system and comply with the instructions for use.

Value	System effects	Application
One-stage load-shedding scheme (Load shedding 1)	If the Sunny Island has activated the load-shedding system and then an external energy source is connected, the load-shedding process is terminated immediately (regardless of the battery's state of charge). The external energy source is then supplying the loads. The battery is only charged with the excess energy.	<ul style="list-style-type: none"> <li>Works only in off-grid and battery-backup systems</li> </ul>
One-stage load-shedding scheme or first stage in terms of two-stage load-shedding schemes (Load shedding 1)	Setting for a one-stage load-shedding scheme or the first stage of a two-stage load-shedding scheme. Load shedding is only stopped when the battery has been sufficiently charged. This setting affects the system behavior regardless of whether an external energy source is present.	<ul style="list-style-type: none"> <li>Suitable in systems for increased self-consumption (battery-storage systems)</li> </ul>
Second stage in terms of two-stage load-shedding scheme (Load shedding 2)	Settings for second load-shedding contactor in terms of a two-stage load-shedding scheme. Load shedding is only stopped when the battery has been sufficiently charged.	<ul style="list-style-type: none"> <li>Suitable in off-grid systems, battery-backup systems and systems for increased self-consumption</li> </ul>
Load shedding in multicenter system (Load shedding 1)	In a multicenter system, this setting is intended for additional one-stage load-shedding. When the battery state of charge of a cluster falls below a set value, the load-shedding process begins. The load shedding only ends when the batteries of all clusters have reached the set value of the battery state of charge. How long it takes to reach this value depends on the battery technology used and the selected battery capacity. If different battery technologies and different battery capacities are combined in the clusters of a multicenter system, the display values for the individual clusters may vary.	<ul style="list-style-type: none"> <li>Only for multicenter systems</li> </ul>

#### Requirements:

- The technical requirements of the multifunction relay must be met (see Section 16 "Technical Data", page 178).

#### Cable requirements:

- Copper wire
- Conductor cross-section: 0.2 mm<sup>2</sup> to 2.5 mm<sup>2</sup>

#### Procedure:

- 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.
- 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. Carry out 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 6.6.5 "Connecting Relay 1 and Relay 2", page 61).
  - Connect the insulated conductor for coil connection **A2** to terminal **BatVtgOut-** (see Section 6.6.6 "Connecting BatVtgOut, DigIn, BatTMP and BatCur", page 63).

- 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. Carry out 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 6.6.5 "Connecting Relay 1 and Relay 2", page 61).
    - Connect the insulated conductor for coil connection **A2** to terminal **BatVtgOut-** (see Section 6.6.6 "Connecting BatVtgOut, DigIn, BatTMP and BatCur", page 63).
    - Connect terminal **BatVtgOut +** to terminal **Relay1 C**. Use the same conductor cross-section as that of the cable for the load-shedding contactor.
  4. Repeat steps 1 to 3 for two-stage load shedding. Connect the second load-shedding contactor to an unused multifunction relay.
  5. Write down the terminal assignment of the load shedding terminal for setting the multifunction relays. Tip: Use the table provided in this document (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105):

### 6.5.13 Connecting the Time Control for External Processes

#### QUALIFIED PERSON

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 16 "Technical Data", page 178).

#### Cable requirements:

- Copper wire
- Conductor cross-section: 0.2 mm<sup>2</sup> to 2.5 mm<sup>2</sup>

#### Procedure:

1.

#### WARNING

#### Danger to life from electric shock due to incorrect insulation

In the case of faulty insulation, supposedly de-energized parts or cables may be live. Touching live components or cables can result in death or serious injury due to electric shock.

- When making the following connections, always insert a silicone tube (see Section 6.6.5, page 61).

2. Connect the control cable on the Sunny Island to either multifunction relay **Relay1** or **Relay2**. Use the **C** and **NO** connections.
3. During configuration, enter the value **TM1** for timer 1 or the value **TM2** for timer 2 in the table of settings (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).

### 6.5.14 Connecting Message Devices for Operating States and Warning Messages

#### QUALIFIED PERSON

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 two 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 16 "Technical Data", page 178).

#### Cable requirements:

- Copper wire
- Conductor cross-section: 0.2 mm<sup>2</sup> to 2.5 mm<sup>2</sup>

#### Procedure:

1.

### **⚠ WARNING**

#### **Danger to life from electric shock due to incorrect insulation**

In the case of faulty insulation, supposedly de-energized parts or cables may be live. Touching live components or cables can result in death or serious injury due to electric shock.

- When making the following connections, always insert a silicone tube (see Section 6.6.5, page 61).

2. Connect the control cable on the Sunny Island to either multifunction relay **Relay1** or **Relay2**. Use the **C** and **NO** connections.
3. Enter the selected configuration into the table of the settings (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105):

Value	Version
Relay is activated when the generator is running	The PV array is running and is connected.
Relay is activated when an external source is available	Voltage and frequency of the generator are within the range for connection.
Relay is activated when the utility grid is available	The utility grid is connected in the off-grid system.
Relay is deactivated in the event of an error	A Sunny Island displays an error message of level 2 or higher.
Relay is activated in the event of a warning	A Sunny Island displays a warning.

Value	Version
Relay is activated when the cluster is running	In a single system, the Sunny Island is operating, or in a cluster system, the cluster is operating.
Relay is activated in the event of power limitation	In a single system, a Sunny Island is in derating, or in a cluster system, the cluster is in derating.

### 6.5.15 Connecting the Battery Room Fan

#### **⚠ QUALIFIED PERSON**

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 16 "Technical Data", page 178).

#### **Cable requirements:**

- Copper wire
- Conductor cross-section: 0.2 mm<sup>2</sup> to 2.5 mm<sup>2</sup>

#### **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**

In the case of faulty insulation, supposedly de-energized parts or cables may be live. Touching live components or cables can result in death or serious injury due to electric shock.

- When making the following connections, always insert a silicone tube (see Section 6.6.5, page 61).

3. With single systems or single-cluster systems, connect the battery room fan to a multifunction relay.
4. With a multi-cluster system, in each cluster, connect one battery room fan on one Sunny Island to any multifunction relay.
5. Enter the configuration **Battery fan** in the table of settings (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).

#### **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**

In the case of faulty insulation, supposedly de-energized parts or cables may be live. Touching live components or cables can result in death or serious injury due to electric shock.

- When making the following connections, always insert a silicone tube (see Section 6.6.5, page 61).

3. Connect the battery room fan to one multifunction relay on one Sunny Island of the main cluster.
4. Enter the configuration **Battery fan in Multicluster** in the table of settings (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).

### 6.5.16 Connecting the Electrolyte Pump for the Battery

#### QUALIFIED PERSON

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 16 "Technical Data", page 178).

#### Cable requirements:

- Copper wire
- Conductor cross-section: 0.2 mm<sup>2</sup> to 2.5 mm<sup>2</sup>

#### Procedure:

1.

#### WARNING

##### **Danger to life from electric shock due to incorrect insulation**

In the case of faulty insulation, supposedly de-energized parts or cables may be live. Touching live components or cables can result in death or serious injury due to electric shock.

- When making the following connections, always insert a silicone tube (see Section 6.6.5, page 61).

2. Connect the control cable of the acid circulation to a multifunction relay on the Sunny Island .
3. With a multi-cluster system, in each cluster, connect the control cable of the acid circulation to a multifunction relay.
4. Enter the configuration **Electrolyte pump** in the table the settings (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).

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

#### QUALIFIED PERSON



#### 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.



### Use 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 16 "Technical Data", page 178).

#### Cable requirements:

- Copper wire
- Conductor cross-section: 0.2 mm<sup>2</sup> to 2.5 mm<sup>2</sup>

#### Procedure:

1.

### ⚠ WARNING

#### Danger to life from electric shock due to incorrect insulation

In the case of faulty insulation, supposedly de-energized parts or cables may be live. Touching live components or cables can result in death or serious injury due to electric shock.

- When making the following connections, always insert a silicone tube (see Section 6.6.5, page 61).

2. Connect the control cable for the utilization of excess energy to the multifunction relay on the Sunny Island .
3. Enter the configuration **Control of add. loads** in the table of settings (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).
4. Set the multifunction relay in accordance with the basic configuration of the system (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105) and set the utilization of excess energy in off-grid systems (see Section 7.7, page 87).

## 6.5.18 Connecting the Signal Cable of the External Generator Request

### ⚠ QUALIFIED PERSON



#### 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.

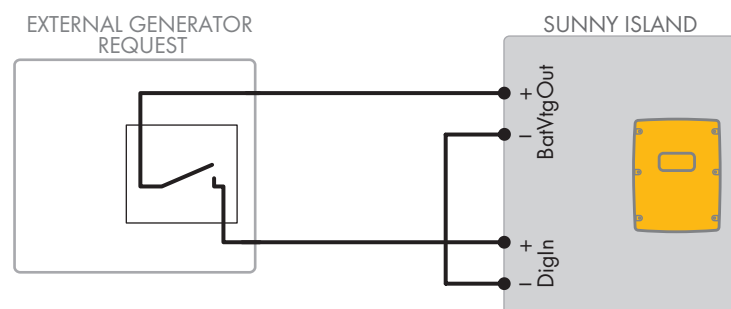


Figure 14: Connection of the control cable of an external generator request (example).

**Requirements:**

- The technical requirements of the multifunction relay must be met (see Section 16 "Technical Data", page 178).

**Cable requirements:**

- Copper wire
- Conductor cross-section: 0.2 mm<sup>2</sup> to 2.5 mm<sup>2</sup>
  1. On the Sunny Island, thread both insulated conductors through a ferrite included in the scope of delivery. (see Section 6.6.6 "Connecting BatVtgOut, DigIn, BatTMP and BatCur", page 63).
  2. Connect one insulated conductor of the control cable to terminal **BatVtgOut+**.
  3. Connect one insulated conductor of the control cable to terminal **DigIn +**.
  4. Connect terminal **BatVtgOut-** to terminal **DigIn -**. Use the same conductor as in the control cable.

## 6.6 Connecting the Cables

### 6.6.1 Connecting the DC Power Cable

**⚠ QUALIFIED PERSON****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 mm<sup>2</sup> to 95 mm<sup>2</sup>
- Cable diameters: 14 mm to 25 mm
- Only copper cables may be used.
- The DC cables must be sized for the maximum battery voltage and the maximum battery current (see battery manufacturer documentation).

**⚠ 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.

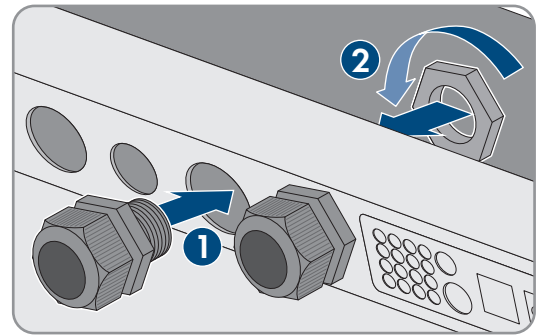
- Ensure that the lithium-ion batteries are approved for use with the Sunny Island (see technical information "List of Approved Batteries" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).
- If no lithium-ion batteries approved for the inverter can be used, lead-acid batteries can be used.
- Verify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

**Procedure:**

1. Ensure that the load-break switch of the battery fuse 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. Attach 2 M32 cable glands with counter nuts included in the scope of delivery to the **DC+** and **DC-** enclosure openings (torque: 12 Nm).



4. Clean the contact surfaces of the connections **DC+** and **DC-** using a clean cloth and ethanol cleaning agent and do not touch the contact surfaces after cleaning.

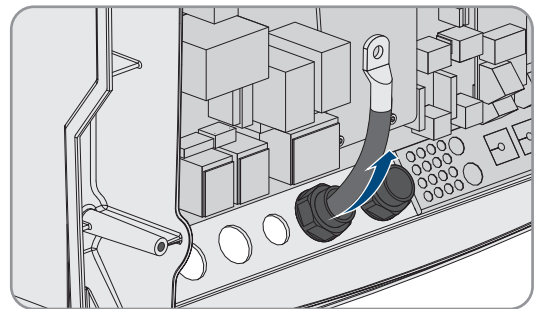
5. **NOTICE**

**Damage to the battery inverter due to excessive electric currents because of the DC cables being incorrectly connected**

If the DC cables are swapped or incorrectly connected, dangerously high currents will flow after the load-break switch has closed. These electric currents can damage the battery inverter.

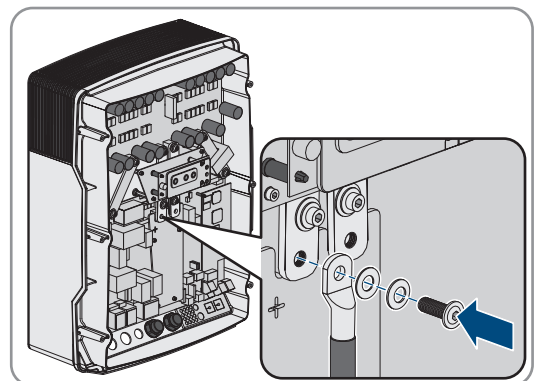
- Use the required terminal lugs when connecting the DC cables.
- Ensure correct polarity when connecting the DC cables.
- Connect the DC cables as described in the following.

6. Strip off the insulation of the **DC+** cable and mount a terminal lug.

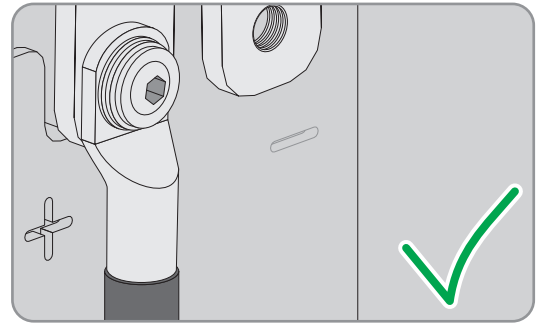


7. Route the **DC+** cable on the side of the protective cover marked with a + symbol.

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

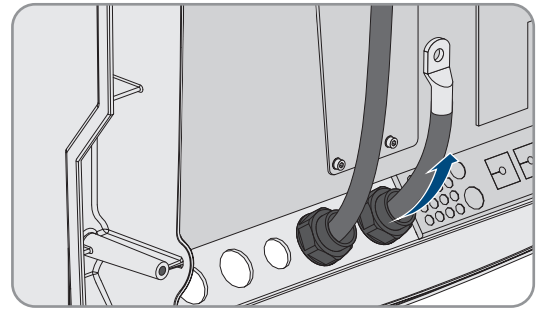


9. Ensure that the entire contact surface of the fender washer is in contact with the terminal lug.



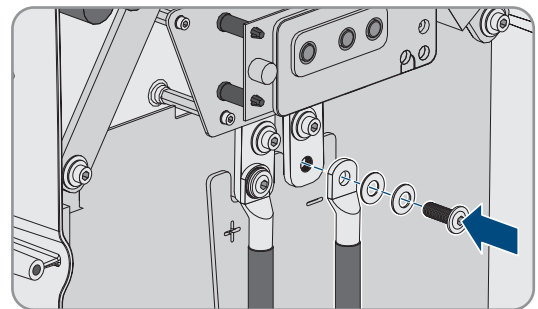
10. Strip off the insulation of the **DC**- cable and mount a terminal lug.

11. Thread the **DC**- cable through the **DC**- cable gland into the Sunny Island.

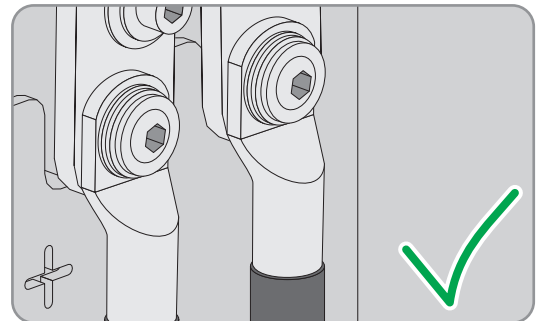


12. Route the **DC**- cable on the side of the protective cover marked with a - symbol.

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



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



15. Ensure that the seal insert is positioned correctly in the cable gland.

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

## 6.6.2 Connecting the AC Power Cable

### ⚠ QUALIFIED PERSON

Always proceed as follows to connect the power cables.

#### Cable requirements:

- Copper wire
- Recommended conductor cross-section: 10 mm<sup>2</sup>

- Conductor cross-section: 1.5 mm<sup>2</sup> to 16 mm<sup>2</sup>
- Cable diameters: 9 mm to 18 mm

### ⚠ WARNING

#### Danger to life from electric shock due to incorrect connection of the neutral conductor in single systems and single-cluster systems

In single systems and single-cluster systems, 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<sub>TT</sub>**. 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<sub>TT</sub>** in systems for increased self-consumption.
- Always connect the neutral conductor to the connection **AC2 Gen/Grid N<sub>TT</sub>** in battery backup systems.
- Always connect the neutral conductor of the generator to the connection **AC2 Gen/Grid N** in off-grid systems.

### ⚠ CAUTION

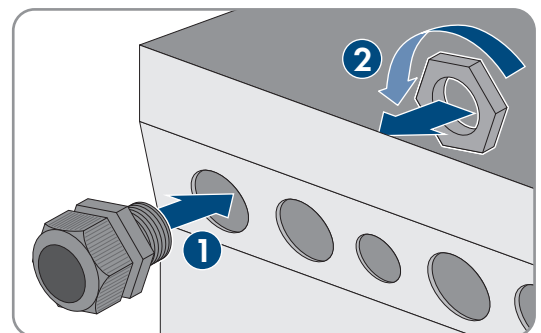
#### Danger of crushing when locking levers snap shut

The locking levers close by snapping down fast and hard.

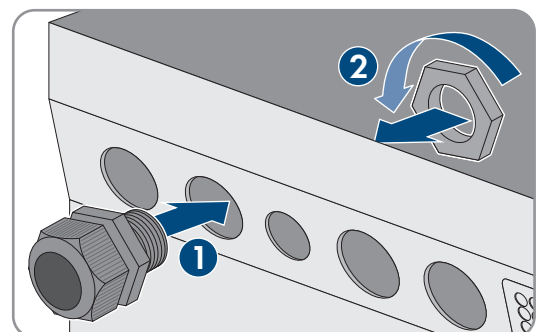
- Press the locking levers of the terminal block for the AC cable down with your thumb only.
- Do not grip the entire terminal block for the AC cable.
- Do not place your fingers under the locking levers.

#### 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 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.
7. Connect the grounding conductor (see Section 6.6.3, page 60).
8. Ensure that the seal insert is positioned correctly in the cable gland.
9. Tighten the swivel nut of the cable gland (torque: 4 Nm).

### 6.6.3 Connecting the Grounding Conductor

#### **⚠ QUALIFIED PERSON**

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 mm<sup>2</sup> or larger. If the conductor cross-section is smaller, an additional grounding conductor must connect the Sunny Island with the ground potential.

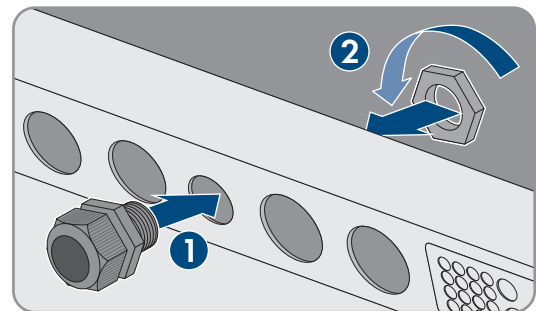
Additional grounding is fulfilled if the Sunny Island is already grounded due to the grounded battery (see Section 6.4 "Connecting the Grounding Conductor with a Grounded Battery", page 34).

#### Cable requirements:

- Cross-section of the connected line conductor or (maximum 16 mm<sup>2</sup>)
- 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 M25 cable gland to the **AC1** or **AC2** enclosure opening using the counter nut (torque: 7 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. Thread the grounding conductor through a ferrite included in the scope of delivery.
6. 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.
7. Tighten the swivel nut of the cable gland (torque: 2.6 Nm).

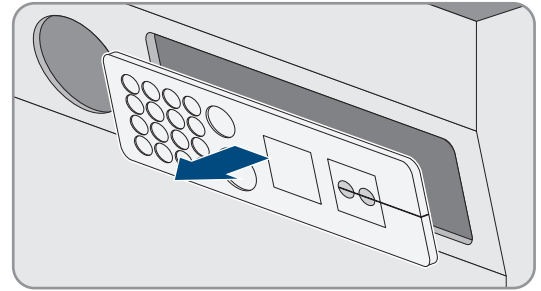
### 6.6.4 Connecting the Data Cable

#### **⚠ QUALIFIED PERSON**

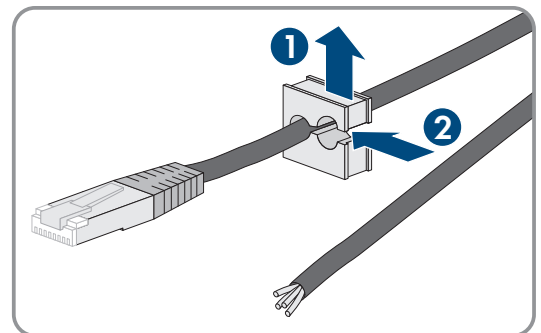
Always proceed as follows to connect data cables.

**Procedure:**

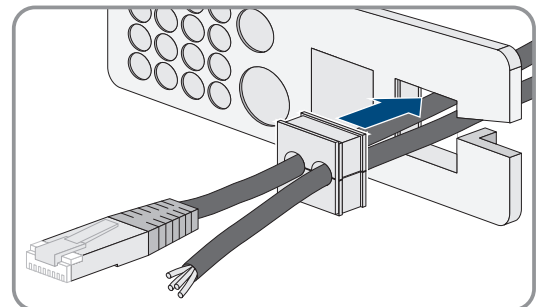
1. Push the cable feed-through plate out of the enclosure from outside.



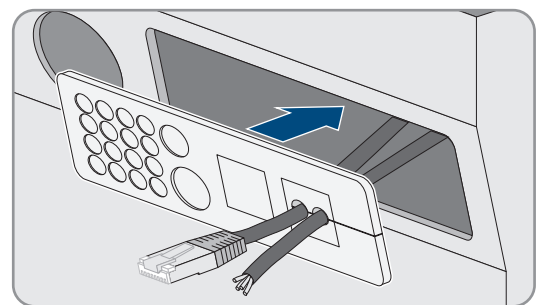
2. Retain the cable feed-through plate for later use.
3. Lead the data cable through the enclosure opening.
4. Connect the data cable.
5. When all data cables are connected, select two cable support sleeves with a suitable number of openings.
6. Open the cable support sleeves and place the cables in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

### 6.6.5 Connecting Relay 1 and Relay 2

#### **⚠ QUALIFIED PERSON**

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 16 "Technical Data", page 178).

**Cable requirements:**

- Copper wire
- Conductor cross-section: 0.2 mm<sup>2</sup> to 2.5 mm<sup>2</sup>

**Procedure:**

1. Break through a suitable location in the cable feed-through plate with a sharp object.
2. Strip 7 mm of the cable insulation.
3. Lead the cable through the hole in the cable feed-through plate into the Sunny Island.

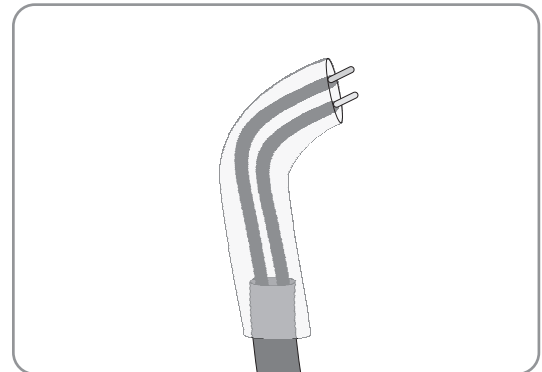
4.

**⚠ WARNING****Danger to life from electric shock due to incorrect insulation**

In the case of faulty insulation, supposedly de-energized parts or cables may be live. Touching live components or cables can result in death or serious injury due to electric shock.

- When connecting cables to **Relay 1** and **Relay 2**, always insert a silicone tube.
- Always connect the cables to **Relay 1** and **Relay 2** as described in the following.

5. Cut a silicon tube to the length of the cable in the Sunny Island.



6. Pull the silicone tube over the cable. In this way, the cable is double-insulated.
7. Lead the cable into the Sunny Island making sure that it does not touch any data cables.
8. Connect the insulated conductors to the 3-pole terminal blocks included in the scope of delivery (torque: 0.5 Nm to 0.6 Nm, blade width: 1 mm). Observe the correct assignment of the connections when doing so.

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

9. Ensure that the conductors are plugged completely into the terminals up to the insulation.
10. In accordance with the labeling, plug the 3-pole terminal block into the connection **Relay1** or **Relay2** on the inverter until the terminal block audibly snaps into place.

## 6.6.6 Connecting BatVtgOut, DigIn, BatTMP and BatCur

### QUALIFIED PERSON

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

#### Information on the connection **BatVtgOut**

The entire DC voltage range of the connections **DC+** and **DC-** is mapped at the connection **BatVtgOut**.

The connection **BatVtgOut** is current-limited and protected against short circuit.

#### 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 mm<sup>2</sup> to 2.5 mm<sup>2</sup>
- Cable length for **BatVtgOut**, **DigIn** and **BatTemp**: less than 30 m
- Cable length for **BatCur**: less than 3 m.

#### Procedure:

1. Break through a suitable location in the cable feed-through plate with a sharp object.
2. Strip 7 mm of the cable insulation.
3. Lead the insulated conductors through the hole in the cable feed-through plate into the Sunny Island.
4. Thread the cable for the connections **BatVtgOut** and **DigIn** through a ferrite included in the scope of delivery.
5. Thread the cable for the connections **BatTmp** and **BatCur** through a ferrite included in the scope of delivery.
6. Connect the insulated conductors to a 4-pole terminal block included in the scope of delivery (torque: 0.5 Nm to 0.6 Nm, blade width: 1 mm):
7. Ensure that the conductors are plugged completely into the terminals up to the insulation.
8. In accordance with the labeling, plug the 4-pole terminal block into the connection on the inverter until the terminal block audibly snaps into place.

## 6.6.7 Connecting ExtVtg

### QUALIFIED PERSON

Always connect the cable to the **ExtVtg** connection as follows.

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

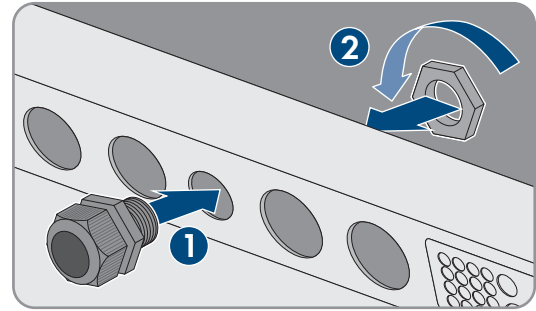
- Suitable bootlace ferrules if using stranded wire

#### Cable requirements:

- Copper wire
- Conductor cross-section: 0.2 mm<sup>2</sup> to 2.5 mm<sup>2</sup>
- The cable length must be less than 3 m.

**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 7 mm of the cable insulation.
3. Lead the cable through the cable gland into the Sunny Island.
4. Connect the insulated conductors to the 2-pole terminal blocks included in the scope of delivery (torque: 0.5 Nm to 0.6 Nm, blade width: 1 mm):
  - Connect the line conductor to terminal **ExtVtg L**.
  - Connect the neutral conductor to terminal **ExtVtg N**.
5. Ensure that the conductors are plugged completely into the terminals up to the insulation.
6. In accordance with the labelling, plug the 2-pole terminal block into the connection **ExtVtg** on the inverter until the terminal block audibly snaps into place.
7. Ensure that the seal insert is positioned correctly in the cable gland.
8. Tighten the swivel nut of the cable gland (torque: 2.6 Nm).

## 6.7 Checking the Wiring

### ⚠ QUALIFIED PERSON

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

**Requirements:**

- All Sunny Island inverters must be disconnected from all voltage sources. Disconnecting the Sunny Island from Voltage Sources.

### Checking the Grounding

Test point	Test criterion	OK
Enclosure opening ExtVtg	Enclosure opening is sealed with a filler plug or M20 cable gland.	<input type="checkbox"/>
		<input type="checkbox"/>
	The cable diameter of the cable must be 7 mm to 14 mm for an M20 cable gland.	<input type="checkbox"/>
Cable length at the ExtVtg connection	The cable length must be less than 30 m.	<input type="checkbox"/>
Conductor cross-section of the grounding conductor at the <b>AC1</b> and <b>AC2</b> connections	If one grounding conductor is connected, the conductor cross-section must be at least 10 mm <sup>2</sup> . If two grounding conductors are connected, the cross-section of each conductor must be at least 4 mm <sup>2</sup> .	<input type="checkbox"/>
	The grounding conductor must be threaded through a ferrite.	<input type="checkbox"/>



Test point	Test criterion	OK
Grounding conductor connection to ground	The grounding conductor must be grounded, e.g., by connection to a grounding busbar or a foundation ground electrode.	<input type="checkbox"/>
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.	<input type="checkbox"/>
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 6.4 "Connecting the Grounding Conductor with a Grounded Battery", page 34).	<input type="checkbox"/>

### 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.	<input type="checkbox"/>
Connection of additional grounding	Hexagon socket screw is screwed tight (torque: 4 Nm to 5.7 Nm).	<input type="checkbox"/>
Grounding conductor connection to ground	The grounding conductors must be grounded, e.g., by connection to a grounding busbar or foundation ground electrode.	<input type="checkbox"/>

### 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.	<input type="checkbox"/>
DC connection	Terminal lugs are pressed on firmly.	<input type="checkbox"/>
	The bolted connection for fitting terminal lugs to the DC connection is assembled as follows: head of M8x20 screw   conical spring washer   fender washer   terminal lug   DC connection.	<input type="checkbox"/>
	Terminal lugs are firmly fastened on the Sunny Island (torque: 12 Nm).	<input type="checkbox"/>
DC power cable	The maximum length of the cables from the battery via the battery fuse to the Sunny Island is 10 m.	<input type="checkbox"/>
	The conductor cross-section meets the cable requirements of 50 mm <sup>2</sup> to 95 mm <sup>2</sup> (for the recommended conductor cross-section, see Section 7.4.1).	<input type="checkbox"/>

Test point	Test criterion	OK
Battery fuse	Fuse links are matched to the Sunny Island. <ul style="list-style-type: none"> <li>• SI4.4M-13: 100 A</li> <li>• SI6.0H-13: 160 A</li> <li>• SI8.0H-13: 200 A</li> </ul>	<input type="checkbox"/>
	The cable glands connected to the battery fuse are tightened with the specified torque (see manufacturer documentation).	<input type="checkbox"/>
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).	<input type="checkbox"/>

### 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.	<input type="checkbox"/>
	For an M25 cable gland, the cable diameter must be 9 mm to 18 mm.	<input type="checkbox"/>
AC1 and AC2 terminals	All contact areas are not insulated.	<input type="checkbox"/>
	All terminal levers are in the downward position.	<input type="checkbox"/>
	All cables are securely clamped.	<input type="checkbox"/>
AC power cable at connection AC1	The cables are sufficiently protected by circuit breakers.	<input type="checkbox"/>
	Trip-capable circuit breakers are installed and additional type A residual-current devices have been installed.	<input type="checkbox"/>
	Maximum trip-capable circuit breakers: <ul style="list-style-type: none"> <li>• SI4.4M-13: Tripping characteristics B6</li> <li>• SI6.0H-13: Tripping characteristics B16 or C6</li> <li>• SI8.0H-13: Tripping characteristics B16 or C6</li> </ul>	
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.	<input type="checkbox"/>

### Checking the Generator Connection

Test point	Test criterion	OK
The connection cables	The conductor cross-section is sufficient for the maximum generator current.	<input type="checkbox"/>
	The cables are sufficiently protected by circuit breakers.	<input type="checkbox"/>

Test point	Test criterion	OK
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.	<input type="checkbox"/>
Grounding	The exposed conductive part of the generator is grounded.	<input type="checkbox"/>

### 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 <b>BatTmp</b> .	<input type="checkbox"/>
	The battery temperature sensor is secured in the middle of the battery-storage system, in the upper third of the battery cell.	<input type="checkbox"/>
If installed, the control and measuring cables of the Multicluster-Box	The control and measuring cables are correctly connected (see Multicluster-Box manual).	<input type="checkbox"/>
If installed, the measuring cable of the battery current sensor	The measuring cable of the battery current sensor is connected to the terminal <b>BatCur</b> with the correct polarity (see Section 6.5.9 "Connecting the Battery Current Sensor in the Off-Grid System", page 46).	<input type="checkbox"/>
Control cable of the load shedding, if installed	The multifunction relay and the load-shedding contactors are correctly wired to each other (see Section 6.5.12 "Connecting Load-Shedding Contactors", page 49).	<input type="checkbox"/>
Cables at <b>BatTemp</b> and <b>BatCur</b>	The insulated conductors must be threaded through a ferrite.	<input type="checkbox"/>
	The cable length for <b>BatCur</b> must be less than 3 m.	<input type="checkbox"/>
	The cable length for <b>BatTmp</b> must be less than 30 m.	<input type="checkbox"/>
Cable at <b>BatVtgOut</b> and <b>DigIn</b>	The cable must be threaded through a ferrite.	<input type="checkbox"/>
	The cable length must be less than 30 m.	<input type="checkbox"/>

### 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.	<input type="checkbox"/>
	The communication products are connected to an electricity supply.	<input type="checkbox"/>
Termination of the communication buses	The communication buses are connected to the first and last device in the bus.	<input type="checkbox"/>
Multicluster-Box control and measuring cable ( <b>BackupVtgCur</b> )	The cable length must be less than 30 m.	<input type="checkbox"/>

## Checking the System Devices

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

## 6.8 Sealing and Closing the Sunny Island

### ⚠ QUALIFIED PERSON

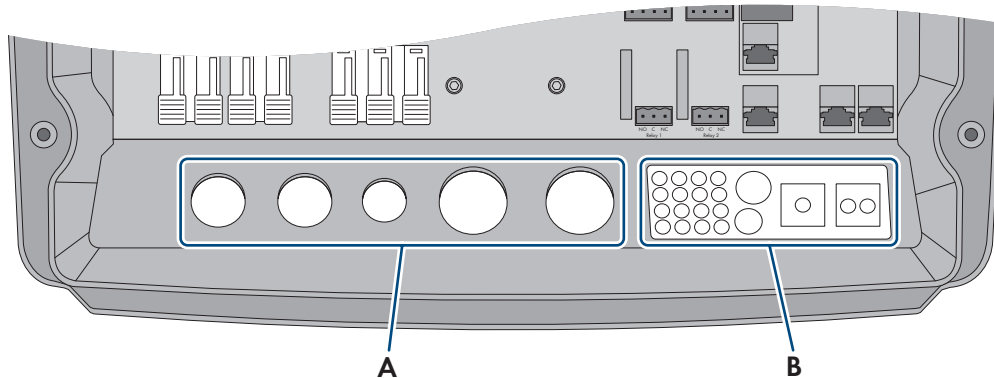
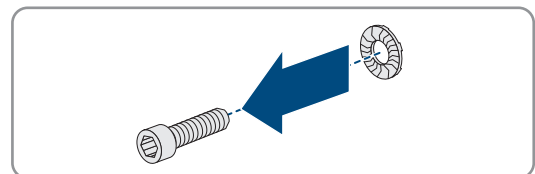


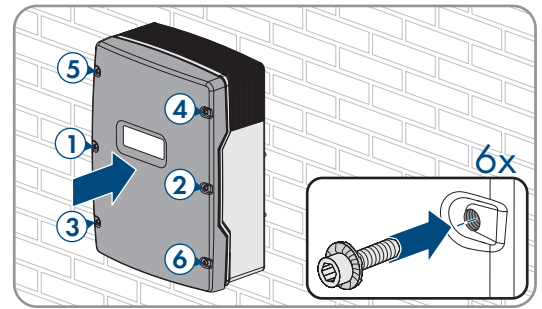
Figure 15: Position of the cable glands and the cable feed-through plate.

Position	Designation
A	Cable glands
B	Cable feed-through plate

- 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.
- 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 serrated conical spring washer must press into the enclosure lid. This ensures that the enclosure lid is grounded.



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

## 6.9 Inserting the Fuse Links in the Fuse Switch-Disconnecter

### ⚠ QUALIFIED PERSON

Device type	Fuse link
SI4.4M-13	100 A
SI6.0H-13	160 A
SI8.0H-13	200 A

#### Procedure:

1. Ensure that the NH1 fuse link for the fuse switch-disconnector of the battery fuse is correct:
2. Insert the fuse link and close the battery fuse.

## 7 Commissioning

### 7.1 Commissioning Procedure

#### **⚠ QUALIFIED PERSON**

Before commissioning the system, you must make various settings. This section describes the procedure and gives an overview of the steps, which must always be performed in the prescribed sequence.

#### **i The inverter supports different firmware versions that are suitable for different systems.**

**SI4.4M-13 as of firmware version 3.20.09.R:** suitable in off-grid, battery-storage and battery-backup systems.

**SI6.0H-13 / SI8.0H-13 as of firmware version 3.20.09.R:** suitable in all off-grid systems (single systems, single-cluster and multicluster systems) as well as in battery-storage and battery-backup systems without MC-BOX-12.3-20 (only single systems and single-cluster systems).

**SI6.0H-13 / SI8.0H-13 with firmware version 1.04.00.R:** intended for battery-storage and battery-backup systems with MC-BOX-12.3-20 (multicluster systems with parallel grid operation).

- Ensure that the inverter is equipped with a firmware version that are suitable for the respective system.

#### **i Parameter names and units depend on the inverter's firmware version.**

The parameter names and units depend on the inverter's firmware version. Parameter names and units of inverters with a firmware version  $\leq 2.99.99.R$  differ from those of inverters with a firmware version  $\geq 3.00.00.R$ .

Procedure	See
1. Commission the inverter.	Section 7.2, page 71
2. Establish a connection to the user interface of the inverter. The following connection options are available to choose from:	
• Direct connection via Wi-Fi	Section 8.1.1, page 107
• Direct connection via Ethernet	Section 8.1.3, page 109
• Connection via Ethernet in the local network	Section 8.1.4, page 110
3. Log into the user interface. The installation assistant opens automatically when logging into the user interface for the first time.	Section 8.2, page 110
4. Set the system-specific basic configuration. Note that the personal SMA Grid Guard code for changing the grid-relevant parameters must be available after completion of the first 10 operating hours (see "Application for SMA Grid Guard Code" at <a href="http://www.SMA-Solar.com">www.SMA-Solar.com</a> ).	Section 7.3, page 72

Procedure	See
5. Make individual parameter settings:	
• Set country data set.	Section 7.4, page 73
• Configure the thresholds for systems for increased self-consumption	Section 7.5, page 73
• Set parameters for battery management.	Section 7.6, page 74
• Set parameters for energy management.	Section 7.7, page 87
• Set parameters for generator management.	Section 7.8, page 93
• Set parameters for off-grid systems.	Section 7.9, page 102
• Set multifunction relay.	Section 7.10, page 104
6. Complete commissioning. 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 <a href="http://www.SMA-Solar.com">www.SMA-Solar.com</a> ).	Section 7.11, page 105
7. Start the system.	Section 9.2, page 121

## 7.2 Commissioning the Inverter

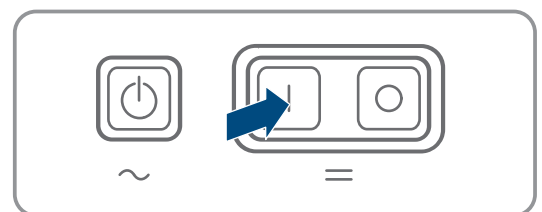
### ⚠ QUALIFIED PERSON

#### Requirements:

- All circuit breakers in the AC distribution board must be open.
- All Sunny Island inverters must be connected correctly (see Section 6.7, page 64).
- All inverters must be closed (see Section 6.8, page 68).
- All Sunny Island inverters must be switched off.
- The fuse switch-disconnector of the battery fuse must be closed (see Section 6.9, page 69).

#### Procedure:

1. Switching on the Sunny Island:



- For systems with one Sunny Island, press the "On" button.
  - For systems with three Sunny Island inverters, press and hold the "On" button on the master until an acoustic signal sounds.
  - For multicluster systems, press and hold the "On" button on each master until an acoustic signal sounds.
2. Establish a connection to the user interface of the inverter (see Section 8.1, page 107).

## 7.3 Performing Basic Configuration of the Installation Assistant

### **i** Standard configuration of single-cluster and multicluster systems

In single-cluster systems, the master captures all user input. The slaves wait in standby mode for the start command from the master.

In multicluster systems, the master of the main cluster captures all user input and sends it to the master of the extension clusters. The masters of the extension clusters wait in standby mode for the start command from the master of the main cluster.

Once you have logged into the user interface as **Installer**, the installation assistant opens.

#### Layout of the installation assistant

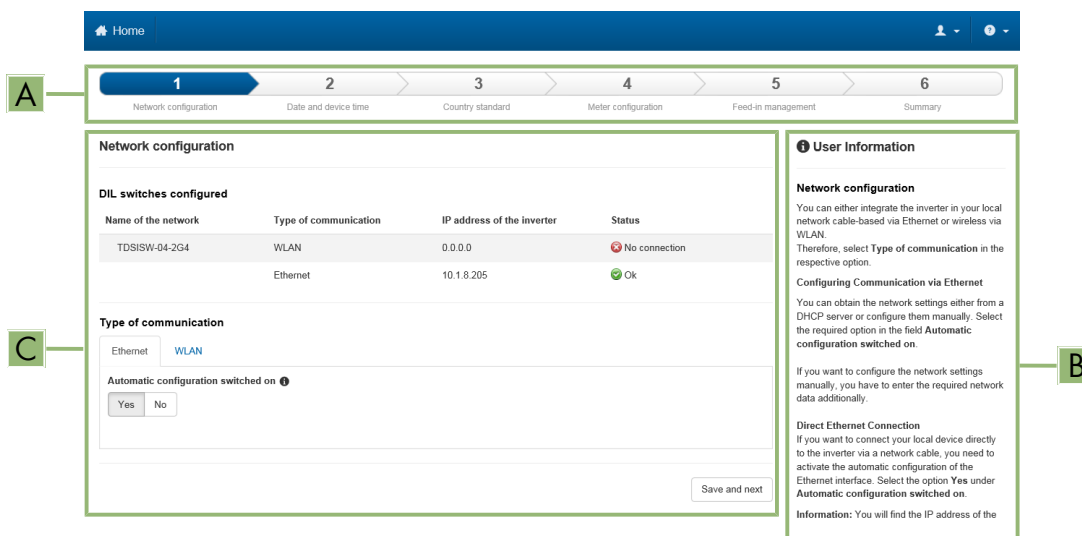


Figure 16: Layout of the installation assistant (example)

Position	Designation	Description
A	Configuration steps	Overview of the installation assistant steps. The number of steps depends on the type of device and the additionally installed modules. The current step is highlighted in blue.
B	User information	Information about the current configuration step and the setting options of the configuration step.
C	Configuration field	You can make settings in this field.

#### Procedure:

1. Select the configuration option **Configuration with Installation Assistant**.
  - The installation assistant will open.
2. Follow the installation assistant steps and make the settings appropriate for your system.
3. For every setting made in a step, select **[Save and next]**.
  - In the last step, all made settings are listed in a summary.
4. To save the settings to a file, select **[Export a summary]** and save the file on your computer, tablet PC or smartphone.



5. To correct settings you made, select [**Back**], navigate to the desired step, correct settings and select [**Save and continue**].
  6. Once all settings are correct, select [**Next**] in the summary.
- The start page of the user interface opens.

## 7.4 Configuring the Country Data Set

### QUALIFIED PERSON

During configuration of a storage or battery-backup system the inverter is configured to a country data set valid for VDE-AR-N 4105:2018-11. You must adjust the country data set for the installation site.

#### The country data set must be set correctly.

If you select a country data set which is not valid for your country and purpose, it can cause a disturbance in the PV system and lead to problems with the grid operator. When selecting the country data set, you must always observe the locally applicable standards and directives as well as the properties of the PV system (e.g. PV system size, grid-connection point).

- If you are not sure which standards and directives are valid for your country or purpose, contact the grid operator.

#### Country data sets not included in firmware for all EU countries

The firmware of the inverter does not include country data sets for all EU countries. A generally valid country data set in accordance with EN 50549 is included instead. It can be used in EU countries for which no country data set is available. For individual EU countries, however, it may be temporarily necessary to make adjustments to the locally valid grid connection regulations via parameter settings. This is done on the basis of the country data set previously valid for the country in the firmware version  $\leq 2.99.99.R$ .

- It is decided how to proceed according to the locally valid regulations and the SMA manufacturer's declaration valid for the country of use. Set the generally valid country dataset according to EN 50549 with the firmware version  $\geq 3.00.00.R$  or select the previously valid country dataset with the firmware version  $\leq 2.99.99.R$ . Make the parameter settings according to the manufacturer's declaration.

#### Change to the names and units of grid parameters to comply with the grid-connection requirements in accordance with Regulation (EU) 2016/631 (valid from April 27, 2019)

To comply with the EU grid-connection requirements (valid from April 27, 2019) the names and units of grid parameters were changed. The change is valid from firmware version  $\geq 3.00.00.R$ . Names and units of grid parameters for inverters with firmware version  $\leq 2.99.99.R$  are not affected by this change and remain valid.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Procedure:

- In the parameter group **Grid monitoring > Grid monitoring** select the parameter **Set country standard** and set the required country data set.

## 7.5 Changing Thresholds for Systems for Increased Self-Consumption



Relevant for systems connected to the utility grid

### **i** Country data sets not included in firmware for all EU countries

The firmware of the inverter does not include country data sets for all EU countries. A generally valid country data set in accordance with EN 50549 is included instead. It can be used in EU countries for which no country data set is available. For individual EU countries, however, it may be temporarily necessary to make adjustments to the locally valid grid connection regulations via parameter settings. This is done on the basis of the country data set previously valid for the country in the firmware version  $\leq 2.99.99.R$ .

- It is decided how to proceed according to the locally valid regulations and the SMA manufacturer's declaration valid for the country of use. Set the generally valid country dataset according to EN 50549 with the firmware version  $\geq 3.00.00.R$  or select the previously valid country dataset with the firmware version  $\leq 2.99.99.R$ . Make the parameter settings according to the manufacturer's declaration.

#### Procedure:

- If the Sunny Island may be operated on the utility grid and a change is necessary, change the configuration of the Sunny Island in accordance with the system description of the selected Sunny Island system (see [www.SMA-Solar.com](http://www.SMA-Solar.com)).

## 7.6 "Battery Management"

### 7.6.1 Safety When Setting the Battery Management Parameters

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.

#### NOTICE

##### Damage to the battery due to incorrect settings

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

- Set the correct battery type as well as the correct values for nominal voltage and battery capacity when configuring.
- 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).

### 7.6.2 Adjusting the Battery Management to the Battery

#### **⚠ QUALIFIED PERSON**

You will find further information on battery management and the charging processes of the Sunny Island for lead-acid batteries in the technical information "Battery Management" at [www.SMA-Solar.com](http://www.SMA-Solar.com).

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Procedure:

1. Select **Battery > Charge**.
2. Set the parameter **Maximum charging current** to the maximum battery charging current recommended by the battery manufacturer.
3. Set the parameters for boost charge.
  - Set the parameter **Battery boost charge time** to the boost charge absorption time recommended by the battery manufacturer.
  - Set the parameter **Cell charge nominal voltage for boost charge** to the cell voltage setpoint recommended by the battery manufacturer for boost charge.

4. Set the parameters for full charge.
  - Set the parameter **Battery full charge time** to the full charge absorption time recommended by the battery manufacturer.
  - Set the parameter **Cycle time full charge** to the full charge cycle time recommended by the battery manufacturer.
  - Set the parameter **Cell charge nominal voltage for full charging** to the cell voltage setpoint recommended by the battery manufacturer for full charge.
5. Set the parameters for equalization charge.
  - Set the parameter **Battery equalization charge time** to the equalization charge absorption time recommended by the battery manufacturer.
  - Set the parameter **Cycle time equalization charge** to the equalization charge cycle time recommended by the battery manufacturer.
  - Set the parameter **Cell charge nominal voltage for equalization charge** to the cell voltage setpoint recommended by the battery manufacturer for equalization charge.

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

#### **QUALIFIED PERSON**



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.

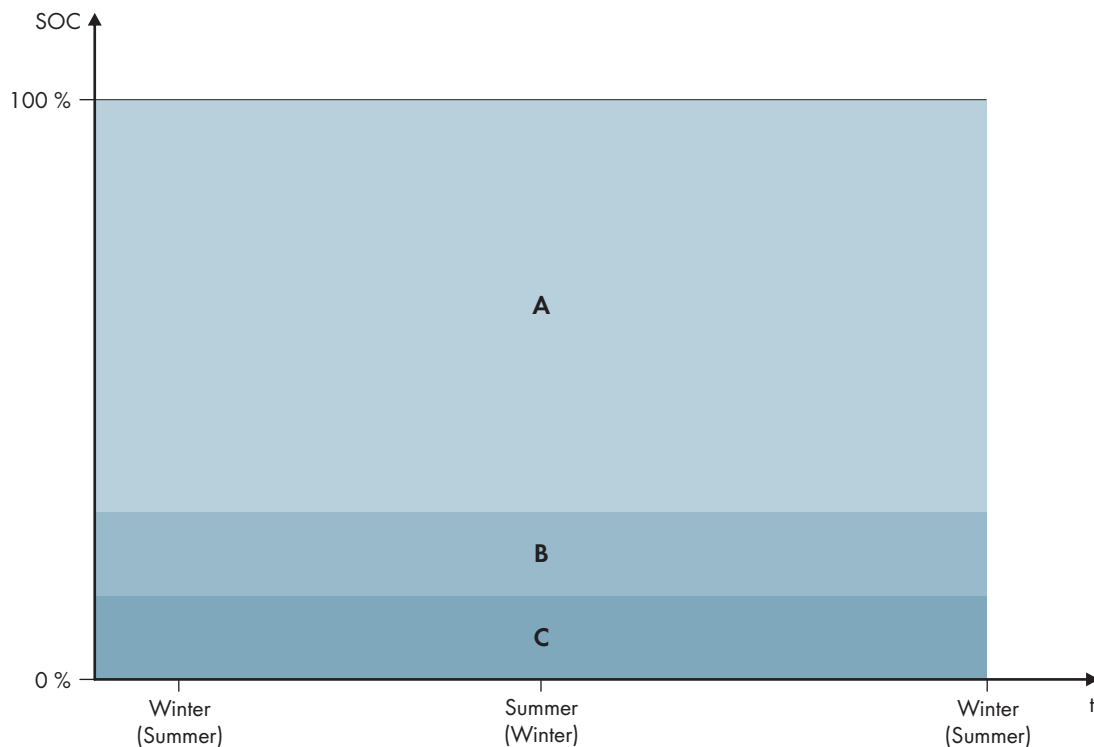


Figure 17: State of charge ranges of the battery according to the time of year (example)

Range	Explanation of the range and parameters	Behavior of the Sunny Island inverter
A	<p><b>Backup power area (BuRes)</b></p> <p>Battery &gt; Areas of application &gt; Minimum width of backup power area</p>	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.
B	<p><b>Deep discharge protection area (BatRes)</b></p> <p>This range can only be reached when the utility grid fails.</p> <p>Battery &gt; Areas of application &gt; Minimum width of deep discharge protection area</p>	<p>The Sunny Island is switching to energy-saving 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 energy-saving mode.</p> <p>When the utility grid is available again, the battery is charged by the Sunny Island with nominal power from the utility grid.</p>
C	<p><b>Deep discharge area (ProtRes)</b></p> <p>This range can only be reached when the utility grid fails.</p> <p>Battery &gt; Areas of application &gt; Lower lmt deep disch. protect area prior shutdown</p>	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
<b>Backup power area</b>	15% to 100%	13% to 100%

Range	Lead-acid battery	Lithium-ion battery
Deep discharge protection area	10% to 15%	3% to 13%
Deep discharge area	0% to 10%	0% to 3%

### **i** Procedure for multicluster systems with battery-backup grid

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

- In a multicluster system with battery-backup grid and increased self-consumption, set the ranges of battery state of charge for each cluster to the same values.
- In a multicluster system with battery-backup grid and without increased self-consumption, always set the **Internal consumption increase switched on** parameter to **No**.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Procedure:

1. Select **Battery > Areas of application**.
2. Set the following parameters for increased self-consumption:

Parameter	Value
Rise in self-consumption switched on	Yes
Lower lmt deep disch. protect area prior shut-down	Range for protection during deep discharge as a percentage of the battery capacity
Minimum width of deep discharge protection area	Range for protection against deep discharge as a percentage of the battery capacity
Minimum width of backup power area	Range for battery-backup function If all ranges combined do not amount to 100%, the <b>BuRes</b> range will be increased automatically.
Season operation active	No

## 7.6.4 Battery Usage through Systems for Increased Self-Consumption

### 7.6.4.1 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. Furthermore, you can set a seasonal adjustment (**Battery > Areas of application > Season operation active**). 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.

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

##### **QUALIFIED PERSON**



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. This results in the seasonal progression of the ranges.

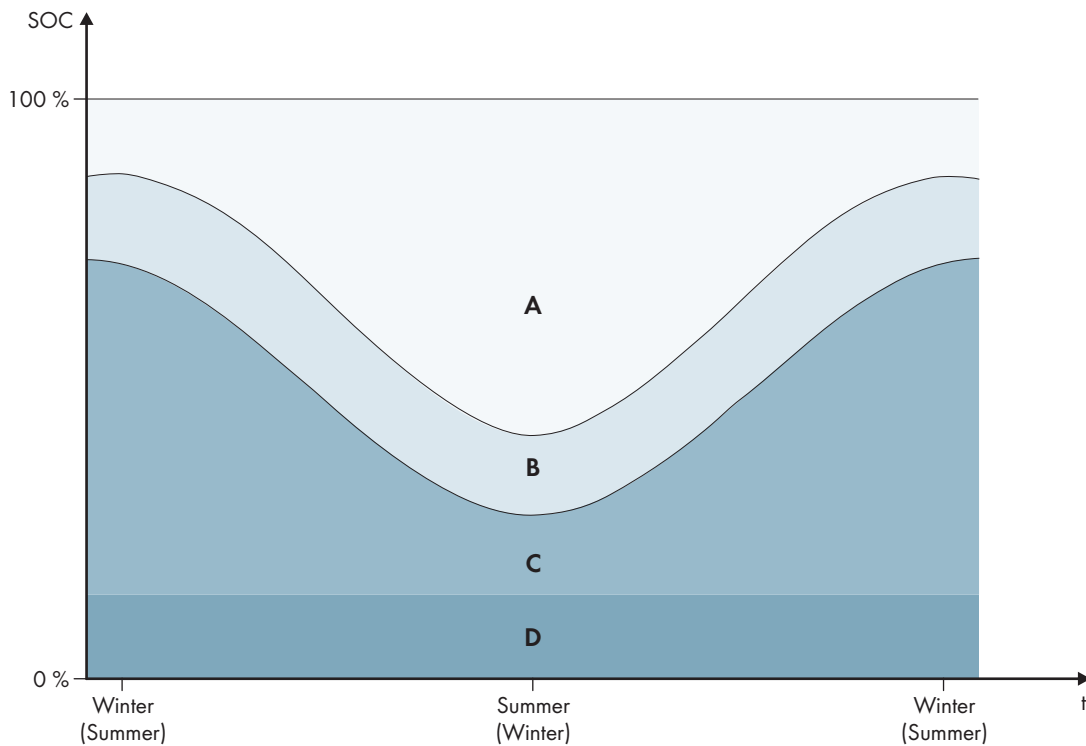


Figure 18: State of charge ranges of the battery according to the time of year (example)

Range	Explanation of the range and parameters	Behavior of the Sunny Island inverter
A	<p><b>Self-consumption area (SlfCsmP)</b></p> <p>The <b>SlfCsmP</b> range applies to the shortest day of the year with seasonal adjustment (see Section 7.6.4.1, page 77). When seasonal adjustment is deactivated, only the <b>SlfCsmP</b> range is used and the <b>BatRes</b> range increased accordingly.</p> <p><b>Battery &gt; Areas of application &gt; Minimum width of backup power area</b></p>	<p>The Sunny Island uses the battery for increased self-consumption.</p>
B	<p><b>State of charge conservation area (PVRes)</b></p> <p>The range size is constant year-round.</p> <p><b>Battery &gt; Areas of application &gt; Area width for conserving battery state of charge</b></p>	<p>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 <b>BatRes</b> range limit, the Sunny Island charges the battery up to half of the <b>PVRes</b> 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.</p>

Range	Explanation of the range and parameters	Behavior of the Sunny Island inverter
C	<p><b>Deep discharge protection area (BatRes)</b></p> <p>This range can only be reached when the utility grid fails. The <b>BatRes</b> range applies to the longest day of the year with seasonal adjustment (see Section 7.6.4.1, page 77). If seasonal adjustment is deactivated, the <b>BatRes</b> range is increased accordingly.</p> <p><b>Battery &gt; Areas of application &gt; Minimum width of deep discharge protection area</b></p>	If a utility grid is available, the Sunny Island charges the battery using nominal power from the utility grid.
D	<p><b>Deep discharge area (ProtRes)</b></p> <p>This range can only be reached when the utility grid fails.</p> <p><b>Battery &gt; Areas of application &gt; Lower lmt deep disch. protect area prior shutdown</b></p>	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	
	Shortest day*	Longest day**	Shortest day*	Longest day**
<b>Self-consumption area</b>	65% to 100%	45% to 100%	30% to 100%	10% to 100%
<b>State of charge conservation area</b>	60% to 65%	40% to 45%	25% to 30%	5% to 10%
<b>Deep discharge protection area</b>	10% to 60%	10% to 40%	3% to 25%	3% to 5%
<b>Deep discharge area</b>	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
<b>Self-consumption area</b>	65% to 100%	30% to 100%
<b>State of charge conservation area</b>	60% to 65%	25% to 30%
<b>Deep discharge protection area</b>	10% to 60%	3% to 25%
<b>Deep discharge area</b>	0% to 10%	0% to 3%

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Requirements:

- The system is not a battery backup system




**Procedure:**

1. Select **Device > Device > Self-consumption**.
2. Set the parameter **Rise in self-consumption switched on** to **Yes**.
3. Select **Battery > Areas of application >**.
4. Set the following parameters for the battery usage:

Parameter	Value
<b>Lower lmt deep disch. protect area prior shut-down</b>	Range for protection during deep discharge as a percentage of the battery capacity
<b>Minimum width of deep discharge protection area</b>	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.
<b>Area width for conserving battery state of charge</b>	Range for maintaining the state of charge of the battery as a percentage of the battery capacity
<b>Minimum width of own consumption area</b>	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.
<b>Highest-yielding month for battery utilization range:</b>	<b>June profitable</b> for northern hemisphere*  <b>December profitable</b> for southern hemisphere**
<b>Season operation active</b>	<b>No</b> for no seasonal adjustment  or <b>Yes</b> for seasonal adjustment

\* Set the value to **June profitable** when June is the month with the highest yield.

\*\* Set the value to **December profitable** when December is the month with the highest yield.

5.  **If the values for the battery usage ranges are incorrect, no adjustment is possible**  
If all battery usage ranges combined exceed 100%, the parameters for battery usage cannot be set.
  - Ensure that all battery usage ranges combined result in the value 100%.

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

#### **QUALIFIED PERSON**



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 battery-backup function (BURes)

You specify the percentage of the battery capacity that is to be used for the battery-backup 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. This results in the seasonal progression of the ranges.

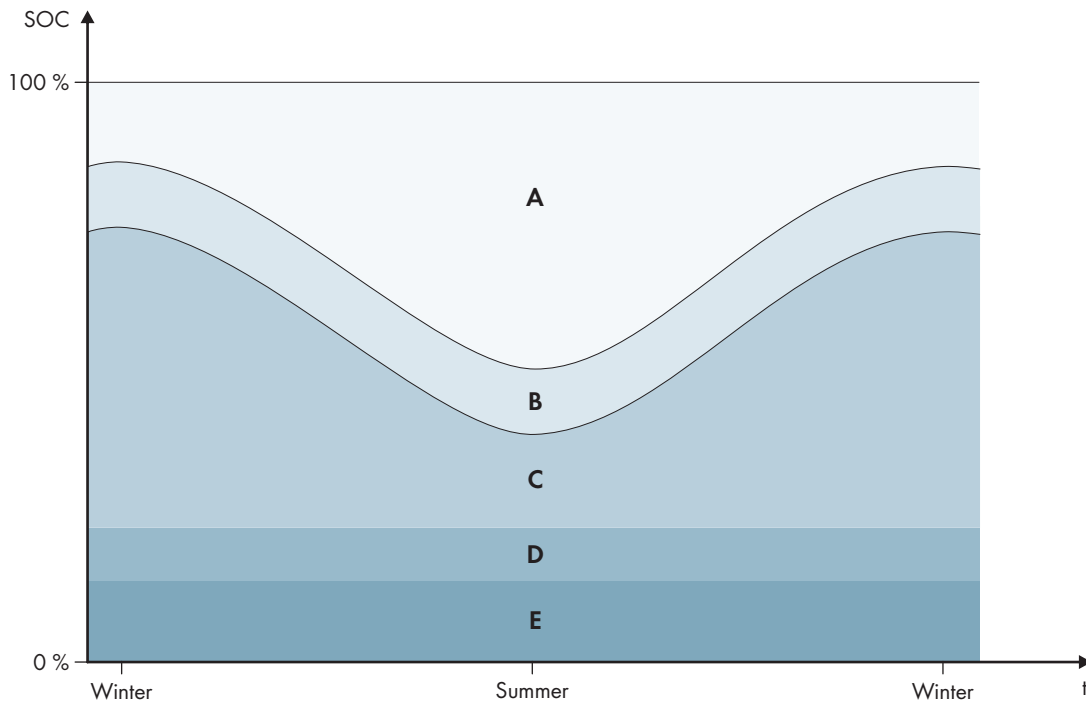


Figure 19: Ranges of the battery state of charge as a function of the season for the northern hemisphere (example)

Range	Explanation of the range and parameters	Behavior of the Sunny Island inverter
A	<p><b>Self-consumption area (SlfCsmP)</b></p> <p>The <b>SlfCsmP</b> range applies to the shortest day of the year with seasonal adjustment (see Section 7.6.4.1, page 77). When seasonal adjustment is deactivated, only the <b>SlfCsmP</b> range is used and the <b>BURes</b> range increased accordingly.</p>	The Sunny Island uses the battery for increased self-consumption.
	<p><b>Battery &gt; Areas of application &gt; Minimum width of backup power area</b></p>	

Range	Explanation of the range and parameters	Behavior of the Sunny Island inverter
B	<p><b>State of charge conservation area (PVRes)</b> The range size is constant year-round.</p> <hr/> <p><b>Battery &gt; Areas of application &gt; Area width for conserving battery state of charge</b></p>	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.
C	<p><b>Backup power area (BuRes)</b> The <b>BURes</b> range applies to the longest day of the year with seasonal adjustment (see Section 7.6.4.1, page 77). When seasonal adjustment is deactivated, only the minimum range is used and the <b>SIfCsmP</b> range increased accordingly.</p> <hr/> <p><b>Minimum width of backup power area</b></p>	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.
D	<p><b>Deep discharge protection area (BatRes)</b> Range for protection against deep discharge This range can only be reached when the utility grid fails.</p> <hr/> <p><b>Battery &gt; Areas of application &gt; Minimum width of deep discharge protection area</b></p>	<p>The Sunny Island is switching to energy-saving 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 energy-saving mode.</p> <p>When the utility grid is available, the Sunny Island charges the battery with nominal power from the utility grid.</p>
E	<p><b>Deep discharge area (ProtRes)</b> This range can only be reached when the utility grid fails.</p> <hr/> <p><b>Battery &gt; Areas of application &gt; Lower lmt deep disch. protect area prior shutdown</b></p>	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**
Self-consumption area	65% to 100%	45% to 100%	30% to 100%	28% to 100%
State of charge conservation area	60% to 65%	40% to 45%	25% to 30%	23% to 28%
Backup power area	15% to 60%	15% to 40%	13% to 25%	13% to 23%
Deep discharge protection area	10% to 15%	10% to 15%	3% to 13%	3% to 13%

Range	Lead-acid battery		Lithium-ion battery	
	Shortest day*	Longest day**	Shortest day*	Longest day**
<b>Deep discharge area</b>	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
<b>Self-consumption area</b>	65% to 100%	30% to 100%
<b>State of charge conservation area</b>	60% to 65%	25% to 30%
<b>Backup power area</b>	15% to 60%	13% to 25%
<b>Deep discharge protection area</b>	10% to 15%	3% to 13%
<b>Deep discharge area</b>	0% to 10%	0% to 3%

### **i** Procedure for multicluster systems with battery-backup grid

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

- In a multicluster system with battery-backup grid and increased self-consumption, set the ranges of battery state of charge for each cluster to the same values.
- In a multicluster system with battery-backup grid and without increased self-consumption, always set the **Internal consumption increase switched on** parameter to **No**.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### **Procedure:**


1. Select **Device > Device > Self-consumption**.
2. Set the parameter **Rise in self-consumption switched on** to **Yes**.
3. Select **Battery > Areas of application >**.
4. Set the following parameters for the battery usage:

Parameter	Value
<b>Lower lmt deep disch. protect area prior shut-down</b>	-
<b>Minimum width of deep discharge protection area</b>	Range for protection against deep discharge as a percentage of the battery capacity

Parameter	Value
<b>Minimum width of backup power area</b>	Range for the battery-backup 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.
<b>Area width for conserving battery state of charge</b>	Range for maintaining the state of charge of the battery as a percentage of the battery capacity
<b>Minimum width of own consumption area</b>	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.
<b>Highest-yielding month for battery utilization range:</b>	<b>June profitable</b> for northern hemisphere*  <b>December profitable</b> for southern hemisphere**
<b>Highest-yielding month for battery utilization range:</b>	<b>No</b> for no seasonal adjustment or <b>Yes</b> for seasonal adjustment

\* Set the value to **June profitable** when June is the month with the highest yield.

\*\* Set the value to **December profitable** when December is the month with the highest yield.

5.  **If the values for the battery usage ranges are incorrect, no adjustment is possible**  
If all battery usage ranges combined exceed 100%, the parameters for battery usage cannot be set.
- Ensure that all battery usage ranges combined result in the value 100%.

### 7.6.5 Changing the Battery Protection Mode in Off-Grid Systems

#### **QUALIFIED PERSON**

#### **Relevant for off-grid systems**

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### **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 energy-saving 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 8.12.2 "Setting Time-Dependent Functions", page 120).

- Level 1

If the state of charge falls below the threshold for level 1, the Sunny Island switches to energy-saving mode 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 energy-saving mode. 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 energy-saving mode.

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 energy-saving 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 the energy-saving 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 energy-saving mode between the start time and end time.

If the state of charge falls below the threshold for level 2, the Sunny Island switches to energy-saving mode between the start time and end time. The Sunny Island attempts to charge the battery in the remaining time.

### Procedure:

1. Select **Battery > Protection mode**.
2. Set the parameter **Start time of battery protection mode** to the desired start times for level 1 and 2.
3. Set the parameter **End time of battery protection mode** to the desired end times for level 1 and 2.
4. Set the parameter **Battery state of charge for protection mode** to the desired SOC threshold for level 1, 2 and 3.

## 7.6.6 Configuring the Resistance of the Battery Cable

### ⚠ QUALIFIED PERSON

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

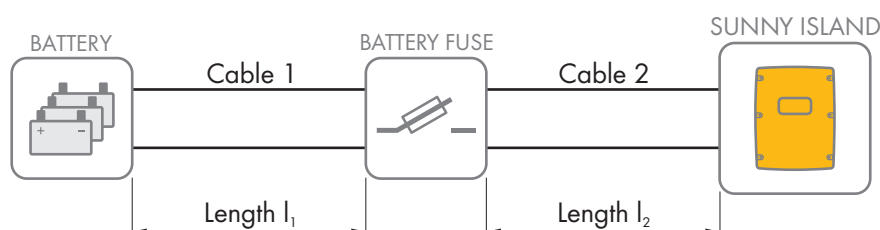


Figure 20: Designation of the cable

The resistance of the battery cable is the sum of the resistance of cable 1, the battery fuse and the resistance of cable 2.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

**Procedure:**

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

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

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

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

$A$  = conductor cross-section in  $\text{mm}^2$

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

$R_{\text{BatRes}} = R_{\text{cable 1}} + R_{\text{battery fuse}} + R_{\text{cable 2}}$

$R_{\text{BatRes}}$  = total resistance of the battery cable

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

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

$R_{\text{battery fuse}}$  = total resistance of the battery fuse (see manufacturer documentation)

3. Select **Battery > Battery**.
4. Select the parameter **Line resistance of battery connection** and set this to the resistance of the battery cable.

## 7.6.7 Setting the Control of the Battery Room Fan

### QUALIFIED PERSON

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

**Procedure:**

1. Select **Device > Multifunction relay**.
2. Set the parameter **Temp lmt for multifunct. relay with batt comp fan** 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 **Battery compartment fan** or **Battery fan in Multicluster** (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).
4. Ensure that the battery room is sufficiently ventilated in the case of malfunctions – for example, on failure of the multifunction relay.

## 7.7 Energy management

### 7.7.1 Setting Load Shedding in a Multicluster System

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### 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.

**Procedure:**

1. Select **Device > Load shedding 1**.
2. Set the parameter **Limit of battery state of charge for start** to the lower SOC threshold.
3. Set the parameter **Limit of battery state of charge for stop** to the upper SOC threshold. The upper SOC threshold must be at least 10 percentage points above the lower SOC threshold.
4. Select **Device > Load shedding 1 > Additional time range >**.
5. Set the parameter **Time load shedding 1** and the parameter **Start time additional time range load shedding 1** each to the same value, e.g. to **00:00:00**. This will switch the time-dependent load shedding off.
6. If the off-grid system is a multicluster system, ensure that the parameter of the multifunction relay is set to **Load shedding in Multicluster** (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).

**7.7.2 Setting One-Level Load Shedding**

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

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.

**Procedure:**

1. Select **Device > Load shedding 1 > Additional time range**.
2. Set the parameter **Lmt value battery state of charge for start load shedding 1** to the lower SOC threshold.
3. Set the parameter **Lmt value battery state of charge for stop load shedding 1** 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** and the parameter **Start time additional time range load shedding 1** 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 **1-stage load shedding or 1st stage with 2-stage load shedding** (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).
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 **1-stage load shedding** (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).
  - 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 **Load shedding in Multicluster** (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).



### 7.7.3 Setting Two-Level Load Shedding

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

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.

#### Procedure:

1. Setting the First Level of Load Shedding:
  - Select **Device > Load shedding 1 > Additional time range**.
  - Set the parameter **Lmt value battery state of charge for start load shedding 1** to the lower SOC threshold.
  - Set the parameter **Lmt value battery state of charge for stop load shedding 1** to the upper SOC threshold.
  - Set the parameter **Time load shedding 1** and the parameter **Start time additional time range load shedding 1** 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 **1-stage load shedding or 1st stage with 2-stage load shedding** (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).
2. Setting the second level of load shedding:
  - Select **Device > Load shedding 2**.
  - Set the parameter **Lmt value battery state of charge for start load shedding 2** to the lower SOC threshold.
  - Set the parameter **Limit battery state of charge for stop load shedding 2 in add time range** to the upper SOC threshold.
  - Select **Device > Load shedding 2 > Additional time range**.
  - Set the parameter **Time load shedding 2** and the parameter **Start time additional time range load shedding 2** 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 **1st stage with 2-stage load shedding** (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).

## 7.7.4 Setting Time-Dependent One-Level Load Shedding

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

The time-dependent load shedding divides the day into two intervals (see Section 8.12.2 "Setting Time-Dependent Functions", page 120). 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.



**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.**

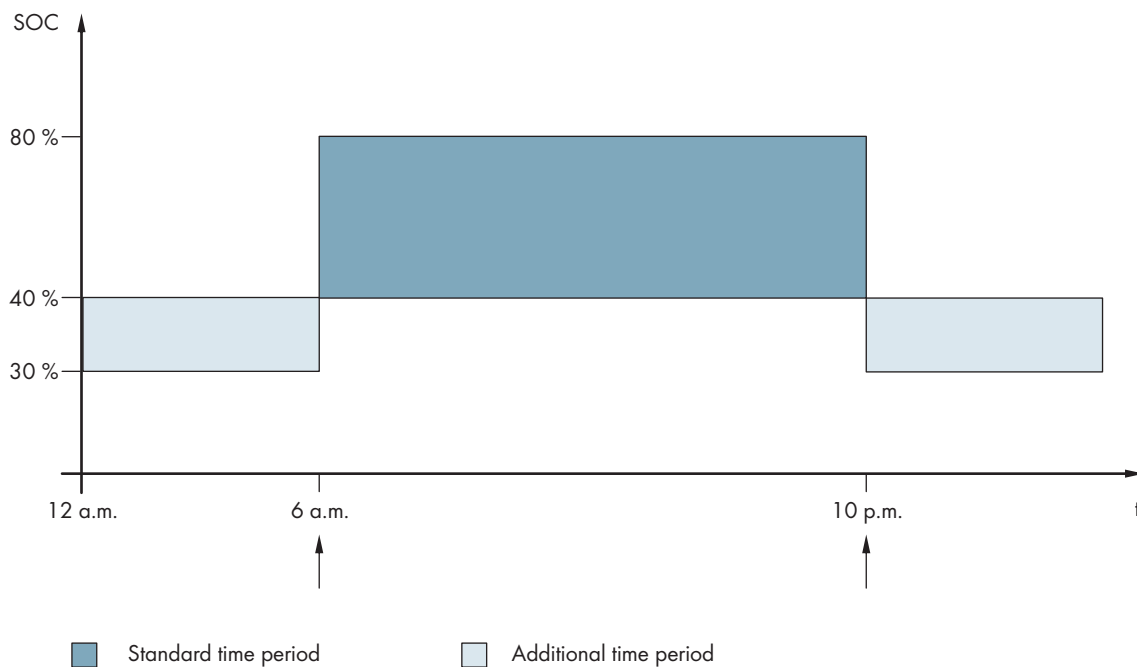


Figure 21: Profile of the SOC thresholds for controlling the load-shedding contactor and the start times for the intervals

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.

### Procedure:

1. Select **Device > Load shedding 1 > Additional time range**.
2. Set the parameters for the standard time period:
  - Set the parameter **Time load shedding 1** to the start time for the standard time period.
  - Set the parameter **Lmt value battery state of charge for start load shedding 1** to the lower SOC threshold for the standard time period.
  - Set the parameter **Lmt value battery state of charge for stop load shedding 1** to the upper SOC threshold for the standard time period.
3. Set the parameters for the additional time period:

- Set the parameter **Start time additional time range load shedding 1** to the start time for the additional time period.
  - Set the parameter **Limit battery state of charge for start load shedding 1 in add time range** to the lower SOC threshold for the additional time period.
  - Set the parameter **Limit battery state of charge for stop load shedding 1 in add time range** to the upper SOC threshold for the additional time period.
4. Ensure that the parameter of the multifunction relay is set to **1-stage load shedding or 1st stage with 2-stage load shedding** (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).

### 7.7.5 Setting Time-Dependent Two-Level Load Shedding

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

The time-dependent load shedding divides the day into two intervals (see Section 8.12.2 "Setting Time-Dependent Functions", page 120). 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.

#### Procedure:

1. Select **Device > Load shedding 1 > Additional time range**.
2. Set the parameter **Time load shedding 1** to the start time for the first interval.
3. Set the parameter **Start time additional time range load shedding 1** to the start time for the second interval.
4. Set the SOC threshold for the standard time period:
  - Select **Device > Load shedding 1**.
  - Set the parameter **Lmt value battery state of charge for start load shedding 1** to the lower SOC threshold for the first level of load shedding.
  - Set the parameter **Lmt value battery state of charge for stop load shedding 1** to the upper SOC threshold for the first level of load shedding.
  - Select **Device > Load shedding 2**.
  - Set the parameter **Lmt value battery state of charge for start load shedding 2** to the lower SOC threshold for the second level of load shedding.
  - Set the parameter **Limit battery state of charge for stop load shedding 2 in add time range** to the upper SOC threshold for the second level of load shedding.

5. Set the SOC threshold for the additional time period:
  - Select **Device > Load shedding 1**.
  - Set the parameter **Limit battery state of charge for start load shedding 1 in add time range** to the lower SOC threshold for the first level of load shedding.
  - Set the parameter **Limit battery state of charge for stop load shedding 1 in add time range** to the upper SOC threshold for the first level of load shedding.
  - Select **Device > Load shedding 2**.
  - Set the parameter **Limit battery state of charge for start load shedding 2 in add time range** to the lower SOC threshold for the second level of load shedding.
  - Set the parameter **Limit battery state of charge for stop load shedding 2 in add time range** 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 **1-stage load shedding or 1st stage with 2-stage load shedding** (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).
7. Ensure that the multifunction relay used for controlling the second level of load shedding is set to **1st stage with 2-stage load shedding**.

## 7.7.6 Setting Utilization of Excess Energy in Off-Grid Systems



### Relevant for off-grid systems

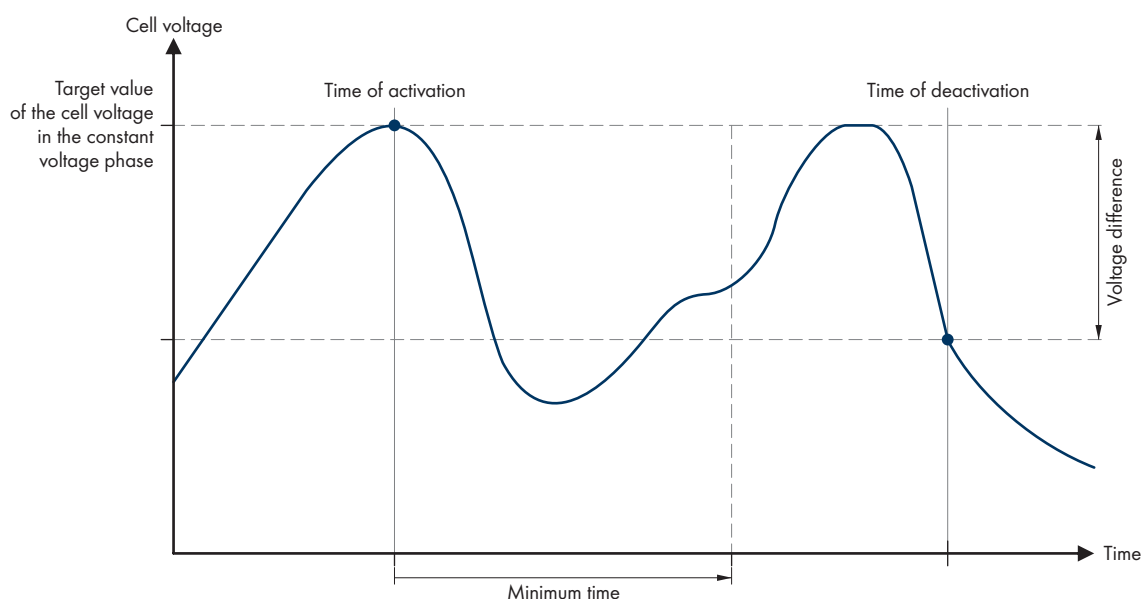


Figure 22: Switching-on time and switching-off time for utilization of excess energy during constant voltage phase


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 specified (**Minimum time for the use of excess energy**). If the cell voltage differs by more than a specified value (**Voltage difference for the use of excess energy**) from the setpoint of the cell voltage after the minimum time, the multifunction relay is deactivated. The setpoint of the cell voltage depends on the charging process during the constant voltage phase.

Charging Process	Parameters	Default value
Boost charge	<b>Battery &gt; Charge &gt; Cell charge nominal voltage for boost charge</b>	2.40 V

Charging Process	Parameters	Default value
Full charge	<b>Battery &gt; Charge &gt; Cell charge nominal voltage for full charging</b>	2.45 V
Equalization charge	<b>Battery &gt; Charge &gt; Cell charge nominal voltage for equalization charge</b>	2.45 V

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Procedure:

1. Set the parameter **Minimum time for the use of excess energy** to the minimum time that the multifunction relay remains activated.
2. Set the parameter **Voltage difference for the use of excess energy** to the voltage difference relative to the setpoint of the cell voltage during the constant voltage phase.
3.  **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.
4. Ensure that the multifunction relay used for control is set to **Control of add. loads** (see Section 7.10.2 "Setting the Functions of the Multifunction Relays", page 105).

## 7.8 Generator Management

### 7.8.1 Configuration of the Thresholds for Generator Connection

#### 7.8.1.1 Changing the Current Thresholds for the Generator

#### **QUALIFIED PERSON**

#### **Relevant for off-grid systems**

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### 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. Select **Generator > Generator**.
2. Set the parameter **Rated generator current** to the desired value. Tip: A suitable value for the **Rated generator current** is 80% of the maximum generator current per line conductor.

### 7.8.1.2 Changing the Voltage Thresholds for the Generator

#### QUALIFIED PERSON

#### 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.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Procedure:

1. Select **Generator > Generator > Voltage monitoring**.
2. Set the parameter **Voltage monit. gener. lower minimum threshold** to the minimum generator voltage.
3. Set the parameter **Voltage monit. gener. upper maximum threshold** to the maximum generator voltage.

### 7.8.1.3 Changing the Frequency Thresholds of the Generator Voltage

#### QUALIFIED PERSON

#### 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.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Procedure:

1. Select **Generator > Generator**.
2. Set the parameter **Generator nominal frequency** to the rated frequency of the generator voltage.
3. Select **Generator > Generator > Frequency monitoring**.
4. Set the parameter **Frequency monit. generator lower minimum threshold** to the minimum frequency of the generator voltage.
5. Set the parameter **Frequency monit. generator without max. threshold** to the maximum frequency of the generator voltage.

### 7.8.1.4 Changing the Permitted Reverse Power in the Generator

#### QUALIFIED PERSON

#### 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.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Procedure:

1. Select **Generator > Generator > Power monitoring**.
2. Set the parameter **Voltage monitoring generator maximum reverse power** to the active power of the generator reverse power.
3. Set the parameter **Volt. monit. gener. max. reverse power trip. time** to the time of the generator reverse power.

### 7.8.1.5 Configuring the Current Limit for the Generator Depending on the Frequency

#### ⚠ QUALIFIED PERSON



#### 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.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Requirement:

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

#### Procedure:

1. Select **Generator > Generator**.
2. Set the parameter **Rated generator current** to the desired value. Tip: A suitable value for the parameter **Rated generator current** is 80% of the maximum generator current per line conductor.
3. Select **Generator > Operation**.
4. Set the parameter **Limitation type of generator current** to **Frequency-dependent current limitation**. This will activate the frequency-dependent current limiting.

## 7.8.2 Changing the Type of the Generator Interface

### QUALIFIED PERSON

#### 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.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Procedure:

1. Select **Generator > Generator**.
2. If the generator has an autostart function, set the parameter **Generator request** to **Automatic**.
3. If the generator does not have an autostart function, set the parameter **Generator request** to **Manual control**.

## 7.8.3 Configuring Generator Run Times

### 7.8.3.1 Changing the Warm-Up Time for the Generator

#### Relevant for off-grid systems

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### 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 system 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. Select **Generator > Operation**.
2. Set the parameter **Warm-up time of generator** in accordance with the generator properties.

Generator properties		Setting Parameters
Without internal warm-up time		<ul style="list-style-type: none"> <li>• Set the desired warm-up time.</li> </ul>
With internal warm-up time	Autostart compatible	<ul style="list-style-type: none"> <li>• Set the warm-up time to be at least half the internal warm-up time of the generator.</li> </ul>
	Without an autostart function	

- The generator start is not terminated prematurely.

### 7.8.3.2 Changing the Minimum Run Time for the Generator

#### Relevant for off-grid systems

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).



1. Select **Generator > Operation**.
2. Set the parameter **Average operating time of generator** to the desired value.

### 7.8.3.3 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.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Procedure:

1. Select **Generator > Operation**.
2. Set the parameter **Cooling down time of generator** to the desired value.

### 7.8.3.4 Changing the Minimum Stop Time for the Generator

 Relevant for off-grid systems

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Procedure:

1. Select **Generator > Operation**.
2. Set the parameter **Average idle period of generator** to the desired value.

## 7.8.4 Configuring the Generator Request

### 7.8.4.1 Changing the Automatic Generator Operation

#### QUALIFIED PERSON

 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.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Procedure:

1. Select **Generator > Generator**.
2. To deactivate automatic generator mode, set the parameter **Automatic generator start** to **Disable**.
3. To activate automatic generator mode, set the parameter **Automatic generator start** to **Enable**.

### 7.8.4.2 Changing a State-Of-Charge-Dependent Generator Request

#### QUALIFIED PERSON

 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.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

**Procedure:**

1. Select **Generator > Generator queries state of charge**.
2. Set the parameter **Generator startup battery state of charge limit** to the lower SOC threshold.
3. Set the parameter **Generator shutdown battery state of charge limit** to the upper SOC threshold.
4. Select **Generator > Generator queries state of charge > Additional time range**.
5. Set the parameter **End time range for generator request** and **Start time range for generator request** each to the same value, e.g., to **00:00:00**. This deactivates the time-dependent generator request.

### 7.8.4.3 Setting a Time-Dependent Generator Request

#### **QUALIFIED PERSON**

#### **Relevant for off-grid systems**

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

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 8.12.2 "Setting Time-Dependent Functions", page 120). 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.



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

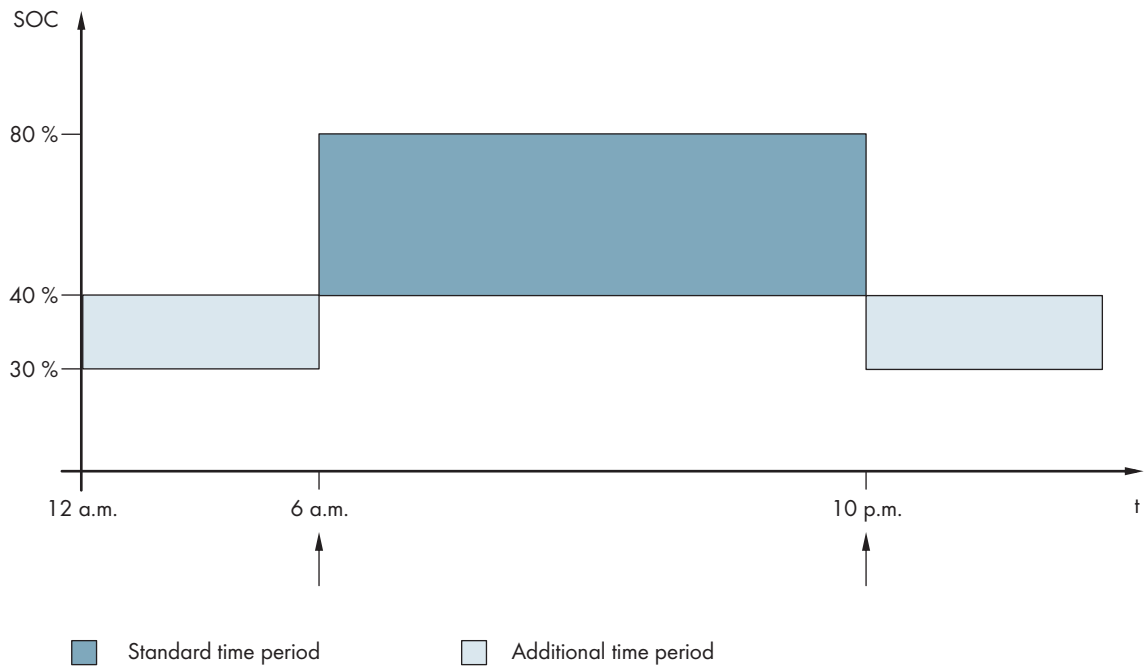


Figure 23: Profile of the SOC and the times for generator requests

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. Set the start times for the standard time period and the additional time period:
  - Select **Generator > Generator queries state of charge > Additional time range**.
  - Set the parameter **End time range for generator request** to the start time for the standard time period.
  - Set the parameter **Start time range for generator request** to the start time for the additional time period.
2. Set the switch-on limits (lower SOC thresholds) for the standard time period and the additional time period:
  - Select **Generator > Generator queries state of charge > Additional time range > Switch-on limit in time range**.
  - Set the parameter **Generator startup battery state of charge limit** to the lower SOC threshold during the standard time period.
  - Set the parameter **Limit battery state of charge generator start in add time range** to the lower SOC threshold during the additional time period.
3. Set the switch-off limits (upper SOC thresholds) for the standard time period and the additional time period:
  - Select **Generator > Generator queries state of charge > Switch-off limit in time range**.
  - Set the parameter **Generator shutdown battery state of charge limit** to the upper SOC threshold during the standard time period.
  - Set the parameter **Limit battery state of charge generator stop in add time range** to the upper SOC threshold during the additional time period.

#### 7.8.4.4 Configuring the Load-Dependent Generator Request

##### QUALIFIED PERSON

##### Relevant for off-grid systems

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

##### 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 across the averaging time. The longer the averaging time set, the less the generator management reacts to load peaks (parameter: **Generator > Time-controlled generator operation > Average time for generator request via power**).

##### 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. Select **Generator > Generator request via power**.
2. Set the parameter **Generator request via power on** to **Enable**. This will activate the load-dependent generator request.
3. Set the parameter **Generator startup load limit** to the switch-on power limit.
4. Set the parameter **Generator shutdown load limit** to the switch-off power limit.
5. Select **Generator > Time-controlled generator operation**.
6. Set the parameter **Average time for generator request via power** to the averaging time with which the generator management calculates the average power.

#### 7.8.4.5 Time-Controlled Generator Requesting

##### QUALIFIED PERSON

##### 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 8.1.2.3 "Setting Time-Controlled Functions", page 120).

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

**Procedure:**

1. Select **Generator > Time-controlled generator operation**.
2. Set the parameter **Time-controlled generator operation** to **Enable**.
3. Set the parameter **Start time for time-controlled generator op.** to the desired start time of the generator with date and time.
4. Set the parameter **Operating time for time-controlled generator op.** to the desired operating time.
5. Set the parameter **Repeat cycle of time-controlled generator op.** to the desired repetition cycle:

Value	Explanation
Once	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.

#### 7.8.4.6 Changing the Generator Request via the Charging Process of the Battery

##### **QUALIFIED PERSON**

##### **Relevant for off-grid systems**

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

**Procedure:**

1. Select **Generator > Generator request via charge type**.
2. Set the parameter **Generator request with set charge type** to the desired generator request:

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

#### 7.8.4.7 Setting an External Generator Request

##### **QUALIFIED PERSON**

##### **Relevant for off-grid systems**

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

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

**Procedure:**

1. Select **Generator > Generator request via digital input**.

2. In order to activate the external generator request, set the parameter **Reaction to digital input of generator request** to **Enable**.
3. In order to deactivate the external generator request, set the parameter **Reaction to digital input of generator request** to **Disable**.

### 7.8.5 Configuring the Procedure in the Event of a Generator False Start

#### **QUALIFIED PERSON**

#### **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. The Sunny Island attempts to restart the generator upon expiry of the **Idle period after generator fault**.

##### **Single cluster systems:**

The generator management classifies 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:**

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

1. Select **Generator > Generator**.
2. Select the parameter **Automatic generator start**.
3. Activate the automatic generator start and set the desired number of start attempts.
4. In order to change the idle time of the generator after the maximum number of start attempts has been exceeded, select **Generator > Operation** and set the parameter **Idle period after generator fault** to the desired stop time.

## 7.9 Off-Grid System

### 7.9.1 Commissioning the Battery Current Sensor in Off-Grid Systems

#### **QUALIFIED PERSON**

#### **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.

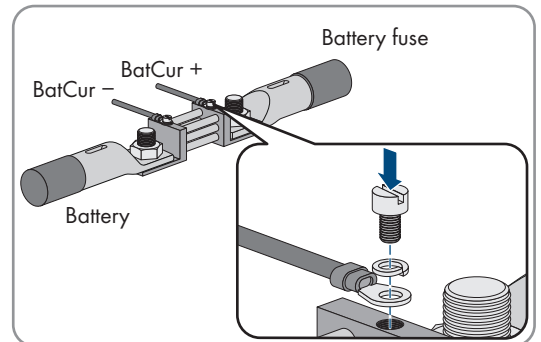
The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

**Procedure:**

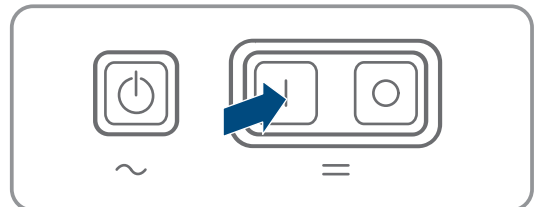
1. Switch off the Sunny Island and open the battery fuse load-break switch quickly.



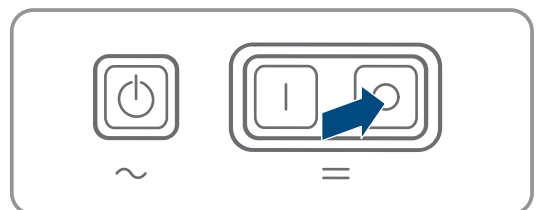
2. Short-circuit the measuring cable at the battery current sensor. To do so, connect the **BatCur-** and **BatCur+** insulated measuring conductors to the connection for **BatCur+**.



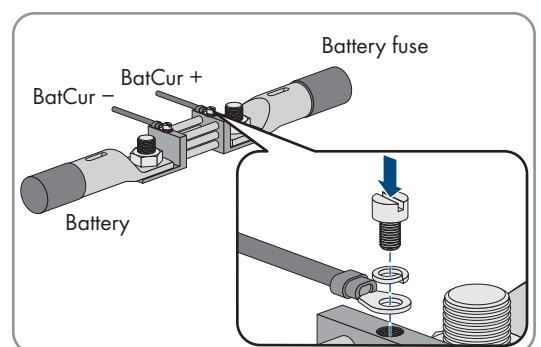
3. Close the battery fuse load-break switch quickly and switch on the Sunny Island.



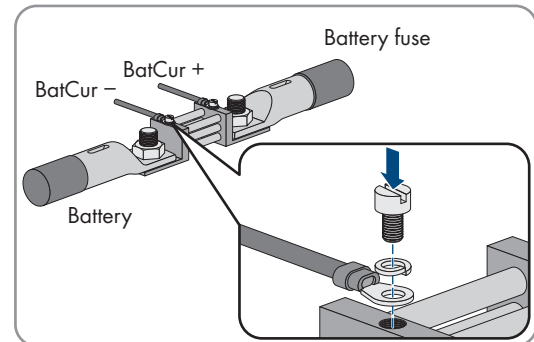
4. Set the parameter **Current sensor type (60mV, 50mV)** to the type and amplification factor of the battery current sensor used.
5. Select the parameter **Autocalibration of the external battery current sensor** and set to **On**.
  - The Sunny Island starts the adjustment.
6. After 10 seconds, select the parameter **Battery > Battery > Current > Battery current** and read off the value.
7. If the value of the parameter is not between 0 A and 1 A, perform the following steps:
  - Check whether the measuring conductors are correctly connected and whether the battery current sensor is short-circuited.
  - Repeat steps 4 to 6.
8. If the value of the parameter is between 0 A and 1 A, switch off the Sunny Island and open the battery fuse load-break switch quickly.



9. Connect the **BatCur+** insulated measuring conductor on the side for connecting the battery fuse.



10. Connect the **BatCur-** insulated measuring conductor on the side for connecting the battery.



11. Close the battery fuse load-break switch quickly and switch on the inverter.

## 7.9.2 Changing the Automatic Frequency Synchronization in Off-Grid Systems

### ⚠ QUALIFIED PERSON

#### 🔌 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.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Procedure:

1. Select **AC Side > Operation**.
2. To deactivate automatic frequency synchronization, set the parameter **Automatic frequency control** to **Disable**.
3. To activate automatic frequency synchronization, set the parameter **Automatic frequency control** to **Enable**.

## 7.10 Multifunction Relay

### 7.10.1 Setting the Time Control

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

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Procedure:

1. Select **Device > Multifunction relay > Timer**.
2. Select the parameter **Start date of relay control for timer** and set the desired start times.
  - Start time for timer 1, date
  - Start time for timer 1, time
  - Start time for timer 2, date
  - Start time for timer 2, time
3. Select the parameter **Duration for which multifunction relay is activated for timer** and set the desired running times:
  - Running time for timer 1



- Running time for timer 2
4. Select the parameter **Repeat cycle time of relay control for timer** and set the desired cycle times:
    - Repetition cycle time for timer 1
    - Repetition cycle time for timer 2

## 7.10.2 Setting the Functions of the Multifunction Relays

### QUALIFIED PERSON

The multifunction relays of the master are preset in a single-cluster system for increased self-consumption and cannot be changed. In multicenter systems with Multicenter-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. Furthermore, free multifunctional relays can be used for additional functions.

Note the function of the multifunction relays in the following table during the electrical connection (see Section 6.5 "Connecting the Components", page 35).

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

Parameter	Multifunction relay	Value	Function/output
Operating mode of the multifunction relay	<b>Relay 1</b> of Sunny Island inverter/master		
	<b>Relay 2</b> of Sunny Island inverter/master		
Slave 1: Operating mode of multifunction relay	<b>Relay 1</b> of Slave 1		
	<b>Relay 2</b> of Slave 1		
Slave 2: Operating mode of multifunction relay	<b>Relay 1</b> of Slave 2		
	<b>Relay 2</b> of Slave 2		

#### Procedure:

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

1. Select the display group **Device > Multifunction relay > Operating mode**.
2. Set the parameter for the multifunction relay functions as shown in the table above.

## 7.11 Complete Commissioning.

### QUALIFIED PERSON

#### 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 will be displayed on the Sunny Island user interface.

#### Procedure:

1. Make sure that the wiring is correct (see Section 6.7, page 64).
2. Ensure that all system-specific preparations for commissioning have been implemented correctly ( see system description Sunny Island system used).

3. Connect the circuit breakers and fuse switch-disconnectors for the 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. Start the Sunny Island system (see Section 9.2, page 121).
6. With off-grid systems only, when full charge is complete, switch on all circuit breakers and load-break switches.
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](http://www.SMA-Solar.com)).

## 8 Operation

### 8.1 Establishing a connection to the user interface

#### 8.1.1 Establishing a direct connection via WLAN

You have several options to connect the product to an end device. The procedure can be different depending on the end devices. If the procedures described do not apply to your end device, establish the direct connection via Wi-Fi as described in the manual of your end device.

The following connection options are available:

- Connection to SMA 360° App
- Connection with WPS
- Connection with Wi-Fi network search

#### Requirements:

- The product must be commissioned.
- An end device (e.g. computer, tablet PC or smartphone) must be available.
- The respective latest version of one of the following web browsers must be installed: Chrome, Edge, Firefox or Safari.
- JavaScript must be enabled in the web browser of the end device.
- The personal SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten operating hours or of the installation assistant (see "Application for SMA Grid Guard Code" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

#### **i** SSID, IP address and WLAN password

- SSID in WLAN: **SMA[serial number]** (e.g. SMA0123456789)
- Device-specific WLAN password: see WPA2-PSK on the type label of the product or the rear side of the manual included in delivery
- Standard access address for a direct connection via WLAN outside of a local network: **<http://smalogin.net>** or **192.168.12.3**

#### **i** Importing and exporting files with end devices having an iOS operating system is not possible.

For technical reasons, importing and exporting files (e.g., importing an inverter configuration, saving the current inverter configuration or exporting events and parameters) is not possible with mobile end devices having an iOS operating system.

- Use an end device that does not have an iOS operating system for importing and exporting files.

#### Connection to SMA 360° App

- An end device with camera must be available.
  - The SMA 360° App must be installed on the end device.
  - An user account for Sunny Portal must already exist.
1. Open the SMA 360° App and login with dem Sunny Portal account details.
  2. Select **QR-Code Scan** in the menu.

3. Scan the QR Code on your product via the SMA 360° App.
  - The end device automatically connects to the product. The web browser of your end device opens and the login page of the user interface is displayed.
4. If the web browser of your end device does not open automatically and the login page of the user interface is not displayed, open the web browser and enter **http://smalogs.net** in the address bar.

## Connection with WPS

### Requirements:

- The end device must have a WPS function.

### Procedure:

1. Enable the WPS function on the inverter. To do this, tap on the enclosure lid of the inverter twice.
  - A signal sounds for one second followed by a one second break. After this break the signal sounds again for one second.
2. Enable the WPS function on your end device.
  - The end device automatically connects to the product. The web browser of your end device opens and the login page of the user interface is displayed.
3. If the web browser of your end device does not open automatically and the login page of the user interface is not displayed, open the web browser and enter **http://smalogs.net** in the address bar.

## Connection with Wi-Fi network search

1. Search for Wi-Fi networks with your end device.
2. Select the SSID of the product **SMA[serial number]** in the list with the detected Wi-Fi networks.
3. Enter the device-specific Wi-Fi password (see WPA2-PSK on the type label of the product or the rear side of the manual included in delivery).
4. Open the web browser of your end device and enter **http://smalogs.net** in the address bar.
  - The login page of the user interface is displayed.
5. If the login page of the user interface does not open, enter the IP address **192.168.12.3** or, if your end device supports mDNS services, **SMA[serial number].local** or **http://SMA[serial number]** in the address bar of the web browser.

## 8.1.2 Establishing a Connection via WLAN in the Local Network

### **i** New IP address for connecting with a local network

If the product is connected to a local network (e.g. via a router), the product will receive a new IP address. Depending on the type of configuration, the new IP address will be assigned automatically by the DHCP server (router) or manually by you. Upon completion of the configuration, the product can only be reached via the following access addresses:

- Generally applicable access address: IP address manually assigned or assigned by the DHCP server (router) (identification via network scanner software or network configuration of the router).
- Access address for Apple and Linux systems: **SMA[serial number].local** (e.g. SMA0123456789.local)
- Access address for Windows and Android systems: **http://SMA[serial number]** (e.g., http://SMA0123456789)

### **i** Connection via Wi-Fi exclusively for temporary access to the user interface

A permanent connection of the product with Sunny Portal via Wi-Fi is not possible for technical reasons.

- Use the connection via Wi-Fi exclusively for temporary access to the user interface (e.g. for setting of parameters).

**Requirements:**

- The product must be commissioned.
- The product must be integrated into the local network. Tip: There are various methods of integrating the product into the local network with the aid of the installation assistant.
- An end device (e.g. computer, tablet PC or smartphone) must be available.
- The end device must be in the same local network as the product.
- The respective latest version of one of the following web browsers must be installed: Chrome, Edge, Firefox or Safari.
- The personal SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten operating hours or of the installation assistant (see "Application for SMA Grid Guard Code" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

**i Importing and exporting files with end devices having an iOS operating system is not possible.**

For technical reasons, importing and exporting files (e.g., importing an inverter configuration, saving the current inverter configuration or exporting events and parameters) is not possible with mobile end devices having an iOS operating system.

- Use an end device that does not have an iOS operating system for importing and exporting files.

**Procedure:**

- Enter the IP address of the product in the address bar of the web browser.
  - The login page of the user interface opens.

### 8.1.3 Establishing a Direct Connection via Ethernet

**Requirements:**

- The product must be commissioned.
- An end device (e.g. computer) with an Ethernet interface must be available.
- The product must be connected directly to the end device.
- The respective latest version of one of the following web browsers must be installed: Chrome, Edge, Firefox or Safari.
- The personal SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten operating hours or of the installation assistant (see "Application for SMA Grid Guard Code" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

**i IP address of the inverter**

- Standard inverter IP address for the direct connection via Ethernet: **169.254.12.3**

**Procedure:**

1. Open the web browser of your end device, enter the IP address **169.254.12.3** in the address bar and press the enter key.
2. **i Web browser signals a security vulnerability**

After the IP address has been entered, a message might appear indicating that the connection to the user interface of the product is not secure. SMA Solar Technology AG guarantees the security of the user interface.

  - Continue loading the user interface. The login page of the user interface opens.

## 8.1.4 Establishing a Connection via Ethernet in the local network

### **i** New IP address for connecting with a local network

If the product is connected to a local network (e.g. via a router), the product will receive a new IP address. Depending on the type of configuration, the new IP address will be assigned automatically by the DHCP server (router) or manually by you. Upon completion of the configuration, the product can only be reached via the following access addresses:

- Generally applicable access address: IP address manually assigned or assigned by the DHCP server (router) (identification via network scanner software or network configuration of the router).
- Access address for Apple and Linux systems: **SMA[serial number].local** (e.g. SMA0123456789.local)
- Access address for Windows and Android systems: **http://SMA[serial number]** (e.g., http://SMA0123456789)

#### Requirements:

- The product must be connected to the local network via a network cable (e.g. via a router).
- The product must be integrated into the local network. Tip: There are various methods of integrating the product into the local network with the aid of the installation assistant.
- An end device (e.g. computer, tablet PC or smartphone) must be available.
- The end device must be in the same local network as the product.
- The respective latest version of one of the following web browsers must be installed: Chrome, Edge, Firefox or Safari.
- The personal SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten operating hours or of the installation assistant (see "Application for SMA Grid Guard Code" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

#### Procedure:

1. Open the web browser of your end device. Enter the IP address of the product in the address bar of the web browser. Then press Enter key.
  2. **i** **Web browser signals a security vulnerability**  
After the IP address has been entered, a message might appear indicating that the connection to the user interface of the product is not secure. SMA Solar Technology AG guarantees the security of the user interface.
    - Continue loading the user interface.
- The login page of the user interface opens.

## 8.2 Logging In and Out of the User Interface

After a connection to the user interface of the inverter has been established, the login page opens. Log onto the user interface as described below.

### **i** Usage of cookies

For the correct display of the user interface, cookies are required. The cookies are used for convenience only. By using this user interface you agree to the placement of cookies.

## Log in as Installer or User for the First Time

### **i** Password assignment for user and installer

The passwords for the user groups **Installer** and **User** must be assigned when accessing the user interface for the first time. If the inverter was registered in a communication device (e.g., SMA Data Manager) and the system password was assigned, the system password is also the installer password. In this case, only the user password must be assigned.

- If you as a specialist assign the user password, only pass the password on to persons to access the inverter data via the user interface.
- If you as a user assign the installer password, only pass the password on to persons to receive access to the system.

### **i** Installer password for inverters registered in a communication device or in Sunny Portal

To be able to register the inverter in a communication device (e.g., SMA Data Manager) or in a Sunny Portal system, the password for the user group **Installer** must match the system password. If you assign a password for the user group **Installer** via the user interface of the inverter, the same password must also be used as the system password.

- Assign a uniform installer password to all SMA devices in the system.
1. In the drop-down list **Language**, select the desired language.
  2. In the **Password** field, enter a password for the **User** user group.
  3. In the **Repeat password** field, enter the password again.
  4. Click on **Save**.
  5. In the **New password** field, enter a password for the **Installer** user group. Assign a uniform password to all SMA devices to be registered in a system. The installer password is also the system password.
  6. In the **Repeat password** field, enter the password again.
  7. Click on **Save and log in**.
- The installation assistant or the home page of the user interface opens.

## Log in as the User or Installer

1. In the drop-down list **Language**, select the desired language.
  2. In the **User group** drop-down list, select the entry **Installer** or **User**.
  3. Enter the password in the field **Password**.
  4. Select **Login**.
- The start page of the user interface opens.

## Log Out as the User or Installer

1. On the right-hand side of the menu bar, select the menu **User Settings**.
  2. In the subsequent context menu, select **[Logout]**.
- The login page of the user interface opens. The logout was successful.

### 8.3 Start Page Design of the User Interface

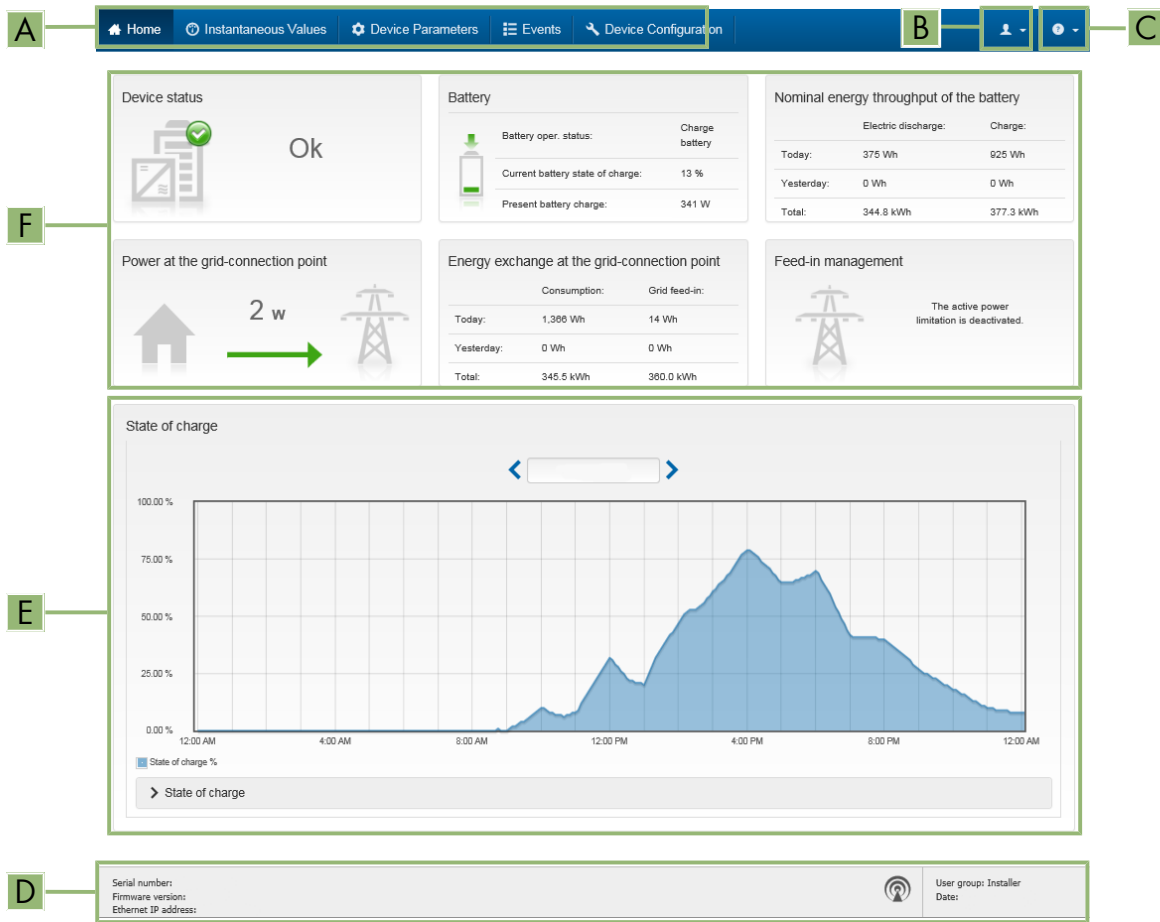


Figure 24: Design of the user interface's start page (example)



Position	Designation	Description
A	Menu	<p>Provides the following functions:</p> <ul style="list-style-type: none"> <li>• <b>Home</b> Opens the user interface homepage</li> <li>• <b>Instantaneous values</b> Current measured values of the inverter</li> <li>• <b>Device Parameters</b> The various operating parameters of the inverter can be viewed and configured here depending on the user group.</li> <li>• <b>Events</b> All events that have occurred in the selected time period are displayed here. The event types are <b>Information</b>, <b>Warning</b> and <b>Error</b>. Currently existing events of the types <b>Error</b> and <b>Warning</b> will be additionally displayed in the <b>Device status</b> viewlet. However, only the higher-priority event is displayed. If, for example, there is a Warning and an Error present at the same time, only the Error will be displayed.</li> <li>• <b>Device configuration</b> Various settings for the inverter can be made here. The selection available is dependent on which user group you are logged in as and the operating system of the device with which the user interface has been called up.</li> <li>• <b>Data</b> You will find all data that is saved in the internal memory of the inverter or on an external storage medium on this page.</li> </ul>
B	User settings	<p>Provides the following functions, depending on the user group logged in:</p> <ul style="list-style-type: none"> <li>• Starting the installation assistant</li> <li>• SMA Grid Guard login</li> <li>• Logout</li> </ul>
C	Help	<p>Provides the following functions:</p> <ul style="list-style-type: none"> <li>• Displaying information on Open Source licenses used</li> <li>• Link to the website of SMA Solar Technology AG</li> </ul>
D	Status bar	<p>Displays the following information:</p> <ul style="list-style-type: none"> <li>• Inverter serial number</li> <li>• Inverter firmware version</li> <li>• IP address of the inverter within the local network and/or IP address of the inverter during WLAN connection</li> <li>• With WLAN connection: Signal strength of WLAN connection</li> <li>• User group logged in</li> <li>• Date and device time of the inverter</li> </ul>

Position	Designation	Description
E	State of charge	Chronological sequence of the state of charge (SOC) of the battery
F	Status display	<p>The various areas display information on the current status of the system.</p> <ul style="list-style-type: none"> <li>• <b>Device status</b> Displays whether the inverter and/or the battery is/are currently in a fault-free operating state or whether there is an event type <b>Error</b> or <b>Warning</b> present.</li> <li>• <b>Feed-in management</b> Displays whether the inverter is currently limiting its active power.</li> <li>• <b>Nominal energy throughput of the battery</b> Indicates how much energy has been charged to the battery and how much has been discharged from the battery.</li> <li>• <b>Battery</b> Displays the following information: <ul style="list-style-type: none"> <li>- Operating status of battery</li> <li>- Current battery state of charge</li> <li>- Current battery charging power</li> </ul> </li> <li>• <b>Energy exchange at the grid-connection point</b> Indicates how much energy was obtained from the utility grid to supply the household and how much the PV system fed in.</li> <li>• <b>Power at the grid-connection point</b> Indicates which power is currently fed in or obtained at the grid-connection point.</li> <li>• <b>MC-status system</b> Status of the multicluster system</li> <li>• <b>MC system total power</b> Total active power of all Sunny Island inverters in the multicluster system</li> </ul>

## 8.4 Changing the Password

The password for the inverter can be changed for both user groups. Furthermore, the user group **Installer** can change the password for the user group **User** as well as its own password.

### **i** PV systems registered in a communication product

With PV systems that are registered in a communication product (e.g. Sunny Portal, Sunny Home Manager), you can also assign a new password for the user group **Installer** via the communication product. The password for the user group **Installer** is also the system password. If you assign a password for the user group **Installer** via the user interface of the inverter that does not correspond to the system password in the communication product, the inverter can no longer be reached by the communication product.

- Ensure that the password for the user group **Installer** is the same as the system password in the communication product.

**Procedure:**

1. Activate the user interface (see Section 8.1, page 107).
2. Log into the user interface (see Section 8.2, page 110).
3. Call up the menu **Device Parameters**.
4. Select [**Edit parameters**].
5. In the parameter group **User Rights > Access Control** change the password of the desired user group.
6. Select [**Save all**] to save the changes.

## 8.5 Starting the Installation Assistant

### ⚠ QUALIFIED PERSON

The installation assistant leads you step-by-step through the steps necessary for the initial configuration of the inverter.

#### Layout of the installation assistant

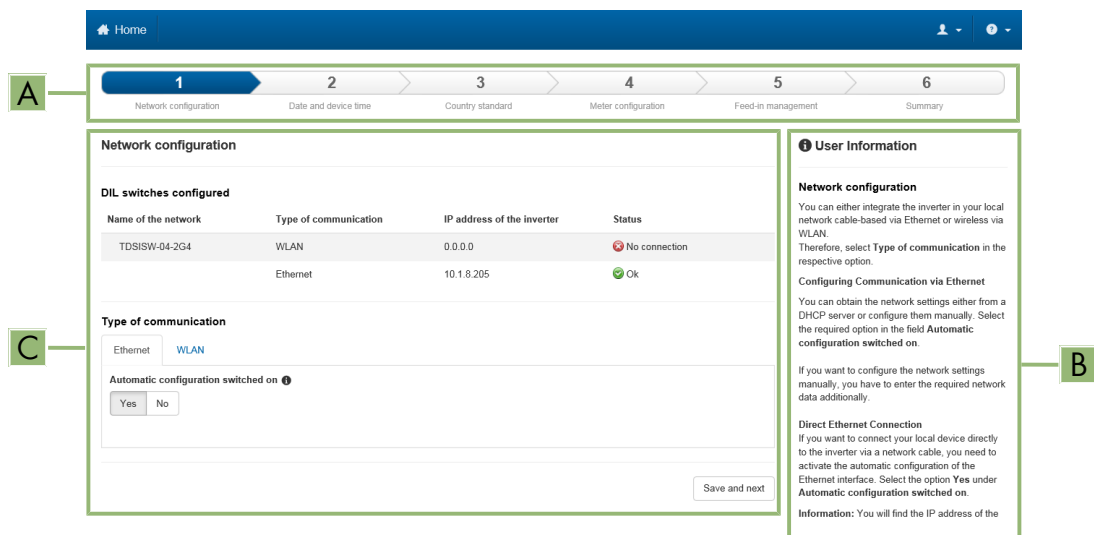


Figure 25: Layout of the installation assistant (example)

Position	Designation	Description
A	Configuration steps	Overview of the installation assistant steps. The number of steps depends on the type of device and the additionally installed modules. The current step is highlighted in blue.
B	User information	Information about the current configuration step and the setting options of the configuration step.
C	Configuration field	You can make settings in this field.

**Requirement:**

- The personal SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten operating hours or of the installation assistant (see "Application for SMA Grid Guard Code" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

**Procedure:**

1. Open the user interface (see Section 8.1, page 107).
2. Log in as **Installer**.

3. Select the menu **User Settings** (see Section 8.3, page 112) on the start page of the user interface.
  4. In the context menu, select [**Starting the installation assistant**].
- The installation assistant will open.

## 8.6 Changing Operating Parameters

The operating parameters of the inverter are set to certain values by default. You can change the operating parameters to optimize the performance of the inverter.

This section describes the basic procedure for changing operating parameters. Always change operating parameters as described in this section. Function-sensitive parameters are only visible to qualified persons and can only be changed upon logging in as Installer. These parameters are designated in the user interface with a locked padlock.

### NOTICE

#### Damage to the battery due to incorrect settings

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

- Set the correct battery type as well as the correct values for nominal voltage and battery capacity when configuring.
- 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).

#### **i** Parameter names and units depend on the inverter's firmware version.

The parameter names and units depend on the inverter's firmware version. Parameter names and units of inverters with a firmware version  $\leq 2.99.99.R$  differ from those of inverters with a firmware version  $\geq 3.00.00.R$ .

#### **i** Setting of parameters in single-cluster and multicluster systems

In single-cluster systems, the master captures all user input. The slaves follow the specifications of the master.

In multicluster systems, the master of the main cluster captures all user input and sends it to the master of the extension clusters. The slaves in all clusters follow the specifications of the respective master.

#### Requirements:

- The personal SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten operating hours or of the installation assistant (see "Application for SMA Grid Guard Code" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

#### Procedure:

1. Open the user interface (see Section 8.1, page 107).
  2. Log into the user interface (see Section 8.2, page 110).
  3. Call up the menu **Device parameters**.
  4. Click on [**Edit parameters**].
  5. Log in using the SMA Grid Guard code to change those parameters designated by a lock (only for installers):
    - Select the menu **User settings** (see Section 8.3, page 112).
    - In the subsequent context menu, select [**SMA Grid Guard login**].
    - Enter the SMA Grid Guard code and select [**Login**].
  6. Expand the parameter group that contains the parameter which is to be configured.
  7. Change the required parameters.
  8. Select [**Save all**] to save the changes.
- The inverter parameters are set.

## 8.7 Setting Time-Controlled Inverter Operation in Off-Grid Systems

Time-controlled inverter operation enables the regular supply of loads (e.g. electrical heating) during defined time periods (at weekends). In time-controlled inverter operation, the battery inverter only makes the stand-alone grid available during the set time period. For the remaining time, the battery inverter remains in standby mode.

1. Activate the user interface of the inverter (see Section 8.1, page 107).
  2. Log in as Installer (see Section 8.2, page 110).
  3. Select **Device > Operation > Time control**.
  4. Set time-controlled inverter operation:
    - Set the parameter **Start date for time-controlled inverter operation** to the desired start date.
    - Set the parameter **Start time for time-controlled inverter operation** to the desired start time.
    - Set the parameter **Operating time for time-controlled inverter op.** to the desired operating time.
    - Select the **Repetition cycle for time-controlled inverter operation / Repetition** parameter and set it to the desired repetition cycle.
  5. To activate time-controlled inverter operation, select the parameter **Time-controlled inverter operation** and set it **Yes**.
- Time-controlled inverter operation is active. If the battery inverter has started automatically under time-control and you stop the battery inverter, time-controlled inverter operation is deactivated automatically.

## 8.8 Activate WPS Function

- Activate the WPS function on the inverter. To do this, tap on the enclosure lid of the inverter twice.
  - A signal sounds for one second followed by a one second break. After this break the signal sounds again for one second.

The inverter deactivates the WPS function automatically. When this happens, a signal sounds: long signal (one second) > break (one second) > very long signal (three seconds).

## 8.9 Switching WLAN On and Off

The inverter is equipped with an activated WLAN interface as standard. If you do not want to use WLAN, you can switch the WLAN function off and switch it on again whenever needed. In doing so, you can switch the WLAN direct connection and the WLAN connection in the local network on independently of each other.

### **i** Switching on the WLAN function only possible via Ethernet connection

If you switch off both the WLAN function for the direct connection and for the connection in the local network, access to the inverter user interface and therefore reactivation of the WLAN interface is only possible via an Ethernet connection.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

### Switching WLAN Off

If you would like to switch the WLAN function off completely, you must switch off both the direct connection and the connection in the local network.

#### Procedure:

- To switch off the direct connection in the parameter group **PV system communication > WLAN**, select the parameter **Soft-access-point is turned on** and set this to **No**.
- To switch off the connection in the local network in the parameter group **PV system communication > WLAN**, select the parameter **WLAN is turned on** and set this to **No**.

## Switching WLAN On

If you have switched the WLAN function for direct connection or for connection in the local network off, you can switch the WLAN function back on in accordance with the following procedure.

### Requirement:

- If the WLAN function was previously switched off completely, the inverter must be connected to a computer or router via Ethernet.

### Procedure:

- To switch on the WLAN direct connection, in the parameter group **PV system communication > WLAN**, select the parameter **Soft-access-point is turned on** and set this to **Yes**.
- To switch on the WLAN connection in the local network, in the parameter group **System communication > WLAN**, select the parameter **WLAN is turned on** and set this to **Yes**.

## 8.10 Configuring the Energy Meter

You can add an energy meter to your PV system or replace an existing energy meter.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

### **i** Removing a detected energy meter from the PV system

If only one energy meter is detected by the inverter, this will be added to the PV system automatically. Removal via the menu **Device configuration** is not possible in this case. To remove the energy meter from the PV system, proceed as follows:

- In the parameter group **System communication > Measured values > Meter on Speedwire**, set the parameter **Serial number** to any number (e.g. **1**). In this way, instead of the energy meter detected, the PV system will add a fictitious energy meter to which the inverter cannot establish communication.

### Procedure:

1. Activate the user interface (see Section 8.1, page 107).
2. Log in as **Installer**.
3. Start the installation assistant (see Section 8.5, page 115).
4. In the context menu, select [**Starting the installation assistant**].
5. Select [**Save and next**] until you get to the step **Meter configuration**.
6. Add or replace the desired energy meter.

## 8.11 Configuring the Modbus Function

### **⚠ QUALIFIED PERSON**

The Modbus interface is deactivated by default and the communication ports 502 set.

In order to access SMA inverters with SMA Modbus®, the Modbus interface must be activated. After activating the interface, the communication ports of the IP protocol can be changed. For information on commissioning and configuration of the Modbus interface, see the technical information "SMA Modbus® Interface" at [www.SMA-Solar.com](http://www.SMA-Solar.com).

### **i** Measures for data security during activated Modbus interface

If you activate the Modbus interface, there is a risk that unauthorized users may access and manipulate the data or devices in your PV system.

To ensure data security, take appropriate protective measures such as:

- Set up a firewall.
- Close unnecessary network ports.
- Only enable remote access via VPN tunnel.
- Do not set up port forwarding at the communication port in use.
- In order to deactivate the Modbus interface, reset the inverter to the default settings or deactivate the activated parameter again.

### **i** Deactivate the dynamic active power limitation for the PV inverters when controlled via Modbus

If the PV inverters and the battery inverter are controlled in a PV system via Modbus, the dynamic active power limitation of the PV inverters must be deactivated.

#### Procedure:

- Activate the Modbus interface and adjust the communication ports if necessary (see the technical information "SMA Modbus® Interface" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

## 8.12 Supplementary Information

### 8.12.1 Determining the Battery Capacity

Manufacturers state the battery capacity depending on the discharge time. In the **installation assistant** and in parameter **Rated battery capacity**, always specify the battery capacity for a ten hour electric discharge (C10).

#### Procedure:

1. Determine the battery capacity C10 specified by the battery manufacturer.
2. If the battery capacity C10 is not specified, determine the battery capacity C1, C5, C20, C100 or C120 and use the following table to estimate the battery capacity C10. 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)	$C10 = C20 / 1.09$
5 h (C5)	$C10 = C5 / 0.88$
1 h (C1)	$C10 = C1 / 0.61$

3. After commissioning, contact the battery manufacturer as soon as possible, request the C10 battery capacity and set the correct battery capacity in the installation assistant. In this case, proceed as if you had replaced the battery (see Section 13.9, page 138).

### 8.12.2 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.

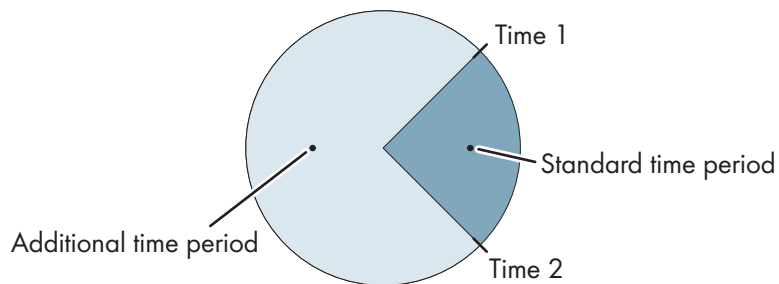


Figure 26: Division of the time of day into two time periods

### 8.12.3 Setting Time-Controlled Functions

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



#### 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: Yes** (activation of the function)
- **Start time for time-controlled generator op.:** 2015-01-05 (Monday)
- **Start time for time-controlled generator operation:** 07:00:00 (starting time)
- **Operating time for time-controlled generator op.:** 01:00:00 (duration)
- **Repeat cycle of time-controlled generator op.:** **Weekly** (repetition type)

### 8.13 Activating the Smart Inverter Screen

With the Smart Inverter Screen, the most important inverter data is displayed directly on the user interface login page. To activate the Smart Inverter Screen, proceed as listed in the following.

#### Procedure:

1. Activate the user interface (see Section 8.1, page 107).
  2. Log in as **Installer** or **User**.
  3. Select the menu **User Settings** (see Section 8.3, page 112) on the start page of the user interface.
  4. Select [**Smart Inverter Screen**].
- The Smart Inverter Screen has been activated.



## 9 Starting and Stopping the System

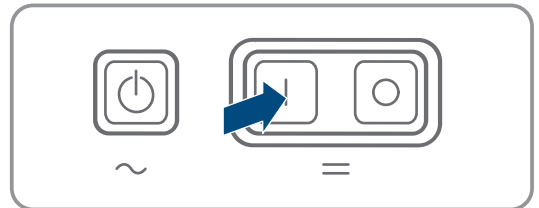
### 9.1 Switching on the System

#### Requirements:

- All inverters must be closed (see Section 6.8, page 68).
- The fuse switch-disconnector of the battery fuse must be closed (see Section 6.9, page 69).
- The battery inverter must not have switched itself off (see Section 13.7.2, page 135).

#### Procedure:

1. For systems with one Sunny Island, press the "On" button on the Sunny Island.



2. For systems with up to three Sunny Island inverters, press and hold the "On" button on the master until an acoustic signal sounds.
  3. For multicluster systems, press and hold the "On" button on each master until an acoustic signal sounds.
- The inverter LED on each Sunny Island inverter is glowing orange and the Sunny Island inverters are in standby mode.

### 9.2 Starting the System

#### **i** Start inverter via user interface

Starting the inverter via the user interface is an alternative to pressing the start-stop button.

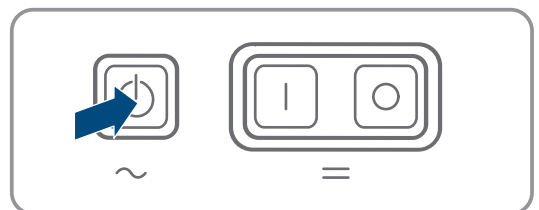
- To start the inverter via the user interface, set **Device parameters > Device > Operation > General operating mode** to **Start**.

#### Requirements:

- All Sunny Island inverters must be switched on.
- The circuit breakers for the AC sources in the stand-alone grid must be switched off in the AC distribution board.
- The load-break switch of the PV array must be open.

#### Procedure:

1. For systems with 1 Sunny Island, press the "start-stop" button on the Sunny Island until an acoustic signal sounds.



#### 2. **i** Start of a single-cluster system

When starting a single-cluster system, the slaves wait for the start command from the master.

- For systems with up to 3 Sunny Island inverters, press and hold the "start-stop" button on the master until an acoustic signal sounds.

### 3. **i** Starting a multicluster system

When starting a multicluster system, the extension cluster masters wait for the start command from the main cluster master.

- For multicluster systems, press and hold the "start-stop" button on the master of the main cluster until an acoustic signal sounds.

The inverter LED on each Sunny Island is glowing green. The Sunny Island inverters are in operation.

## 9.3 Stopping the System

If you stop the system, the Sunny Island switches from operation into standby mode. In standby mode, the Sunny Island discharges the battery due to its standby consumption. Tip: For longer shutdown periods, switch off the Sunny Island (see Section 9.4, page 122).

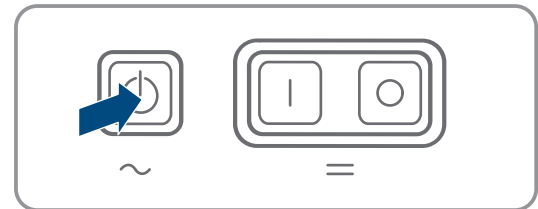
### **i** Stop via user interface

Stopping the inverter via the user interface is an alternative to pressing the start-stop button.

- To stop the inverter via the user interface, set **Device parameters > Device > Operation > General operating mode** to **Stop**.

#### Procedure:

1. For systems with 1 Sunny Island, press the "start-stop" button on the Sunny Island until an acoustic signal sounds.



2. **i** Stop of a single-cluster system

When stopping a single-cluster system, the slaves automatically follow the stop command of the master.

- For systems with up to 3 Sunny Island inverters, press and hold the "start-stop" button on the master until an acoustic signal sounds.

3. **i** Stop of a multicluster system

When a multicluster system is stopped, the extension cluster masters automatically follow the stop command from the main cluster master.

- For multicluster systems, press and hold the "start-stop" button on the master of the main cluster until an acoustic signal sounds.

The inverter LED on each Sunny Island is glowing orange. The Sunny Island inverters are in standby mode.

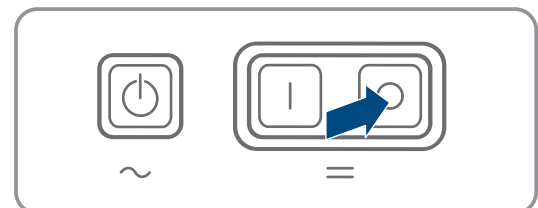
## 9.4 Switching off the System

#### Requirements:

- The system is stopped.

#### Procedure:

1. For systems with one Sunny Island, press and hold the "Off" button until an acoustic signal sounds.



2. For systems with up to three Sunny Island inverters, press and hold the "Off" button on the master until an acoustic signal sounds.
  3. For multicluster systems, press and hold the "Off" button on each master until an acoustic signal sounds.
- The inverter LED is off on all Sunny Island inverters.

## 9.5 Tripping the Emergency Disconnection of the System

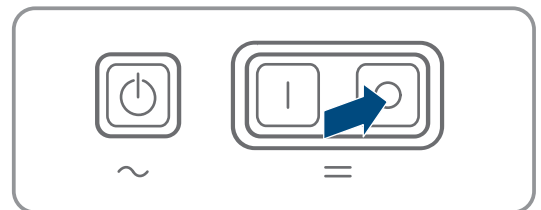
### **i** Effects of an emergency disconnection

Emergency disconnection triggers the uncontrolled shutdown of the system and unsaved data is lost.

- Only trip the emergency disconnection to avoid danger or consequential damage.
- In the event of an emergency disconnection in a multicluster system, always check whether any fuse elements in the Multicluster-Box, such as circuit breakers, have tripped. If any fuse elements have tripped, reactivate these fuse elements.

#### Procedure:

1. For systems with one Sunny Island, press the "Off" button on the Sunny Island.



2. For systems with up to three Sunny Island inverters, press the "Off" button on the master.
  3. For multicluster systems, press and hold the "Off" button on the master of the main cluster.
- The inverter LED is off on all Sunny Island inverters.

## 10 Data Storage and Firmware Update

### 10.1 Viewing Event Messages or Instantaneous Values

#### Data Storage

Event messages and instantaneous values are saved in the Sunny Island. This data can be evaluated and thus the operating processes in the Sunny Island system can be traced. From this, for example, parameter settings can be derived that will e.g. increase the self-consumption of PV energy or the service life of the battery. For SMA Service, this data simplifies the analysis of any errors present and the identification of possible solutions.

The storage capacity of the inverter can be extended with the optional micro SD card. Thus, for example, data can be recorded over longer time periods, enabling extended diagnostics possibilities to be used (see Section 16.14, page 185).

#### Procedure:

1. Activate the user interface of the individual inverter or the user interface of the master in a cluster (see Section 8.1 "Establishing a connection to the user interface", page 107).
2. Log in as **Installer** or **User**.
3. To call up event messages, select the menu **Events**.
4. To call up instantaneous values, select the menu **Data**.
5. Follow the instructions in the user interface.

### 10.2 Exporting Event Messages

With this function, you can save the events of your system to the computer as CSV files.

#### Procedure:

1. Activate the user interface of the individual inverter or the user interface of the master in a cluster (see Section 8.1 "Establishing a connection to the user interface", page 107).
2. Log in as **Installer** or **User**.
3. Select the menu **Events**.
4. To filter event messages, activate or deactivate the filters **Information** / **Warning** / **Error** as necessary.
5. Select the button **[Export events]**.
6. Follow the additional instructions in the user interface.

### 10.3 Exporting Service Files and Values

With this function, you can save measured values and service data of your system to the computer as CSV files.

#### Procedure:

1. Activate the user interface of the individual inverter or the user interface of the master in a cluster (see Section 8.1 "Establishing a connection to the user interface", page 107).
2. Log in as **Installer** or **User**.
3. Select the menu **Data**.
4. Select the desired measured values or the **Service files** from the drop-down list.
5. Select the button **[Export data]**.
6. Follow the additional instructions in the user interface.

### 10.4 Exporting Parameters

With this function, you can save the events of your system to the computer as HTML files.

**Procedure:**

1. Activate the user interface of the individual inverter or the user interface of the master in a cluster (see Section 8.1 "Establishing a connection to the user interface", page 107).
2. Log in as **Installer** or **User**.
3. Select the menu **Device Parameters**.
4. Select the button **[Parameter export]**.
5. Follow the additional instructions in the user interface.

## 10.5 Updating the Firmware

### **QUALIFIED PERSON**

If no automatic update is set in the communication product (e.g. SMA Data Manager or Sunny Home Manager) or in Sunny Portal, you have the option of carrying out a manual firmware update.

#### **Duration of firmware update**

For systems with 1 battery inverter, the firmware update takes about 15 minutes. For systems with 3 or more battery inverters, the firmware update takes about 30 minutes. Premature intervention via the user interface leads to the termination of the firmware update.

- After starting the firmware update, wait until the system-specific duration of the firmware update has expired.

#### **Firmware update for single-cluster and multicluster systems**

In each cluster, the master carries out the firmware update on the slaves. In a multicluster system, each master requires its own firmware update.

- In a single-cluster system, carry out the firmware update on the master.
- In a multicluster system, carry out the firmware update on each master in any order.

**Requirements:**

- An update file with the desired inverter firmware must be available. The update file is, for example, available for download on the product page of the inverter at [www.SMA-Solar.com](http://www.SMA-Solar.com). To download the update file, it is necessary to enter the serial number of the inverter.

**Procedure:**

1. Open the user interface (see Section 8.1, page 107).
2. Log into the user interface as an **Installer** (see Section 8.2, page 110).
3. Select the menu **Device Parameters**.
4. Click on **[Edit parameters]**.
5. Set **PV system communication > Device update > Operating mode** to **Automatic update**.
6. Select the menu **Device Configuration**.
7. In the inverter row, click on the gear icon and select **Update firmware**.
8. Select **[Browse]** and select the update file for the inverter.
9. Select **Update firmware**.
10. Follow the instructions in the dialog.
11. If the message **Connection to device lost** appears on the user interface, log on to the user interface again.
12. Call up the user interface of the inverter and check the events to see whether a firmware update has been successfully completed.

## 10.6 Saving the Configuration in a File

You can save the current configuration of the inverter in a file. When saving, only the device parameters will be saved, not any passwords. The saved file is coded with the serial number of this inverter and can only be used on this inverter. To configure the inverter, you can import the saved file.

### Procedure:

1. Activate the user interface (see Section 8.1, page 107).
2. Log into the user interface (see Section 8.2, page 110).
3. Select the menu **Device Configuration**.
4. Select [**Settings**].
5. In the context menu, select [**Saving the configuration in a file**].
6. Follow the instructions in the dialog.

## 10.7 Adopting a Configuration from a File

### QUALIFIED PERSON

To configure the inverter, you can adopt the configuration data from a file (see Section 10.6 "Saving the Configuration in a File", page 126). However, the file must have the same serial number as the inverter.

### Requirements:

- Changes to grid-relevant parameters must be approved by the responsible grid operator.
- The SMA Grid Guard code must be available (see "Application for SMA Grid Guard Code" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

### Procedure:

1. Open the user interface (see Section 8.1, page 107).
2. Log into the user interface as an **Installer** (see Section 8.2, page 110).
3. Select the menu **Device Configuration**.
4. Select [**Settings**].
5. In the context menu, select [**Adopting the configuration from a file**].
6. Follow the instructions in the dialog.

## 11 Manually Controlling the Generator

### 11.1 Starting the Generator via the User Interface

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

**Requirement:**

- The Sunny Island must be able to control the generator via a control cable.

**Procedure:**

1. Select **Generator > Generator**.
2. Set the parameter **Manual generator control** to **Start**.
  - The electricity generator starts and runs until you stop it again.
3. To start the generator and leave it running for one hour, perform the following steps.
  - Select **Generator > Operation >**.
  - Set the parameter **Reason for requesting generator** to **Run1h**.
  - The generator starts. If there is no generator request after one hour, the Sunny Island stops the generator.

### 11.2 Stopping the Generator via the User Interface

#### ⚠ WARNING

**Risk of crushing injuries due to moving PV array parts**

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

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

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

**Requirement:**

- The Sunny Island must be able to control the generator via a control cable.

**Procedure:**

1. Select **Generator > Generator**.
2. Set the parameter **Manual generator control** to **Stop**.
  - The generator is stopped temporarily. The generator restarts when a generator request is issued in automatic generator mode and the minimum stop time has elapsed.
3. To stop the generator permanently, deactivate the automatic generator mode:
  - Select **Generator > Generator**.
  - Set the parameter **Automatic generator start** to **Off**.

### 11.3 Starting the Generator without Autostart Function

1. Start the generator (see manufacturer's manual).
2. Close the load-break switch between the generator and Sunny Island.
- After the warm-up period, the Sunny Island connects the stand-alone grid to the generator.

## 11.4 Stopping the Generator without Autostart Function

1. Stop the generator via the user interface (see Section 11.2, page 127). When you do this, the Sunny Island disconnects the stand-alone grid from the generator.
2. Open the load-break switch between the generator and the Sunny Island.
3. Stop the generator (see manufacturer's manual).
  - The generator is stopped. After the power-down time and the minimum stop time, you can use the generator again.



## 12 Disconnecting the Inverter from Voltage Sources

### QUALIFIED PERSON

#### Procedure:

1. Stop the system (see Section 9.3, page 122).
2. Switch all Sunny Island off (see Section 9.4, page 122).
3. Disconnect the circuit breakers and the load-break switches in the sub-distributions and secure against reconnection.
4. Open the load-break switch in the battery fuse and secure against reconnection.
5. Wait 15 minutes. This enables electric discharge of the capacitors in the inverter.

6.

#### NOTICE

##### **Destruction of the Sunny Island inverter due to electrostatic discharge (ESD)**

By touching electronic components within the Sunny Island, you can damage or destroy the Sunny Island.

- Ground yourself before touching any component.

7. Unscrew all six screws of the enclosure lid using an Allen key (AF 5) and remove the enclosure lid.
8. Ensure that the **DC** connection is disconnected from voltage sources (see Section 6.2, page 33).
9. Ensure that the terminals **AC1 Loads/SunnyBoys** and **AC2 Gen/Grid** are disconnected from voltage sources (see Section 6.2, page 33).
10. Ensure that the **ExtVtg** is disconnected from voltage sources (see Section 6.2, page 33).
11. Ensure that the connections **Relay1** and **Relay2** are disconnected from voltage sources (see Section 6.2, page 33).
12. Ground and short-circuit the AC power cables outside the Sunny Island.
13. Cover or isolate any adjacent live components.

## 13 Cleaning and Maintenance

### 13.1 Cleaning and Checking the Sunny Island Inverter Enclosure

#### NOTICE

##### Damage due to cleaning agents

The use of cleaning agents may cause damage to the product and its components.

- Clean the product and all its components only with a cloth moistened with clear water.

##### Procedure:

- Ensure that the inverter is free of dust, foliage and other dirt. Carefully remove heavy dirt with a soft brush.

### 13.2 Checking the Function

#### Testing period

- For new systems, check every week during the six months following commissioning whether error messages have been logged. This will reveal any hidden errors in the installation or configuration.
- For all other systems, check every six months whether error messages have been logged.

##### Procedure:

1. Activate the user interface of the inverter (see Section 8.1, page 107).
2. Log in as User (see Section 8.2, page 110).
3. Select the menu **Events**.
4. Set filter:
  - Activate **Warning** and **Error**.
  - Deactivate **Information**.
5. Set the desired time period and select [**Apply time filter**].
6. If error messages have been logged, eliminate the cause (see Section 14.2, page 144).

### 13.3 Checking the Connections

#### ⚠ QUALIFIED PERSON

#### ⚠ DANGER

##### Danger to life due to electric shock when live components or cables are touched

High voltages are present in the conductive components or cables of the product. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Disconnect the product from voltage sources and make sure it cannot be reconnected before working on the device.
- After disconnection, wait 15 minutes until the capacitors have discharged.
- Observe all safety information on components associated with the product.
- Wear suitable personal protective equipment for all work on the product.

1. Make sure the Sunny Island is dead. Disconnecting the Sunny Island from Voltage Sources.
2. Ensure that the cables on the **DC+** and **DC-** connections are securely fastened (torque: 12 Nm).
3. Ensure that the connections are free of corrosion.

4. Ensure that the cables in the **AC1** and **AC2** connections are securely fastened.
5. Close the Sunny Island (see the Sunny Island inverter installation manual).
6. Switch on all load-break switches and miniature circuit breakers (see Section 13.12, page 143).

## 13.4 Cleaning the Fans

### **⚠ QUALIFIED PERSON**

If the user interface displays the warning **Derating due to temp.** unusually often, it is likely that one of the fans is defective or blocked.

#### **Procedure:**

- Clean the ventilation grids.
- Clean the fans.

#### **Cleaning the Ventilation Grids**

Proceed as follows to clean each ventilation grid.

#### **Procedure:**

1. Remove the ventilation grid laterally.

2.

### **NOTICE**

#### **Damage to the inverter due to foreign bodies**

- Do not remove the ventilation grid permanently, otherwise foreign bodies could penetrate the enclosure.

3. Clean the ventilation grid with a soft brush, a paint brush, or compressed air.
4. Close the recessed grips with the ventilation grids. Ensure that the assignment is correct. The correct assignment is marked on the inside of each ventilation grid: **links/left** for the left-hand side and **rechts/right** for the right-hand side.

#### **Cleaning the Fans**

Proceed as follows to clean each fan.

### **⚠ DANGER**

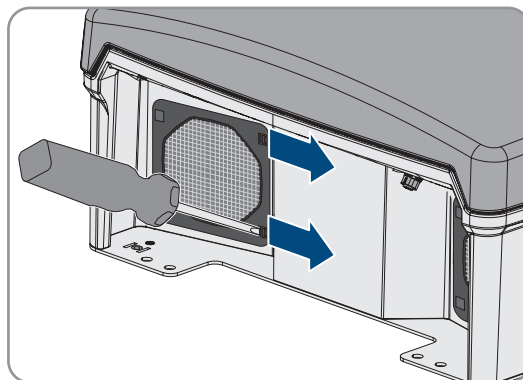
#### **Danger to life due to electric shock when live components or cables are touched**

High voltages are present in the conductive components or cables of the product. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Disconnect the product from voltage sources and make sure it cannot be reconnected before working on the device.
- After disconnection, wait 15 minutes until the capacitors have discharged.
- Observe all safety information on components associated with the product.
- Wear suitable personal protective equipment for all work on the product.

1. Disconnect the Sunny Island from voltage sources Disconnecting the Sunny Island from Voltage Sources.
2. Wait for the fans to stop rotating.
3. Check whether the fan guard is dusty or badly clogged.
  - If the fan guard is dusty, clean it with a vacuum cleaner or a soft brush.
  - If the fan guard is heavily soiled, remove it and clean it:

- Use a screwdriver to push the two locking tabs at the right-hand edge of the fan guard to the right-hand side and remove them from the retainer.

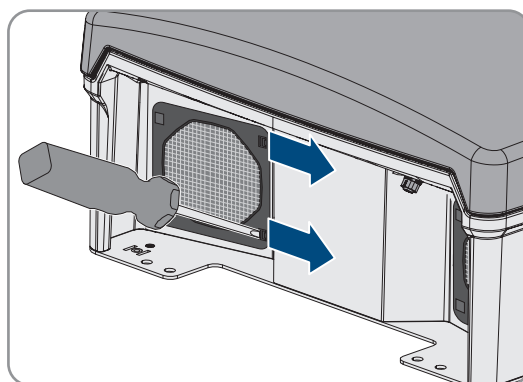


- Carefully remove the fan guard.
- Clean the fan guard with a soft brush, a paint brush, a cloth or compressed air.

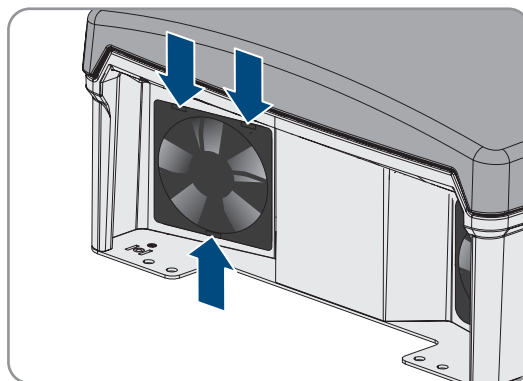
#### 4. Check whether the fan is soiled.

If the fan is soiled, remove the fan:

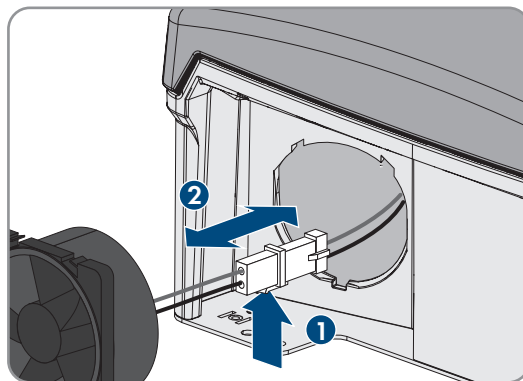
- Use a screwdriver to push the two locking tabs at the right-hand edge of the fan guard to the right-hand side and remove them from the retainer.



- Carefully remove the fan guard.
- Push the front locking tabs of the fan backwards and the rear locking tabs of the fan forwards.



- Slowly remove the fan from the Sunny Island.
- Release and remove the fan plug.



5.

**NOTICE****Damage to the fan due to compressed air**

- Clean the fan with a soft brush, a paint brush, or a damp cloth.

6. Insert the plug of the fan in the pin connector until it snaps into place.
7. Insert the fan into the Sunny Island until the fan audibly snaps into place.
8. Press the fan guard into the bracket until it audibly snaps into place.

### 13.5 Performing a Manual Equalization Charge in the Off-Grid System

After extended periods without charging (e.g., systems operated seasonally), perform a manual equalization charge at the end or start of the season.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

**Procedure:**

1. Select **Battery > Battery > Operation**.
2. Set the parameter **Manual equalization charge** to **Start**.

### 13.6 Checking and Maintaining the Battery

#### **⚠ QUALIFIED PERSON**

#### **⚠ WARNING**

##### **Danger to life due to explosive gases**

Explosive gases may escape from the battery and cause an explosion.

- 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 burn the battery and do not heat it beyond the permitted temperature.
- Additional measures for lead-acid batteries: Ensure that the battery room is sufficiently ventilated.

#### **⚠ WARNING**

##### **Chemical burns due to battery electrolyte**

If handled inappropriately, battery electrolyte can leak from the battery and cause irritation to the eyes, respiratory system and skin.

- Install, operate, maintain and dispose of the battery according to the manufacturer's specifications.
- Whenever working on the battery, wear suitable personal protective equipment such as rubber gloves, an apron, rubber boots and goggles.
- Rinse acid splashes thoroughly for a long time with clear water, and consult a doctor immediately.
- If acid fumes have been inhaled, consult a doctor immediately.

**⚠ WARNING****Danger to life due to burns caused by electric arcs through short-circuit currents**

Short-circuit currents in the battery can cause heat build-up and electric arcs. Heat build-up and electric arcs may result in lethal injuries due to burns.

- Remove watches, rings and other metal objects prior to carrying out any work on the battery.
- Use insulated tools for all work on the battery.
- Do not place tools or metal parts on the battery.
- Observe all safety information of the battery manufacturer.

**⚠ 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.

**Procedure:**

1. Check whether the current state of the battery corresponds to the expected state:
  - In the parameter group **Battery > Battery > Diagnosis**, select the parameter **Number of battery charge throughputs** and compare the value with the expected nominal energy throughput.
  - In the parameter group **Battery > Battery > Diagnosis**, select the parameter **Current battery capacity** and compare the value with the expected usable battery capacity.

If the current state of the battery does not correspond to the expected state, carry out the following steps:

  - Ensure that the requirements for the ambient temperature of the battery are met (see documentation of the battery manufacturer).
  - Check and optimize the battery management settings.
  - If you cannot determine the cause for the deviation, contact the Service (see Section 18, page 188).
2. Stop the system and switch off the Sunny Island (see Section 9, page 121).
3. Open the load-break switch of the BatFuse and secure against reconnection.
4. Check and maintain the battery (see documentation of the battery manufacturer). For this, perform at least the following steps:
  - 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.
5. Quickly close the load-break switch of the BatFuse and close the BatFuse (see BatFuse installation manual).
6. Switch the Sunny Island on and start the system (see Section 9, page 121).

## 13.7 Emergency charge mode after automatic shutdown

### 13.7.1 Safety Information for Automatic Shutdown for Lithium-Ion Batteries

#### ⚠ WARNING

##### **Danger to life due to fire or explosion when batteries are fully discharged**

A fire may occur due to incorrect charging of fully discharged batteries. This can result in death or serious injury.

- Before commissioning the system, verify that the battery is not fully discharged.
- Do not commission the system if the battery is fully discharged.
- If the battery is fully discharged, contact the battery manufacturer for further proceedings.
- Only charge fully discharged batteries as instructed by the battery manufacturer.

### 13.7.2 Charging the Lead-Acid Battery After Automatic Shutdown (Emergency Charge Mode)

#### ⚠ QUALIFIED PERSON

When a battery is deeply discharged, the battery inverter shuts down automatically and you cannot restart it. In order to start the battery inverter again after an automatic shutdown, you must charge the battery. The emergency charge mode is designed for charging the battery.

The emergency charge mode is only an option in single-phase off-grid systems. For all other Sunny Island systems, the system configuration must be adjusted temporarily.

#### ⚠ DANGER

##### **Danger to life due to electric shock when live components or cables are touched**

High voltages are present in the conductive components or cables of the product. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Disconnect the product from voltage sources and make sure it cannot be reconnected before working on the device.
- After disconnection, wait 15 minutes until the capacitors have discharged.
- Observe all safety information on components associated with the product.
- Wear suitable personal protective equipment for all work on the product.

#### **i** Restricted management functions in emergency charge mode

In emergency charge mode, the generator management is not active. The limits for voltage, current and frequency are not monitored. Set the maximum current consumption of the battery inverter for charging the battery in emergency charge mode. The battery inverter does not record additional stress on the generator caused by loads.

#### **Requirements:**

- Lead-acid batteries must be connected (for lithium-ion battery see documentation of the battery manufacturer).

#### **Procedure:**

- Connect the generator with connection AC1.
- Adjust the system configuration for the emergency charge mode (not required for single-phase off-grid system).
- Charge the battery.
- Disconnect the generator from connection **AC1**.
- Restore the original system configuration (not required for single-phase off-grid system).

- Start the off-grid system.

### Connect the generator with connection AC1.

1. Disconnect the inverter from all voltage sources Disconnecting the Sunny Island from Voltage Sources.
2. Open the inverter (see Section 13.11, page 142).
3. Only if the system is **not** a single-phase off-grid system, connect the system as a single-phase off-grid system (single system) temporarily (see system description "Off-Grid Systems" of the battery inverter). In systems with more than 1 battery inverter, the following rules must be observed:
  - If the system is a single-cluster system (single-phase or three-phase), the master must be temporarily connected as a single-phase off-grid system.
  - If the system is a multicluster system (single-phase or three-phase), the master of the main cluster must be temporarily connected as a single-phase off-grid system.

4.

### 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.

- Ensure that the generator is connected to **AC2** as specified for off-grid systems (see Section 6.5.6, page 41).

5. Bridge the terminals **AC1 Loads/SunnyBoys L** and **AC2 Gen/Grid L**.
6. Close the battery inverter (see Section 13.11, page 142)

### Adjust the system configuration for the emergency charge mode (not required for single-phase off-grid system)

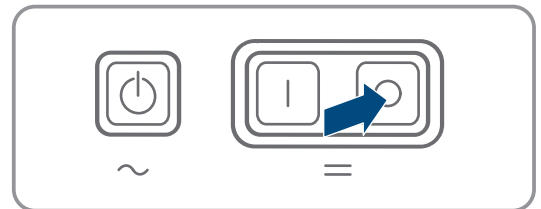
1. Ensure that all loads are switched off.
2. Close the load-break switch of the battery fuse.
3. Start the generator.
4. Switch the battery inverter on (see Section 9.1, page 121).
5. Activate the user interface of the inverter (see Section 8.1, page 107).
6. Log in as **Installer** (see Section 8.2, page 110).
7. Save the current configuration to a file(see Section 10.6, page 126)
8. Start the installation assistant (see Section 8.5, page 115).
9. Select [**Save and next**] for each step up to the step **Application**.
10. Select the [**New system configuration**] button.
11. Select the option **Functions for off-grid operation** under **Select application**.
12. Select [**Save and next**].
13. Select the option **Single phase** under **Type**.
14. Select the option **Generator** under **Grid-forming generator**.
15. Enter the nominal current of the generator connected under **Nominal current**.
16. Select [**Save and next**] for each step up to the step **Summary**.
17. Once all settings are correct, select [**Next**] in the summary.

### Charging the Battery

1. Start the installation assistant (see Section 8.5, page 115).



2. Click on **[Save and next]** for each step up to the step **Battery configuration**.
3. Select the button **[New battery configuration]**.
4. Select **Start new battery configuration** in the following prompt.
5. Set the parameters **Type**, **Voltage**, and **Nominal capacity** to the values of the lead-acid battery connected (see battery manufacturer documentation).
6. Select the button **[Emergency charging]** and confirm the following prompt with **Start battery emergency charge mode**.
  - The message **Emergency charging of the battery can be started** appears.
7. Start the system (see Section 9.2, page 121).
8. Activate the user interface of the inverter (see Section 8.1, page 107).
9. Log in as **Installer** (see Section 8.2, page 110).
10. Select **Battery > Battery > Nominal voltage > Battery voltage**.
11. When the battery voltage has reached at least 45 V, stop the generator.
12. Switch off the battery inverter.



### Disconnect the generator from connection AC1

1. Ensure that the generator is stopped permanently.

#### 2. **⚠ WARNING**

##### **Danger to life from electric shock due to high voltages**

High voltages are present on the AC power cables and on the control cables. Touching live components can result in death or serious injury due to electric shock.

- Disconnect the battery inverter from all voltage sources. Disconnecting the Sunny Island from Voltage Sources.

3. Remove the bridge between the connections **AC1 Loads/SunnyBoys L** and **AC2 Gen/Grid L**.
4. If a mobile generator is connected, disconnect the generator from connection **AC2**.
5. Restore the system-specific connection (see quick reference guide of the used system).
6. Close the battery inverter (see Section 13.11, page 142).
7. Connect the circuit breakers and fuse switch-disconnectors for the energy sources.

### Restore the original system configuration (not required for single-phase off-grid system)

1. Switch the battery inverter on (see Section 9.1, page 121).
2. Activate the user interface of the inverter (see Section 8.1, page 107).
3. Log in as **Installer** (see Section 8.2, page 110).
4. Transfer the original system configuration from the saved file (see Section 10.7, page 126).

## Starting the System

1. Start the system (see Section 9.2, page 121).
2. Connect the circuit breakers and fuse switch-disconnectors for the loads.

## 13.8 Changing Slave Addresses in a Cluster

### QUALIFIED PERSON

If you want to change slave addresses (e.g. after replacing a Sunny Island inverter), you can assign the slaves a new address via the user interface. Only the address is changed; all other configurations remain as they were, e.g., assignment of the clusters in a multicluster system. When replacing a master, you must reconfigure the cluster (see the quick reference guide for the relevant system for configuring single-cluster operation or multicluster operation).

#### Requirements:

- All Sunny Island inverters must be switched off.

#### Procedure:

1. Switch the slaves on first, and then the master (see Section 9.1, page 121).
2. Activate the user interface of the inverter (see Section 8.1, page 107).
3. Log in as **Installer** (see Section 8.2, page 110).
4. Start the installation assistant.
5. Select [**Save and next**] for each step up to the step **System setup**.
6. For a single-phase system, set the parameter **Type** to **Single phase**.
7. For a three-phase system, set the parameter **Type** to **Three phase**.
8. Under **System devices**, set the parameters **Serial number** and **Phase assignment** as follows.

Serial number	Phase assignment
Serial number of the master	Line conductor L1
Serial number slave 1	Line conductor L2
Serial number slave 2	Line conductor L3

9. Select [**Save and next**] until the installation assistant closes.
10. Start the system (see Section 9.2, page 121).

## 13.9 Replacing the Battery

### QUALIFIED PERSON

#### 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.

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

**⚠ WARNING****Danger to life due to explosive gases**

Explosive gases may escape from the battery and cause an explosion.

- 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 burn the battery and do not heat it beyond the permitted temperature.
- Additional measures for lead-acid batteries: Ensure that the battery room is sufficiently ventilated.

**⚠ WARNING****Chemical burns due to battery electrolyte**

If handled inappropriately, battery electrolyte can leak from the battery and cause irritation to the eyes, respiratory system and skin.

- Install, operate, maintain and dispose of the battery according to the manufacturer's specifications.
- Whenever working on the battery, wear suitable personal protective equipment such as rubber gloves, an apron, rubber boots and goggles.
- Rinse acid splashes thoroughly for a long time with clear water, and consult a doctor immediately.
- If acid fumes have been inhaled, consult a doctor immediately.

**⚠ WARNING****Danger to life due to burns caused by electric arcs through short-circuit currents**

Short-circuit currents in the battery can cause heat build-up and electric arcs. Heat build-up and electric arcs may result in lethal injuries due to burns.

- Remove watches, rings and other metal objects prior to carrying out any work on the battery.
- Use insulated tools for all work on the battery.
- Do not place tools or metal parts on the battery.
- Observe all safety information of the battery manufacturer.

**⚠ 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 Batteries").
- Set the battery capacity for a ten-hour electric discharge (C10). The battery manufacturer specifies the battery capacity in relation to discharge time.

**Procedure:**

1. Stop the system and switch off the Sunny Island (see Section 9, page 121).
2. Ensure that the battery is not grounded unintentionally.  
If the battery is unintentionally grounded, identify the connection between the battery and ground potential and remove the unintentional connection. This helps to prevent electric shock caused by malfunction of other system devices.
3. Open the load-break switch of the battery fuse and secure against reconnection.
4. Remove the battery to be replaced (see battery manufacturer's manuals).
5. Mount and connect the new battery (see manuals of the battery manufacturer). The battery must comply with the technical requirements of the Sunny Island inverter (refer to the Sunny Island inverter installation manual for technical data of the DC connection).
6. Quickly close the load-break switch of the battery fuse and close the battery fuse (see battery fuse documentation).
7. Switch the Sunny Island on (see Section 9.1, page 121).
8. Activate the user interface of the inverter (see Section 8.1, page 107).
9. Log in as Installer (see Section 8.2, page 110).
10. Start the installation assistant.
11. Click on [**Save and next**] for each step up to the step Battery configuration.
12. Select the button [**New battery configuration**].
13. Set the parameter **Type** to the battery type used.
14. Only make the following settings for lead-acid batteries.
  - Set the parameter **Voltage** to the battery voltage.
  - Set the parameter **Nominal capacity** to the C10 nominal capacity of the battery (see Section 8.12.1 "Determining the Battery Capacity", page 119).
15. Select [**Save and next**] until the installation assistant closes.

## 13.10 Replacing the Micro SD Card

### **⚠ QUALIFIED PERSON**

### **⚠ DANGER**

#### **Danger to life due to electric shock when live components or cables are touched**

High voltages are present in the conductive components or cables of the product. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Disconnect the product from voltage sources and make sure it cannot be reconnected before working on the device.
- After disconnection, wait 15 minutes until the capacitors have discharged.
- Observe all safety information on components associated with the product.
- Wear suitable personal protective equipment for all work on the product.

### **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.

#### **Requirements on the micro SD card:**

- A micro SD card must be used. Other memory cards (e.g. MMC cards) may not be used.
- Data storage in the FAT16/32 file format must be possible.
- Minimum storage capacity: 1 GB
- Maximum storage capacity: 64 GB
- Quality: industry standard

#### **Requirements:**

- The microSD card must be available.
- The inverter must be disconnected from all voltage sources Disconnecting the Sunny Island from Voltage Sources.

#### **Procedure:**

1. Disconnect the inverter from all voltage sources Disconnecting the Sunny Island from Voltage Sources.
2. Open the inverter (see Section 13.11, page 142).
3. Remove the defective micro SD card.
4. Insert the micro SD card into the slot up to the stop. Do not jam the micro SD card when doing so.
5. Ensure that the micro SD card is correctly plugged in.
6. Close the inverter (see Section 13.11, page 142).
7. Recommission the inverter (see Section 13.12, page 143).

## 13.11 Opening and Closing the Inverter

### **⚠ QUALIFIED PERSON**

If you have to open the inverter enclosure lid for repairs or replacement, proceed as described in the following.

### **⚠ DANGER**

#### **Danger to life due to electric shock when live components or cables are touched**

High voltages are present in the conductive components or cables of the product. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Disconnect the product from voltage sources and make sure it cannot be reconnected before working on the device.
- After disconnection, wait 15 minutes until the capacitors have discharged.
- Observe all safety information on components associated with the product.
- Wear suitable personal protective equipment for all work on the product.

### **NOTICE**

#### **Damage to the enclosure seal in subfreezing conditions**

If you open the product when temperatures are below freezing, the enclosure seals can be damaged. Moisture can penetrate the product and damage it.

- Only open the product if the ambient temperature is not below  $-5^{\circ}\text{C}$ .
- If a layer of ice has formed on the enclosure seal when temperatures are below freezing, remove it prior to opening the product (e.g. by melting the ice with warm air).

### **NOTICE**

#### **Damage to the inverter due to electrostatic discharge**

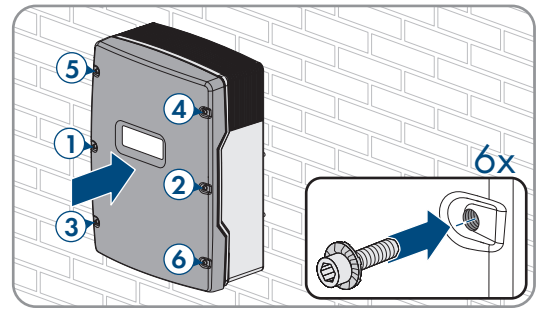
Touching electronic components can cause damage to or destroy the inverter through electrostatic discharge.

- Ground yourself before touching any component.

#### **Procedure:**

1. To prevent water or dust entering the interior of the inverter, clean and dry the lid prior to removal.
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. Carefully remove the enclosure lid.
4. Perform the repair or replacement.
5. Replace the enclosure lid with the screws onto the enclosure and hold in place.
6. Attach one conical spring washer to each screw. The grooved side of the conical spring washer must point to the screw head. Tip: The scope of delivery of the Sunny Island inverter includes one additional replacement screw with a conical spring washer.

7. 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 serrated conical spring washer must press into the enclosure lid. This ensures that the enclosure lid is grounded.



8. Recommission the inverter (see Section 13.12, page 143).

## 13.12 Recommissioning the Inverter

### ⚠ QUALIFIED PERSON

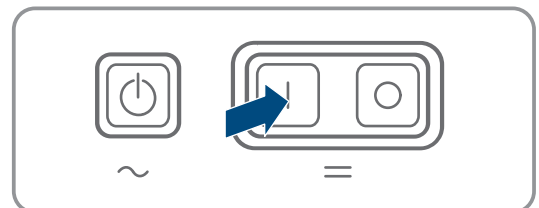
If you have disconnected the inverter from all voltage sources and want to recommission it, proceed as follows.

#### Requirements:

- All circuit breakers in the AC distribution board must be open.
- All Sunny Island inverters must be connected correctly (see Section 6.7, page 64).
- All inverters must be closed (see Section 6.8, page 68).
- All Sunny Island inverters must be switched off.
- The fuse switch-disconnector of the battery fuse must be closed (see Section 6.9, page 69).

#### Procedure:

1. Switching on the Sunny Island:



- For systems with one Sunny Island, press the "On" button.
  - For systems with three Sunny Island inverters, press and hold the "On" button on the master until an acoustic signal sounds.
  - For multicluster systems, press and hold the "On" button on each master until an acoustic signal sounds.
2. Establish a connection to the user interface of the inverter (see Section 8.1, page 107).

## 14 Troubleshooting

### 14.1 Sunny Island Inverter Behavior Under Fault Conditions

#### Event messages

Warnings and errors are displayed in the menu **Events** in the user interface until the causes of these warnings and errors are no longer detected by the Sunny Island. Exception: Some errors must be acknowledged via the user interface.

Information is also displayed in the menu **Events** by the Sunny Island (see Section 14.2, page 144).

#### Autostart

The autostart function allows automatic restarts in the event of malfunctions. If the autostart function fails in the event of a malfunction, the Sunny Island attempts to carry out the next autostart immediately. The number of autostarts is restricted.

When the maximum number of autostarts has been reached, the Sunny Island reacts as follows:

- The Sunny Island waits ten minutes.
- The autostart counter is reset.
- The Sunny Island attempts to perform an autostart.
- When the maximum number of autostarts has been reached, the Sunny Island waits again for ten minutes.

### 14.2 Event Messages

Event number	Message, cause and corrective measures
104	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>The voltage of the generator or of the utility grid of the Sunny Island Phase Lxx is too high.</p> <p><b>Corrective measures for generator:</b></p> <ul style="list-style-type: none"> <li>• Adjust the thresholds for the generator voltage of the Sunny Island (see Sunny Island technical information "Measured Values and Parameters"). As an aid to this, observe and evaluate the measured values <b>Voltage of external grid connection Lxx</b> during ongoing operation.</li> </ul> <p>Adjust the generator voltage and/or generator frequency.</p> <p><b>Corrective measures in battery-backup system:</b></p> <ul style="list-style-type: none"> <li>• Contact the service.</li> </ul>



Event number	Message, cause and corrective measures
204	<p data-bbox="443 241 730 280"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="427 302 592 331"><b>Grid incident</b></p> <p data-bbox="427 347 1465 414">The voltage of the generator or of the utility grid of the Sunny Island line conductor Lxx is too low.</p> <p data-bbox="427 430 868 459"><b>Corrective measures for generator:</b></p> <ul data-bbox="448 474 1453 616" style="list-style-type: none"> <li>• Adjust the thresholds for the generator voltage of the Sunny Island (see Sunny Island technical information "Measured Values and Parameters"). As an aid to this, observe and evaluate the measured values <b>Voltage of external grid connection Lxx</b> during ongoing operation.</li> </ul> <p data-bbox="480 629 1129 658">Adjust the generator voltage and/or generator frequency.</p> <p data-bbox="427 674 1015 703"><b>Corrective measures in battery-backup system:</b></p> <ul data-bbox="448 719 703 748" style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
301	<p data-bbox="443 779 730 817"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="427 840 743 869"><b>Rise-in-voltage protection</b></p> <p data-bbox="427 884 948 913">Rise-in voltage protection of line conductor Lxx</p> <p data-bbox="427 929 692 958"><b>Corrective measures:</b></p> <ul data-bbox="448 974 1305 1003" style="list-style-type: none"> <li>• Ensure that the conductor cross-section of the AC cables is correctly sized.</li> </ul>
405	<p data-bbox="443 1037 730 1075"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="427 1093 1190 1122"><b>External grid disconnection due to undesired electrical island</b></p> <p data-bbox="427 1137 1476 1205">Unintended stand-alone grid is present at connection <b>AC2</b> of the Sunny Island at line conductor Lxx.</p> <p data-bbox="427 1220 692 1249"><b>Corrective measures:</b></p> <ul data-bbox="448 1265 1453 1332" style="list-style-type: none"> <li>• Ensure that the insulated wires at connection <b>AC2</b> are securely connected and that the conductors in the terminals are free of insulation.</li> </ul> <p data-bbox="427 1348 868 1377"><b>Corrective measures for generator:</b></p> <ul data-bbox="448 1393 1453 1579" style="list-style-type: none"> <li>• Implement control of the contactor via a Sunny Island multifunction relay. To do so, set the parameter <b>Operating mode of multifunction relay</b> to <b>Automatic generator request</b>.</li> <li>• Set the parameter <b>Sensitivity of generator failure detection</b> to a lower sensitivity level.</li> </ul> <p data-bbox="427 1594 868 1624"><b>Corrective measures for utility grid:</b></p> <ul data-bbox="448 1639 703 1668" style="list-style-type: none"> <li>• Contact the Service.</li> </ul>

Event number	Message, cause and corrective measures
504 505	<p data-bbox="395 241 694 277"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="384 300 555 331"><b>Grid incident</b></p> <p data-bbox="384 344 1410 416">The frequency of the generator or the utility grid of the Sunny Island at line conductor Lxx is too low or too high.</p> <p data-bbox="384 427 831 459"><b>Corrective measures for generator:</b></p> <ul data-bbox="411 472 1410 544" style="list-style-type: none"> <li data-bbox="411 472 1410 544">• The generator may be overloaded. Reduce the total power of the loads by staggering their use over time.</li> </ul> <p data-bbox="438 555 1390 658">Change the frequency thresholds of the generator voltage. As an aid to this, observe and evaluate the measured values <b>Grid frequency of external grid connection</b> during ongoing operation.</p> <p data-bbox="438 669 1015 701">Adjust the frequency of the external energy source.</p> <p data-bbox="384 712 831 743"><b>Corrective measures for utility grid:</b></p> <ul data-bbox="411 757 668 788" style="list-style-type: none"> <li data-bbox="411 757 668 788">• Contact the Service.</li> </ul>
803	<p data-bbox="395 817 694 853"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="384 875 555 907"><b>Grid incident</b></p> <p data-bbox="384 920 1422 992">The voltage and/or frequency of the generator or the utility grid is/are outside of the configured range.</p> <p data-bbox="384 1003 831 1034"><b>Corrective measures for generator:</b></p> <ul data-bbox="411 1048 1350 1200" style="list-style-type: none"> <li data-bbox="411 1048 1350 1151">• Configure the thresholds for generator connection. As an aid to this, observe and evaluate the measured values <b>Voltage of external grid connection</b> and <b>Grid frequency of external grid connection</b> during ongoing operation.</li> <li data-bbox="411 1164 1091 1200">• Adjust the generator voltage and/or generator frequency.</li> </ul> <p data-bbox="384 1211 831 1243"><b>Corrective measures for utility grid:</b></p> <ul data-bbox="411 1256 668 1288" style="list-style-type: none"> <li data-bbox="411 1256 668 1288">• Contact the Service.</li> </ul>
1304	<p data-bbox="395 1310 694 1346"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="384 1368 807 1400"><b>Grid connection installation error</b></p> <p data-bbox="384 1413 1402 1485">Assignment of the line conductors of the external energy source to the <b>AC2</b> connections of the Sunny Island does not result in a right-rotating magnetic field.</p> <p data-bbox="384 1496 655 1527"><b>Corrective measures:</b></p> <ul data-bbox="411 1541 1374 1612" style="list-style-type: none"> <li data-bbox="411 1541 1374 1612">• Ensure that the master is connected to L1, slave 1 is connected to L2, and slave 2 is connected to L3.</li> </ul>

Event number	Message, cause and corrective measures
1402	<p data-bbox="432 241 732 280"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="427 302 592 331"><b>Grid incident</b></p> <p data-bbox="427 347 1477 416">The voltage of the generator or the utility grid at the Sunny Island at line conductor Lxx is outside the configured thresholds (redundant measurement).</p> <p data-bbox="427 432 868 461"><b>Corrective measures for generator:</b></p> <ul data-bbox="448 477 1401 622" style="list-style-type: none"><li data-bbox="448 477 1401 577">• Change the voltage thresholds for the generator. As an aid to this, observe and evaluate the measured values <b>Voltage of external grid connection Lxx</b> during ongoing operation.</li><li data-bbox="448 593 927 622">• If possible, adjust the generator voltage.</li></ul> <p data-bbox="427 638 868 667"><b>Corrective measures for utility grid:</b></p> <ul data-bbox="448 683 703 712" style="list-style-type: none"><li data-bbox="448 683 703 712">• Contact the Service.</li></ul>
1403	<p data-bbox="432 741 732 779"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="427 801 592 831"><b>Grid incident</b></p> <p data-bbox="427 846 1477 947">The Sunny Island at line disconnecter Lxx disconnects from the external energy source because the ratio of AC voltage and battery voltage is too high. Either the voltage at connection <b>AC2</b> is too high or the battery voltage too low.</p> <p data-bbox="427 963 692 992"><b>Corrective measures:</b></p> <ul data-bbox="448 1008 703 1037" style="list-style-type: none"><li data-bbox="448 1008 703 1037">• Contact the Service.</li></ul>
1404	<p data-bbox="432 1070 732 1108"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="427 1131 592 1160"><b>Grid incident</b></p> <p data-bbox="427 1176 1477 1245">The Sunny Island at line conductor Lxx disconnects from the utility grid due to phase conductor failure/overload at terminal <b>AC2</b>.</p> <p data-bbox="427 1261 692 1290"><b>Corrective measures:</b></p> <ul data-bbox="448 1305 1318 1377" style="list-style-type: none"><li data-bbox="448 1305 1318 1335">• Reduce the total power of the loads, e.g. by staggering their use over time.</li><li data-bbox="448 1350 1206 1377">• Ensure that there is not a short circuit present at connection <b>AC2</b>.</li></ul>
1405	<p data-bbox="432 1400 732 1438"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="427 1460 592 1489"><b>Grid incident</b></p> <p data-bbox="427 1505 1382 1534">A short circuit is present at connection <b>AC2</b> of the Sunny Island at line conductor Lxx.</p> <p data-bbox="427 1550 692 1579"><b>Corrective measures:</b></p> <ul data-bbox="448 1594 703 1624" style="list-style-type: none"><li data-bbox="448 1594 703 1624">• Contact the Service.</li></ul>
1407	<p data-bbox="432 1659 732 1697"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="427 1720 592 1749"><b>Grid incident</b></p> <p data-bbox="427 1765 1477 1834">Disconnection from the utility grid due to non-compliance with the voltage-frequency ratio at line conductor Lxx</p> <p data-bbox="427 1850 692 1879"><b>Corrective measures:</b></p> <ul data-bbox="448 1895 703 1924" style="list-style-type: none"><li data-bbox="448 1895 703 1924">• Contact the Service.</li></ul>

Event number	Message, cause and corrective measures
1408	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>AC sources in the system are driving the generator. The reverse power in the generator has been exceeded for too long.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Adjust the generator request to the properties of the AC sources in the system and the loads, e.g., for PV inverters, preferably request the generator at night.</li> <li>• If the generator can absorb reverse power, adjust the reverse power in the generator settings.</li> </ul>
1409	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>The Sunny Island disconnects from the utility grid due to prohibited feedback.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
1410	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>The feed-in current at line conductor Lxx is higher than the set maximum value (parameter <b>Maximum current from utility grid</b>).</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
1411	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>The external current on line conductor Lxx is greater than the permissible maximum current (see parameter <b>Maximum current from utility grid</b> or <b>Nominal generator current</b>).</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Reduce power consumption of all loads.</li> <li>• Reduce power output of the AC sources (e.g. PV inverter).</li> </ul>
1412	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>The pre-fuse <b>F104.1</b>, <b>F104.2</b> or <b>F104.3</b> in the Multicluster-Box is open. A Sunny Island in the main cluster (master / slave 1 / slave 2) detects a supply voltage at ExtVtg and tries to switch to Lxx in the multicluster system. At line conductor Lxx an anti-islanding error occurs due to the open pre-fuse.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Reactivate the pre-fuse.</li> <li>• Check the voltage supply at terminal <b>AC2</b> of the master in the main cluster.</li> </ul>

Event number	Message, cause and corrective measures
1413	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>Phase position of the measured AC voltage at <b>ExtVtg</b> and <b>AC2</b> does not match at line conductor Lxx.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the neutral conductor and line conductor are correctly connected to connection <b>ExtVtg</b>.</li> <li>• Ensure that the neutral conductor and line conductor are correctly connected to connection <b>AC2</b>.</li> <li>• Ensure that connections <b>ExtVtg</b> and <b>AC2</b> are connected to the same line conductor.</li> </ul>
1415	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>Tie switch does not close.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the triggering of the tie switch is correct.</li> <li>• Ensure that the tie switch is correctly wired.</li> <li>• Ensure that the feedback contact is correctly connected.</li> </ul>
1416	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>The Sunny Island system disconnects from the generator or utility grid due to a voltage imbalance between the line conductors.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Eliminate any faults in the installation.</li> </ul>
1601	<b>Automatic generator start due to set criteria, e.g. battery state of charge</b>
1602	<b>Automatic generator stop due to set criteria, e.g. battery state of charge</b>
1603	<b>Manual generator start</b>
1604	<b>Manual generator stop</b>
1605	<b>Manual error acknowledgment of generator error</b>
1606	<b>Generator requested</b>
1607	<b>Generator started in current-controlled operation</b>
1608	<b>Generator stopped in current-controlled operation</b>
1609	<b>Grid request due to low battery state of charge</b>
1610	<b>Release of grid disconnection due to sufficient battery state of charge</b>
1611	<b>Grid request due to power limit being exceeded</b>

Event number	Message, cause and corrective measures
1612	<p><b>Grid disconnection release as power limit not reached</b></p> <p>Relevant for load-dependent grid requirement: The power requirement of the loads has fallen below the power limit stored in the battery inverter. The battery inverter issues the release for grid disconnection.</p>
1613	<p><b>Manual grid request</b></p>
1614	<p><b>Manual grid disconnection release</b></p>
1615	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Locking of generator due to excessive connect. processes</b></p> <p>Blocking of generator due to too many interrupted start-ups</p> <p><b>Corrective measures:</b></p> <p>A warm-up time <b>Warm-up time of generator</b> that is too short may have been configured and hence the generator is unable to supply valid voltage.</p> <ul style="list-style-type: none"> <li>• Ensure that the generator triggering is functioning, the generator starts, and there is constant and stable generator voltage present at connection AC2.</li> <li>• Ensure that the warm-up time for the generator is set to a sufficient duration.</li> <li>• To re-enable connection of the generator, acknowledge the error.</li> </ul>
1616	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Synchronization not executed</b></p> <p>Synchronization with the generator not successful.</p> <ul style="list-style-type: none"> <li>• Ensure that the generator can be started. The fuel level may be too low.</li> <li>• Ensure that a constant and stable voltage is present at connection <b>AC2</b>.</li> <li>• Ensure that the thresholds for the generator voltage are correctly configured.</li> </ul>
1701	<p><b>Automatic frequency control intervenes</b></p>
1702	<p><b>Automatic frequency control ends</b></p>
1704	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Generator operation not possible</b></p> <p>Generator operation not possible</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Reset the off-grid system. For this, disconnect all loads, AC sources, generator and DC sources. Open the battery fuse load-break switch. Wait 10 minutes and restart the off-grid system. Wait until all AC sources are feeding into the stand-alone grid and all loads are connected before connecting the generator.</li> <li>• Contact the Service.</li> </ul>
1705	<p><b>No valid grid voltage for requested grid operation</b></p> <p>Voltage of the external energy source is not within the valid thresholds for connection.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Acknowledge the error.</li> <li>• Contact the Service.</li> </ul>

Event number	Message, cause and corrective measures
1706	<p data-bbox="432 241 732 280"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="427 302 608 336"><b>System failure</b></p> <p data-bbox="427 347 1114 380">A contactor in the Multicluster-Box is not functioning correctly.</p> <p data-bbox="427 392 692 425"><b>Corrective measures:</b></p> <ul data-bbox="448 436 1318 568" style="list-style-type: none"><li data-bbox="448 436 1318 470">• Reset the off-grid system. For this, disconnect the off-grid system and restart.</li><li data-bbox="448 481 1230 515">• Start the installation assistant and reconfigure multicluster operation</li><li data-bbox="448 526 703 560">• Contact the Service.</li></ul>
1707	<p data-bbox="432 591 732 629"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="427 651 639 685"><b>Stand-alone grid</b></p> <p data-bbox="427 696 1437 730">An overvoltage has occurred at connection <b>AC1</b> of the Sunny Island at line conductor Lxx.</p> <p data-bbox="427 741 692 775"><b>Corrective measures:</b></p> <ul data-bbox="448 786 1453 936" style="list-style-type: none"><li data-bbox="448 786 1453 853">• Ensure that the Sunny Island is functional. For this, disconnect all AC sources and loads from the Sunny Island and restart the Sunny Island.</li><li data-bbox="448 864 1453 936">• Find the cause of the overvoltage through measurement and step-by-step connection of the AC sources and loads.</li></ul>
1708	<p data-bbox="432 958 732 996"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="427 1019 639 1052"><b>Stand-alone grid</b></p> <p data-bbox="427 1064 1465 1097">An overfrequency has occurred at connection AC1 of the Sunny Island at line conductor Lxx.</p> <p data-bbox="427 1108 692 1142"><b>Corrective measures:</b></p> <ul data-bbox="448 1153 1453 1303" style="list-style-type: none"><li data-bbox="448 1153 1453 1220">• Ensure that the Sunny Island is functional. For this, disconnect all AC sources and loads from the Sunny Island and restart the Sunny Island.</li><li data-bbox="448 1232 1453 1303">• Find the cause of the overvoltage through measurement and step-by-step connection of the AC sources and loads.</li></ul>
1709	<p data-bbox="432 1326 732 1364"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="427 1386 639 1420"><b>Stand-alone grid</b></p> <p data-bbox="427 1431 1433 1498">An underfrequency has occurred at connection AC1 of the Sunny Island at line conductor Lxx.</p> <p data-bbox="427 1509 692 1543"><b>Corrective measures:</b></p> <ul data-bbox="448 1554 1465 1704" style="list-style-type: none"><li data-bbox="448 1554 1453 1621">• Ensure that the Sunny Island is functional. For this, disconnect all AC sources and loads from the Sunny Island and restart the Sunny Island.</li><li data-bbox="448 1632 1465 1704">• Find the cause of the underfrequency through measurement and step-by-step connection of the AC sources and loads.</li></ul>

Event number	Message, cause and corrective measures
1710	<p data-bbox="411 241 694 277"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="384 300 600 331"><b>Stand-alone grid</b></p> <p data-bbox="384 344 1361 412">Voltage at terminal AC1 of the Sunny Island at line conductor Lxx is too low due to AC sources in the system.</p> <p data-bbox="384 427 655 459"><b>Corrective measures:</b></p> <ul data-bbox="411 472 1430 618" style="list-style-type: none"> <li data-bbox="411 472 1430 539">• Ensure that the Sunny Island is functional. For this, disconnect all AC sources and loads from the Sunny Island and restart the Sunny Island.</li> <li data-bbox="411 553 1430 618">• Find the cause of the undervoltage through measurement and step-by-step connection of the AC sources and loads.</li> </ul>
1711	<p data-bbox="411 645 694 680"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="384 703 600 734"><b>Stand-alone grid</b></p> <p data-bbox="384 748 1418 779">The Sunny Island at line conductor Lxx has measured an undesired voltage at terminal AC1.</p> <p data-bbox="384 795 655 826"><b>Corrective measures:</b></p> <p data-bbox="384 840 1075 871">A bypass switch may have bridged the internal transfer relay.</p> <ul data-bbox="411 884 1318 1081" style="list-style-type: none"> <li data-bbox="411 884 1318 1003">• Ensure that the bypass switch is in the position for operation with Sunny Island. An external energy source (e.g., generator) may have been connected to the connection <b>AC1</b>.</li> <li data-bbox="411 1016 1382 1081">• Disconnect external energy source from connection <b>AC1</b> and connect to connection <b>AC2</b>.</li> </ul>
1712	<p data-bbox="411 1108 694 1144"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="384 1167 600 1198"><b>Stand-alone grid</b></p> <p data-bbox="384 1211 1120 1243">With open tie switch, AC voltage is applied at line conductor Lxx.</p> <p data-bbox="384 1258 655 1290"><b>Corrective measures:</b></p> <ul data-bbox="411 1303 1018 1384" style="list-style-type: none"> <li data-bbox="411 1303 1018 1335">• Ensure that the triggering of the tie switch is correct.</li> <li data-bbox="411 1348 919 1384">• Ensure that the tie switch is correctly wired.</li> </ul>
1713	<p data-bbox="411 1406 694 1442"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="384 1464 568 1496"><b>System failure</b></p> <p data-bbox="384 1509 916 1541">The line conductor of a Sunny Island is missing.</p> <p data-bbox="384 1556 655 1588"><b>Corrective measures:</b></p> <ul data-bbox="411 1601 1423 1906" style="list-style-type: none"> <li data-bbox="411 1601 1423 1668">• Ensure that all circuit breakers of the Sunny Island inverters in the Multicluster-Box are closed.</li> <li data-bbox="411 1682 1423 1861">• Search for the missing line conductor and eliminate the error. To identify the missing line conductor, measure the AC voltage between each line conductor and between the line conductors and the neutral conductors with the loads connected. If an AC voltage deviates from the nominal voltage by <math>\pm 10\%</math>, the corresponding line conductor is missing.</li> <li data-bbox="411 1874 1279 1906">• Reset the off-grid system. For this, disconnect the off-grid system and restart.</li> </ul>



Event number	Message, cause and corrective measures
3809	<p><b>Overcurrent in inverter bridge at line conductor Lxx</b></p> <p>Too much current is flowing through the DC connection of a Sunny Island at line conductor Lxx.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Reduce the power of the loads.</li> </ul>
6120-6135	<p><b>Device fault</b></p> <p>OCU watchdog has triggered (an error has occurred in the program sequence).</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
6316	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Device fault</b></p> <p>Voltage or current measurement interferences at external measurement point of the AC sub-distribution (Multicluster-Box) at line conductor Lxx.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the control and measuring cable between the Multicluster-Box and the corresponding Sunny Island of the main cluster is correctly inserted. When doing so, observe the correct sequence of the Multicluster-Box connections to the Sunny Island inverters (see the Multicluster-Box documentation).</li> </ul>
6463	<p><b>Device fault</b></p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
6465	<p><b>Device fault</b></p> <p>Processor voltage in the device at Lxx is incorrect.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
6466	<p><b>System failure</b></p> <p>15 V voltage supply or 24 V voltage supply in the Multicluster Box is defective.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
6502-6514	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Overtemperature</b></p> <p>Temperature of the transformer or the heat sink in the Sunny Island at line conductor Lxx is too high (due to overload or ambient temperature).</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the Sunny Island is functional. For this, disconnect all AC sources and loads from the Sunny Island and restart the Sunny Island.</li> <li>• Reduce the total power of the loads, e.g. by staggering their use over time.</li> <li>• Clean the fans.</li> </ul>

Event number	Message, cause and corrective measures
6609	<p data-bbox="411 241 692 271"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="389 302 512 331"><b>Overload</b></p> <p data-bbox="389 347 679 376">Battery voltage is too low.</p> <p data-bbox="389 392 655 421"><b>Corrective measures:</b></p> <ul data-bbox="411 436 1423 685" style="list-style-type: none"> <li data-bbox="411 436 1423 600">• Charging the battery: <ul data-bbox="459 481 1423 600" style="list-style-type: none"> <li data-bbox="459 481 1139 517">– Charge the lead-acid battery in emergency charge mode.</li> <li data-bbox="459 526 1423 600">– Charge lead-acid batteries with external battery charger (see documentation of the battery manufacturer).</li> </ul> </li> <li data-bbox="411 609 1423 685">• Ensure that DC loads are shed via a load-shedding contactor when the battery state of charge is low.</li> </ul>
6610	<p data-bbox="411 703 692 732"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="389 763 512 792"><b>Overload</b></p> <p data-bbox="389 808 823 837">Battery voltage is temporarily too high.</p> <p data-bbox="389 853 655 882"><b>Corrective measures:</b></p> <ul data-bbox="411 898 1423 1021" style="list-style-type: none"> <li data-bbox="411 898 1015 936">• Ensure that all DC sources are correctly configured.</li> <li data-bbox="411 945 1423 1021">• Ensure that all SMA inverters are configured to the country data set for stand-alone grid operation.</li> </ul>
6612	<p data-bbox="411 1039 692 1068"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="389 1099 512 1128"><b>Overload</b></p> <p data-bbox="389 1144 1394 1211">Excessive current has been applied to the internal transfer relay of the Sunny Island at line conductor Lxx.</p> <p data-bbox="389 1227 655 1256"><b>Corrective measures:</b></p> <ul data-bbox="411 1272 1423 1469" style="list-style-type: none"> <li data-bbox="411 1272 1278 1310">• Reduce the total power of the loads, e.g. by staggering their use over time.</li> <li data-bbox="411 1319 1423 1393">• Connect the loads with very high power directly to the generator whenever possible or connect the utility grid. Ensure that the generator is not overloaded.</li> <li data-bbox="411 1402 1423 1469">• In off-grid systems, ensure that the country data sets of the SMA inverters are set to stand-alone mode.</li> </ul>
6613	<p data-bbox="411 1487 692 1516"><b>⚠ QUALIFIED PERSON</b></p> <p data-bbox="389 1547 512 1576"><b>Overload</b></p> <p data-bbox="389 1592 1246 1621">The power of the loads is too high for the Sunny Island at line conductor Lxx.</p> <p data-bbox="389 1637 655 1666"><b>Corrective measures:</b></p> <ul data-bbox="411 1682 1423 1966" style="list-style-type: none"> <li data-bbox="411 1682 1278 1720">• Ensure that the inverter is functional. Clean the fans and restart the inverter.</li> <li data-bbox="411 1729 1423 1803">• Ensure that there are no short circuits in the system and that the power of the loads is not greater than the power of the Sunny Island inverter.</li> <li data-bbox="411 1812 1423 1886">• Use a star delta electronic circuit to start three-phase loads with a high start-up electricity demand (e.g. motors).</li> <li data-bbox="411 1895 1423 1966">• Connect the loads with very high power directly to the generator whenever possible. Ensure that the generator is not overloaded.</li> </ul>

Event number	Message, cause and corrective measures
6614	<p><b>Overload</b></p> <p>The device at Lxx has been loaded over its 5-minute rated capacity.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Reduce the power of the loads.</li> </ul>
6615	<p><b>Overload</b></p> <p>The device at Lxx has been loaded over its 30-minute rated capacity.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Reduce the power of the loads.</li> </ul>
6616	<p><b>Overload</b></p> <p>The device at Lxx has been loaded over its rated short-term capacity.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Reduce the power of the loads.</li> </ul>
7002 7003 7004	<p><b>Fan sensor error permanently on</b></p> <p>There is a short circuit or cable break at a temperature sensor of the device at line conductor Lxx.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
7010	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Short circuit battery temp. sensor &gt; Check sensor status and function</b></p> <p>Short circuit on battery temperature sensor</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the battery temperature sensor is correctly connected.</li> <li>• Contact the Service.</li> </ul>
7011	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Cable break battery temp. sensor &gt; Check sensor status and function</b></p> <p>Cable break, battery temperature sensor</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the battery temperature sensor is correctly connected.</li> <li>• Contact the Service.</li> </ul>
7101	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>SD memory card defective</b></p> <p>Micro SD card in the inverter is faulty.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Replace the micro SD card.</li> </ul>

Event number	Message, cause and corrective measures
7102	<p><b>Parameter file not found or defective</b></p> <p>Parameter file not found / defective. The parameter file could not be found or is defective. The update failed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Copy the parameter file to the correct folder again.</li> </ul>
27103	<p><b>Set parameter</b></p> <p>The parameter change has been adopted.</p>
27104	<p><b>Parameters set successfully</b></p> <p>The parameter changes were successfully adopted.</p>
7105	<p><b>Param. setting failed</b></p> <p>Parameters could not be set using the memory card.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure thresholds of the parameters are complied with.</li> <li>• Change the parameter again.</li> <li>• For grid-relevant parameter: Ensure that the SMA Grid Guard code is available.</li> </ul>
7106	<p><b>Update file defective</b></p> <p>The update file is defective. The update failed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Update the firmware again.</li> </ul>
27107	<p><b>Update file OK</b></p> <p>The update file is suitable for this inverter and its components and is fully available for the next update step.</p>
27108	<p><b>SD memory card is read</b></p> <p>The inverter is currently reading the SD memory card.</p>
27109	<p><b>No new update SD memory card</b></p> <p>The micro SD memory card contains an update file that has already been used.</p>
7110	<p><b>No update file found</b></p>
7112	<p><b>Update file successfully copied</b></p> <p>Update file was copied successfully to the inverter's internal memory.</p>
7113	<p><b>The memory card is full or write-protected</b></p>
27301	<p><b>Update communication</b></p> <p>The inverter is updating the communication component.</p>
27302	<p><b>Update main CPU</b></p> <p>The inverter is updating the inverter component.</p>

Event number	Message, cause and corrective measures
7303	<p><b>Update main CPU failed</b></p> <p>The cause must be determined by the Service.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
27312	<p><b>Update completed</b></p> <p>The inverter has successfully completed the update.</p>
7320	<p><b>The device with serial number [xx] was successfully updated to firmware version [xxx].</b></p> <p>The firmware update was completed successfully.</p>
7329	<p><b>Condition test successful</b></p> <p>The testing of the update conditions was not successful. The firmware update package is not suitable for this inverter.</p>
7330	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Condition test failed</b></p> <p>The conditions of the update file used for the inverter settings are not fulfilled.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Retry update.</li> <li>• Ensure that the selected update file is suitable for this inverter.</li> <li>• If this message is displayed again, contact the Service.</li> </ul>
7331	<p><b>Update transport started</b></p> <p>Update file is being copied.</p>
7332	<p><b>Update transport successful</b></p> <p>Update file was copied successfully to the inverter's internal memory.</p>
7333	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Update transport failed</b></p> <p>Update file could not be copied to the inverter's internal memory. In the event of connection with the inverter via WLAN, a poor connection quality can be the cause.</p> <p><b>Corrective measures</b></p> <ul style="list-style-type: none"> <li>• Establish connection with the inverter via Ethernet.</li> <li>• Retry update.</li> <li>• If this message is displayed again, contact the Service.</li> </ul>
7341	<p><b>Update Bootloader</b></p> <p>The inverter is performing a bootloader update.</p>

Event number	Message, cause and corrective measures
7342	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Update Bootloader failed</b> The bootloader update failed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Retry update.</li> <li>• If this message is displayed again, contact the Service.</li> </ul>
7345	<p><b>Master starts firmware update of cluster</b> The firmware update for slave 1 and slave 2 has been started.</p>
7347	<p><b>Incompatible file</b> The configuration file is not suitable for this inverter. <b>⚠ QUALIFIED PERSON</b></p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the selected configuration file is suitable for this inverter.</li> <li>• Retry import.</li> </ul>
7348	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Incorrect file format</b> The configuration file is not of the required format or is damaged.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the selected configuration file is of the required format and is not damaged.</li> <li>• Retry import.</li> </ul>
7349	<p><b>Incorrect login rights for configuration file</b> The user group logged in does not have the user rights necessary to be able to import a configuration.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Log in as Installer.</li> <li>• Import configuration file again.</li> </ul>
7350	<p><b>Transfer of a configuration file has started</b> The configuration file is being transferred.</p>
7351	<p><b>Update Wi-Fi</b> The inverter is updating the Wi-Fi module.</p>
7352	<p><b>Update of Wi-Fi not successful</b> The update of the Wi-Fi module failed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Retry update.</li> <li>• If this message is displayed again, contact the Service.</li> </ul>
7353	<p><b>Update time zone database</b> The inverter is updating the time zone database.</p>

Event number	Message, cause and corrective measures
7354	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Update of time zone database not successful</b> The update of the time zone database failed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"><li>• Retry update.</li><li>• If this message is displayed again, contact the Service.</li></ul>
7355	<p><b>Update WebUI</b> The inverter is updating the inverter user interface.</p>
7356	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Update of the WebUI not successful</b> The update of the inverter user interface failed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"><li>• Retry update.</li><li>• If this message is displayed again, contact the Service.</li></ul>
7601	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Communication impaired &gt; Communication error IPC</b> There is an error in the inverter.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"><li>• Contact the Service.</li></ul>
7602	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Communication impaired</b> Device-internal CAN communication is missing in the device at Lxx.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"><li>• Ensure that the terminators in the communication bus are attached.</li><li>• Ensure that undamaged CAT5e cables are used for communication and that the cables are plugged in correctly.</li><li>• Contact the Service.</li></ul>
7608	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Communication impaired</b> Cluster-internal communication to the device at line conductor Lxx is interrupted.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"><li>• Ensure that undamaged CAT5e cables are used for communication and that the cables are plugged in correctly.</li><li>• Ensure that the communication bus is equipped with a terminator at both ends.</li></ul>

Event number	Message, cause and corrective measures
7609	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Communication impaired</b> Communication with an energy meter is faulty.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the optical probe is correctly installed and connected.</li> </ul>
7611	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Communication impaired</b> A protocol that is not supported has been recognized on 1 energy meter.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
7613	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>CAN communication with energy meter is faulty.</b> Communication with an energy meter is faulty.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the data cables are correctly installed.</li> </ul>
7616	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Communication impaired</b> Device-internal communication of the device at Lxx is disturbed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
7617	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Communication with MC-BOX interrupted</b> Communication with Multicluster Box is interrupted.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that undamaged CAT5e cables are used for communication and that the cables are plugged in correctly.</li> <li>• Ensure that the communication bus is equipped with a terminator at both ends.</li> </ul>
7618	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Communication impaired</b> CAN communication within the cluster is faulty. Device-internal communication pulse is missing on at least 1 device (line conductor L2 or L3).</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that undamaged CAT5e cables are used for communication and that the cables are plugged in correctly.</li> <li>• Ensure that the communication bus is equipped with a terminator at both ends.</li> </ul>



Event number	Message, cause and corrective measures
7619	<p><b>Communication fault with meter unit</b></p> <p>The inverter is not receiving any data from the energy meter.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the energy meter is correctly integrated into the same network as the inverter (see energy meter manual).</li> <li>• Establish connection between the inverter and the DHCP server (router) via Ethernet.</li> </ul>
7620	<p><b>Communication with grid power meter faulty</b></p> <p>The inverter is not receiving any data from the energy meter.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the energy meter is correctly integrated into the same network as the inverter (see energy meter manual).</li> <li>• Establish connection between the inverter and the DHCP server (router) via Ethernet.</li> </ul>
7716	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Section switch does not open</b></p> <p>Tie switch does not open.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the triggering of the tie switch is correct.</li> <li>• Ensure that the tie switch is correctly wired.</li> <li>• Ensure that the feedback contact is correctly connected.</li> </ul>
7717	<p><b>Device fault</b></p> <p>Neutral conductor relay of the device at Lxx does not open.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
7718	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Interference device</b></p> <p>Transfer relay does not open at line conductor Lxx. A bypass switch may have bridged the internal transfer relay.</p> <ul style="list-style-type: none"> <li>• Ensure that the bypass switch is in the position for operation with Sunny Island.</li> <li>• Ensure that the connections <b>AC1</b> and <b>AC2</b> are not bridged.</li> </ul>
7719	<p><b>Plausibility check MC-BOX failed</b></p> <p>Plausibility check on the contactors in the Multicluster-Box has failed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>

Event number	Message, cause and corrective measures
8003	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Derating occurred</b> The inverter at Lxx reduces the battery charging current due to overheating.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Reduce the total power of the loads, e.g. by staggering their use over time.</li> <li>• Clean the fan (see Section 11.7, page 97).</li> <li>• If the inverter reduces its power often, increase the power (install a more powerful device type or more inverters of the same type).</li> </ul>
8101	<b>Communication impaired</b>
8102	The cause must be determined by the Service.
8103	<b>Corrective measures:</b>
8104	<ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
8609	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>A slave is in error state, cluster is stopped</b> A slave has a fault status, cluster is stopped.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Read off the pending and logged warnings and errors and eliminate the causes.</li> <li>• Contact the Service.</li> </ul>
8610	<b>⚠ QUALIFIED PERSON</b>
8611	<p><b>Error in the cluster configuration</b> The addresses of the slaves in the cluster are incorrect.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Change the addresses of the slaves in the cluster.</li> </ul>
8612	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>No message from cluster master (only slave)</b> Communication to the master is interrupted.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that undamaged CAT5e cables are used for communication and that the cables are plugged in correctly.</li> <li>• Ensure that the communication bus is equipped with a terminator at both ends.</li> </ul>
8613	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Cluster incomplete</b> Voltage of the main cluster cannot be measured at Lxx.</p> <p><b>Corrective measures</b></p> <ul style="list-style-type: none"> <li>• Ensure that all circuit breakers of the Sunny Island inverters in the Multicluster-Box are closed.</li> <li>• Ensure that the cabling at connection <b>AC1</b> is correctly installed.</li> </ul>

Event number	Message, cause and corrective measures
8615	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Box encoding does not correspond to software settings</b></p> <p>Box coding conflicts with software settings: Configuration of the Sunny Island inverters does not match the Multicluster-Box.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check whether the value set for parameter <b>Type of AC subdistribution</b> matches the connected Multicluster-Box.</li> <li>• If the value does not match, restart the installation assistant.</li> <li>• Contact the Service.</li> </ul>
8616	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Cluster incomplete</b></p> <p>Due to a short circuit on the load side, the supply voltage of the Sunny Island at line conductor Lxx drops and can no longer be maintained. This causes the voltage supply of contactor <b>Q10/Q110</b> of the Multicluster-Box to fail.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Eliminate the short circuit.</li> </ul>
8617	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Extension clusters have a country data set configured that is different to that of the main cluster</b></p> <p>At least in 1 extension cluster, the Sunny Islands are set to another country standard than the Sunny Islands in the main cluster.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Set the same country standard (<b>Country standard set</b> parameter) in all Sunny Island inverters in the main cluster and in the extension cluster.</li> </ul>
8618	<b>System failure</b>
8619	<p>Tie contactor or tie switch does not open.</p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
8620	<p><b>System failure</b></p> <p>At least 1 extension cluster has another firmware version than the main cluster.</p> <ul style="list-style-type: none"> <li>• Update the firmware.</li> </ul>
8706	<b>System control: Setpoint spec. activated</b>
8707	<b>System control: Setpoint spec. deactivated</b>
8716	<b>Inverter switches to energy saving mode because battery range reached</b>
29001	<b>Grid Guard code valid</b>

Event number	Message, cause and corrective measures
9002	<p><b>SMA Grid Guard code invalid</b></p> <p>The SMA Grid Guard code entered is incorrect. The operating parameters are still protected and cannot be changed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Enter the correct SMA Grid Guard code.</li> </ul>
9003	<p><b>Grid parameter locked</b></p> <p>Changes to the grid-relevant parameters are now blocked. In order to be able to make changes to the grid parameters, from now on you must log in using the SMA Grid Guard code.</p>
29004	<p><b>Grid parameters unchanged</b></p>
9301	<p><b>Reset battery management due to new battery</b></p>
9308	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Battery error</b></p> <p>The timeout monitoring system of the battery management has triggered</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> <li>• Ensure that the data cable of the external lithium-ion battery is connected correctly.</li> <li>• Ensure that the terminators of the CAN bus in the communication bus are attached.</li> </ul>
9313	<p><b>Battery error</b></p> <p>The lower limit of the temperature range approved by the battery manufacturer has been undercut.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the ambient conditions of the battery manufacturer are complied with.</li> </ul>
9314	<p><b>Battery error</b></p> <p>The upper limit of the temperature range approved by the battery manufacturer has been exceeded.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the ambient conditions of the battery manufacturer are complied with.</li> </ul>
9318	<p><b>Emergency charge</b></p>
9319	<p><b>Status change to battery float charge</b></p>
9320	<p><b>Status change to battery boost charge</b></p>
9321	<p><b>Status change to battery full charge</b></p>
9322	<p><b>20 percent calibration being executed</b></p> <p>In the event that the Sunny Island detects an unexpectedly sharp battery voltage drop during electric discharge, resulting in a lower battery voltage for the given discharging current than expected at a certain state of charge, a recalibration of the state of charge to 20% will be performed. Frequent state of charge recalibrations to 20% may be caused by poor battery maintenance, aged batteries, or installation errors (see technical information "Battery Management").</p>

Event number	Message, cause and corrective measures
9324	<p><b>Battery error</b></p> <p>Current battery capacity (SOH) is below 70%.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Verify the plausibility of the error message.</li> <li>• Replace the battery if necessary.</li> </ul>
9325	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Battery error</b></p> <p>A 20% recalibration of the battery state of charge has been performed with a jump of more than 10%.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check the battery.</li> </ul>
9326	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Battery error</b></p> <p>Battery protection mode 1, 2 or 3 is activated.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Disconnect the loads, start the generator, start the Sunny Island and charge the battery.</li> </ul>
9331	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Battery error</b></p> <p>Battery voltage in the Sunny Island at Lxx is above the permissible measurement range.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check whether the value set for the parameter <b>Battery voltage</b> is above 65.0 V. If the value is above 65.0 V, check the settings of the DC sources and ensure that the battery capacity is sufficient. Observe the technical data for the battery at the DC connection.</li> <li>• Ensure that the DC sources are correctly connected and configured.</li> <li>• For off-grid systems: ensure that all SMA inverters are configured to the country data set for stand-alone mode.</li> </ul>
9332	<p><b>Battery error</b></p> <p>External battery management has been detected but not configured.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Start the installation assistant and configure a new system with external energy management (e.g., system with lithium-ion battery).</li> </ul>
9333	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Battery error</b></p> <p>Measured battery voltage in the Sunny Island at Lxx is below the permissible measurement range. The usable battery capacity may be too small, e.g., due to aging.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Charge the battery.</li> <li>• Ensure that all battery cells are functional.</li> </ul>

Event number	Message, cause and corrective measures
9341	<b>Status change to battery equalization charge</b>
9362	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Battery error</b></p> <p>The area for protection against deep discharge (<b>Deep discharge protection area</b>) or the area for protection during deep discharge (<b>Deep discharge area</b>) has been reached.</p> <p>A fuse may have tripped at the grid-connection point.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Activate the fuse.</li> <li>• Replace the fuse if necessary.</li> </ul> <p>The utility grid may not work within the set system limits.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check whether the grid parameters is still within the set system limits.</li> <li>• Contact the grid operator if necessary.</li> </ul>
9401	<b>Energy saving mode of slaves in single-phase parallel operation</b>
9402	<b>Energy saving at the grid</b>
9403	<b>Energy saving mode start</b>
9404	<b>Energy saving mode stop</b>
9601	<b>Digital input at [xx] has changed its status to [xx]</b>
10001	<b>Parallel grid operation</b>
10003	<b>Operation status</b>
10004	<b>Cold start status</b>
10006	<b>Startup status</b>
10007	<b>Stop status</b>
10010	<b>Restart diagnosis system in device</b>
10060	<b>Operation at generator (at external input)</b>
10061	<b>Feeding network op (at external input)</b>
10100	<p><b>Parameter [xx] set successfully. [xx] to [xx]</b></p> <p>The displayed parameter was successfully changed.</p>
10101	<p><b>Setting of parameter [xx] failed. [xx] to [xx]</b></p> <p>The displayed parameter was not changed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure thresholds of the parameters are complied with.</li> <li>• Change the parameter again.</li> </ul>
10102	<p><b>Parameter [xx] set successfully. [xx] to [xx]</b></p> <p>The displayed parameter was successfully changed.</p>

Event number	Message, cause and corrective measures
10103	<p><b>Setting of parameter [xx] failed. [xx] to [xx]</b></p> <p>The displayed parameter was not changed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure thresholds of the parameters are complied with.</li> <li>• Change the parameter again.</li> </ul>
10108	<b>Time adjusted / old time</b>
10109	<b>Time adjusted / new time</b>
10110	<b>Time synchronization failed: [xx]</b>
10114	<p>No time information could be called up from the set NTP server.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the NTP server was configured correctly.</li> <li>• Ensure that the inverter is integrated into a local network with Internet connection.</li> </ul>
10117	<p><b>Invalid date &gt; Set time and date</b></p> <p>System time is invalid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Set the <b>Date and Device Time</b> via the installation assistant.</li> </ul>
10118	<p><b>Parameter upload successfully performed</b></p> <p>The configuration file was loaded successfully.</p>
10121	<b>Setting of parameter [xx] failed. Device must be stopped first</b>
10122	<b>Setting of parameter Lxx failed. Installation assistant must be started</b>
10248	<b>Network busy &gt; Network overloaded</b>
10249	<p>The network is busy. Data exchange between the devices is not at an optimum and is greatly delayed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Reduce the number of devices in the network.</li> <li>• If necessary, increase the data query intervals.</li> <li>• If necessary, reduce the number of devices in the network.</li> </ul>
10250	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Package error rate [ok / high]</b></p> <p>The package error rate has changed. If the package error rate is high, the network is overloaded or the connection to the network switch or DHCP server (router) is disturbed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged.</li> <li>• If necessary, increase the data query intervals.</li> <li>• If necessary, reduce the number of devices in the network. 12 Troubleshooting SMA Solar Technology AG 78</li> </ul>

Event number	Message, cause and corrective measures
10251	<p><b>Communication status goes to [OK / Warning / Error / Not connected]</b></p> <p>The communication status to the network switch or DHCP server (router) has changed. An additional error message may be displayed.</p>
10252	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Communication impaired</b></p> <p>There is no valid signal on the network line.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged.</li> <li>• Ensure that the DHCP server (router) and any network switches are signaling correct operation.</li> </ul>
10253	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Connection speed goes to [100 Mbit / 10 Mbit]</b></p> <p>The data transfer rate has changed. The cause for the status [10 Mbit] can be a defective plug, a defective cable or the pulling or plugging of the network connector.</p> <p><b>Corrective measures if the status is [10 Mbit]:</b></p> <ul style="list-style-type: none"> <li>• Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged.</li> <li>• Ensure that the DHCP server (router) and any network switches are signaling correct operation.</li> </ul>
10254	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Duplex mode goes to [Full / Half]</b></p> <p>The duplex mode (data transfer mode) has changed. The cause for the status [Half] can be a defective plug, a defective cable or the pulling or plugging of the network connector.</p> <p><b>Corrective measures if the status is [Half]:</b></p> <ul style="list-style-type: none"> <li>• Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged.</li> <li>• Ensure that the DHCP server (router) and any network switches are signaling correct operation.</li> </ul>
10255	<p><b>Network load OK</b></p> <p>The network load has returned to a normal range after being busy.</p>
10282	<p><b>[User group]-Login via [protocol] locked</b></p> <p>After several incorrect login attempts, login has been blocked for a limited time. In this case, the User login will be blocked for 15 minutes, the Grid Guard login for 12 hours.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Wait until the given time has expired and then retry login.</li> </ul>



Event number	Message, cause and corrective measures
10283	<p><b>Wi-Fi module faulty</b></p> <p>The Wi-Fi module integrated in the inverter is defective.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
10284	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>No Wi-Fi connection possible</b></p> <p>The inverter does not currently have a Wi-Fi connection to the selected network.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the SSID, the Wi-Fi password and the encryption method have been entered correctly. The encryption method is specified by your Wi-Fi router or Wi-Fi access point and can be changed there.</li> <li>• Ensure that the Wi-Fi router or Wi-Fi access point is in range and is signaling correct operation.</li> <li>• If this message is displayed often, improve the Wi-Fi connection by using a Wi-Fi repeater.</li> </ul>
10285	<p><b>Wi-Fi connection established</b></p> <p>Connection to the selected Wi-Fi network has been established.</p>
10286	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Wi-Fi connection lost</b></p> <p>The inverter has lost Wi-Fi connection to the selected network.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the Wi-Fi router or Wi-Fi access point is still active.</li> <li>• Ensure that the Wi-Fi router or Wi-Fi access point is in range and is signaling correct operation.</li> <li>• If this message is displayed often, improve the Wi-Fi connection by using a Wi-Fi repeater.</li> </ul>
10287	<p><b>Wi-Fi module detected</b></p>
10339	<p><b>Webconnect enabled</b></p> <p>The inverter can communicate with Sunny Portal without an additional SMA communications product (e.g. Sunny Home Manager).</p>
10340	<p><b>Webconnect disabled</b></p> <p>The Webconnect function has been switched off. This means that the inverter can not communicate with Sunny Portal without an additional SMA communications product (e.g. Sunny Home Manager).</p> <ul style="list-style-type: none"> <li>• If the inverter is to communicate with Sunny Portal without an additional SMA communication product, switch the Webconnect function on.</li> </ul>
10414	<p><b>Shutdown due to fault</b></p>
10415	<p><b>Automatic start</b></p>
10416	<p><b>Manual start (change-over from standby to op)</b></p>

Event number	Message, cause and corrective measures
10417	<b>Manual stop (change-over from op to standby)</b>
10418	<b>Ext. start via system control (chg-over from op to standby)</b>
10419	<b>Ext. stop via system control (chg-over from op to standby)</b>
10420	<b>Self-consumption control was started</b> The battery is automatically charged or discharged depending on the purchased electricity or the grid feed-in.
10421	<b>Self-consumption control was stopped</b> The automatic charging or discharging of the battery stopped due to an external control command.
10422	<b>Only charging operation in self-consumption mode</b> The battery is charged only when increased self-consumption is active. The battery is only charged again once there is sufficient PV power in the system.
10423	<b>Full or equalization charge with active increased self-consumption</b>
10424	<b>Switch back to increased self-consumption after completion of full or equalization charge</b>
10425	<b>The device switches off</b>
10426	<b>Multifunction relay [xx] of device at Lxx is [xx]</b>
10427	<b>Transfer relay [xx] of device at Lxx is [xx]</b>
10428	<b>Event [xx] of process interface</b>
10429	<b>Message from process interface: [xx]</b>
10517	<b>Dynamic active power limitation started.</b> The inverter limits the active power of the PV inverters to the set limit.
10518	<b>Dynamic active power limitation terminated.</b> The inverter terminated the active power limitation of the PV inverters.
10520	<b>⚠ QUALIFIED PERSON</b> <b>Supplied power: [xx] W (permitted value: [xx] W)</b> The set active power limitation cannot be met. <b>Corrective measures:</b> <ul style="list-style-type: none"> <li>• Ensure that the correct active power limitation has been configured.</li> <li>• Ensure that the PV inverters have been configured correctly.</li> <li>• Ensure that the communication between battery inverter and PV inverter functions perfectly.</li> <li>• Ensure that no external feeders are in the system.</li> </ul>
10521	<b>Active power was limited today for [xx] minutes.</b> The active power limitation of the PV inverters was limited for the specified time.

Event number	Message, cause and corrective measures
10528	<b>System password of the connected device  xx  invalid</b>
10704	<b>The current sensor is not connected, not available or defective</b> <b>Corrective measures:</b> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>

### 14.3 Providing Files for Troubleshooting

If you need to contact Service in case of a warning or error, always use the following procedure to provide the files for troubleshooting. Service requires these files in order to provide you with the necessary assistance.

#### Requirement:

- The menu 'Events' is open on the user interface.

#### Procedure:

1. Carry out the corrective measures defined for **Warning** or **Error** (see Section 14.2, page 144).
2. Deactivate the filters **Information** / **Warning** / **Error**. This will make the event messages available for export.
3. Export the event messages into a file and have it ready for transmission (see Section 10.2, page 124).
4. Export the service files and have them ready for transmission (see Section 10.3, page 124).
5. To answer any questions concerning the event, stay on site.
6. Contact Service (see Section 18, page 188).

### 14.4 Acknowledge Errors

If a disturbance (e.g. generator false starts are occurring too often) can lead to the system being permanently damaged, the inverter switches to the **Standby** operating state. To enable a restart of the system, you must eliminate the cause of the disturbance and acknowledge the error.

The basic procedure for changing operating parameters is explained in another section (see Section 8.6 "Changing Operating Parameters", page 116).

#### Requirements:

- The cause of the error must be eliminated.

#### Procedure:

1. Select **Device > Operation**.
2. Set **Reset operating data** to **Reset operation inhibition**.
3. Start the system (see Section 9.2, page 121).

### 14.5 Frequently Asked Questions (FAQs)

#### 14.5.1 Questions Regarding the Sunny Island

##### Why is the Sunny Island not switching off even though I have opened the load-break switch of the battery fuse?

The Sunny Island may still be supplied from the AC side.

#### **⚠ QUALIFIED PERSON**

- Switch off all AC sources and disconnect them from the Sunny Island.

### Why is the Sunny Island not switching to energy-saving mode?

Another function might have a higher priority than energy saving mode, e.g., equalization charge or full charge.

### After automatic disconnection in battery protection mode, the Sunny Island can no longer be started?

#### ⚠ QUALIFIED PERSON

- Charge the battery only when the Sunny Island cannot be switched on (see Section 13.7.2 "Charging the Lead-Acid Battery After Automatic Shutdown (Emergency Charge Mode)", page 135).
  - Switch off all loads.
  - If there is a generator in the system, start the generator manually. When doing so, observe the warm-up time of the generator. 5 minutes without charge current can result in disconnection of the Sunny Island inverter.
  - If sufficient power is available from the generator or the AC sources in the stand-alone grid, e.g., sufficient solar irradiation for PV inverters, switch the Sunny Island on. AC sources in the stand-alone grid can start feeding in electric current only once the Sunny Island has been started and is in operation.

### An IPC error is displayed during a firmware update?

- The display of an IPC error during a firmware update is normal (IPC - Internal Process Communication). The processors cannot communicate with each other during the firmware update.

### How can the Modbus interface be tested on Sunny Island?

#### ⚠ QUALIFIED PERSON

- Test the function of the Modbus interface with a Modbus program. Query simple registers (e.g. serial number).  
Tip: Record the settings in the Modbus program and the queried registers (e.g. with screenshots). The Service requires this information in order to be able to help you in a targeted matter.

## 14.5.2 Questions Regarding the Battery

### What happens if a battery is defective?

#### ⚠ QUALIFIED PERSON

- Remove the defective battery cell from the battery system. This reduces the rated voltage of the battery by the voltage of the battery cell.
- Start the installation assistant on the inverter user interface.
- Select [**Save and next**] up to the step **Battery configuration**.
- Select the button [**New battery configuration**].
- Set the parameter **Voltage** to the actual rated voltage of the battery (see Section 13.9 "Replacing the Battery", page 138).

### Why is the SOC of the battery not 100% after completion of full charge?

The power requirements of the loads might have been so high before completion of the full charge that the battery could not be charged to 100 percent.

- Where necessary, select **Battery > Charge** and set the parameter **Battery full charge time** to a longer time period.

### Why is the battery discharging even though the generator is running?

The Sunny Island may not have connected to the generator.

- Eliminate the cause (see Section 14.5.3 "Questions Regarding the Generator", page 173).

The power of the loads might exceed the power of the generator.

### What do you need to do after replacing a battery current sensor?

#### ⚠ QUALIFIED PERSON

- Calibrate the battery current sensor (see the Commissioning section in the Sunny Island inverter installation manual).

### May DC loads or DC energy sources be connected?

#### ⚠ QUALIFIED PERSON

- The DC terminal of the inverter is exclusively intended for the connection of a battery with external battery fuse. Only DC loads or DC energy sources that are immune to electromagnetic interference may be used.

### Why is the battery not charged with the maximum possible power?

Possibly the ambient temperature is too high or too low. With lithium-ion batteries, the battery management of the battery can also limit the charging power.

### Can the charging performance of the battery be influenced?

#### ⚠ QUALIFIED PERSON

- The charging capacity of the battery can be influenced by the maximum AC charging current. To do this, set **Device parameters > Device > Inverter > Maximum AC-charging current** to the value required.

## 14.5.3 Questions Regarding the Generator

### Why is the Sunny Island not connecting to the running generator?

A high output power of the Sunny Island inverter when the battery state of charge is low may lead to the Sunny Island not being able to raise the AC voltage in the stand-alone grid to the AC voltage of the generator. The Sunny Island cancels the synchronization.

- To charge the battery, reduce the power of the loads.

The generator voltage might not be within the thresholds for voltage and frequency.

- Check whether the voltage and frequency of the generator are within the thresholds set (see technical information "Parameters and Measured Values" at <http://www.SMA-Solar.com>).
  - If the voltage and frequency of the generator are not within the thresholds set, ensure that the fuse is not defective or that the circuit breaker is switched on.
  - If the voltage and frequency of the generator are only sometimes within the thresholds set, set the thresholds for the voltage and frequency of the generator voltage (see Sunny Island inverter installation manual).
  - If the voltage and frequency of the generator are within the thresholds set, the Sunny Island is in the warm-up period or is blocked for connection.

### Why does the Sunny Island connect to the generator for only a short time?

The generator may be overloaded.

- Select **Generator > Generator** and set the parameter **Rated generator current** to 75% of the rated current of the generator.
- If possible, reduce the power of the loads.

The maximum permissible generator voltage may be set too low.

#### ⚠ QUALIFIED PERSON

- Select **Generator > Generator** and set the parameter **Voltage monit. gener. upper maximum threshold** to the maximum generator voltage.

The minimum frequency for the generator voltage may be set too high.

#### **⚠ QUALIFIED PERSON**

- Select **Generator > Generator** and set the parameter **Frequency monit. generator lower minimum threshold** to the minimum frequency of the generator voltage.

It may be that the permissible time for reverse power was exceeded (see **Generator > Generator > Power monitoring > Volt. monit. gener. max. reverse power trip. time**).

- Check whether the warning **Reverse power prot. (generator)** has been entered in the menu **Events**.
- Select **Generator > Generator > Operation** and set the parameter **Acknowledge generator errors** to **Execute**. This acknowledges the generator error.

### **The Sunny Island does not reconnect to the generator after disconnection from the generator due to non-compliance with the thresholds for voltage and frequency – why?**

The Sunny Island is switched with a hysteresis, i.e., the thresholds for connection do not correspond to the thresholds for disconnection.

- To unload the generator, disconnect unnecessary loads.
- Wait until the voltage and frequency have reached the nominal values.

## **14.5.4 Questions Regarding Multicluster Systems**

### **Extension clusters remain in standby or energy-saving mode even though the main cluster is in inverter mode?**

The data cable between the masters of the individual clusters might not be connected. The master of the main cluster cannot forward the "Start" command to the masters of the extension clusters.

### **Why is the multicluster system not supplying full power?**

An extension cluster or individual Sunny Island inverters of an extension cluster might have failed.

### **Why are high levels of energy being transferred between the clusters in the multicluster system?**

The state of charge of the batteries might differ temporarily. The off-grid system equalizes different states of charge automatically.

The nominal frequencies and nominal voltages may be defined differently.

- Select **Device > Inverter** and set the parameters **Inverter nominal voltage** and **Inverter nominal frequency** to the same value for all masters.

The battery capacities might differ significantly.

#### **⚠ QUALIFIED PERSON**

- Distribute the battery capacities to the clusters as evenly as possible.

Individual battery cells of a battery might have failed.

#### **⚠ QUALIFIED PERSON**

- Disconnect defective battery cells and set the new rated voltage and capacity (see Section 13.9 "Replacing the Battery", page 138).

## 14.6 Forgotten Password

If you have forgotten the password for the inverter, you can unlock the inverter with a Personal Unlocking Key (PUK). For each inverter, there is one PUK for each user group (**User** and **Installer**). Tipp: With PV systems that are registered in a communication product, you can also assign a new password for the user group **Installer** via the communication product. The password for the user group **Installer** is the same as the system password in the communication product.

### Procedure:

1. Request PUK (application form available at [www.SMA-Solar.com](http://www.SMA-Solar.com)).
2. Open the user interface (see Section 8.1, page 107).
3. Enter the PUK instead of the password into the field **Password**.
4. Select **Login**.
5. Call up the menu **Device Parameters**.
6. Click on [**Edit parameters**].
7. In the parameter group **User Rights > Access Control** change the password of the desired user group.
8. Select [**Save all**] to save the changes.

### **i** Password assignment for inverters that are registered in a communication product

The password for the user group **Installer** is also the system password for the system in the communication product. Changing the password of the user group **Installer** can lead to the inverter no longer being able to be reached by the communication product.

- In the communication product, assign the changed password of the user group **Installer** as the new system password (see the manual of the communication product).

## 14.7 Problems with streaming services

If you use the streaming service in your local network (in which the inverter is also included), there may be interference to the transfer of data. In this case, the IGMP settings of the inverter can be changed via operating parameters.

- Contact the Service and change IGMP settings in consultation with the Service department.

## 15 Decommissioning the Inverter

### ⚠ QUALIFIED PERSON

### ⚠ DANGER

#### Danger to life due to electric shock when live components or cables are touched

High voltages are present in the conductive components or cables of the product. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Disconnect the product from voltage sources and make sure it cannot be reconnected before working on the device.
- After disconnection, wait 15 minutes until the capacitors have discharged.
- Observe all safety information on components associated with the product.
- Wear suitable personal protective equipment for all work on the product.

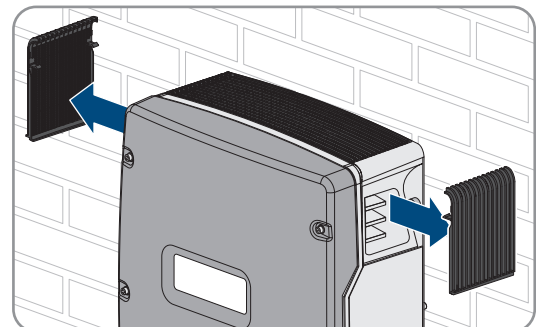
### ⚠ CAUTION

#### Risk of injury due to weight of product

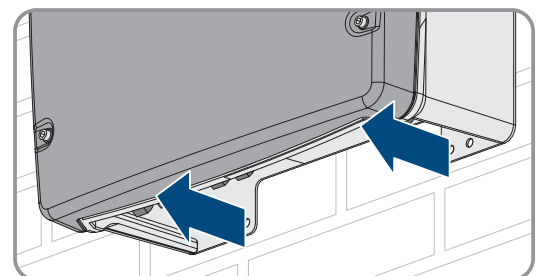
Injuries may result if the product is lifted incorrectly or dropped while being transported or mounted.

- Transport and lift the product carefully. Take the weight of the product into account.
- Wear suitable personal protective equipment for all work on the product.

1. Ensure that the inverter is disconnected from all voltage sources Disconnecting the Sunny Island from Voltage Sources.
2. Remove all cables from the inverter.
3. Close the inverter.
4. Remove the ventilation grids laterally.

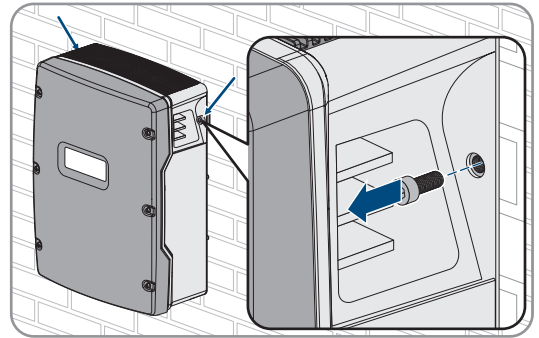


5. If the inverter is protected against theft, loosen the safety screws.

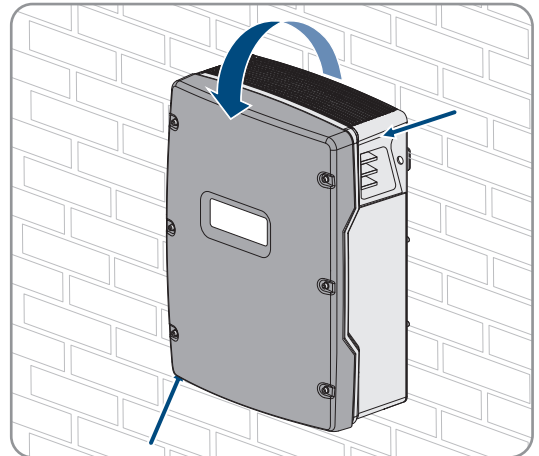




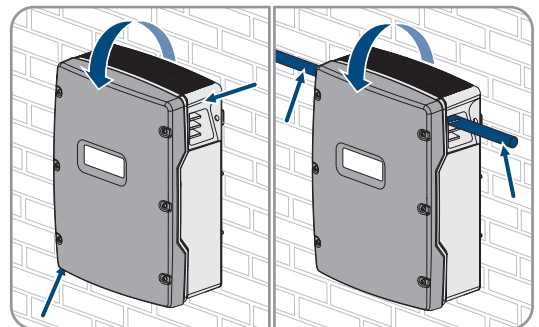
6. Loosen the screws on both sides between the inverter and the wall mounting bracket using an Allen key (AF 5).



7. Regarding SI4.4M-13: Remove the inverter by lifting it vertically up and off the wall mounting bracket. For this, use the side recess grips. Transport the inverter horizontally.



8. Regarding SI6.0H-13 and SI8.0H-13: Remove the inverter by lifting it vertically up and off the wall mounting bracket. For this, use the side recess grips or a steel rod (diameter: maximum 30 mm). Transport the inverter horizontally.



9. Remove the cable glands from the inverter.
10. If the inverter is to be stored or shipped, pack the inverter. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter.
11. Dispose of the inverter in accordance with the locally applicable disposal regulations for electronic waste.

## 16 Technical Data

### 16.1 AC1 Connection for Stand-Alone Grid

	SI4.4M-13	SI6.0H-13	SI8.0H-13
Rated power at 25°C	3300 W	4600 W	6000 W
Power for 30 minutes at 25°C	4400 W	6000 W	8000 W
Power for 5 minutes at 25°C	4600 W	6800 W	9100 W
Power for 1 minutes at 25°C	4800 W	7500 W	9600 W
Maximum AC power for 3 s at 25°C	5500 W	11000 W	11000 W
Only in single systems and single-cluster systems: Maximum connectable power of the PV inverters in off-grid systems and battery-backup systems*	6600 W	9200 W	12000 W
Maximum connectable AC power in the stand-alone grid with the use of AC sources**	3300 W	4600 W	6000 W
Rated grid voltage	230 V	230 V	230 V
Voltage range	202 V to 253 V	202 V to 253 V	202 V to 253 V
Rated frequency	50 Hz	50 Hz	50 Hz
Frequency range	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
Rated Current	14.5 A	20.0 A	26.1 A
Maximum output current as a peak value for 60 mil- liseconds	60 A	120 A	120 A
Total harmonic distortion of the output voltage (THD)	<5 %	<1.5 %	<1.5 %
Power factor at rated power	-1 to +1	-1 to +1	-1 to +1
Recommended conductor cross-section	10 mm <sup>2</sup>	10 mm <sup>2</sup>	10 mm <sup>2</sup>
Maximum connectable conductor cross-section	16 mm <sup>2</sup>	16 mm <sup>2</sup>	16 mm <sup>2</sup>
Cable diameter	9 mm to 18 mm	9 mm to 18 mm	9 mm to 18 mm
Terminal	Lever terminal	Lever terminal	Lever terminal
Trip-capable miniature circuit breakers	Tripping character- istics B6	Tripping character- istics B16 or C6	Tripping character- istics B16 or C6
Short circuit power of the device	13.8 kW	27.6 kW	27.6 kW
Maximum fuse size per Sunny Island	50 A	50 A	50 A

\* In multicluster systems, the Multicluster-Box specifies the maximum connectable output of the PV inverters (for technical data, see the Multicluster-Box operating manual at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

\*\* AC sources that can not be regulated by the Sunny Island (e.g. CHP plant)

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

	<b>SI4.4M-13</b>	<b>SI6.0H-13</b>	<b>SI8.0H-13</b>
Maximum power in an off-grid system	11 500 W	11 500 W	11 500 W
Rated voltage	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
Rated frequency	50 Hz	50 Hz	50 Hz
Permitted frequency range	40 Hz to 70 Hz	40 Hz to 70 Hz	40 Hz to 70 Hz
Maximum AC current for increased self-consumption (grid operation)	14.5 A	20.0 A	26.0 A*
Maximum AC power for increased self-consumption (grid operation)	3.3 kVA	4.6 kVA	6.0 kVA*
Displacement power factor $\cos \varphi$	-0.8 to +0.8	-0.8 to +0.8	-0.8 to +0.8
Maximum AC input current (off-grid system)	50 A	50 A	50 A
Maximum inrush current for 4 ms	$\pm 3.6$ A	$\pm 1$ A	$\pm 1$ A
Maximum connectable power of the PV inverters in battery-backup systems	5000 W	9200 W	12000 W
Recommended conductor cross-section	10 mm <sup>2</sup>	10 mm <sup>2</sup>	10 mm <sup>2</sup>
Maximum connectable conductor cross-section	16 mm <sup>2</sup>	16 mm <sup>2</sup>	16 mm <sup>2</sup>
Cable diameter	9 mm to 18 mm	9 mm to 18 mm	9 mm to 18 mm
Terminal	Lever terminal	Lever terminal	Lever terminal
Maximum back-up fuse	50 A	50 A	50 A

\* different limitation depending on the configured country data set (e.g., VDE-AR-N 4104:2018= 4.6 kVA and 20 A)

## 16.3 DC Connection for Battery

	<b>SI4.4M-13</b>	<b>SI6.0H-13</b>	<b>SI8.0H-13</b>
Rated input voltage	48 V	48 V	48 V
Voltage range	41 V to 63 V	41 V to 63 V	41 V to 63 V
Rated charging current	63 A	90 A	115 A
Rated discharging current	75 A	103 A	136 A
Maximum battery charging current	75 A	110 A	140 A
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 *

	SI4.4M-13	SI6.0H-13	SI8.0H-13
Battery capacity range of lead-acid batteries	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
Recommended minimum battery capacity C10 in systems for increased self-consumption	100 Ah	100 Ah	100 Ah
Recommended minimum battery capacity C10 in battery-backup systems	100 Ah	120 Ah	160 Ah
Recommended minimum battery capacity C10 in off-grid systems	150 Ah	190 Ah	250 Ah
Minimum capacity recommended for lead-acid batteries C10 per 1000 Wp output of the PV system in off-grid systems	100 Ah	100 Ah	100 Ah
Minimum capacity recommended for lithium-ion batteries C10 per 1000 Wp output of the PV system in off-grid systems	50 Ah	50 Ah	50 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
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
Permitted conductor cross-section:	50 mm <sup>2</sup> to 95 mm <sup>2</sup> **	50 mm <sup>2</sup> to 95 mm <sup>2</sup> **	50 mm <sup>2</sup> to 95 mm <sup>2</sup> **
Maximum connectable conductor cross-section	95 mm <sup>2</sup> **	95 mm <sup>2</sup> **	95 mm <sup>2</sup> **
Cable diameter	14 mm to 25 mm	14 mm to 25 mm	14 mm to 25 mm
Torque	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 Batteries").

\*\* In the event of a cross-section of 95 mm<sup>2</sup>, observe the maximum cable diameter.

## 16.4 Efficiency

	SI4.4M-13	SI6.0H-13	SI8.0H-13
Maximum efficiency	95.3 %	95.8 %	95.8 %
European weighted efficiency	94.0 %	94.3 %	94.1 %

### 16.5 Sunny Island 4.4M Efficiency Profile

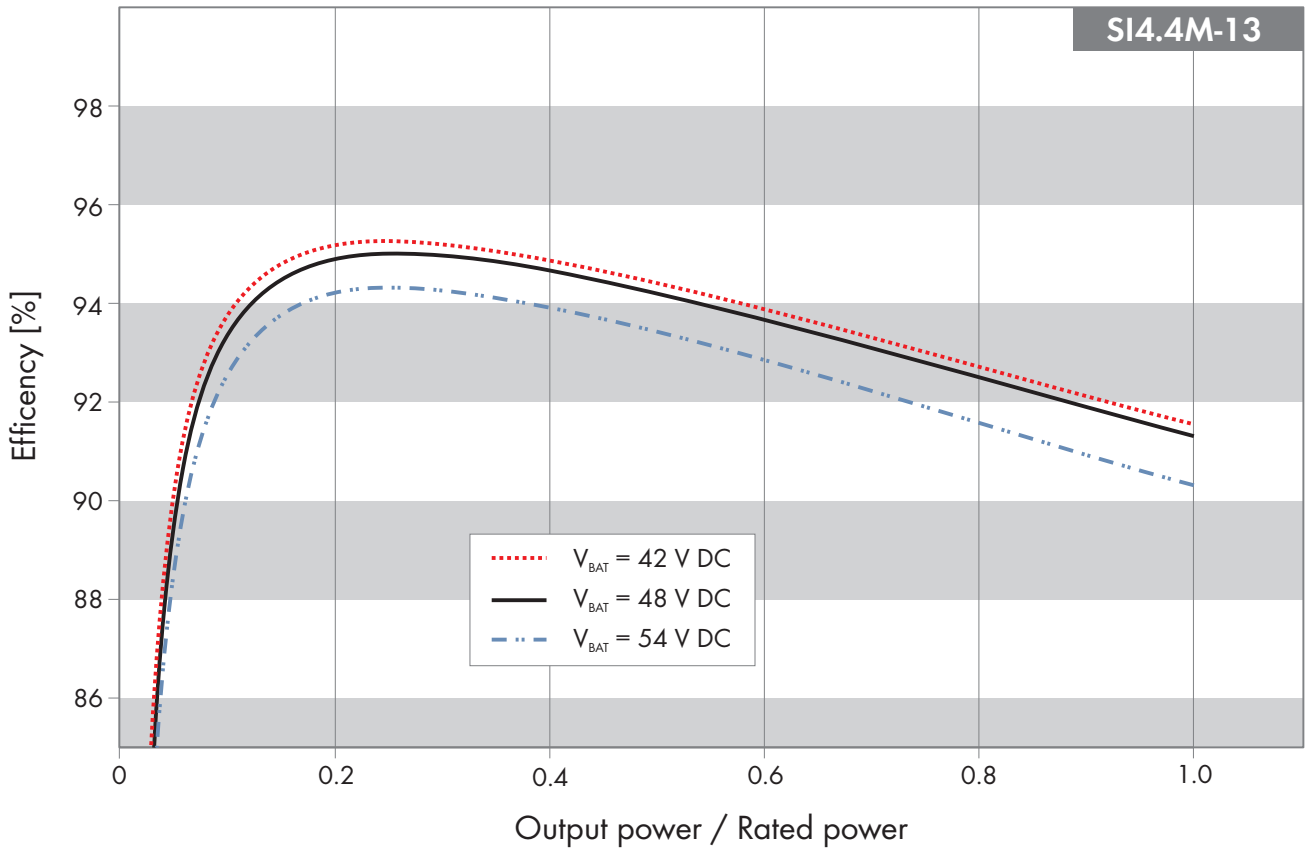


Figure 27: Characteristic efficiency curve

### 16.6 Sunny Island 6.0H Efficiency Profile

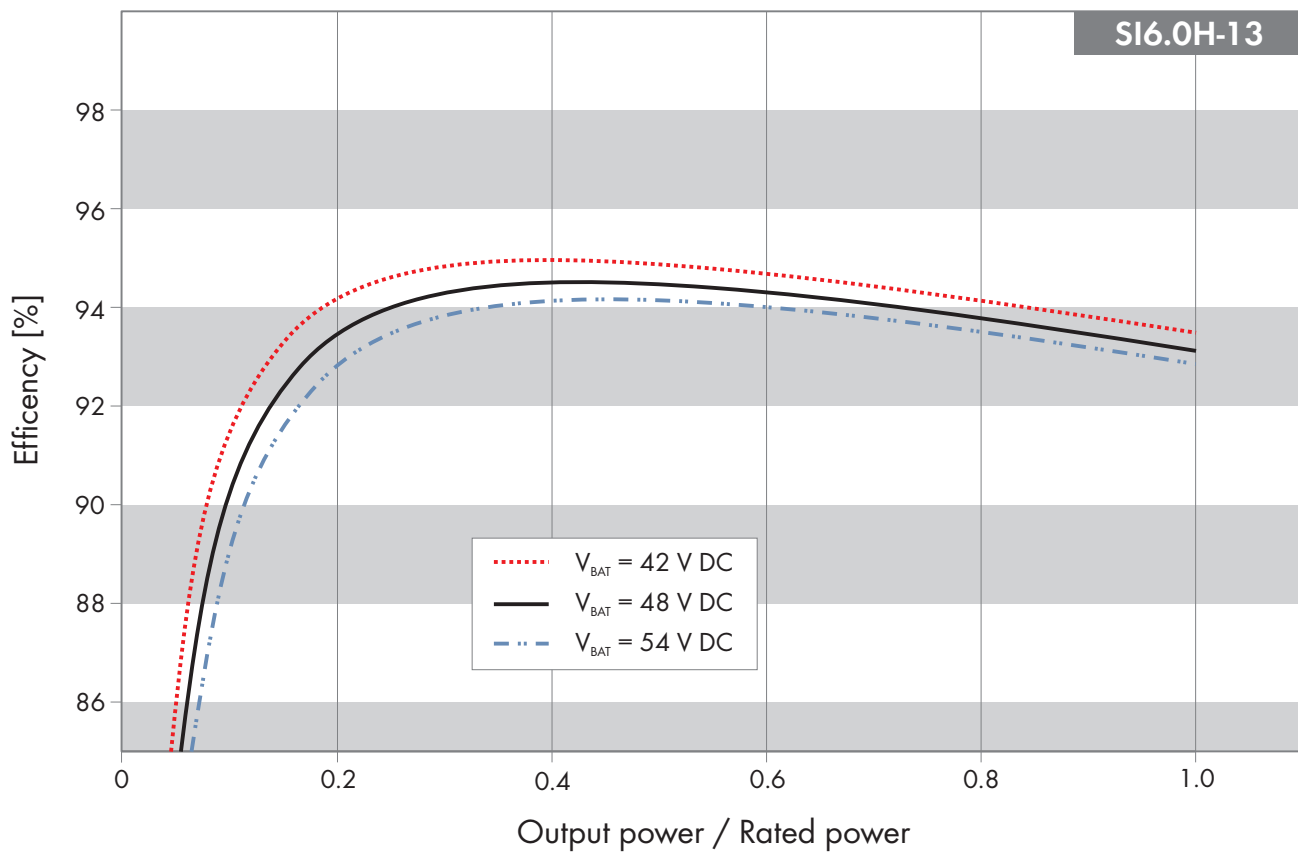


Figure 28: Characteristic efficiency curve

### 16.7 Sunny Island 8.0H Efficiency Profile

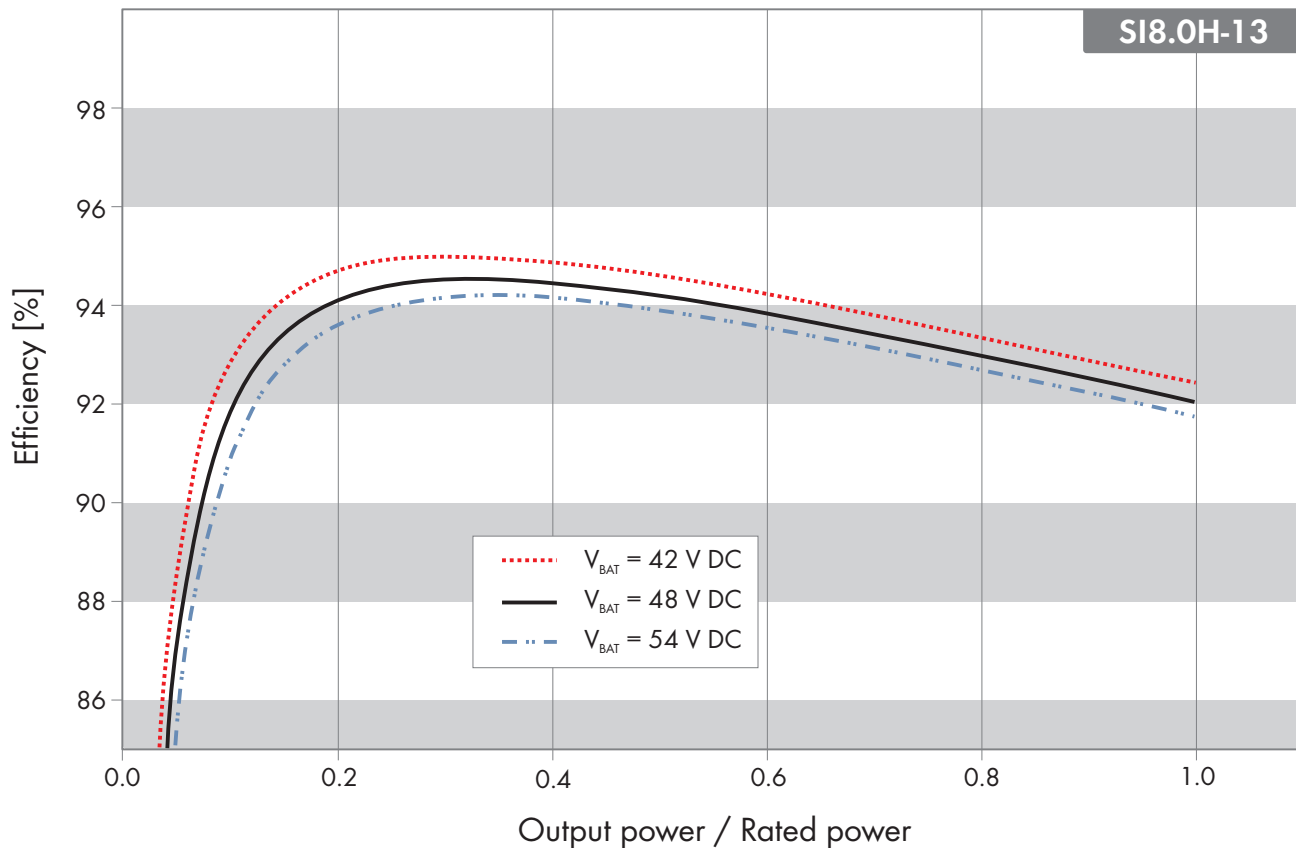


Figure 29: Characteristic efficiency curve

### 16.8 Switchover times of the Sunny Island 6.0H / 8.0H

Switchover time of the inverter for high-impedance switching\* 0 ms

Switchover time of the inverter for low-impedance switching\* 20 ms

\* For the entire system, the switchover times of the automatic transfer switching device or Multicluster-Box must also be taken into account.

### 16.9 Energy Consumption in No-Load Operation and Standby or Energy-Saving Mode

	SI4.4M-13	SI6.0H-13	SI8.0H-13
Consumption in standby or energy-saving mode	6.8 W	6.5 W	6.5 W
Consumption in no-load operation and in discharge mode	18.0 W	25.8 W	25.8 W

### 16.10 Noise Emission

Noise emission, typical 49 dB(A)

### 16.11 Grid Configuration

TN-S grid configuration Suitable

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

This grid configuration is used in battery-backup systems and systems for increased self-consumption (not for off-grid systems). When using systems with MC-BOX-12.3-20, a GRID-BOX-12.3-20 must be installed.

TT grid configuration	Suitable
-----------------------	----------

## 16.12 Protective Devices

AC short-circuit	yes
------------------	-----

AC overload	yes
-------------	-----

DC reverse polarity protection	not available
--------------------------------	---------------

Battery deep discharge	yes
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Overtemperature	yes
-----------------	-----

Overvoltage category in accordance with IEC 60664-1	III
---	-----

## 16.13 Equipment

Number of buttons	3
-------------------	---

Number of LEDs	3 two-color LEDs
----------------	------------------

Number of interface slots	1
---------------------------	---

COM SYNC	for internal communication only
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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	$\pm 10\%$
--	------------

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
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DC load switching limit for multifunction relays 1 and 2	(see Section 16.15, page 185)
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## 16.14 Data Storage Capacity

	With internal inverter memory	With optional micro SD card
Instantaneous values recorded per second over one day (1 file for 1 day)	-	over two months
Instantaneous values recorded over the duration of five minutes over one day (1 file for 1 day)	64 days	-
Event messages	1024	Inverter service life
Instantaneous values recorded per second over two minutes before and after each error (1 file per error)	For 50 errors	For 50 errors

## 16.15 DC Load Limitation Curve of the Multifunction Relays

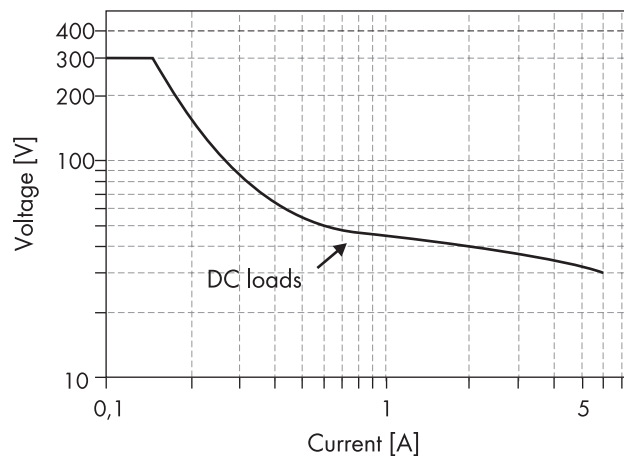


Figure 30: DC load limitation curve of multifunction relays 1 and 2

## 16.16 General Data

	SI4.4M-13	SI6.0H-12 / SI8.0H-13
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
Leakage current	2.22 mA	2.22 mA
Cooling method	SMA OptiCool	SMA OptiCool
Protection class in accordance with IEC 62103	I	I

	<b>SI4.4M-13</b>	<b>SI6.0H-12 / SI8.0H-13</b>
Climatic category in accordance with IEC 60721	3K6	3K6
Degree of protection in accordance with IEC 60529	IP54	IP54
Radio technology	WLAN 802.11 b/g/n	WLAN 802.11 b/g/n
Radio spectrum	2.4 GHz	2.4 GHz
Maximum transmission power	100 mW	100 mW

## 17 Spare Parts and 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.

<b>Designation</b>	<b>Brief description</b>	<b>SMA order number</b>
SI-SYSCAN.BGx	Communication interface for communication between clusters in a multicluster system	SI-SYSCAN-NR
BAT-TEMP-SENSOR	Battery temperature sensor of the type KTY with connection line (length: 10 m)	BAT-TEMP-SENSOR

## 18 Contact

If you have technical problems with our products, please contact the SMA Service Line. The following data is required in order to provide you with the necessary assistance:

- Battery inverter:
  - Device type
  - Serial number
  - Firmware version
  - Event message
  - File with event messages for troubleshooting
  - Service files for troubleshooting
  - Type and size of additional energy sources
  - Type, power and maximum current for the generator (if present)
  - Optional equipment, e.g. communication products
- Batteries:
  - Type
  - Nominal capacity and nominal voltage (with lead-acid batteries)

Deutschland	SMA Solar Technology AG	Belgien	SMA Benelux BVBA/SPRL
Österreich	Niestetal	Belgique	Mechelen
Schweiz	Sunny Boy, Sunny Mini Central, Sunny Tripower, Sunny Highpower: +49 561 9522-1499	België	+32 15 286 730
	Monitoring Systems, SMA EV Charger: +49 561 9522-2499	Luxemburg	for Netherlands: +31 30 2492 000
	Hybrid Controller: +49 561 9522-3199	Luxembourg	SMA Online Service Center: www.SMA-Service.com
	Sunny Island, Sunny Boy Storage, Sunny Backup: +49 561 9522-399	Nederland	
	Sunny Central, Sunny Central Storage: +49 561 9522-299	Česko	SMA Service Partner TERMS a.s +420 387 6 85 111
	SMA Online Service Center: www.SMA-Service.com	Magyarország	SMA Online Service Center: www.SMA-Service.com
		Slovensko	
		Türkiye	SMA Service Partner DEKOM Telekomünikasyon A. Ş +90 24 22430605
			SMA Online Service Center: www.SMA-Service.com
France	SMA France S.A.S.	Ελλάδα	SMA Service Partner AKTOR FM.
	Lyon	Κύπρος	Αθήνα
	+33 472 22 97 00		+30 210 8184550
	SMA Online Service Center: www.SMA-Service.com		SMA Online Service Center: www.SMA-Service.com
España	SMA Ibérica Tecnología Solar, S.L.U.	United Kingdom	SMA Solar UK Ltd.
Portugal	Barcelona		Milton Keynes
	+34 935 63 50 99		+44 1908 304899
	SMA Online Service Center: www.SMA-Service.com		SMA Online Service Center: www.SMA-Service.com

Italia	SMA Italia S.r.l. Milano +39 02 8934-7299 SMA Online Service Center: www.SMA-Service.com	Australia	SMA Australia Pty Ltd. Sydney Toll free for Australia: 1800 SMA AUS (1800 762 287) International: +61 2 9491 4200
United Arab Emirates	SMA Middle East LLC Abu Dhabi +971 2234 6177 SMA Online Service Center: www.SMA-Service.com	India	SMA Solar India Pvt. Ltd. Mumbai +91 22 61713888
ไทย	Service Partner for String inverter: Solar Power Engineering Co., Ltd. 333/7,8,9 United Tower Building 4th floor. Soi Sukhumvit 55 (Thonglor 17), Klongton Nua, Wattana, 10110 Bangkok, Thailand +66 20598220 smaservice@spe.co.th Service Partner for Utility: Tirathai E & S Co., Ltd 516/1 Moo 4, Bangpoo Industrial Estate Sukhumvit Road, T. Praksa, A. Muang 10280 Samutprakarn, Thailand +63 1799866 servicepartner.sma@tirathai.co.th	대한민국	Enerone Technology Co., Ltd 4th Fl, Jungbu Bldg, 329, Yeongdong-daero, Gangnam-gu, Seoul, 06188, Korea +82-2-520-2666
		Argentina Brasil Chile Perú	SMA South America SPA Santiago de Chile +562 2820 2101
		South Africa	SMA Solar Technology South Africa Pty Ltd. Cape Town 08600SUNNY (08600 78669) International: +27 (0)21 826 0699 SMA Online Service Center: www.SMA-Service.com
Other countries	International SMA Service Line Niestetal 00800 SMA SERVICE (00800 762 7378423) SMA Online Service Center: www.SMA-Service.com		

## 19 EU Declaration of Conformity

within the scope of the EU directives



- Electromagnetic compatibility 2014/30/EU (29.3.2014 L 96/79-106) (EMC)
- Low Voltage Directive 2014/35/EU (29.3.2014 L 96/357-374) (LVD)
- Radio Equipment Directive 2014/53/EU (22.5.2014 L 153/62) (RED)
- Restriction of the use of certain hazardous substances 2011/65/EU (L 174/88, June 8, 2011) and 2015/863/EU (L 137/10, March 31, 2015) (RoHS)

SMA Solar Technology AG confirms herewith that the products described in this document are in compliance with the fundamental requirements and other relevant provisions of the above-mentioned directives. The entire EU Declaration of Conformity can be found at [www.SMA-Solar.com](http://www.SMA-Solar.com).



