Stand-alone grid inverter

SUNNY ISLAND 2012 / 2224

Technical Description

SI2012_2224-TEN091830 | 98-2005130 | Version 3.0

EN

Table of Contents

1 Notes on this Manual

This technical description explains the function as well as the correct mounting, installation and operation of a stand-alone grid system. It describes the Sunny Island 2012/2224 island inverters and the Sunny Remote Control 1 external display.

1.1 Validity

The technical description applies to the Sunny Island 2012/2224 firmware versions 3.0 and later (see section 4.2 "Type Label/Firmware Version" (page 19)).

You can read the firmware version of your Sunny Island 2012/2224 on the display using the "312.02 FwVer" parameter (see section 17.3 "Diagnosis" (page 160)).

The stand-alone grid system devices may only be operated within the intended area of application described in this documentation.

- The use of a stand-alone grid system to power life-sustaining medical devices is not permitted.
- The Sunny Remote Control 1 is suited only for installation in enclosed spaces (protection rating IP20).
- The Sunny Island 2012/2224 has been designed for use at elevations of up to 2600 m above sea level. Please contact SMA Solar Technology before using the device at elevations above 2600 m.

  A performance loss of 0.5 % per 100 m is to be expected starting at an elevation of 2000 m above sea level.

Do not use the stand-alone grid system devices for purposes other than those indicated in this technical description. Use of the devices for other purposes can void the warranty as well as damage both the devices and the system.

For further questions, you can call the Sunny Island hotline at

- +49 561 95 22 399
- E-mail: SunnyIsland.Service@SMA.de.

1.2 Target Group

This technical description is intended both for the installer and the operator of the stand-alone grid system. Some of the tasks described in this document must be performed only by qualified electricians and are labeled accordingly with warnings.

1.3 Storage of this Manual

The manuals for the stand-alone grid system and its installed components must be kept in the immediate vicinity of the Sunny Island so as to be accessible at all times.

1.4 Additional Information

You will find further information on special topics such as selecting and using PV inverters in stand-alone grid systems in the download area at www.SMA.de

1.5 Description of the Symbols Used

The following types of safety notices are used in this document:

DANGER!

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

WARNING!

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

CAUTION!

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

NOTICE!

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

Information

Information provides tips that are valuable for the optimal installation and operation of your product.

1.6 Syntax

The syntax specified here for menus and parameters applies throughout the entire document:

Menu: Menu number, hash and menu name (150# Meter Compact)

Parameter: Menu number, dot, parameter number and parameter name (150.01 GdRmgTm)

Information

The parameter names used comply with the international standards IEC 61850-7-4 and IEC 61400-25.

2 System Overview

The Sunny Island is a bidirectional inverter (battery inverter and charger) for stand-alone systems. The Sunny Island supplies loads on the stand-alone grid side and charges battery banks with the energy from grid-feeding units connected on the AC side.

High Efficiency

The comfortable support of AC and DC coupling as well as the expandability of the systems formed with the Sunny Island guarantee highest flexibility. In addition, innovative technology allows the Sunny Island to achieve a maximum efficiency of more than 93 %. Optimized for partial load operation it impresses with a low open-circuit and standby consumption. Due to the high overload capabilities and the integrated output management, there is no need to oversize the Sunny Island.

Multiple Phase / Parallel Connection Capabilities

The parallel operation of up to three devices on a single phase of a battery or of three devices on a three-phase system enables the Sunny Island to be used to set up stand-alone power supply systems with outputs of up to 9 kW.

Automatic Generator Control

Thanks to its sophisticated generator management it can control connected diesel generators in a particularly gentle and fuel-saving manner. It can also be integrated into the public grid. The Sunny Island can also deactivate loads automatically if the battery does not provide sufficient electrical energy.

Expanded Generator Management System

The Sunny Island possesses an expanded generator management system (see section 13.1 "Generator" (page 114)). If necessary, the Sunny Island and the generator can jointly supply loads; the sum of (nominal) power of both energy sources is available via the stand-alone grid.

Perfected Battery Management

The stand-alone grid's critical component, the battery, is monitored diligently and utilized optimally. The intelligent battery management precisely records the battery's charge level. This makes an improved utilization of the battery capacity possible, which also means that smaller and thus more cost-effective batteries can be used without affecting performance.

In order to prevent premature aging caused by incorrect charging and frequent deep discharge, the Sunny Island has an intelligent charge control and reliable deep discharge protection. Because of these functions the battery service life can be largely extended in comparison with simpler devices.

DC Fuse

WARNING!

The Sunny Island 2012/2224 has no internal DC fuse.

Install an external DC fuse between the Sunny Island and the battery (see section 7.2 "DC Connection" (page 37)).

As an external DC fuse, the BatFuse secures the Sunny Island's battery connection leads. Furthermore, the BatFuse allows the disconnection of the DC side of the Sunny Island.

NH fuse links

Diverse BatFuse versions, each with their particular fuse links, exist for the Sunny Island 2012 and the Sunny Island 2224 as well as for single-phase, single-phase parallel, or 3-phase systems. More information is available in the BatFuse installation guide. You can obtain the BatFuse as an accessory from SMA Solar Technology.

Easy Installation and Configuration

Despite the complex function of these battery inverters, the Sunny Island is easy to install and configure. All the settings required for operation can be quickly and easily programmed in a few steps using the "Quick Configuration Guide". By employing the concept of central operation referred to as "Single Point of Operation", the system/cluster parameters are only set on the master device, and all other devices automatically adopt the configuration.

Menu Navigation and Data Storage

The easy-to-understand menu navigation allows quick access to all important data, even while the system is running. The Sunny Island can be controlled easily with the Sunny Remote Control 1 (SRC-1) external display. An MMC/SD card provides uncomplicated system control, and thus makes any service work easier.

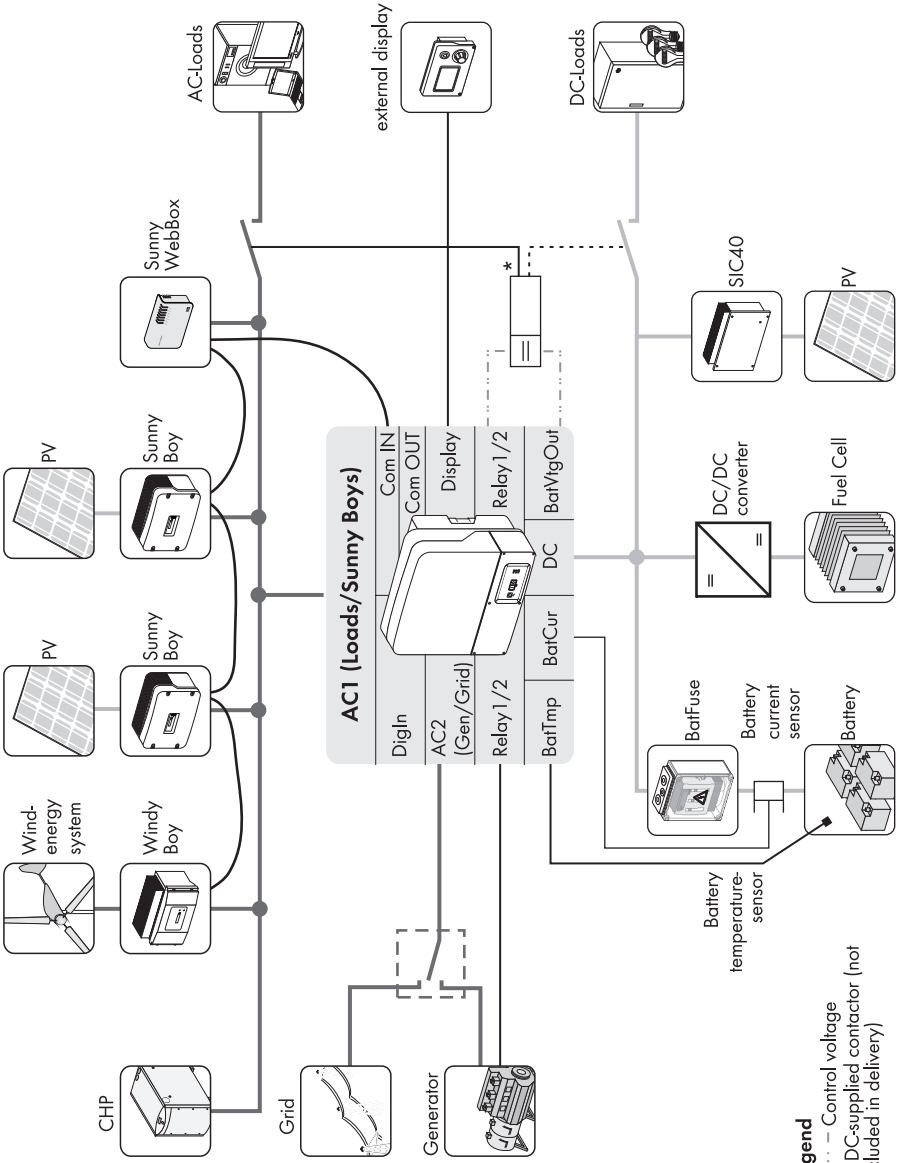
Saving data

Always use the MMC/SD card to save data and events. In case of a failure SMA Solar Technology can thus quickly help you.

The Sunny Island monitors the set voltage and frequency limits on the grid and generator. If these limits are not observed, it disconnects from the external source without interruption and changes to stand-alone grid operation. The Sunny Island also has an integrated anti-islanding process in order to prevent unintended islanding on the public grid. If this process is triggered, the system also completely switches into stand-alone mode without interruption.

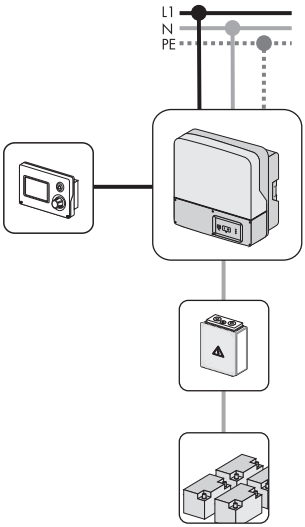
You can use the Sunny Island within various system configurations:

- The graphic on the following page shows which components can be integrated into a stand-alone grid system.
- The graphics on the page after next show the different wiring options (1-phase, 1-phase parallel and 3-phase).

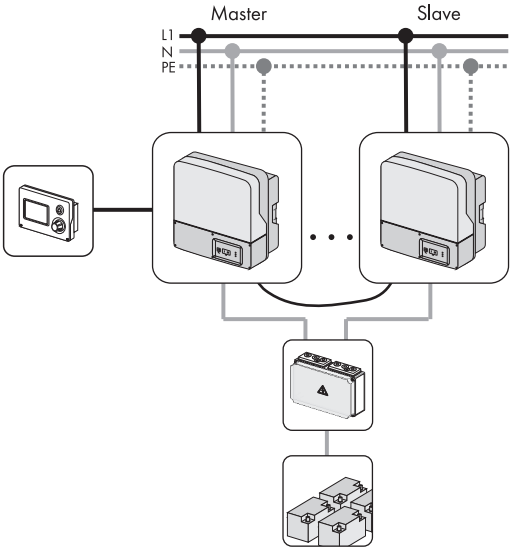

AC-Loads
external display
DC-Loads
Sunny WebBox
SIC40
PV
PV
Sunny Boy
DC/DC converter
Fuel Cell
PV
Sunny Boy
AC1 (Loads/Sunny Boys)
Com IN
Com OUT
Display
Relay1/2
BatVtgOut
DC
BatCur
BatTmp
DigIn
AC2 (Gen/Grid)
Relay1/2
BatFuse
Battery current sensor
Battery
Wind-energy system
Windy Boy
Battery temperature-sensor
CHP
Grid
Generator
Legend
– ·· – Control voltage
*) DC-supplied contactor (not included in delivery)

1-phase and 1-phase parallel system:

1-phase

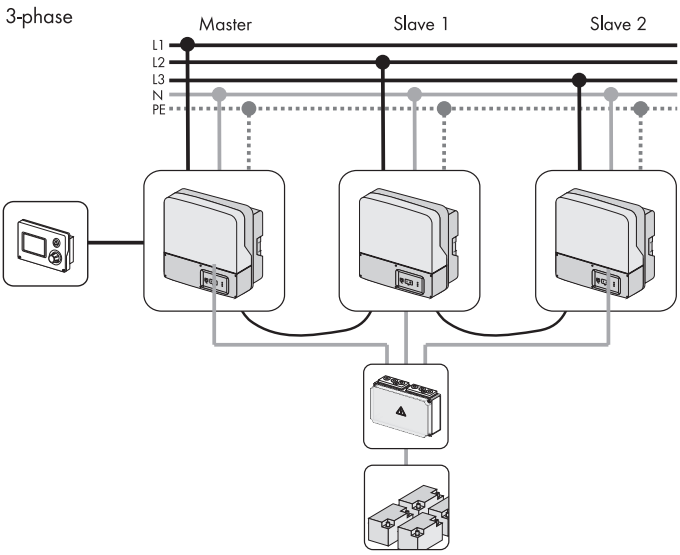


1-phase parallel



3-phase system (cluster):

3-phase



3 Safety Precautions

Follow all operating and safety precautions in this manual. Failure to follow these instructions could result in damage to the device and in danger to persons.

DANGER!

Risk of lethal electric shock when opening the devices.

- Installation and repair of the devices in the stand-alone grid system must be carried out exclusively by qualified personnel.
- Observe all instructions and safety notices.
- Before starting work disconnect all live components by using line circuit breakers.
- Secure line circuit breakers against accidental switching on.

Information

Be sure to observe all applicable regional standards and guidelines.

4 Unpacking

Before installing the Sunny Island and the Sunny Remote Control, make sure that all parts are included in the delivery.

- Carefully check the packaging and the devices for any signs of damage.
- Ensure that all parts are included in the delivery (see section 4.1 "Packing List" (page 18)).

If something is missing or if the devices have been damaged during shipment, contact SMA Solar Technology immediately. For more information, please see section 21 "Contact" (page 181).

Information

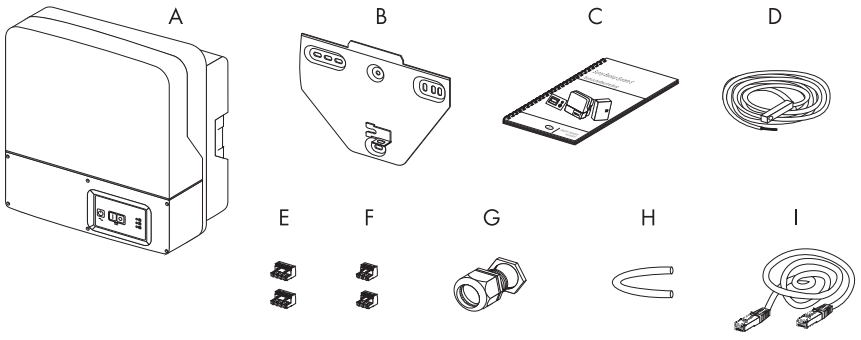
Keep the packaging in case you need to return the Sunny Island, the Sunny Remote Control or their accessories.

4.1 Packing List

Check the delivery for completeness and for visual damage. Please contact your dealer if you find any damage or if there are parts missing.

4.1.1 Sunny Island 2012/2224

The following elements are included in the packing list:



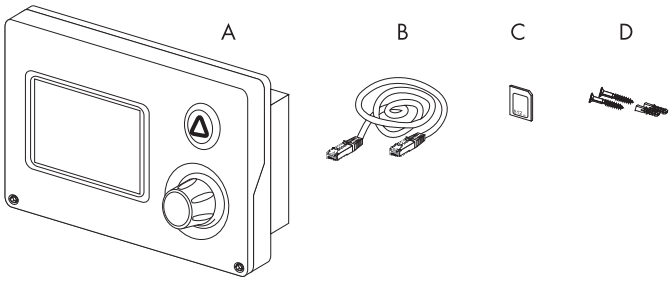
A	1	Sunny Island 2012/2224 with cover
B	1	Wall mounting bracket
C	1	Technical description (manual)
D	1	Battery temperature sensor
E	2	4-pole print terminals (e.g. for connecting battery temperature sensors)
F	2	3-pole print terminals (for connecting relays 1 & 2)
G	1	M25 metric-thread cable screw connection
H	1	Silicone tube 10 mm x 0.5 m
I	1	CAT5e-FTP patch cables (2 x RJ45 plugs, black, 2 m)

Optional communication accessories (not shown):

1	RS485 Piggy-Back
2	RS485, RJ45 communication cable, 3 wires

4.1.2 Sunny Remote Control

The following elements are included in the packing list:



A	1	Sunny Remote Control (SRC-1)
C	1	CAT5e-FTP patch cables (2 x RJ45 plugs, 5 m)
C	1	MMC/SD card
D	2	Screws and wall anchors

4.2 Type Label/Firmware Version

4.2.1 Sunny Island 2012/2224

Identify the Sunny Island by the series number and the device type indicated on the type label. The type label is on the right side of the enclosure.

You can read the firmware version of the Sunny Island on the display using the "312.02 FwVer" parameter (see section 17.3 "Diagnosis" (page 160)).

4.2.2 Sunny Remote Control

Identify the Sunny Remote Control by the series number and the version indicated on the type label The type label can be found on the back of the enclosure.

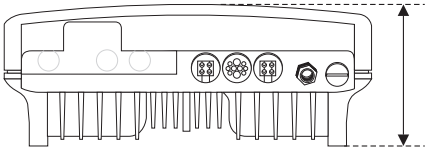
5 Mounting the Device

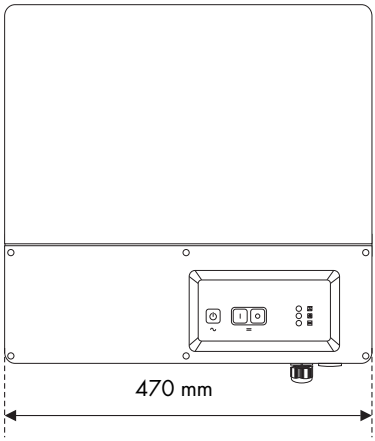
Take note of the required installation conditions specified in the sections below **before** mounting, installing and commissioning the Sunny Island.

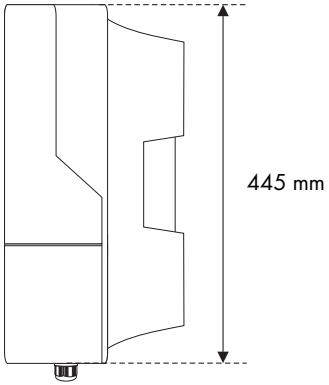
5.1 Sunny Island 2012/2224

5.1.1 Dimensions

Enclosure:







5.1.2 Mounting Location

DANGER!
Danger to life due to fire or explosion.

The temperature of the Sunny Island can reach 60 °C during operation.

Do not install the Sunny Island

- on flammable construction materials
- in areas where highly flammable materials are stored
- in potentially explosive areas

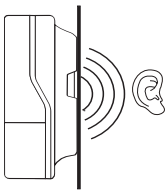
CAUTION!
Touching could result in burns.

The temperature of the Sunny Island can reach 60 °C during operation.

- Mount the Sunny Island such that it cannot be touched inadvertently.

- The mounting location and method must be suitable for the weight (approx. 19 kg) and dimensions.
- Choose a solid foundation for mounting.
- The mounting location must be accessible at all times (do not mount in inaccessible locations).
- An ambient temperature of between -25 °C and +60 °C ensures optimum operation.
- Avoid direct solar radiation. Excessive heating could lead to a reduction in performance.
- In a living area, do not mount the unit on plasterboard walls etc. in order to avoid audible vibrations.

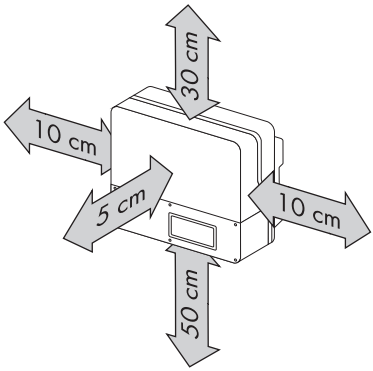
  The Sunny Island can make noises when in use which can be considered a nuisance when installed in a living area.



5.1.3 Safety Clearances

Observe the following minimum clearances to walls, other devices or objects to ensure sufficient heat dissipation

All external cables are connected through the underside of the enclosure. This requires a minimum clearance of at least 50 cm.



Sufficient ventilation

When installing the Sunny Island in smaller rooms, make sure that adequate ventilation is available. The Sunny Island produces heat when operating that must be removed.

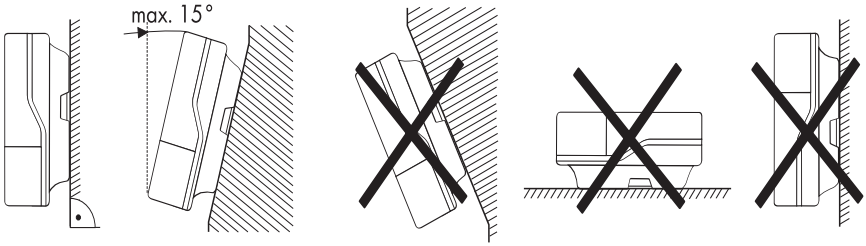
5.1.4 Mounting Position

NOTICE!

Short-circuit due to condensation!

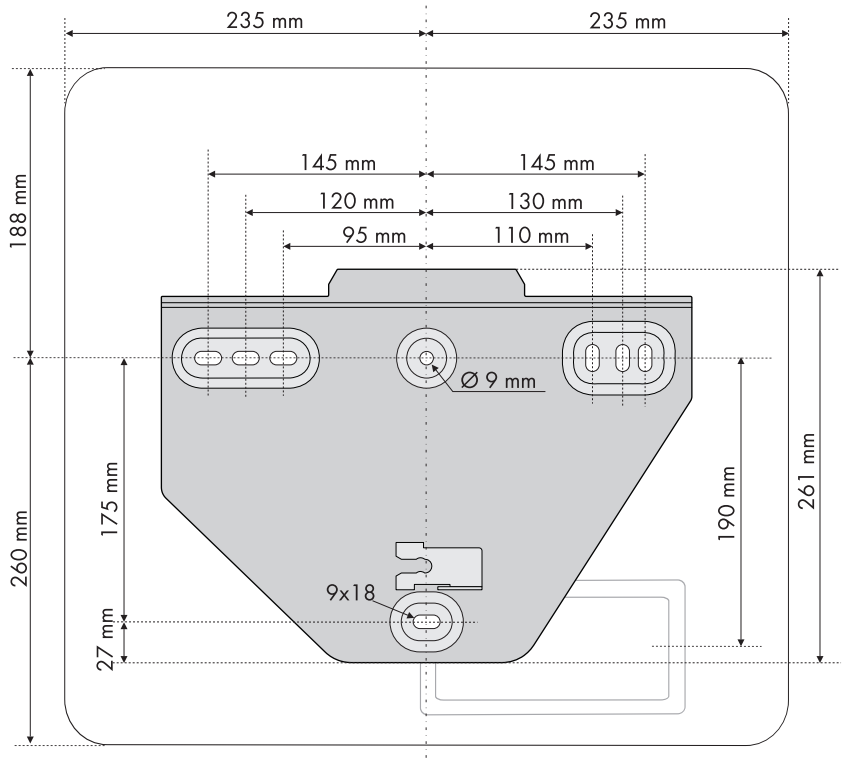
If the device is in operation while lying flat, water can accumulate due to condensation.

- Operate the Sunny Island only while it is installed vertically on a wall.



- Mount the Sunny Island only vertically or with a backward inclination of at most 15°!
- Do not mount the Sunny Island with a forward inclination!
- Do not mount the Sunny Island horizontally!
- Mount the Sunny Island at eye level.

5.1.5 Mounting the Sunny Island with a Wall Mounting Bracket

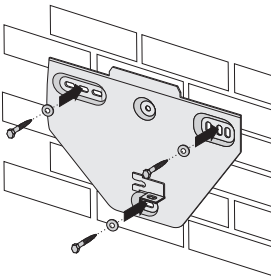


1. Use the wall mounting bracket as a drilling template and mark the positions of the drill holes.

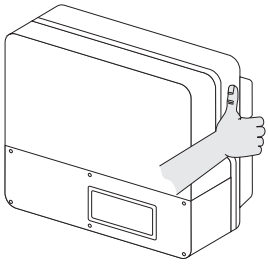
Number of drill holes used

- When mounting onto a wall, use at least two of the horizontal holes and the lowest hole in the middle
- Use the two holes in the middle when mounting to a pillar.

2. Mount the wall bracket.

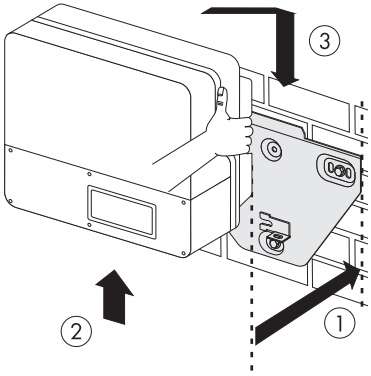


3. Transport the Sunny Island using the handles at the sides of the enclosure.

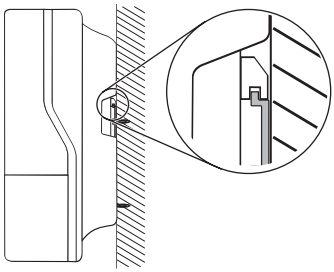


4. Attach the Sunny Island to the wall bracket slightly to the left of its final position.

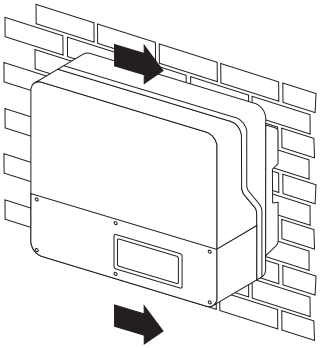
   The right edge of the back side of the Sunny Island must be flush with the right edge of the wall mounting bracket.



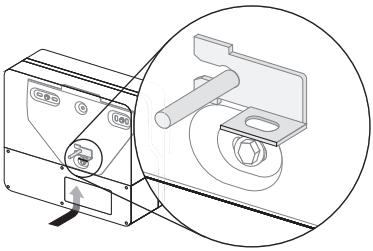
5. Check both sides to ensure that it is correctly in place.



6. Push the Sunny Island to the right on the wall mounting bracket, until it locks into place with the locking bolt on the back wall.

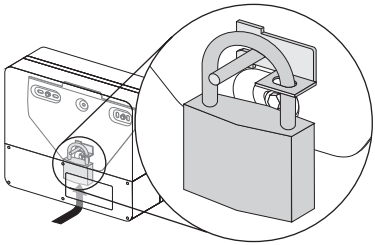


7. Ensure that it is correctly in place.



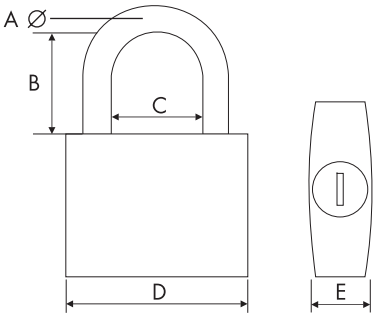
Optional Anti-Theft Protection

Protect the device against theft. Secure the Sunny Island with a lock onto the wall mounting bracket.



The lock must meet the following requirements:

- Size:
  - A: 6 mm – 10 mm in diameter
  - B: 21mm – 35 mm
  - C: 20 mm – 33 mm
  - D: 40 mm – 60 mm
  - E: 13 mm – 21 mm
- stainless
- hardened shackle
- secured lock cylinder



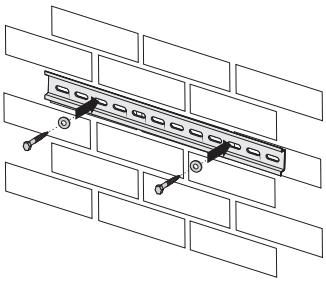
5.1.6 Mounting the Sunny Island with a Top Hat Rail

Requirements:

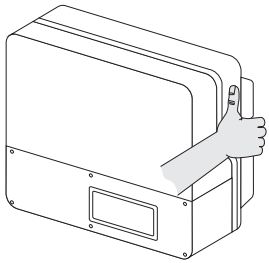
- ➢ Use a TH-35-7.5 supporting rail compliant with DIN EN 60715.
- ➢ Use stainless steel top hat rails and screws. Prevent contact corrosion.
- ➢ The foundation must be level.
- ➢ Use suitable fastening material. Take the weight of the Sunny Island into account.

1. Use the top hat rail as a drilling template and mark the positions of the drill holes.
2. Mount the top hat rail.

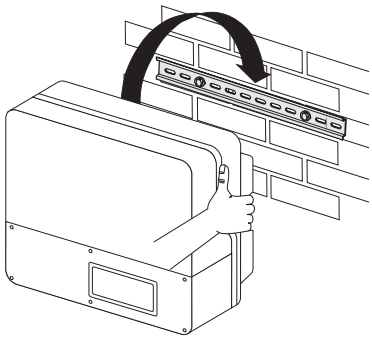
   Secure one screw at least every 300 mm.



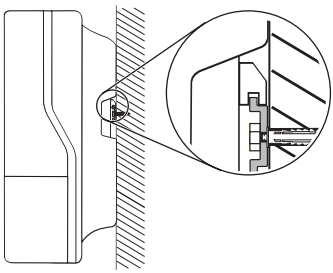
3. Transport the Sunny Island using the handles at the sides of the enclosure.



4. Attach the Sunny Island to the top hat rail using the mounting opening in the back wall.



5. Check both sides to ensure that it is correctly in place.

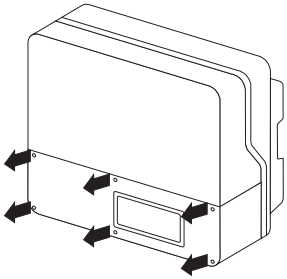


☑ The Sunny Island is now mounted with top hat rail.

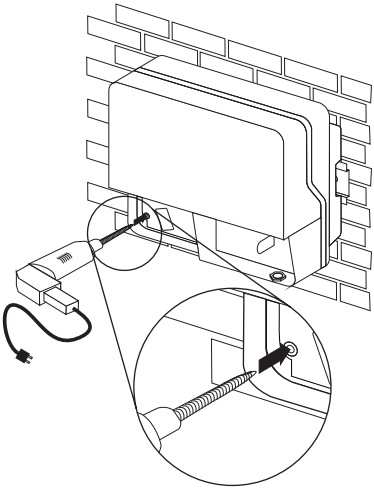
Securing the Sunny Island against lifting:

Screw the enclosure additionally onto the wall.

1. Open the lower lid (see section 6.1 "Opening the Sunny Island" (page 33)).

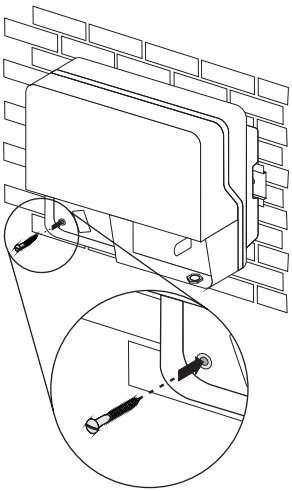


2. Drill through the back wall of the enclosure.
3. Use a suitable drill bit at least 120 mm in length.



4. Secure the Sunny Island with a screw.
   The screw must meet the following requirements:

Length:	at least 100 mm
Diameter:	8 mm
Screw head:	not hexagon head not countersunk



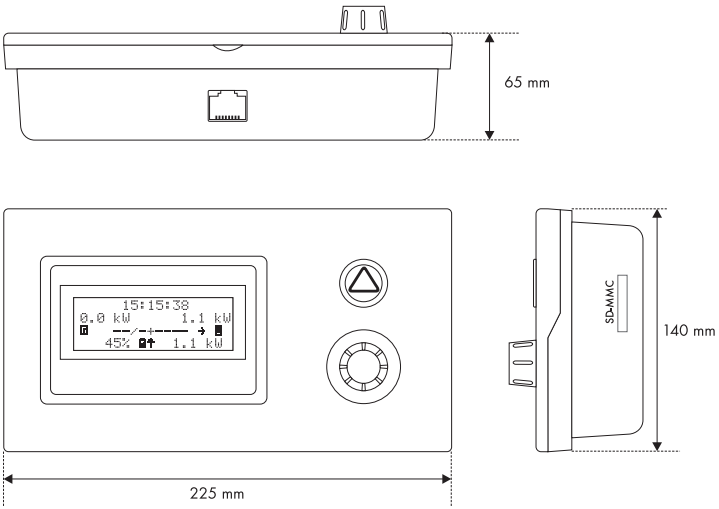
5. Check that the unit is securely in place.

☑ The Sunny Island is secured against lifting.

5.2 Sunny Remote Control

5.2.1 Dimensions

The external display has the following dimensions:



5.2.2 Mounting Location

- The mounting location must be easily accessible.

  Using the display, you can control the Sunny Island and with it the stand-alone grid system.

Distance between the Sunny Remote Control and the Sunny Island

The communication cable between the Sunny Island and the Sunny Remote Control must not exceed 20 m in length.

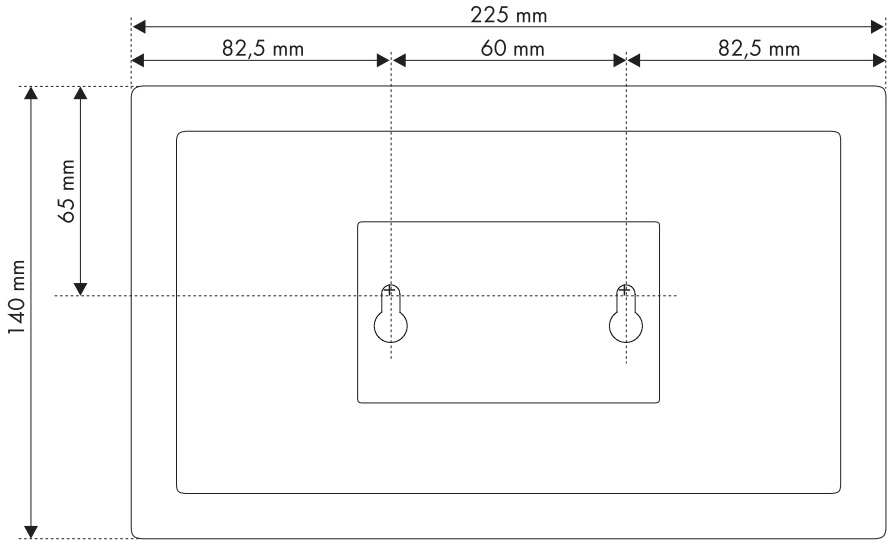
- Choose a solid foundation for mounting.
- Protect the Sunny Remote Control from dust, wet conditions, corrosive substances and vapors.
- An ambient temperature of between 0 °C and 50 °C ensures optimum operation.
- Avoid direct solar radiation.
- The Sunny Remote Control is suited only for use in enclosed spaces.

5.2.3 Fastening the Sunny Remote Control with a Mounting Plate

➢ Fasten the Sunny Remote Control with the mounting plate to the wall:

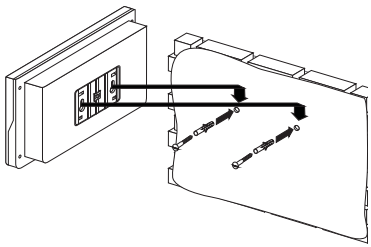
1. Allow enough room for installing a communications cable and a MMC/SD card.
2. Determine the position of the two holes to be drilled using the Sunny Remote Control's mounting plate.

   To do this, unscrew and remove the mounting plate from the back of the Sunny Remote Control.



3. Mark the position of the holes to be drilled.
4. Drill the holes.
5. Install the wall anchors and screws included.

   Leave about a 6 mm clearance between the screw head and the wall.
6. Screw the mounting plate onto the Sunny Remote Control enclosure.
7. Hang the Sunny Remote Control on the screws.
8. Ensure the unit is correctly in place.



5.3 Installing Batteries

Information

Observe the battery manufacturer's installation instructions, as provided with the battery upon delivery, and the applicable standards and directives for installation of batteries (EN 50272-2).

DANGER!

Danger to life due to

- explosion an d fire
- short circuit
- chemical burns due to leaking electrolytes

1. Smoking prohibited!

   Do not allow open flames, embers, or sparks near the battery.
2. The metal parts of the battery carry voltages.

   Do not place objects or tools on the batteries.

   Work on the battery with insulated tools only!
3. Use protective clothing and eyewear when working on the battery.
4. During normal operation, it is not possible to accidentally touch the electrolyte.

   Do NOT damage the enclosure of the battery! The electrolyte is extremely corrosive.

Dimensioning for the battery capacity

To ensure a faultless operation of the stand-alone grid system, SMA Solar Technology recommends a battery capacity of at least:

- 175 Ah per Sunny Island 2224 (24 V) at C_{10}
- 350 Ah per Sunny Island 2012 (12 V) at C_{10}

If an AC-coupled PV plant is to be connected to the system, SMA Solar Technology recommends a battery capacity of at least:

- 200 Ah (C_{10}) per kW of AC nominal power of the PV inverter in the case of 24 V systems
- 400 Ah (C_{10}) per kW of AC nominal power of the PV inverter in the case of 12 V systems

Batteries must be accommodated in protected areas, and sufficient ventilation of the installation location must be ensured. In the case of batteries which are connected to one Sunny Island exclusively, there is no need for protection against direct or indirect contact, due to the safety low-voltage.

It is not necessary to install such batteries in a separate battery room, or in a self-contained electrical facility.

The necessary air volume flow for ventilation of the room which accommodates the batteries is calculated as per EN 50272-2 as follows:

$$Q = 0.05 * n * I_{Gas} * C_{10}/100 \ [m^3/h]$$

Q = required air flow volume

n = number of cells

I_{Gas} = maximal finishing charge rate

with C_{10} as the 10 hour nominal capacity in [Ah]

$$A = 28 * Q \ [cm^2]$$

Sufficient dissipation of explosive gases is not always ensured in the vicinity of the battery. For this reason, a clearance distance is to be observed in which no equipment which causes sparks or smoldering is permitted.

The clearance distance is calculated as follows:

$$d = 5.76 * (C_{10})^{1/3} \ [cm]$$

Installation of a battery with liquid electrolyte

With closed batteries, installation in an acid-resistant collecting tray is to be provided for so that, in the event of a fault, leaking electrolyte cannot cause further damage.

Finally, install the battery bank in accordance with the installation instructions provided by the battery manufacturer. Refer to the following table for the preferred values for the finishing charge rates and charge voltages for the battery types which may be used in the system, unless the battery manufacturer has determined other values:

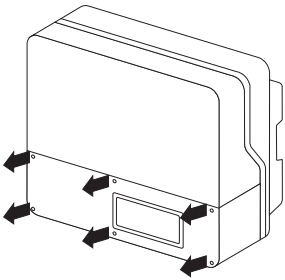
Maximal charging voltage in [V/cell]	**maximal finishing charge rate IGas in [A/100 Ah]**		
Type	**FLA***	**VRLA**	**NiCd**
1.4	-	-	0.5
1.55	-	-	5
1.6	-	-	5
1.65	-	-	5
2.25	0.5	0.1	-
2.4	2	0.8	-
2.5	4	1.5	-
2.6	6	6	-
*These values are valid only for battery types with low antimony content (SB < 3 %)			

Consult the appropriate battery manufacturer for other battery type values.

6 Opening and Closing

Enclosure lid

Only remove the lower enclosure lid from the Sunny Island when you want to mount, install or maintain it.



DANGER!

Risk o f lethal electric shock

High voltages are present in the Sunny Island!

- Only qualified personnel should open the device!
- Do not open the upper enclosure cover!

  After the system has been disconnected (see section 10.1.4 "Disconnecting the Sunny Island from Power Supply Units" (page 84)) there are still dangerous voltages present for up to 15 minutes.

6.1 Opening the Sunny Island

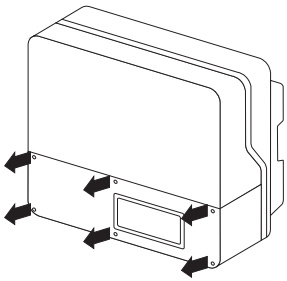
NOTICE!

Electrostatic discharges can damage the Sunny Island.

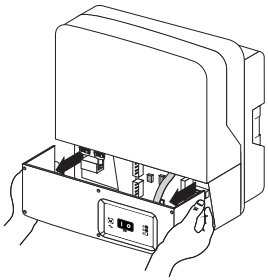
Internal components of the Sunny Island can be irreparably damaged by static discharge.

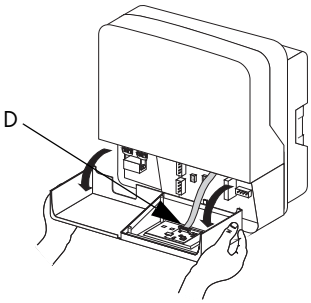
- Ground yourself before you touch a component.

1. Shut down the Sunny Island.
2. Disconnect the Sunny Island from all power supply units (battery, generator, grid) (see section 10.1.2 "Stopping the Sunny Island" (page 83) and 10.1.3 "Switching off the Sunny Island" (page 84)).
3. Ensure that the stand-alone grid system cannot be accidentally switched on again.
4. Loosen the six non-removable allen screws on the lower lid.



5. Remove the lid carefully.
6. Remove cable (D) of the control panel from the inside of the lid. (In the case of a new device the cable is not in place).





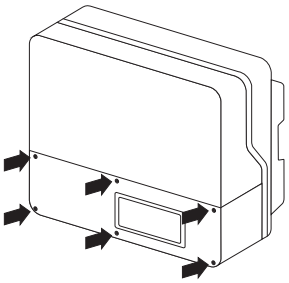
7. Keep the lid in a safe place.

Information

The lid screws can be loosened but not removed, which keeps them from getting lost.

6.2 Closing the Sunny Island

1. Ensure that all cables are properly laid and that all tools have been removed from within the Sunny Island's enclosure (see section 7 "Sunny Island Electrical Connection" (page 35)).
2. Plug the cable for the control panel into the lower enclosure lid.
3. Starting from the front, place the lid evenly on the enclosure.
4. Screw all six screws in sequence and lightly into their threads (one or two turns).
5. Tighten the screws in a crosswise sequence and with 2.5 Nm of torque.



7 Sunny Island Electrical Connection

DANGER!

Risk of lethal electric shock due to wrong connection.

- Only qualified personnel are permitted to install the electrical connections of the devices.
- Follow all the safety precautions provided in this section during installation work.

NOTICE!

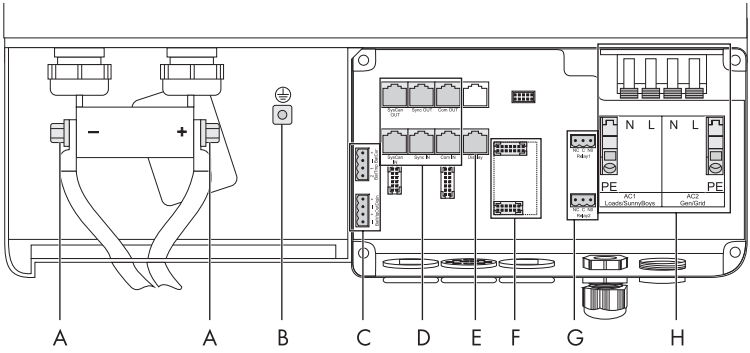
Electrostatic discharges can damage the Sunny Island.

Internal components of the Sunny Island can be irreparably damaged by static discharge.

- Ground yourself before you touch a component.

7.1 Overview of the Connection Area

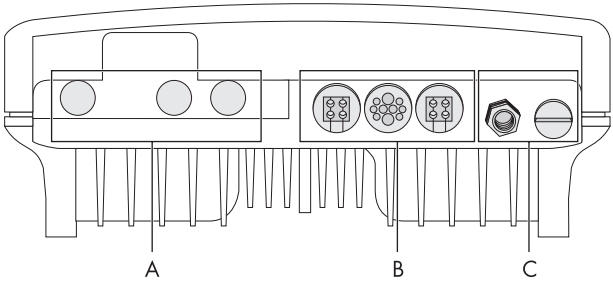
The following figure provides an overview of all connections of the Sunny Island:



A	DC connections
B	Additional protective earth connection
C	Additional connection terminals (battery current sensor, battery temperature sensor, etc.)
D	Communication connections
E	Sunny Remote Control connection ("display")
F	RS485 interface slot (Piggy-Back)
G	Multi-function relay connections
H	AC connections

Cable Openings in the Enclosure

All cables are fed through the openings on the bottom side of the device and connected to the appropriate connection terminals on the Sunny Island.



A	Insertion of DC cables
B	Cable opening seal
C	Metric-thread cable screw connection

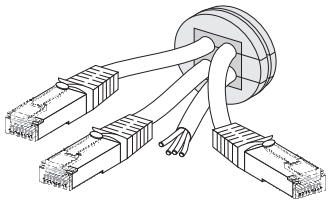
Metric-thread Cable Screw Connection

Use the metric-thread cable screw connections provided to fasten the AC cables inside the Sunny Island enclosure in a manner conforming to the appropriate standards. The metric-thread cable screw connections guarantee a dust-free and waterproof installation of the cables in the enclosure and also provide strain relief for the cable connection.

Close all unused openings in the enclosure using the appropriate filler plugs.

Cable Opening Seal

The cable opening seal provides an easy way to connect the pre-assembled communication and control cables (with RJ45 plugs).



NOTICE!

Damage to device can be caused by moisture penetration.

- Properly install the screw connections and cable opening seals.
- Close all unused openings.

If properly installed, the screw connections and cable opening seals guarantee IP54 protection.

Obtain an overview of the different components and connection areas of the Sunny Island 7.1 "Overview of the Connection Area" (page 35)).

Detailed installation descriptions of the connections are provided in the following sections:

- DC connection: Section 7.2 "DC Connection" (page 37)
- AC connection: Section 7.3 "AC Connection" (page 41)
- Connection to ground: Section 7.3.1 "Connection to Ground" (page 42)
- Sunny Remote Control: Section 7.4 "Connecting the Sunny Remote Control" (page 47)
- External communication: Section 7.5 "Communication" (page 49)
- Battery Temperature Sensor: Section 7.6.1 "Battery Temperature Sensor" (page 54)
- Multi-function relay 1 and 2: Section 7.6.3 "Multi-Function Relays 1 and 2" (page 57)

7.2 DC Connection

WARNING!

The Sunny Island 2012/2224 has no internal DC fuse.

Install a BatFuse between the Sunny Island and the battery as a cable protection and load disconnection unit. Dimension the fuse in accordance with the information provided in the installation manual for the BatFuse and in proportion to the cable-cross sections used.

NOTICE!

Function impairment of devices on the DC side

The Sunny Island is NOT suitable for use with DC supply grids.

Function impairment can occur on devices in which a flexible connection and cables exceeding 30 meters are installed on the DC side of a Sunny Island.

- Only use fixed installations.
- Do not use cables between the Sunny Island and the battery and/or DC device greater than 30 meters in length.

SMA Solar Technology offers the following external DC fuses:

BATFUSE-A.01	NH00 battery fuse for a Sunny Island 2224
BATFUSE-A.03	NH00 battery fuse for up to three Sunny Island 2224
BATFUSE-B.01	NH01 battery fuse as a load disconnecting switch for a Sunny Island 2012/2224
BATFUSE-B.03	NH01 battery fuse as a load disconnecting switch for up to 3 Sunny Island

DC cables

The DC cables should be as short as possible (in any case < 30 m). Long cables and insufficient cable cross-sections reduce the system efficiency as well as the overload capabilities. Do not lay the battery feed cables under plaster or in armored plastic pipes. Since high currents flow through the battery cables, they can become very warm.

Sunny Island in parallel operation

Always use same-length cables as well as the same cable cross-sections on the DC side during installation.

7.2.1 Connection to Ground

External grounding

- External grounding of the negative pole of the batteries is possible, because the batteries and the grid side are galvanically isolated within the Sunny Island. In this case make sure that the high currents that may occur under fault conditions can be adequately discharged.
- If a ground connection is necessary, it must be established separately by an installer outside of the Sunny Island.
- When grounding the battery, the Sunny Island's enclosure must be additionally grounded, also in the DC area (see section 7.3.1 "Connection to Ground" (page 42)).

Calculating the Required Grounding Cable Cross-Section

SMA Solar Technology cannot state generally valid values for the cross-section of the cable required for the external grounding of the battery. The cable dimensions depend on the type and size of the battery connected, the external fuse (DC side) and the material used in the grounding conductor.

Determining the cross-section

Exact calculation of the grounding conductor cross-section must take account of the regionally applicable standards and guidelines (e.g DIN VDE 0100 Part 540).

The required cross-section of a (copper) grounding conductor can be calculated using the following formula. Trigger times of about 25 ms are typical for short-circuit currents between 2000 A and 10,000 A.

$$S \quad \frac{\sqrt{I_{SC}^2 * t}}{143}$$

t = disconnection time in seconds
I_{SC} = maximal battery current (short circuit current) in Ampere
S = cross-section of the conductor in mm²

A grounding conductor of 16 mm² cross-section is thus adequate for short-circuit currents up to 10,000 A.

7.2.2 Battery Connection

Connect a suitable battery to the DC side (see section 20 "Technical Data" (page 177)).

WARNING!

Risk of lethal electric shock when the battery is connected.

Connect the NH fuse to the BatFuse bracket or close the BatFuse disconnector only after completing all installation work on the stand-alone grid system.

The DC connection must be established in observance of all applicable regulations (e.g., DIN EN 50272-2, "Safety Requirements for Batteries and Battery Systems - Part 2: Stationary Batteries").

WARNING!

Risk of burns or even death due to arcing and short-circuiting when connecting the battery.

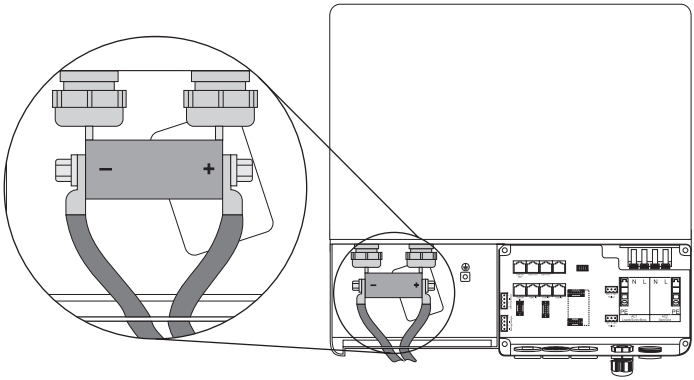
- Follow all safety and maintenance instructions provided by the battery manufacturer.
- Use special (insulated) tools to mount and install the battery.
- Make sure the cross-section of the cables is adequate and the polarity of the cables leading to the battery is correct.

7.2.3 Connecting the Sunny Island on the DC Side

There is a "DC –" and a "DC +" connection provided for each cable lug (max. 95 mm²) for the battery feed cables in the Sunny Island. The following cable cross-sections are recommended for the DC cables:

Sunny Island 2224 (connection with M8 screw):	min. 35 mm²
	max. 95 mm²
Sunny Island 2012 (connection with M8 screw):	min. 70 mm²
	max. 95 mm²

Install the DC connections in the following sequence:



1. Remove the protective insulation from each DC cable.
2. Attach a suitable cable lug to the exposed cable ends.
3. Insert the DC cables into the enclosure from the lower left corner.
4. Attach the "DC –" cable with the cable lug to the "DC –" connection and tighten the nut (with a torque of 4.0 Nm to 10 Nm).
5. Now attach the "DC +" cable with the cable lug to the "DC +" connection and tighten the nut (with a torque of 4.0 Nm to 10 Nm).

7.3 AC Connection

Connect the Sunny Island through a sub-distribution to the stand-alone grid (loads, PV generator (Sunny Boy), wind turbine system (Windy Boy)) and to any other external sources (generator, grid).

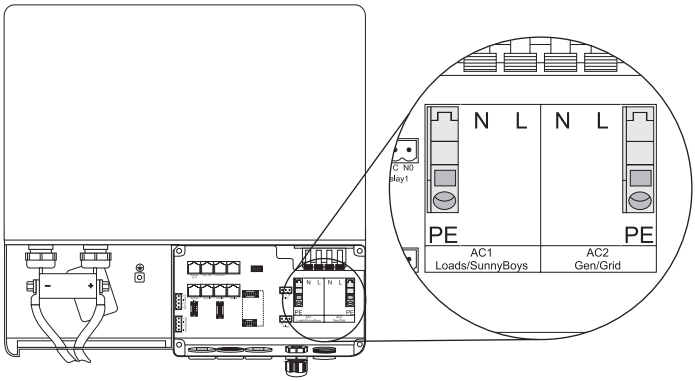
Information

The sub-distribution unit must be equipped with appropriate line circuit breakers. Observe all the applicable regional standards and guidelines.

Information

The Sunny Island is not disconnected on all poles: The neutral conductor (N conductor) is looped through the device and the N connection terminals of AC1 and AC2 are connected inside the device.

Use cables with a maximum cross-section of 6 mm² for the AC installation The nominal AC current is 9.6 A.



7.3.1 Connection to Ground

TN system

When working with main power grids (energy supply companies), the Sunny Island may only be installed as TN system

In stand-alone configurations, the (protective) ground of the Sunny Island and its individual components must be wired as a TN system only.

All valid standards and guidelines must be taken into account!

CAUTION!

Risk of injury due to high discharge currents against PE

The N conductor of the Sunny Island has NOT been connected with PE by default.

- Ground the stand-alone grid system outside the Sunny Island before commissioning (see section 7.3.3 "Connecting the AC2 (Gen/Grid)" (page 45)).
- For safety reasons (discharge currents exceeding 3.5 mA), use either two protective earth conductors (redundant grounding) or a protective earth conductor of >=10 mm².

For the ground connection with two redundant protective earth conductors use the PE connections in the AC connection area of the Sunny Island..

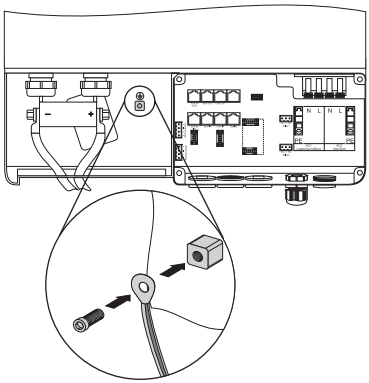
For the ground connection with the protective earth conductor of >= 10 mm² use the additional PE connection (PE crown on the enclosure) in the DC connection area (see following segment).

Additional Grounding of the Enclosure:

If the Sunny Island is used in a country which prescribes the use of a second protective earth conductor (e.g., Switzerland), you can ground the enclosure additionally by using the PE crown in the DC connection area.

Proceed as follows:

1. Strip the protective earth conductor.
2. Attach a suitable ring cable lug to the protective earth conductor (maximum cross-section of 50 mm²).
3. Screw the ring cable lug onto the PE dome of the enclosure (M8 x 20 mm screws).



7.3.2 Connecting AC1 (Loads/Sunny Boys)

Connect, with three wires via the sub-distribution, for example, loads, PV generators (Sunny Boy) and wind turbine systems (Windy Boy), to the Sunny Island's AC1 connection.

DANGER!
Danger to life due to residual currents

- Use residual current devices (RCD) to protect each individual load.

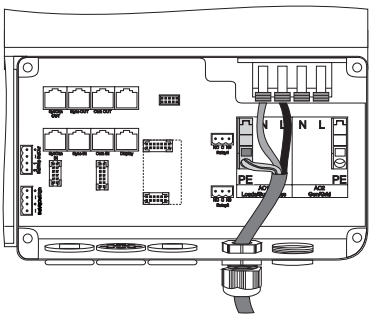
Cable protection

SMA Solar Technology recommends the use of a line circuit breaker (B type, min. 16 A). This has the following advantages:

- The cable cross-section is dimensioned based on the value of the 1-fold nominal current.
- For maintenance work, the Sunny Island can be switched off via the line circuit breaker on the stand-alone grid side.

Connecting the AC1 of the Sunny Island:

1. Loosen the metric-thread cable screw connection on the right bottom of the enclosure.
2. Pull the three-cable conductor through the screw connection.
3. Pull the conductor into the enclosure.
4. Flip the AC1 terminals (N and L conductors) all the way up.



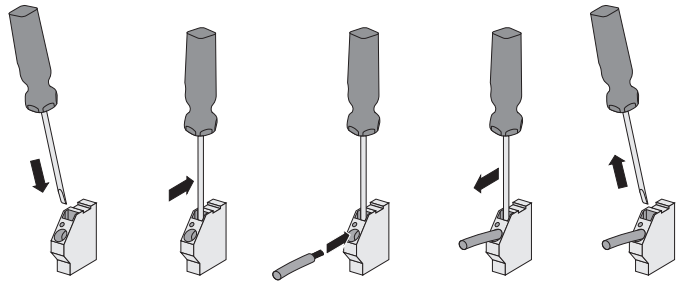
DANGER!
Risk o f lethal electric shock

Improperly laid cables may become detached from the terminal.

- Do not use wire sleeves when connecting the AC cable.

5. Remove the protective insulation from each of the three wires (at least 12 - 13 mm).

6. Attach the protective earth conductor (PE) to the spring-type terminal. Use a flathead screwdriver for this purpose (see figure below).



   – Insert the screwdriver into the slit of the spring-type terminal.
   – Push the screwdriver upward. The spring-type terminal is now open.
   – Push the stripped PE conductor into the terminal (round opening).
   – Bring the screwdriver back to its original position. The spring-type terminal is closed and the PE conductor is fixed in place.

7. Connect the N and L conductors to the AC1 terminals as labeled.

   L and N must not be swapped!

CAUTION!

Danger of crushing when the terminals snap closed!

The terminals snap down rapidly and hard when closing.

- Flip down the terminals carefully.
- Press the terminals down with your thumb, do not grip the entire terminal on all sides.
- Keep your fingers away from the snapping portion of the terminal!

8. Tighten the counter nut of the cable screw connection.

☑ The AC1 connection of the Sunny Island is installed.

Connection in a single-phase parallel system

In a single-phase parallel system, connect all Sunny Islands using the same cable cross-sections and the same cable lengths.

Connection in a 3-phase system

- In a 3-phase system, always connect the master to phase L1, slave 1 to phase L2 and slave 2 to phase L3. This circuitry results in a right-hand rotating field.
- If a phase fails within a 3-phase grid, the cluster continues to run. In order to protect your loads, you may require phase monitoring or a motor overload switch.

7.3.3 Connecting the AC2 (Gen/Grid)

Connect, with three wires via the distribution, the generator or the public grid to the Sunny Island's AC2 connection.

DANGER!

Danger to life due to residual currents if the neutral conductor is not grounded.

- Do not install an RCD circuit breaker in the grid-side supply cable of the stand-alone grid system.
- Ground the grid-side PEN conductor within the system (before or at the point of separation into N and PE conductors (e.g., the connection from the house's junction box to the equipotential bonding bar).

NOTICE!

Device damage due to high currents.

A maximum of 25 A should flow through the Sunny Island's AC input.

- Install a line circuit breaker (B type, max. 25 A) on the grid side in order to protect the Sunny Island against overcurrents.

  For maintenance work, the Sunny Island can be switched off via the line circuit breaker on the grid side.

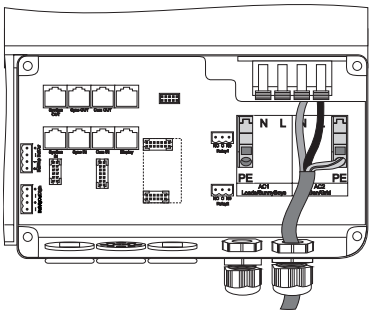
Transfer relay in the Sunny Island

The Sunny Island's transfer relay connects phase L-AC2 with L-AC1. In the event grid voltage is present, the transfer relay maintains an active through-connection even when the device has been switched off. It functions like a break contact.

Connecting the AC2 of the Sunny Island:

1. Remove the filler plugs from the opening on the right bottom of the enclosure.
2. Introduce the M25 metric-thread cable screw connection (included in the delivery) into the opening and tighten.

   Do not forget the seal!
3. Wire the AC2 cable as described in section 7.3.2 "Connecting AC1 (Loads/Sunny Boys)" (page 43).



Connection in a single-phase parallel system

- In single-phase parallel systems, connect each of the Sunny Islands via the AC2 terminal to the generator or the public grid.
- Install a line circuit breaker (max. 25 A) upstream of each Sunny Island on the grid side.
- The cable cross-sections and cable lengths used must be identical.

Connection in a 3-phase system

- In a 3-phase system, always connect the master to phase L1, slave 1 to phase L2 and slave 2 to phase L3. This circuitry results in a right-hand rotating field.
- Install a line circuit breaker (max. 25 A) upstream of each Sunny Island on the grid side.
- The system does not monitor additional fuses. Check any additional fuses regularly!

7.4 Connecting the Sunny Remote Control

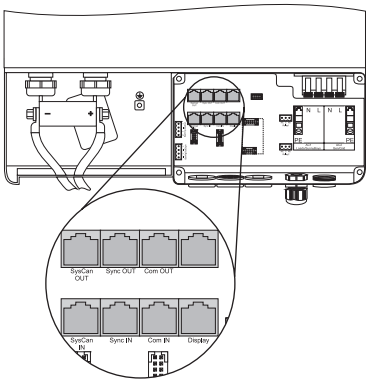
NOTICE!

Electrostatic discharges can damage the Sunny Island.

Internal components of the Sunny Island can be irreparably damaged by static discharge.

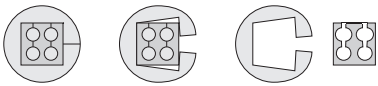
- Ground yourself before you touch a component.

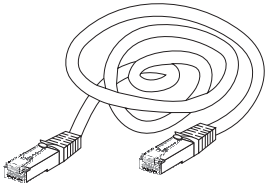
The Sunny Remote Control is connected to the "Display" terminal in the Sunny Island.

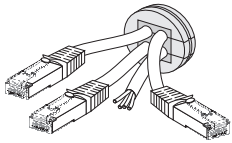


Connecting the Sunny Remote Control:

1. Loosen the preinstalled plug receptacle on the base of the enclosure.
2. Remove the bulkhead receptacle completely from the mounting opening.
3. Lay the cable equipped with RJ45 plugs through one of the openings in the inner rubber element.



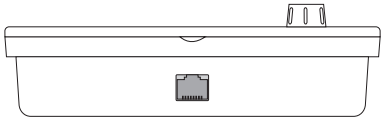




Cable length

Make sure the cable is long enough to reach from the bulkhead receptacle to the desired "Display" socket on the circuit board.

4. Install all communication cables (see section 7.5 "Communication" (page 49)) before assembling the bulkhead receptacle and then re-inserting it into the mounting opening on the Sunny Island.
5. Fit any unused openings on the enclosure with filler plugs.
6. Insert the RJ45 plug into the "Display" socket in the Sunny Island. The plug snaps audibly into place.
7. Connect the second RJ45 plug on the cable (outside the Sunny Island) to the Sunny Remote Control Display socket.



Information

The communication cable can also be plugged into the Sunny Remote Control during operation (hotplug-able).

☑ The Sunny Remote Control is connected to the Sunny Island.

7.5 Communication

7.5.1 Connecting the Communication Units to the Sunny Island

The Sunny Island can be connected in parallel or in a 3-phase system with up to two other Sunny Islands in order to increase the overall power. The devices communicate through CATe-FTP patch cables (with two RJ45 plugs each). A patch cable is referred to subsequently as a communication cable.

Information on installation

1. Always lay the communication cable separately from the AC cables.
2. Lay the communication cable over the same rubber element with which the Sunny Remote Control is connected to the Sunny Island (see sections "Connecting the Sunny Remote Control:" (page 47)).
3. If the length of the provided communication cable is insufficient, use commercially available Cat5e-FTP patch cables (single shield) with gold contacts.
4. The maximum cable length is 30 m. The cable cross-section is at least AWG 26/7.
5. Upon delivery of a Sunny Island, the "SyncIn" socket is terminated.

Installation in a single-phase parallel system or in a 3-phase system

- A communication cable is included with each Sunny Island.

  You need the cable in order to establish an (internal) communication between several Sunny Islands. If you operate only one Sunny Island in your system, the cable is not required.
- If needed, choose a parallel/multi-phase configuration in the Quick Configuration Guide (see section 9 "(First) Commissioning" (page 75)).

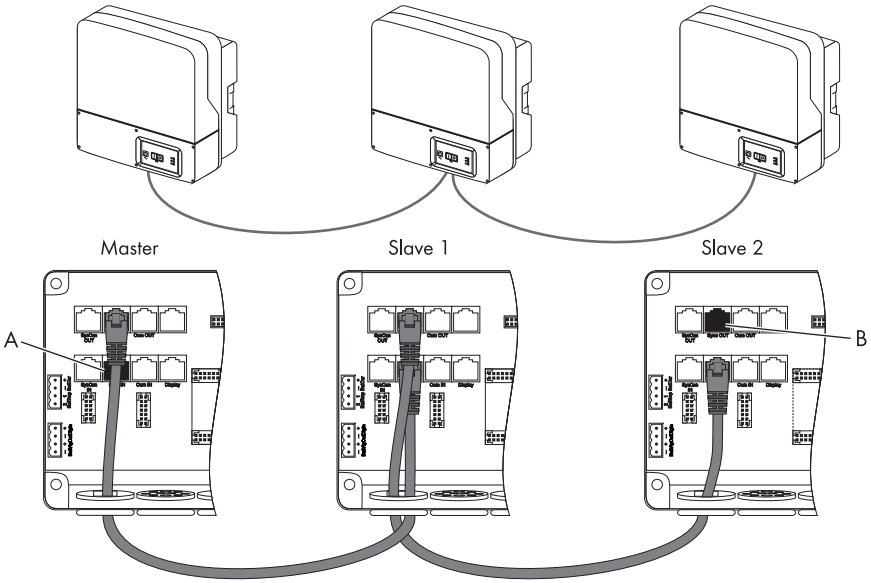
Laying Communication Cables in a Cluster (3-Phase System):

➢ Make sure each cable is long enough to reach from the bulkhead receptacle to the desired "Display" socket on the circuit board.

➢ Lay the cable equipped with RJ45 plugs through one of the four openings in the inner rubber element of the plug receptacle.

➢ Install one after the other the first (master), the second (slave 1) and the third Sunny Island (slave 2).

The following figure shows the cabling between several Sunny Islands:



A terminator (termination resistor) is plugged into the "SyncIn" socket of the master (**A**).

1. Insert the RJ45 plug of the communication cable in the "SyncOut" socket.

   The plug snaps audibly into place.
2. Lay the other end of the communication cable in slave 1.
3. Remove the terminator from the "SyncIn" socket of slave 1.
4. Insert the RJ45 plug of the communication cable from the master device in the "SyncIn" socket of slave 1.

   The plug snaps audibly into place.

   ☑ The communication cable between the first and the second Sunny Island is installed.
5. If **no other Sunny Island** (slave 2) is to be installed in the stand-alone grid system, plug a terminator in the "SyncOut" socket of slave 1.

   The terminator snaps audibly into place.

   or

   Insert the RJ45 plug of another communication cable in the "SyncOut" socket of slave 1.

   The plug snaps audibly into place.
6. Lay the other end of the communication cable in slave 2.
7. Remove the terminator from the "SyncIn" socket of slave 2.

8. Insert the RJ45 plug of the communication cable from the slave 1 device in the "SyncIn" socket of slave 2.

   The plug snaps audibly into place.

9. Plug the terminator in the "SyncOut" socket of slave 2 (**B**).

   The terminator snaps audibly into place.

   ☑ The communication cable between the second and the third Sunny Island is installed.

Note

The first and last Sunny Island in a chain must always be terminated.

10. Install all communication cables before assembling the bulkhead receptacle and then re-inserting it into the mounting opening on the Sunny Island.
11. Fit any unused openings on the enclosure with filler plugs.

☑ The installation of the cluster communication cables is complete.

Information

The "SysCanOut" and "SysCanIn" sockets have no function.

7.5.2 Connecting the Communication Units to the External Devices

You can connect SMA communication devices (e.g., Sunny Boy Control, Sunny WebBox) or a PC with the appropriate software to a communication interface. A detailed wiring diagram can be found in the communication device manual, the software or on the Internet at www.SMA.de.

This wiring diagram includes the following information:

- Details on the required cable type
- Which of the Sunny Island's connections are used
- Whether or not the communication cables must be terminated
- Whether or not the cable shield needs to be connected to the protective earth conductor

You can incorporate an RS485 communication interface into the Sunny Island.

Information

Communication via Powerline/Powerline modem (NLM) is not possible in stand-alone grids.

NOTICE!

Electrostatic discharges can damage the communication interface.

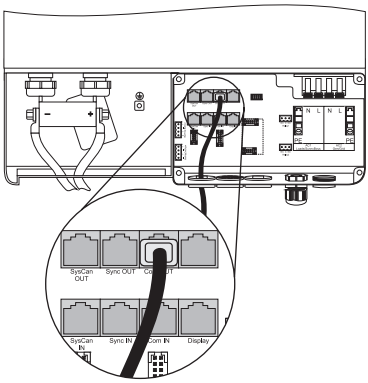
Internal components of the Sunny Island can be irreparably damaged by static discharge.

- Ground yourself before you touch a component.

When installing the communication interface proceed as follows:

1. Insert the communication cable of the interface into an available opening of the internal rubber element of the cable opening seal.

   Make sure the cable is long enough to reach from the bulkhead receptacle to the desired "ComOut" socket on the circuit board of the Sunny Island.
2. Pull the communication cable into the enclosure from the outside.
3. Insert the RJ45 plug of the communication cable into the "ComOut" socket in the Sunny Island. The plug snaps audibly into place.
4. Reassemble the bulkhead receptacle and re-insert it into the mounting opening on the bottom of the Sunny Island.
5. Fit any unused openings on the enclosure with filler plugs.
6. Connect the other end of the communication cable to the communication device.



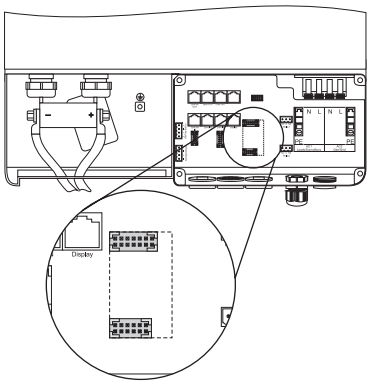
The installation guide of the communication device specifies which three pins should be used. The following table shows the assignment of these pins to the corresponding pins of the RJ45 socket.

WebBox assignment - "SMACOM" plug	RS 485 - signal assignment	RJ45 socket - Sunny Island "ComOut"
2	Data+	3
7	Data–	6
5	GND	2

7. Terminating the Sunny Island using RS485.

   The RS485 data bus of the Sunny Island is terminated with a plug. This plug is already pre-installed in your Sunny Island. Please only remove the plug if you want to connect another communication device.

8. Plug the communication interface (Piggy-Back) onto the board.



The Sunny Island can be operated at different data transmission rates (1200 to 19200 bps) to communicate with external devices. The parameter "250.06 ComBaud" must be set correspondingly.

Setting the baud rate

If Sunny Boys are connected to the communication bus, then the baud rate must be set to 1200 bps (factory setting).

The Sunny Island uses the SMA data protocol for communication.

7.6 Additional Connections

7.6.1 Battery Temperature Sensor

The battery temperature sensor measures the temperature of the connected battery. This is necessary since the optimum charging voltage for a battery strongly depends on the temperature. Further information is provided in section 12.4 "Charge Control" (page 107). A battery temperature sensor is provided with the Sunny Island (see packing list).

Defective battery temperature sensor

If the battery temperature sensor is rendered inoperative, e.g., due to a short circuit or broken cable, the Sunny Island works with a fixed setting which, however, leads to an insufficient charge of the battery in the long run. In this case the Sunny Island's display shows a warning.

- Replace the defective battery temperature sensor as soon as possible.
- Always operate the Sunny Island with the battery temperature sensor (included in the delivery).

NOTICE!

Damage to the battery due to faulty installation

- Always install the battery temperature sensor included in the delivery.
- Do not drill holes into the battery when installing the battery temperature sensor.
  - Attach the battery temperature sensor externally to one of the battery cells.
  - Choose a position in the space between two cells or in the middle area of the battery bank, where heat generation during operation is greatest.

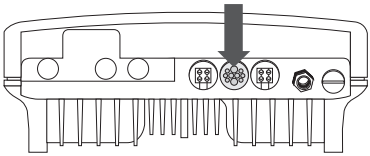
One battery temperature sensor per cluster!

A battery temperature sensor is provided with each Sunny Island.

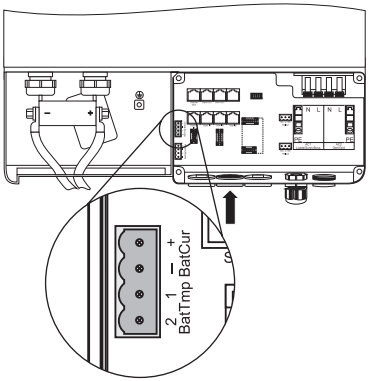
Only one battery temperature sensor, which is connected to the corresponding master, is required for a cluster.

Connect the Battery Temperature Sensor:

1. Pierce the rubber plug with a pin-shaped object.
2. Introduce both conductors from the outside through the opening.
3. Attach the wire sleeves to the conductors.



4. Plug one wire into each of the "BatTmp" contacts of the 4-pole terminal included.
5. Tighten the screws of the contact.
6. If needed, install a battery current sensor before you insert the contact into the "BatCur BatTmp" socket on the board.



Installation notice

The polarity of the two wires is irrelevant for the functioning of the battery temperature sensor.

7.6.2 Battery Current Sensor

In addition to the internal measurement, the Sunny Island provides the possibility to measure the battery current via a shunt. You need this function if you intend to operate additional DC generators and DC loads in your stand-alone grid system.

NOTICE!

Damage to the battery due to the connection of additional DC generators or DC loads to the stand-alone grid system.

In this operating situation, the Sunny Island's internal current measurement works imprecisely; the charge state of the battery is not determined exactly.

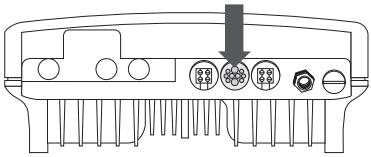
- Install an external battery current sensor (shunt).

Use cables of intrinsically safe circuits

Always use cables of intrinsically safe circuits for the connection of battery current sensors. "Intrinsically safe" means here that the cable is double-insulated and that the wire melts but the insulation remains intact in the event of a short circuit. In addition, the cable is not combustible. In order to avoid measuring errors, make sure to use twisted cables (see DIN VDE 0100-430).

Install the Battery Current Sensor:

1. Pierce the rubber plug with a pin-shaped object.
2. Introduce both conductors from the outside through the opening.
3. Fit the wires with wire sleeves.

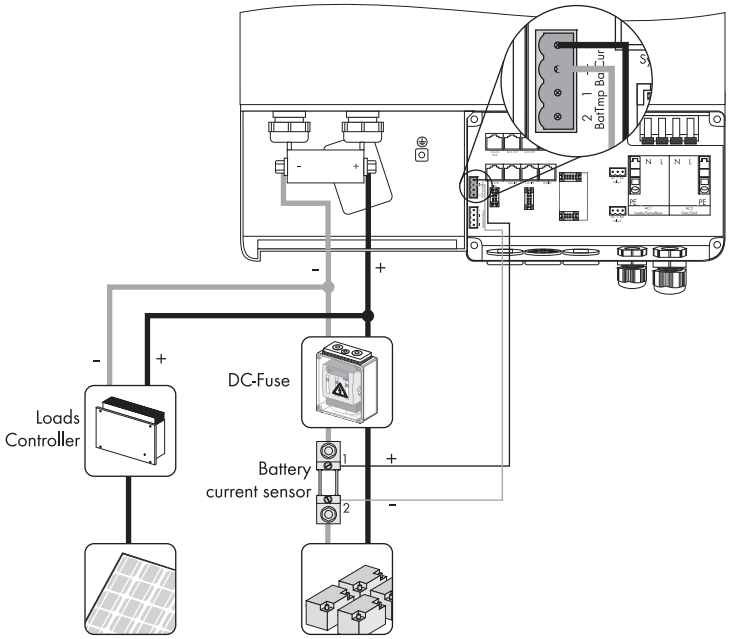


Installation notice

The battery current sensor must be looped around the negative pole of the battery. In addition, the contact of that battery current sensor which is connected to the Sunny Island (1) must be connected to the terminal "BatCur+" (see following figure).

If the battery current sensor is connected as described above,

- positive battery current means that the battery is discharging (current from the battery)
- negative battery current means that the battery is charging (current into the battery)



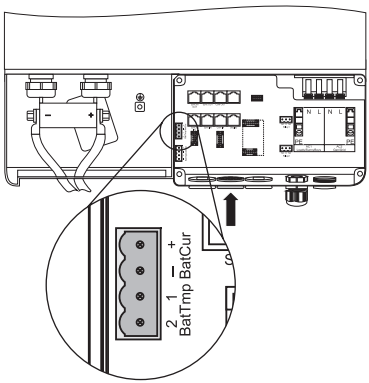
Information

Charge controller and PV generator in the illustration above are only examples.

4. Plug one wire into each of the "BatCur" contacts of the 4-pole terminal included.
5. Tighten the screws of the contact.

   Make sure the wires have the correct polarity (see also the installation notice above).
6. Insert the contact into the "BatCur BatTmp" socket on the board.

☑ The battery current sensor is installed.



Commissioning the battery temperature sensor

When connecting the battery current sensor, set up the internal offset on the Sunny Island during the first commissioning of the stand-alone grid system (see section 9.3 "Commissioning the Battery Temperature Sensor" (page 79)).

7.6.3 Multi-Function Relays 1 and 2

DANGER!

Danger to life due to faulty insulation

Securely disconnect the relay cable from the communication area and the AC area.

- Strip the wires of the relay cable.
- Sheathe all relay cables installed using the silicone tube provided.
- Do not operate the device without the silicone tube.

The Sunny Island offers you several options for the control of internal and external processes. To this end, the device is equipped with two multi-function relays to which you can assign functions with the parameters "241.01 Rly1Op" and "241.02 Rly2Op" (see section 14 "Relays" (page 134)).

Information

The slave devices' relays can also be used and programmed separately.

Information on the switching capacities of the relays is provided in section 20 "Technical Data" (page 177).

Operating principles of the relays

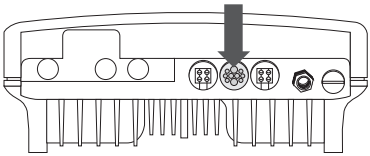
The relays are changeover contacts; they can be used as normally closed contacts (NCC) or as normally open contacts (NOC).

The contact is open. In presence of a fault, the relay is deactivated and the contact closes. In the event of fault, with the help of this relay function you can, for instance, activate a warning light.

Note:
You can only assign one function to each relay.

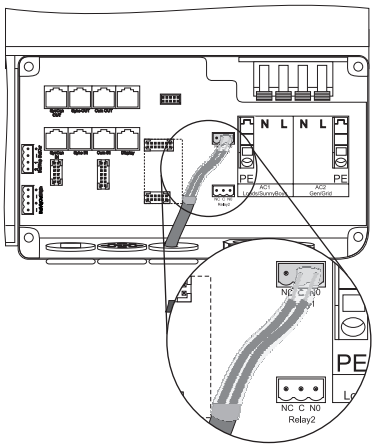
Connecting Relay Cables (e.g. relay 1) in the Sunny Island:

1. Pierce the rubber plug with a pin-shaped object.
2. Introduce both conductors from the outside through the opening.
3. Fit the wires with wire sleeves.

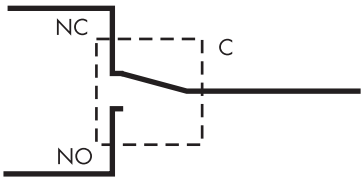


4. Strip the wires of the relay cable.

   Cut an appropriate piece from the silicone tube (see packing list) and pull it over both wires.
5. Insert the wires in the "Relay1" or "Relay2" contacts of the 3-pole terminals provided.
6. Tighten the contact screws.



7. Note how the pins are labeled:
   - NC: Normally closed (closed when idle)
   - C: Contact (operation contact)
   - NO: Normally opened (open when idle)
8. Insert the contact into the appropriate socket on the board.



Power Contactor for Load Shedding

The Sunny Island can automatically switch off loads to protect the batteries from deep discharge. To do this, an external (AC or DC) power contactor must be installed between the Sunny Island and the loads (see also section 19 "Accessories (Optional)" (page 176)).

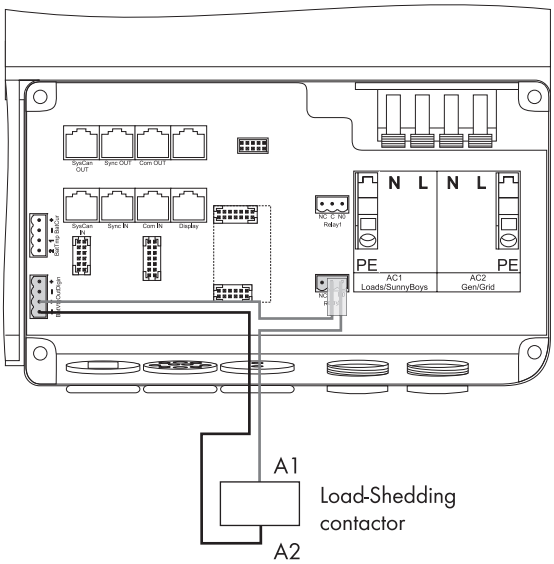
NOTICE!

If a relay is used for load shedding, the loads connected to the power contactor will no longer be supplied with electricity in the event of a fault in the stand-alone grid system, even if the grid is available.

Installing the Power Supply of a DC Power Contactor for Load Shedding (e.g. relay2):

Power supply of the DC power contactor

A 12 V (Sunny Island 2012) or 24 V (Sunny Island 2224) voltage is present in the battery-supplied control circuit. The voltage can handle loads up to a maximum of 600 mA.



1. Wire the A1 coil connector of the power contactor to the connection terminal NO (relay2).
2. Wire connection terminal C (relay2) to the connection terminal BatVtgOut +.
3. Wire the A2 coil connector of the power contactor to the connection terminal BatVtgOut –.

☑ The control circuit of the power contactor is installed..

Generator Start

The Sunny Island can control generators. The Suny Island directly supports generators that can be started/stopped using a single contact. Generators which require more than one contact must be connected to the Sunny Island via a Generator Manager (GenMan). This product can be acquired through SMA Solar Technology.

Default setting of the relays

By default, relay 1 is set to the generator start function "AutoGn" and relay 2 is set to the load shed function "AutoLodSoc".

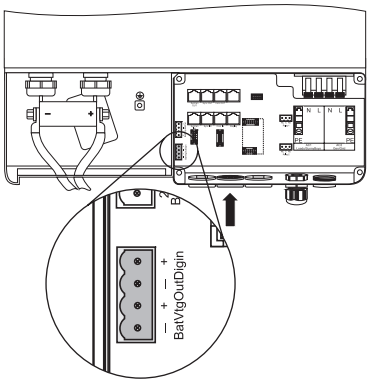
The first figure in section 2 "System Overview" (page 12) shows the principal connection.

7.6.4 BatVtgOut Power Supply

The battery voltage is conducted to the outside at these terminals. The battery voltage is fused at both poles by PTC resistors (max. 0.6 A) and can fluctuate depending on the battery status. This connection can, for example, be used to supply a DC contactor for load shedding.

Proceed as follows when connecting the power supply:

1. Pierce the rubber plug with a pin-shaped object.
2. Attach the wire sleeves to the conductors.
3. Introduce both conductors from the outside through the opening.
4. Plug one wire into each of the "BatVtgOut" contacts of the 4-pole terminal included.
5. Tighten the screws of the contact.
6. If needed, install DigIn before you insert the contact into the "DigIn BatVtgOut" socket on the board.



7.6.5 DigIn Digital Input

These terminals are used as a digital input for external electrical sources. For example, the feedback contact for the GenMan (GenRn) is connected here.

The level on the digital input is located between:

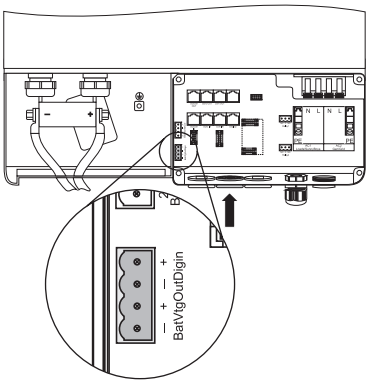
- High: from 6 V (to 35 V)
- Low: 0 to 2 V

Information

If you connect a GenMan, or operate the system with the generator and utility (GenGrid) in parallel, use the relays on the master device in order to activate the respective functions.

Proceed as follows when connecting the digital input:

1. Pierce the rubber plug with a pin-shaped object.
2. Introduce both conductors from the outside through the opening.
3. Attach the wire sleeves to the conductors.
4. Plug one wire into each of the "DigIn" contacts of the 4-pole terminal included.
5. Tighten the screws of the contact.
6. Insert the contact into the "DigIn BatVtgOut" socket on the board.



Further information

For more information on connecting and operating the GenMan, see the technical description of the GenMan.

7.7 Configuring a System with Several Sunny Islands

The Sunny Island can be configured for diverse system constellations:

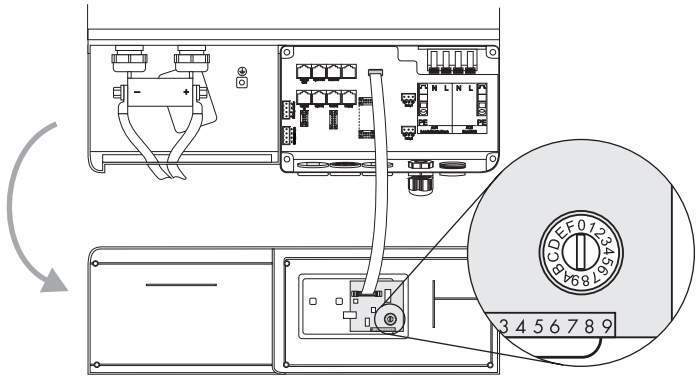
- Single-phase system with one Sunny Island
- Single-phase system with two or three Sunny Islands connected in parallel
- 3-phase system with three Sunny Islands (one Sunny Island per phase)

Carry out the configuration before the first commissioning of the system. Each Sunny Island must be configured with the aid of the rotary code switch. Upon delivery this rotary code switch is set to "0".

Note:

The position of the rotary code switch must only be changed if you intend to operate more than one Sunny Island in your system!

The rotary code switch is found on the back of the control panel, on the inside of the lower enclosure lid of the Sunny Island.



To configure the system proceed as follows:

Set the arrows on the rotary code switch to the required position using a screwdriver (2.5 mm).

Set the rotary code switch to

- 0 for master
- 1 for slave 1
- 2 for slave 2

7.8 Concluding Tasks

1. Remove all tools from the enclosure.
2. Have all cables been laid so as to be strain-relieved?
3. Are there no communication cables inside the Sunny Island which are touching a stripped 230 V wire?
4. Are all cable openings on the Sunny Island sealed?
5. Have all unused openings been closed with filler plugs?
6. Close the lower enclosure lid (see section 6.2 "Closing the Sunny Island" (page 34)).

The installation of the Sunny Island and Sunny Remote Control is complete.

8 Control Elements and Menu Navigation

Before commissioning the stand-alone grid system, familiarize yourself with the operation of the device.

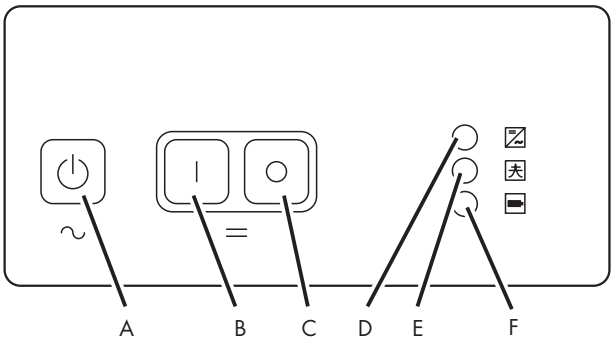
The Sunny Island is operated with the control panel on the enclosure only under the standard setup (for default values see section 17.2 "Adjustable System Parameters" (page 148)).

To change the Sunny Island's parameter setup you need the Sunny Remote Control external display.

8.1 Sunny Island

8.1.1 Control Panel on the Enclosure

The following figure describes the elements of the control panel:



A	Start / Stop button
B	DC start button
C	DC stop button
D	Inverter LED
E	Grid LED
F	Battery LED

8.1.2 Control Panel Buttons

The Sunny Island's control panel has three buttons.

- Start / Stop starts and stops the inverter operation of the Sunny Island (see also section 10.1 "Activation and Deactivation" (page 81)).
- DC start turns on the Sunny Island (standby).
- DC stop turns off the Sunny Island.

8.1.3 Meaning of the Light Emitting Diodes (LEDs)

In descending order, the three LEDs show the status messages for the

- Sunny Island (inverter LED)
- Grid / Generator (grid LED)
- Battery (battery LED)

Depending on the message, the corresponding LED glows green, red, orange, or not at all.

Inverter LED:

Green	Red	Orange	Operating state Sunny Island
–	–	–	Off (device has been switched off)
–	–	ON	Standby (no inverter operation)
ON	–	–	In operation
–	ON	–	Disturbance or fault

Grid LED:

Green	Red	Orange	Operating state Grid / Generator
–	–	–	Possibly no grid / generator (third party access possible)
–	–	ON	Synchronization with the external grid / generator
ON	–	–	Operation with grid / generator
–	ON	–	Disturbance or fault

Battery LED:

Green	Red	Orange	Charge level Battery
–	–	–	Off (device has been switched off)
ON	–	–	100 % – 50 %
–	–	ON	50 % – 20 %
–	ON	–	20 % – 0 %

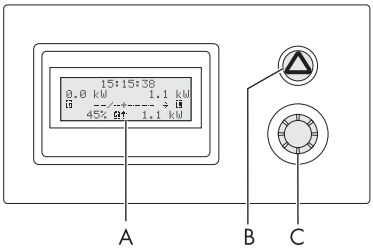
8.2 Sunny Remote Control

Information

The Sunny Island is controlled via the external display (Sunny Remote Control).

You can use the external display (Sunny Remote Control) to navigate through the menus of the Sunny Island.

The Sunny Remote Control consists of one



A	Display
B	Indicator light button
C	Rotary pushbutton

8.2.1 Display Messages

The display of the Sunny Remote Control has four lines, each having 20 characters.

Change to standard view 1

The display switches to standard view 1 (home screen) automatically if the Sunny Remote Control has not been used for more than five minutes (inactivity).

Display illumination

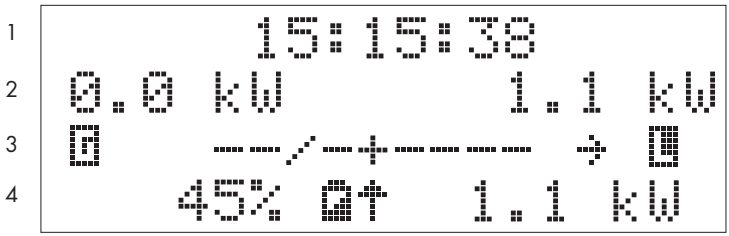
The background illumination is automatically deactivated after a short time of inactivity. Switch the lighting back on by turning the pushbutton slightly. Turning the button only reactivates the display illumination and has no effect on the settings.

Display of messages

Messages are displayed whenever the device is in operation and have priority over the Home Screen display.

Standard View 1

The standard view 1 (home screen) shows the operating states of the Sunny Island:



Icon	Explanation
	Grid / Generator
	Battery
	Loads (Loads/Sunny Boys)
	Direction of energy flow between grid/generator and load side.
	Battery charge
	Battery discharge

1st line: Time in [hh:mm:ss]

2nd line: Grid or generator power in kW ("TotExtPwrAt")

= arrow in direction of energy flow, if applicable (e.g. feed power of a PV generator)

Consumer power in kW ("TotExtPwrAt" + "TotInvPwrAt")

3rd line: = Symbols for grid / generator

= Loads

= Generator relay or load shedding relay: On

= Generator relay or load shedding relay: Off

arrow in direction of energy flow, if applicable

4th line: State of charge of battery (SOC) in [%]

= Symbol for battery

arrow in direction of energy flow

Inverter power in [kW] („TotInvPwrAt“)

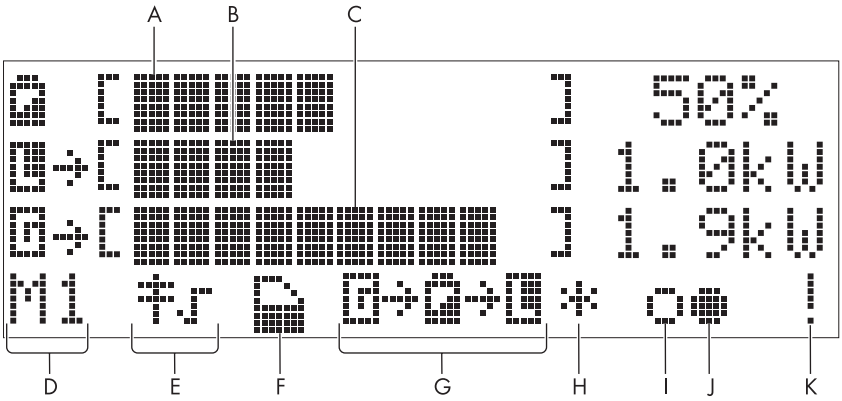
- positive value: the battery is discharging / the Sunny Island is feeding the loads
- negative value: the battery is charging

Standard View 2

The standard view 2 shows the operating states of the Sunny Island

- Battery charge level
- Output power
- Power from the grid / generator

as well as a variety of information in the status bar.

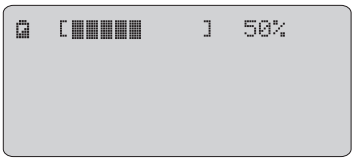


A	Battery charge level in [%]
B	Output power of loads in [kW]
C	Power drawn from the grid / generator (AC2) in [kW]
D	Device hierarchy (master, slave 1, slave 2)
E	Active grid limits
F	MMC/SD card inserted
G	Direction of energy flow and system status
H	Status of grid / generator (alternates with GenReq)
I	Relay 1 status
J	Relay 2 status
K	Warning message

1st line

The bar shows the charge state of the battery in [%].

The value of the charge state is also indicated as a symbol on the right side.



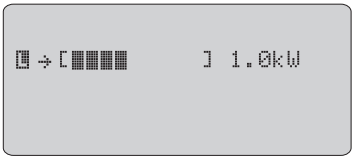
2nd line

The status bar displays the level of total output power in [kW] that is used to supply the loads.

The arrow to the right of the load symbol indicates the direction of the energy flow:

- → = Load is being supplied
- ← = Sunny Boy (PV inverter) feeds into the grid

The level of total output power in [kW] is also indicated as a symbol on the right side.



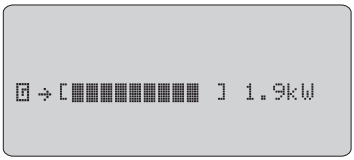
3rd line

The bar shows the level of the power drawn from the grid / generator in [kW].

The arrow to the right of the grid / generator symbol indicates the direction of the energy flow:

- → = The stand-alone grid system is being supplied by the grid / generator

The level of total output power in [kW] is also indicated as a symbol on the right side.



4th line

Status bar

The following information is shown in the status bar (from left to right):

1. Device hierarchy:
   - M1 = Master
   - S1 = Slave 1
   - S2 = Slave 2
2. Connection to the public grid / a generator:
   - = Active grid limits
   - = Inactive grid limits

3. MMC/SD card (memory card) in the Sunny Remote Control:
   = Card inserted
   = Card missing
4. These indicators label the energy flow direction of the
   = Grid / Generator
   = Battery
   = Loads
   There are four operating states:
   = The grid / generator charges the battery and supplies the loads
   = The grid / generator supplies the loads
   = The grid / generator charges the battery, there are no loads connected
   = The battery supplies the loads
5. The state of the external sources is described by the following symbols:
   * = Grid / generator voltage and frequency are within the set limits
   ? = Generator voltage and/or frequency are outside of the set limits The Sunny Island will not connect the generator to the stand-alone grid while this situation exists.
   ! = The maximal admissible grid / generator reverse power was exceeded, the Sunny Island has disconnected the grid / generator from the stand-alone grid.
   The following letters indicate why the generator was requested:
   B = Battery = The generator has been requested as a result of the battery charge level
   L = Load = Generator has been requested as a result of the load-dependent generator request
   S = Start = Generator has been requested by the operator manually setting the generator request in the Sunny Island from "Auto" to "Start". The generator is then NO LONGER automatically controlled or switched off by the Sunny Island.
   T = Time = The generator was run for an hour by the Sunny Island via the parameter setting "Run1h". Once this time has passed, the Sunny Island automatically switches off the generator.

The screen changes

The generator status and the reason for the request are shown (alternating) under "Status of external sources" in the display.

- If, for example, the display changes every 3 seconds from "*" to "B", this means that the generator voltage and frequency lie within the specified limits and that the generator was requested as a result of the battery charge level.
- If the generator has been manually set to "Stop", then no generator status information is shown on the display. The field remains empty.

6. Relay:
   - = Relay activated
   - = Relay deactivated
7. Warning message:
   - ! = Warning

     The symbol blinks until you have seen and cleared the warning in menu "410# Fail Current" or "420# Fail History".

     Fault: If there is a fault, the device goes into Standby. A fault indication appears in the display. Acknowledge and clear the fault; then the Sunny Island can be restarted.

8.2.2 Indicator light button

If a device error occurs, the indicator light button will glow red.

Push the indicator light button to acknowledge the error and the warning light will then switch off (see also section 18.1 "Error Confirmation" (page 166)).

8.2.3 Rotary Pushbutton

The Sunny Remote Control is controlled via a rotating pushbutton. The rotating pushbutton allows you to easily navigate through the menus of the Sunny Island.

The rotating pushbutton can either be pushed or turned to the right or left.

- Turning:
  - Move up and down in the menu
  - Enter values
- Pushing:
  - Open/close menu
  - Select/cancel function
  - Select value
  - Confirm entry.
  - Answer YES/NO
  - Start the device (hold down the button while on standby)
  - Stop the device (hold down the button during operation)

Operation of the Sunny Island with the Sunny Remote Control using the rotating pushbutton is described in detail in 10 "Operation" (page 81).

In the remainder of the manual, the "rotating pushbutton" will only be referred to as "button".

8.2.4 MMC/SD Card

The Sunny Remote Control features an MMC/SD card for firmware updates or as a service interface. For details, see section 10.3 "Storing Data on an MMC/SD Card" (page 94).

8.2.5 Navigation Area

The navigation area includes the Home Screen and the main menu items

- 100# Meters (display values)
- 200# Settings
- 300# Diagnosis
- 400# Failure/Event (lists)
- 500# Operation (operating functions)
- 600# Direct Access

The main menus are divided into several submenus.

In a submenu you can select a second submenu or a parameter.

NOTICE!

Incorrect parameters may cause system damage

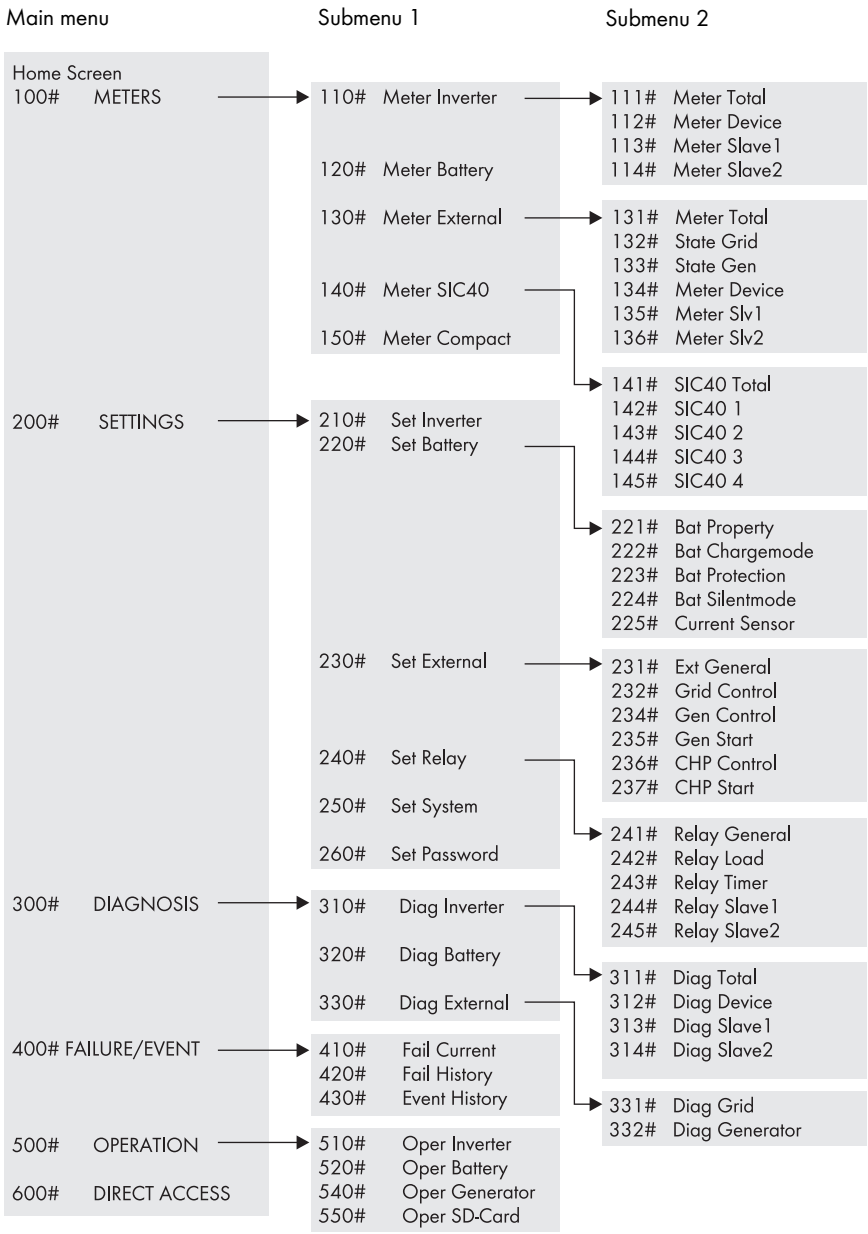
- Only qualified personnel are permitted to set and adjust system parameters.

You can access the navigation area from one of two levels:

- User level
- Installer level (password required)

The menu items and parameters which allow the changing of system parameters are accessible after entering the installer password (see section 10.2.6 "Setting the Installer Password" (page 90)).

Overview of the Navigation Area:



100# Meters - display values: In this main menu you will find the display values for the following components of the stand-alone grid system:

- 110# Meter Inverter - Sunny Island
- 120# Meter Battery
- 130# Meter External - grid / generator
- 140# Meter SIC40 - battery charge controller
- 150# Meter Compact - compact view of values for commissioning

By opening the corresponding submenus or the second tier of submenus, you can see the parameters (for example, parameter "112.03 InvVtg").

200# Settings: you can view and set system parameters in the following sub-menus:

- 210# Set Inverter
- 220# Set Battery
- 230# Set External - grid / generator
- 240# Set Relay
- 250# Set System
- 260# Set Passwort - password entry

300# Diagnosis: you can view system data in the following sub-menus:

- 310# Diag Inverter - device data (Sunny Island)
- 320# Diag Battery - battery data
- 330# Diag External - grid / generator

400# History - lists: In the following submenus you can see various error and event lists:

- 410# Fail Current - current errors
- 420# Fail History - previous warnings and errors
- 430# Event History - events

500# Operation - operating functions: you can view and set operation parameters in the following sub-menus:

- 510# Oper Inverter
- 520# Oper Battery
- 540# Oper Generator
- 550# Oper SD Card - MMC/SD card

600# Direct Access: In this main menu you can access settings and display values directly (see section 10.2.7 "Direct Access to Parameters" (page 92)).

9 (First) Commissioning

9.1 Requirements

Check the connections

Before starting the commissioning process, make sure all electrical connections have the correct polarity and are connected according to the instructions in sections *7* "Sunny Island Electrical Connection" (page 35).

Always save data

Always use the MMC/SD card to save data and events. In case of a failure SMA Solar Technology can thus quickly help you.

The Quick Configuration Guide (QCG) allows you to quickly and easily commission your stand-alone grid system.

- On the Sunny Island, choose one of the following positions:
  - Start System
  - New System
  - New Battery
- Set the parameters for the particular system you want to use.

QCG requires the Sunny Remote Control

You need the Sunny Remote Control in order to read the menus and error lists or set the parameters. The QCG can only be operated in conjunction with the Sunny Remote Control!

9.2 Starting the Quick Configuration Guide (QCG)

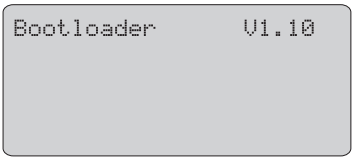
Information

The QCG sets up all parameter values automatically. This makes efficient operation possible with very little effort.

The QCG is automatically activated when the device is started for the first time. Please continue reading under point *7*, otherwise follow this list.

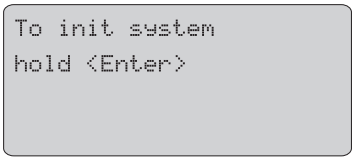
1. Insert the NH fuse in the BatFuse or close the BatFuse's DC disconnector.
2. Start the Sunny Island.

   Press the DC start key on the Sunny Island.



3. The Sunny Island initiates the startup phase. The following messages appear on the display.

4. As soon as the startup phase is finished, the message "To init system hold <Enter>" is displayed.



5. Push and hold the button on the Sunny Remote Control.

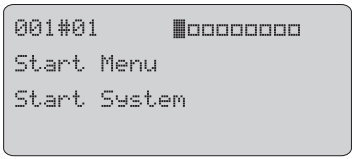
   You hear three beep tones.

6. Release the button on the Sunny Remote Control.

   ☑ The Quick Configuration Guide is started.

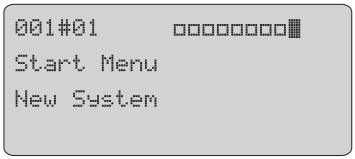
7. By turning the button you can now choose between the following options:

   – "Start System" (if you have accidentally accessed the QCG and only would like to restart the system)



   – "New Battery" (if you would like to change the main battery settings, but retain the system configuration)

   – "New System" (if you would like to start a new system or perform changes to the system configuration)



"New Battery"

The "New Battery" option is required whenever you want to install a new battery in the stand-alone grid system.

With this option, only specific battery settings can be reset and adjusted. System settings are not affected.

The following parameters must be set when "New Battery" is selected:

(default setting shown in bold)

- Battery type: 002#05 BatTyp (**VRLA**, FLA, NiCd)
- Nominal battery voltage: 002#06 BatVtgLst (22 V, 24 V in 2 V increments for FLA and VRLA, 21,6 V, 22.8 V, 24 V in 1.2 V increments for NiCd), **24 V** Sunny Island 2224, (12 V for FLA and VRLA, 10.8 V, 12 V for NiCd), **12 V** Sunny Island 2012
- Nominal battery capacity: 002#07 BatCpyNom (100 Ah to 10000 Ah, preset **100 Ah** for Sunny Island 2224, **280 Ah** for Sunny Island 2012)

The following parameters must be set when "New System" is selected:

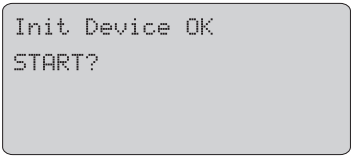
(default setting shown in bold)

- System configuration: 003#01 ("**1phase"**, 1phase2; 1phase3, 3phase; see section 7.7 "Configuring a System with Several Sunny Islands" (page 62))
- Voltage / Frequency type: 003#03 AcVtgFrqSet (**230 V_50 Hz**, 220 V_60 Hz)
- Date: 003#04 Dt (dd.mm.yyyy)
- Time: 003#05 Tm (hh:mm:ss)
- Battery type: 003#06 BatTyp (**VRLA**, FLA, NiCd)
- Nominal battery voltage: 003#08 BatVtgLst (22 V, 24 V in 2 V increments for FLA and VRLA, 21.6 V, 22.8 V, 24 V in 1.2 V increments for NiCd), **24 V** Sunny Island 2224**,** (12 V for FLA and VRLA, 10.8 V, 12 V for NiCd), **12 V** Sunny Island 2012
- Nominal battery capacity: 003#09 BatCpyNom (100 Ah to 10000 Ah, **100 Ah** for Sunny Island 2224, **280 Ah** for Sunny Island 2012)
- External power supply unit: 003#10 ExtSrc (**PvOnly**, Gen, Grid, GenGrid)
- Maximal grid current: 003#11 GdCurNom (0 to 25 A, **16 A**)
- Maximal generator current: 003#12 GnCurNom (0 to 25 A, **16 A**)
- Generator interface: 003#13 GnStrMod (Manual, GenMan, **Autostart**)

8. Conclude the Quick Configuration Guide. Turn the button: The following message is displayed:

   "Init Device OK

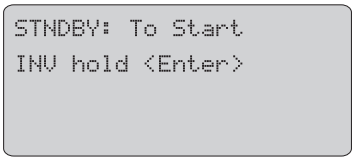
   START?"



9. Confirm the question:

   Push the button on the Sunny Remote Control 1.

10. The following message appears:
    "ST(A)NDBY: To Start INV(erter) hold <Enter>"



☑ The QCG is complete.

Starting the Sunny Island:

1. Push and hold the button on the Sunny Remote Control.
   You hear one beep tone.
   ☑ The Sunny Island starts.
2. Release the button.

☑ The Sunny Island is in operation.

If there is a fault indication

If the device indicates a fault, this fault must be fixed before the device can be put into operation. For this purpose, refer to section 18 "Troubleshooting / Problem Solving" (page 166).

Parameter lists

For more information on adjustable parameters, see section 17 "Parameter List Overview" (page 141).

Note that you must first enter the installer password before some parameters can be changed (see section 10.2.6 "Setting the Installer Password" (page 90)). In addition, some parameters can only be changed in standby mode (see section 10.1.2 "Stopping the Sunny Island" (page 83)).

9.3 Commissioning the Battery Temperature Sensor

In the event you have installed a battery current sensor in your system (see section 7.6.2 "Battery Current Sensor" (page 55)), you are required to synchronize the device's internal offset.

Proceed as follows:

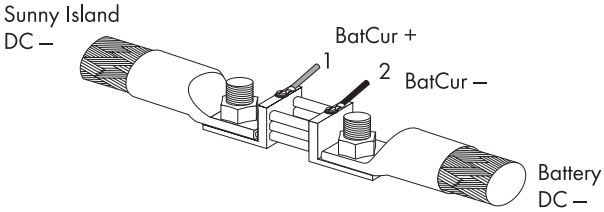
1. Set the Sunny Island to standby mode (see section 10.1.2 "Stopping the Sunny Island" (page 83)).

NOTICE!

Incorrect parameters may cause system damage

All parameters that can affect the operating safety of the stand-alone grid system are protected/locked by the installer password.

- Only qualified personnel are permitted to set and adjust system parameters.
- Enter the installer password.



2. Remove the "BatCur+" wire from the terminal 1 of the battery current sensor.
3. Connect both the "BatCur+" and the "BatCur-" wires to the terminal 2.
4. Set the following parameters:

   Choose the type of battery current sensor:

   – "225.01 BatCurSnsTyp" (None/50 mV/60 mV). Only after activation of the parameter with 50 mV or 60 mV will other parameters (02, 03 and 04 in the menu "225# Battery Current Sensor") be shown and activated.

   Set the maximal current for the battery current sensor (e.g., 400 A / 60 mV):

   – "225.02 BatCurGain60": (for a 60 mV output)

   – "225.03 BatCurGain50": (for a 50 mV output)
5. Start the self-calibration:

   – Set "225.04 BatCurAutoCal" to "Start".

   The Sunny Island conducts a self-calibration.
6. Subsequently, check the offset error:

   The display value "120.06 TotBatCur" should be (close to) zero.

7. Connect the "BatCur+" wire to the battery current sensor's terminal 2 again.

   Make sure the wires have the correct polarity.

   – BatCur+ to terminal 1

   – BatCur– to terminal 2

8. Start the Sunny Island (see section 10.1.1 "Switching On/Starting the Sunny Island" (page 81)).

9. Check the current direction: "120.06 TotBatCur"

Current direction

Discharging the battery:

- No generator / grid connected
- Loads are being supplied

The value of the battery current is positive.

Charging the battery:

- Generator / grid connected
- Loads are not/are marginally supplied
- Battery is being charged

The value of the battery current is negative.

10 Operation

10.1 Activation and Deactivation

10.1.1 Switching On/Starting the Sunny Island

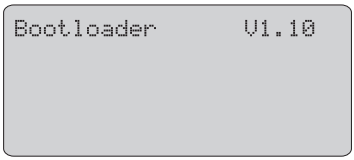
WARNING!

Danger due to incorrect wiring of the stand-alone grid system

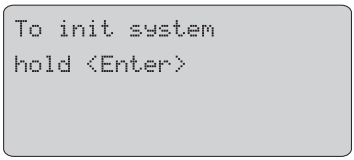
Only qualified personnel are permitted to start up the device for the first time. Check the stand-alone grid system for:

- correct electrical connections
- correct connection
- voltages and polarities

1. Insert the NH fuse in the BatFuse or close the BatFuse's DC disconnector.
2. Press the DC start key on the Sunny Island.
   The Sunny Island is switched on.
3. The Sunny Island initiates the startup phase.
   The following messages appear on the display.



4. As soon as the startup phase is finished, the message "To init system hold <Enter>" is displayed.



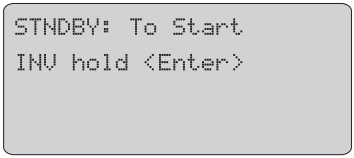
5. If you want to access the QCG, push and hold the button on the Sunny Remote Control 1.

   Instructions on how to proceed further can be found in section 9.2 "Starting the Quick Configuration Guide (QCG)" (page 75).

6. If you do **not** press the button within 5 seconds, the Sunny Island skips the QCG.

   The following message appears:

   "ST(A)NDBY: To Start INV(erter) hold <Enter>"



7. Push and hold the button on the Sunny Remote Control.

   You hear one beep tone.

   ☑ The Sunny Island starts.

8. Release the button.

☑ The Sunny Island is in operation.

Starting the Sunny Island automatically

Even with the "250.01 AutoStr" parameter set, the Sunny Island must be manually started for inverter operation after each DC start.

If there is a fault indication

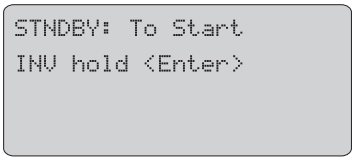
If the device indicates a fault, this fault must be fixed before the device can be put into operation. For this purpose, refer to section 18 "Troubleshooting / Problem Solving" (page 166).

10.1.2 Stopping the Sunny Island

1. Push and hold the button on the Sunny Remote Control.

   The following message appears:

2. Hold the button down until the bars indicating the remaining time of the stopping process are gone.
3. The screen changes.



4. Release the button.

☑ The Sunny Island is stopped.

DANGER!
Danger to life due to high voltages

The stand-alone grid system is in Standby mode.

- Do not open the device!
- Do not work on the stand-alone grid system!

There are still voltages present on the Sunny Island (DC and AC sides).

- Switch off the Sunny Island.
- Disconnect the Sunny Island from power supply units.

Internal consumption in standby mode

Even in standby mode the Sunny Island still requires about 6 W of power from the battery.

10.1.3 Switching off the Sunny Island

1. Disconnect all loads.
2. Set the Sunny Island to standby mode (see section 10.1.2 "Stopping the Sunny Island" (page 83)).
3. Press the DC stop key on the Sunny Island.

☑ The Sunny Island is switched off.

DANGER!
Danger to life due to high voltages

The stand-alone grid system is switched off. There are still voltages present on the Sunny Island (DC and AC sides).

- Disconnect the Sunny Island from power supply units.

Information

The only way to ensure that all internal meter readings/values are saved is to follow this shutdown sequence.

10.1.4 Disconnecting the Sunny Island from Power Supply Units

1. Switch off the Sunny Island (see section 10.1.3 "Switching off the Sunny Island" (page 84)).
2. Remove the NH fuse from the BatFuse and/or open the BatFuse's DC disconnector.
   The Sunny Island is disconnected from the battery.
3. Disconnect the Sunny Island from all AC power supply units.
4. Check to see if the Sunny Island has been safely disconnected from all power supply units.
5. Wait at least 15 minutes.
   The capacitors discharge and the voltage in the device drops down to a safe level.

☑ The Sunny Island is now completely free of voltage.
You can now open the lower enclosure lid of the Sunny Island.

10.1.5 Restarting the Sunny Island Following Automatic Shutdown

NOTICE!

System will shut down if device settings are incorrect

- Check the entire stand-alone grid system for errors before and after you reactivate the device.
  - Wiring
  - Components
  - Wrong parameter settings at the Sunny Island
- Correct any errors found.

➢ If the Sunny Island has switched itself off due to a battery which is too deeply discharged, proceed as follows to restart:

1. Press the DC stop key on the Sunny Island.
2. Press the DC start key on the Sunny Island.
3. Start the Sunny Island (see section 10.1.1 "Switching On/Starting the Sunny Island" (page 81)).

Charging the battery

After reactivation, it is important that the batteries are charged. If the grid is available again, and/or the generator starts, the grid/generator will recharge the batteries after a few minutes.

4. Use the Sunny Remote Control to monitor the process in which the Sunny Island switches to charge mode.
5. Make sure all other energy generators in the stand-alone grid system are functioning properly.

If Sunny Island begins to operate in battery-preservation mode, disconnect the loads!

If the Sunny Island enters the battery-preservation mode immediately after restarting (see section 12.5 "Battery Preservation Mode" (page 112))

- check for grid availability.
- Only reconnect loads when the Sunny Island is in charge mode.

10.2 Displays and Settings

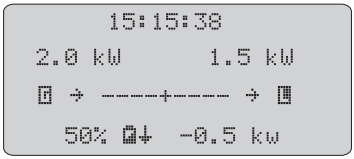
10.2.1 Selecting a Menu

Use the button on the Sunny Remote Control to navigate through the menus of the Sunny Island.

- Press the button to access the submenu level.
- Turn the button to the left or right to navigate within this menu level.
- Select the line labeled "back" and press the button to exit the menu level and go one level higher.

Example:

The display shows the standard view 1. Browse through the main menu by turning the button to the right or left.

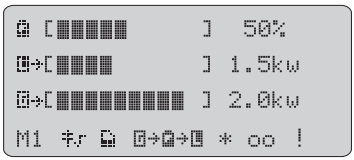


1. Turn the button to the right.

   The display illumination is activated.

2. Turn the button further to the right.

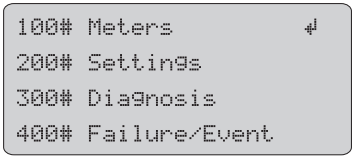
   The display shows standard view 2.



3. Turn the button further to the right.

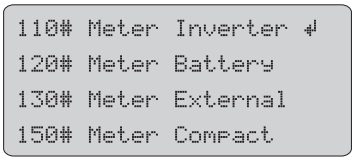
   The following message appears:

   The menu number and name are indicated on the left side. The enter arrow on the right side indicates which line is currently active.



4. Push the button.

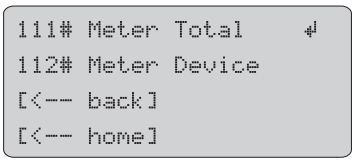
   The arrow jumps to the submenu of the "100# Meters" main menu.



5. Push the button.

   The arrow jumps to the next menu level. Now you have three options:

   – Push the button. The arrow jumps to the next level. You can view the parameters assigned to this menu.



- Select "back". To do so, turn the button forwards (or backwards) until the enter arrow appears in the appropriate line. Push the button.
- Select "home". Push the button. Now you can see the standard view 1.

Order of menu items

Some menu items may be skipped, which means you will not see all the parameters in consecutive order. This depends on which password level is set. If you are operating the device in user level, the parameters which may only be changed by the installer are hidden. The menu numbers are fixed, that means they do not change if an item (or several items) are skipped.

10.2.2 Selecting Parameters

Parameters are displayed as follows:

- The menu and parameter numbers are listed on the left. A bar indicating the set value within the value range appears on the right.
- The parameter name is shown on the left and the enter arrow appears on the right. The arrow indicates an adjustable parameter.
- Value and unit.

Document syntax

The syntax specified here for menus and parameters applies throughout the entire document.

A menu is denoted by a menu number, a hash and a menu name (110# Meter Inverter).

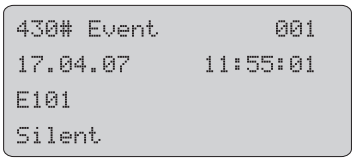
A parameter is denoted by a menu number, dot (hash, on the display), a parameter number and a parameter name (225.01 BatCurSnsTyp).

10.2.3 Selecting Events

The event list is found in the main menu under 400# Failure/Event. Then go to the submenu 1 and activate 430# Event.

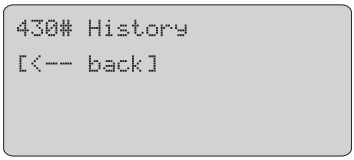
Events are displayed as follows:

- The menu number and name are indicated on the left. The serial number (quantity) of the event is displayed on the right.
- Date and time of the event.
- Event and number (see section 18.5 "Events" (page 167)).
- Description of the event.



Returning to the previous menu level:

- Turn the button all the way to the left or right until "back" appears in the display.
- Push the button.



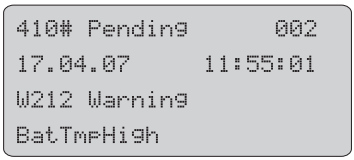
10.2.4 Selecting Warnings and Errors

The warnings and errors list can be found in the main menu under 400# Failure/Event. Then go to the submenu 1.

- List of the current warnings and errors - 410# Fail Current.
- List of all warnings and errors (history) - 420# Fail History.

Example:

Warnings and errors are displayed as follows:



- The menu number and name are indicated on the left. The serial number (quantity) of the warning and/or error is displayed on the right.
- Date and time of the warning/error.
- Warning or error and number (see section 18.7 "Warnings and Fault Indications" (page 169)).
- Description of the warning or error.

Pending:	The warning/error is pending. The error has not yet been cleared.
Arrive:	Time at which the warning/error appeared.
Clear:	The warning/error has been cleared.

10.2.5 Setting Parameters

Use the button on the Sunny Remote Control to navigate through a menu and select the parameter you want. When the relevant parameter appears on the display, you can read its present value.

An enter arrow to the right of a parameter name indicates that you can adjust that parameter.

1. Push the button.
2. The arrow skips behind the unit and blinks.
3. Turn the button to the left or right. The value will decrease or increase accordingly.
4. If the value you want is displayed, save it. Push the button.

   On the display appears "Ok"? Y(es)/N(o) and the enter arrow.
5. Select Y or N. The letter selected blinks.

   You can confirm the parameter change with Y. You can cancel the change with N and the previous value will remain saved.
6. Push the button.

   The parameter is set.

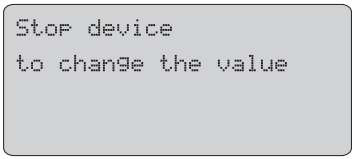
Setting parameters in standby mode

Note that some parameters can only be changed when the device is in standby mode. The parameters for which this applies can be found in the tables in sections 17.2 "Adjustable System Parameters" (page 148) and 17.5 "Functions in Operation" (page 164).

The Sunny Island will display a message notifying you of parameters that can only be changed in standby mode or with a password.

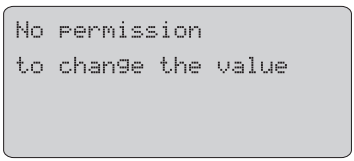
The following message is displayed:

- This parameter can only be changed in standby mode.
- Stop the Sunny Island (see section 10.1.2 "Stopping the Sunny Island" (page 83)).
- You can now change the parameter.



The following message is displayed:

- Incorrect operating level (user level).
- The installer password is required to make changes in this menu area.
- Follow the instructions in section 10.2.6 "Setting the Installer Password" (page 90).



10.2.6 Setting the Installer Password

NOTICE!

Incorrect parameters may cause system damage

All parameters that can affect the operating safety of the stand-alone grid system are protected/locked by the installer password.

- Only qualified personnel are permitted to set and adjust system parameters.

Do not disclose the password to unauthorized persons

Do not provide the following information for entering the installer password to unauthorized persons. Illegal provision of this information to other persons will lead to invalidation of all warranties by SMA Solar Technology.

Entering the password

The Sunny Island allows you to enter the password not only in standby, but also during operation.

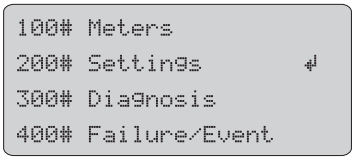
The password is dependent on the operating hours counter. In the installer level there are extended access privileges to all necessary parameters.

Password = Sum of digits of the operating hours.

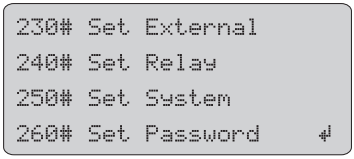
Proceed as follows to enter the installer password:

The display shows standard view 1.

1. Select the "200# Settings" menu.
2. Push the button.



3. Select the "260# Set Password" menu.
4. Push the button.



The following message appears:

- Two place holders (**) for the password (PW)
- Level [0] = user level
- Operating hours (OnTmh)
- Sum of all operating hours
- Unit

5. Determining the password

   Calculate the sum of digits of the operating hours. In this case:

   1 +2 + 3 + 4 + 5 + 6 = 21

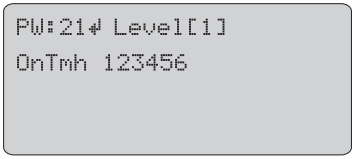
6. Push the button. The placeholders start to blink.
7. Enter the password ("21" in this example).

   Turn the button to the right or left. The value increases or decreases accordingly.

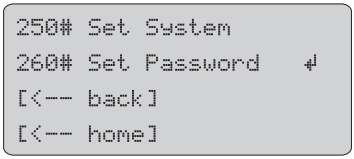
8. Confirm the password. Push the button.

   The password is confirmed.

   Operating level [1] = the installer level is set.



9. Exit the menu.



Switching operating levels

If the password is invalid, the Sunny Island does not switch to the installer level. In this case, recalculate and re-enter the installer password as described in this section.

The installer level is switched back to the user level if

- the Sunny Island is switched off and on again
- specific parameters are entered (e.g., the "510.01 InvRs" parameter) that cause a restart.
- an incorrect password is entered.
- if no activity takes place within five minutes.

10.2.7 Direct Access to Parameters

The "600# Direct Access" menu gives you direct access to the selected parameter using the parameter name or number.

Via the Select Name submenu, you have direct access to the following functions:

- ChrgSelMan: manual initiation of an equalization charge (see section 12.4.3 "Equalization Charge" (page 110))

Via the Select Number menu, you have direct access to every parameter by entering the parameter number.

Example

Using the menu #600 Direct Access, you can select the "#222.01 BatChrgCurMax" parameter, for example, to set the maximum battery charging current.

The direct access must be entered as a five-digit number, for example, 22201. Here, the first three digits describe the menu number and the last two describe the parameter number.

Exit the menu level after the parameter has been set.

10.2.8 Meter Compact

The "150# Meter Compact" menu is primarily intended to help the installer commission the device. The display gives you information at a glance on the following areas:

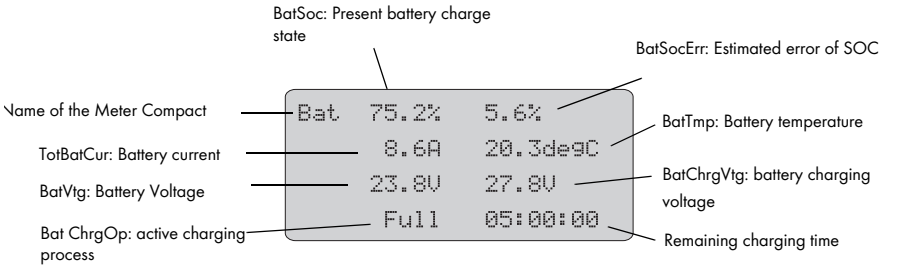
- Battery
- Inverter (AC values)
- Grid/generator (external)
- Inverter status

Selecting the area

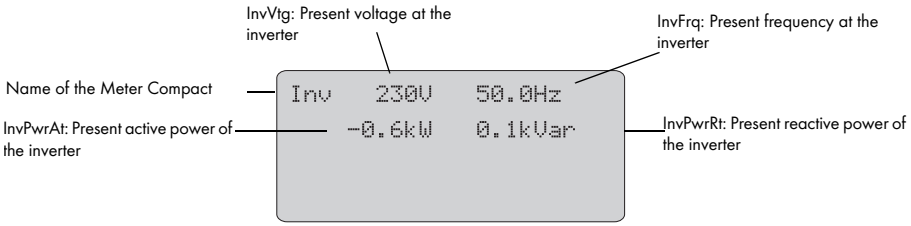
Select the various Meter Compact screens by turning the button to the right or left.

Exit the menu by pressing the button.

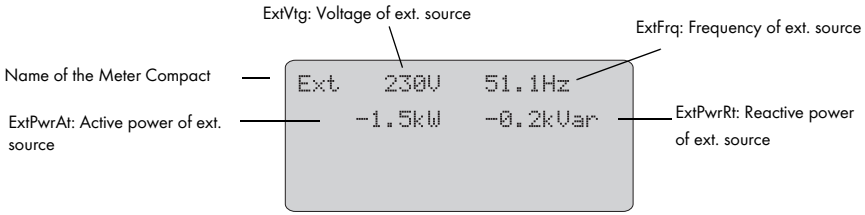
Bat (Battery Values)



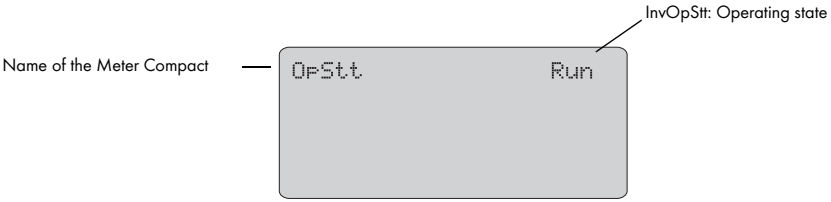
InvTot (Total AC Values of Inverter)



ExtTot (Total AC Values of External Source)



OpStt (Inverter and Generator Status)



10.3 Storing Data on an MMC/SD Card

The Sunny Remote Control can store firmware, parameters and measured data on a multimedia card (MMC/SD card) which must be FAT 16 formatted, with a max. size of 2 GB (possible memory sizes are 32/64/128/256/512 MB, 1 GB and 2 GB). File names are saved in 8.3 format and files with other names are ignored.

Format example

A valid 8.3 format is, for example, "M1LOG.DAT".

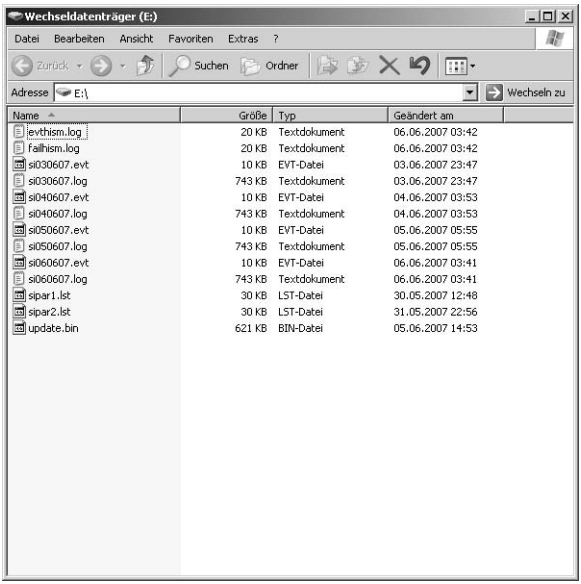
8.3 is the "old" MS-DOS format with a file name that has a maximum of 8 characters before and 3 characters after the dot.

Memory card type

SMA Solar Technology recommends using MMC/SD cards manufactured by Transcend.

If you use a memory card from another manufacturer, check whether the card is FAT 16 formatted. If necessary, format the card. Be aware that data stored on the card will be lost.

After you have inserted the MMC/SD card into the card reader slot on your PC, you can search for the respective drive in the Explorer (in Microsoft Windows). The following data are on this drive (here: E:):



The files on the MMC/SD card have the following meanings:

File name	Meaning
evthism.log (evthisN.log for SlaveN)	Event history of the device, saved by means of parameter "550.03 CardFunc", option StoEvtHis
failhism.log (failhisN.log for SlaveN)	Failure history of the device, saved by means of parameter "550.03 CardFunc", option StoFailHis
si030607.evt	Event/failure history for the day (format: ddmmyy)
si030607.log	Data recording for the day (format: ddmmyy)
sipar1.lst	Parameter list of the device, created by means of parameter "550.01 ParaSto", option Set1
sipar2.lst	parameter list of the device, created by means of parameter "550.01 ParaSto", option Set2
update.bin	Software for the device

Information

The "BOOTEX.LOG" file is not necessarily on the card. It is created depending on the operating system used (e.g. WindowsXP or Windows2000).

The Sunny Island's firmware expects device-specific data in the main directory of the MMC/SD card. This data includes a new firmware, parameters and measuring data.

The Sunny Island uses the MMC/SD card in the Sunny Remote Control to store and load device parameters.

In addition, the Sunny Island supports the acquisition of measurement data on the MMC/SD card. It saves this data in a special file. This contains, among other things, a header, time stamp, date and data type. There are two different types of log data:

- Measurement data (is saved cyclically)
- Events and errors (are only saved when they occur)

The Sunny Island supports the acquisition of measurement data with data from the fields:

- Battery
- Inverter
- System
- External source and
- Loads

Always save data

Always use the MMC/SD card to save data and events. In case of a failure SMA Solar Technology can thus quickly help you.

The data saved on the MMC/SD card can be processed using common table calculation programs.

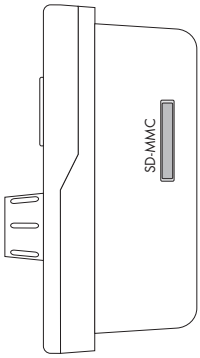
- The first 11 lines of the file are used for information (file header).
- This is followed by two column header lines.
- The data following this are separated by semicolons.
- Decimal places are separated by periods.
- The date format is dd.mm.yyyy.
- The time format is hh:mm.

Log data

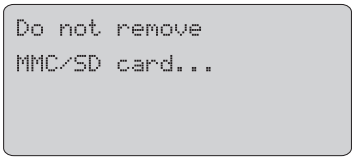
For additional information on processing the log data, please refer to the manual of the data processing software you use.

10.3.1 Inserting the Card

1. Insert the MMC/SD card with the slanted corner toward the top (the sticker faces forward) into the external display's card slot.



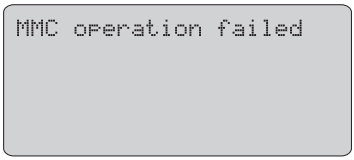
2. After inserting the MMC/SD card, a message will appear on the display prohibiting the removal of the card:



3. The initialization of the MMC/SD card can take several minutes.

   On the display, three dots move along the bottom line.

4. If an error occurs, the following message is displayed:



5. Confirm the message by pressing the button.

10.3.2 Removing the Card

To ensure that all log data is saved upon deactivation, write all data not yet saved from the buffer to the MMC/SD card by using the parameter "550.03 CardFunc" with the option "ForceWrite".

Data loss

If you remove the MMC/SD card without first activating the parameter "550.03 CardFunc", you will lose all data not yet saved since the last save process (15 minutes max.).

10.3.3 Saving and Loading Parameters

The "550.01 ParaSto" parameter allows the storage of all current parameter settings. Parameters already saved can be loaded using the "550.02 ParaLod" parameter.

Saving optimal settings

If the system is working optimally, it is a good idea to save these settings. This is especially useful if you try out new settings and then wish to reset the inverter back to the previous settings.

When saving the parameters you have the following options:

- Set1 (save parameter set 1)
- Set2 (save parameter set 2)

When loading the parameters you have the following options:

- Set1 (load parameter set 1)
- Set2 (load parameter set 2)
- Factory (load the factory settings (reset))

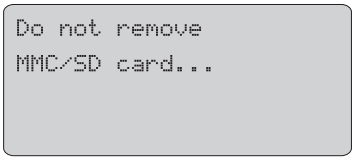
Write protection

The write protection function of SD cards (plastic sliding clip on the left side) is **not** supported by the display. You should take note of this when writing data to your card.

10.3.4 Writing Log Data

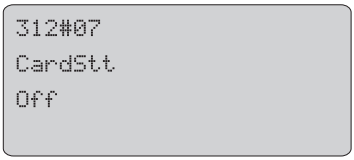
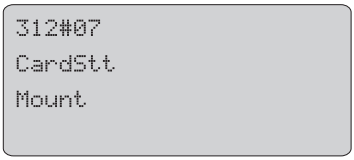
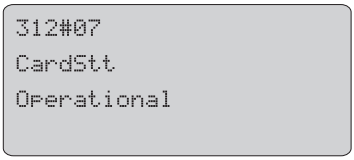
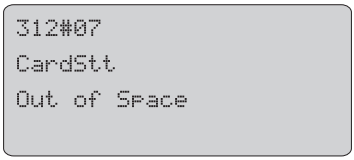
Using the "550.04 DatLogEna" parameter, you can activate the writing of log data onto your MMC/SD card (activated by default).

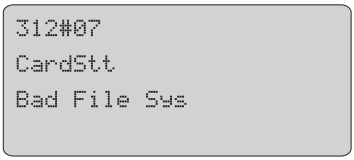
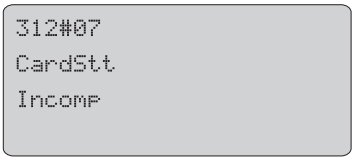
While the Sunny Remote Control is writing data to the MMC/SD-Card, removal of the card is prohibited. The following message is displayed:



10.3.5 Displaying the Status

You can use the "312.07 CardStt" parameter to query the status of your MMC/SD card:

Meaning	Display
MMC/SD card is deactivated.	
MMC/SD card initializes.	
MMC/SD card is activated.	
MMC/SD card memory is full.	

Meaning	Display
MMC/SD card has an invalid file format.	
MMC/SD card is not compatible.	

Troubleshooting

For help on troubleshooting, refer to section 18.8 "Troubleshooting" (page 173).

10.3.6 Firmware Update

The firmware of the Sunny Island can be updated using the MMC/SD card. During startup and MMC/SD card detection, the Sunny Island checks the MMC/SD card for any special update files. If the memory card contains new files, the Sunny Island will perform an update once it is in standby mode.

New MMC/SD card

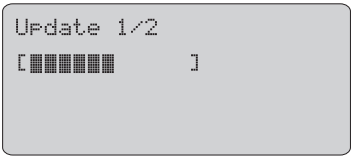
Always save the latest firmware version on the MMC/SD card first. The card is empty when delivered (unwritten).

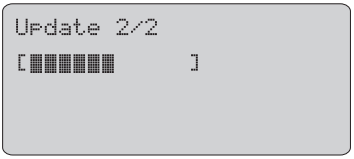
Note:

- Do not switch off the device during the firmware update!
- Do not remove the MMC/SD card during the firmware update!
- Observe notices regarding the update files.

Updating Firmware:

1. Set the Sunny Island to standby mode.
2. Insert the MMC/SD card into the card slot in Sunny Remote Control.
3. While the Sunny Island performs the update, the following messages are displayed:





After the update

- Once the update has been successfully completed, a mandatory reset follows so that the changes become effective.
- Note

4. After the reset, the Sunny Island remains in standby mode.
5. Start up the device manually (see section 10.1.1 "Switching On/Starting the Sunny Island" (page 81)).

Parameter settings

- Individual parameters and settings are retained during a firmware update.
- When updating, new parameters in the updated firmware are saved with the factory default values automatically.

11 Additional Functions

11.1 Load Shedding

The Sunny Island can automatically switch off loads to protect the batteries from deep discharge. To do this, an external (AC or DC) power contactor must be installed between the Sunny Island and the loads (see also section 19 "Accessories (Optional)" (page 176)).

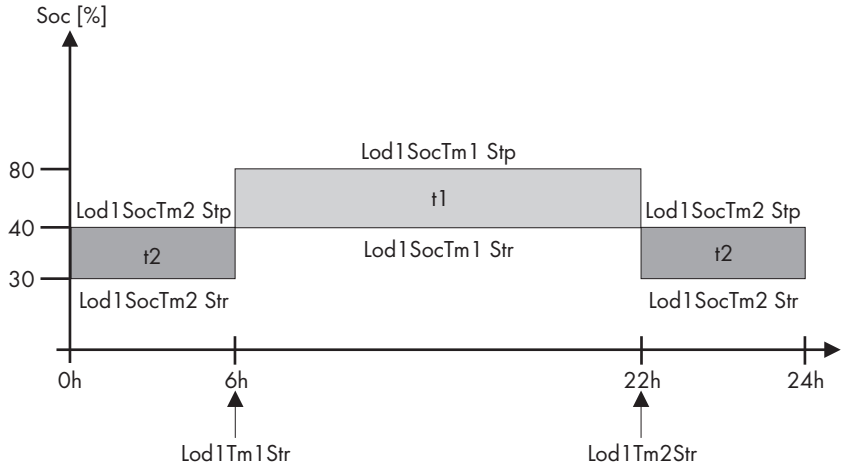
NOTICE!

Faulty system operation due to lack of load shedding.

Install an external load-shedding contactor in case the stand-alone grid system on the AC generating side is coupled to PV generators or wind generators.

If there is overloading due to low energy production or very high energy consumption, you must be able to switch off loads.

Always switch off the loads, never the energy generators (e.g., Sunny Boy)!



The graphic shows an example for the settings that minimize the load shedding function at night. From 6:00 am to 10:00 pm the load shedding is activated for a charge state (SOC) of 40 %, during nighttime (from 10:00 pm to 6:00 am) the charge state of the battery is allowed to go down to 30 % before the load shedding is activated.

The load shedding function can be assigned twice. In the parameters mentioned above, the "Lod1" part represents the first assigned function and the "Lod2" part represents a second, identical function. These two load shedding functions, which are dependent on the battery's state of charge, allow for tiered load shedding in which, by using different SOC values, different priorities can be given to various load groups.

Define the time intervals t1 and t2:

- Starting time t1: With the parameter "242.05 Lod1Tm1Str", set the start time for t1 (and with it the end of t2).
- Starting time t2: With the parameter "242.06 Lod1Tm2Str", set the start time for t2 (and with it the end of t1).
- If the time intervals t1 (Lod1Tm1Str) and t2 (Lod1Tm2Str) are consistent with one another, only t1 will be activated.

Set the battery state of charge at which the time interval t1 or t2 will start/stop:

- The battery state of charge during the t1 interval, the recognition of which will lead to the load shedding function being started: Parameter "242.01 Lod1SocTm1Str"
- The battery state of charge during the t1 interval, the recognition of which will lead to the load shedding function being stopped: Parameter "242.02 Lod1SocTm1Stp"
- The battery state of charge during the t2 interval, the recognition of which will lead to the load shedding function being started: Parameter "242.03 Lod1SocTm2Str"
- The battery state of charge during the t2 interval, the recognition of which will lead to the load shedding function being stopped: Parameter "242.04 Lod1SocTm2Stp"

11.2 Sleep Mode

Using the "250.10 SleepEna" parameter set to "Enable" allows the sleep mode to be activated in single-phase grids, which the master uses to switch off the slaves when the power value allows this.

Sleep mode

- The "Sleep Mode" works exclusively in stand-alone grid operation!
- The values for connection and disconnection of the Sunny Island are already set at the factory (optimized in terms of efficiency).

11.3 Search Mode

The search mode is an energy-saving mode. The Sunny Island checks in regular intervals whether loads are connected to the system. When the power of the loads is less than 10 W for a period of time (Delta t), the Sunny Island switches to the search mode.

With the parameter "250.27 SearchModTm", you can set the time interval Delta t. You can define a time interval of between 0 and 600 seconds. Upon delivery of the Sunny Island, the search mode is deactivated (Delta t = 0 sec).

The search mode works exclusively in stand-alone grid operation! Once a load is connected and the power consumption exceeds 10 W, the Sunny Island exits energy saving mode and returns to normal operation.

Single-phase parallel system

In single-phase parallel systems the search mode only functions once the sleep mode has been activated.

3-phase system

In a 3-phase system the search mode is activated independently for each phase.

In a 3-phase system the Sunny Island does not identify the consumers as a load when they are connected via delta connections.

11.4 Time-Controlled Operation

The Sunny Island can be operated in a time-controlled fashion using a timer function (like a clock timer), supplying power at a planned point in time.

To do this, this function must be activated by using the "510.02 InvTmOpEna" parameter. With the "510.03 InvTmOpStrDt" parameter you can specify the starting date, and with the "510.04 InvTmOpStrTm" you can specify the starting time. With the parameter "510.05 InvTmOpRnDur" you set the running time and with the parameter "510.06 InvTmOpCyc" you determine whether this function will be carried out once, every day or weekly, at or for the first time at the specified start time (date and time).

11.5 Overload and Short-Circuit Behavior

The Sunny Island can be temporarily operated under overload conditions. It can also supply short-circuit currents. At an ambient temperature of 25 °C, the

- Sunny Island 2012 supplies
  - an output of 2500 W for 30 minutes
  - an output of 3600 W for 5 minutes
- Sunny Island 2224 supplies
  - an output of 2900 W for 30 minutes
  - an output of 3800 W for 5 minutes

In the event of a short circuit, the Sunny Island provides a maximum current of 25 A.

11.6 Device Faults and Autostart

If a critical fault occurs, the Sunny Island automatically shuts down and displays the reason on the display. If the autostart function is activated ("250.01 AutoStr" parameter), the Sunny Island can confirm the failure automatically and restart on its own. If the failure persists the Sunny Island cannot be started.

Information

If the autostart counter has counted down to 0, the Sunny Island waits for 10 minutes before attempting to restart automatically.

Information

Messages can be displayed at any time while the device is in operation and they have priority over the Home Screen display.

12 Battery Management

The battery management of the Sunny Island supports the following three battery types ("221.01 BatTyp" parameter):

FLA	**-** **F**looded **L**ead **A**cid:	Closed lead acid batteries with liquid electrolyte in all standard designs available on the market (grid plate, tubular plate, small, large, etc.)
VRLA	**-** **V**alve **R**egulated **L**ead **A**cid:	Closed lead acid batteries with immobilized electrolyte in gel or AGM (**A**bsorbent **G**lass **M**at Separator) in all standard designs available on the market (grid plate, tubular plate, small, large, AGM, Gel, etc.)
NiCd	**-** **Ni**ckel-**Cd**mium:	Pocket-type plate or fiber plate closed nickel cadmium batteries

The battery capacity ("221.02 BatCpyNom" parameter) is to be entered as the nominal capacity for a ten hour discharge (C10). If this information is not available from the battery manufacturer's data sheet, it can be calculated from the data for different discharge times (120 h, 100 h, 20 h, 5 h, 1 h) in the following manner:

C10	C120/1.28	C10	C10
C10	C100/1.25	C10	C5/0.88
C10	C20/1.09	C10	C1/0.61

The Sunny Island is designed and set by default (parameter "221.03 BatVtgNom") for a nominal battery voltage.

- For lead acid batteries (FLA and VRLA):
  - Sunny Island 2224: 24 V (12 cells with 2 V each)
  - Sunny Island 2012: 12 V (6 cells with 2 V each)
- For nickel cadmium batteries:
  - Sunny Island 2224: 22.8 V (19 cells with 1.2 V)
  - Sunny Island 2012: 12 V (10 cells with 1.2 V each)

12.1 Battery Temperature

The Sunny Island continuously monitors the battery temperature using the battery temperature sensor provided. At 5 °C under the maximal temperature allowed (set using the "221.04 BatTmpMax" parameter), a warning is displayed. If the maximal value for the battery temperature is exceeded, the Sunny Island switches off.

When lead acid batteries drop below –10 °C and NiCd batteries drop below –20 °C, a warning is displayed.

The battery temperature is taken into consideration when the charging voltage is calculated (see section 12.4 "Charge Control" (page 107)).

NOTICE!

Possible damage to the battery as a result of faulty temperature measurement

If the battery temperature sensor is defective or missing, the Sunny Island continues to run, assuming a battery temperature of 40 °C. This can result in insufficient charging of the battery in the long run.

- Observe the corresponding warnings of the Sunny Island.
- Connect the battery temperature sensor.
- Replace the defective battery temperature sensor.

12.2 Start Options

If the battery is replaced in a system, the battery management system must be restarted and reconfigured. This can be done using the "Quick Configuration Guide QCG" (see section 9.2 "Starting the Quick Configuration Guide (QCG)" (page 75)).

12.3 State of Charge/SOC and SOH

The Sunny Island has a very precise internal charge level calculation (display value "120.01 BatSoc"). The operation for calculating the charge level is based on balancing the ampere hours. This means that all currents flowing in and out of the battery are accumulated and referred to the nominal capacity. In order to take into consideration faults caused by self discharge and charging losses caused by gassing, these losses are already internally extracted. Unlike other operations, no fixed charging factor must be set.

After full charge has been reached, the charge state value is reset to 90 %, 95 % or 100 %, depending on the actual state of charge of the battery. If default settings are not changed, a state of charge of 90 % after boost charge, 95 % after full charge and 100 % after equalization charge is reached.

Since fully charged states are only rarely achieved, the operation used here can also use the battery voltage during constant discharge phases with low discharge currents to recalibrate the charge state. Compared to the ampere hour balancing method, the operation used here exhibits a high level of stability over the long term when recalibrated at regular intervals.

Both the ampere hour balancing method and the recalibration procedure, which is performed via the voltage, automatically adjust to the connected battery over time (depends on the number of grid failures).

The estimated charge state error (display value "120.11 BatSocErr") will provide you with continuous information on the accuracy of the battery charge state currently calculated. The average error will continuously diminish as the adjustment to the actual battery state of charge increasingly improves.

Only when the battery is new does its usable capacity correspond to the capacity specified by the battery manufacturer. As the battery ages and as a result of frequent insufficient charging, the battery's usable capacity may decrease considerably on a permanent or only temporary basis.

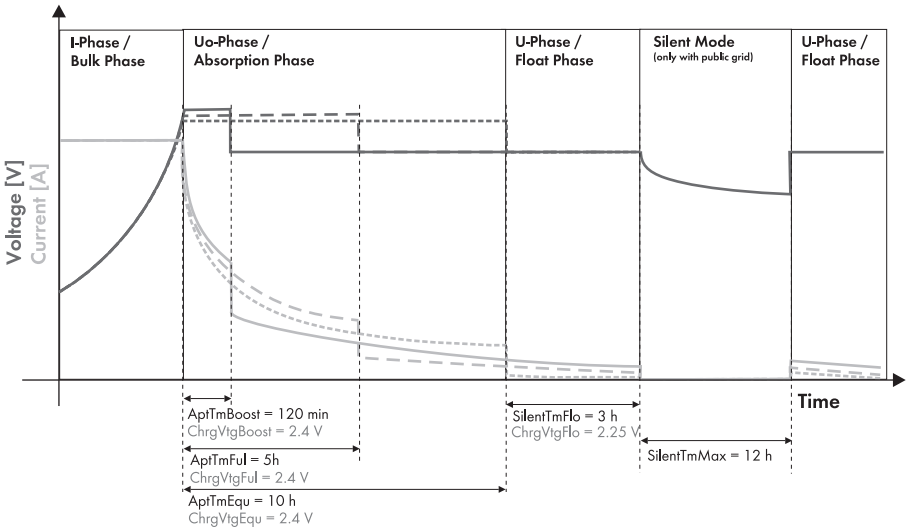
The battery's state of health (display value "320.01 Soh") is a measurement of the present usable capacity expressed as a percentage relative to the nominal capacity. 100 % means that the entire nominal capacity can be used. 50% means that only half of the original nominal battery capacity can be used. The battery's state of health is also calculated by means of a self-adapting method which, however, can only produce good and exact values after a number of charging cycles.

The present capacity for the Sunny Island is automatically adjusted downwards for temperatures < 20 °C, since the usable capacity of batteries is significantly reduced at temperatures below the nominal temperature.

In case of lead acid batteries, the nominal capacity is adjusted by a fixed factor of –1 %/°C. For NiCd batteries a factor of –0.75 %/°C is used.

12.4 Charge Control

The Sunny Island uses a 3-phase charge control, using the IUoU procedure. When the device operates with the public grid, there is also an optional fourth phase called silent mode.

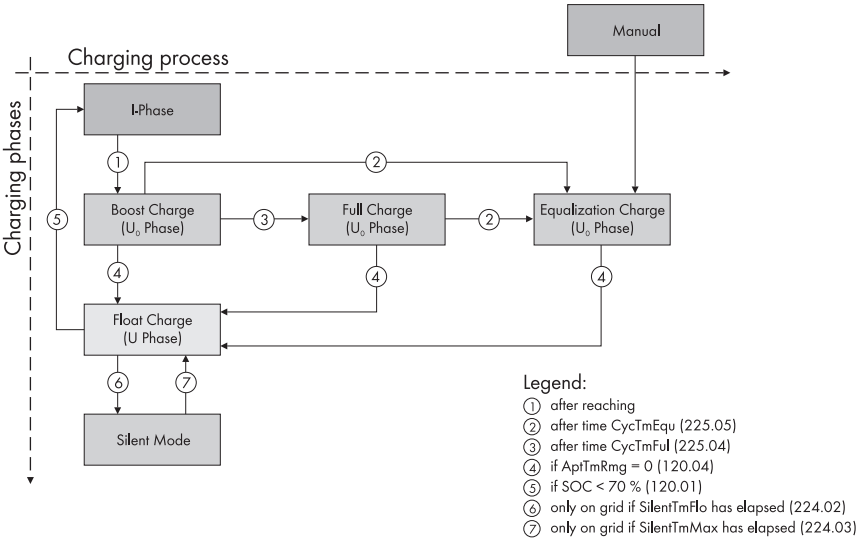


The I stands for the constant current phase (I phase). In this phase, charging is limited by the maximum defined battery current ("222.01 BatChrgCurMax" parameter), the nominal grid current ("232.03 GdCurNom" parameter) or the maximal AC charging current of the Sunny Island ("210.02 InvChrgCurMax" parameter). The respective value reached first is the limiting value. During this phase the battery voltage increases as the battery is charged.

Once the battery voltage reaches the predefined value for the second phase Uo ("222.07 – 222.09", ChrgVtgBoost or ChrgVtgFul or ChrgVtgEqu parameters), the constant voltage charging (absorption phase) begins.

In this phase, the battery voltage is maintained at a constant level, resulting in a continually decreasing battery current. The Sunny Island remains in this phase for a defined period of time ("222.02 – 222.03", AptTmBoost or AptTmFul or AptTmEqu parameters). For this charging phase, the Sunny Island automatically selects one of three possible charging methods (boost, full, equalizing) which are described in detail in sections 12.4.1 "Boost Charge" (page 109) to 12.4.3 "Equalization Charge" (page 110). The remaining charging time (display value "120.04 AptTmRmg") of this phase and the current process (display value "120.05 BatChrgOp") can be read on the display.

The following figure shows the relationship and the process diagram of the charging phases and charging processes.



Once this constant voltage phase is finished, the Sunny Island switches to float charge which again provides constant voltage charging but at a largely reduced charging voltage ("222.10 ChrgVtgFlo" parameter). The purpose of the float charge is to keep the battery in a fully charged state without causing premature aging through overcharging. The Sunny Island remains in this phase until either more than 30 % of the nominal capacity has been used (all discharges are added up) or the state of charge is below 70 %. When the Sunny Island is operating on the public grid, it can also switch from the float charge into silent mode.

Changing the charging voltage

The charging voltage does not rapidly change, but is slowly adjusted to the new nominal value by approx. 0.5 mV/cell*s as the constant voltage phase changes to the float charge. This also takes place if the nominal value is changed manually.

The charging capability of batteries is highly dependent on the battery temperature. For temperatures < 20 °C, the charging voltage must be slightly increased, and for temperatures > 20 °C it must be slightly decreased. This is necessary to prevent overcharging and insufficient charging reliably at any battery temperature. For this reason, the Sunny Island is equipped with automatic temperature compensation of the charging voltage. The battery charging voltage is adjusted by:

- 4 mV/°C and cell, in the case of VLA and FRLA battery types
- 0 mV/°C and cell, in the case of NiCd batteries

The temperature compensation value can be set using the "222.11 BatTmpCps" parameter.

12.4.1 Boost Charge

The boost charge is the most common charging process of the Sunny Island. The boost charge ensures a high generator capacity through a high charging voltage over a short period of time. With liquid FLA lead acid batteries, this charge process should be used for gassing and thus compensating the electrolytes. The boost charge process can charge the battery up to approx. 85 % to 90 %.

12.4.2 Full Charge

Every 14 days or 8 nominal charge throughputs, the Sunny Island initiates a full charge automatically (parameter "222.05 CycTmFul").

Nominal charge throughput

A nominal charge throughput is reached when the sum of the discharge currents corresponds to the nominal capacity of the battery.

Example: The battery has a nominal capacity of 100 Ah. A nominal charge throughput is reached when the battery has been discharged 10 times for 1 hour by 10 A.

The objective is to recharge the battery to a charge level of at least 95 % and to compensate the possible effects of an insufficient charge. Regular full charging approximately every 2 to 4 weeks can double the service life of the battery.

Information

If the Sunny Island changes to full charge after a specific time of boost charging has elapsed, the entire time of boost charge elapsed is considered for the full charge.

Information

If more than 1 % of the battery's nominal capacity is discharged during a full charge, 50 % of the time elapsed is considered for the next constant voltage phase.

External charging device

If an external charger or charge controller is connected to the battery and the criteria for a full charge are fulfilled due to external charging, the Sunny Island treats this as if it had performed the full charge itself.

Information

Any parallel procedures causing the generator to stop during the full charging process are not taken into account until the charging process is completed.

12.4.3 Equalization Charge

A battery bank consists of many individual battery cells connected in series which all behave slightly differently. Over time, this results in different charge levels in the individual cells. This can lead to premature failure, initially of individual cells, and finally to failure of the entire bank.

The Sunny Island can perform an equalization charge automatically every 180 days ("222.06 CycTmEqu" parameter) or every 30 nominal charge throughputs. During this process, it performs controlled overcharging of the battery bank to ensure that even the weaker cells are fully recharged. Equalization charging extends the battery service life by up to 50 %. The automatic equalization charging function can also be deactivated ("222.12 AutoEquChrgEna" parameter, activated by default) or manually started ("520.01 ChrgSelMan" parameter).

Information

If the Sunny Island changes to equalization charge after a specific time of boost charging or full charging has elapsed, these times are completely considered for the equalization charge.

Information

If more than 1 % of the battery's nominal capacity is discharged during an equalization charge, 50 % of the time elapsed is considered for the next constant voltage phase.

Information

If an external charger or charge controller is connected to the battery and the criteria for a full charge are fulfilled due to external charging, the Sunny Island treats this as if it had performed the full charge itself.

12.4.4 Manual Equalization Charge

The parameter "520.01 ChrgSelMan" activates the manual equalization charge on the Sunny Island. If a generator is connected to the system, it is automatically started and stopped once the equalization charge is completed.

Information

An equalization charge should be performed at least once a year. After a long period of time without charging, e. g., in the case of systems which are only operated seasonally, manual equalization charges are required at the end or at the beginning of the season.

12.4.5 Silent Mode

In addition to the float charge, the silent mode can be used ("224.01 SilentEna" parameter) when operating on the public grid.

The main purpose of the silent mode is to save energy by switching from charge mode to standby mode in utility backup systems where the Sunny Island is predominantly in float charge.

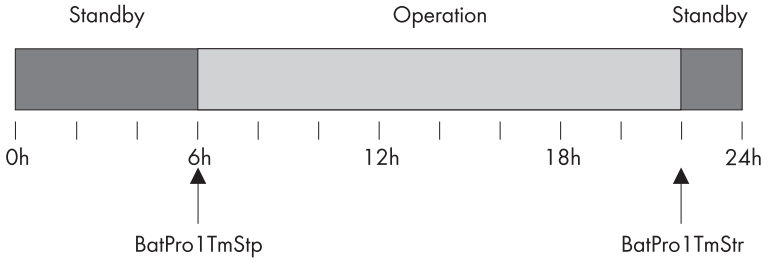
The silent mode is activated after the time set for float charge ("224.02 SilentTmFlo" parameter) has expired. The Sunny Island remains in silent mode for a fixed time ("224.03 SilentTmMax" parameter) or until the battery voltage per cell is 0.14 V lower than the set voltage ("222.10 ChrgVtgFlo" parameter). This ensures that the battery is always fully charged, even in silent mode. If a grid failure is detected during silent mode, the Sunny Island makes a stand-alone grid available within 10 sec.

12.5 Battery Preservation Mode

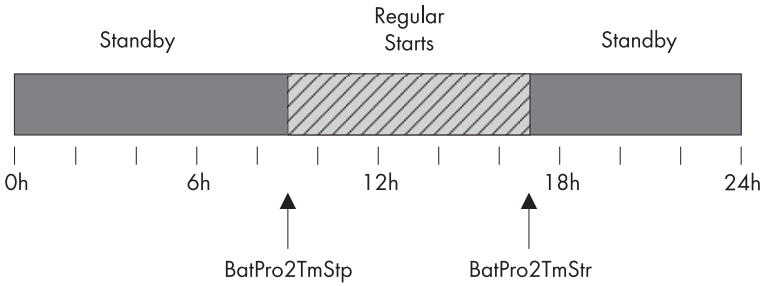
The Sunny Island has a sophisticated battery preservation mode. The battery preservation mode prevents the battery from being deeply discharged as far as possible when the energy supply is low, thus preventing a total system failure as well as damage to the battery.

The battery preservation mode has three levels that are activated as a result of the state of charge (when the charge drops below the respective limit, parameters "223.05 BatPro1Soc", "223.06 BatPro2Soc" and "223.07 BatPro3Soc"):

Level 1: The first level is used to switch the Sunny Island into standby mode at times when the energy is not necessarily required (e.g., at night). You define the start time using the parameter "223.01 BatPro1TmStr" and define the stop time using the parameter "223.02 BatPro1TmStp".



Level 2: The second level of the battery preservation mode ensures that the Sunny Island is started regularly every two hours only in the time period during which energy supply is expected, and that it attempts to charge the battery from the AC side. In case of PV systems this time is during the day. In this case, you define the start time using the parameter "223.03 BatPro2TmStr" and the stop time using the parameter "223.04 BatPro2TmStp" parameter.



Level 3: The third level ensures that the battery is protected from deep discharge and thus against damage. In this case, the Sunny Island is switched off completely. To start it, see section 10.1.5 "Restarting the Sunny Island Following Automatic Shutdown" (page 85).

At all three levels, the Sunny Island is stopped only if no battery charging current flows within 5 minutes (limit for the Sunny Island 2224: 3 A charging current, limit for the Sunny Island 2012: 6 A charging current).

The limits for all three levels can be set independently of each other. This allows individual levels to be skipped.

Information

If the BatPro1Soc parameter < BatPro2Soc, level 1 is skipped and only level 2 is carried out.

For level 1 and 2, a hysteresis of 5 % of the SOC charge level is designated for exiting this state.

Battery preservation mode is not automatically exited if an external voltage source (grid reconnection/generator start) is present.

The battery preservation mode can be exited by manually starting the Sunny Island. If a charging current is detected within 5 minutes (see above) the Sunny Island remains in operation; otherwise, it is disconnected again.

12.6 Battery Diagnostics

The "320# Diag Battery" menu displays several values that provide information on the past operational behavior of the battery. These values are helpful in checking the efficiency of the set parameters and in viewing the typical operating conditions of the battery
(see section 17.3 "Diagnosis" (page 160)).

13 Connecting External Sources

The Sunny Island supports the integration of external energy sources. Here a distinction is made between the integration of a generator and the integration of the public grid.

Both the generator as well as the public grid are integrated through the AC2 connection of the Sunny Island. A single-phase or a 3-phase connection is possible. During single-phase parallel operation, the transfer relays are operated in parallel, making it possible to use a correspondingly larger current, which in turn allows for generator or grid connections with a higher capacity.

Connection in a single-phase parallel system

When installing single-phase parallel systems, the connection cables for AC1 and AC2 of all Sunny Islands must have the same cable cross-sections and cable lengths.

The Sunny Island has separate parameters for the grid and generator. This generally allows both operating modes to be used without making additional adjustments. The parameter settings and display values distinguish between settings or values which are generator-specific or grid-specific and settings or values (EXT) common to both grid and generator.

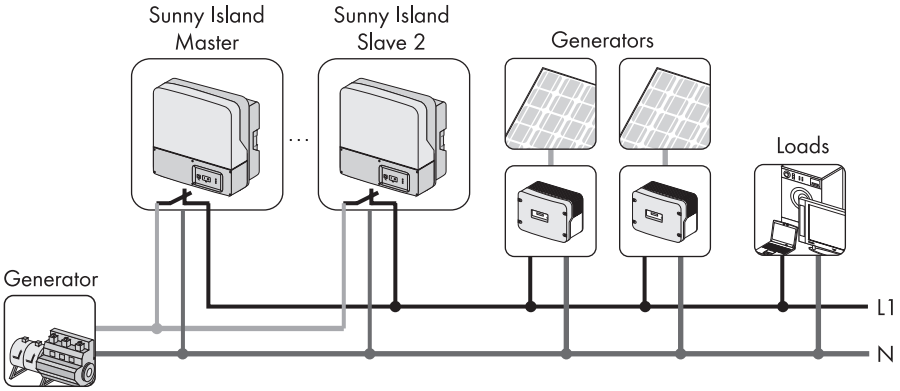
13.1 Generator

The Sunny Island can start or stop a generator depending on consumer power or battery state of charge. In this case, diverse limits and times are taken into consideration
(see section 13.1.5 "Automatic Generator Operation" (page 121)).

13.1.1 Connecting Generator Connections in Parallel

In the case of Sunny Islands connected in parallel which operate on the same phase, the internal transfer relay is activated simultaneously It is thus possible to multiply the generator current and therefore to connect a larger generator or a higher grid current.

The maximum value of the current depends on the number of transfer relays and therefore on the number of Sunny Islands connected in parallel. One can count on a maximal current of 25 A per Sunny Island.



Information

Use the same cable lengths and cable cross-sections when installing the Sunny Islands with the generator.

13.1.2 Generator Start Options

The Sunny Island supports the following options for starting the generator which can be set in standby mode with the "234.07 GnStrMod" parameter:

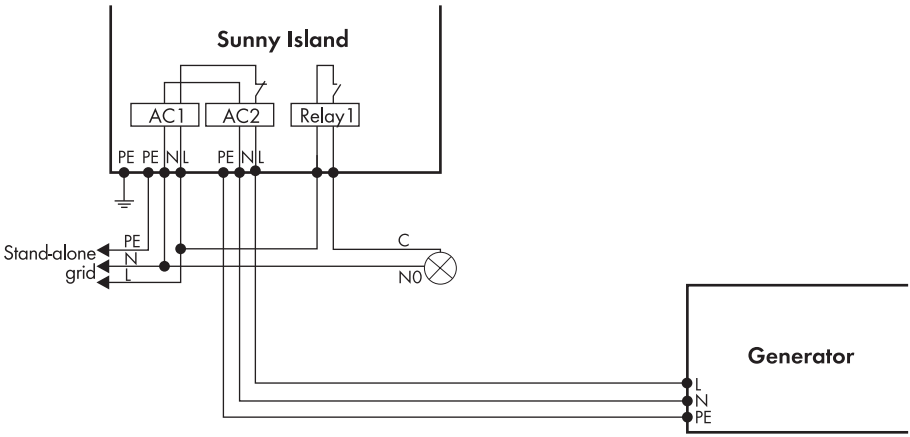
- Manual
- Autostart
- GenMan

Manual (Manual Generator Start)

This setting is for generators that do not have an electrical remote starting option and, for example, are started using cable winches or cranks, among other things.

In this case, the Sunny Island does not have the option of starting the generator. It only monitors the generator input (AC2). If, while monitoring the input, the device detects that the generator voltage and frequency are within the set limits (see 13.1.6 "Limits and Power Adjustment" (page 124)), the device is synchronized and connected following the warm up time.

The following figure shows the wiring for a generator that cannot be started remotely:



The generator is also always switched off manually. The Sunny Island then automatically switches to operation without generator.

GnReq signal

The GnReq signal (see 14 "Relays" (page 134)) is set for signaling the generator request and can thus be used as an alarm contact (in this case: a bulb). If no request is pending, the signal is disabled again.

If an internal request is sent while the generator is already running, the signal is disabled until the generator is externally stopped and the stop time has expired (30 seconds).

Disconnecting the generator

A disconnector should be positioned between the Sunny Island and the generator. If the generator is to be stopped, it is first manually disconnected using the disconnector and then it is stopped. Actuation of the generator by the Sunny Island when switching off is thus prevented.

Autostart

This allows autostart generators to be directly integrated. They have a separate internal controller that controls the start procedure.

The Sunny Island requests the generator via the GnReq signal. If the generator voltage and frequency are within the set limits (see 13.1.6 "Limits and Power Adjustment" (page 124)), the device is synchronized and connected following the warm up time.

The Sunny Island keeps the request signal active until a disconnection is made and the set power-down time has expired.

Power down

Autostart generators can have an internal power down cycle that is only activated when the request has been disabled. This can extend the power down time accordingly.

Information

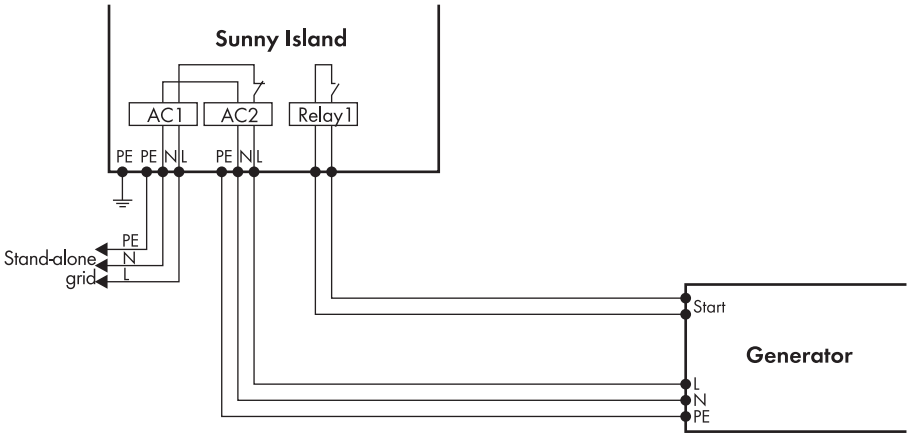
With some generator types, the voltage is only switched to the output after the internal warm up phase is finished. Therefore the time of the generator activation sequence is monitored internally.

- **Time to activation = 10 minutes for GenMan**

or

- **2 x "234.12 GnWarmTm" + 2 minutes for manual and autostart**

The following figure shows the wiring for a generator capable of autostart:



If the generator is started manually in this operating mode, the Sunny Island detects the running generator and connects it once the warm up time has expired. If the generator is externally stopped, this is detected, the generator is disconnected and the stand-alone grid is continued to be supplied.

Information

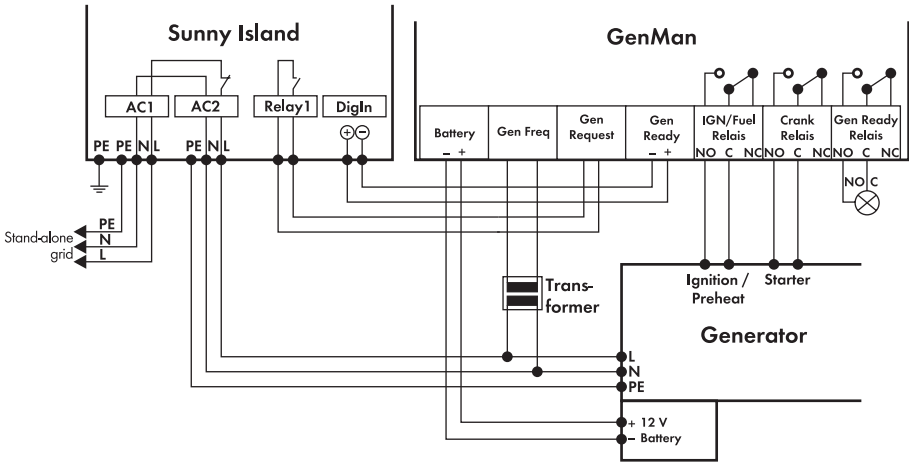
If the generator is running after being externally started and a generator request occurs, the GnReq signal is disabled until the generator is externally stopped again and the stop time has expired.

GenMan

If a GenMan (generator manager) is integrated into the system, it assumes direct control of the generator. It is connected between the Sunny Island and the generator. The GenMan is responsible for controlling the generator (warm up time, cooling off time and autostart).

The Sunny Island requests the generator from the GenMan via the GnReq signal and keeps the signal active as long as the generator is required. The GenMan returns the GENRDY signal via DigIn when the generator is ready for operation. Then the Sunny Island synchronizes and connects. If the generator is no longer required, the Sunny Island disconnects itself and disables the GnReq signal.

The following figure shows the principle of starting the generator via the "GenMan" generator control:



A manual generator start at the GenMan is notified to the Sunny Island via the GENRDY signal. The device synchronizes and connects.

If the generator is started manually and externally at the GenMan, the Sunny Island blocks the GnReq signal:

- Manual stop and start at the Sunny Island are ignored.
- Internal requests (e.g. via the battery charge state) are also ignored.

Information

If the generator has been manually started at the GenMan, it must also be stopped there.

The generator is disconnected by the Sunny Island after the GENRDY signal has been withdrawn by the GenMan.

Notice!

A manual start directly at the generator is not permitted. Unforseeable operational states could result (see the GenMan manual).

13.1.3 Generator Operation

The Sunny Island allows automatic operation (depending on charge state or load) (see 13.1.5 "Automatic Generator Operation" (page 121)). In addition, manual operation is also possible.

13.1.4 Manual Generator Operation

The manual operating modes for the generator management are triggered using the "540.01 GnManStr" parameter. The following operating modes are distinguished:

Auto: In this operating mode, the generator is automatically started due to the settings. This includes the start via the state of charge or the consumer power or by the request for a manual equalization charge.

("520.01 ChrgSelMan" = Start).

Stop: The generator is stopped manually. The current generator request is canceled – immediate disconnection from generator and change to lock state. Once the lockout time has ended, the generator switches into automatic operation. The generator can only be started manually.

Start: Manual generator start – the generator runs "continuously" until stopped. The generator can only be stopped manually.

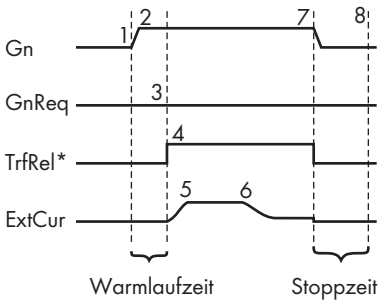
Run1h: Operation for one hour. Once the lockout time has expired, the transition back into automatic mode follows.

An equalization charge can be manually started using the "520.01 ChrgSelMan" parameter. This sets the battery management (see 12 "Battery Management" (page 105)) into the equalization charge state and requests the generator. This request persists until equalization charge has been completed.

The following process diagrams provide an overview of the start/stop behavior of the Sunny Island during manual generator operation:

Generator Interface 234.07 GnStrMod Manual; Start at the Generator

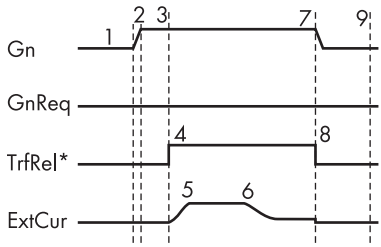
1 Manual generator start
2 "Generator is running" detected, beginning of warm up phase
3 Internal generator request is ignored
4 Warm up phase is completed, generator is connected
5 Generator current limit
6 Current is reduced, battery absorption phase
7 Manual generator stop, disconnection of the generator
8 Minimum stop time has expired



* Transfer relay

Generator Interface 234.07 GnStrMod Autostart; Start at the Generator

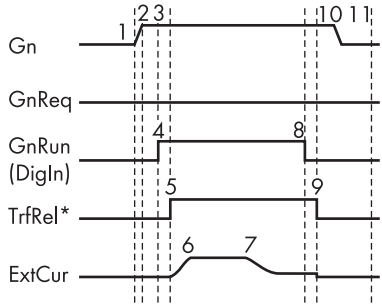
1 Manual generator start
2 "Generator is running" detected, beginning of warm up phase
3 Warm up phase completed
4 Generator is connected
5 Generator current limit
6 Current is reduced, battery absorption phase
7 Manual generator stop, disconnection of the generator
8 Generator is disconnected, beginning of stop time
9 End of stop time



* Transfer relay

Generator Interface 234.07 GnStrMod GenMan; Start at the Generator

1 Generator start at GenMan
2 Beginning of GenMan generator warm up phase
3 Generator warm up time
4 GenMan sends ready for connection signal
5 Sunny Island connects generator
6 Current limit
7 Current is reduced, battery absorption phase
8 GenMan signals generator stop
9 Sunny Island disconnects generator
10 Generator power down time expired, generator stop
11 Stop time has expired



*Transfer relay

13.1.5 Automatic Generator Operation

In automatic operating mode ("235.01 GnAutoEna" parameter), the Sunny Island automatically defines the settings (as a function of battery charge state or loads) to determine when the generator starts and how long it runs. The automatic operating mode is activated using GnAutoEna = On (default). If GnAutoEna = Off, the automatic operating mode is deactivated.

In addition, the user can also manually start and stop the generator, if required.

Charge State Dependent Start

NOTICE!

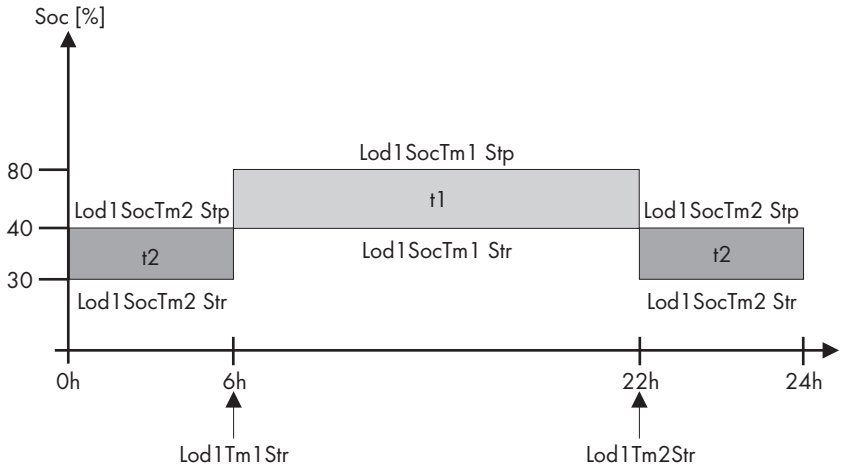
- Manual inputs on the Sunny Island have a higher priority than automatic operation.
- If the Sunny Island is manually stopped while the automatic operating mode is activated it switches to stop/lock operating mode.
- If Generator Automatic Start is activated and the conditions for automatic operation are met, the Sunny Island changes back into the start operating mode after lock time (or manual acknowledgment with the "540.02 GnAck" parameter).

The time periods t1 and t2 are defined using the "235.07 GnTm1Str" and "235.08 GnTm2Str" parameters respectively. The start time for t1 (and the end of t2) is defined with "GnTm1Str" and the start time for t2 (end of t1) is defined with "GnTm2Str".

Information

If GnTm1Str = GnTm2Str, only t1 is activated!

The time intervals t1 and t2 are assigned charge states for start-up and stop with the "#235.03 GnSocTm1Str", "#235.04 GnSocTm1Stp", "#235.05 GnSocTm2Str" and "#235.06 GnSocTm2Stp" parameters. GnSocTm1Str designates the battery charge state at which the generator is started during the t1 time and GnSocTm1Stp designates the charge state at which the generator is switched off during t1. The GnSocTm2Str and GnSocTm2Stp parameters are similarly defined during the time t2.



Example

The figure shows an example of the settings if operation of the generator at night is to be avoided as much as possible. Between 6 am and 10 pm, the generator is started at a charge state (SOC) of 40 % whereas the battery is may be discharged to 30 % at night (between 10 pm and 6 am) before the diesel generator starts.

Information

If the float charging process (see section 12.4 "Charge Control" (page 107)) is activated before the cutoff limit (GnSocTm1Stp or GnSocTm2Stp) is reached, the generator request is disabled again. If a full or equalization charge is active, the generator is only stopped after this charge is completed and not when "235.04 GnSocTm1Stp" or "234506 GnSocTm2Stp" is reached.

Load Dependent Start

In case increased energy demands arise, the generator can be requested for support. This function can be switched on or off (default) using the "235.09 GnPwrEna" parameter. The function is only effective if the "235.01 GnAutoEna" parameter is simultaneously set to On.

The load limit for the request and the generator stop is configured using the "235.10 GnPwrStr" and "235.11 GnPwrStp" parameters. The averaging time used to calculate an average value for the consumer power can be set using "235.12 GnPwrAvgTm". This prevents temporary power consumption peaks of a few seconds from causing a power-dependent generator start.

If the generator has been started due to the load, it runs according to the minimum generator run time. If, once this time has expired, the average power is below the cutoff limit, the generator is stopped again.

Multiple-phase system

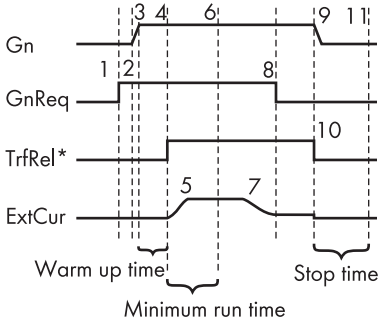
Only the total consumer power of all phases is monitored. Individual phases in a multi-phase system are not monitored.

The consumer power is calculated using the Sunny Island power ("111.01 TotInvPwrAt" parameter) and generator power ("131.01 TotExtPwrAt" parameter).

The following process diagrams provide an overview of the start/stop behavior of the Sunny Island during automatic generator operation:

Generator Interface 234.07 GnStrMod Manual; Generator Request Via Sunny Island

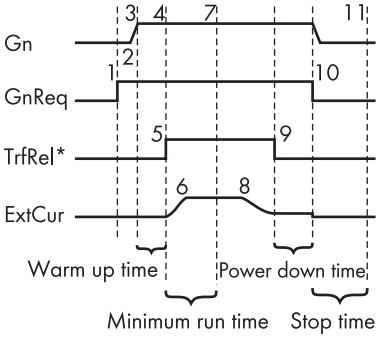
1 Generator is requested via Sunny Island
2 Manual generator start
3 "Generator is running" detected, beginning of warm up phase
4 Warm up phase is completed, connection
5 Generator current limit
6 Minimum run time has expired
7 Current is reduced, battery absorption phase
8 Charging process is completed, request signal is disabled
9 Manual generator stop
10 Generator is disconnected
11 Stop time has expired



*Transfer relay

Generator Interface 234.07 GnStrMod Autostart; Generator Request Via Sunny Island

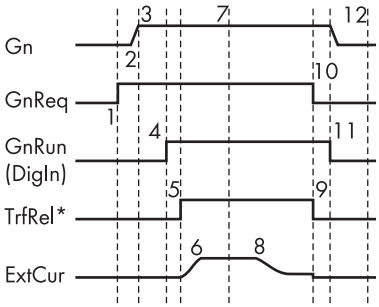
1 Generator started by Sunny Island
2 Generator start
3 Beginning of warm up time
4 Warm up time has expired
5 Generator is connected
6 Current limit
7 Minimum run time has expired
8 Current is reduced, battery absorption phase
9 Charging process is completed, generator disconnection
10 Generator power down time expired, generator disconnection
11 Stop time has expired



*Transfer relay

Generator Interface 234.07 GnStrMod GenMan; Generator Request Via Sunny Island

1 Generator start by Sunny Island using GenMan
2 Generator start by GenMan
3 Beginning of GenMan warm up time
4 GenMan warm up time has expired, connection signaled by GenMan at Sunny Island
5 Sunny Island connects generator
6 Current limit
7 Minimum run time (Sunny Island) has expired
8 Current is reduced, battery absorption phase
9 Charging process is completed, generator disconnection by Sunny Island
10 Signal at GenMan
11 GenMan power down time has expired, generator stopped
12 Stop time has expired



*Transfer relay

Information

Warm up times, minimum run times and power down times are also maintained for power dependent generator starts.

13.1.6 Limits and Power Adjustment

The voltage limits for generator operation can be set using the "234.01 GnVtgMin" and "234.02 GnVtgMax" parameters; the frequency limits for generator operation can be set using the "234.05 GnFrqMin" and "234.06 GnFrqMax" parameters. If the values are outside these permitted limits, the generator is disconnected. Slightly narrower limits apply to generator connection.

Information

The system voltage (AC) depends on the generator voltage when the generator is running.

The voltage and frequency limits are monitored in phases. At least the phase on the master device must comply with the limits defined for connecting the generator. If the limits are not maintained, slave devices, where applicable, connect or disconnect individually.

Information

If the master device disconnects the generator, all slave devices are disconnected as well.

Information

If a slave device is disconnected from a generator (and the master continues to be connected to the generator), the slave device can reconnect once the voltage and frequency are within the valid range again.

There is, however, a monitoring period in this case. Only after voltage and frequency are determined to be valid according to the "234.12 GnWarmTm" parameter does reconnection take place.

The Sunny Island burdens the generator at each phase as a maximum with the current defined in the parameter "234.03 GnCurNom". The power that is not directly used by the loads flows into the battery for charging. At the same time, the limits for the AC charging current limit ("210.02 InvChrgCurMax" parameter) on the Sunny Island and the DC charging current limit ("222.01 BatChrgCurMax" parameter) are active.

Low values for this limit may be the reason why the defined generator current cannot be adjusted. If the battery voltage reaches the charging voltage nominal value, it is also reduced (absorption phase, see section 12.4 "Charge Control" (page 107)).

Information

A sensible value for the "234.03 GnCurNom" parameter is approximately 80 % of the maximum generator current for each phase.

If the "234.15 GnCtlMod" parameter is set to CurFrq, the generator current is also limited at frequencies lower than the nominal frequency ("234.04 GnFrqNom" parameter). This function can be used if the full generator output is not always available and you want to prevent the generator from being overloaded. The default setting is only intended to control the nominal generator current.

If the current set using the "234.03 GnCurNom" parameter is not sufficient for powering the loads, the battery provides support ("real generator support").

The Sunny Island provides all the required reactive power.

13.1.7 Run Times

If the generator is started (or the Sunny Island detects an external generator start), the warm up phase starts. If, during this time, the voltage or frequency detected is not within the permissible range, the warm up time begins again.

If the generator cannot be connected at the GenMan within twice the time set at "234.12 GnWarmTm" + 2 or 10 minutes, the connection process is canceled and a new attempt is made. After three attempts, the system changes to error state (Fail "GnNoSync").

If the generator has been connected, the minimum run time begins ("234.08 GnOpTmMin" parameter). The generator remains connected during this time, even if in the meantime the generator request is no longer pending.

If the minimum run time has ended and a generator request is no longer present, the generator disconnects and enters the power down phase (Cool). If this power down phase is completed after the time specified in "234.10 GnCoolTm", the generator is stopped.

Information

The power down time ("234.10 GnCoolTm" parameter) defined on the Sunny Island should be set equal to or greater than the power down time of the GenMan.

If a generator fault (e.g. generator failure) is detected, the generator is also disconnected and then stopped immediately. In doing so, the power down time is skipped.

Once the stop time (234.09 GnStpTmMin" parameter) has elapsed, the generator is ready for the next request.

Information

An internal generator request is disabled during the power down time and stop time or in error state.

If a generator fault is detected several times and the number of autostarts ("235.02 GnAutoStr" parameter) has been exceeded, the system transitions into the locked error state.

This state lasts for the time period set at "234.11 GnErrStpTm". Once this time has expired, the generator is ready for another attempt.

Information

The recording of autostarts is only reset after the generator has been successfully connected and the minimum run time has expired or when the locked error state (FailLock) is disabled.

Information

The error state and the locked error state can be canceled by acknowledging the generator fault ("540.02 GnAck" parameter).

The "133.03 GnRmgTm" display value is used to display the remaining time of the generator meter.

Depending on the current request or the phase in which the generator state machine is, the following times are displayed:

- Remaining time of Run1h
- Remaining run time during the warm up phase (Warm)
- Remaining minimum run time in operation (Run)
- Remaining run time during the power down time (Cool)
- Remaining stop time after the power down time has expired (Lock)
- Remaining time in the error state (Fail)
- Remaining time in the locked error state (FailLock)

13.1.8 Operation Together With Sunny Boy

NOTICE!

Damage to devices due to improper plant design.

When designing your stand-alone grid system, observe the following:

$P_{AC\ max.,\ Sunny\ Boy} = 2 \times P_{AC\ nom.,\ Sunny\ Island}$

- The maximal AC output power of the PV inverter connected should not exceed 4 kW (Sunny Island 2012) and 4.4 kW (Sunny Island 2224).

If the battery is fully charged, the frequency limits the power output of the AC feed-in generators (Sunny Boy). If the generator is now manually started, for example, the frequency would be lowered, if required, as the Sunny Island synchronizes with the generator. The AC feed-in generators (Sunny Boy) would then feed additional energy into the system and possibly overload the batteries. In order to prevent this, in this case the stand-alone grid frequency is temporarily increased, in line with the synchronization, until the AC feed-in generators (Sunny Boy) are disconnected from the stand-alone grid as a result of the grid limits being exceeded.

13.1.9 Stopping the Generator

If the generator was started via the Sunny Island (automatically or manually), it can be manually stopped at any time using the "540.01 GnManStr" parameter. This disconnects the generator (the minimum run time is not taken into account here) and the power down time (Cool) is skipped. Afterwards, the system transitions into the stop time (Lock).

DANGER!
Danger to life due to high voltages

The power down time depends on the generator type.

During the power down time, there is still grid voltage at the loads.

- Wait until the generator stops.

Information

Generators with the "manual" start option can generally only be started and stopped at the generator.

Information

If the generator start is to be disabled after a manual stop, this must be performed by setting the "235.01 GnAutoEna" parameter to "Off".

13.1.10 Failures

Reverse Power

If the reverse power ("234.13 GnRvPwr" parameter) set for the "234.14 GnRvTm" time is exceeded, the generator is disconnected and stopped. The power down time (Cool, parameter "234.10 GnCoolTm") is skipped and the system transitions into the minimum stop time (Lock). After reverse power, the connection is blocked for at least for the period "231.03 ExtLkTm" or "234.09 GnStpTmMin".

Generator Failure

If a generator failure is detected (failure on the master phase), the generator is disconnected immediately and a stop signal occurs on generator. The system transitions into the minimum stop time (Lock).

Generator Phase Failure

The failure of a phase (e.g. broken fuse) on a slave device is treated as a phase failure. The slave device then disconnects this phase. If the phase is detected as being available again, it is reconnected after the warm up time "234.12 GnWarmTm" has elapsed.

The phase failure on the master device is treated as a generator failure (see above).

Slave Device Failure

The cluster automatically switches off in the event a slave device fails completely. If, for example, a slave device goes into standby due to an error, the remaining cluster's Sunny Islands will remain in operation.

13.2 Grid

The Sunny Island supports the operation of grid backup systems on the grid. Here, a distinction is made between two main states: either a main power grid and stand-alone grid are connected or a main power grid and stand-alone grid are disconnected. The operating mode of the Sunny Island is derived from this. If the stand-alone grid is disconnected, the Sunny Island alone is responsible for powering this stand-alone grid. If the main power grid is connected to the stand-alone grid, the stand-alone grid is powered from the main power grid. The voltage and frequency in the stand-alone grid and in the main power grid are identical.

Information

Under specific conditions, the system can also temporarily feed energy from the stand-alone grid into the main power grid in the GridCharge operating mode ("232.08 GdMod" parameter).

13.2.1 Grid Limits

In order to operate on the grid, very strict limits (for voltage and frequency) must generally be maintained. These strict limits are not sensible for generator operation. The limits are therefore set separately for grid operation and the generator limits are not used.

Information

The default settings for limits during grid operation comply with the following standards:

- For 230V_50Hz: DIN VDE 0126-1-1 (not entirely)

NOTICE!

The Sunny Island does not meet the VDE 0126-1-1 directive required in Germany and, for legal reasons, it must therefore be MSD-certified (e.g. by UfE GmbH) when operated while connected to the public grid.

13.2.2 Stand-Alone Grid Operation

The main power grid and stand-alone grid are disconnected and the Sunny Island powers the stand-alone grid. This state is characterized by the system waiting for the grid to reconnect.

As long as the battery has a sufficient charge level, the loads are powered. In stand-alone operation, the AC feed-in generators (e.g. Sunny Boy) perform a charge operation, if required.

13.2.3 Grid Reconnection

In stand-alone operation, the Sunny Island constantly checks whether the grid has been reconnected (see above). If the voltage and frequency of the main power grid are within the permissible range of the "232.01 GdVtgMin" and "232.02 GdVtgMax" parameters for the "232.07 GdVldTm" time, and if the frequency is within the permissible range of the "232.05 GdFrqMin" and "232.06 GdFrqMax" parameters (see also section 13.2.1 "Grid Limits" (page 129)), the stand-alone grid is synchronized with the main power grid and then connected.

13.2.4 Grid Operation

In grid operation, the stand-alone grid and main power grid are connected. The Sunny Island is connected along with the stand-alone grid to the main power grid. In this case, the voltage and frequency in both grids are identical.

Information

All grid failures that occur during grid operation affect the stand-alone grid.

In grid operation, the grid monitoring checks whether the permissible limits for voltage and frequency (see Grid Reconnection) are maintained or whether the grid fails to assume powering the stand-alone grid. To do this, the main power grid is disconnected (grid backup operation).

The battery is generally charged or its charge is maintained on the grid.

Charge Mode

Charge mode on the grid is indicated by energy flowing to the battery. The battery is charged until the respective charge process (Boost, Full, Equalize) has been completed and the system transitions into float charge (Float) (see section 12.4 "Charge Control" (page 107)).

Silent Mode

In order to save energy, the silent mode can be activated using the "224.01 SilentEna" parameter set to "enable" (default disable). In this case, the Sunny Island is set to standby mode if the charge has been completed and the battery has been in float charge for some time (see section 12.4.5 "Silent Mode" (page 111)).

The silent mode is exited regularly to recharge the battery.

Feeding Operation

Whether energy is fed from the stand-alone grid into the main power grid is controlled using the "232.08 GdMod" parameter. If GridCharge (Default) is set, no energy is fed into the grid. If GridFeed is set, energy is fed into the grid.

Information

In order to allow electricity to be fed from the battery into the grid, the battery voltage in a charged battery (on the grid) must be increased by external DC chargers above the nominal charging voltage.

AC feed-in generators on the stand-alone grid side (Sunny Boy) can feed their energy into the grid through the internal transfer relay of the Sunny Island; for limitations, see section 13.2.7 "Limits and Power Adjustment" (page 132).

13.2.5 Grid Failure

A grid fault is characterized by the voltage or frequency being outside of the permissible limits (see section 13.2.3 "Grid Reconnection" (page 130)) or the main power grid being disconnected. In this case, the time limits are relevant: Smaller deviations are permitted for longer than large deviations (see section 13.2.1 "Grid Limits" (page 129)).

In case of a grid fault/failure, the main power grid is disconnected and the inverter is started from silent mode.

Information

If the Sunny Island is in silent mode when there is a public grid failure, there is a short grid failure in the stand-alone grid (see section 12.4.5 "Silent Mode" (page 111)).

13.2.6 Failures

Reverse Power

If the defined reverse power ("232.09 GdRvPwr" parameter) is exceeded for the time "232.10 GdRvTm", the grid is disconnected. After reverse power, connection is blocked for at least "231.03 ExtLkTm".

Grid Failure

If a grid failure is detected (failure at the master phase), the grid is disconnected immediately.

Grid Phase Failure

The failure of a phase (e.g. broken fuse) on a slave device is treated as a phase failure. The slave device then disconnects this phase. If the phase is detected as being available again, it is reconnected.

The phase failure on the master device is treated as a grid failure (see above).

13.2.7 Limits and Power Adjustment

The Sunny Island burdens the grid with the current defined in the parameter "232.03 GdCurNom". The power that is not directly used by the loads flows into the battery for charging. At the same time, the limits for the AC charging current limit ("210.02 InvChrgCurMax" parameter) on the Sunny Island and the DC charging current limit ("222.01 BatChrgCurMax" parameter) are active. If the battery voltage reaches the charging voltage nominal value, it is also reduced
(see section 12.4 "Charge Control" (page 107)).

If the current set using the "232.03 GdCurNom" parameter is not sufficient for powering the loads, the battery provides support.

13.2.8 Operation Together With Sunny Boy

Since electricity is fed into the grid through the transfer relay of the Sunny Island, it must be prevented from overloading. For this reason, reverse power monitoring is used that, if required, disconnects the connection to the main power grid if the reverse power limit is exceeded.

NOTICE!

Device damage due to high currents.

The quantity of PV output installed in the stand-alone grid must not exceed the maximum quantity allowed by the AC input (see section 20 "Technical Data" (page 177)).

- Install a line circuit breaker (B type, min. 16 A) in order to protect the Sunny Island against overcurrents.

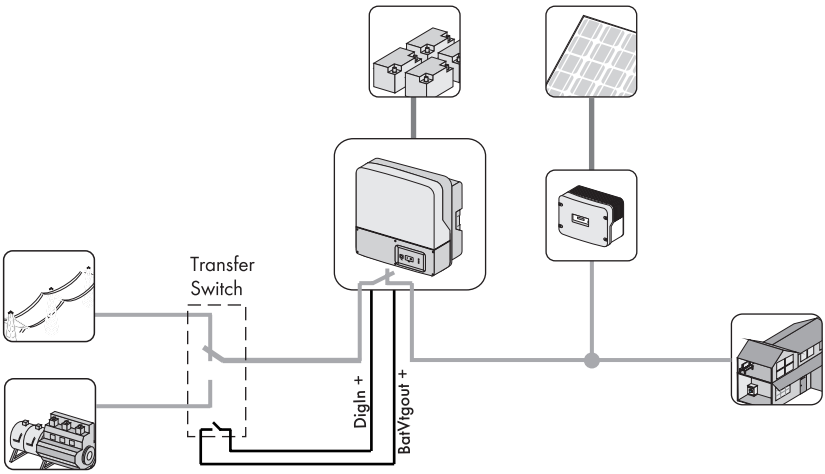
  For maintenance work, the Sunny Island can be switched off via the line circuit breaker on the stand-alone grid side.

If the battery is fully charged, the frequency limits the power output of the AC feed-in generators (Sunny Boy) in the stand-alone grid. If the grid is now reconnected, the frequency would be lowered, if required, as the Sunny Island is synchronized with the grid. The AC feed-in generators (Sunny Boy) would then feed additional energy into the system and possibly overload the batteries. In order to prevent this, in this case the stand-alone grid frequency is temporarily increased, in line with the synchronization, until the AC feed-in generators (Sunny Boy) are disconnected from the stand-alone grid as a result of the grid limits being exceeded.

13.3 Generator and Grid

In addition to the public grid, a generator can also be integrated into a stand-alone grid system as a secondary protective measure. This is particularly useful in case of long-term grid failures, even if the battery size is no longer sufficient to bridge the failure after a period of time.

The standard solution in such cases is to use a transfer switch that can be purchased as a manual or an automatic switch. By using such a switch, a diesel generator is connected to the AC2 connection, to which the public grid is normally connected, as displayed in the figure below:



To use such a switch, proceed with the installation as follows:

1. Connect the negative pole of the DigIn connection on the Sunny Island to the negative pole of the BatVtgOut connection, also located on the Sunny Island.
2. Connect the positive pole of the DigIn connection to a NO connection of an auxiliary contact of the transfer switch.
3. Connect the positive pole of the BatVtgOut connection to the second contact of the same auxiliary contact on the transfer switch.

An auxiliary contact is used because the Sunny Island must "know" whether it is connected to the public grid or whether it must manage a diesel generator.

To enable such operation, the "GenGrid" (GridBackup + Generator) selection is absolutely imperative (see section 9.2 "Starting the Quick Configuration Guide (QCG)" (page 75)).

Information

All the settings made for the generator and grid in the submenus also apply to the "GridBackup + Generator" selection.

14 Relays

The Sunny Island offers you several options for the control of internal and external processes. For this purpose, there are two relays integrated into the device to which you can assign functions using the "241.01 Rly1Op" and "241.02 Rly2Op" parameters. Information on connecting the relays is provided in section 7.6.3 "Multi-Function Relays 1 and 2" (page 57). The different settings have the following meanings:

Function/ Settings	Meaning	Functional description
Off	Off	Relay remains permanently switched off (deactivated).
On	On	Relay remains permanently switched on (e. g. relay function test during commissioning).
AutoGn	Automatic generator request is active	
AutoLodExt	Automatic load shedding with regard to an external source	Automatic connection / disconnection of loads. Connection only occurs if the device is connected to an external source (e.g. generator), or if the absorption phase is active.
AutoLod1Soc	Auto LoadShedding Soc1	Automatic connection / disconnection of loads. Load is only connected if SOC limit 1 has exceeded the set value again.
AutoLod2Soc	Auto LoadShedding Soc2	Automatic connection / disconnection of loads. Load is only connected if SOC limit 2 has exceeded the set value again.
Tmr1	Timer 1 (time-controlled switching of relay 1)	Programmable timer 1 (once, daily, weekly) with duty cycle.
Tmr2	Timer 2 (time-controlled switching of relay 2)	Programmable timer 2 (once, daily, weekly) with duty cycle.
Apt-Phs	Absorption phase active	Relay switching when battery charge is in absorption phase.
GnRun	Generator is running	Relay switching when generator is in operation and connected.
ExtVfOk	External voltage and frequency is OK	External voltage and frequency are within the valid range for connection.
GdOn	Public grid	Relay switching when public grid is available and connected.
Error	Error	Sunny Island has a fault; contact is open if there is a fault (relay is deactivated).
Warn	Alarm	Relay is switched if the Sunny Island is in warning mode.
Run	Run	Sunny Island is in operation, contact is closed (relay is activated) if the device is running in inverter operation.
BatFan	Battery fan	Relay is used for automatic battery room ventilation (switching the fan).
AcdCir	Acid circulation	Relay is used for automatic acid circulation (switching the electrolyte pump)
CHPReq	CHP plant request	CHP plant in operation. Additional output via a CHP plant is requested.

Function/ Settings	Meaning	Functional description
CHPAdd	Request of several CHP plants.	Several CHP plants in operation. Additional output via several CHP plants is requested.

Relay configuration

You can only assign one function to each relay.

Operating principles of the relays

The relays are changeover contacts. They can be used as normally closed or as normally open contacts.

All relay functions are designed as NO contacts, which means the contact closes if the relay is activated by selecting the function.

The exception is the "Error" relay function. In this case the relay is designed as a NCC contact. Normally the relay is active and the contact is open. Once an error occurs the relay deactivates, the contact closes and switches on a warning light, for example.

Relays in fault situations

In case of a fault, the relays switch to safe mode, i.e they are deactivated.

15 Sunny Boy in Stand-Alone Grid Systems

You will find further information on selecting and using Sunny Boy PV inverters in stand-alone grid systems in the download area at www.SMA.de.

15.1 Requirements

Keep the following in mind when configuring the Sunny Boy for use with stand-alone grid systems:

Preset parameters

You can order all Sunny Boys with preset stand-alone grid parameters through SMA Solar Technology.

WARNING!

Once a Sunny Boy is set to stand-alone grid parameters, the device no longer complies with certain standards and guidelines (e.g. in Germany the DIN VDE 0126-1-1). Danger of feedback if the public grid is down.

- Never operate the PV inverter directly on the public grid using these settings.

Access permission

For changing the grid relevant parameters in the Sunny Boy you need a special access code, the installer code. Contact the Sunny Island Hotline at the phone number +49 561 9522 399 or by e-mail at SunnyIsland.Service@SMA.de to obtain this personal code.

You will need one of the following communication units in order to set the parameters of a Sunny Boy:

- Sunny Boy Control
- Sunny WebBox
- PC/laptop with Sunny Data/Sunny Data Control software and a service cable for data transfer (SMA order number: "USBPBS-11" USB service interface)

Set the parameters in accordance with the respective user manual of the device or software.

15.2 Setting the PV Inverters SB 3000TL-20 / 4000TL-20 / SB 5000TL-20

Making Adjustments using the Device's Internal Rotary Code Switch

During the first 10 operating hours you can set Sunny Boy inverter models SB 3000TL-20 / 4000TL-20 / SB 5000TL-20 to stand-alone grid operation (“off-grid”) via the rotary code switch. During this time period you do not require access authorization to change the grid parameters.

Turn the rotary code switch to the "E1" position. "E" stands for off-grid and "1" stands for German.

Making Adjustments using the Sunny Data/Sunny Data Control Software

Following the first 10 hours of operation adjustments to the stand-alone grid parameters can only be made via the communication units. In order to do so you will need the necessary access authorization.

Set the "GridGuard.CntrySet" parameter to "None".

Using the PV Inverters in 60 Hz Grids

No grid frequency detection

Sunny Boys SB 3000TL-20 / 4000TL-20 / SB 5000TL-20 do not perform an automatic grid frequency detection (50 Hz or 60 Hz).

Switching the parameters to off-grid with the help of the rotary code switch does not change the frequency. The device continues to function at a frequency of 50 Hz. Change the frequency manually from 50 Hz to 60 Hz if you would like to use these Sunny Boys in 60 Hz grids

Parameter settings for use in 60 Hz grids:

- "GridGuard.FrqCtl.hLim" = 65 Hz
- "GridGuard.FrqCtl.Max" = 65 Hz
- "GridGuard.FrqCtl.lLim" = 55 Hz
- "GridGuard.FrqCtl.Min" = 55 Hz

15.3 Setting Additional PV Inverter Types

This section describes the setting of the following PV inverter types:

- SB 700
- SB 1100 / 1700
- SB 1100LV
- SB 2400
- SB 2500
- SB 2800i
- SB 3000
- SB 3300
- SB 3800

The following PV inverters can only be used in a system with several Sunny Islands 2012/2224:

- SMC 4600A / 5000A / 6000A
- SMC 5000 / 6000
- SMC 7000HV
- SMC 6000TL / 7000TL / 8000TL
- SMC 9000TL / 10000TL / 11000TL

You can set these inverter types to off-grid operation by switching the parameter from "default" to "offgrid". In order to do so you will need the necessary access authorization.

The "OffGrid" parameter setting automatically sets the following Sunny Boy parameters to the values listed in the following table:

No.	Parameter	Unit	Value
1	I-NiTest	mA	Off (MSD = 0)
2	Uac-Min	V	180
3	Uac-Max	V	260
4	Fac-delta- Lower range in which the Sunny Boy is active relative to f_0	Hz	-4.5 (starting from base frequency f_0)
5	Fac-delta+ Upper range in which the Sunny Boy is active relative to f_0	Hz	+1.5 (starting from base frequency f_0)
6	dFac-Max Max. rate of change	Hz/s	4
7	Fac-start delta Frequency increase relative to f_0, at which point the power adjustment via frequency begins.	Hz	1 (starting from base frequency f_0)
8	Fac-limit delta Frequency increase relative to f_0, at which point the power adjustment via frequency ends. The output of the Sunny Boy at this point is 0 W.	Hz	2 (starting from base frequency f_0)

You will find further information on "Frequency Shift Power Control (FSPC)" in the download area at www.SMA.de.

16 Maintenance and Care

16.1 Enclosure

Check that the enclosure of the stand-alone grid system is mechanically sound. If damage (e.g. cracks, holes, missing covers) endangers the operating safety, the Sunny Island must be deactivated immediately.

Larger particles of dirt should be removed from the device with a soft brush or similar item. Dust can be removed with a damp cloth. Solvents, abrasives or corrosive materials must not be used for cleaning!

16.2 The Sunny Island's Control Panel

NOTICE!

Unintended starting of the Sunny Island while cleaning the membrane keypad.

Only clean the membrane keypad when the device is deactivated.

16.3 Sunny Remote Control

It is best to clean the control elements with a soft, damp cloth. Solvents, abrasives or corrosive materials must not be used for cleaning!

NOTICE!

Unintended starting up of the device while cleaning the button by accidentally pushing or turning it!

1. Switch off the device.
2. Clean the device.

16.4 Functional Test

Check regularly whether fault indications are present. If a fault indication is displayed for which you cannot identify any apparent cause, the stand-alone grid system must be inspected by an installer. To ensure optimal operation, the operator should regularly check the Sunny Island's entries in the error list at short intervals (monthly, or even weekly), especially during the first months after commissioning. This can help to discover hidden faults in the installation or errors in the configuration.

Checking the ground connection

Once a year, visually inspect the ground connection at the house connection box, or on the meter board between PEN and the equipotential bonding bar!

16.5 Battery

NOTICE!

Possible damage to the battery due to a lack of inspection and maintenance!

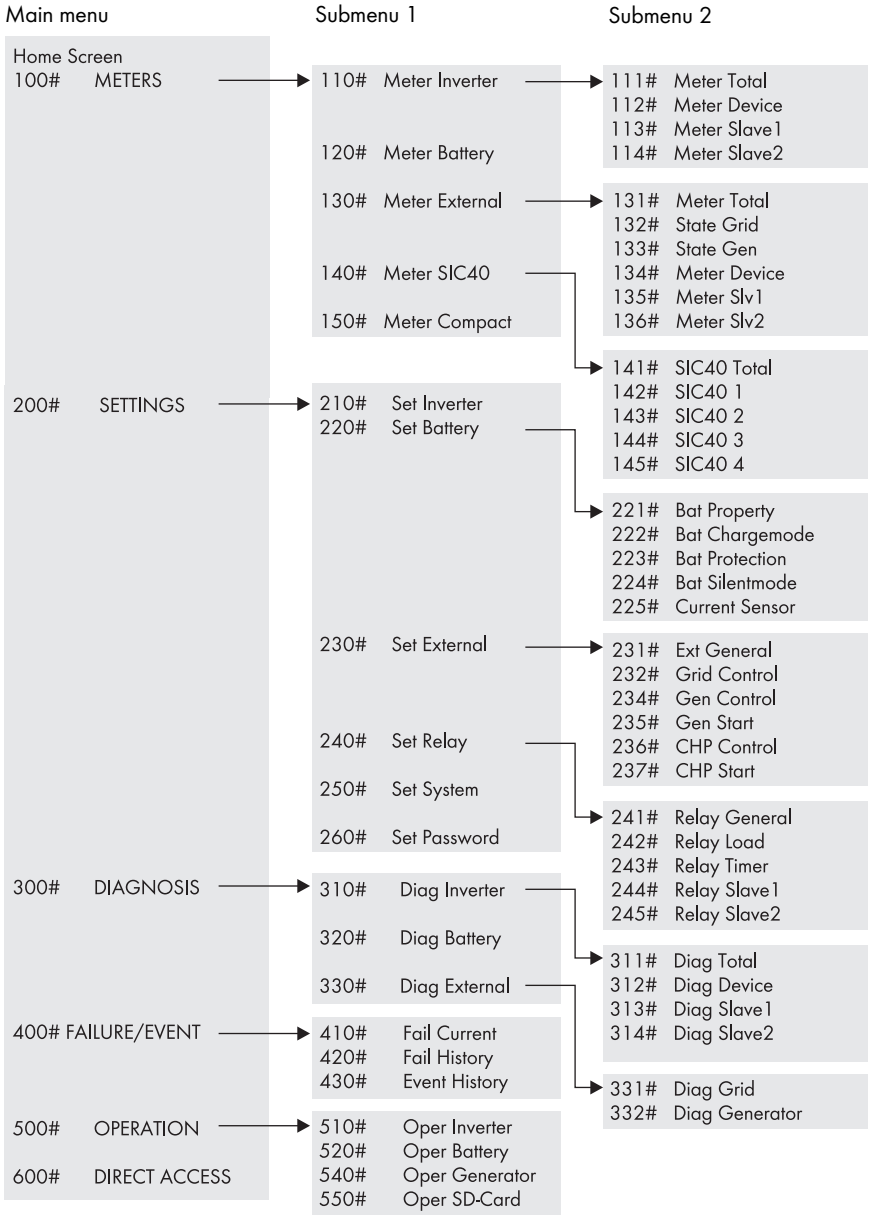
In this regard, observe the battery manufacturer's specifications.

16.6 Disposal

Dispose of the devices at the end of their service life in accordance with the disposal regulations for electronic scrap which apply at the installation site at that time. Alternatively, send them back to SMA Solar Technology with shipping paid by sender and labeled "ZUR ENTSORGUNG" ("FOR DISPOSAL") (section 21 "Contact" (page 181)).

17 Parameter List Overview

Overview of the navigation area:



Only parameters in the menu branches "200# Settings" and "500# Operation" can be changed. The other values are only shown on the display. All menu items that can only be changed after entering the installer password are shaded in gray in the following tables.

Fault-prone operation of the Sunny Island due to wrong parameter settings.

- Proceed carefully when setting parameters!
- Take note of the original values of all parameters that you change.

Saving settings onto the MMC/SD card

Once the system is working optimally, i.e., the selected settings have proven effective, save the selected values on the MMC/SD card using the "550.01 ParaSto" parameter (see section 10.3 "Storing Data on an MMC/SD Card" (page 94)).

Afterwards, you can perform new settings. If you would like to reject these settings again, you can restore the system to its previous state using the "550.02 ParaLod" parameter.

Labeling parameters

The parameter names used comply with the international standards IEC 61850-7-4 and 61400-25.

17.1 Display Values

110# Meter Inverter

Menu no.	Parameter no.	Parameter name	Range/Unit	Description
111# Meter Total				
111	01	TotInvPwrAt	kW	Total active power of inverter (single-phase, parallel, 3-phase)
111	02	TotInvCur	A	Total inverter current (single-phase, parallel, 3-phase)
111	03	TotInvPwrRt	kVar	Total reactive power of inverter (single-phase, parallel, 3-phase)
112# Meter Device				
112	01	InvOpStt	 Init Standby Startup RlyTest Operate Error	Operating state: = Waiting for request (ready) = Standby = Transfer standby -> operation = Relay test = Operation = Error
112	02	InvPwrAt	kW	Active power of inverter
112	03	InvVtg	V	Voltage at the inverter
112	04	InvCur	A	Inverter current
112	05	InvFrq	Hz	Frequency at the inverter
112	06	InvPwrRt	kVar	Reactive power of the inverter
112	07	Rly1Stt	–,Off,On	State of relay 1
112	08	Rly2Stt	–,Off,On	State of relay 2
113# Meter Slave 1				
113	01	InvOpSttSlv1	 Init Standby Startup RlyTest Operate Error	Operating state of slave 1: = Waiting for request (ready) = Standby = Transfer standby -> operation = Relay test = Operation = Error
113	02	InvPwrAtSlv1	kW	Active power of inverter on slave 1
113	03	InvVtgSlv1	V	Voltage of inverter on slave 1
113	04	InvCurSlv1	A	Inverter current on slave
113	05	InvPwrRtSlv1	kVar	Reactive power of inverter on slave 1
113	06	Rly1SttSlv1	–,Off,On	State of relay 1 on slave 1
113	07	Rly2SttSlv1	–,Off,On	State of relay 2 on slave 1

Menu no.	Parameter no.	Parameter name	Range/Unit	Description
114# Meter Slave 2				
114	01	InvOpSttSlv2	 Init Standby Startup RlyTest Operate Error	Operating state of slave 2: = Waiting for request (ready) = Standby = Transfer standby -> operation = Relay test = Operation = Error
114	02	InvPwrAtSlv2	kW	Active power of inverter on slave 2
114	03	InvVtgSlv2	V	Voltage of inverter on slave 2
114	04	InvCurSlv2	A	Inverter current on slave 2
114	05	InvPwrRtSlv2	kVar	Reactive power of inverter on slave 2
114	06	Rly1SttSlv2	Off On	State of relay 1 on slave 2
114	07	Rly2SttSlv2	Off On	State of relay 2 on slave 2

120# Meter Battery

Menu no.	Parameter no.	Parameter name	Range/Unit	Description
120	01	BatSoc	%	Present battery charge state (SOC)
120	02	BatVtg	V	Battery voltage
120	03	BatChrgVtg	V	Battery charging voltage
120	04	AptTmRmg	hhmmss	Remaining absorption time (hhmmss)
120	05	BatChrgOp	 Boost Full Equalize Float Silent	Active charging process: = Boost charge = Full charge = Equalization charge = Float charge = Silent Mode
120	06	TotBatCur	A	Total battery current
120	07	BatTmp	°C	Battery temperature
120	08	RmgTmFul	d	Remaining time until next full charge
120	09	RmgTmEqu	d	Remaining time until next equalization charge
120	10	AptPhs	Off On	Absorption phase is active
120	11	BatSocErr	%	Estimated error of the charge state

130# Meter External

Menu no.	Parameter no.	Parameter name	Range/Unit	Description
131# Meter Total				
131	01	TotExtPwrAt	kW	Total active power of external source
131	02	TotExtCur	A	Total current of external source
131	03	TotExtPwrRt	kVar	Total reactive power of external source
132# State Grid				
132	01	GdRmgTm	hhmmss	Remaining time of GdValTm parameter (valid grid time)
133# State Gen				
133	01	GnDmdSrc		Source for generator request:
			None	= No request
			Bat	= Dependent on battery state of charge
			Lod	= Load dependent
			Tim	= Time controlled
			Run 1 h	= For 1 hour
			Start	= Manually started
			ExtSrcReq	= External source request
133	02	GnStt		Generator state:
			Off	= Switched off
			Ready	= Waiting for request (ready)
			Warm	= Warming up
			Connect	= Connecting
			Run	= Operation
			Retry	= Restarting
			Disconnect	= Disconnecting
			Cool	= Cooling down
			Lock	= Locked after operation
			Fail	= Error
			FailLock	= Locked after error
			Reinit	
133	03	GnRmgTm	hhmmss	Remaining generator run time (minimum run time) (hhmmss)
133	04	GnRnStt	Off	State of generator response on master (DigIn)
			On	
134# Meter Device				
134	01	ExtPwrAt	kW	Active power of external source
134	02	ExtVtg	V	Voltage of external source
134	03	ExtCur	A	Current of external source
134	04	ExtFrq	Hz	Frequency of external source
134	05	ExtPwrRt	kVar	Reactive power of external source
135# Meter Slave 1				
135	01	ExtPwrAtSlv1	kW	Active power of external source on slave 1
135	02	ExtVtgSlv1	V	Voltage of external source on slave 1
135	03	ExtCurSlv1	A	Current of external source on slave 1
135	04	ExtPwrRtSlv1	kVar	Reactive power of external source on slave 1

Menu no.	Parameter no.	Parameter name	Range/Unit	Description
136# Meter Slave 2				
136	01	ExtPwrAtSlv2	kW	Active power of external source on slave 2
136	02	ExtVtgSlv2	V	Voltage of external source on slave 2
136	03	ExtCurSlv2	A	Current of external source on slave 2
136	04	ExtPwrRtSlv2	kVar	Reactive power of external source on slave 2
138# Meter CHP				
138	01	ChpStt		State of CHP plant:
			Off	= Off
			Ready	= Waiting for request (ready)
			Warm	= Warming up
			Connect	= Connecting
			Run	= Operation
			Retry	= Restarting
			Disconnect	= Disconnecting
			Cool	= Cooling down
			Lock	= Locked after operation
			Fail	= Error
			FailLock	= Locked after error
138	02	ChpPwrAt	kW	Nominal power of CHP plant
138	03	ChpRmgTm	hhmmss	Minimum run time of CHP plant
138	04	ChpStrRmgTm	hhmmss	Start time of minimum run time of CHP plant

140# Meter SIC40

If one or more external SIC40 DC charge controller is connected to the stand-alone grid system communication, the following menus will appear on the display:

Menu no.	Parameter no.	Parameter name	Range/Unit	Description
141# SIC40 Total				
141	01	TotSicEgyCntIn	kWh	Total energy yield of all SIC 40
141	02	TotSicDyEgyCntIn	kWh	Total daily yield of all SIC40
141	03	TotSicPvPwr	W	Total power of all SIC40
141	04	TotSicBatCur	A	Battery current of all SIC40
142# SIC40 1				
142	01	Sic1EgyCntIn	kWh	Energy yield of the first SIC40
142	02	Sic1TdyEgyCntIn	kWh	Daily yield of the first SIC40
142	03	Sic1PvPwr	W	PV power of the first SIC40
142	04	Sic1PvVtg	V	PV voltage of the first SIC40
142	05	Sic1BatVtg	V	Battery voltage of the first SIC40
142	06	Sic1BatCur	A	Battery current of the first SIC40
142	07	Sic1HsTmp	°C	Heatsink temperature of the first SIC40
142	08	Sic1SWVers	–	SW version number SIC-PB

Menu no.	Parameter no.	Parameter name	Range/Unit	Description
143# SIC40 2				
143	01	Sic2EgyCntIn	kWh	Energy yield of the second SIC40
143	02	Sic2TdyEgyCntIn	kWh	Daily yield of the second SIC40
143	03	Sic2PvPwr	W	PV power of the second SIC40
143	04	Sic2PvVtg	V	PV voltage of the second SIC40
143	05	Sic2BatVtg	V	Battery voltage of the second SIC40
143	06	Sic2BatCur	A	Battery current of the second SIC40
143	07	Sic2HsTmp	°C	Heatsink temperature of the second SIC40
143	08	Sic2SWVers	–	SW version number SIC-PB
144# SIC40 3				
144	01	Sic3EgyCntIn	kWh	Energy yield of the third SIC40
144	02	Sic3TdyEgyCntIn	kWh	Daily yield of the third SIC40
144	03	Sic3PvPwr	W	PV power of the third SIC40
144	04	Sic3PvVtg	V	PV voltage of the third SIC40
144	05	Sic3BatVtg	V	Battery voltage of the third SIC40
144	06	Sic3BatCur	A	Battery current of the third SIC40
144	07	Sic3HsTmp	°C	Heatsink temperature of the third SIC40
144	08	Sic3SWVers	–	SW version number SIC-PB
145# SIC40 4				
145	01	Sic4EgyCntIn	kWh	Energy yield of the fourth SIC40
145	02	Sic4TdyEgyCntIn	kWh	Daily yield of the fourth SIC40
145	03	Sic4PvPwr	W	PV power of the fourth SIC40
145	04	Sic4PvVtg	V	PV voltage of the fourth SIC40
145	05	Sic4BatVtg	V	Battery voltage of the fourth SIC40
145	06	Sic4BatCur	A	Battery current of the fourth SIC40
145	07	Sic4HsTmp	°C	Heatsink temperature of the fourth SIC40
145	08	Sic4SWVers	–	SW version number SIC-PB

For a detailed description of the **"150# Meter Compact"** menu see section 10.2.8 "Meter Compact" (page 92).

17.2 Adjustable System Parameters

NOTICE!

Damage due to mistakenly entered values

Directly after pressing the button, operating values can immediately change to their new settings. It could happen that wrong entries for these parameter values cannot be corrected quickly enough.

- Only qualified personnel are permitted to set and adjust system parameters.

Parameters marked with (Stby) are to be changed only when the Sunny Island is in standby mode.

Changes to parameters

All menu items that can only be changed after entering the installer password are shaded in gray in the following tables.

All parameters can be set using a connected PC/laptop with the Sunny Data Control software, a Sunny WebBox or a Sunny Boy Control (see section 7.5 "Communication" (page 49)).

210# Set Inverter

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
210	01	InvVtgNom	V	230	Nominal inverter voltage
210	02	InvChrgCurMax	A	9.6	Maximum AC charging current
210	03	InvFrqNom	Hz	50	Nominal inverter frequency

220# Set Battery

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
221# Bat Property					
221	01	BatTyp	VRLA FLA NiCd	VRLA	Battery type: = Valve regulated lead acid = Flooded lead acid = Nickel cadmium Can only be changed in QCG
221	02	BatCpyNom	Ah	100 Ah for SI2224 280 Ah for SI2012	Nominal battery capacity (E:C10/U:C20) Can only be changed in QCG
221	03	BatVtgNom	V	24 V for SI2224 12 V for SI2012	Nominal battery voltage Can only be changed in QCG
221	04	BatTmpMax	degC	40	Maximum battery temperature
221	05	BatTmpStr	degC	35	Battery restart temperature following stop due to overtemperature

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
221	06	BatCabRis	mOhm	0	Line resistance of the battery connection (from the battery to the Sunny Island (master)). IEC standard
222# Bat Chargemode					
222	01	BatChrgCurMax	A	80 A for SI2224 160 A for SI2012	Battery charging current limit (depends on nominal battery capacity), <= 60 % of the nominal battery capacity (221.02)
222	02	AptTmBoost	min	120	Absorption time for normal charge 120 = VRLA 90 = FLA 300 = NiCd Depending on the setting in QCG
222	03	AptTmFul	h	5	Absorption time for full charge 5 = VRLA 5 = FLA 7 = NiCd Depending on the setting in QCG
222	04	AptTmEqu	h	10	Absorption time for equalization charge 10 = VRLA 10 = FLA 10 = NiCd Depending on the setting in QCG
222	05	CycTmFul	d	14	Full charge cycle time
222	06	CycTmEqu	d	180	Equalization charge cycle time
222	07	ChrgVtgBoost	V	2.4	Nominal value of cell voltage for normal charge 2.4 = VRLA 2.55 = FLA 1.65 = NiCd Depending on the setting in QCG
222	08	ChrgVtgFul	V	2.4	Nominal value of cell voltage for full charge 2.4 = VRLA 2.5 = FLA 1.65 = NiCd Depending on the setting in QCG
222	09	ChrgVtgEqu	V	2.4	Nominal value of cell voltage for equalization charge 2.4 = VRLA 2.5 = FLA 1.65 = NiCd Depending on the setting in QCG

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
222	10	ChrgVtgFlo	V	2.25	Nominal value of cell voltage for float charge 2.25 = VRLA 2.25 = FLA 1.55 = NiCd Depending on the setting in QCG
222	11	BatTmpCps	mV/degC	4.0	Battery temperature compensation 4.0 = VRLA 4.0 = FLA 0.0 = NiCd Depending on the setting in QCG
222	12	AutoEquChrgEna	Disable Enable	Enable	Activates automatic equalization charge
222	13	BmsOp	On Off BasicBasic	On	Enable/disable battery management
222	14	BatChrgVtgMan	V	12 V for SI2012 24 V for SI2224	Manual battery charging voltage value (nominal value) for deactivated battery management
222	16	BatDischrgVtg	V		Minimum battery discharging voltage
222	17	BatDischrgVtgStr	V		Start voltage after battery undervoltage detection
222	18	BatResist	mOhm	0	Internal resistance of battery
223# Bat Protection					
223	01	BatPro1TmStr	hhmmss	220000	Time for starting battery preservation mode level 1
223	02	BatPro1TmStp	hhmmss	060000	Time for stopping battery preservation mode level 1
223	03	BatPro2TmStr	hhmmss	170000	Time for starting battery preservation mode level 2
223	04	BatPro2TmStp	hhmmss	090000	Time for stopping battery preservation mode level 2
223	05	BatPro1Soc	%	20	SOC limit for preservation mode level 1
223	06	BatPro2Soc	%	15	SOC limit for preservation mode level 2
223	07	BatPro3Soc	%	10	SOC limit for preservation mode level 3
224# Bat Silentmode					
224	01	SilentEna	Disable Enable	Disable	Allows silent mode on the grid
224	02	SilentTmFlo (Stby)	h	3	Max. time for float charge until transfer into silent
224	03	SilentTmMax (Stby)	h	12	Max. time for silent mode until transfer into float
225# Bat Current Sensor					
225	01	BatCurSnsTyp	None 60 mV 50 mV	None	Current sensor type (60 mV, 50 mV)

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
225	02	BatCurGain60	A/60 mV	100	External battery current sensor 60 mV type
225	03	BatCurGain50	A/50 mV	100	External battery current sensor 50 mV type
225	04	BatCurAutoCal	Start	–	Automatic calibration of the external battery current sensor

230# Set External

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
231# Ext General					
231	01	PvFeedTmStr	hhmmss	040000	Start time for PV grid feeding
231	02	PvFeedTmStp	hhmmss	220000	Stop time for PV grid feeding
231	03	ExtLkTm	min	20	Lock time after reverse power or relay protection
231	06	ExtSrc	PvOnly Gen Grid GenGrid	PvOnly	Grid operation
231	13	ChpEna	Disable Enable	Disable	CHP plant activated
232# Grid Control					
232	01	GdVtgMin	V	184	Minimum grid voltage 184 V = 230 V – 50 Hz 194 V = 220 V – 60 Hz
232	02	GdVtgMax	V	264.5	Maximum grid voltage 264.5 V = 230 V – 50 Hz 242 V = 220 V – 60 Hz
232	03	GdCurNom	A	16	Nominal grid current
232	04	GdFrqNom	Hz	50	Nominal grid frequency
232	05	GdFrqMin	Hz	47.50	Minimum grid frequency 47.5 Hz = 230 V – 50 Hz 59.3 Hz = 220 V – 60 Hz
232	06	GdFrqMax	Hz	50.20	Maximum grid frequency 50.2 Hz = 230 V – 50 Hz 60.5 Hz = 220 V – 60 Hz
232	07	GdVldTm	sec	30	Minimum time required for grid (voltage and frequency) to be within permissible range for connection
232	08	GdMod	GridCharge GridFeed	GridCharge	Grid interface
232	09	GdRvPwr	W	100	Permissible grid reverse power (active power)
232	10	GdRvTm	sec	5	Permissible time for grid reverse power
232	15	GdAISns	Low Medium Normal High	Normal	AI sensitivity

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
234# Gen Control					
234	01	GnVtgMin	V	172.5	Minimum generator voltage
234	02	GnVtgMax	V	250	Maximum generator voltage
234	03	GnCurNom	A	16	Nominal generator current
234	04	GnFrqNom	Hz	50	Nominal generator frequency (at nominal load) 230V_50HZ = 50 220V_60HZ = 60 Depending on the setting in QCG
234	05	GnFrqMin	Hz	44.64	Minimum generator frequency 230V_50HZ = 44.64 220V_60HZ = 50 Depending on the setting in QCG
234	06	GnFrqMax	Hz	60	Maximum generator frequency 230V_50HZ = 60 220V_60HZ = 70 Depending on the setting in QCG
234	07	GnStrMod	Manual Autostart GenMan	Autostart	Generator interface
234	08	GnOpTmMin	min	15	Minimum generator run time
234	09	GnStpTmMin	min	15	Minimum generator stop time
234	10	GnCoolTm	min	5	Generator cooling-off time
234	11	GnErrStpTm	h	6	Generator stop time in case of generator failure
234	12	GnWarmTm	sec	60	Warm up time (minimum time required for generator voltage and frequency to be within permissible range for connection)
234	13	GnRvPwr	W	100	Permissible generator reverse power (active power)
234	14	GnRvTm	sec	30	Permissible time for reverse power/reverse current
234	15	GnCtlMod	Cur CurFrq	Cur	External (gen/grid) controller (current or frequency)
234	20	GnAISns	Low Medium Normal High	Normal	AI sensitivity
235# Gen Start					
235	01	GnAutoEna	Off On	On	Activate generator autostart
235	02	GnAutoStr		3	Number of autostarts
235	03	GnSocTm1Str	%	40	SOC limit for switching on generator for time 1
235	04	GnSocTm1Stp	%	80	SOC limit for switching off generator for time 1

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
235	05	GnSocTm2Str	%	40	SOC limit for switching on generator for time 2
235	06	GnSocTm2Stp	%	80	SOC limit for switching off generator for time 2
235	07	GnTm1Str	hhmmss	000000	Time 1 for generator request (begin time 1, end time 2) (hhmmss)
235	08	GnTm2Str	hhmmss	000000	Time 2 for generator request (begin time 2, end time 1) (hhmmss)
235	09	GnPwrEna	Off On	Off	Activate generator request as a result of power
235	10	GnPwrStr	kW	1.7	Generator request Starting capacity
235	11	GnPwrStp	kW	0.8	Generator request Interrupting capacity
235	12	GnPwrAvgTm	sec	60	Average time for power-related generator start
235	13	GnTmOpEna	Disable Enable	Disable	Activates time-controlled generator operation
235	14	GnTmOpStrDt	ddmmyyyy	01012006	Start date of time-controlled generator operation
235	15	GnTmOpStrTm	hhmmss	000000	Start time of time-controlled generator operation
235	16	GnTmOpRnDur	hhmmss	000000	Run time for time-controlled generator operation
235	17	GnTmOpCyc	Single Dayly Weekly	Single	Repeat cycle for time-controlled generator operation
235	18	GnStrChrgMod	Off Full Equal Both	Both	Generator start for charge type
235	19	GnStrDigIn	Disable Enable	Disable	Generator start for signal on activated digital input
236# CHP Control					
236	01	ChpOpTmMin	min	60	Minimum run time of CHP plant
236	02	ChpStpTmMin	min	10	Minimum stop time of CHP plant
236	03	ChpPwrMax	kW	5.0	Maximum power of CHP plant
236	04	ChpPwrMin	kW	2.0	Minimum power of CHP plant
236	05	ChpFrqPwrMax	Hz	51	Maximum frequency of CHP plant
236	06	ChpFrqPwrMin	Hz	52	Minimum frequency of CHP plant
236	07	ChpFrqOff	Hz	53	
237# CHP Start					
237	01	ChpSocTm1Str	%	40	SOC limit for switching on CHP plant for time 1
237	02	ChpSocTm1Stp	%	80	SOC limit for switching off CHP plant for time 1
237	03	ChpSocTm2Str	%	40	SOC limit for switching on CHP plant for time 2

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
237	04	ChpSocTm2Stp	%	80	SOC limit for switching off CHP plant for time 2
237	05	ChpTm1Str	hhmmss	000000	Time 1 for CHP plant request (begin time 1, end time 2)
237	06	ChpTm2Str	hhmmss	000000	Time 2 for CHP plant request (begin time 2, end time 1)
237	07	ChpPwrEna	Disable Enable	Enable	Activate CHP plant request as a result of power
237	08	ChpPwrStr	kW	1.5	CHP plant request Starting capacity
237	09	ChpPwrStrDly	min	5	Time delay for CHP plant output request
237	10	ChpManStr	Auto Start Stop	Auto	
237	11	ChpAddOnTm	sec	60	Time activated for the additional CHP request
237	12	ChpAddOffTm	sec	120	Time deactivated for the additional CHP request
237	13	ChpAddSocDel	%	5	Distance to the next SOC limit

240# Set Relay

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
241# Relay General					
241	01	Rly1Op		AutoGn	Function of relay 1
			Off		= Switched off
			On		= Switched on
			AutoGn		= Automatic generator connection
			AutoLodExt		= Automatic disconnection of loads, connection only if external sources are available
			AutoLod1Soc		= Automatic connection/disconnection of loads due to SOC1
			AutoLod2Soc		= Automatic connection/disconnection of loads due to SOC2
			Tmr1		= Programmable timer 1
			Tmr2		= Programmable timer 1
			AptPhs		= Absorption phase is active
			GnRn		= Generator is running
			ExtVfOk		= Ext. voltage and frequency in permissible range
			GdOn		= Ext. grid is connected
			Error		= Error
			Warn		= Alarm
			Run		= Operation
			BatFun		= Battery room fan
			AcdCir		= Electrolyte pump
			CHPReq		= Additional output via a CHP plant is requested
			CHPAdd		= Additional output via several CHP plants is requested
241	02	Rly2Op	See 241.01	AutoLodExt	Function of relay 2 For details, see 241.01
242# Relay Load					
242	01	Lod1SocTm1Str	%	30	SOC limit for load shedding 1 start for t1
242	02	Lod1SocTm1Stp	%	50	SOC limit for load shedding 1 stop for t1
242	03	Lod1SocTm2Str	%	30	SOC limit for load shedding 1 start for t2
242	04	Lod1SocTm2Stp	%	50	SOC limit for load shedding 1 stop for t2
242	05	Lod1Tm1Str	hhmmss	000000	Load shedding 1 time 1 (begin time 1, end time 2)
242	06	Lod1Tm2Str	hhmmss	000000	Load shedding 1 time 2 (begin time 2, end time 1)
242	07	Lod2SocTm1Str	%	30	SOC limit for load shedding 2 start for t1
242	08	Lod2SocTm1Stp	%	50	SOC limit for load shedding 2 stop for t1
242	09	Lod2SocTm2Str	%	30	SOC limit for load shedding 2 start for t2
242	10	Lod2SocTm2Stp	%	50	SOC limit for load shedding 2 stop for t2

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
242	11	Lod2Tm1Str	hhmmss	000000	Load shedding 2 time 1 (begin time 1, end time 2)
242	12	Lod2Tm2Str	hhmmss	000000	Load shedding 2 time 2 (begin time 2, end time 1)
243# Relay Timer					
243	01	RlyTmr1StrDt	ddmmyyyy	01012006	Start date timer 1
243	02	RlyTmr1StrTm	hhmmss	000000	Start time for relay control Timer1
243	03	RlyTmr1Dur	hhmmss	000000	Run time for relay control timer 1
243	04	RlyTmr1Cyc	Single Dayly Weekly	Single	Repeat cycle time for timer 1
243	05	RlyTmr2StrDt	ddmmyyyy	01012006	Start date timer 2
243	06	RlyTmr2StrTm	hhmmss	000000	Start time for relay control timer 2
243	07	RlyTmr2Dur	hhmmss	000000	Run time for relay control timer 2
243	08	RlyTmr2Cyc	Single Dayly Weekly	Single	Repeat cycle time for timer 2
244# Relay Slave 1					
244	01	Rly1OpSlv1		Off	Function of relay 1 on slave 1:
			Off		= Switched off
			On		= Switched on
			AutoGn		= Automatic generator connection
			AutoLodExt		= Automatic disconnection of loads, connection only if external sources are available
			AutoLod1Soc		= Automatic connection/disconnection of loads due to SOC1
			AutoLod2Soc		= Automatic connection/disconnection of loads due to SOC2
			Tmr1		= Programmable timer 1
			Tmr2		= Programmable timer 1
			AptPhs		= Absorption phase is active
			GnRn		= Generator is running
			ExtVfOk		= Ext. voltage and frequency in permissible range
			GdOn		= Ext. grid is connected
			Error		= Error
			Warn		= Alarm
			Run		= Operation
			BatFun		= Battery room fan
			AcdCir		= Electrolyte pump
			CHPReq		= Additional output via a CHP plant is requested
			CHPAdd		= Additional output via several CHP plants is requested

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
244	02	Rly2OpSlv1		Off	Function of relay 2 on slave 1:
			Off		= Switched off
			On		= Switched on
			AutoGn		= Automatic generator connection
			AutoLodExt		= Automatic disconnection of loads, connection only if external sources are available
			AutoLod1Soc		= Automatic connection/disconnection of loads due to SOC1
			AutoLod2Soc		= Automatic connection/disconnection of loads due to SOC2
			Tmr1		= Programmable timer 1
			Tmr2		= Programmable timer 1
			AptPhs		= Absorption phase is active
			GnRn		= Generator is running
			ExtVfOk		= Ext. voltage and frequency in permissible range
			GdOn		= Ext. grid is connected
			Error		= Error
			Warn		= Alarm
			Run		= Operation
			BatFun		= Battery room fan
			AcdCir		= Electrolyte pump
			CHPReq		= Additional output via a CHP plant is requested
			CHPAdd		= Additional output via several CHP plants is requested

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
245# Relay Slave 2					
245	01	Rly1OpSlv2		Off	Function of relay 1 on slave 2:
			Off		= Switched off
			On		= Switched on
			AutoGn		= Automatic generator connection
			AutoLodExt		= Automatic disconnection of loads, connection only if external sources are available
			AutoLod1Soc		= Automatic connection/disconnection of loads due to SOC1
			AutoLod2Soc		= Automatic connection/disconnection of loads due to SOC2
			Tmr1		= Programmable timer 1
			Tmr2		= Programmable timer 1
			AptPhs		= Absorption phase is active
			GnRn		= Generator is running
			ExtVfOk		= Ext. voltage and frequency in permissible range
			GdOn		= Ext. grid is connected
			Error		= Error
			Warn		= Alarm
			Run		= Operation
			BatFun		= Battery room fan
			AcdCir		= Electrolyte pump
			CHPReq		= Additional output via a CHP plant is requested
			CHPAdd		= Additional output via several CHP plants is requested

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
245	02	Rly2OpSlv2		Off	Function of relay 2 on slave 2:
			Off		= Switched off
			On		= Switched on
			AutoGn		= Automatic generator connection
			AutoLodExt		= Automatic disconnection of loads, connection only if external sources are available
			AutoLod1Soc		= Automatic connection/disconnection of loads due to SOC1
			AutoLod2Soc		= Automatic connection/disconnection of loads due to SOC2
			Tmr1		= Programmable timer 1
			Tmr2		= Programmable timer 1
			AptPhs		= Absorption phase is active
			GnRn		= Generator is running
			ExtVfOk		= Ext. voltage and frequency in permissible range
			GdOn		= Ext. grid is connected
			Error		= Error
			Warn		= Alarm
			Run		= Operation
			BatFun		= Battery room fan
			AcdCir		= Electrolyte pump
			CHPReq		= Additional output via a CHP plant is requested
			CHPAdd		= Additional output via several CHP plants is requested

250# Set System

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
250	01	AutoStr (Stby)		3	Autostart (0 = autostart deactivated)
250	02	Dt	ddmmyyyy		Date
250	03	Tm	hhmmss		Time
250	05	ClstCfg	1Phase1 1Phase2 1Phase3 3Phase	1Phase1	Cluster configuration
250	06	ComBaud	1200 4800 9600 19200	1200	Baud rate interface
250	09	ComAdr		1	Interface address (communication)
250	10	SleepEna	Disable Enable	Disable	Allows sleep mode
250	13	SlpAtNgt	Disable Enable	Disable	Deactivate the slaves at night with "SleepAtNight".
250	14	SlpStrTm	hhmmss	200000	Start time for sleep mode
250	15	SlpStpTm	hhmmss	050000	Stop time for sleep mode
250	24	BatVtgOut	Auto Off On	On	Switching on and off of the battery voltage output
250	27	SearchModTm	sec	0	Time interval for search mode
250	28	ChrgCtlOp	Auto DCOnly SMA	Auto	Type of DC charging device

For a detailed description of the **"260# Set Password"** menu see section 10.2.6 "Setting the Installer Password" (page 90).

17.3 Diagnosis

310# Diag Inverter

Menu no.	Parameter no.	Parameter name	Range/Unit	Description
311# Diag Total				
311	01	EgyCntIn	kWh	Energy absorbed
311	02	EgyCntOut	kWh	Energy fed
311	03	EgyCntTm	h	Energy metering run time

Menu no.	Parameter no.	Parameter name	Range/Unit	Description
312# Diag Device				
312	01	Adr	Master Slave1 Slave2	Device address (type)
312	02	FwVer		BFR firmware version
312	03	SN		Series number
312	04	OnTmh	h	Operating hours
312	05	ClstCfgAt	1Phase1 1Phase2 1Phase3 3Phase	Set cluster configuration
312	06	OpStt	Operating Warning Failure	Operating state (device)
312	07	CardStt	 Off Operational Mount OutOfSpace BadFileSys Incomp Parameter ParamFailed WriteLogData WriteLogFailed	MMC/SD card status message: = No Sunny Island = In operation = Card initializing = Insufficient memory capacity (on card or in main directory) = Incorrect file system = Incompatible card = Parameter update is active = Error during parameter update = Writing log data to card = Error upon writing log data to card
312	08	FwVer2		DSP firmware version
312	09	FwVer3		BFR boot loader
312	10	FwVer4		DSP boot loader
313# Diag Slave 1				
313	01	FwVerSlv1		BFR firmware version on slave 1
313	02	SNSlv1		Series number Slave 1
313	03	OnTmhSlv1	h	Operating hours of slave 1
313	04	PhSlv1	L1 L2 L3	Phase position on slave 1
313	05	OpSttSlv1	Operating Warning Failure	Operating state (slave 2)
313	06	FwVer2Slv1		DSP firmware version Slave 1
313	07	FwVer3Slv1		BFR boot loader, slave 1
313	08	FwVer4Slv1		DSP boot loader, slave 1

Menu no.	Parameter no.	Parameter name	Range/Unit	Description
314# Diag Slave 2				
314	01	FwVerSlv2		BFR firmware version Slave 2
314	02	SNSlv2		Series number Slave 2
314	03	OnTmhSlv2	h	Operating hours of slave 2
314	04	PhSlv2	L1 L2 L3	Phase position Slave 2
314	05	OpSttSlv2	Operating Warning Failure	Operating state (slave 2)
314	06	FwVer2Slv2		DSP firmware version Slave 2
314	07	FwVer3Slv2		BFR boot loader, slave 2
314	08	FwVer4Slv2		DSP boot loader, slave 2

320# Diag Battery

Menu no.	Parameter no.	Parameter name	Range/Unit	Description
320	01	Soh	%	State of health (SOH), ratio of current capacity and nominal value
320	02	StatTm	d	Statistics metering run time
320	03	ChrgFact		Charging factor
320	04	BatEgyCntIn	kWh	Energy meter for battery charge
320	05	BatEgyCntOut	kWh	Energy meter for battery discharge
320	06	AhCntIn	Ah	Meter for battery charging ampere hours
320	07	AhCntOut	Ah	Meter for battery discharging ampere hours
320	08	BatTmpPkMin	degC	Minimum battery temperature
320	09	BatTmpPkMax	degC	Maximum battery temperature
320	10	EquChrgCnt		Equalization charge meter
320	11	FulChrgCnt		Full charge meter
320	12	BatCurOfsErr	A	Current offset error of battery current
320	13	OcvPointCnt		Meter for open-circuit voltage points
320	15	AhCntFul	Ah/100Ah	Meter for battery discharging ampere hours since the last full charge
320	16	AhCntEqu	Ah/100Ah	Meter for battery discharging ampere hours since the last equalization charge
320	17	BatVtgPk	V	Max. battery voltage to have arisen (SMA)
320	18	BatCurPkIn	A	Max. battery current in the charging direction (SMA)
320	19	BatCurPkOut	A	Max. battery current in discharging direction (SMA)
320	20	SocHgm100	%	Frequency scale of state of charge 100 % > SOC >= 90 %
320	21	SocHgm90	%	Frequency scale of state of charge 90 % > SOC >= 80 %
320	22	SocHgm80	%	Frequency scale of state of charge 80 % > SOC >= 70 %

Menu no.	Parameter no.	Parameter name	Range/Unit	Description
320	23	SocHgm70	%	Frequency scale of state of charge 70 % > SOC >= 60 %
320	24	SocHgm60	%	Frequency scale of state of charge 60 % > SOC >= 50 %
320	25	SocHgm50	%	Frequency scale of state of charge 50 % > SOC >= 40 %
320	26	SocHgm40	%	Frequency scale of state of charge 40 % > SOC >= 30 %
320	27	SocHgm30	%	Frequency scale of state of charge 30 % > SOC >= 20 %
320	28	SocHgm20	%	Frequency scale of state of charge 20 % > SOC >= 10 %
320	29	SocHgm10	%	Frequency scale of state of charge 10 % > SOC >= 0 %
320	30	SocHgm000	%	Frequency scale of state of charge SOC < 0 %
320	31	SocVtgCal	%	Charge state recalibration only via open-circuit voltage
320	32	ErrSocVtgCal	%	Estimated error of the voltage-calibrated charge state
320	33	SocChrgCal	%	Charge state recalibration only via full charge
320	34	ErrSocChrgCal	%	Estimated error of the full-charge-calibrated charge state
320	35	OcvGra	Ah/V	Slope of the open-circuit voltage curve
320	36	OcvMax	V	Max. open-circuit voltage

330# Diag External

Menu no.	Parameter no.	Parameter name	Range/Unit	Description
331# Diag Grid				
331	01	GdEgyCntIn	kWh	Energy meter for grid feed-in
331	02	GdEgyCntOut	kWh	Energy meter for power taken from the grid
331	03	GdEgyTmh	h	Run time of grid energy meter
331	04	GdOpTmh	h	Operating hour meter for grid operation
331	05	GdCtcCnt		Meter for grid connections
332# Diag Generator				
332	01	GnEgyCnt	kWh	Generator energy meter
332	02	GnEgyTm	h	Run time of generator energy meter
332	03	GnOpTmh	h	Operating hour meter for generator
332	04	GnStrCnt	-	Number of generator starts

17.4 Events, Warnings and Failures (History)

Events and fault indications [**410# (Fail Current)**, **420# (Fail History)** and **430# (Event History)**] are described in section 18.4 "Display of Errors and Events" (page 166)).

17.5 Functions in Operation

510# Oper Inverter

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
510	01	InvRs (Stby)	Restart	–	Triggers inverter restart
510	02	InvTmOpEna	Disable Enable	Disable	Activates time-controlled inverter operation
510	03	InvTmOpStrDt	ddmmyyyy	01012006	Start date of time-controlled inverter operation
510	04	InvTmOpStrTm	hhmmss	000000	Start time of time-controlled inverter operation
510	05	InvTmOpRnDur	hhmmss	000000	Run time for time-controlled inverter operation
510	06	InvTmOpCyc	Single Daily Weekly	Single	Repeat cycle time for timer 1
510	07	CntRs	Inv Bat Gn Gd All Sic1 Sic2 Sic3 Sic4 SicAll	–	Clears selected energy meter

520# Oper Battery

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
520	01	ChrgSelMan	Start Stop	–	Triggers equalization charge (manual)

540# Oper Generator

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
540	01	GnManStr	Auto Stop Start Run1h	Auto	Manual generator start
540	02	GnAck	Ackn		Error confirmation for generator fault

550# Oper SD-Card

Menu no.	Parameter no.	Parameter name	Range/Unit	Default value	Description
550	01	ParaSto	Set1 Set2	Set1	Saves parameter settings
550	02	ParaLod	Set1 Set2 Factory	Set1	Loads parameter settings
550	03	CardFunc	 ForcedWrite StoEvtHis StoFailHis		Functions for MMC/SD card = Forces writing of data = Writes event list = Writes failure list
550	04	DatLogEna	Off On	On	Activates automatic data storage

The "600# Direct Access" menu is described in detail in section 10.2.7 "Direct Access to Parameters" (page 92).

18 Troubleshooting / Problem Solving

In general the Sunny Island distinguishes between events and errors. These messages are shown on the Sunny Remote Control external display.

- **Events** describe state changes or transient states (e.g. generator connection).
- **Errors** describe states that are not permitted or are only permitted up to a certain rate. This includes warnings, failures and errors. A user interaction is generally required.

18.1 Error Confirmation

If there is an error or fault, the Sunny Island goes into standby.

Proceed as follows to confirm an error:

1. Remove the cause.
2. Acknowledge and confirm the error by pressing the indicator light button on the Sunny Remote Control.
3. Start the Sunny Island again.

18.2 Autostart Handling

The Sunny Island has an autostart counter which counts down by 1 with every automatic start. After 10 minutes of normal operation of the Sunny Island, the autostart counter is set back to its original value.

If another fault occurs when the autostart counter is at 0, the Sunny Island waits for 10 minutes and then attempts to restart. The autostart counter begins to run again.

The number of autostarts allowed can be set using the parameter "250.01 AutoStr" (in standby mode).

18.3 Handling Pending Errors During the Booting Procedure

During the start phase (booting procedure), the Sunny Island confirms all pending errors without an entry being made in the history (see menu "400# Failure/Event"). This way, an error that is still pending after the booting of the Sunny Island is re-entered.

The Sunny Remote Control shows:

- "Arrive" - the Sunny Island has recognized a fault (again) and has entered it in the list.
- "Clear" - the source of the fault has been cleared and the fault is "gone".

18.4 Display of Errors and Events

Every error and every event is clearly labeled and placed according to the Parameter/Measured value classification.

The message has four characters and is made up of one letter and three digits.

1. The letter at the beginning corresponds to the message type. There are three categories of messages:
   - F = Fault/Error
   - W = Warning
   - E = Event
2. In the second position there is a digit between 1 and 8 which describes the area to which the error, event or warning relates:
   - y1xx - INV = Inverter
   - y2xx - BAT = Battery
   - y3xx - EXT = Extern
   - y4xx - GEN = Generator
   - y5xx - GRD = Grid
   - y6xx - RLY = Relay
   - y7xx - SYS = System
3. In the third and
4. fourth positions there are two digits.

In addition, the Sunny Remote Control shows whether the message is up-to-date, i.e., whether it is necessary to take corrective action or whether the cause for the message has been taken care of.

- "Arrive" - the Sunny Island has recognized a fault (again) and has entered it in the list.
- "Clear" - the source of the fault has been cleared successfully.

18.5 Events

The meanings of the events displayed by the Sunny Island are described in the following table:

Display no.	Description
Category INV	
E101	Wait status
E102	Startup process
E103	In operation
E104	Operation with generator
E105	Operation with grid
E106	Feed-in grid operation (at external input)
E107	Sleep mode (slave in 1-phase systems)
E108	Silent mode on the grid
E110	Shutting down due to fault
E118	Automatic start
E119	Manual start (transfer from standby mode into operation)
E120	Manual stop (transfer from operation into standby mode)

Display no.	Description
Category BAT	
E202	(Partial) reset of BMS due to new battery (QCG NewBat)
E203	State change, battery charging algorithm for float charge
E204	State change, battery charging algorithm for boost charge
E205	State change, battery charging algorithm for full charge
E206	State change into silent mode (BMS)
E207	State change, battery charging algorithm for equalization charge
E221	Battery preservation mode level 1
E222	Battery preservation mode level 2
E223	Battery preservation mode level 3
Category GEN	
E401	Automatic generator start due to user-defined criteria (battery charge state, power, time, etc.)
E402	Automatic generator stop due to user-defined criteria (battery charge state, power, time, etc.)
E403	Manual generator start
E404	Manual generator stop
E405	Manual error confirmation of generator fault
Category REL	
E601	Relay 1 off
E602	Relay 1 on
E603	Relay 1 slave 1 off
E604	Relay 1 on slave 1 on
E605	Relay 1 on slave 2 off
E606	Relay 1 on slave 2 on
E609	Transfer relay open (disconnection from grid)
E610	Transfer relay closed (connect to grid)
E611	Transfer relay on slave 1 open
E612	Transfer relay on slave 1 closed
E613	Transfer relay on slave 2 open
E614	Transfer relay on slave 2 closed
E617	Relay 2 open
E618	Relay 2 closed
E619	Relay 2 on slave 1 open
E620	Relay 2 on slave 1 closed
E621	Relay 2 on slave 2 open
E622	Relay 2 on slave 2 closed

Display no.	Description
Category SYS	
E705	Device start
E706	Date/time changed (entry with "old" time)
E707	New system configured in QCG
E708	Part 1 of the firmware updated (entry of the "old" version)
E709	Part 2 of the firmware updated (entry of the "old" version)
E711	MMC/SD card inserted
E712	Sunny Remote Control: parameter update
E715	Sunny Remote Control is activated
E851	First SIC40 was detected
E852	Second SIC40 was detected
E853	Third SIC40 was detected
E854	Fourth SIC40 was detected

18.6 Error Categories

The Sunny Island distinguishes between five different levels of failures, each requiring different user interaction:

Level	Display	Meaning
1	Warning	Warning, device continues to run. There is an explicit information on the Home Screen that a warning was recorded.
2	Malfunction	Failure that can only be detected during operation. Device switches off. Device can be restarted immediately (autostart).
3	Malfunction	Failure that can also be detected in standby mode. Device switches off. The device can only be restarted (autostart) after the system detects that the failure has stopped.
4	Failure	Device fault. Device switches off. User interaction required (troubleshooting, confirmation, manual restart).
5	Defect	Device is defect. Device switches off and does not switch on again. Permanent disable. Device must be replaced.

18.7 Warnings and Fault Indications

The meanings of the faults and warnings displayed by the Sunny Island are described in the following table:

Displ. no.	Level	Description
Category INV		
F109	3	Overtemperature Transformer
F110	3	Overtemperature Transformer Slave 1
F111	3	Overtemperature Transformer Slave 2
F117	2	AC current limit (short-circuit control active for too long)
F118	2	AC current limit (short-circuit control active for too long) on slave 1
F119	2	AC current limit (short-circuit control active for too long) on slave 2
F121	3	Inverter surge voltage
F122	3	Inverter surge voltage on slave 1

Displ. no.	Level	Description
F123	3	Inverter surge voltage on slave 2
F150	3	Overtemperature (inverter)
W151	1	Overtemperature (inverter) Slave 1
W152	1	Overtemperature (inverter) Slave 2
F154	3	Overtemperature (voltage converter)
W155	1	Overtemperature (voltage converter) Slave 1
W156	1	Overtemperature (voltage converter) Slave 2
F158	2	Voltage on output AC1
F159	2	Voltage on output AC1 Slave 1
F160	2	Voltage on output AC1 Slave 2
Category BAT		
F206	3	Battery overtemperature
F208	3	Battery surge voltage (internal limit for cell voltage)
W210	1	Battery surge voltage warning (dependent upon charge voltage setpoint value)
W211	1	Low battery temperature warning
W212	1	High battery temperature warning
Category EXT		
W309	1	Relay protection
W310	1	Relay protection on slave 1
W311	1	Relay protection on slave 2
W315	1	Disconnection from grid/generator, external voltage too low
W316	1	Disconnection from grid/generator, external voltage too low Slave 1
W317	1	Disconnection from grid/generator, external voltage too low Slave 2
W319	1	Disconnection from grid/generator, external voltage too high
W320	1	Disconnection from grid/generator, external voltage too high Slave 1
W321	1	Disconnection from grid/generator, external voltage too high Slave 2
W323	1	Disconnection from grid/generator, external frequency too low
W324	1	Disconnection from grid/generator, external frequency too low Slave 1
W325	1	Disconnection from grid/generator, external frequency too low Slave 2
W327	1	Disconnection from grid/generator, external frequency too high
W328	1	Disconnection from grid/generator, external frequency too high Slave 1
W329	1	Disconnection from grid/generator, external frequency too high Slave 2
W331	1	Disconnection from grid/generator due to anti-islanding (unintended stand-alone grid)
W332	1	Disconnection from grid/generator due to anti-islanding (unintended stand-alone grid) Slave 1
W333	1	Disconnection from grid/generator due to anti-islanding (unintended stand-alone grid) Slave 2
W335	1	Disconnection from grid/generator due to violation of voltage limits (redundant measurement)
W336	1	Disconnection from grid/generator due to violation of voltage limits (redundant measurement), slave 1
W337	1	Disconnection from grid/generator due to violation of voltage limits (redundant measurement), slave 2
W339	1	Disconnection from grid/generator, voltage increase protection
W340	1	Disconnection from grid/generator, voltage increase protection Slave 1
W341	1	Disconnection from grid/generator, voltage increase protection Slave 2
W360	1	Disconnection from grid/generator due to overcurrent
W361	1	Disconnection from grid/generator due to overcurrent Slave 1

Displ. no.	Level	Description
W362	1	Disconnection from grid/generator due to overcurrent Slave 2
W401	1	Reverse power protection (generator)
W501	1	Reverse power protection during grid operation
Category RLY		
F605	4	Transfer relay does not open
F606	4	Transfer relay does not open Slave 1
F607	4	Transfer relay does not open Slave 2
Category SYS		
W702	1	DSP reset detected.
F703	3	Time limit exceeded during internal processing
F704	4	Invalid DSP calibration
F705	4	DSP watchdog has been triggered
F706	4	Watchdog meter has expired (watchdog triggered several times in succession)
F707	4	Watchdog meter on slave 1 has expired (watchdog triggered several times in succession)
F708	4	Watchdog meter on slave 2 has expired (watchdog triggered several times in succession)
F710	4	Autostart counter has expired (several autostarts in succession)
F711	2	Threshold violation Hardware (group signal)
F712	2	Internal undervoltage
W713	1	Watchdog has been triggered
F714	2	Internal surge voltage
F722	3	Short circuit in battery temperature sensor
F723	3	Cable break on battery temperature sensor
W724	1	Autostart counter has expired Slave 1
W725	1	Autostart counter has expired Slave 2
F731	4	Error in the cluster configuration
W738	1	Synchronization not successful
F739	3	Internal device communication BFR-DSP missing
F740	3	Internal device communication BFR-DSP missing on slave 1
F741	3	Internal device communication BFR-DSP missing on slave 2
F743	3	Internal device communication BFR-DSP missing
W753	1	Invalid date (date is set automatically when launched)
W755	1	Battery preservation mode level 1
W756	1	Battery preservation mode level 2
W757	1	Battery preservation mode level 3
F762	4	Short circuit or cable break on temperature sensor/voltage converter
F763	4	Short circuit or cable break on temperature sensor/voltage converter Slave 1
F764	4	Short circuit or cable break on temperature sensor/voltage converter Slave 2
F766	4	Short circuit or cable break on temperature sensor/inverter
F767	4	Short circuit or cable break on temperature sensor/inverter Slave 1
F768	4	Short circuit or cable break on temperature sensor/inverter Slave 2
W770	1	Short circuit at the 24 V DC output
W772	1	Threshold violation Hardware Slave 1 (group signal)
W773	1	Threshold violation Hardware Slave 2 (group signal)

Displ. no.	Level	Description
W774	1	Internal surge voltage on slave 1
W775	1	Internal surge voltage on slave 2
F780	4	Cluster error (cluster not complete)
W851	1	Pole of battery connection is reversed or short circuit on the first SIC40
W852	1	Battery surge voltage (> 65 V) on the first SIC40
W853	1	Surge voltage of PV generator on the first SIC40
W854	1	No PV voltage or short circuit on the first SIC40
W855	1	Sensor error or undertemperature on the first SIC40
W856	1	Device overtemperature on the first SIC40
W857	1	Communications loss on the first SIC40 for more than 24 h
W861	1	Pole of battery connection is reversed or short circuit on the second SIC40
W862	1	Battery surge voltage (> 65 V) on the second SIC40
W863	1	Surge voltage of PV generator on the second SIC40
W864	1	No PV voltage or short circuit on the second SIC40
W865	1	Sensor error or undertemperature on the second SIC40
W866	1	Device overtemperature on the second SIC40
W867	1	Communications loss on the second SIC40 for more than 24 h
W871	1	Pole of battery connection is reversed or short circuit on the third SIC40
W872	1	Battery surge voltage (> 65 V) on the third SIC40
W873	1	Surge voltage of PV generator on the third SIC40
W874	1	No PV voltage or short circuit on the third SIC40
W875	1	Sensor error or undertemperature on the third SIC40
W876	1	Device overtemperature on the third SIC40
W877	1	Communications loss on the third SIC40 for more than 24 h
W881	1	Pole of battery connection is reversed or short circuit on the fourth SIC40
W882	1	Battery surge voltage (> 65 V) on the fourth SIC40
W883	1	Surge voltage of PV generator on the fourth SIC40
W884	1	No PV voltage or short circuit on the fourth SIC40
W885	1	Sensor error or undertemperature on the fourth SIC40
W886	1	Device overtemperature on the fourth SIC40
W887	1	Communications loss on the fourth SIC40 for more than 24 h
F905	4	Sunny Island was unable to read the calibration data or the data was incomplete at start-up.
F906	4	Sunny Island (slave 1) was unable to read the calibration data or the data was incomplete at start-up.
F907	4	Sunny Island (slave 2) was unable to read the calibration data or the data was incomplete at start-up.

18.8 Troubleshooting

Answers are provided below for faults that may occur in practice:

Can the Sunny Island also be started without the Sunny Remote Control?

- The Sunny Island can also be started without the Sunny Remote Control. Keep in mind that during the first commissioning the Sunny Island does not run through the Quick Configuration Guide without the Sunny Remote Control. In this case the Sunny Island will only run with the factory default parameters.
- Before starting the emergency configuration, set the Sunny Islands for your system via the rotary code switch (see section 7.7 "Configuring a System with Several Sunny Islands" (page 62)). The configuration possibilities of the rotary code switch at a glance:

Position of the rotary code switch	Function	Description
0	SW (default)	Software configuration via Sunny Remote Control (Master)
1	Slave 1	Device is slave 1
2	Slave 2	Device is slave 2
9	Master 1Phs2	Device is master single-phase 2 parallel
10	Master 1Phs3	Device is master single-phase 3 parallel
11	Master 3Phs	Device is master 3-phase
15	Res.	Resetting the system to manufacturer settings

Why does the Sunny Island not connect to the running generator?

- Is the fuse on the generator ok?
- Has the power allowed to be fed back into the generator during the permissible time been exceeded ("234.14 GnRvTm" parameter)? If this is the case, "!" will appear on the display. Generator connection is blocked for the set time. Set the "540.02 GnAck" parameter to Ackn.
- If the generator control relay (GnReq) is open: Has the generator been started manually ("234.07 GnStrMod" parameter)? Change the setting to autostart, if required.

Why does the Sunny Island sporadically display the F711 error message when it switches from operation to standby mode?

- Are AC contactors installed in the stand-alone grid using unshielded coils?

  In this case, switching these coils can lead to surge voltages in the stand-alone grid, thus prompting the Sunny Island to report the F711 error message. Use a quenching circuit to shield the coils.

Why is the display of the Sunny Remote Control dark and why is nothing displayed?

- Is the communication cable connected, and did both RJ45 plugs snap into their sockets audibly?
- Has the BatFuse (external DC fuse) been triggered?

  The Sunny Island is disconnected from the battery this way and has switched off. Replace the DC fuse.
- Is the BatFuse functional?

  In this case, the device has switched off to protect the battery against deep discharge (see also section 12.3 "State of Charge/SOC and SOH" (page 106)). To restart the Sunny Island, see section 10.1.5 "Restarting the Sunny Island Following Automatic Shutdown" (page 85).

Why is it not possible to change parameters?

- Has the installer password been entered correctly? Check whether you are actually in "Installer Level" (see section 10.2.6 "Setting the Installer Password" (page 90)). If necessary, repeat the calculation and entry of the password.
- You are in the "100-Meters" (measuring data) menu or the "300-Diagnose" (diagnosis) menu. You can only read the data values shown here.
- Some parameters can only be changed in standby mode or in the QCG (see e.g. the "234.07 GnStrMod" parameter in section 17.2 "Adjustable System Parameters" (page 148)). Stop the Sunny Island as described in section 10.1.2 "Stopping the Sunny Island" (page 83). Note that this causes a dropout in the stand-alone grid and the loads are no longer supplied.

Why does the Sunny Island connect to the running generator only for a short time?

- The limits for the maximum permissible AC voltage or the minimum permissible frequency of the generator are too strict (parameter in the menu "#234 Generator Control"). Change voltage and/or frequency limits while observing the technical data for your generator.

What happens when a battery cell can no longer be used?

- Remove the unusable cell from your battery bank. Start the Sunny Island and change the battery voltage in the QCG under "New Battery".

What can I do if the QCG does not start?

- Switch off the Sunny Island (see section 10.1.3 "Switching off the Sunny Island" (page 84)) and restart it (see section 10.1.1 "Switching On/Starting the Sunny Island" (page 81)).

What happens when "MMC operation failed" appears on the display?

- You wanted to perform an action using the MMC/SD card, but it failed (see section 10.2.4 "Selecting Warnings and Errors" (page 88)). Check the card (on your PC/laptop) and use a new MMC/SD card, if necessary.
- Format the MMC/SD card using FAT16.

Why is my battery discharging even though the generator is running?

- The power produced by the generator does not reach the Sunny Island. Check the voltage and frequency values. The fuses on the generator may have been triggered.
- The power produced by the generator is not enough to supply the loads. The generator and the battery supply the loads.

Why is the deactivation defined by the SOC in case of a full or equalization charge and generator start in the second time zone?

- Full or equalization charge has a higher priority than silent time.

Why is the SOC not at 100 % even after full charging has been completed?

- Set a longer absorption period.

How is it possible to ensure that the maximum battery charging current is correctly calculated after a reinstallation of the battery current sensor?

- Re-calibrate the battery current sensor using the "225.04 BatCurAutoCal" parameter with the setting "Start" (see section9.3 "Commissioning the Battery Temperature Sensor" (page 79)).

  This parameter can only be changed by the installer, using the installer password.

What is required if the Sunny Island is continuously switched off after Low Battery Mode (LBM) when restarting the device?

- Start the generator manually, if required (e.g.: Run1h). Consider the time for warming up: 5 minutes without charging current in battery preservation mode (BatProtMode) can cause the device to change to standby mode.

How is it possible to change between wintertime and summertime operation e.g. in case of alpine huts?

- Save two different parameter sets on the MMC/SD card and activate them via the "550.02 ParaLod" parameter (see section 10.3.3 "Saving and Loading Parameters" (page 98)).

What happens if the card inserted is not FAT16 formatted?

- The Sunny Island displays the message "Incomp".

Why does the generator or grid not reconnect, although the voltage/frequency lie within the limits for disconnection?

- The Sunny Island connects with a so-called hysteresis, i.e., the connection value is slightly below or above the disconnection value. The disconnection values are factory-set.

19 Accessories (Optional)

In addition, SMA Solar Technology offers the following accessories:

- Battery rack for two batteries
- Power contactor for load shedding
- Software to make settings in and read/analyze data from your Sunny Island (free download at www.SMA.de)

Use of communication devices

SMA Solar Technology also offers an extensive range of products allowing you to communicate with the Sunny Island, to query data and much more. Among these devices are:

- Sunny Boy Control
- Sunny WebBox
- Sunny Sensor Box.

You cannot use the Sunny Beam and Sunny Matrix communication devices. They do not work together with the Sunny Island.

You can obtain further information in the download area at www.SMA.de

20 Technical Data

20.1 Sunny Island 2012/2224

EC Declaration of Conformity

You can download the EC Declaration of Conformity in the download area at www.SMA.de under Certificate.

	SI 2012	SI 2224
Output Values		
Nominal AC voltage ($U_{AC, nom}$) (adjustable)	230 V (202 to 253 V)	230 V (202 to 253 V)
Nominal frequency (f_{nom})	50 Hz (45 to 65 Hz)	50 Hz (45 to 65 Hz)
Continuous AC output power (P_{nom}) at 25 °C	2000 W	2200 W
Continuous AC output power (P_{nom}) at 45 °C	1400 W (-30 %)	1600 W (-27 %)
AC output power for 30 min at 25 °C	2500 W	2900 W
AC output power for 5 min at 25 °C	3600 W	3800 W
AC output power for 1 min at 25 °C	3800 W	3800 W
Nominal AC current ($I_{AC, nom}$)	8.7 A	9.6 A
Max. stand-alone grid current (limitations based on hardware)	25 A_{peak} (500 ms)	25 A_{peak} (500 ms)
Max. stand-alone grid current (limitations based on software)	17 A_{eff} (2.5 s)	17 A_{eff} (2.5 s)
Harmonic distortion of output voltage (K_{VAC})	< 4 %	< 4 %
Power factor (cos j)	–1 to +1	–1 to +1
Input Values		
Input voltage ($U_{AC, ext}$) (adjustable)	230 V (172.5 to 264.5 V)	230 V (172.5 to 264.5 V)
Input frequency (f_{ext}) (adjustable)	50 Hz (40 to 70 Hz)	50 Hz (40 to 70 Hz)
Max. AC input current ($I_{AC, ext}$) (adjustable)	25 A	25 A
Max. input power ($P_{AC, ext}$)	5.75 kW	5.75 kW
Battery Data		
Battery voltage ($U_{Bat, nom}$) (range)	12 V (8.4 V to 15.6 V)	24 V (16.8 to 31.5 V)

	SI 2012	SI 2224
Max. battery charging current ($I_{Bat, max}$)	180 A	90 A
Continuous charging current ($I_{Bat, nom}$)	160 A	80A
Battery capacity	100 to 10,000 Ah	100 to 10,000 Ah
Charge control	IUoU process with automatic full and equalization charge	IUoU process with automatic full and equalization charge
Battery type	VRLA/FLA/NiCd	VRLA/FLA/NiCd
Efficiency / Power absorbed		
Max. efficiency	93.0 %	93.6 %
Internal consumption with no load (in standby mode)	6 W	6 W
Certification		
	CE	CE
Protection Rating		
Per DIN EN 60529	IP 54	IP 54
USA	Not available	Not available
Device Protection		
Short circuit	Yes	Yes
Overload	Yes	Yes
Overtemperature	Yes	Yes
Interfaces		
Displays:	3-color LEDs	3-color LEDs
Control elements:	3 pushbuttons	3 pushbuttons
Electrically separated control contacts:	2 multi-function relays	2 multi-function relays
Communication:	RS485 galvanically isolated (opt.)	RS485 galvanically isolated (opt.)
External display:	Sunny Remote Control (SRC-1)	Sunny Remote Control (SRC-1)
Data storage and firmware update via SRC-1:	MMC/SD card	MMC/SD card

	SI 2012	SI 2224
Digital input level (Dig-In)	High level from 6 V (to 35 V), low level 0 to 2 V	High level from 6 V (to 35 V), low level 0 to 2 V
Load limits of multi-function relays 1 and 2: - connection to ohmic loads - connection to strongly inductive loads	 AC1: 6.0 A at 250 V~ AC15: 1.2 A at 250 V~	 AC1: 6.0 A at 250 V~ AC15: 1.2 A at 250 V~
Interruption time		
Maximal interruption time	approx. 60 ms	approx. 60 ms
Mechanical Data		
Width x height x depth	(470 x 445 x 185) mm	(470 x 445 x 185) mm
Weight	approx. 19 kg	approx. 19 kg
Ambient Conditions		
Ambient temperature	From –25 °C to +60 °C	From –25 °C to +60 °C
Other		
Warranty (EU)	5 years	5 years
Accessories		
External battery temperature sensor	Included	Included
CAT5e-FTP patch cable, 2 m	Included	Included
Generator manager (GenMan)	Optional	Optional
External DC fuse (BatFuse)	Required (not included in delivery)	Required (not included in delivery)
External DC charge controllers (SIC40)	Optional	Optional

20.2 Sunny Remote Control 1

Interfaces	
DC supply voltage	12 V (from the Sunny Island via communication cable)
Nominal current	200 mA
Data storage and service	128 MB MMC/SD card
Communication	RS 422
Communication cable	CAT5e-FTP patch cable (2 x RJ45 plugs)
Maximal cable length	20 m
Display and Operation	
Display	4 x 20 characters
Operation	Rotating pushbutton (button) Indicator light button
Mechanical Data	
Width x height x depth	(225 x 140 x 65) mm
Weight	ca. 0.5 kg
Ambient Conditions	
Ambient temperature	From 0 °C to + 50 °C
Protection Rating	
Per DIN EN 60529	IP 20
Certification	
	CE
Accessories Included in Delivery	
SD/MMC card	128 MB
Communication cable	CAT5e-FTP patch cable, 5 m

21 Contact

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

- Inverter type (Sunny Island 2012/2224, see type label)
- Voltage/frequency type
- Series number (see type label or parameter "312.03 SN")
- Firmware version (see parameter "312.02 FwVer")
- Fault indication shown on the display
- Battery type
- Nominal battery capacity
- Nominal battery voltage
- Communication products used
- Type and size of additional energy sources (generator, PV system, Sunny Boy)
- If a generator exists:
  - Generator type
  - Generator power
  - Maximum generator current
  - Generator interface

Recording of data and events

Always use the MMC/SD card to save data and events. In case of a failure SMA Solar Technology can thus quickly help you.

To ensure that you have saved the present error list and event list on the MMC/SD card, write all data to the MMC/SD card with the parameter "550.03 CardFunc" and the option "ForceWrite".

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22 Glossary

Absorption phase

Constant V phase: a charging phase using constant charging voltage. The charging current constantly decreases during this phase.

AC

Abbreviation for “Alternating Current”.

AC coupling

The connection of various loads, generators and storage devices on the AC side.

AGM battery

Absorbent glass mat separator battery. This is a battery where the electrolyte (a mixture of water and sulfuric acid) is bound to a glass fiber mat, a type of closed lead acid battery. A gas mixture (hydrogen and oxygen) is always generated when lead acid batteries are charged, and in normal operation this is internally recombined to form water. This removes the need for regularly refilling the battery cells with water, which is why these batteries are often described as “low maintenance” or even “maintenance free”. AGM batteries are available from many different manufacturers for a wide range of applications. They usually have very good high current properties but are not very charge-cycle resistant.

Ah

Abbreviation for “ampere hours”: unit of electrical charge; one ampere hour is the charge provided by a constant current of 1 A over a period of one hour - when two separate charges are connected.

Anti-islanding

Anti-Islanding is a procedure for preventing unintended islanding on the generator and/or external grid connection point. It is required in order to ensure that, in case of a public grid failure or generator failure, the Sunny Island reliably prevents possible reverse voltages in these power supply units.

Battery

A battery is an electrochemical storage device which can release previously stored chemical energy as electrical energy. A distinction is made between non-rechargeable primary elements (often used in consumer markets, for example) and rechargeable secondary elements (accumulators). In so-called stand-alone grid systems, the batteries used as rechargeable secondary elements are almost exclusively lead acid batteries and, very rarely, nickel/cadmium batteries.

Battery bank

See Battery system

Battery charging mode

A battery inverter operating mode, in which the inverter takes energy from the AC grid to recharge the battery in a controlled fashion. In this operating mode, the battery inverter is primarily responsible for correctly charging the battery, and acts as an independent battery charger.

Battery inverter

See Battery power converter

Battery management

The battery management is responsible for optimal battery charging and reliable protection against deep discharge. This is the only way of ensuring that the battery service life reflects the manufacturer's specifications.

Battery power converter

A bidirectional power converter which can regulate voltage and frequency in a stand-alone grid and is also responsible for correct battery charging.

Battery system

Series connection and possibly also parallel connection of several identical batteries. Battery banks of 12 V, 24 V, 48 V and 60 V are typical.

Boost charge

Allows the battery to be charged to a level of approx. 85 – 90 % as quickly and efficiently as possible.

Bulk phase

I phase: the charging phase in which charging can be performed using the maximum charging current.

Capacity

Describes the storage capacity of a cell or battery, specified in Ah (ampere hours). The capacity of a battery is heavily dependent on the charging cycle, the amount of current drawn and the temperature.

Central inverter

An inverter concept in which all PV modules are connected to each other (in series and/or parallel) and which uses a single inverter for feeding energy into the external grid. The lower cost of the inverter is usually offset by the much higher installation outlay required and possible yield losses due to variations in shadowing on individual solar modules.

Charge level

Describes the present amount of charge which can be drawn from the battery, in percent of the nominal capacity (100 % = battery full, 0 % = battery empty).

Charge mode

See Battery charging mode

Charging throughput

See Nominal charging throughput

Cluster

Several Sunny Island or Sunny Backup inverters which are connected in parallel on the DC side, and which are connected to a shared battery system. On the AC output side, these inverters can also be connected in parallel (single-phase system), or form a multi-phase system. The devices within a cluster must be connected by communication cables, and must be configured in such a manner that one device (-> master) leads the cluster, and all other devices (-> slaves) communicate with the leading device.

C rate

The nominal capacity specification is always provided along with the discharge time on which the capacity is based. The nominal capacity is the product of the constant charging current I_N and the discharge time t_N, which passes between commencement of discharging the fully charged battery and when the final discharge voltage U_S is reached. For stationary batteries, the C_{10} capacity is usually specified, i. e. a battery with C_{10} = 200 Ah can be discharged for 10 hours at a nominal current of 0.1 × C_{10} = I_{10} = 20 A.

DC

Abbreviation for "Direct Current".

Derating

A controlled reduction in performance, usually dependent on component temperatures. Compared with the (also common) practice of completely shutting down the device, the effect on the external grid is smaller with derating.

DSP

Abbreviation for Digital Signal Processor. A DSP is a microprocessor chip especially developed for digital signal processing and control.

Electrolyte

Allows the conduction of ions within a battery.

In a lead acid battery, the electrolyte is diluted sulfuric acid and is also a reactant in the electrochemical reaction.

Nickel/cadmium batteries use an alkaline electrolyte (potassium hydroxide).

EPROM

See Flash EEPROM

Equalization charge

See Equalize charge

Equalize charge

Allows different series-connected battery cells to be charged to a unified charge level of 95 – 100 %. Without regular equalization charging, the charge states of the individual cells slowly drift apart, which can lead to premature battery bank failure.

Firmware

Firmware is software which is embedded in a chip in various electronic devices, such as hard disk recorders, DVD burners and players, newer television sets, household appliances and computers - in contrast to software, which is stored on hard drives, CD-ROMs or other media. These days, firmware is usually stored in a flash memory or an EEPROM.

FLA

Flooded lead acid battery: a lead acid battery with liquid electrolyte, also often described as a closed lead acid battery.

Flash EEPROM

The abbreviation EEPROM stands for Electrically Erasable Programmable Read-Only Memory. Flash memories are digital storage devices (chips). The exact designation is "flash EEPROM". In contrast to "normal" EEPROM memories, in flash EEPROM it is not possible to delete individual bytes (the smallest addressable memory units).

EEPROM is a non-volatile, electronic memory component used (for example) in computer technology, and mainly in embedded systems.

Flash EEPROMs are used where information must be permanently stored in the smallest amount of space, e.g. for storing the firmware.

Float charge

Allows the battery to be slowly charged to a charge level of 100 % without the negative effects of overcharging. Complete charging to 100 % using float charge takes several days. For this reason, float charging is more important for grid backup systems and less important for stand-alone grids.

Full charge

Recharging of the battery to a level of approx. 95 % on a regular basis (at least once a month). This efficiently avoids premature battery aging caused by inadequate charging.

Gel battery

A type of battery in which the electrolyte (a mixture of water and sulfuric acid) is bound into a gel. This is a type of so-called closed lead acid battery. A gas mixture (hydrogen and oxygen) is always generated when lead acid batteries are charged, and in normal operation this is internally recombined to form water. This removes the need for regularly refilling the battery cells with water, which is why these batteries are often described as "low maintenance" or even "maintenance free" (see also AGM battery). Gel batteries are available from many different manufacturers for a wide range of applications. There are gel batteries for high current applications but also for cycle operation with very high cycle resistance.

Generator

An electrical generator is an electrical machine which converts kinetic energy into electrical energy. Here, not only the electrical generator itself, but also the combustion unit (diesel, petrol, or gas motor) necessary for the power unit is combined together with the electrical generator and simplified under the term “generator”. This is also described colloquially as a power generator.

Grid-connected system

PV system which is connected to the power supply grid of an external energy supplier.

Inverter

A device for converting the direct current (DC) from the PV generator into alternating current (AC), which is necessary for connection of most normal household devices and especially for feeding solar energy into an existing supply grid. Inverters for PV systems usually include at least one MPP tracker, store operating data, and monitor the grid connection of the PV system.

Inverter mode

Operating mode of a battery inverter where it supplies the stand-alone grid from the battery energy. In this operating mode, the battery inverter is especially responsible for the control of frequency and voltage in the stand-alone grid.

Islanding

Islanding is the undesired formation of a stand-alone grid system on the generator and/or external grid connection point. There is a danger that, if there is a public grid failure or generator failure, the Sunny Island may deliver reverse voltages in these power supply units.

Master

A configuration setting which assigns the leading role in a cluster to a Sunny Island or Sunny Backup inverter. This stipulates that centralized control and monitoring tasks, which in a cluster must be performed by just one device (e.g., frequency regulation, battery management, generator control, and control of the Automatic Switch Box in the Sunny Backup system) are to be performed by this device. All other inverters in the cluster must be configured so as to leave these tasks to the master, and to be led by the master (-> slave). The master is also the device at which the cluster's configuration, operation, and data recording occurs in a centralized manner.

Maximum Power Point “MPP“

The operating point (defined current/voltage curve) of a PV generator where the maximum power can be drawn. The actual MPP changes constantly depending, for example, on the level of solar radiation and the ambient temperature.

MPP tracker

Regulation of the power drawn so that a PV generator is operated for as long as possible at the MPP. This operating point varies with the solar radiation and temperature conditions of the modules. MPP tracking optimizes the extraction of electrical power and is a feature of inverters and charge

Multi-string inverter

An inverter which to a great extent combines the advantages of several string inverters (separate MPP tracking of individual strings) and a central inverter (low specific costs).

controllers.

NiCd

Nickel/cadmium battery, contains nickel, cadmium, and potassium hydroxide as the electrolyte. These batteries require a significantly higher charging voltage, have a lower level of efficiency and are significantly more expensive than lead acid batteries. However, their robustness, cycle resistance and low-temperature capabilities mean that they are used in certain special applications.

NLM

Abbreviation for "Netzleitungsmodem" (Powerline modem): communication between SMA inverters and monitoring devices is possible via a cable, a radio link, or a Powerline modem. Powerline modems use a carrier frequency of approx. 132 kHz modulated onto the AC cables, and data is transferred using FSK (Frequency Shift Keying) of this carrier signal. Details on the Powerline modem can be found (e.g.) in the technical description of the SMA-NLM.

Nominal charge throughput

The charging throughput is the cumulative total discharge current over time, measured in ampere hours (Ah). These meters are not automatically reset after charging. The nominal charging throughput is the charging throughput with regard to the nominal capacity of the batteries.

Overload capability

The overload capability of an inverter describes its ability to supply short-term (seconds or minutes) excessive loads that can be significantly higher than the nominal capacity of battery inverters. The overload capability is important to allow startup of electrical machines which have a nominal power output close to the nominal power output of the stand-alone grid inverter, since these machines typically require six times the nominal current when starting.

Parallel connection

Parallel connection of batteries (all positive poles together and all negative poles together) increases the capacity of the battery bank while keeping the voltage constant. For example, two 24 V/100 Ah batteries connected in parallel still have a voltage of 24 V, but have a capacity of 100 Ah + 100 Ah = 200 Ah.

Piggy-Back (board)

A printed circuit board which is plugged into another board to increase performance or expand capabilities. A piggy-back board can also replace an individual chip. In this case, the chip is removed and the board is plugged into the empty socket.

PLC

Abbreviation for "Power Line Communication": describes the process of data transfer over the power line. The PLC power module is used to amplify the signal and is connected in Multi-String and Sunny Mini Central inverters.

PV

Photovoltaics (PV) is the conversion of solar radiation into electrical energy using special semiconductors, so-called solar cells.

PV generator

Technical device for the conversion of solar energy into electrical energy. This term encompasses all the electrically connected (in series and in parallel) solar modules in a PV system.

PV module

See Solar module

PV system

Describes a solar power system for generating electrical power. This includes the complete collection of components needed for the acquisition and utilization of solar energy. As well as the PV generator, this also includes the Sunny Boy or Sunny Mini Central inverter, for example, in the case of grid-connected systems.

Self discharge

Capacity loss of a battery cell while it is stored or not used. A higher ambient temperature has a strong influence on self discharge.

Series connection

In this case the positive pole of each battery is connected to the negative pole of the next battery. There is only one circuit where current can flow. Series connection increases the voltage of the entire battery bank. If two 24 V batteries with a capacity of 100 Ah each are connected in series, the total voltage is 24 V + 24 V = 48 V, while the total capacity remains at 100 Ah.

Slave

A configuration setting which assigns a subordinate role in a cluster to a Sunny Island or Sunny Backup inverter. Thus, this device is relieved of control tasks and monitoring tasks, which must (or may) only be performed by one device in a cluster (-> master). Slave devices accept the configuration settings, present firmware, and start/stop commands from the master, and report these events, as well as warnings and fault indications.

SOC

State of Charge: the charge level of the battery, see Charge Level. If, for example, 25 Ah are taken from a 100-Ah battery, the charge level (SOC) is then 75 %.

SOH

State of health: describes the relationship between the present capacity and the battery's nominal value, given as a percentage.

Solar cell

An electronic component which generates electrical energy when irradiated with sunlight. Since the voltage produced by a solar cell is very small (approx. 0.5 V), several solar cells are combined to form a solar module. The most common semiconductor material presently used for solar cells is silicon, which is manufactured in different forms (monocrystalline, polycrystalline, amorphous). In addition to vastly different mechanical variations, which are usually designed to increase the level of efficiency, there are also different materials such as cadmium telluride, cadmium indium sulphide, titanium dioxide and many others.

Solar energy

"Sun energy", this means energy from sunlight or other solar radiation (heat and/or UV radiation).

Solar module

Electrical connection of several solar cells encapsulated in an enclosure to protect the sensitive cells from mechanical stress and environmental influences.

String

Describes a group of solar modules electrically connected in series. A PV system usually consists of a number of strings, which avoids excessive yield losses caused by variations in shadowing on different modules.

String inverter

An inverter concept which avoids the disadvantages of the central inverter concept. The PV generator is split into individual strings, each of which is connected to the external grid by means of its own string inverter. This greatly simplifies installation and reduces the yield losses which can be caused by manufacturing deviations or variations in shadowing on the solar modules.

VRLA

Valve regulated lead acid battery: lead acid battery with semi-solid electrolyte or closed lead acid battery. Examples of this type of battery are gel batteries and AGM batteries (Absorbent Glass Mat).

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