Off-Grid Inverter

SUNNY ISLAND 5048

Technical Description

SI5048-TB-TEN110340 | TBE-SI5048 | Version 4.0

EN

Table of Contents

1 Notes on this Manual

This manual describes the functionality, assembly, electrical connections and operation of the Sunny Island 5048. Keep this guide in a convenient place for future reference.

1.1 Validity

This manual is valid for the Sunny Island 5048 (SI 5048), firmware version 5.0 and later.

1.2 Target Group

This manual is exclusively for electrically skilled persons. The tasks described in this manual may be performed by electrically skilled persons only.

1.3 Additional Information

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

1.4 Nomenclature

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

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

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

1.5 Symbols Used

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.

2 The Sunny Island 5048

2.1 Properties

The Sunny Island 5048 is a bidirectional inverter (battery inverter and charger) for stand-alone systems. The Sunny Island supplies consumers on the stand-alone grid side and charges battery banks with the energy from grid-feeding units connected on the AC side.

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 95 %. Optimized for partial load operation, it impresses with 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.

The parallel operation of up to 3 devices on a single phase system or 3 devices on a three-phase system enables the Sunny Island to be used to set up stand-alone grid supply systems with output power of 3 kW ... 26 kW and up to 300 kW in Multicluster systems. Thanks to its sophisticated generator management, it can control connected diesel generators in a particularly gentle and fuel-saving manner. The power distribution grid can also be integrated. The Sunny Island can also deactivate loads automatically if the battery does not provide sufficient electrical energy.

The stand-alone grid's critical component, the battery, is monitored diligently and optimally utilized. The intelligent battery management precisely records the battery's state of charge. This makes possible an improved utilization of the battery capacity, 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. Thanks to these functions, the battery life can be greatly extended in comparison with simpler devices.

Despite its complex functioning, the Sunny Island is easy to 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 adopt the configuration automatically. The easy-to-understand menu navigation allows quick access to all important data, even while the system is running. An SD card provides uncomplicated system control, and thus facilitates any service work.

Saving Data and Events

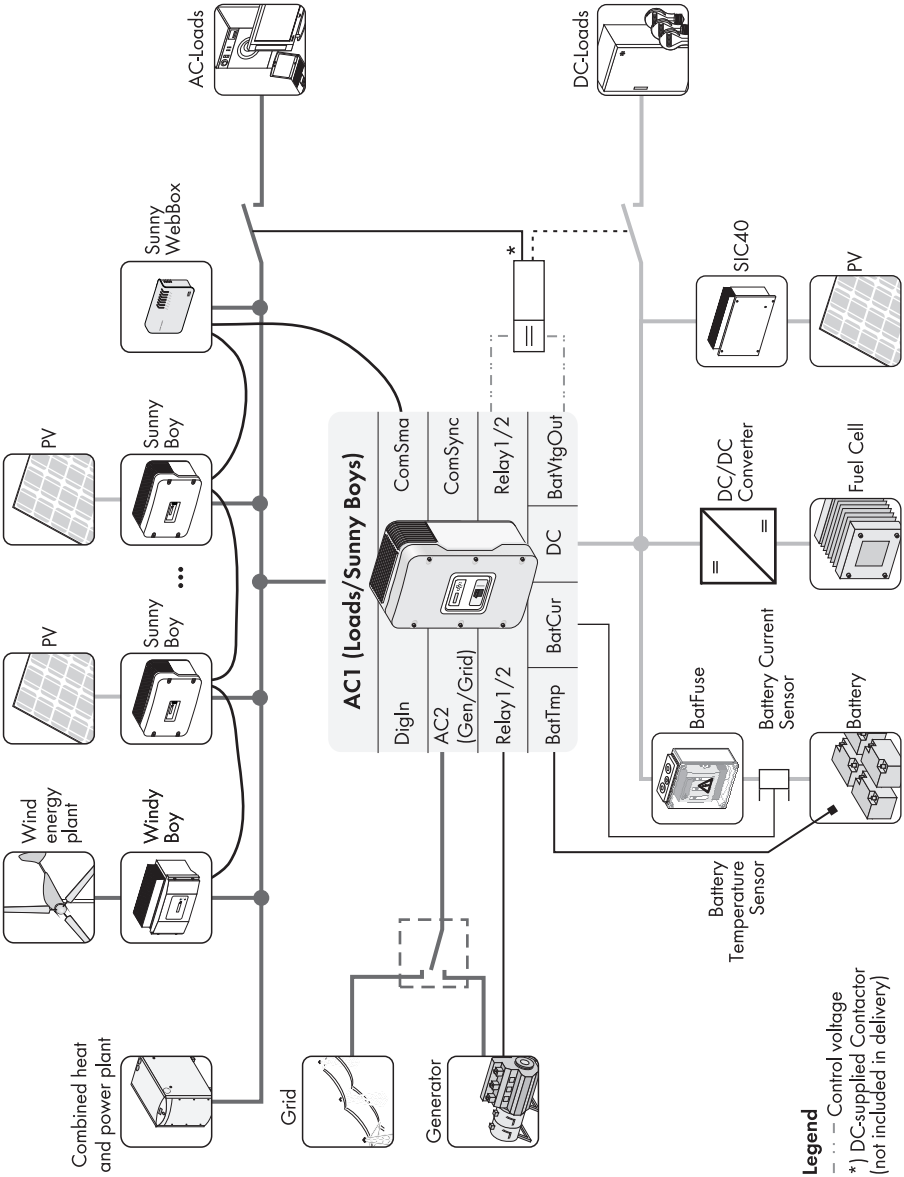
Always use the SD card to save data and events. This way, in case of a failure, SMA Solar Technology can help you quickly.

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 with virtually no interruption and changes to stand-alone grid operation. The Sunny Island 5048 also has an integrated anti-islanding feature. This is a protective procedure for preventing unintended islanding on the generator and/or external power supply line point.

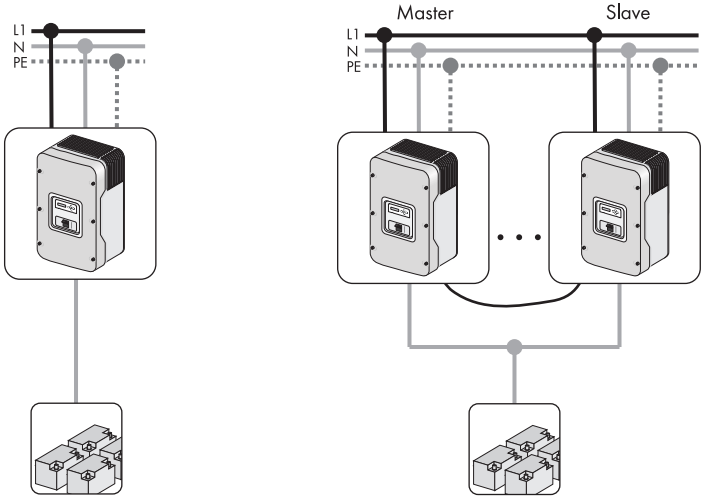
The anti-islanding procedure is required in order to ensure that, in case of a power distribution grid failure or generator failure, the Sunny Island reliably prevents possible reverse voltages in these power supply units. In case of a power distribution grid failure, Sunny Island disconnects from the grid and continues supplying the the loads.

The Sunny Island can be integrated into different system constellations. The following graphics show the Sunny Island's system components and the different wiring options (single-phase / single-phase parallel and three-phase).

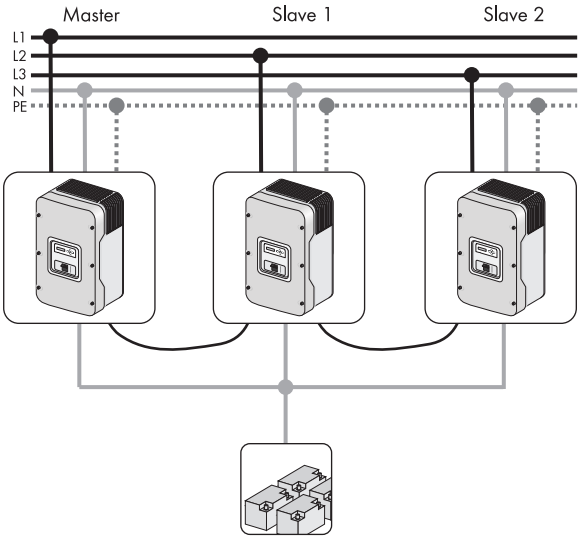
Components of a Sunny Island System



Single-phase and single-phase parallel system:



Three-phase system (cluster):

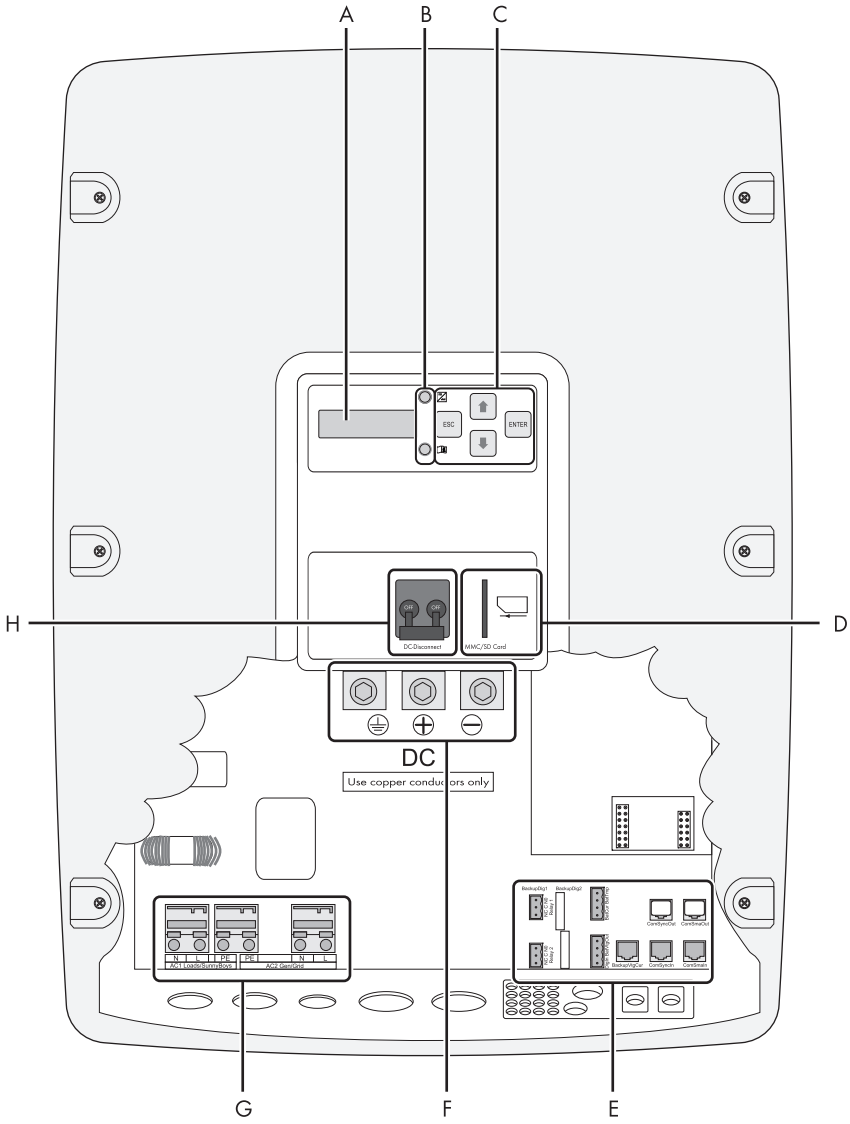


SMA Multicluster technology

Refer to the manual of the Multicluster Box for information about SMA Multicluster Technology.

2.2 At a glance

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

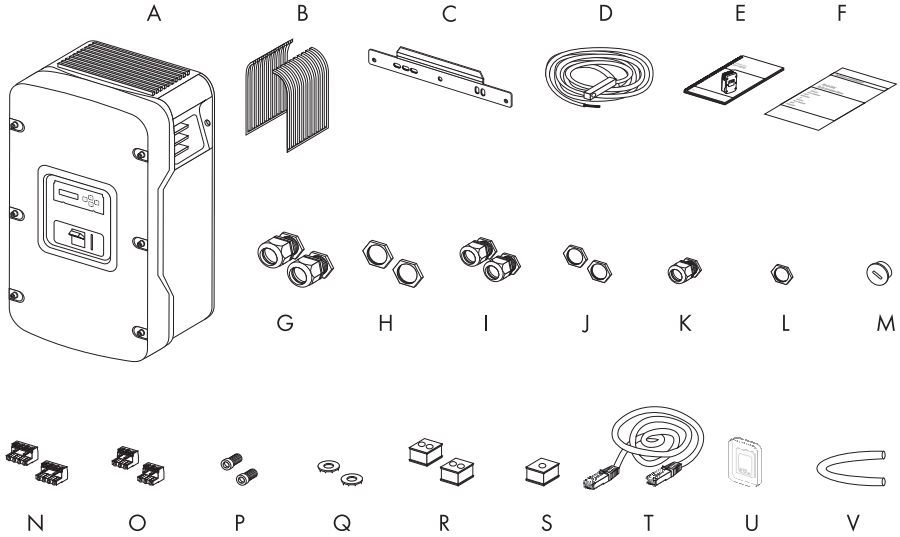


Position	Description
A	Display
B	LEDs showing device operation
C	Control buttons
D	Slot for the SD card
E	Connection area for additional connections
F	DC connection area
G	AC connection area
H	DC circuit breaker

2.3 Scope of delivery

Check that the delivery is complete. Check the packaging and the Sunny Island for externally visible damage.

Contact your supplier in case of damage to the packaging. Please contact your dealer if you find any damage to the Sunny Island or if the delivery is incomplete.



Position	Quantity	Description
A	1	Sunny Island
B	2	Ventilation grid
C	1	Wall mounting bracket
D	1	Battery temperature sensor
E	1	Technical description
F	1	Document set
G	2	M32 cable gland
H	2	Counter nut for M32 cable gland
I	2	M25 cable gland
J	2	Counter nut for M25 cable gland
K	2	M20 cable gland
L	2	Counter nut for M20 cable gland
M	1	Filler plug
N	2	4-pole print terminal for connecting the battery temperature and current sensors

Position	Quantity	Description
O	2	3-pole print terminal for connecting relays 1 and 2
P	2	M6x10 mm hexagon socket screw to attach the Sunny Island to the wall mounting bracket
Q	2	M6 contact washers to attach the Sunny Island to the wall mounting bracket
R	2	Rubber plugs for feed-through of 2 cables
S	1	Rubber plugs for feed-through of one cable
T	1	RJ45 Cable
U	1	SD Card
V	1	Silicone tube

2.4 Identifying the Sunny Island

Identify the Sunny Island by the serial number (Serial No.) and the device type (Type) on the type plate. The type plate is on the right side of the enclosure.

3 Safety Instructions

3.1 Important Notes Regarding Operation

Follow all operating and safety precautions in this manual. If these instructions are ignored, a significant danger of injury or death arises and damage to the device, system or plant may also result. Carefully read the safety instructions before installing and commissioning the device. Store the manual at an easily accessible location.

DANGER!

Electric shock due to high voltage in the Sunny Island. Death or serious injuries.

- All work on the Sunny Island must only be carried out by electrically skilled persons.
- Work on the Sunny Island should only be carried out as described in this manual.
- All listed safety instructions must be observed.

NOTICE!

Destruction of the Sunny Island due to parallel connection of different types of tension.

- Always makes sure to use the same type of Sunny Islands in one system.
- Never operate with different voltage types in parallel.

Connection requirements

Be sure to observe all applicable regional standards and guidelines.

Internal consumption

The internal consumption of the Sunny Island discharges the battery. In standby mode, this load is about 4 W and about 25 W in idle mode. Observe this when you install the Sunny Island, but do not use it immediately or do not use it for an extended period of time within the year.

It may be necessary to set the Sunny Island to Stop mode (see section 9.3 "Switching Off" (page 64)) and disconnect it from the battery by means of the DC circuit breaker.

Installation altitude

The Sunny Island has been designed for use at elevations of up to 3000 m above sea level. Please contact SMA Solar Technology before using the device at elevations above 3000 m.

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

3.2 Potential Hazards

DANGER!

Electric shock upon contact due to high voltage and currents in the Sunny Island. Death or serious injuries.

Complete protection against accidental contact by hand is only ensured when the following points are followed according to the manual:

- The Sunny Island is mounted correctly.
- The Sunny Island is properly grounded.
- All connections are made correctly.
- The lid is securely closed.

DANGER!

Electric shock due to high voltage in the stand-alone grid. Death or serious injuries.

The Sunny Island can start on its own.

- Before working on the stand-alone grid, disconnect all sources of AC and DC power.

DANGER!

Death hazard if the Sunny Island is used to supply energy to life-sustaining medical devices.

The Sunny Island was not developed to power life-sustaining medical devices.

- Never use the Sunny Island in systems in which a power outage might result in personal injury.

NOTICE!

Destruction of the device due to incorrect installation.

The Sunny Island's degree of protection is IP30 (IP40 with an inserted SD card) and is therefore only suited for installation in enclosed spaces.

- Never expose the Sunny Island to humidity, rain or direct sunlight.

4 Mounting

4.1 Selecting the Mounting Location

DANGER!

Danger of death if installed in improper locations. Death or serious burns.

Despite careful construction, electrical devices can cause fires.

- Do not mount the Sunny Island on flammable construction materials.
- Do not mount the Sunny Island near highly flammable materials.
- Do not mount the Sunny Island in potentially explosive areas.

CAUTION!

Risk of burns through contact with hot enclosure parts during operation. Burns to the body.

- Mount the inverter in such a way that the enclosure cannot be touched inadvertently.

CAUTION!

Risk of injury due to the Sunny Island falling during transport. Physical injury (fractures or crushing) and damage to the Sunny Island.

- Take the Sunny Island's weight of 63 kg into account.

Overheating of the Sunny Island due to close proximity to other Sunny Island inverters in areas with high ambient temperatures.

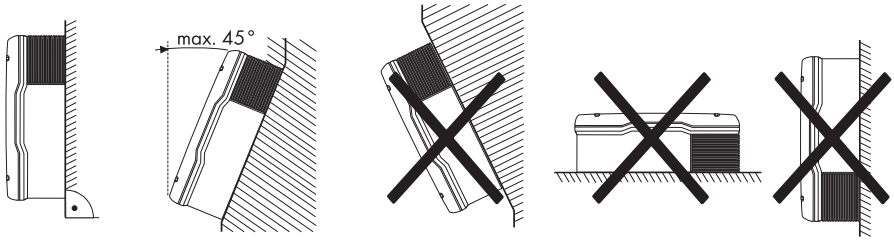
If several inverters have been installed in areas with high ambient temperatures, the independent cooling of individual inverters needs to be guaranteed.

If needed, increase the distance between the individual inverters and provide enough fresh air to ensure the optimal operation of the inverters.

Observe the following conditions during mounting:

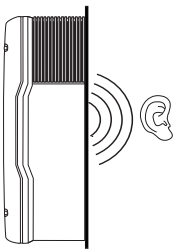
- The mounting location and method must be suitable for the Sunny Island's weight and dimensions.
- Mount on a solid surface.
- The mounting location must be accessible at all times.
- The ambient temperature must be between –25 °C and +50 °C.
- Do not expose the Sunny Island to direct sunlight, so as to avoid power reduction due to excessive heating.
- Install at eye level in order to allow operation conditions to be read at all times.
- Mount vertically or tilted backward by max. 45°.
- Never mount the device with a forward tilt.

- Do not mount in a horizontal position.
- The connection area may not point upwards.

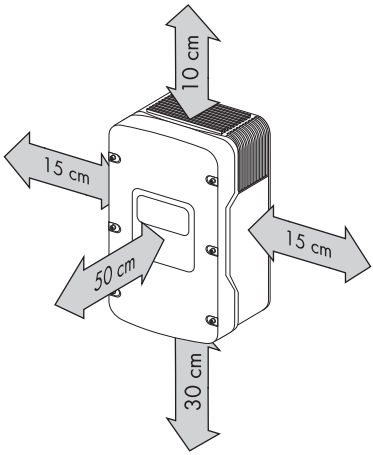


- In a living area, do not mount the unit on plasterboard walls, etc. in order to avoid audible vibrations.

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



- Observe minimum clearances to the wall as well as to other devices and objects as shown in the illustration.



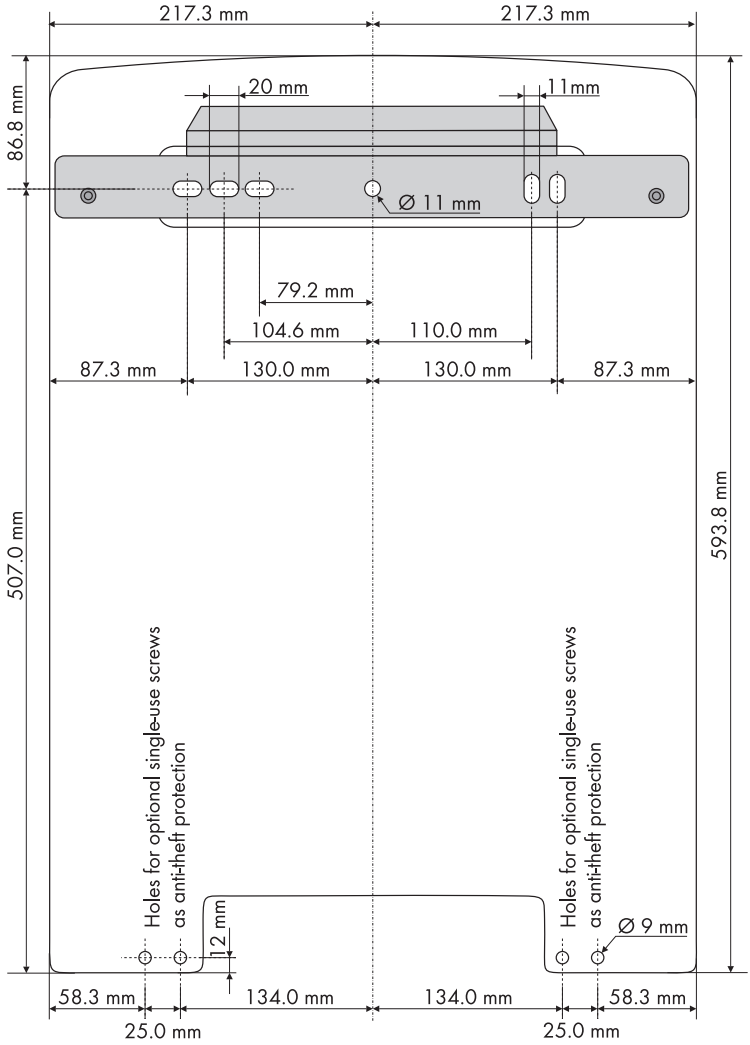
4.2 Mounting the Sunny Island with the Wall Mounting Bracket

CAUTION!

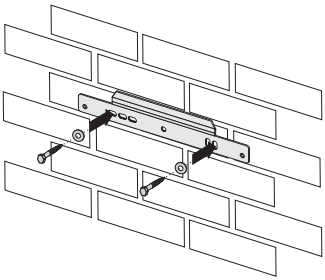
Risk of injury due to the Sunny Island falling during transport. Physical injury (fractures or crushing) and damage to the Sunny Island.

- Take the Sunny Island's weight of 63 kg into account.

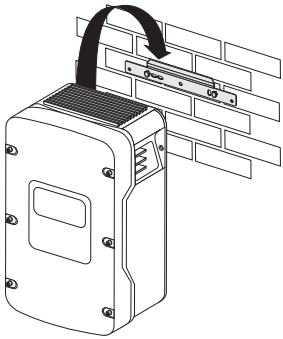
1. Mark the position of the drill holes using the wall mounting bracket and drill the holes. Use at least 1 hole on the left and right-hand side in the wall mounting bracket.



2. Secure the wall mounting bracket to the wall using appropriate screws and washers.

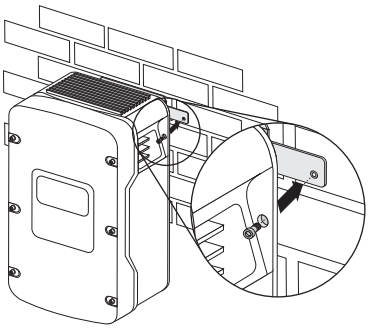


3. Hang the Sunny Island onto the wall mounting bracket using the opening for this purpose in its back panel.

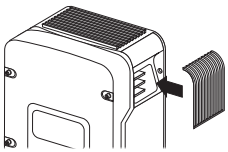


4. Screw the Sunny Island to the wall mounting bracket on both sides using the screws (M6x8) provided. Only tighten the screws by hand.

   ☑ The Sunny Island is now mounted on the wall.



5. Make sure that the device is securely in place.
6. Close the recessed grips with the fan grills provided. To help you identify the sides, the ventilation grids are marked with "links/left" or "rechts/right" on the inside.

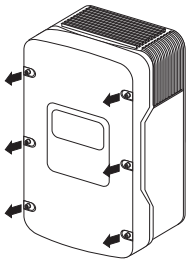


5 Opening and Closing

The enclosure of the Sunny Island has a removable lid. Remove the enclosure lid only when installing the device or for required maintenance or repair work.

5.1 Opening the Sunny Island

1. Stop the Sunny Island as described in section 9.2 "Stopping the Sunny Island (Standby)" (page 63).
2. Disconnect the Sunny Island from voltage sources as described in section 9.4 "Disconnecting the Device from Voltage Sources" (page 64).
3. Ensure that the system cannot be accidentally switched on again.
4. Loosen all 6 screws on the enclosure lid and set them aside.



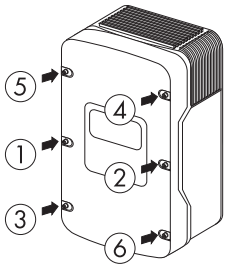
5. Remove the lid and set it aside.

☑ The Sunny Island is open.

5.2 Closing the Sunny Island

1. Place the lid onto the enclosure and fasten it with the 6 screws and the corresponding washers.

   Tighten the screws with 6 Nm torque in the order shown in the figure on the right. The toothing of the washers must face toward the lid.



DANGER!

Electric shock due to live lid. Death or serious burns.

The grounding of the lid is ensured by the toothed washers.

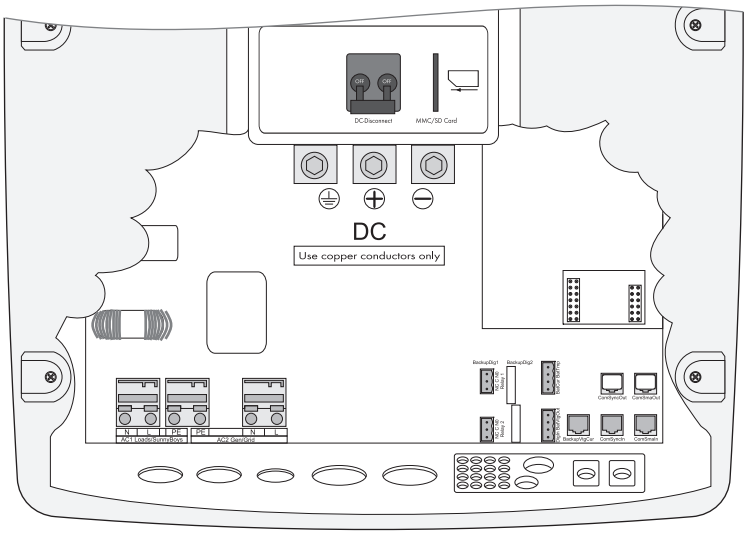
- Fasten the washers for all six screws with the toothing facing toward the lid.

2. Commission the Sunny Island as described in section 9.1 "Switching On" (page 62).

☑ The Sunny Island is closed and in operation.

6 Electrical Connection

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



Use the provided cable glands to fasten the cables inside the Sunny Island enclosure in a manner conforming to the appropriate standards. The metric thread cable glands 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.

Obtain an overview of the different components and connection areas of the Sunny Island, see section 2.2 "At a glance" (page 18).

6.1 Grounding

Before commissioning the Sunny Island, it must be externally grounded according to the relevant regulations. To allow different types of grounding, the N connection of the Sunny Island is **not** connected to PE at the factory. However, since a connection between N and PE is required for correct operation, this must be done outside of the device.

Due to filter measures in the Sunny Island, increased leakage currents to PE can always occur. For this reason, a "fixed terminal" of grounding must be implemented according to EN 50178. Ground the Sunny Island with a copper conductor (at least 10 mm² cross-section), or with two separate copper conductors with a cross-section of at least 4 mm² each.

External grounding

External grounding of the positive or negative pole of the batteries (positive or negative grounding) is generally 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.

Calculating the Required Grounding Cable Cross-section

SMA Solar Technology cannot provide 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 cable.

Determining the Cross-section

Exact calculation of the grounding conductor cross-section must take account of the regionally applicable standards and guidelines.

The required cross-section of a (copper) grounding conductor can be calculated using the following formula. Tripping times for short-circuit currents of between 2,000 A and 10,000 A are typically about 25 ms.

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

t = Interruption time in seconds

I_{SC} = Maximum battery current (short-circuit current) in amperes

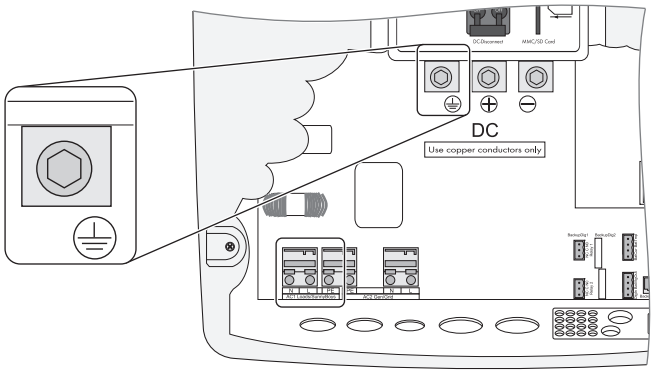
S = Conductor cross-section in mm^2

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

The DC grounding conductors must be connected to the connection labeled "Ground". The grounding conductor is installed in five steps:

1. Loosen the cable gland on the Sunny Island.
2. Thread the grounding conductor through the cable gland.
3. Remove the protective insulation from the conductor and fit a suitable ring terminal lug to the exposed end of the conductor.

4. Install the cable gland with the adapter M20 (included in scope of delivery) in the cable third cable feed-through on the right.
   - Insert the cable gland with the thread in the cable opening.
   - Screw the counter nut onto the cable gland thread on the inside of the enclosure and tighten.
5. Insert the conductor with the ring terminal lug into the ground connection terminal and tighten the screw firmly with a torque of 4.0 Nm to 5.7 Nm.



6.2 DC connection

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 installed on the DC side of a Sunny Island with cables exceeding 30 meters and with a flexible connection.

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

6.2.1 Safety Precautions/Conditions

Connect a suitable battery to the DC side (see section 22 "Technical Data" (page 217)). DC must be connected observing all local valid guidelines and regulations.

DANGER!

Death hazard due to inappropriate handling of the battery. Death or serious chemical burns.

- All safety and maintenance instructions provided by the battery manufacturer must be observed.
- Use special (insulated) tools to mount and install the battery.

6.2.2 Cable Sizing

Be sure to observe all standards applicable to the installation site for sizing the cable.
DIN VDE 0298-4 applies in Germany.

Size the battery cables as short as possible. Long cables and insufficient cable diameters reduce system efficiency and overload capabilities.

Example for Cable Sizing

At an AC output of 5000 W and a battery voltage of 48 V, a current of up to 140 A flows through the battery cable.

The current flowing through the battery cable causes a power loss and a drop in voltage with every meter of plain battery cable. You can use the following table to find the power loss and voltage drop associated with different cable cross-sections.

Cable cross-section	Power loss	Voltage drop
35 mm^2	12 W/m	90 mV
50 mm^2	8.5 W/m	60 mV
70 mm^2	6 W/m	45 mV

This means that:

For a 10-meter distance between the Sunny Island and the battery, at least 20 m of cable are needed. Using a cross section of 50 mm^2, 140 A (current flowing through the battery cable) cause a power loss of 170 W in total and an effective voltage drop of 1.2 V.

6.2.3 Cable Protection

In addition to the internal DC circuit breaker, install a separate, external fuse as close as possible to the battery. Install a suitable fuse link for the fuse according to the maximum specified DC currents (e.g. NH1 with 250 A).

DANGER!

Risk of lethal electric shock. Death or serious burns.

If no external cable protection is available, observe the following:

- Lay the DC cables so that they are ground-fault and short-circuit-proof.
- If there are short-circuit currents of over 10000 A, use an additional thermal fuse.

6.2.4 Connection

DANGER!

Danger to life due to high voltages. Death or serious burns.

- Connect the external fuse and the battery cable to the battery only after all installation work has been completed.

There is a "DC –" and a "DC +" terminal provided for each tube terminal lug (max. 70 mm^2) for the battery feed cables in the Sunny Island.

Install the DC Terminals in the Following Sequence:

1. Loosen the cable gland on the Sunny Island.
2. Thread the DC cable through the cable gland.
3. Remove the protective insulation from the conductor and fit a suitable ring terminal lug to the exposed end of the conductor.
4. Install the M32 cable gland (included in delivery) for "DC –" and "DC +" in the cable feed-throughs.
   - Insert the cable gland with the thread in the cable opening.
   - Screw the counter nut onto the cable gland thread on the inside of the enclosure and tighten.

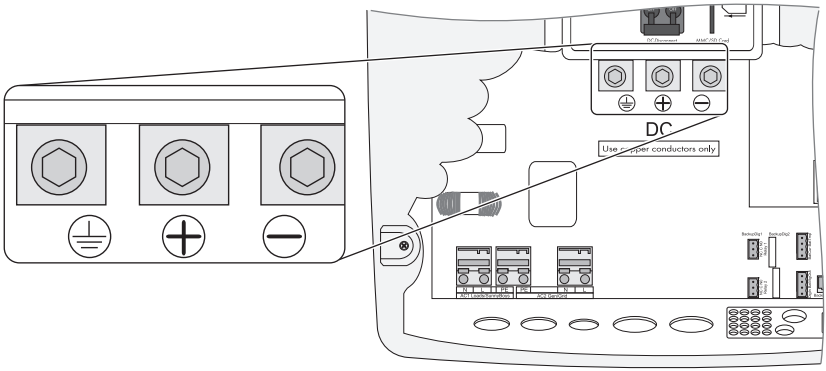
DC connection area

The positions between the ring terminal lug and connection area must be clean. This way a transition resistance and the heating of the terminals is reduced.

5. Insert the "DC–" conductor with the ring terminal lug into the "DC – " terminal and tighten the screw firmly with a torque of 4 Nm to 5.7 Nm.
6. Insert the "DC+" conductor with the ring terminal lug into the "DC+" terminal and tighten the screw firmly with a torque of 4.0 Nm to 5.7 Nm.

DC cables

Do not connect any other components to the DC cables. Other components must be connected directly to the battery via a separate distribution board.



6.3 AC Connection

6.3.1 Cable Protection

Connect the Sunny Island to the stand-alone grid and to any other existing external source using a distribution sub-panel.

Provide the distribution sub-panel with appropriate line circuit breakers, and observe all regional standards and guidelines.

NOTICE!

Destruction of the Sunny Island due to overcurrent at the AC input.

- Do not exceed the maximum input current of 56 A.

The Sunny Island is not equipped with an all-pole isolator. The neutral conductor (N conductor) is looped through the device and the N terminals of AC1 and AC2 are connected inside the Sunny Island.

6.3.2 AC1 (Loads/Sunny Boys)

The stand-alone grid distribution sub-panel (e.g. loads, PV inverters, wind power inverters) is connected to the AC1 output of the Sunny Island.

If you wish to provide separate protection for an individual load circuit, then use a maximum 16 A circuit breaker with B-type tripping characteristics. In the event of a short circuit, the Sunny Island can trip this circuit breaker. If larger fuses are used, or fuses that blow more slowly, the Sunny Island cannot trip them. In these cases, be sure to install a residual current device (RCD) in order to avoid dangerous touch currents.

Connection in a single-phase parallel system

Connect all single-phase parallel Sunny Islands with the same cross-sections and cable lengths. Connect all AC inputs in parallel.

Connection in a Three-phase Parallel System

Always install the master on phase L1, slave 1 on L2 and slave 2 on L3. This installation has a right-hand rotary field.

Failure of a Phase within a Three-phase System

If in a 3-phase system a phase fails on the master, the cluster stops. If a phase fails on a slave, the cluster can either continue to operate or switch off. You may require a phase monitor or a motor circuit breaker to protect your loads.

Distributing loads and AC feed-ins in multiple-phase systems

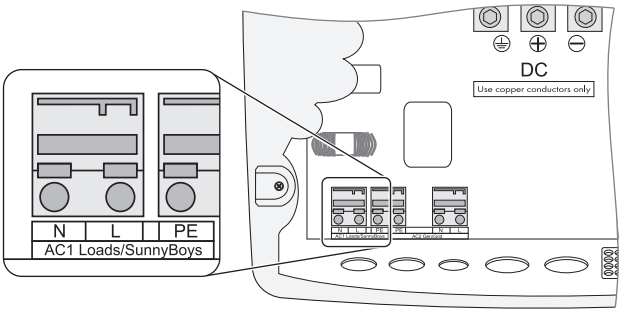
Distribute the power of the feeding and loads as well as the AC feed-in generators as equally as possible on all system phases.

For connection, proceed as follows:

Cable cross-section

The maximum cable cross-section for connecting the loads / PV inverters is 16 mm^2.

1. Sheathe the cable gland over the three-conductor cable and then insert the conductor through the cable opening into the Sunny Island.
2. Install the M25 cable gland (included in scope of delivery) in the "AC1 Loads/Sunny Boys" cable opening.
   - Insert the cable gland with the thread in the cable opening.
   - Screw the counter nut onto the cable gland thread on the inside of the enclosure and tighten.
3. Remove the protective insulation from each of the three conductors.
4. Connect PE to the "AC1 Loads/Sunny Boys" according to the label.
5. Connect N and L to the "AC1 Loads/Sunny Boys" according to the label.



6.3.3 AC2 (Generator/Grid)

The distribution sub-panel of the generator/power distribution grid is connected to the AC2 output of the Sunny Island.

Single-phase parallel system

In the case of single-phase parallel systems, also connect the generator or the grid to all slaves on AC2. The AC cables between all Sunny Island and the generator/grid in a system must have the same size and length.

Distributing loads and AC feed-in generators in multiple-phase systems

Distribute the power of the feeding and loads as well as the AC feed-in generators as equally as possible on all system phases.

Three-phase system

Always install the master on phase L1, slave 1 on L2 and slave 2 on L3. This installation has a right-hand rotary field. The AC cables between all Sunny Island and the generator/grid in a system must have the same size and length.

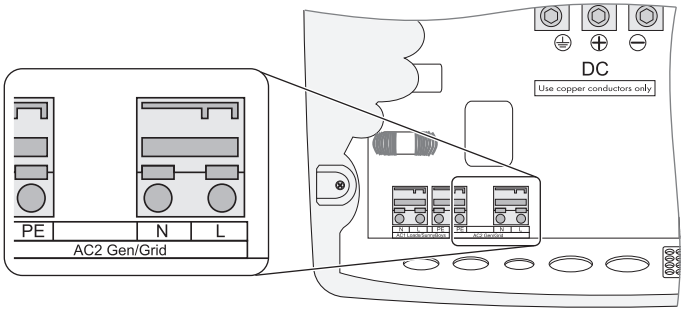
The system does not monitor additional fuses. Check any additional fuses regularly!

For connection, proceed as follows:

Cable cross-section

The maximum cable cross-section for connecting the generator is 16 mm^2.

1. Sheathe the cable gland over the three-conductor cable and then insert the conductor through the cable opening into the Sunny Island.
2. Install the M25 cable gland (included in scope of delivery) in the "AC2 Gen/Grid" cable feed-through.
   - Insert the cable gland with the thread in the cable opening.
   - Screw the counter nut onto the cable gland thread on the inside of the enclosure and tighten.
3. Remove the protective insulation from each of the three conductors.
4. Connect PE to the "AC2 Gen/Grid" according to the label.
5. Connect N and L to the "AC2 Gen/Grid" according to the label.



6.4 Additional Connections

For installing the connections described below, feed the cables through the specified holes in the rubber connection block. Plags for sealing the RJ45 communication cable for internal and external communication are provided in the cable insert upon delivery. Combining plugs allows you to establish 0 to 4 feed-throughs (2 plugs without a feed-through, 1 with 1 feed-through and 2 with 2 feed-throughs). Remove any of these to connect the communication cable.

6.4.1 Battery Temperature Sensor

A battery temperature sensor must be connected for operating the Sunny Island (included in the scope of delivery). In case of a fault (short circuit, cable break), the Sunny Island operates in a safe setting, which over time leads to insufficient battery charging. A warning indicating that the defective battery temperature sensor should be replaced immediately is displayed.

The KTY type battery temperature sensor with a 10 m connection cable 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 13.4 "Charge Control" (page 99).

NOTICE!

Destruction of the battery and battery temperature sensor.

- Only use the battery temperature sensor included in the scope of delivery.
- Fasten the battery temperature sensor to the outside of one of the battery cells. Choose a place where the heat generation during operation is the greatest.

Battery Temperature Sensor in a Cluster

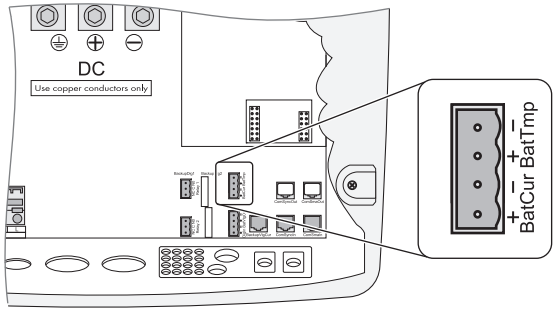
A battery temperature sensor is provided with each Sunny Island. Only one battery temperature sensor is required for a cluster. It is connected to the corresponding master.

For connection, proceed as follows:

Polarity of the conductors

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

1. Pierce a hole in the rubber connection area at the corresponding position.
2. Starting from the outside, lead the insulated conductors with bootlace ferrules through the hole in the Sunny Island.
3. Connect the insulated conductors correspondingly to the "BatTmp" terminal of the 4-pole print terminal included in the delivery.
4. Tighten the terminals.
5. Insert the 4-pole print terminal into the "BatTmp" socket on the Sunny Island.



6. Fasten the battery temperature sensor to the outside of one of the battery cells. Choose a position between two cells or as close as possible to such a position. The position should be in the middle area of the battery bank, since the heat generation during operation is the greatest here.

6.4.2 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 off-grid system. Only one battery current sensor connected to the respective master is required for a cluster.

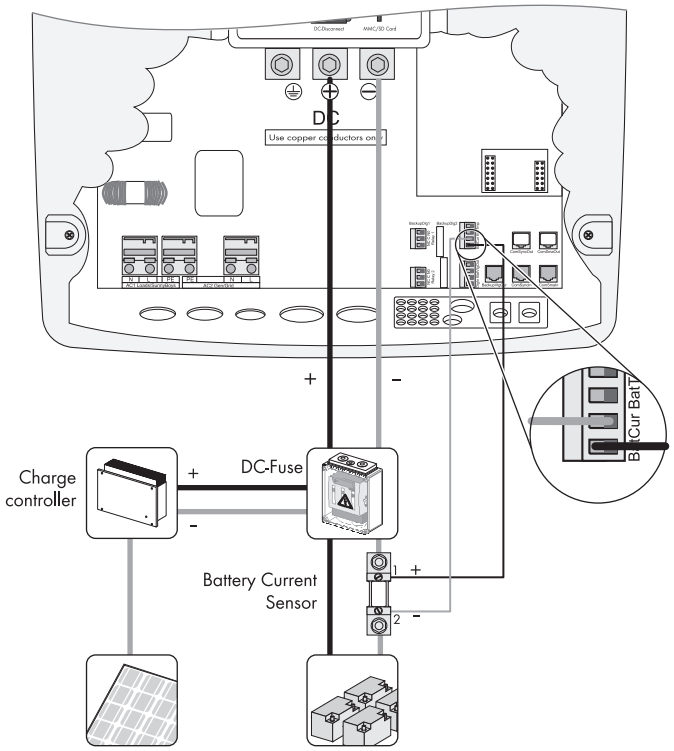
NOTICE!

Connecting additional DC generators or DC loads in the off-grid system damages the battery.

In this operating case, the Sunny Island does not measure internal power accurately and the battery's charge state is not precisely determined.

- Install an external battery current sensor (shunt).

Example:



Connecting the Battery Current Sensor:

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.

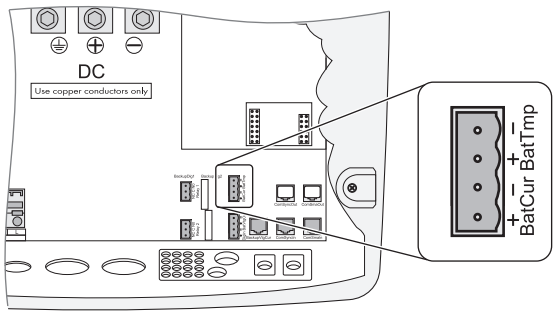
Installation notice

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).

- 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)

1. Pierce a hole in the rubber connection area at the corresponding position.
2. Starting from the outside, lead the insulated conductors with bootlace ferrules through the hole in the Sunny Island.
3. Connect the cables correspondingly to the "BatCur" connection of the 4-pole print terminal included in the delivery.
4. Tighten the terminals.
5. Insert the 4-pole print terminal into the "BatCur" socket on the Sunny Island.

☑ The battery current sensor is installed.



Commissioning the battery current sensor

When connecting a battery current sensor to the Sunny Island, the device's internal offset must be adjusted during the first commissioning of the off-grid system. To do this, proceed as described in section 8.3 "Commissioning the Battery Current Sensor" (page 60).

6.4.3 Communication for Multi-device Connection

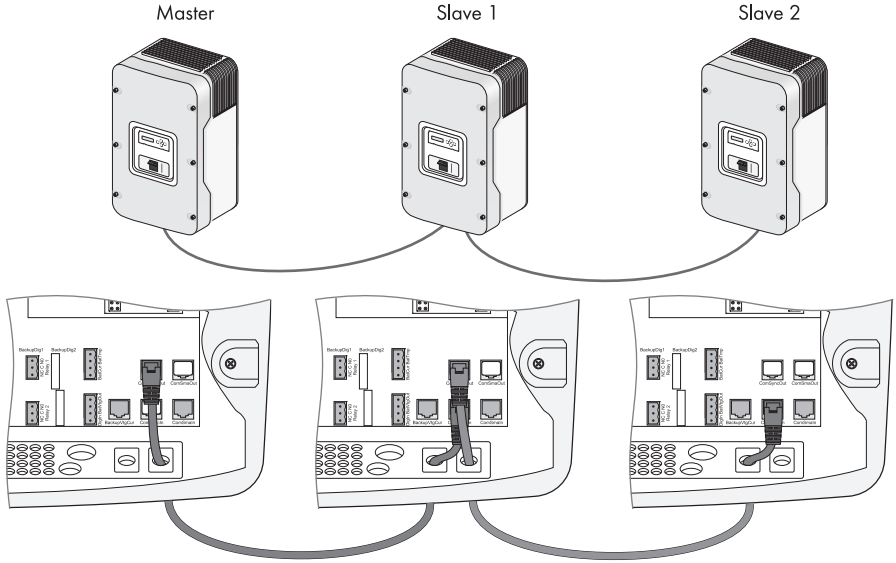
The Sunny Island can be connected in parallel or in a three-phase system with other Sunny Island in order to increase the overall power. The Sunny Island inverters communicate with each other via an RJ45 communication cable. A black RJ45 cable is provided with each Sunny Island. You need it in order to establish an (internal) communication between several Sunny Island inverters. The communication bus's maximum total length may **not** exceed 30 m. If you operate only one Sunny Island in your system, the cable is not required.

Proceed as follows to implement the connection:

1. Remove one of the two plugs in the rubber connection area.
2. Lead the RJ45 cable from the outside through the plugs inside the Sunny Island master.
3. Remove the termination resistor plugged into the master's "ComSyncOut" socket and insert it in the master's "ComSyncIn" socket.
4. Plug the RJ45 cable into the "ComSyncOut" socket.
5. Connect the Sunny Island master to the slave:

Number of slaves	Connection procedure
1 Slave	• Take the RJ45 cable coming from the master, insert it into the Sunny Island slave and plug it into the "ComSyncIn" socket. • Leave the termination resistor plugged into the "ComSyncOut" socket. ☑ The Sunny Island master and Sunny Island slave are connected.

Number of slaves	Connection procedure
2 Slaves	• Take the RJ45 cable coming from the master, insert it into the Sunny Island slave 1 and plug it into the "ComSyncIn" socket there. • Remove the terminating resistor in the Sunny Island slave 1 from the "ComSyncOut" socket. • Plug the RJ45 cable, which is included in the delivery, into the "ComSyncOut" socket of slave 1. • Take the RJ45 cable coming from slave 1, insert it into the Sunny Island slave 2 and plug it into the "ComSyncIn" socket there. ☑ The Sunny Island master and slaves are connected.



6.4.4 Multi-function Relay 1 and 2

The Sunny Island offers you several options for the control of internal and external processes. For this purpose, two multi-function relays are integrated into the Sunny Island to which you can assign functions using the "241.01 Rly1Op" and "241.02 Rly2Op" parameters (see section 15 "Relays" (page 130)).

We recommend connecting the load shedding and generator request functions to the master, since, if a failure occurs, the slave may be waiting for a confirmation, but the master continues to operate and the device can at least operate in a limited capacity.

Generator request function during Multicluster operation

The generator request function during Multicluster operation only functions on the main cluster.

Operating principles of the relays

The relays are changeover contacts; they can be used as break contact (NCC) or as make contact (NOC).

You can only assign one function to each relay!

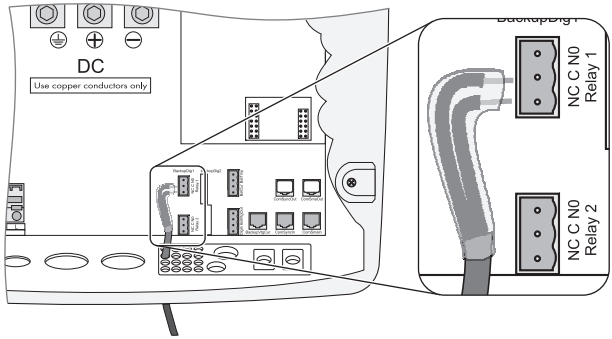
For connection to the relay contact, proceed as follows:

DANGER!

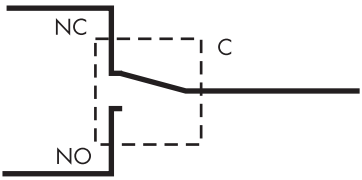
Danger to life due to faulty insulation Death or serious injuries.

- Securely disconnect the relay cable from the communication area and the AC area.
- Strip the insulated conductors of the relay cable.
- Sheathe all relay cables installed using the silicone tube provided.
- Do not operate the device without the silicone tube.

1. Pierce a hole in the rubber connection area at the corresponding position.
2. Starting from the outside, lead the insulated conductors with bootlace ferrules through the hole in the Sunny Island.
3. Cut an appropriate piece from the silicone tube (included in scope of delivery) and pull it over the insulated conductors.



4. Connect the corresponding insulated conductors to the 3-pole print terminals included in the delivery. The pins have the following meaning:
   - NC: Normally closed (closed when idle)
   - C: Contact (operating contact)
   - NO: Normally opened (open when idle)



5. Tighten the terminals.
6. Insert the 3-pole print terminal into the corresponding socket on the Sunny Island.

Power Contactor for Load Shedding

The Sunny Island can automatically disconnect 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 12.1 "Load Shedding" (page 92)).

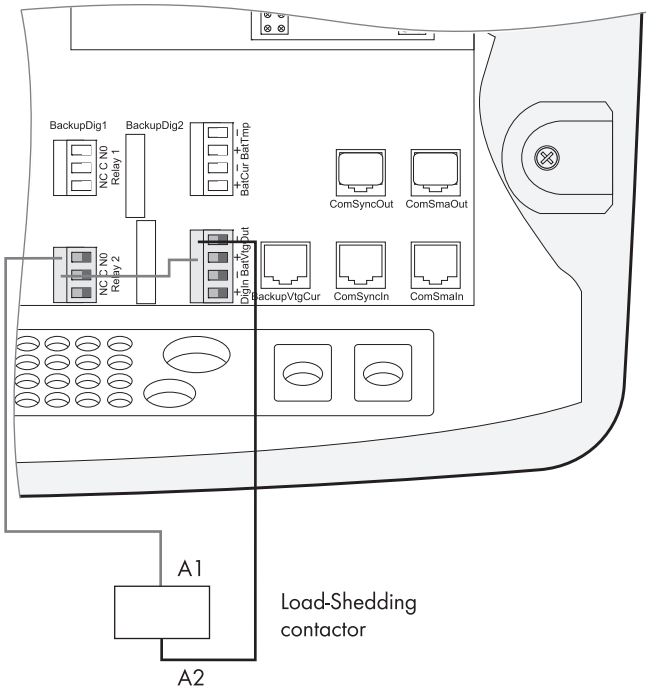
Installing the power supply of a DC power contactor for load shedding (e.g. Relay2):

Power supply of the DC power contactor

A 48 V 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 terminal C (Relay2) to the terminal "BatVtgOut +".
3. Wire the A2 coil connector of the power contactor to the terminal "BatVtgOut –".

☑ The control circuit of the power contactor is installed.



Generator start

The Sunny Island can control generators. The Sunny Island directly supports generators that can be started and 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 from SMA Solar Technology.

Default setting of the relays

Relay 1 is preset to the "AutoGn" generator start function and relay 2 to the "AutoLodSoc" load shedding function.

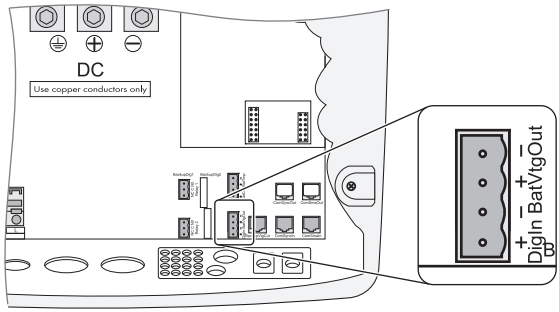
6.4.5 BatVtgOut Power Supply

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). Depending on the internal temperature of the Sunny Island, the tripping threshold is higher than 0.6 A.

This connection can be used, for example, to supply a DC contactor for load shedding.

For connection, proceed as follows:

1. Pierce a hole in the rubber connection area at the corresponding position.
2. Starting from the outside, lead the insulated conductors with bootlace ferrules through the hole in the Sunny Island.
3. Connect the wires correspondingly to the "BatVtgOut" terminal of the 4-pole print terminal included in the delivery.
4. Tighten the terminals.
5. Insert the 4-pole print terminal into the "BatVtgOut" socket on the Sunny Island.



6.4.6 DigIn Digital Input

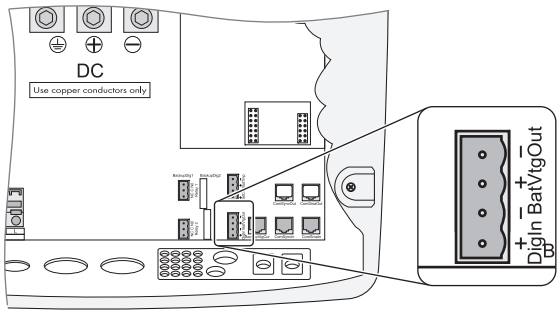
These terminals are used as a digital input for external electrical sources. For example, the feedback contact for the "GenRn" for the generator manager (GenMan) is connected here.

Related Functions

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

For connection, proceed as follows:

1. Pierce a hole in the rubber connection area at the corresponding position.
2. Starting from the outside, lead the insulated conductors with bootlace ferrules through the hole in the Sunny Island.
3. Connect the cables correspondingly to the "DigIn" terminal of the 4-pole print terminal included in the delivery.
4. Tighten the terminals.
5. Insert the 4-pole print terminal into the "DigIn" socket on the Sunny Island.



Further Information

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

6.5 Interface for External Communication

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

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

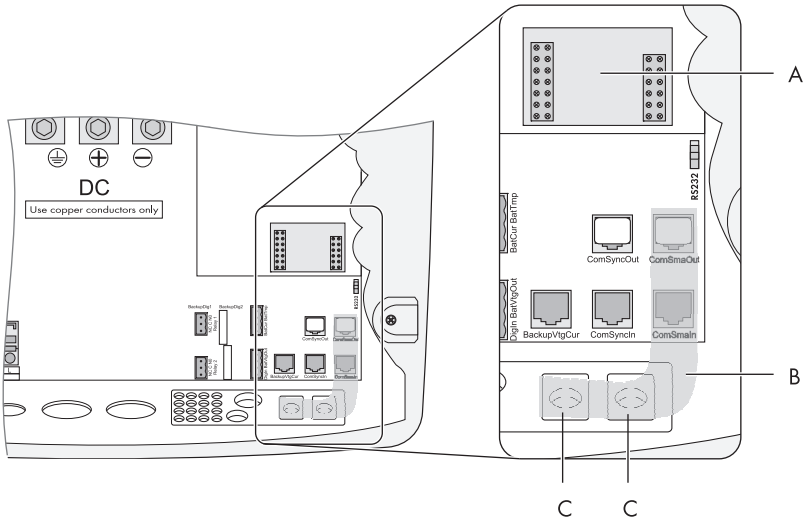
Powerline / Powerline modem (NLM)

Communication via Powerline/Powerline modem (NLM) is not possible in off-grid systems.

Communication in a cluster

Fitting a communication interface in a cluster is only necessary on the master.

6.5.1 Connection of the Interface



Position	Description
A	Slot for communication interface
B	Cable route
C	Enclosure opening in the base of the Sunny Island

For connection, proceed as follows:

NOTICE!

Electrostatic discharges can damage the communication interface.

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

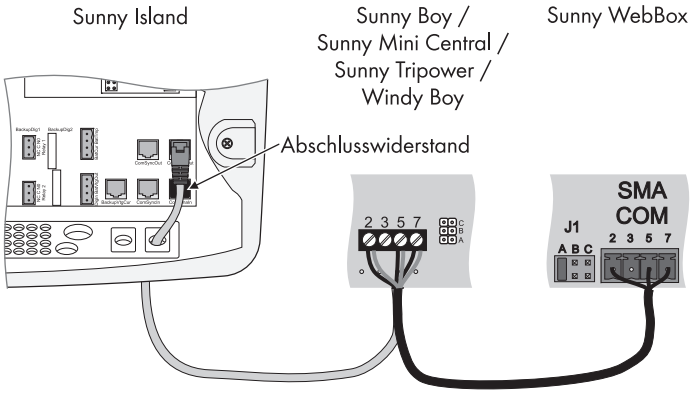
- Ground yourself before touching a component.

1. Remove the right plug of the two plugs in the rubber connection area.
2. Feed the cable from the outside through the cable conduit (D) into the Sunny Island.
3. Plug the cable into the "ComSmaIn" socket.
4. Place the plug around the cable.
5. Insert the plug in its designated opening in the rubber connection area.
6. Lay the cable in area (C).
7. Connect the cable. Assignment pins in the RJ45 socket:

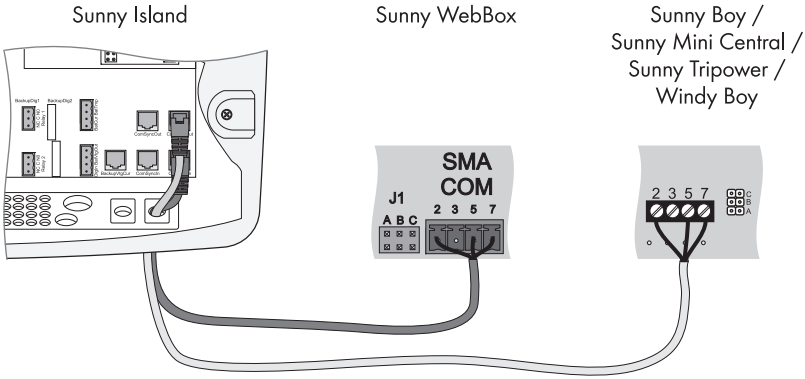
PV inverter / wind power inverter / Sunny WebBox	RS485 - signal assignment	RJ45 socket - Sunny Island	RJ45 color coding
2	A (Data+)	3	White and green
5	GND	2	Orange
7	B (Data–)	6	Green

8. The RS485 data bus of the Sunny Island is terminated with a terminating resistor.
   This terminating resistor is already plugged into the "ComSmaOut" socket. Only remove the plug if you want to connect another communication device.
9. Plug the communication interface onto the board (A).

Connecting Sunny Island to the Sunny Boy/Sunny Mini Central/Sunny Tripower/ Windy Boy and Sunny WebBox with one RS485 cable



Connecting Sunny Island to the Sunny Boy/Sunny Mini Central/Sunny Tripower/ Windy Boy and Sunny WebBox with separate RS485 cables



Data Transmission Speed

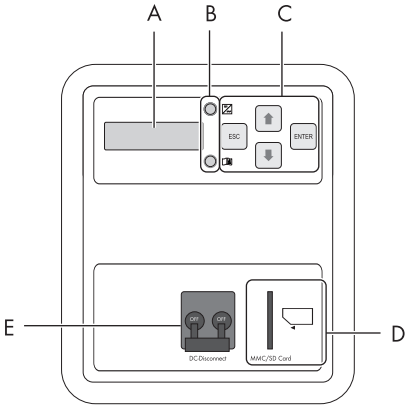
The Sunny Island can be operated at different data transmission rates to communicate with external devices. The parameter "250.06 ComBaud" must be set correspondingly.

Setting the baud rate

If PV inverters are connected to the communication bus, then the baud rate must be set to 1 200 bps (default setting).

7 Control Elements

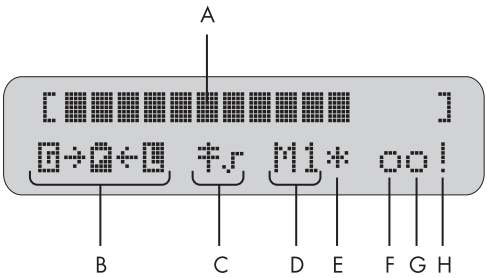
In order to commission the Sunny Island, you should familiarize yourself with its operation beforehand. The individual control elements can be seen in the following figure.



Position	Description
A	Display
B	LEDs
C	Control buttons
D	Slot for the SD card
E	DC circuit breaker

7.1 Display Messages

The display of the Sunny Island has two lines, each with 16 characters. For details, see section 10.6 "Display Messages (Overview)" (page 77).



Position	Description
A	Output power / charging power (load status)
B	Direction of energy flow and system status
C	Grid status
D	Device assignment
E	Status of the external source (asterisk, question mark or exclamation mark)
F	Relay 1 status
G	Relay 2 status
H	Warning message (exclamation mark)

For more information, see section 10.6 "Display Messages (Overview)" (page 77).

7.2 DC Circuit Breaker

The DC circuit breaker is used to switch on/off as well as to disconnect the Sunny Island on the DC side. For details, see section 9 "Switching On and Off" (page 62).

7.3 Buttons

The table explains the functions of the buttons on the Sunny Island:

Button	Function
	cancels the selected function answers NO navigates one menu level higher stops device (when held pressed down)
	navigates up one list element, increases data value
	navigates down one list element, decreases data value
	selects function selects value confirms change answers YES navigates one menu level down starts device (when held pressed down) stops device (when held pressed down)

7.4 Meaning of the Light Emitting Diodes (LED's)

On the Sunny Island control panel, there are both a green (above) and a red (below) light emitting diode (LED), the functions of which are described in the table below:

Green LED	Red LED	Operating condition
–	–	Standby or off (no inverter operation)
ON	–	Operation
–	ON	Disturbance or Fault
ON	ON	Initialization

7.5 SD Card

The Sunny Island features an SD card which can be used for updating firmware and as a service interface. For details, see section 11 "Archiving Data on a SD Card" (page 83).

8 Initial Start-up

8.1 Requirements

Check the connections

Before starting the commissioning process, ensure that all electrical connections have the correct polarity and make sure that everything is connected according to the instructions.

Always save data

Always use the SD card to save data and events. This way, in case of a failure, SMA Solar Technology can help you quickly.

The Quick Configuration Guide (QCG) allows you to quickly and easily commission your stand-alone grid power system. To do so, use the menu to select the 'right' system for you. The display then shows special queries via which the system's parameters can be set specifically.

8.2 Starting the Quick Configuration Guide (QCG)

Error occurrence

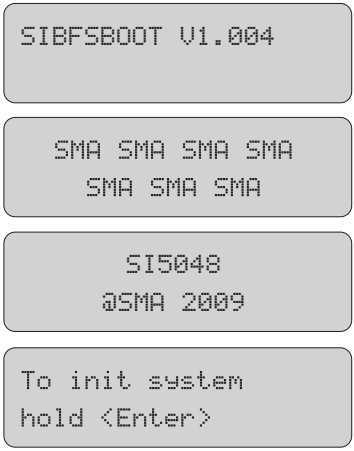
If the device displays an error message unexpectedly, this error must be fixed before the Sunny Island can be put into operation. For this purpose, refer to section 20 ”Troubleshooting” (page 194).

Default setting of parameters

Upon starting the Quick Configuration Guide, viable parameter values are set by default.

The QCG is automatically activated during the initial start-up of the Sunny Island. In this case begin with point 3. If the QCG is not activated automatically, begin with point 1.

1. Switch the Sunny Island DC circuit breaker to the "ON" position.
   ☑ The Sunny Island initiates the start-up phase. The notifications shown here are displayed. The last notification is displayed as soon as the start-up phase is completed.



2. Press and hold down <ENTER> until the Sunny Island beeps three times.
   ☑ The QCG is started.

Systems with several Sunny Island

If you have a system with more than one Sunny Island, you must first run the QCG on the slave(s) **before** starting the master device (display message "INIT MASTER OK START?"). Only the device type is set there. Only start the master device thereafter!

- **"Start System"** (if you have accidentally accessed the QCG and would only like to restart the system)
- **"New System"** (if you would like to start a new system or perform changes to the plant configuration)

- **"New Battery"** (if you wish to reset battery-specific parameters only. You cannot change general parameters using "New Battery".
- **"Emerg Charge"** (if you would like to charge a deeply discharged battery using an external source)

3. Use **"New System"** to set the following parameters:
   - Device type (master, slave 1, slave 2, slave 3)

Systems with one Sunny Island

If only one Sunny Island is used in the system, the device type is permanently set to "master" and is not displayed.

   - Voltage/frequency type (230V_50Hz, 220V_60Hz), default setting: "230V_50Hz"
   - System configuration (see table for setting options), default setting: "1Phase1"

Displayed text	Description
3Phase	Three-phase system, 3 Sunny Island
1Phase1	Single-phase system, 1 Sunny Island
1Phase2	Single-phase system, 2 Sunny Island
1Phase3	Single-phase system, 3 Sunny Island
1Phase4	Single-phase system, 4 Sunny Island
MC-Box	Setting for Multicluster operation

   - Date / Time
   - Battery type (VRLA, FLA, NiCd), default setting: "VRLA"

Battery types

VRLA: Valve **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.)

FLA: Flooded **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.)

NiCd: Nickel **Cd**mium

Sealed pocket-type plate or fiber plate nickel-cadmium batteries.

   - Nominal voltage of the battery (42 V - 52 V in 2-V steps for FLA and VRLA, 43.2 V to 48 V in 1.2-V steps for NiCd), default setting: "48.0 V"
   - Nominal capacity of the battery (100 Ah - 10000 Ah), default setting: "100 Ah"
   - External power supply unit (PvOnly, Gen, Grid, GenGrid)

Displayed text	Description
PvOnly	Off Grid, no grid, no generator
Gen	Stand-alone grid with generator
Grid	Power distribution grid
GenGrid	Power distribution grid and generator

GenGrid:

- Maximum generator current (0 A - 224 A), default setting: "16 A"
- Generator interface (Manual, GenMan, Autostart), default setting: "Autostart"
- Maximum grid current (0 A - 224 A), default setting: "16 A"

Grid:

- Maximum grid current (0 A - 224 A), default setting: "16 A"

Gen:

- Maximum generator current (0 A - 224 A), default setting: "16 A"
- Generator interface (Manual, GenMan, Autostart), default setting: "Autostart"

4. The following parameters must be set when **"New Battery"** is selected:
   - Battery type (VRLA, FLA, NiCd), default setting: "VRLA"
   - Nominal voltage of the battery (42 V - 52 V in 2-V steps for FLA and VRLA, 43.2 V to 48 V in 1.2-V steps for NiCd), default setting: "48.0 V"
   - Nominal capacity of the battery (100 Ah - 10000 Ah), default setting: "100 Ah"

   ☑ After entering all parameters, the following notification appears.

5. Press <ENTER> to confirm.

   ☑ The notification shown here is displayed.

6. Press <ENTER> and hold until you hear a beep.

☑ The Sunny Island has started and is in operation.

Adjustable parameters

For more information on adjustable parameters, see section 19 "Parameter lists" (page 146).

Note that some parameters can only be changed after entering the installer password (see section 10.5 "Entering the Installer Password" (page 76)), or in standby mode (see section 9.2 "Stopping the Sunny Island (Standby)" (page 63)).

8.3 Commissioning the Battery Current Sensor

In the event you have installed a battery current sensor in your system, you are required to synchronize the device's internal offset. To do this, proceed as follows:

1. Switch the Sunny Island to standby as described in section 9.2 "Stopping the Sunny Island (Standby)" (page 63).

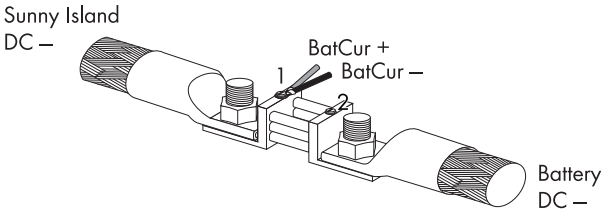
NOTICE!

System error due to wrong parameters being entered.

All parameter settings which could affect the operating safety of the stand-alone system are protected by the installer password.

- Only electrically skilled persons are permitted to set and adjust system parameters.
- Enter the password as described in section 10.5 "Entering the Installer Password" (page 76).

2. Short-circuit the battery current sensor cables.
   - BatCur+ to terminal 1
   - BatCur – to terminal 1



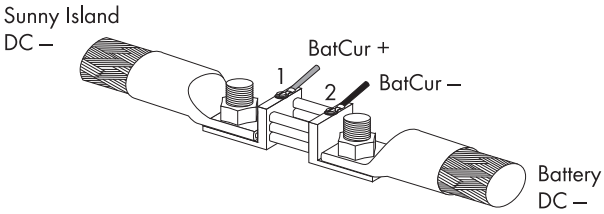
3. Set the following parameters:

   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 other parameters (02, 03 and 04 in the menu "225# Battery Current Sensor") will be shown and activated.
4. Set the nominal 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 automatic calibration:
   - Set "225.04 BatCurAutoCal" to "Start".

   ☑ The Sunny Island conducts an automatic calibration.
6. Check the offset error:

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

7. Reconnect the battery current sensor's lines correctly as displayed in the graphic.
   Make sure the lines have the correct polarity when doing this.
   - BatCur+ to terminal 1
   - BatCur– to terminal 2



8. Start the Sunny Island (see section 9.1 "Switching On" (page 62)).
9. Check the current direction: "120.06 TotBatCur".

Current direction: Discharging the battery

- No generator/grid connected
- Consumers are being supplied

The value of the battery current is positive.

Current direction: Charging the battery

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

The value of the battery current is negative.

9 Switching On and Off

9.1 Switching On

Systems with several Sunny Islands

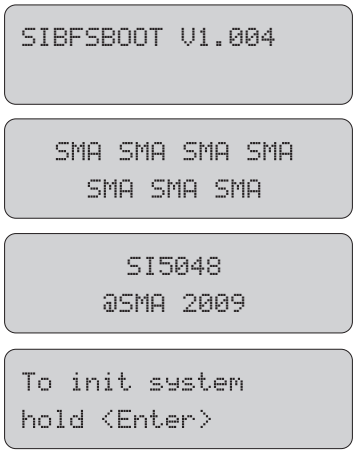
Switch on the Slaves **before** you switch on the master. To do this, proceed as follows.

1. Check the following requirements:
   - correct electrical connections
   - voltages and polarities
2. Switch the Sunny Island DC circuit breaker to the "ON" position.
   ☑ The display light of the Sunny Island switches on.

"250.01 AutoStr" Parameter

Even with the "250.01 AutoStr" parameter set, the Sunny Island must be manually started after each time the device is switched on using the DC circuit breaker.

☑ The Sunny Island initiates the start-up phase. The notifications shown here are displayed. The last notification is displayed as soon as the start-up phase is completed.



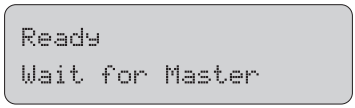
3. Start QCG (press and hold down <ENTER> until the Sunny Island beeps three times).
   ☑ The QCG is started and the notification displayed here is shown. Continue as described in section 8.2 "Starting the Quick Configuration Guide (QCG)" (page 57).

or

4. Wait 5 seconds.
   ☑ The Sunny Island skips the QCG and the notification shown here is displayed.

5. Press and hold <ENTER>.
   ☑ The remaining time is displayed as a bar.

   ☑ On a slave, the notification displayed here is shown until the master is started.



6. Press <ENTER> on the master.

☑ A beep is heard. The Sunny Island is in operation and the green (top) LED is on.

9.2 Stopping the Sunny Island (Standby)

Standby

Even in standby mode the Sunny Island still requires approx. 4 W of power from the battery.

Proceed as follows to stop the Sunny Island:

1. Press <ENTER> or <ESC> to stop the Sunny Island.
   ☑ The notification shown here is displayed.

2. Press and hold <ENTER>.
   ☑ The remaining time is displayed as a bar.

☑ The Sunny Island is stopped. The notification shown here is displayed.

9.3 Switching Off

To switch off the Sunny Island, proceed as follows:

"Switching sequence"

Only with the sequence shown here can you ensure that all internal meter positions/values are saved.

1. Stop the Sunny Island as described in section 9.2 "Stopping the Sunny Island (Standby)" (page 63).
2. Switch the Sunny Island's DC circuit breaker to the "OFF" position.

☑ The Sunny Island is switched off.

9.4 Disconnecting the Device from Voltage Sources

1. Switch off the Sunny Island as described in section 9.3 "Switching Off" (page 64).
2. Disconnect the Sunny Island from the battery.
3. Disconnect the Sunny Island from the voltage sources (AC1 and AC2). Separate AC1 and AC2 and disconnect from voltage sources.
   ☑ If PV inverters are connected to AC1, they automatically switch off once they are no longer connected to the stand-alone grid.
4. Check that the Sunny Island has been disconnected from voltage sources.
5. Wait at least 15 minutes to let the capacitors discharge and to allow the voltage inside the device to drop to a safe level.

☑ The Sunny Island is free of voltage.

9.5 Reactivating the Device Following Automatic Shutdown

A complete shutdown indicates that stand-alone grid components have failed or are not working correctly due to incorrect parameter settings. Check the off-grid system for possible faults, both before and after reactivating the system, to avoid a complete shutdown in the future.

To reactivate the Sunny Island after it has switched off due to a battery being too deeply discharged, proceed as follows:

NOTICE!

If the Sunny Island switches off automatically, the Sunny Island and connected devices will be damaged.

- Disconnect the loads only.
- Do not disconnect generators.
- Install external load-shedding protection in case the Sunny Island is coupled to PV generators or small wind generators on the AC-generating side.

1. Switch the Sunny Island DC circuit breaker to the "OFF" position.

DANGER!
Danger to life due to high voltages in the Sunny Island.

After an automatic disconnection, high residual voltages can remain in the Sunny Island capacitors.

- Wait at least 15 minutes to let the capacitors discharge and to allow the voltage inside the device to drop to a safe level.

2. Switch the Sunny Island DC circuit breaker to the "ON" position.
   ☑ The display light of the Sunny Island switches on.

Switching on the DC circuit breaker

If, in rare cases, the device cannot be switched back on after 15 minutes, wait a little longer and try it again.

3. Switch on the Sunny Island as described in section 9.1 "Switching On" (page 62).

Charging the batteries

After reactivation, it is important that the batteries are charged. If an autostart generator is present in the stand-alone grid, the Sunny Island will request the generator after a few minutes.

4. Monitor the generator startup and check that the Sunny Island switches to charge mode.
5. Check for error-free functioning of all other energy generators in the system.

Battery Preservation Mode after Reactivation

If, after reactivation, the Sunny Island immediately switches into battery preservation mode (see section 13.5 "Battery Preservation Mode" (page 104)), disconnect all consumers from the AC output (AC1 and AC2).

The consumers can be reconnected once the Sunny Island enters the charge state.
A precondition for this is that a generator capable of providing the required power is connected.

For more information, see section 20.10 "What to Do during Emergency Charge Mode" (page 213).

10 Operation

The main menu consists of a "Home Screen" and the other main menu entries, which split up into the different menu levels. Operating states, for example, the current operating mode, power, etc. are displayed on the "Home Screen" (see section 10.6 "Display Messages (Overview)" (page 77)).

The menu consists of a main menu and maximum two sub-menu levels (see section 10.1 "Menu Structure" (page 67)).

Use the up and down arrow buttons to navigate through the menu levels. The cyclical arrangement (wrap around) allows you to scroll both forward and backwards to access the desired menu as quickly as possible.

Faster access to menus

If you would like to access submenu "7", navigate backwards from "1" over "9", instead of six steps forwards.

When the desired menu is reached press the <ENTER> key in order to access it. The <ESC> key exits the menu and puts you one menu level up.

Switching to the Home Screen in case of inactivity

If you do not press any buttons for more than five minutes (inactivity), the Home Screen is automatically displayed.

Background illumination

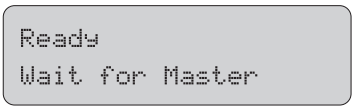
The display's background illumination is automatically deactivated after a short time of inactivity. You can switch the background illumination back on by pressing one of the four buttons. No settings are changed when you press the button, this only activates the display illumination.

Acoustic button sounds

If "250.04 BeepEna" is set to "off", the Sunny Island does not alert faults and errors with an acoustic warning signal.

Slaves wait for commands from the master

Slave devices must wait for commands from the master devices. The following message appears during this time.



The Sunny Island utilizes an operation concept referred to as **"Single Point of Operation"**. For a system with more than one Sunny Island, all entries are made on the master. There you configure the entire system, confirm events, warnings and errors in the QCG (see section 8 "Initial Start-up" (page 56)), and update your firmware when required (see section 11.6 "Updating the Firmware" (page 89)).

Exception: When starting the device for the first time, you must set the slave devices as slave in the QCG and everything else is performed at the master.

Single Point of Operation

Single Point of Operation also means that all master log data, including the slave log data, is saved at the master device on the SD card.

Messages

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

10.1 Menu Structure

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 sub-menus.

In a sub-menu, you can select a second sub-menu or a parameter.

NOTICE!

Incorrect parameters may cause system damage.

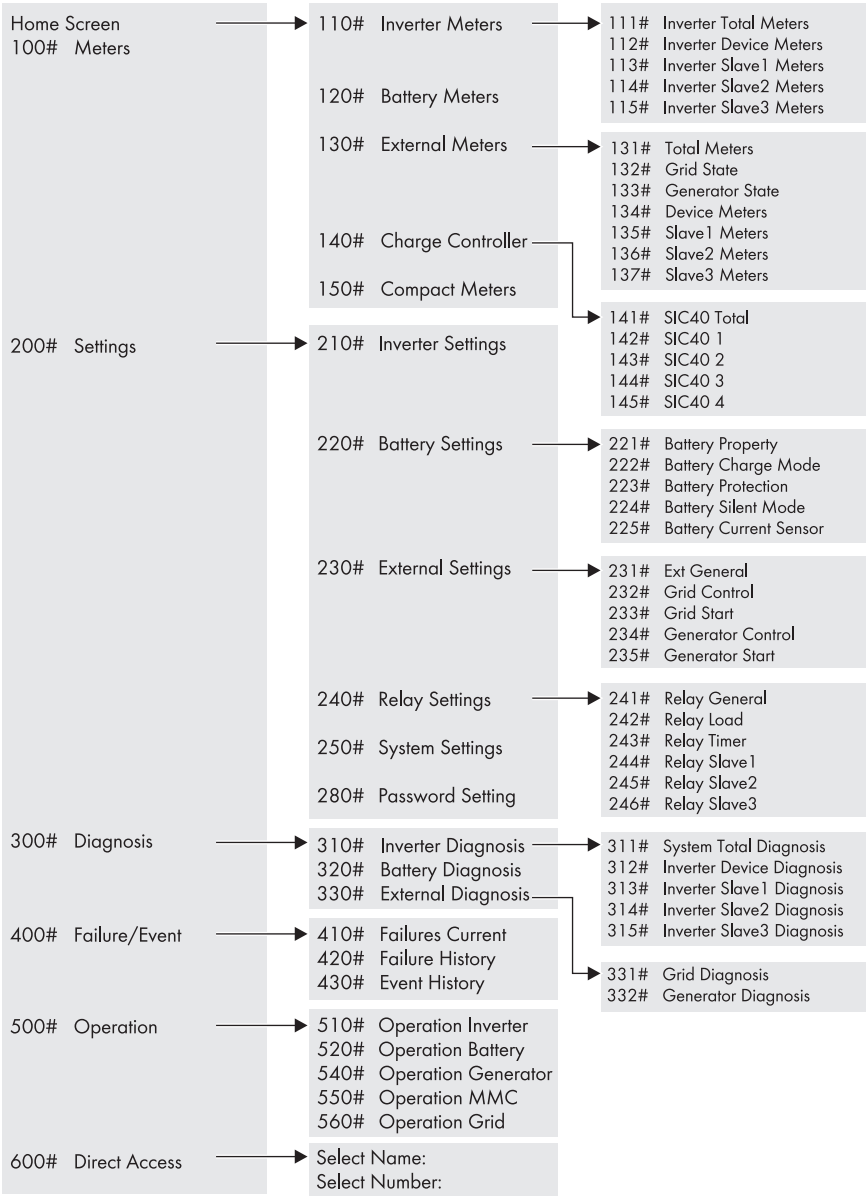
- Only electrically skilled persons are permitted to set and adjust system parameters.

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 10.5 "Entering the Installer Password" (page 76)).

Overview of the Menu Structure:



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# Battery Meters - Battery
- 130# External Meters - Grid/Generator
- 140# Charge Controller - Sunny Island Charger (is only shown when there is at least one Sunny Island Charger connected to the Sunny Island)
- 150# Compact Meters - compact view of values for commissioning

By opening the relevant sub-menu - if necessary, the second sub-menu - you can view the parameters (e.g., Parameter "112.03 InvVtg).

200# Settings

The following sub-menus allow you to view and adjust the system parameters:

- 210# Inverter Settings - Sunny Island
- 220# Battery Settings - Battery
- 230# External Settings - Grid/Generator
- 240# Relay Settings - Relays
- 250# System Settings - System
- 280# Password Setting - Password entry

300# Diagnosis

The following sub-menus allow you to view system data:

- 310# Inverter Diagnosis - Sunny Island
- 320# Battery Diagnosis - Battery
- 330# External Diagnosis - Grid/Generator

400# Failure/Event - Failures and Events

The following sub-menus contain various error and event lists:

- 410# Failures Current - Current failures
- 420# Failure History - Previous warnings and failures
- 430# Event History - Events

500# Operation - Functions during operation

The following sub-menus allow you to view and adjust operating parameters:

- 510# Operation Inverter - Sunny Island
- 520# Operation Battery - Battery
- 540# Operation Generator - Generator
- 550# Operation MMC - SD Card
- 560# Operation Grid - Grid

600# Direct Access -Direct access to the parameters

This is a main menu that gives you direct access to the settings and display values (see section 10.3 "Direct Access - Direct Access to the Parameters" (page 71)).

10.2 Changing Parameters

Using the up and down arrow buttons, you navigate through a selected menu to view or change a parameter, for example. When the relevant parameter is displayed, you can read its present value.

An arrow next to the value indicates that the parameter can be changed.

If you press <ENTER>, the arrow begins to blink, and you can use the up and down arrow buttons to change the value of the "150# Compact Meters" parameter.

Increments (speed)

The increment size (speed) of the change increases if you hold the button pressed down.

As soon as the desired value appears on the display, press <ENTER> to save the new value.

Then select Y(es) or N(o) by pressing the up/down arrow buttons to accept or reject the changes.

Finally, press <ENTER> again in order to finish the process and continue with other modifications.

Changing parameters

Note that some parameters can only be changed when the device is in standby mode (see section 9.2 "Stopping the Sunny Island (Standby)" (page 63)). The parameters for which this applies can be found in the tables in sections 19.2 "Adjustable Parameters" (page 158) and 20 "Troubleshooting" (page 194).

The Sunny Island displays a corresponding message for parameters that can only be changed in standby mode or require a different password level.

Display	Description
No permission to change the value	Incorrect password level, you cannot make any changes in the menus. This is explained in section 10.5 "Entering the Installer Password" (page 76). All menu items and parameters that can only be changed by the installer are shown with a gray background in the parameter list (see section 19 "Parameter lists" (page 146)).
Stop device to change the value	This parameter can only be changed in standby mode. Stop the Sunny Island to change the parameter (see section 9.2 "Stopping the Sunny Island (Standby)" (page 63)).

10.3 Direct Access - Direct Access to the Parameters

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

Via the Select Name sub-menu, you have direct access to the following functions:

- GnManStr: manual starting of the generator (see section 14.1.4 "Manual Generator Operation" (page 112)).
- ManChrgSel: manual starting of equalization charge (see section 13.4.3 "Equalization Charge" (page 102)).

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

Example

Using the menu 600#, 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.

10.4 Compact Meters

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

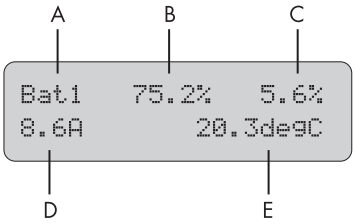
- Battery 1
- Battery 2
- Inverter (AC values)
- InvTot
- Grid/Generator (external)
- ExtTot
- Inverter status

Selecting the area

You can select the different displays of the compact meters using the up/down arrow buttons. Here, you can also use the "Wrap around" function.

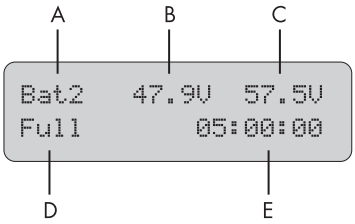
The displays are always shown from the upper left to the lower right.

Bat 1 (Battery Value 1)



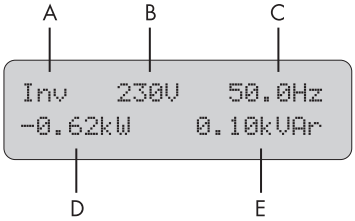
Position	Description
A	Name of the compact meter
B	Present battery state of charge (BatSoc)
C	Estimated error of the state of charge (BatSocErr)
D	Total battery current of the cluster (TotBatCur)
E	Battery temperature (BatTmp)

Bat 2 (Battery Value 2)



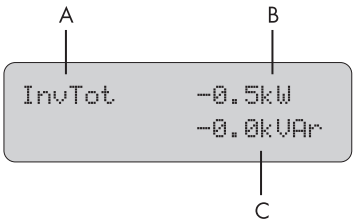
Position	Description
A	Name of the compact meter
B	Battery voltage (BatVtg)
C	Setpoint of charging voltage (BatChrgVtg)
D	Active charging process (BatChrgOp)
E	Remaining absorption time (AptTmRmg)

Inv (AC Values of Inverter)



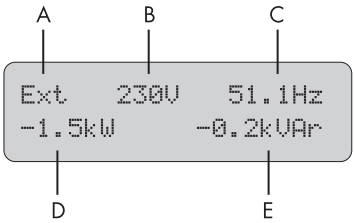
Position	Description
A	Name of the compact meter
B	Present voltage at the inverter (InvVtg)
C	Present frequency at the inverter (InvFrq)
D	Present active power of the inverter (InvPwrAt)
E	Present reactive power at the inverter (InvPwrPt)

InvTot (Total AC Values of Inverter)



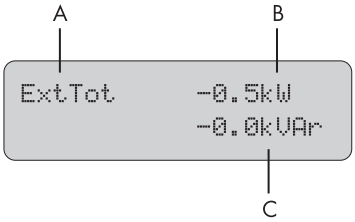
Position	Description
A	Name of the compact meter
B	Total active power of the inverter (cluster)
C	Total reactive power of the inverter (cluster)

Ext (AC Values of External Source)



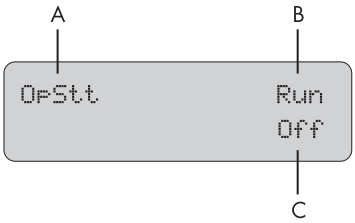
Position	Description
A	Name of the compact meter
B	Voltage of the external source (ExtVtg)
C	Frequency of the external source (ExtFrq)
D	Active power of the external source (ExtPwrAt)
E	Reactive power of the external source (ExtPwrPt)

ExtTot (Total AC Values of External Source)



Position	Description
A	Name of the compact meter
B	Total active power of the external source (cluster)
C	Total reactive power of the external source (cluster)

OpStt (Inverter and Generator Status)



Position	Description
A	Name of the compact meter
B	Operating state of the inverter (InvOpStt)
C	State of the generator (GnStt)

10.5 Entering the Installer Password

NOTICE!

Entering incorrect parameters may cause system damage.

All parameter settings which could affect the operating safety of the stand-alone system are protected/blocked by the installer password.

- Only electrically skilled persons 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 guarantees by the SMA Solar Technology.

Entering the password

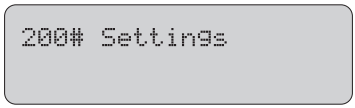
The Sunny Island allows you to enter the password not only in standby, but also during operation.

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

Password = Checksum of the operating hours

Proceed as follows to enter the installer password from the Home Screen:

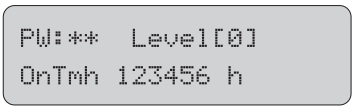
1. Keep pressing the "arrow down" key until the "200# Settings" menu is displayed.



2. Press <ENTER>.
3. Keep pressing the "arrow down" key until the "280# Password Setting" menu is displayed.

4. Press <ENTER>.

   ☑ The "280# Password Setting" sub-menu opens.



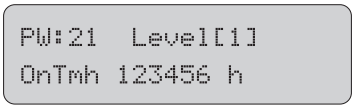
5. Press <ENTER>.
6. Determine the password. Calculate the checksum (sum of all digits) of the operating hours. In the message shown here:

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

7. Enter the password by pressing the up/down arrow buttons.
8. Confirm the password by pressing <ENTER>.

☑ The installer password has been entered.
Operating level [1] = the installer level is set.

9. Exit the menu by pressing the <ESC> key.



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.

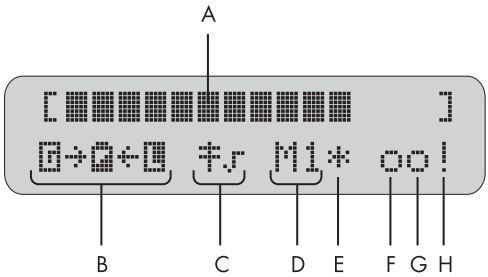
The installer level is switched back to the user level if:

- 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.
- no activity takes place within 5 minutes.

10.6 Display Messages (Overview)

The display has two lines, each with 16 characters. The first line shows the menu number and the menu name, or the name of the parameter where applicable. The menu name is supplemented or the added text is displayed (e.g., parameter value) in the lower line, if required.

"Home Screen"



Position	Description
A	Output power / charging power (load status)
B	Direction of energy flow and system status
C	Grid status
D	Device assignment
E	Status of the external source (asterisk, question mark or exclamation mark)
F	Relay 1 status
G	Relay 2 status
H	Warning message (exclamation mark)

The Sunny Island also shows the following values one after the other in the upper line of the Home Screen (parameter name and parameter value in 3-second intervals):

- Bar display for output power or charging power (the direction of energy flow is displayed by the arrows in the lower line)
- Total active power of the inverter (cluster)
- Active power of external source (total of all phases)
- Present state of charge of the battery (SOC)
- Meters (always one of five possibilities, depending on priority)
  - Remaining absorption time
  - Remaining generator warm up time
  - Remaining Run1h time for the generator
  - Remaining time of Timer 1
  - Remaining time of Timer 2
- Active charging process

Situational displaying of text and values

The values shown in the display are cyclically displayed depending on the situation. This means that if there is no generator connected, no generator values are displayed

Messages on the slave devices

The slave devices only show the bar display for output and charging power and the device assignment in the bottom line (e. g. S1 for slave 1) as well as the status of external sources, if applicable (*, for the description see above).

Meaning of the Symbols that appear in the Home Screen:

Symbol	Meaning
	Nominal power
	Nominal load exceeded.
	Direction of energy flow between grid/generator side, battery and load side.
	Generator/grid side is on.
	Battery
	Load side (loads/Sunny Boys)
	Power pole
	Power distribution grid is connected. The Sunny Island is working with grid limits.
	The generator is connected. The Sunny Island is working with generator limits.
	The Sunny Island is configured as master.
	The Sunny Island is configured as slave 1.
	The Sunny Island is configured as slave 2.
	Status of the external source: Voltage and frequency of the generator/grid are within set limits.
	Status of the external source: Voltage and frequency of the external source are not within set limits. In this case, the Sunny Island does not connect the generator to the stand-alone grid.
	Status of the external source: The maximal admissible generator reverse power was exceeded and the Sunny Island has disconnected the generator from the stand-alone grid.
	"**B**attery" request reason: The generator has been requested as a result of the battery state of charge.

Symbol	Meaning
	"**C**ycle" request reason: The generator was requested via the generator operation's time-dependent repetition cycle (Parameter: 235.17 GnTmOpCyc).
	This symbol can only be shown in Multicluster operation. "**E**xternal" request reason: The generator was requested via the extension cluster. This only applies to Multicluster operation.
	"**L**oad" request reason: The generator has been requested as a result of the load-dependent generator request.
	"**S**tart" request reason: The 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**ime" request reason: The generator was started for one hour using the "Run1h" setting in the Sunny Island. Once this time has passed, the Sunny Island automatically switches off the generator.
	Display for relays (solid circle = the relay is activated / empty circle = the relay is deactivated).
	Warning message: This symbol blinks until you have confirmed the warning or the error in the menu "410# Failures Current" or "420# Failure History".

Display "Generator Status" and "Request Reason"

The two displays above are cyclically shown on the display as the status of the external source.

Example:

If the display changes every 3 seconds from "*" to "B", this means that the generator voltage and frequency lie within the set limits and that the generator was requested as a result of the battery state of charge.

Stopping the generator manually

If the generator has been manually set to "Stop", then no generator status information is shown on the display. The field remains empty in this case.

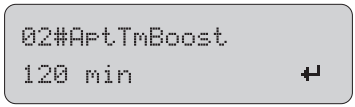
Indications of a warning

If faults occur, the device switches into standby mode and shows the fault on the display. The fault must be eliminated and confirmed, then the Sunny Island carries out an autostart.

10.7 Parameter Display

Parameters on the Sunny Island are displayed as follows:

In the upper line, the parameter number comes first, then a separator (hash) followed by the parameter name. In the lower line, there is the value with the unit and the modification mark (enter arrow) is on the far right.



Parameter/value list

If you would like to switch from a menu (regardless of whether it is a main or sub-menu) into a parameter/value list, the menu numbers are not included on the display.

Syntax for menus and parameters

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

A menu is identified by the number of the menu, the hash and the name of the menu (e.g., 120# Battery Meters).

A parameter is labeled with the menu number, dot, and the parameter number and name (120.02 BatVtg).

10.8 Display of Events

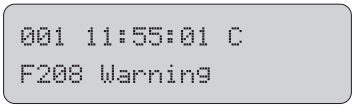
The Sunny Island can display a list of events:

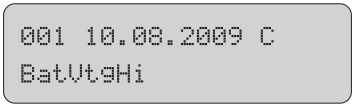
The serial number (quantity) of the events, the time and date display, which changes in 2-second intervals, is in the upper line. In the lower line are the number of the event and the corresponding short text.

10.9 Display of Warnings and Failures

The Sunny Island can display a list of errors and warnings:

The serial number (quantity) of the error is on the upper line; the time and date display changes in 2-second intervals. On the lower line are the number of the error and the corresponding error short text.





An "!" on the right on the upper line indicates when the warning and/or error occurred.

A "C" on the right on the upper line indicates when the warning or the error was confirmed or cleared.

Direct access to the error list

As a shortcut, press ESC and the arrow up button simultaneously to go directly to the error list (420# Failure History).

11 Archiving Data on a SD Card

The Sunny Island can store firmware, parameters and measured data on a SD card, which must be FAT-16-formatted and may have a maximum size of 2 GB (possible storage sizes are 32/64/128/256/512 MB and 1 GB and 2 GB). Use the SD card included in delivery solely for the Sunny Island. Do not save any multimedia data on the SD card.

File names are saved in 8.3 format and files with other designations are ignored.

Example of a format

A valid 8.3 format is, for example, "M1111LOG.DAT".

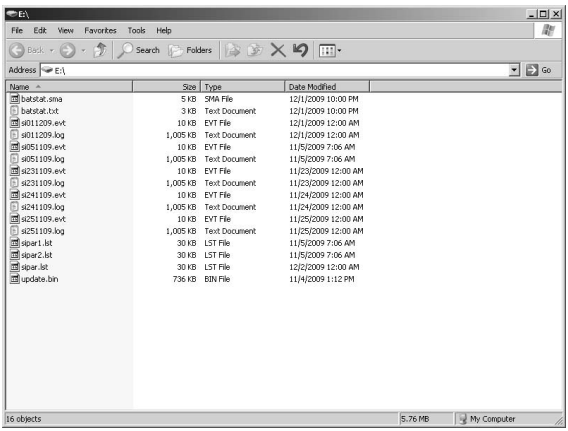
8.3 is the "old" MS-DOS format with a file name that has a maximum of 8 figures before and 3 figures after the dot.

Type of Memory Card

SMA Solar Technology recommends using 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 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 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
sipar.lst	This file is saved after changing a parameter.
update.bin	Software for the device
batstat.txt	Statistical values of the battery. These values are saved every day at 10:00 p.m.
batstat.sma	Internal data from SMA Solar Technology
si.ccf	System information from Sunny Island.

"BOOTEX.LOG" File

The file "BOOTEX.LOG" is not necessarily saved on the card, it is generated according to the operating system used (e. g. WindowsXP or Windows2000).

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

The Sunny Island uses the SD card for saving and loading device parameters.

In addition, the Sunny Island supports the acquisition of measurement data on the 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 (are 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
- Loads

Always save data

Always use the SD card to save data and events. This way, in case of a failure, SMA Solar Technology can help you quickly.

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

- The first 13 lines of the file are used for information (file header).
- The following data is 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.

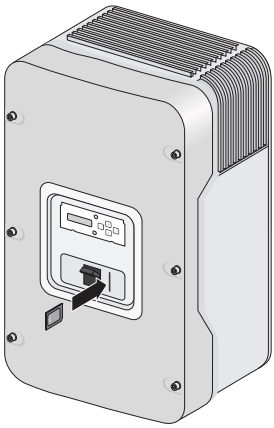
11.1 Inserting the Card

NOTICE!

Damage due to electrostatic discharges.

- Ground yourself before you insert or remove the SD card from the Sunny Island enclosure.

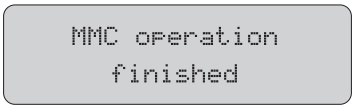
Insert the SD card with the cut corner pointing down into the slot on the Sunny Island (see illustration).



After inserting the SD card into the Sunny Island, the adjacent message appears on the display prohibiting the removal of the card:

The initialization of the SD card can take several minutes. During this time, the buttons are disabled and cannot be used for making entries, and three points appear in the lower line of the display.

If the procedure was successful, the graphic shown here is displayed.



In case of a fault, the following message appears:

11.2 Removing the SC Card

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

Data loss

If you remove the SD card without first activating the parameter "550.03 CardFunc", you lose up to a maximum of 15 minutes of data.

11.3 Saving and Loading Parameters

Using the "510.02 ParaSto" parameter, you can save the current parameter settings and using the "510.02 ParaLod" parameter, you can load the saved parameters.

Save 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))

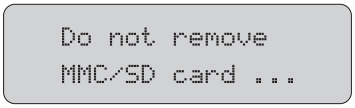
SD card write protection

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

11.4 Writing Log Data

Using the "#550.04 DatLogEna" parameter, you can activate the function for writing log data to your SD card (activated by default).

If the Sunny Island is writing data to the SD card, removing the card is prohibited and the following message appears on the display:



11.5 Status Messages

Using the "312.07 CardStt" parameter, you can request the status of your SD card:

Display	Description
07# CardStt Off	The SD card is deactivated.
07# CardStt Operational	The SD card is activated.
07# CardStt Out of Space	The memory capacity of your SD card has been exceeded.
07# CardStt Bad File Sys	The SD card has an invalid file format.
07# CardStt Incomp	The SD card is not compatible.
07# CardStt Parameter	Your Sunny Island is loading parameters from the SD card.
07# CardStt Param Failed	Loading parameters from SD card has failed.
07# CardStt Mount	The SD card is being accessed.
07# CardStt Write Log Data	The Sunny Island is writing log data onto the SD card.

11.6 Updating the Firmware

The firmware of the Sunny Island can be updated using the SD card. When the Sunny Island starts up or when the SD card is inserted, the Sunny Island searches for special update files on the SD card. If it finds files containing new firmware versions, it performs an update when the Sunny Island is in standby mode.

Proceed as follows for a firmware update:

Take note of:

- You may only download firmware versions from www.SMA.de/en. Using unauthorized firmware versions cancels the warranty.
- None of the already existing parameter settings are changed or erased during a firmware update.
- New parameters are assumed with default values.
- If there is an update to firmware version greater or equal to 5 000, the battery management is automatically reset. This means that some of the set parameters for the battery management are lost.
- Do not activate the DC circuit breaker during the firmware update.
- Updating the firmware or single-phase systems takes approximately 5 minutes.
- Do not switch off the Sunny Island during the firmware update.
- Updates in systems with a master and slaves can take up to 20 minutes. A progress bar is shown on the master display.
- The slave update starts approximately 5 minutes after the master update.
- An equalization charge is automatically initialized after the firmware update.

1. Create a backup copy of the existing parameter lists (see section 11.3 "Saving and Loading Parameters" (page 87)).
2. Download the current version of the firmware from the Internet at www.SMA.de/en.
3. Copy the "UPDATE.BIN" file onto the SD card.
4. Set the master device to standby.
5. Insert the SD card in the master's slot.

   ☑ The update is carried out.

Reset after a successful update

After the update has been successfully completed a reset is enforced in order for the changes to become effective. After the reset, the master device remains in standby mode.

6. Press and hold <ENTER>.

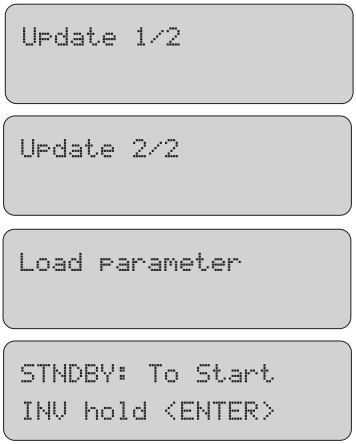
☑ The Sunny Island starts. The update is carried out.

Starting QCG

If you have carried out a firmware update in which the number before the dot in the firmware version has changed, it is advisable to start QCG and to perform all settings anew.

Firmware Update in a System with One Sunny Island

During the update, the Sunny Island displays the following messages.

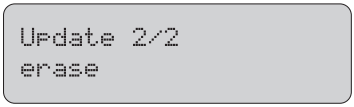
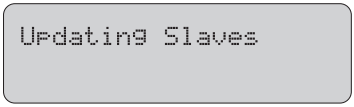
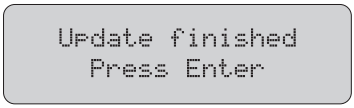
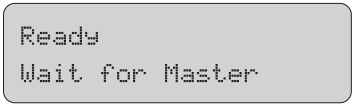


Firmware Update in a System with Several Sunny Island

In a system with several Sunny Island inverters, the firmware is only updated on the master. If the master detects that a slave has a different firmware version, it transmits its firmware to the slave and makes sure that all Sunny Island inverters within a system operate with the identical firmware version.

While the master updates the slaves, the devices show the following messages, among other things. The display messages listed below may be shown at various lengths. Wait until the master displays the message "Update finished. Press Enter" and the slaves display the message "Ready. Wait for Master." Do not make any entries during the update.

Sunny Island	Display message	Explanation
Master	Start update Please wait	The master update starts.
Master	Update 1/2 erase	Master update part 1/2.

Sunny Island	Display message	Explanation
Master		Master update part 2/2.
	⋮	
Slave		The slave update starts.
	⋮	
Master		The slave update is running.
	⋮	
Master		The master update is completed.
	⋮	
Slave		The slave update is completed.

Parameters and settings

Individual parameters and settings are retained during a firmware update.

Switching on a slave with a different firmware version

If a slave with a different firmware version is switched on, the master interrupts operation, performs a cluster update and starts up together with the slaves.

12 Additional Functions

12.1 Load Shedding

If, over an extended period, the loads connected to the Sunny Island use more energy than that which the generators connected produce, the battery can deeply discharge. The Sunny Island shuts down automatically if the state of charge of the battery is too low. This way, the Sunny Island avoids a deep discharge of the battery. Due to the Sunny Island automatic shutdown, the loads are not supplied with current and the generators connected to the Sunny Island cannot charge the battery.

In stand-alone grid systems in which generators are connected directly via DC/DC converters, these generators charge the battery, even if the Sunny Island automatically shuts down. When the battery reaches a particular state of charge, the Sunny Island can carry out an automatic restart after the automatic shutdown. After the automatic restart, the generators connected to the Sunny Island can also charge the battery.

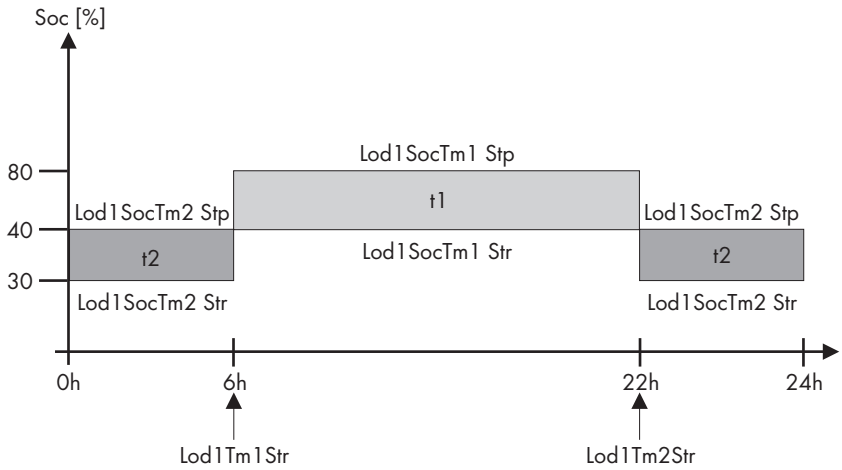
You can prevent the Sunny Island from automatically shutting down by installing a power contactor for load shedding. The power contactor automatically switches off the loads in the stand-alone system when the battery charge level is low. The Sunny Island continues operating and can charge the battery.

Install an external (AC or DC) power contactor between the Sunny Island and the loads (see also section 21 "Accessories" (page 216)).

NOTICE!

Faulty system operation due to lack of load shedding.

- Install an external load shedding contactor in case the stand-alone 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 consumers.
- Always switch off the consumers, never the energy generators (e.g., Sunny Boy)!



The figure shows an example of the settings if the load shedding function at night is to be avoided as much as possible. From 6:00 a.m. to 10:00 p.m., the load shedding is activated for a state of charge (SOC) of 40 %, during nighttime (from 10:00 p.m. to 6:00 a.m.). By contrast, the state of charge of the battery is allowed to go down to 30 % before the load-shedding contactor is activated.

The load shedding function can be assigned a total of two times. In the parameters mentioned above, the "Lod1" part represents the first assigned function and the "Lod2" part represents a second, identical function. These two battery state-dependant load-shedding functions allow a step by step load shedding where different load groups with different SOC values can be defined with different priorities.

Define the time intervals t1 and t2:

- Starting time t1: with the "242.05 Lod1Tm1Str" parameter, set the start time for t1 (and with it the end of t2).
- Starting time t2: with the "242.06 Lod1Tm2Str" parameter, 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"

12.2 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).

12.3 Time-Controlled Operation

The Sunny Island can be operated in a time-controlled manner 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. Using the "510.03 InvTmOpStrDt" parameter, you can specify the starting date, and using the "510.04 InvTmStrTm", you 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 from the specified start time (date and time).

12.4 Overload and Short-Circuit Behavior

The Sunny Island can be temporarily operated under overload conditions. It can also supply short-circuit currents.

In case of overload, the Sunny Island supplies an output of 6 500 W for 30 minutes and can supply 7 200 W for 5 minutes. The device can even supply 8 400 W of output power for one minute.

In the event of a short circuit, the Sunny Island provides a maximum current of 100 A (for 100 ms). This is sufficient to trip commercial 16 A B-type circuit breakers.

12.5 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.

Automatic start meter

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

Displaying messages

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

12.6 Automatic Frequency Control (AFC)

Clocks that depend on the stability of the grid frequency for their accuracy become increasingly inaccurate when there are constant frequency deviations. Frequency fluctuations, i.e., deviations from the nominal frequency occur, for example, in stand-alone grid systems that operate with a diesel generator.

The "Automatic Frequency Control (AFC)" function of the Sunny Island allows the use of grid-coupled clocks in these types of stand-alone grid systems. This function is activated using the "250.11 AfraEna" parameter.

The time deviation is compensated on average.

Quartz-controlled clock in the Sunny Island

The internal clock in the Sunny Island is quartz-controlled and thus operates correctly (within the tolerance limits). The adjustment refers to externally connected clocks that depend on the grid frequency.

12.7 Time-Controlled Standby

You can set the Sunny Island to standby mode in a time-controlled way. Activate the time-controlled standby using the parameter "250.13 SlpAtNgt". Set the parameter to "Enable".

After activation, set the start time and the stop time for standby. Carry out the setting using the "250.14 SlpStrTm" and "250.15 SlpStpTm" parameters.

12.8 Reaction in Case of Failures

You can influence how the Sunny Island reacts to failures occurring in a three-phase system using the "250.30 RnMod" parameter. The parameter is set to "RunAlways" at the factory. This means that the Sunny Island master ignores all faults at the slave devices.

If you set the parameter to "StopAlways", the system will be put in standby mode upon detection of a fault at the slave devices. Faults which can be removed via an autostart are not included.

13 Battery Management

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

- FLA
- VRLA
- NiCd

The battery capacity ("221.02 BatCpyNom" parameter) is to be entered as the nominal capacity for a ten hour discharge (C10). If this 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:

- 48 V (24 cells at 2 V each) in the case of lead batteries (FLA and VRLA)
- 45.6 V (38 cells at 1.2 V each) in the case of Nickel-Cadmium batteries

Failure of individual battery cells

If individual battery cells fail over several years of continuous operation, the nominal voltage can be set in the range from 42 V to 48 V (see 8.2 "Starting the Quick Configuration Guide (QCG)" (page 57)). Up to three individual cells can be removed and the system can still be further operated.

13.1 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 parameter "221.04 BatTmpMax"), a warning is displayed. If the maximum value for the battery temperature is exceeded, the Sunny Island switches off.

A warning is output if the value for lead-acid batteries falls below –10 °C for below –20 °C for NiCd batteries.

The battery temperature is taken into consideration when the charging voltage is calculated (see section 13.4 "Charge Control" (page 99)).

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 the battery has a 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.

13.2 Start Options

If the battery is replaced in a plant, the battery management system must be restarted and reconfigured. This can be done using the "Quick Configuration Guide QCG" (see section 8.2 ”Starting the Quick Configuration Guide (QCG)” (page 57)).

13.3 State of Charge / SOC and SOH

The Sunny Island has a very precise internal state of charge calculation (display value "120.01 BatSoc"). The procedure for calculating the state of charge 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.

When the full charge states are reached, the battery state of charge is reset to values of 90 %, 95 % or 100 %, depending on how full battery was actually charged. If default settings are not changed, a state of charge of 80 % after boost charge, 95 % after full charge and 100 % after equalization charge is reached.

Since full charge states are generally only rarely achieved during a grid failure, the operation used here can also utilize the battery voltage during constant discharge phases with low discharge currents to recalibrate the state of charge. 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 state of charge error (display value "120.11 BatSocErr") will provide you with continuous information on the accuracy of the battery state of charge 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.

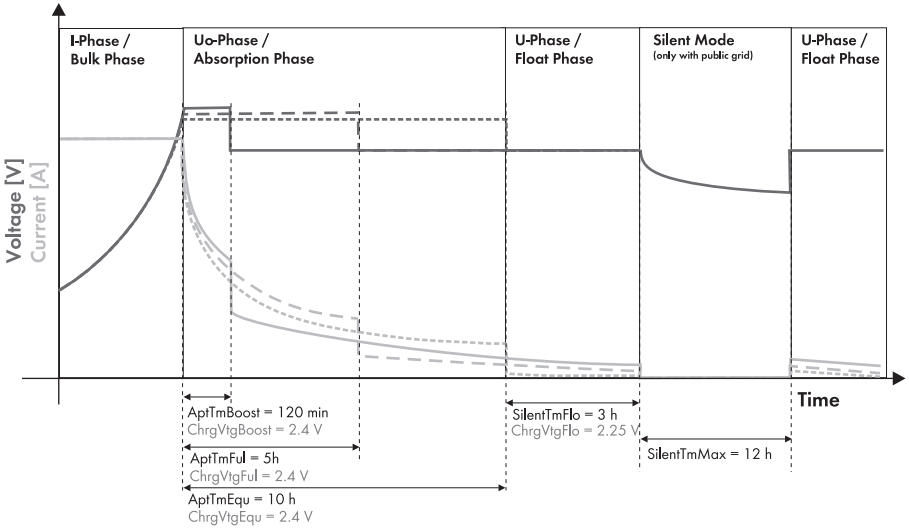
The battery's state of health (display value "320.01 Soh") is a measurement of the present useable capacity expressed as a percentage relative to the nominal capacity. 100 % means that the entire nominal capacity can be used. 50 % means that only half of the original nominal battery capacity can be used. 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.

13.4 Charge Control

The Sunny Island uses a 3-phase charge control, using the IUoU procedure. When operating with the power distribution grid, a fourth level, Silent Mode, is optionally available.

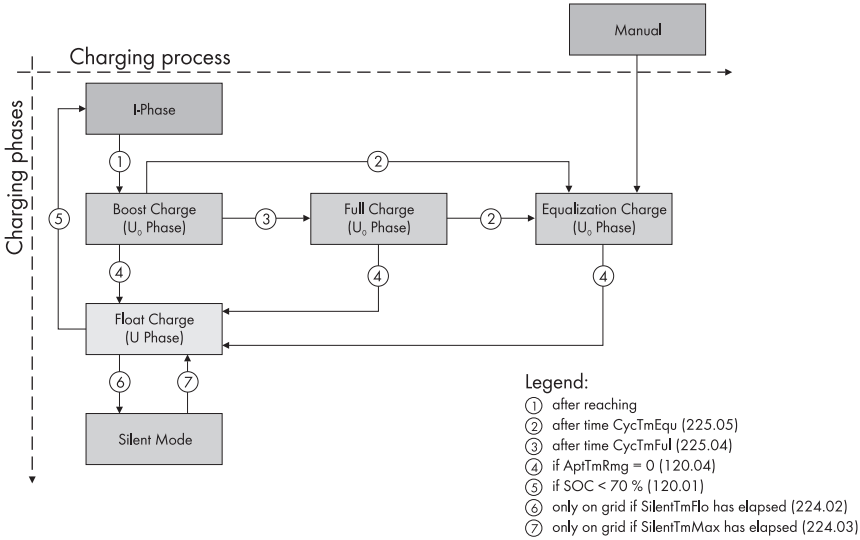


The I stands for the constant current phase (I phase). In this phase, the charging is limited by the maximum defined battery current (parameter "222.01 BatChrgCurMax"), the nominal grid current (parameter "232.03 GdCurNom") or the maximum AC charging current of the Sunny Island (parameter "210.02 InvChrgCurMax"). 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 13.4.1 "Boost Charge" (page 101) to 13.4.3 "Equalization Charge" (page 102). The remaining charging time (display value "120.04 AptTmRmg") of this phase and the actual 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 carries out constant voltage charging but at a greatly 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 power distribution grid, it can also switch from float charge into silent mode.

Changing the charging voltage

The charging voltage does not change erratically. Instead, it slowly changes to the new setpoint at a rate of approximately 0.5mV/cell*s when switching from constant voltage charging to float charge. This also happens if the setpoint is set 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 parameter "222.11 BatTmpCps".

13.4.1 Boost Charge

The boost charge is the most common charging process of the Sunny Island. The boost charge ensures a high generator workload 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 %.

13.4.2 Full Charge

Every 14 days or 8 nominal charge throughputs, the Sunny Island automatically initiates a full charge (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 state of charge of at least 95 % and rectify possible effects caused by an insufficient charge. Regular full charging approximately every 2 to 4 weeks can double the service life of the battery.

Change to a full charge

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.

More than 1% of the nominal battery capacity is discharged

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 charging device 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.

Parallel procedures for full charge

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

13.4.3 Equalization Charge

A battery bank consists of many individual battery cells connected in series which all behave slightly different. 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).

Change to an equalization charge

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.

More than 1 % of the nominal battery capacity is discharged

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.

External charging device

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

13.4.4 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.

Carrying out the equalization charge

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 plants which are only operated seasonally, manual equalization charges are required at the end or at the beginning of the season.

13.4.5 Silent Mode

In addition to the float charge, the silent mode can only be used ("224.01 SilentEna" parameter) when operating with the power distribution 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.

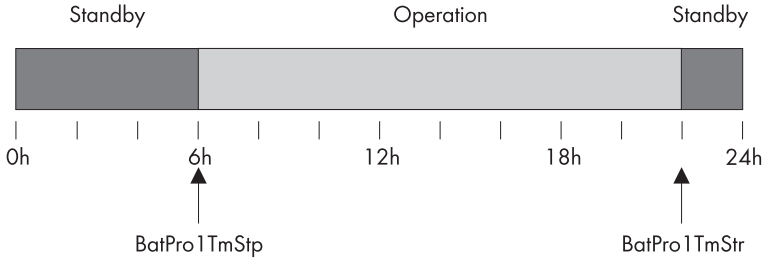
The silent mode is activated after the time set for float charge ("224.02 SilentTmFlo" parameter) has expired. The Sunny Island remains in silent mode for a fixed time ("224.03 SilentTmMax" parameter) or until the battery voltage per cell is 0.14 V lower than the set voltage ("222.10 ChrgVtgFlo" parameter). 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.

13.5 Battery Preservation Mode

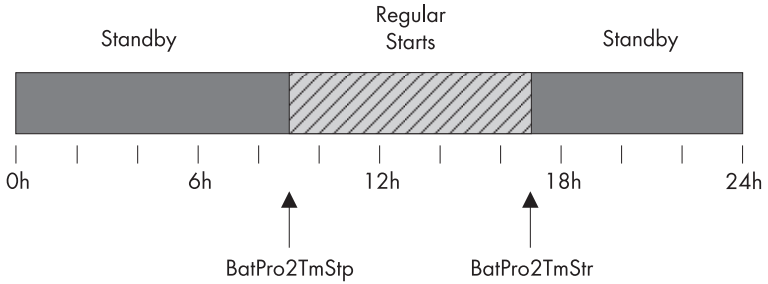
The Sunny Island has a sophisticated battery preservation mode. The battery preservation mode prevents deep discharge from the battery as far as possible when the energy supply is low, thus preventing a total system failure as well as damage to the battery.

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

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 "223.01 BatPro1TmStr" parameter and the stop time using the "223.02 BatPro1TmStp" parameter.



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 photovoltaic plants, 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".



Level 3: The third level ensures that the battery is protected from deep discharge and thus protected against damage. In this case, the Sunny Island is switched off completely. To start it, see section 9.5 "Reactivating the Device Following Automatic Shutdown" (page 64).

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

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

Parameter BatPro1Soc < BatPro2Soc

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 state of charge is designated for exiting this state.

Battery preservation mode LBM1 and LBM2 are 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, within 5 minutes (see above), charging current is detected, the Sunny Island continues to operate; otherwise, it switches off again.

13.6 Battery Diagnostics

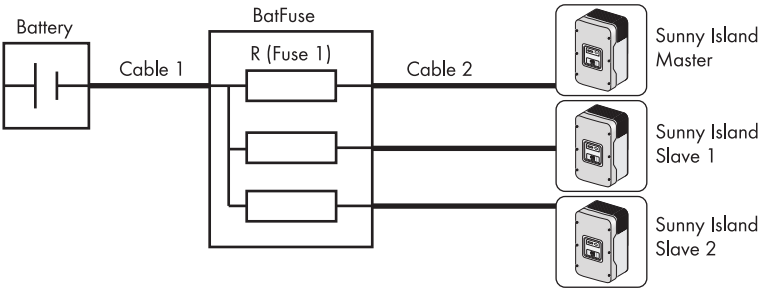
The "320# Battery Diagnosis" menu displays several values that provide information on the past operational behavior of the battery. These values are helpful in checking the efficiency of the set parameters and in viewing the typical operating conditions of the battery (see section 19.3 ”Diagnosis (300#)” (page 182)).

13.7 Battery Lead Resistance

In menu "221# Battery Property", you can specify the battery lead resistance (BatWirRes).
The resistance is the ohmic resistance from the battery to the input of the Sunny Island master device.
The default value of the parameter "221.06 BatWirRes" is 0 m Ω .

The resistance is made up of the resistance of line 1 + fuse + resistance of line 2:

R = R (line 1) + R (fuse 1) + R (line 2).



The following applies:

$$R = \rho \frac{l}{A}$$

ρ = specific resistance for copper $\rho = 0{,}018 \frac{\Omega \ mm^2}{m}$

L = length of cable in m

A = cross-section area of the conductor in mm^2

Batfuse

R (resistance 1) at the Batfuse is approx. 1 m Ω .

14 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 power distribution grid.

Both the generator as well as the power distribution grid are integrated through the AC2 connection of the Sunny Island. A single-phase or a three-phase connection is possible. In the case of 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 a generator or grid connections with a higher capacity.

Connecting in a single-phase parallel system:

When installing parallel 1-phase 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.

14.1 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 14.1.5 "Automatic Generator Operation" (page 114)).

Extended Generator Management

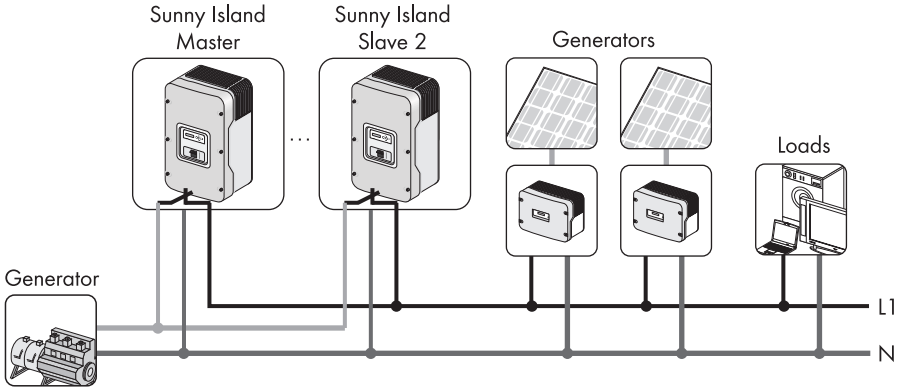
If necessary, the Sunny Island and generator supply consumers together. The total of the (nominal) power of both energy sources is available in the stand-alone grid.

14.1.1 Connecting in Parallel

In the case of Sunny Islands connected in parallel which operate on the same phase and in the same cluster, 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 current in the system is limited to 150 A:

Maximum number of Sunny Island	Maximum current
1 Sunny Island	56 A
2 Sunny Island	112 A
3 Sunny Island	150 A



Cable lengths and cross-sections

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

14.1.2 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

Automatically resetting the parameter "234.07 GnStrMod" to "Auto".

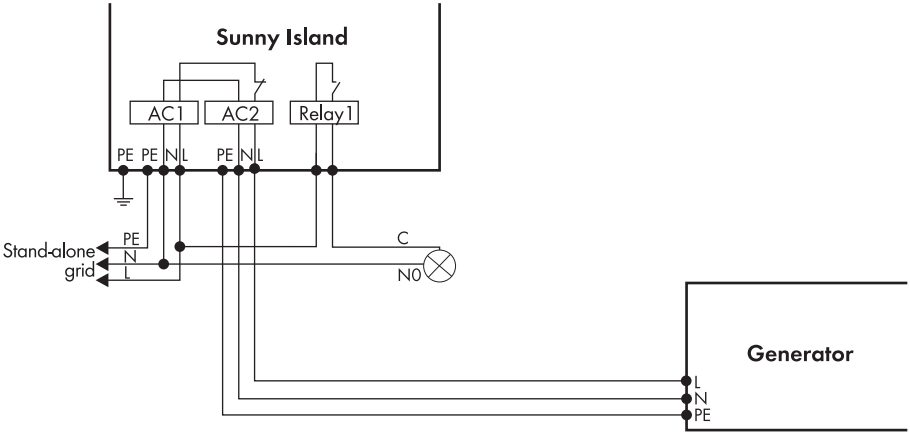
If the Sunny Island switches into "Standby" mode or an error occurs, the parameter "234.07 GnStrMod" is automatically switched to "Auto".

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, or similarly.

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 14.1.6 "Limits and Power Adjustment" (page 118)), 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.

GenReq signal

The GnReq signal (see 15 "Relays" (page 130)) 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 reset.

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 (15 minutes).

Disconnecting the generator

A disconnect should be positioned between the Sunny Island and the generator. If the generator is to be stopped, it is first manually disconnected using the disconnect and then it is stopped. This prevents actuation of the generator by the Sunny Island.

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 section 14.1.6 "Limits and Power Adjustment" (page 118)), 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 follow-up time has expired.

After-run

Autostart generators can have an internal after-run cycle that is only activated when the request has been disabled. This can extend the follow-up time accordingly.

Internal warm-up phase

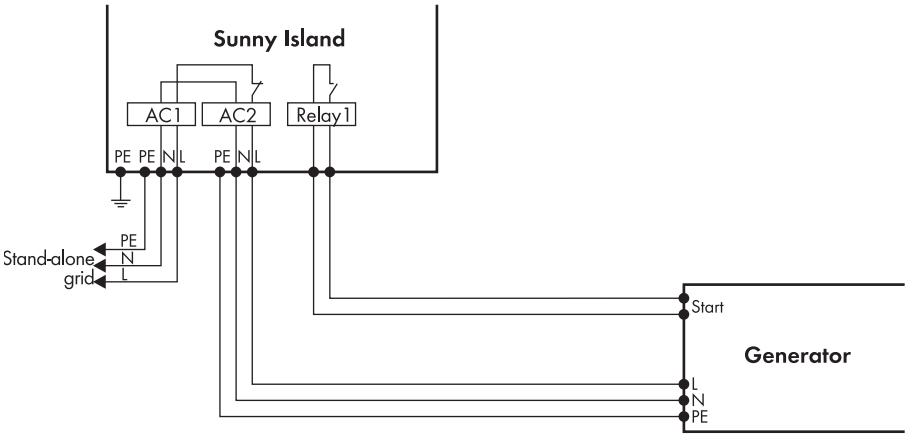
With some generator types, the voltage is only switched to the output after the internal warm-up phase is finished. Therefore, the time of the generator activation sequence is monitored internally.

- **Time for connection = 10 minutes for GenMan**

or

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

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 system is continued to be supplied.

Generator request

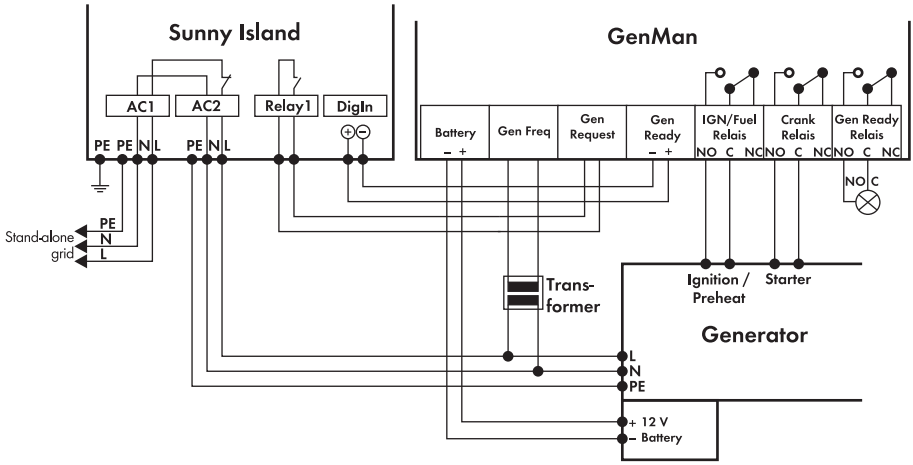
If the generator is running after being externally started and a generator request occurs, the GnReq signal is disabled until the generator is externally stopped again and the stop time has expired.

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 battery state of charge) are ignored.

The generator was started manually using GenMan.

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!

Occurrence of unpredictable operating states.

- Never carry out a manual start directly at the generator.
- Observe the indications in the GenMan manual.

14.1.3 Generator Operation

The Sunny Island allows automatic operation (depending on state of charge or load) (see 14.1.5 "Automatic Generator Operation" (page 114)). In addition, manual operation is also possible.

14.1.4 Manual Generator Operation

The manual operating modes for the generator management are tripped using the "540.01 GnManStr" parameter. Here, a distinction is made between the following operating modes:

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 manually stopped. 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.

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

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

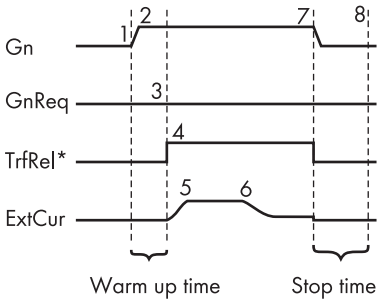
An equalization charge can be manually started using the "520.01 ChrgSelMan" parameter. This sets the battery management (see 13 "Battery Management" (page 97)) in the equalization charge state and the generator is requested. This request persists until equalization charge has been completed.

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

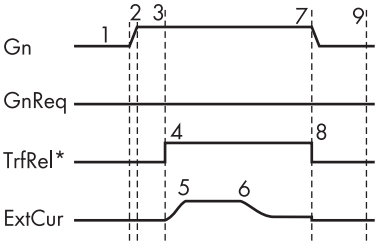
* Transfer relay



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

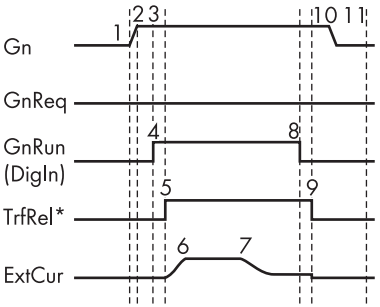
* Transfer relay



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 signals readiness for connection.
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 follow-up time expired, generator stop
11 Stop time has expired

* Transfer relay



14.1.5 Automatic Generator Operation

In automatic operating mode ("235.01 GnAutoEna" parameter), the Sunny Island automatically defines the settings (depending on battery state of charge or load) as to 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!

The Sunny Island changes to the operating mode "Stop/Lock" when stopped manually during automatic operation.

- 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).

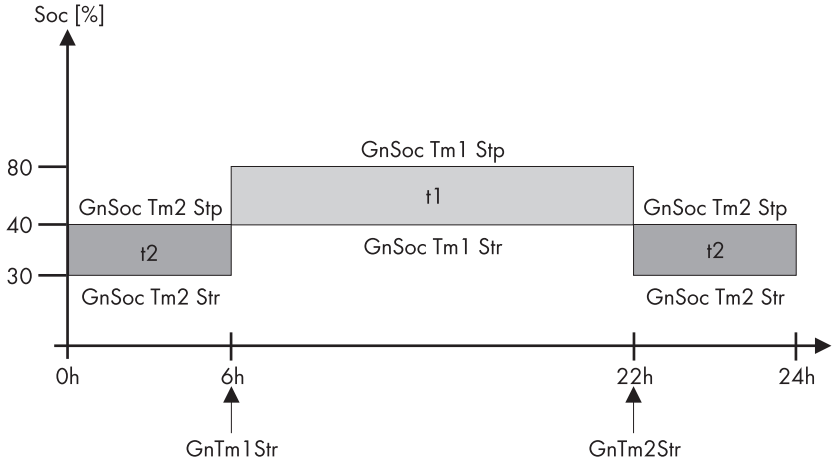
The time periods t1 and t2 are defined using the "235.07 GnTm1Str" and "235.08 GnTm2Str" parameters. The start time for t1 (and thus the end of t2) is defined using GnTm1Str, and the start time for t2 (end of t1) is defined using GnTm2Str.

GnTm1Str = GnTm2Str

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 state of charge at which the generator is started during the t1 time and GnSocTm1Stp designates the state of charge at which the generator is switched off during t1. The GnSocTm2Str and GnSocTm2Stp parameters are similarly defined during the time t2.

The following figure shows an example of the settings if operation of the generator at night is to be avoided as much as possible. From 6:00 a.m. to 10:00 p.m., the load shedding is activated for a state of charge (SOC) of 40 % during nighttime (from 10:00 p.m. to 6:00 a.m.). By contrast, the state of charge of the battery is allowed to go down to 30 % before the load-shedding contactor is activated.



Reaching the float charging process

If the float charging process (see section 13.4 "Charge Control" (page 99)) 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 "235.06 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 average time by which an average value for the consumer power is calculated 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.

Multi-phase System

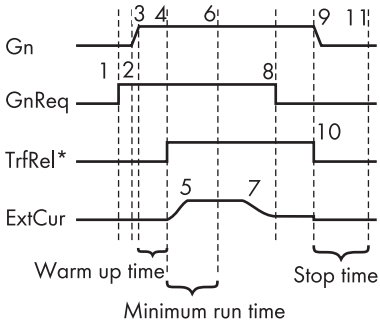
Only the total consumer power of all phases is monitored. Individual phases in a multi-phase system are not monitored.

The consumer power is calculated using the inverter 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:

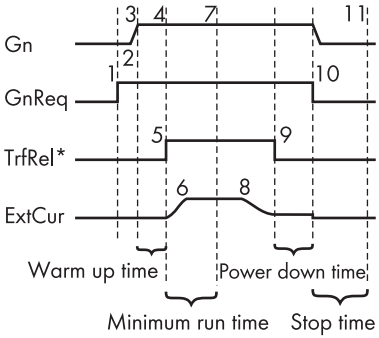
Generator Interface "234.07 GnStrMod" = Manual; Generator Request Via Sunny Island

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



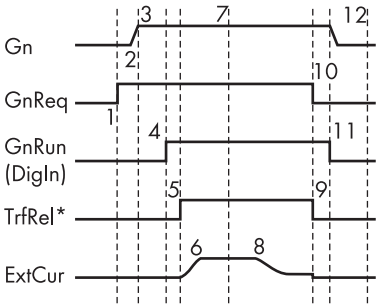
Generator Interface "234.07 GnStrMod" = Autostart; Generator Request Via Sunny Island

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 running time is expired
8 Current is reduced, battery absorption phase
9 Charging process is completed, generator disconnection
10 Generator follow-up time expired, generator disconnection
11 Stop time has expired



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 Charge process complete, generator disconnected by Sunny Island
10 Signal at GenMan
11 GenMan follow-up time has expired, generator stopped
12 Stop time has expired



Power-Dependent Generator Start

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

14.1.6 Limits and Power Adjustment

The voltage limits can be set using the "234.01 GnVtgMin" and "234.02 GnVtgMax" parameters and 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.

System voltage (AC)

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.

Generator disconnection by the master

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

Generator disconnection by a slave

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.

In this case, a monitoring period is running. Only after the time for the "234.12 GnWarmTm" parameter has expired and after voltage and frequency are determined to be valid does reconnection take place.

The Sunny Island burdens the generator at each phase with the current defined in the parameter "234.03 GnCurNom" as a maximum. The power that is not directly used by the consumers 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 target value, it is also reduced (absorption phase, see section 13.4 "Charge Control" (page 99)).

Value for "234.03 GnCurNom" parameter

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 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.

14.1.7 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 after-run phase (Cool). If this power-down phase is completed after the "234.10 GnCoolTm" time, the generator is stopped.

Follow-up time

The follow-up time ("234.10 GnCoolTm" parameter) defined on the Sunny Island should be set equal to or preferably greater than the follow-up 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 follow-up time is skipped.

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

Disabling the internal generator request

An internal generator request is disabled during the after-run 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.

Autostart meter

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.

Error state

The error state and the locked error state can be canceled by confirming 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 follow-up time (Cool)
- Remaining stop time after the follow-up time has expired (Lock)
- Remaining time in the error state (Fail)
- Remaining time in the locked error state (FailLock)

14.1.8 Operation Together with PV Inverters

NOTICE!

Incorrectly plant designs will result in excessive AC power of the PV inverter.

- The maximum AC output power of the PV inverters connected should not exceed 10 kW per Sunny Island.
- Observe the following:

  $P_{AC\ max}$ of the PV inverter = 2 x $P_{AC\ nom}$ of the Sunny Island

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 feeding-in generators (Sunny Boys) 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 system as a result of the grid limits being exceeded.

14.1.9 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 after-run time (Cool) is skipped. Afterwards, the system enters the stop time (Lock).

DANGER!

Danger to life due to high voltages.

The follow-up time depends on the generator type. During the follow-up time, there is still grid voltage at the loads.

- Wait until there is no voltage measurement.

Generators with manual start option

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

Generator start prevented

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".

14.1.10 Disturbances

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 follow-up time (Cool, parameter "234.10 GnCoolTm") is skipped and the system transitions into the minimum stop time (Lock). After reverse power, connection is blocked for at least "231.03 ExtLkTm" or "234.09 GnStpTmMin".

Reverse power

Observe the reverse power which the Sunny Island can generate. The generator must provide this protection, observe the indications of the generator manufacturers regarding this!

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 enters 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

You can influence the behavior of the cluster upon failure of a slave device. For more information, see section 12.8 "Reaction in Case of Failures" (page 96).

14.2 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 power distribution grid and stand-alone grid system are connected or a power distribution grid and stand-alone grid system are disconnected. The operating mode of the Sunny Island is derived from this. If the stand-alone grid power system is disconnected, the Sunny Island alone is responsible for powering this stand-alone grid system. If the power distribution grid is connected to the stand-alone grid system, the stand-alone grid system is powered from the power distribution grid. In this case, the voltage and frequency in the stand-alone grid are identical with the power distribution grid.

Operating mode "Grid Charge"

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

14.2.1 Voltage and Frequency 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.

Default settings

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

- For 230V_50Hz: DIN VDE 0126-1-1 (not entirely)
- For 220V_60Hz: UL1741

NOTICE!

For legal reasons, when operated while connected to the power distribution grid, the Sunny Island must be equipped with a certified automatic disconnection device.

The Sunny Island does not comply with the VDE 0126-1-1 directive requested in Germany. Observe the following for legal reasons:

- When operated while connected to the power distribution grid, the Sunny Island must be equipped with a certified automatic disconnection device.

14.2.2 Starting the Sunny Island

The Sunny Island always starts in stand-alone grid operation. Once the device is operating, it checks for the presence and validity (voltage and frequency) of the external grid.

14.2.3 Stand-Alone Grid Operation

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

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

14.2.4 Grid Reconnection

In stand-alone grid operation, the Sunny Island constantly checks whether the grid has been reconnected (see above). The following conditions have to be fulfilled to guarantee that the Sunny Island synchronizes with the supply grid and connects to the supply grid:

- The frequency of the power distribution grid has to be between the values of the "232.05 GdFrqMin" and "232.06 GdFrqMax" parameter for the time defined in the "232.07 GdVldTm" parameter.
- The voltage of the power distribution grid has to be between the values of the "232.01 GdVtgMin" and 5V below the "232.02 GdVtgMax" parameter for the time defined in the "232.07 GdVldTm" parameter.

14.2.5 Grid Operation

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

Grid failures

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

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 system. For this, the power distribution grid is disconnected (grid replacement 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 changes to float charge (Float) (see section 13.4 "Charge Control" (page 99)).

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 13.4.5 "Silent Mode" (page 103)).

The silent mode is exited regularly to recharge the battery.

In a single-phase parallel system, the grid failure is not detected on the individual Sunny Island. This reaction occurs if the Sunny Island is individually fuse-protected on the grid side and the individual fuses are separately tripped.

Feeding Operation

Whether energy is fed from the stand-alone grid system into the power distribution grid is controlled using the "232.08 GdMod" parameter.

In all cases, make sure to consult your network operator if grid feed-in is possible.

If GridCharge (Default) is set, no energy is fed into the grid. If GridFeed is set, energy is fed into the grid.

Feeding into the grid on the DC side

In order to allow electricity to be fed from the DC side into the grid, the battery voltage in a charged battery (on the grid) must be increased by external DC chargers or the Sunny Island Charger 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 14.1.6 "Limits and Power Adjustment" (page 118).

14.2.6 Grid Failure

A grid failure is characterized by the voltage or frequency being outside of the permissible limits (see section 14.2.4 "Grid Reconnection" (page 124)) or the power distribution grid being disconnected. In this case, the time limits are relevant: Smaller deviations are permitted for longer than large deviations (see section 14.2.1 "Voltage and Frequency Limits" (page 123)).

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

Waking up from the silent mode

If the Sunny Island is in silent mode when there is a power distribution grid failure, there is a short grid failure in the stand-alone grid (see section 13.4.5 "Silent Mode" (page 103)).

14.2.7 Disturbances

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 on 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).

Slave Device Failure

If a slave device fails, the system continues to operate using the remaining devices of the cluster.

14.2.8 Limits and Power Adjustment

The Sunny Island burdens the grid at each phase with the current defined in the parameter "232.03 GdCurNom". The power that is not directly used by the consumers 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 target value, it is also reduced (see section 13.4 "Charge Control" (page 99)).

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

Silent mode active

When silent mode is activated, the grid cannot be supported!

The grid may temporarily fail. This way, the voltage fed to the loads will be interrupted for a short time.

14.2.9 Operation Together with PV Inverters

Since electricity is fed into the grid through the 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 power distribution grid if the reverse power limit is exceeded.

NOTICE!

Damage to the Sunny Island due to high currents.

If the current via the relay exceeds the maximum permissible current, the Sunny Island disconnects from the grid (relay protection).

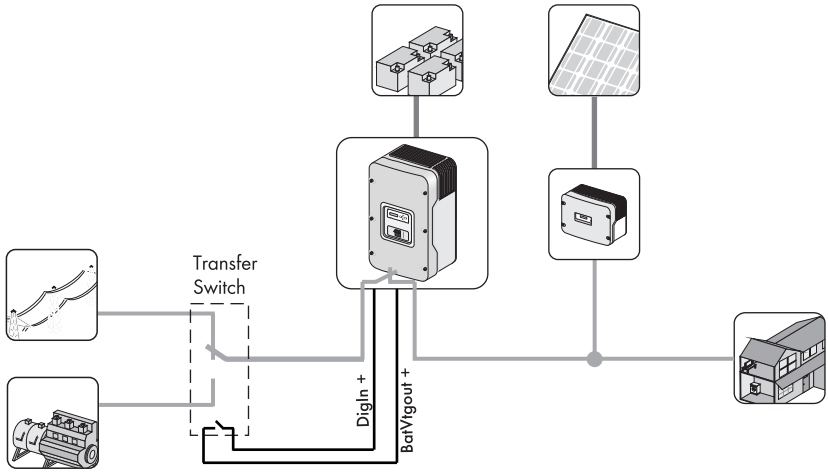
- The quantity of PV output installed in the stand-alone grid must never exceed the maximum quantity allowed by the AC input (see section 22 "Technical Data" (page 217)).

If the battery is fully charged, the frequency limits the power output of the AC feeding-in generators (PV inverter) 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 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 are disconnected from the stand-alone grid system as a result of the grid limits being exceeded.

14.3 Generator and Grid

In addition to the power distribution 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 common solution in such cases is using a transfer switch, which can be purchased as a manual or automatic switch. By using such a switch, a diesel generator is connected to the AC2 connection, to which the power distribution grid is normally connected, as displayed in the figure below:



To use such a switch, carry out the installation as follows.

NOTICE!

Destruction of the Sunny Island due to abrupt switch from power distribution grid to generator and vice versa.

- If an automatic switch is installed, make sure that it completely disconnects the Sunny Island from the grid and from the generator for at least 5 seconds.
- If a manual switch is installed, leave the switch in OFF-position for at least 5 seconds before switching to the new position.
- Upon request to the SMA Serviceline, you can obtain the manual on how to install a switch for connecting the Sunny Island to the power distribution grid and to a generator.

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 power distribution grid or whether it must manage a diesel generator.

To enable such a kind of operation, you must set the "231.05 ExtSrc" parameter to "GenGrid" (see section 8.2 "Starting the Quick Configuration Guide (QCG)" (page 57)).

Settings performed on the generator and grid

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

15 Relays

The Sunny Island offers you several options for the control of internal and external processes. For this purpose, two relays are integrated into the device, to which you can assign functions using the parameters "241.01 Rly1Op" and "241.02 Rly2Op".

You can find more information on both relays in section 6.4.4 "Multi-function Relay 1 and 2" (page 45). The different settings have the following meanings:

Function/Setting	Meaning	Function 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	The generator is automatically activated due to set criteria (see section 14.1.5 "Automatic Generator Operation" (page 114)).
AutoLodExt	Automatic load shedding dependent on an external source	Automatic connection / disconnection of loads. Connection occurs if the device is connected to an external source (e.g. generator), or if the Lod1Soc limits are exceeded. See section 12.1 "Load Shedding" (page 92).
AutoLodSoc1	Auto LoadShedding Soc1	Automatic connection / disconnection of loads. Connection only if Lod1Soc limits are exceeded. See section 12.1 "Load Shedding" (page 92).
AutoLodSoc2	Auto LoadShedding Soc2	Automatic load disconnection. Connection only if Lod2Soc limits are exceeded. See section 12.1 "Load Shedding" (page 92).
Tm1	Timer 1 (time-controlled switching of relay 1)	Programmable timer (once, daily, weekly) with duty cycle.
Tm2	Timer 2 (time-controlled switching of relay 2)	Programmable timer (once, daily, weekly) with duty cycle.
AptPhs	Absorption phase is active	Relay switching when battery charge is in absorption phase.
GnRn	Generator active	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.

Function/Setting	Meaning	Function description
GdOn	Power distribution grid	Relay switching when power distribution grid is available and connected.
Error	Error	Sunny Island has a fault; in case of fault, contact is open (relay is deactivated).
Warn	Warning	The Sunny Island has warning pending.
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).
MccBatFan	Multicluster battery fan	Relay is used for automatic battery room ventilation (switching the fan).
MccAutoLod	Multicluster auto loadshedding	Automatic connection/disconnection of loads due to an extension cluster in the Multicluster system.
CHPReq	CHP plant request	Request of the CHP plant through the CHP plant control
CHPAdd	Request additional CHP plant	Request of additional CHP plant through the CHP plant control
SiComRemote	Remote control via SI Com module	Currently unavailable
Overload	Overload	When using the Sunny Island's output limitation (temperature-dependent), the relay opens.

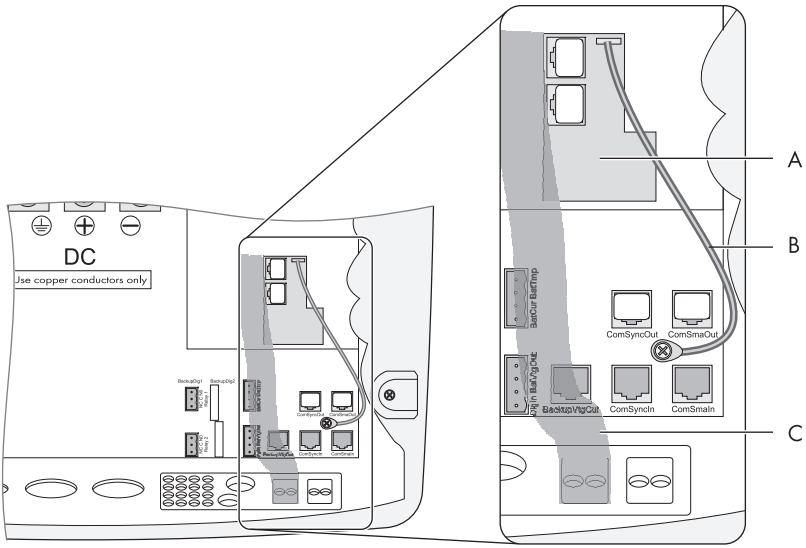
16 Multicluster Operation

16.1 Communication between the Sunny Island

For increased output, up to 12 Sunny Island clusters can be interconnected to form a Multicluster system. Within each cluster, a communication cable connects the master to the slaves. Each cluster is connected to the others via another communication cable, connected to the respective master.

The Multicluster Piggy-Back (MC-PB) is inserted in the Sunny Island at the external communication socket. A grounding conductor is provided with the Multicluster Piggy-Back. It must be connected as displayed in the graphic.

For orientation, refer to the following figure:



Position	Description
A	Multicluster Piggy-Back (MC-PB)
B	Connection of the PE cable
C	Cable route

Electrostatic discharge

Electrostatic discharges are an acute danger to the Sunny Island and to the communication interface. Ground yourself before removing the communication interface from the packaging, and before touching any components within the Sunny Island. To achieve this, touch PE.

RJ45 Cable

The RJ45 communication cable is a standard Cat5e-FTP cable (simple shielding), with gold contacts.

Each Multicluster Piggy-Back (MC-PB) is delivered with one yellow and one gray RJ45 communication cable and two plugs (termination resistors).

You require the yellow cable to establish communication between the master of the main cluster and the masters of the extension clusters.

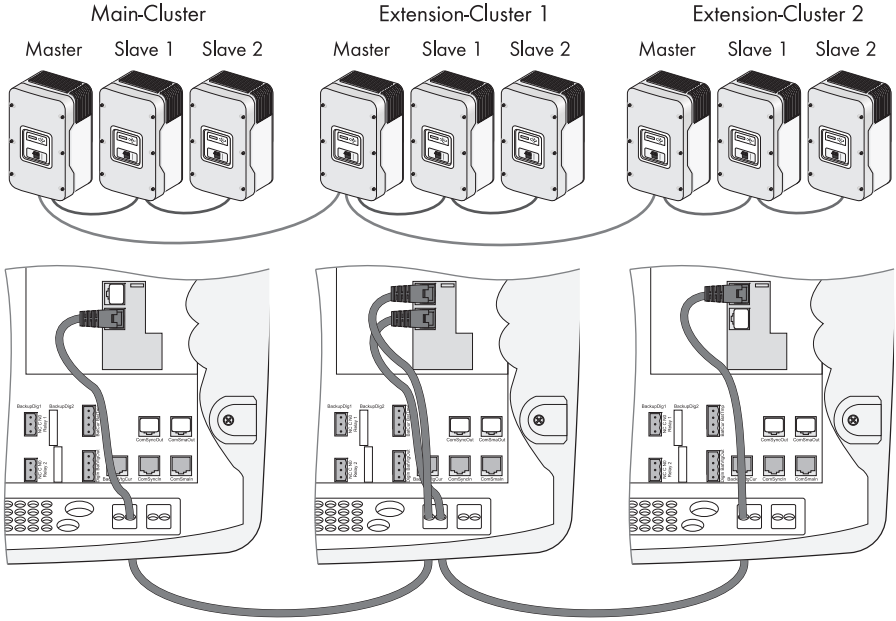
The gray cable is used for external communication (via RS485) needed for the system monitoring (Sunny WebBox).

Multicluster Piggy-Back

If just one cluster is used in connection with an MC-BOX, no Multicluster Piggy-Back is required.

Proceed as follows when connecting the communication cable:

1. Remove the left of the two plugs in the rubber connection area.
2. Feed the RJ45 cable from the outside through the plugs inside the Sunny Island master.
3. Plug the RJ45 plug in the lower socket. The termination resistor remains plugged in the upper one.
4. Lead the RJ45 cable into the next Sunny Island and connect it to the upper socket there.
5. Insert the termination resistor into the lower socket if no other Sunny Island will be connected.
6. Wrap the rubber plug (depending on the number of cables with one or two feed-throughs) around the RJ45 cable.
7. Insert the plug in its designated opening in the rubber connection area.



16.2 Initial Start-up of the Multicluster System

1. Carry out steps 1 - 3 in section 8.2 ”Starting the Quick Configuration Guide (QCG)” (page 57).
2. At "**New System**" set the following parameters:
   - Device type (master, slave 1, slave 2, slave 3)
   - Voltage/frequency type (230V_50Hz, 220V_60Hz), default setting: "230V_50Hz"
   - System configuration (3Phase, 1Phase 1, 1Phase 2, 1Phase 3, 1Phase 4, MC-Box), for Multicluster operation choose "MC-Box". Default setting: "1Phase 1"
   - Multicluster configuration (MainCluster, ExtensionClst1, ExtensionClst2, ExtensionClst3, ExtensionClstN), default setting is "MainCluster"
   - Box type choice (MC-Box-6, MC-Box-9, MC-Box-12), preset: "MC-Box-6"
3. For the other settings proceed as described in section 8.2 ”Starting the Quick Configuration Guide (QCG)” (page 57) under point 3.

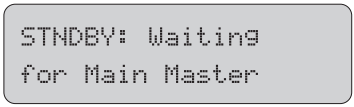
16.3 Switching a Multicluster System On and Off

16.3.1 Activation / Startup

Switching on a Multicluster system can only take place at the master of the main cluster. The extension clusters will be started automatically after starting the main cluster. To do this, the DC circuit breakers of all Sunny Islands in the extension cluster must be set to "ON".

Proceed as follows:

1. Carry out steps 1 - 4 in section 9.1 "Switching On" (page 62) on the master of the main cluster.
   ☑ The extension cluster masters show the following:



2. Press and hold <ENTER> on the main cluster master.
   ☑ The remaining time is displayed as a bar.

☑ A beep is heard. The main master is on and in operation. The green LED is on.

Starting the Multicluster system

The Multicluster system is started once the main master has started. All extension clusters follow the main master.

Error occurrence

If the device displays an error message unexpectedly, this error must be fixed before the Sunny Island can be put into operation. For this purpose, refer to section 20 "Troubleshooting" (page 194).

16.3.2 Stopping and Switching Off

The Sunny Island Multicluster system can only be stopped at the master of the main cluster. Proceed at the main cluster master as described in sections 9.2 "Stopping the Sunny Island (Standby)" (page 63) and 9.3 "Switching Off" (page 64).

16.4 Generator Operation

The main master's generator request comprises its own request (based on SOC, time, etc.) and possible requests from one or more extension clusters. The generator remains in a requested state as long as a request is present.

Generator request

The established generator request at the extension clusters is transferred to the main master via a communication connection.

16.5 Behavior with Different Charge States

In Multicluster systems, each cluster has its own battery bank. To prevent the charge states of the various battery banks from diverging over time, a function for equalization of the charge states is integrated into the Sunny Island devices. This distributes the power to all clusters, however, it is not always distributed identically. Instead, the cluster with the highest state of charge discharges the most power or charges the battery with the lowest power.

The differences in power depend on the difference in the state of charge and total 1 % of the nominal power for each 1 % of difference in the state of charge. Thus, when initial charge states differ, equalization of the charge states over the course of time is ensured. If all batteries in the various clusters have the same capacity, the charge states should always be within a few percent of each other. Only if a fault occurs, or upon deliberate deactivation of individual clusters, can a greater imbalance arise, but even so, such an imbalance should also be equalized after one day at the latest.

Nominal capacity of the battery banks

Ideally, the various battery banks should all have the same nominal capacity.

If the nominal capacity varies by up to 30 %, a similar average state of charge is ensured via the equalization function. However, the smallest battery is then cycled more intensively. The rated output power and overload capability are no longer the value of an individual device multiplied by the number of devices. Instead, it is 10 % – 20 % lower for the cluster with the smaller battery.

16.6 Communication Test

Using the parameter "510.08 TstClstCom" a communication test between the clusters can be started from each master device of a cluster. Switch only one master device of the extension cluster to "Transmit".

The parameter "510.09 ClstComStt" delivers the status of the test. Query this parameter at all master devices, including the transmitting device. If the communication test is successful, the status "OK" appears.

16.7 Automatic Frequency Control (AFC)

In Multicluster operation, automatic frequency control (AFC) can only be activated at the main master. This function is activated using the "250.11 AfraEna" parameter.

16.8 Updating the Firmware

Stopping the Sunny Island

It is recommended to stop the entire cluster network, and to deactivate the loads insofar as this is possible.

DC circuit breaker

Do not activate the DC circuit breaker during update process!

Carry out the update on all masters of the individual clusters via an SD card. All extension masters must have completed their updates! The message shown on the right is displayed.

After the update of the masters has been carried out, carry out an automatic update of the slaves.

Starting the Multicluster system

Start the system only after the firmware on all Sunny Island devices has been updated.

16.9 Error Handling in a Multicluster System

For Multicluster system operation, the entire main cluster is always required. If a device in the main cluster fails (master and/or slave), this causes the main cluster to stop.

If the main cluster is stopped – whether due to a fault, or otherwise – this causes the extension clusters to stop, and thus the entire Multicluster system.

For operation of an extension cluster, it is necessary that at least the master device (of the extension cluster) is in operation. If a slave device in the extension cluster fails, this does not cause the master device to stop.

The devices in an extension cluster are only started up if the respective device detects a voltage when starting.

16.10 Grid Operation

In Multicluster systems, operation with the Sunny Island special grid parameters is not possible. The grid can be incorporated with the generator settings.

16.11 Generator Emergency Operation

If a Multicluster system fails, manual operation via the generator is possible. For this purpose, the generator must be started manually, directly at the generator. As soon as a voltage is present, the Multicluster Box connects the generator through to the loads, without a Sunny Island being in operation.

17 PV Inverters in Stand-alone Grid Systems

You will find further information on "selecting and using PV inverters in stand-alone grid and back-up systems" in the download area at www.SMA.de/en.

To operate the a PV inverter in a Sunny Island system, you must set the PV inverter parameter to stand-alone grid operation.

Depending on the device type, you can set the PV inverter to "stand-alone grid operation" using Sunny Boy Control, Sunny WebBox, Sunny Data Control or Sunny Explorer.

Changing grid-relevant parameters

To change grid-relevant parameters on the PV inverter (Sunny Boy, Sunny Mini Central or Sunny Tripower) you need a personal access authorization, the SMA Grid Guard password. Call the SMA Serviceline to obtain your personal SMA Grid Guard password.

DANGER!

Feedback may occur if the power distribution grid fails. Death or serious burns when working on the power distribution grid.

If you set the PV inverter to stand-alone grid operation, it does not fulfill any country-specific standards and regulations. Therefore, in the event of outage of the power distribution grid, there is a danger of back feed.

- **Never** operate the PV inverter directly on the power distribution grid when set to stand-alone grid operation.

17.1 Setting Stand-alone Grid Operation

If the PV inverter is not set ex works, you must set the PV inverter to stand-alone grid operation at the installation location.

You have several possibilities to set the PV inverter to stand-alone grid operation:

- Setting via rotary switch (only within the first 10 operating hours)
- Setting via Sunny Boy Control, Sunny WebBox
- Setting via Sunny Data Control

You can only carry out the setting via the rotary switch on the PV inverter within the first 10 operating hours. Thereafter you must carry out the setting via Sunny Boy Control or Sunny Data Control.

17.1.1 Setting via Rotary Switch with SB 3000TL/4000TL/5000TL.

1. Set the rotary switch, A, with a screwdriver (2.5 mm) to position "E".
2. Set the chosen language via the rotary switch B with a screwdriver (2.5 mm). You can find the configuration of the switch in the manual of the PV inverter.

☑ Stand-alone grid operation and the desired language have been set.

17.1.2 Setting via Rotary Switch with SB 2000HF/2500HF/3000HF and STP 10000TL/12000TL/15000TL/17000TL

1. Set the rotary switch, A, with a screwdriver (2.5 mm) to the desired position:
   - Position "D" = Stand-alone grid operation at 60 Hz
   - Position "E" = Stand-alone grid operation at 50 Hz
2. Set the chosen language via the rotary switch B with a screwdriver (2.5 mm). You can find the configuration of the switch in the manual of the PV inverter.

☑ Stand-alone grid operation and the desired language have been set.

17.1.3 Setting via Communication or Software

You can set the PV inverter to stand-alone grid operation (OFF-Grid) via communication or software.

Depending on the device type, the stand-alone grid operation (OFF-Grid) is set using the parameter "CntrySet", "Set country standard" or "Default". Carry out the parameter change as described in the manual of the communication device or of the software.

Setting the parameter "CntrySet" or "Set country standard"

The setting to stand-alone grid operation using the parameter "CntrySet" or "Set country standard" can only be performed with the following PV inverters:

- SB 3000TL/4000TL/5000TL
- SB 2000HF/2500HF/3000HF
- STP 10000TL/12000TL/15000TL/17000TL

Setting the "Default" parameter

The setting to stand-alone grid operation using the parameter "Default" can only be performed with the following PV inverters:

- SB 1200, SB1700, SB 2500, SB 3000, SB 3300, SB 3800, SMC 4600A, SMC 5000A, SMC 6000A, SMC 7000HV, SMC 6000TL, SMC 7000TL, SMC 8000TL, SMC 9000TL, SMC 10000TL, SMC 11000TL

After you have set the PV inverter to stand-alone operation, the following PV inverter parameters automatically change:

No.	Parameters	Unit	Value
1	I-NiTest	mA	Off (MSD = 0)
2	Vac-Min	V	180
3	Vac-Max	V	260
4	Fac-delta– Lower range in which the PV inverter is active relative to f_0	Hz	– 4.5 (starting from base frequency f_0)
5	Fac-max+ Upper range in which the PV inverter is active relative to f_0	Hz	+4.5 (starting from base frequency f_0)
6	dFac-Max Maximum rate of change	Hz/s	4
7	Fac-start delta Frequency increase in relation to f_0, at which point the power adjustment via frequency begins	Hz	1 (starting from the base frequency f_0)
8	Fac-Limit delta Frequency rise based on f_0, where the power control via frequency ends. The PV inverter power is 0 W.	Hz	2 (starting from the base frequency f_0)

17.2 Use of SB 3000TL/4000TL/5000TL in 60 Hz Grids

The SB 3000TL/4000TL/5000TL do not perform an automatic grid frequency detection.

Switching to stand-alone grid operation using the rotary switch does not change the frequency. The PV inverters continue to function with a frequency of 50 Hz.

If you want to use the PV inverters in a 60 Hz grid, you must carry out the change from 50 Hz to 60 Hz manually. You can carry out the setting via communication or software:

1. Set the parameter "FrqCtl.hLim" or "Frequency monitoring lower maximum threshold" to "65".
2. Set the parameter "FrqCtl.Max" or "Frequency monitoring upper maximum threshold" to "65".
3. Set the parameter "FrqCtl.lLim" or "Frequency monitoring upper minimum threshold" to "55".
4. Set the parameter "FrqCtl.Lim" or "Frequency monitoring lower minimum threshold" to "55".

☑ The PV inverter is set to a 60 Hz grid.

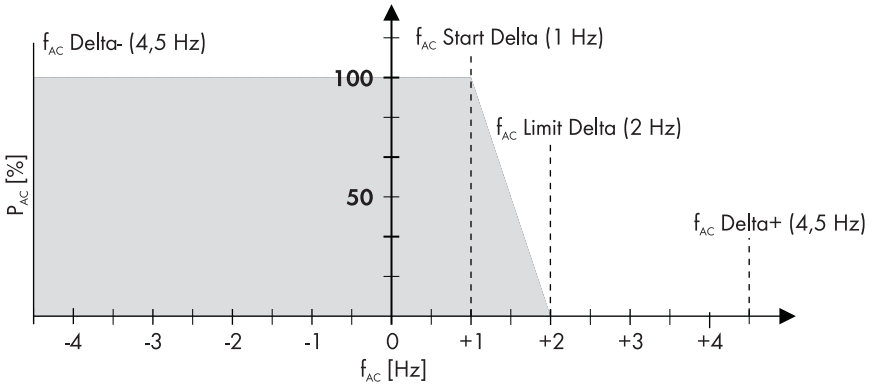
17.3 Frequency Shift Power Control (FSPC) - Power Adjustment of the PV Inverter via Frequency

This section describes the operating principles of the power adjustment of the PV inverters via frequency (Frequency Shift Power Control - FSPC).

If PV inverters are connected to the AC side of the stand-alone grid, the Sunny Island must be able to limit their output power. This situation can occur when, e.g., the Sunny Island battery is fully charged and the (solar) power available from the PV array exceeds the power required by the connected loads.

To prevent the excess energy from overcharging the battery, the Sunny Island 5048 recognizes this situation and changes the frequency at the AC output. This frequency adjustment is analyzed by the PV inverter. As soon as the grid frequency increases beyond the value specified by "Fac-Start delta", the PV inverter limits its output power accordingly.

This function is shown in the following figure:



The different settings have the following meanings:

- f_{AC} = 0 refers to the base frequency of the micro grid created by the Sunny Island.
- f_{AC} Delta– and f_{AC} Delta+ refer to the maximum range in which the PV inverter is active relative to f_{AC} = 0. Fac-delta– and Fac-delta+, for example.
- f_{AC} Start Delta is the frequency increase relative to f_{AC} = 0, at which point the power adjustment via frequency begins.
- f_{AC} Limit Delta is the frequency increase relative to f_{AC} = 0, at which point the power adjustment via frequency ends. The power of the PV inverter at this point is 0 W.

If the value is below the f_{AC} Delta– limit or exceeds the f_{AC} Delta+ limit, the PV inverters disconnect from the grid.

When FSPC is activated and the diesel generator in the stand-alone grid is operating, the diesel generator determines the frequency, and the PV inverters react to certain changes in the diesel generator frequency. The diesel generators generally operate at 50 Hz under load. For this reason, in most cases the PV inverters will deliver their entire power to the stand-alone grid, even when the generator is running.

If the current battery voltage (V_{Bat}) is greater than the nominal battery voltage ($V_{Bat, nom}$) and is also to be synchronized with an external source (generator), the Sunny Island temporarily increases the frequency and disconnects the PV inverters using the frequency shutdown method (overfrequency). Afterwards, it synchronizes with the generator.

18 Maintenance and Care

The Sunny Island has been constructed for low maintenance. Thus, the necessary work is limited to only a few points.

18.1 Enclosure

Check that the Sunny Island enclosure 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. Never use solvents, abrasives or corrosive materials for cleaning!

18.2 Cleaning the Fans

The cleaning intervals depend on the ambient conditions. If the fans are covered with loose dust, you can clean them with the aid of a vacuum cleaner (recommended) or a soft paint brush/hand brush. Clean the fans only when at a standstill. If it is necessary to replace the fans, please contact your installer.

18.3 Display

It is best to clean the control elements with a soft, damp cloth. Never use solvents, abrasives or corrosive materials for cleaning!

Take care not to accidentally press the membrane buttons during cleaning. Only clean the membrane keypad when the Sunny Island is deactivated.

18.4 Function

Check regularly whether fault indications are present. If an error message is displayed, for which you cannot identify any apparent cause, the stand-alone grid 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.

18.5 Battery

Inspect and maintain the battery at regular intervals. In this regard, observe all of the battery manufacturer's specifications.

18.6 Disposal

Dispose of the Sunny Island at the end of its service life in accordance with the disposal regulations for electronic waste which apply at the installation site at that time. Alternatively, send the devices back to SMA Solar Technology with shipping paid by sender, and labeled "ZUR ENTSORGUNG" ("FOR DISPOSAL") (section 23 "Contact" (page 220)).

19 Parameter lists

19.1 Display Values

All parameters contained in this section are display values. These parameters can only be read. The parameters with a gray background are only visible after the installer password has been entered. You will find an overview of the menu structure in section 10.1 "Menu Structure" (page 67).

19.1.1 Inverter Meters (110#)

111# Inverter Total Meters

Number	Name	Description
01	TotInvPwrAt	Total active power of the inverters (cluster) in kW
02	TotInvCur	Total current of the inverters (cluster) in A
03	TotInvPwrRt	Total reactive power of the inverters (cluster) in kVAr

112# Inverter Device Meters

Number	Name	Description	Value (plain text no.)	Explanation
01	InvOpStt	Operating state of the Sunny Island	Standby (2)	Standby
			Run (3)	Operation
			EmCharge (4)	Emergency charge mode
			Error (5)	Error
			Startup (1)	Transfer standby > operation
02	InvPwrAt	Active power Sunny Island in kW		
03	InvVtg	Voltage of the Sunny Island in V		
04	InvCur	Current of the Sunny Island in A		
05	InvFrq	Frequency of the Sunny Island in Hz		
06	InvPwrRt	Reactive power of the Sunny Island in kVAr		
07	Rly1Stt	State of relay 1	Off	Relay open
			On	Relay closed
08	Rly2Stt	State of relay 2	Off	Relay open
			On	Relay closed

113# Inverter Slave1 Meters

Number	Name	Description	Value	Explanation
01	InvOpSttSlv1	Operating state of the Sunny Island slave 1	Standby	Standby
			Run	Operation
			EmCharge	Emergency charge mode
			Error	Error
			Startup	Transfer standby > operation
02	InvPwrAtSlv1	Active power Sunny Island slave 1 in kW		
03	InvVtgSlv1	Voltage of the Sunny Island slave 1 in V		
04	InvCurSlv1	Current of the Sunny Island slave 1 in A		
05	InvPwrRtSlv1	Reactive power of the Sunny Island slave 1 in kVAr		
06	Rly1SttSlv1	State of relay 1 on Sunny Island slave 1	Off	Relay open
			On	Relay closed
07	Rly2SttSlv1	State of relay 2 on Sunny Island slave 1	Off	Relay open
			On	Relay closed

114# Inverter Slave2 Meters

Number	Name	Description	Value	Explanation
01	InvOpSttSlv2	Operating state of the Sunny Island slave 2	Standby	Standby
			Run	Operation
			EmCharge	Emergency charge mode
			Error	Error
			Startup	Transfer standby > operation
02	InvPwrAtSlv2	Active power of the Sunny Island slave 2 in kW		
03	InvVtgSlv2	Voltage of the Sunny Island slave 2 in V		
04	InvCurSlv2	Current of the Sunny Island slave 2 in A		
05	InvPwrRtSlv2	Reactive power of the Sunny Island slave 2 in kVAr		
06	Rly1SttSlv2	State of relay 1 on Sunny Island slave 2	Off	Relay open
			On	Relay closed
07	Rly2SttSlv2	State of relay 2 on Sunny Island slave 2	Off	Relay open
			On	Relay closed

115# Inverter Slave3 Meters

Number	Name	Description	Value	Explanation
01	InvOpSttSlv3	Operating state of the Sunny Island slave 3	Standby	Standby
			Run	Operation
			EmCharge	Emergency charge mode
			Error	Error
			Startup	Transfer standby > operation
02	InvPwrAtSlv3	Active power of the Sunny Island slave 3 in kW		
03	InvVtgSlv3	Voltage of the Sunny Island slave 3 in V		
04	InvCurSlv3	Current of the Sunny Island slave 3 in A		
05	InvPwrRtSlv3	Reactive power of the Sunny Island slave 3 in kVAr		
06	Rly1SttSlv3	State of relay 1 on Sunny Island slave 3	Off	Relay open
			On	Relay closed
07	Rly2SttSlv3	State of relay 2 on Sunny Island slave 3	Off	Relay open
			On	Relay closed

19.1.2 Battery Meters (120#)

Number	Name	Description	Value (Plain text no.)	Explanation
01	BatSoc	Momentary state of charge of battery (SOC) in %		
02	BatVtg	Battery voltage in V		
03	BatChrgVtg	Charging voltage target value in V		
04	AptTmRmg	Remaining absorption time in hours, minutes and seconds		
05	BatChrgOp	Active charging process	Boost (1)	Boost charge
			Full (2)	Full charge
			Float (3;7)	Float charge
			Equalize (4;5)	Equalization charge
			Silent (6;8)	Silent mode (resting phase)
06	TotBatCur	Total battery current of the cluster in A		
07	BatTmp	Battery temperature in °C		
08	RmgTmFul	Remaining time until next full charge in days		
09	RmgTmEqu	Remaining time until next equalization charge in days		
10	AptPhs	Status of the absorption phase	Off (1)	Absorption phase not active
			On (2)	Absorption phase is active
11	BatSocErr	Estimated error of the state of charge in %		

19.1.3 External Meters (130#)

131# Total Meters

Number	Name	Description
01	TotExtPwrAt	Total active power of the external source in kW
02	TotExtCur	Total current of the external source in A
03	TotExtPwrRt	Total reactive power in kVAr
04	TotLodPwr	Total average active power of the loads (cluster) in kW
05	TotMccLodPwr	Total average active power of the loads (Multicluster) in kW

132# Grid State

Number	Name	Description
01	GdRmgTm	Remaining time of "GdValTm" parameter in hours, minutes and seconds

133# Generator State

Number	Name	Description	Value (Plain text no.)	Explanation
01	GnDmdSrc	Source for generator request:	None (1)	No request
			Bat (2)	State-dependent battery charging
			Lod (3)	Load-dependent
			Tim (4)	Time-controlled
			Run1h (5)	Requested for 1 hour
			Start (6)	Manually started
			ExtSrcReq (7)	Requested via an external source
02	GnStt	Generator state	Off (1)	Off
			Init (2)	Init
			Ready (3)	Waiting for request (ready)
			Warm (4)	Warming up
			Connect (5)	Connecting
			Run (6)	Operation
			Retry (7)	Restarting
			Disconnect (8)	Disconnecting
			Cool (9)	Cooling down
			Lock (10)	Locked after operation
			Fail (11)	Error
			FailLock (12)	Locked after error
03	GnRmgTm	Remaining time of the generator (minimum run time) in hours, minutes and seconds		
04	GnRnStt	Status of the generator feedback at the Sunny Island master	Off (1)	Off
			On (2)	On

134# Device Meters

Number	Name	Description
01	ExtPwrAt	Active power of the external source in kW
02	ExtVtg	Voltage of the external source in V
03	ExtCur	Current of the external source in A
04	ExtFrq	Frequency of the external source in Hz
05	ExtPwrRt	Reactive power of the external source in kVAr

135# Slave1 Meters

Number	Name	Description
01	ExtPwrAtSlv1	Active power of the external source slave 1 in kW
02	ExtVtgSlv1	Voltage of the external source slave 1 in V
03	ExtCurSlv1	Current of the external source slave 1 in A
04	ExtPwrRtSlv1	Reactive power of the external source slave 1 in kVAr

136# Slave2 Meters

Number	Name	Description
01	ExtPwrAtSlv2	Active power of the external source slave 2 in kW
02	ExtVtgSlv2	Voltage of the external source slave 2 in V
03	ExtCurSlv2	Current of the external source slave 2 in A
04	ExtPwrRtSlv2	Reactive power of the external source slave 2 in kVAr

137# Slave3 Meters

Number	Name	Description
01	ExtPwrAtSlv3	Active power of the external source slave 3 in kW
02	ExtVtgSlv3	Voltage of the external source slave 3 in V
03	ExtCurSlv3	Current of the external source slave 3 in A
04	ExtPwrRtSlv3	Reactive power of the external source slave 3 in kVAr

138# Chp Meters

Number	Name	Description	Value	Explanation
01	ChpStt	State of CHP plant	Idle	Off
			Run	Operation
			Lock	Locked after operation
02	ChpPwrAt	Power of the CHP plant		
03	ChpRmgTm	Remaining time of the CHP (minimum run time) in hours, minutes and seconds		
04	ChpStrRmgTm	Remaining time of the power request of the CHP in hours, minutes and seconds		

19.1.4 Charge Controller (140#)

Visibility

The parameters in menu 140# are only visible, if one or more Sunny Island Chargers are connected to the system.

141# SIC40 Total

Number	Name	Description
01	TotSicEgyCntIn	Total energy of all Sunny Island Chargers in kWh
02	TotSicDyEgyCntIn	Total daily yield of all Sunny Island Chargers in kWh
03	TotSicPvPwr	Total PV power of all Sunny Island Chargers in W
04	TotSicBatCur	Total battery current of all Sunny Island Chargers in A

142# SIC40 1

Number	Name	Description
01	Sic1EgyCntIn	Energy of the first Sunny Island Charger in kWh
02	Sic1TdyEgyCntIn	Daily yield of the first Sunny Island Charger in kWh
03	Sic1PvPwr	PV power of the first Sunny Island Charger in W
04	Sic1PvVtg	PV voltage of the first Sunny Island Charger in V
05	Sic1BatVtg	Battery voltage of the first Sunny Island Charger in V
06	Sic1BatCur	Battery current of the first Sunny Island Charger in A
07	Sic1HsTmp	Heat sink temperature of the first Sunny Island Charger in °C
08	Sic1SWVers	Software version of the first Sunny Island Charger

143# SIC40 2

Number	Name	Description
01	Sic2EgyCntIn	Energy of the second Sunny Island Charger in kWh
02	Sic2TdyEgyCntIn	Daily yield of the second Sunny Island Charger in kWh
03	Sic2PvPwr	PV power of the second Sunny Island Charger in W
04	Sic2PvVtg	PV voltage of the second Sunny Island Charger in V
05	Sic2BatVtg	Battery voltage of the second Sunny Island Charger in V
06	Sic2BatCur	Battery current of the second Sunny Island Charger in A
07	Sic2HsTmp	Heat sink temperature of the second Sunny Island Charger in °C
08	Sic2SWVers	Software version of the second Sunny Island Charger

144# SIC40 3

Number	Name	Description
01	Sic3EgyCntIn	Energy of the third Sunny Island Charger in kWh
02	Sic3TdyEgyCntIn	Daily yield of the third Sunny Island Charger in kWh
03	Sic3PvPwr	PV power of the third Sunny Island Charger in W
04	Sic3PvVtg	PV voltage of the third Sunny Island Charger in V
05	Sic3BatVtg	Battery voltage of the third Sunny Island Charger in V
06	Sic3BatCur	Battery current of the third Sunny Island Charger in A
07	Sic3HsTmp	Heat sink temperature of the third Sunny Island Charger in °C
08	Sic3SWVers	Software version of the third Sunny Island Charger

145# SIC40 4

Number	Name	Description
01	Sic4EgyCntIn	Energy of the fourth Sunny Island Charger in kWh
02	Sic4TdyEgyCntIn	Daily yield of the fourth Sunny Island Charger in kWh
03	Sic4PvPwr	PV power of the fourth Sunny Island Charger in W
04	Sic4PvVtg	PV voltage of the fourth Sunny Island Charger in V
05	Sic4BatVtg	Battery voltage of the fourth Sunny Island Charger in V
06	Sic4BatCur	Battery current of the fourth Sunny Island Charger in A
07	Sic4HsTmp	Heat sink temperature of the fourth Sunny Island Charger in °C
08	Sic4SWVers	Software version of the fourth Sunny Island Charger

19.1.5 Battery Settings (220#)

221# Battery Property

Number	Name	Description	Value	Explanation
01	BatTyp	Battery type	VRLA	Closed lead acid batteries with immobilized electrolyte in gel or AGM (Absorbent Glass Mat Separator).
			FLA	A sealed lead acid battery with liquid electrolyte.
			NiCd	Nickel-cadmium battery
02	BatCpyNom	Nominal battery capacity (E:C10/U:C20)		
03	BatVtgNom	Nominal battery voltage		VRLA
				FLA
				NiCd

19.1.6 System Settings (250#)

Number	Name	Description	Value	Explanation
05	ClstCfg	Cluster configuration	Slave1	Cluster slave 1
			Slave2	Cluster slave 2
			Slave3	Cluster slave 3
			1Phase1	Single-phase, 1 Sunny Island inverter
			1Phase2	Single-phase, 2 Sunny Island inverters
			1Phase3	Single-phase, 3 Sunny Island inverters
			3Phase	Three-phase, 3 Sunny Island inverters
09	ComAdr	Address for communication		
23	Box	Type of Multicluster Box used	None	None
			MC-Box-6	Multicluster Box 6
			MC-Box-9	Multicluster Box 9
			MC-Box-12	Multicluster Box 12
			MC-Box-36	Multicluster Box 36
24	ClstMod	Cluster type in Multicluster operation (system configuration)	SingleCluster	
			MainCluster	
			ExtensionClst 1	
			ExtensionClst 2	
			ExtensionClst 3	
			ExtensionClst N	
25	ClstAdr	Cluster address		

19.2 Adjustable Parameters

All parameters contained in this section are adjustable. You can only adjust the parameters with a gray background after the installer password has been entered. Some of the parameters with a gray background are only visible after the installer password has been entered. You will find an overview of the menu structure in section 10.1 "Menu Structure" (page 67).

19.2.1 Inverter Settings (210#)

Number	Name	Description	Value	Explanation	Default Value
01	InvVtgNom	Nominal voltage of the Sunny Island		230 V / 50 Hz	230 V
				220 V / 60 Hz	220 V
02	InvChrgCurMax	Maximum AC charging current			20 A
03	InvFrqNom	Nominal frequency of the Sunny Island		230 V / 50 Hz	50 Hz
				220 V / 60 Hz	60 Hz

19.2.2 Battery Settings (220#)

221# Battery Property

Number	Name	Description	Value	Explanation	Default Value
04	BatTmpMax	Maximum battery temperature	35 °C ... 50 °C		40 °C
05	BatTmpStr	Battery start temperature following stop due to overtemperature	0 °C ... "BatTmp Max"		35 °C
06	BatWirRes	Power resistor of the battery connection in mOhm	0 mOhm 50 mOhm		
07	BatFanTmpStr	Starting temperature for the "BatFan" function			40 °C

222# Battery Charge Mode

Number	Name	Description	Value	Explanation	Default Value
01	BatChrgCurMax	Charging current of the battery	10 A ... 1200 A		1,200 A
02	AptTmBoost	Absorption time for normal charge	1 min... 600 min	VRLA	120 min
				FLA	90 min
				NiCd	300 min
03	AptTmFul	Absorption time for full charge	1 h... 20 h	VRLA	5 h
				FLA	5 h
				NiCd	7 h
04	AptTmEqu	Absorption time for equalization charge	1 h... 48 h		10 h
05	CycTmFul	Full charge cycle time	1 day ... 180 days		14 days
06	CycTmEqu	Equalization charge cycle time	7 days 365 days		180 days
07	ChrgVtgBoost	Cell voltage setpoint for normal charge	2.2 V ... 2.7 V	VRLA	2.40 V
				FLA	2.55 V
			1.5 V ... 1.8 V	NiCd	1.65 V
08	ChrgVtgFul	Cell voltage setpoint for full charge	2.3 V ... 2.7 V	VRLA	2.40 V
				FLA	2.50 V
			1.5 V ... 1.8 V	NiCd	1.65 V
09	ChrgVtgEqu	Cell voltage setpoint for equalization charge	2.3 V ... 2.7 V	VRLA	2.40 V
				FLA	2.50 V
			1.5 V ... 1.8 V	NiCd	1.65 V
10	ChrgVtgFlo	Cell voltage setpoint for float charge	2.2 V ... 2.4 V	VRLA	2.25 V
				FLA	2.25 V
			1.4 V ... 1.6 V	NiCd	1.55 V

Number	Name	Description	Value	Explanation	Default Value
11	BatTmpCps	Battery temperature compensation	0 mV / °C 10 mV / °C	VRLA	4.0 mV/°C
				FLA	4.0 mV/°C
				NiCd	0 mV/°C
12	AutoEquChrgEna	Automatic equalization charge	Disable	Disable	Enable
			Enable	Enable	

223# Battery Protection

Number	Name	Description	Value	Default Value
01	BatPro1TmStr	Starting time of the battery-preservation mode (level 1)		22:00:00
02	BatPro1TmStp	End time of battery-preservation mode (level 1)		06:00:00
03	BatPro2TmStr	Starting time of the battery-preservation mode (level 2)		17:00:00
04	BatPro2TmStp	End time of battery-preservation mode (level 2)		09:00:00
05	BatPro1Soc	Battery SOC for preservation mode level 1	0 % ... 70 %	20 %
06	BatPro2Soc	Battery SOC for preservation mode level 2	0 % ... 70 %	15 %
07	BatPro3Soc	Battery SOC for preservation mode level 3	0 % ... 70 %	10 %

224# Battery Silent Mode

Number	Name	Description	Value	Explanation	Default Value
01	SilentEna	Silent mode on the grid	Disable	Disable	Disable
			Enable	Enable	
02	SilentTmFlo	Maximum time for float charge until transfer into silent	1 h... 48 h		3 h
03	SilentTmMax	Maximum time for silent until transfer into float	1 h... 168 h		12 h

225# Battery Current Sensor

Number	Name	Description	Value	Explanation	Default Value
01	BatCurSnsTyp	Type of battery current sensor	None	No sensor is connected.	None
			60 mV	Battery Current Sensor 60 mV	
			50 mV	Battery Current Sensor 50 mV	
02	BatCurGain60	External battery current sensor with 60 mV	0 A ... 1,000 A		100 A/ 60 mV
03	BatCurGain50	External battery current sensor with 50 mV	0 A ... 1,000 A		100 A/ 50 mV
04	BatCurAutoCal	Automatic calibration of the external battery current sensor	Start	Start automatic calibration	

226# BMS Mode Basic/Off

Number	Name	Description	Value	Default Value
01	BatChrgVtgMan	Manual battery charge nominal voltage with deactivated BMS	41 V ... 63 V	54.0 V
02	BatDiChgVtg	Minimum discharging voltage	42 V ... 46 V	44 V
03	BatDiChgVtgStr	Start voltage after battery undervoltage detection		48 V
04	BatRes	Internal resistance of the battery	0 mOhm ... 200 mOhm	0 mOhm

19.2.3 External Settings (230#)

231# Ext General

Number	Name	Description	Value	Explanation	Default Value
01	PvFeedTmStr	Start time for PV grid feeding-in			04:00:00
02	PvFeedTmStp	Stop time for PV grid feeding-in			22:00:00
03	ExtLkTm	Lock time after reverse power or relay protection	0 min 60 min		20 min
05	ExtSrc	Generator and grid operating mode	PvOnly	PV only	PvOnly
			Gen	Generator	
			Grid	Grid	
			GenGrid	Generator / Grid	
12	ChpEna	Enable CHP	Disable	Disable	Disable
			Enable	Enable	

232# Grid Control

Number	Name	Description	Value	Explanation	Default Value
01	GdVtgMin	Minimum grid voltage		230 V / 50 Hz	184.00 V
				220 V / 60 Hz	194.00 V
02	GdVtgMax	Maximum grid voltage		230 V / 50 Hz	264.50 V
				220 V / 60 Hz	242.00 V
03	GdCurNom	Nominal power line current			16.00 A
04	GdFrqNom	Nominal power line frequency		230 V / 50 Hz	50.00 Hz
				220 V / 60 Hz	60.00 Hz
05	GdFrqMin	Minimum power line frequency		230 V / 50 Hz	47.50 Hz
				220 V / 60 Hz	59.30 Hz
06	GdFrqMax	Maximum power line frequency		230 V / 50 Hz	50.20 Hz
				220 V / 60 Hz	60.50 Hz
07	GdVldTm	Minimum time required for grid (voltage and frequency) to be within permissible range for connection		230 V / 50 Hz	30 sec
				220 V / 60 Hz	300 sec

Number	Name	Description	Value	Explanation	Default Value
08	GdMod	Grid interface	GridCharge	Charging on the grid	GridCharge
			GridFeed	Charging and feedback on the grid	
09	GdRvPwr	Permissible grid reverse power (active power)	0 W ... 5000 W		100 W
10	GdRvTm	Permissible time for grid reverse power	0 sec ... 60 sec		5 sec
15	GdAlSns	AI sensitivity	Low	Low	Normal
			Medium	Medium	
			Normal	Normal	
			High	High	
37	GdVtgIncProEna	Voltage increase protection	Disable	Disable	Disable
			Enable	Enable	
38	GdVtgIncPro	Boundary for voltage increase protection		230 V / 50 Hz	253 V
				220 V / 60 Hz	242 V
40	Country	Installation country The installation country is set based on the corresponding applicable standard. The default value is based on your order.	GER_VDE0126_1_1	Germany	
			AS4777	Australia	
			Other	Others	
41	GdSocEna	Activate the grid request based on SOC	Disable	Disable	Disable
			Enable	Enable	
42	GdPwrEna	Activate the grid request based on power	Disable	Disable	Disable
			Enable	Enable	

233# Grid Start

Number	Name	Description	Value	Explanation	Default Value
01	GdSocTm1Str	SOC limit for switching on the grid for time 1			40 %
02	GdSocTm1Stp	SOC limit for switching off the grid for time 1			80 %
03	GdSocTm2Str	SOC limit for switching on the grid for time 2			40 %
04	GdSocTm2Stp	SOC limit for switching off the grid for time 2			80 %
05	GdTm1Str	Time 1 for grid request in hours, minutes and seconds Begin time 1, end time 2			
06	GdTm2Str	Time 2 for grid request in hours, minutes and seconds Begin time 2, end time 1			
07	GdPwrStr	Grid request starting capacity			4.0 kW
08	GdPwrStp	Grid request disconnection power limit			2.0 kW
09	GdStrChrgMod	Charge start when connecting to the grid	Off	Off	Equal
			Full	Full charge	
			Equal	Equalization charge	
			Both	Full and equalization charge	

234# Generator Control

Number	Name	Description	Value	Explanation	Default Value
01	GnVtgMin	Minimum generator voltage			172.5 V
02	GnVtgMax	Maximum generator voltage			250 V
03	GnCurNom	Nominal generator current			16.0 A
04	GnFrqNom	Generator nominal frequency with nominal load		230 V / 50 Hz	50.00 Hz
				220 V / 60 Hz	60.00 Hz
05	GnFrqMin	Minimum generator frequency		230 V / 50 Hz	44.64 Hz
				220 V / 60 Hz	50.00 Hz
06	GnFrqMax	Maximum generator frequency		230 V / 50 Hz	60.00 Hz
				220 V / 60 Hz	70.00 Hz
07	GnStrMod	Generator interface	Manual	Manual	Autostart
			Autostart	Automatic	
			GenMan	Generator management box from SMA Solar Technology	
08	GnOpTmMin	Minimum run time of the generator			15 min
09	GnStpTmMin	Minimum stop time of the generator			15 min
10	GnCoolTm	Cooling-down time of the generator			5 min
11	GnErrStpTm	Stop time of generator in case of errors			1 h
12	GnWarmTm	Warm up time			60 sec
13	GnRvPwr	Generator reverse power (active power)			100 W
14	GnRvTm	Permissible time for reverse power/reverse current			30 sec
15	GnCtlMod	Generator regulation	Cur	Electricity	Cur
			CurFrq	Frequency	

Number	Name	Description	Value	Explanation	Default Value
20	GdAlSns	AI sensitivity	Low	Low	Normal
			Medium	Medium	
			Normal	Normal	
			High	High	

235# Generator Start

Number	Name	Description	Value	Explanation	Default Value
01	GnAutoEna	Generator autostart	Off	Disable	On
			On	Enable	
02	GnAutoStr	Number of autostarts			3
03	GnSocTm1Str	SOC limit for switching on generator for time 1			40 %
04	GnSocTm1Stp	SOC limit for switching off generator for time 1			80 %
05	GnSocTm2Str	SOC limit for switching on generator for time 2			40 %
06	GnSocTm2Stp	SOC limit for switching off generator for time 2			80 %
07	GnTm1Str	Time 1 for generator request in hours, minutes and seconds Begin: Time 1, End: Time 2			
08	GnTm2Str	Time 2 for generator request in hours, minutes and seconds Begin: Time 2, End: Time 1			
09	GnPwrEna	Generator request based on power	Off	Disable	Off
			On	Enable	
10	GnPwrStr	Generator request switch-on power limit			4 kW
11	GnPwrStp	Generator request switch-off power limit			2 kW
12	GnPwrAvgTm	Average time for powerrelated generator start			60 sec

Number	Name	Description	Value	Explanation	Default Value
13	GnTmOpEna	Time-controlled generator operation	Disable	Disable	Disable
			Enable	Enable	
14	GnTmOpStrDt	Starting date for time-controlled generator operation			2010-01-01
15	GnTmOpStrTm	Starting time for time-controlled generator operation in hours, minutes and seconds			
16	GnTmOpRnDur	Running time for time-controlled generator operation in hours, minutes and seconds			
17	GnTmOpCyc	Repeat cycle for time-controlled generator operation	Single	One-time	Single
			Daily	Daily	
			Weekly	Weekly	
18	GnStrChrgMod	Generator start for charge type	Off	Off	Both
			Full	Full charge	
			Equal	Equalization charge	
			Both	Full and equalization charge	
19	GnStrDigIn	Generator start upon signal on activated digital input "DigIn" level shifts are evaluated for the generator start. In case of high levels, the Sunny Island requests the generator. Here, all set times should be observed. In case of low levels, the Sunny Island disables the request and shuts the generator down in a controlled fashion.	Disable	Disable	Disable
			Enable	Enable	

236# CHP Control

Number	Name	Description	Value	Explanation	Default Value
01	ChpOpTmMin	Minimum run time of CHP plant			60 min
02	ChpStpTmMin	Minimum stop time of CHP plant			10 min
03	ChpPwrMax	Maximum power of CHP plant			5 kW
04	ChpPwrMin	Minimum power of CHP plant			2 kW
05	ChpFrqPwrMax	Maximum frequency of CHP plant			51 Hz
06	ChpFrqPwrMin	Minimum frequency of CHP plant			52 Hz
07	ChpFrqOff				53 Hz

237# CHP Start

Number	Name	Description	Value	Explanation	Default Value
01	ChpSocTm1Str	SOC limit for switching on CHP plant for time 1			40 %
02	ChpSocTm1Stp	SOC limit for switching off CHP plant for time 1			80 %
03	ChpSocTm2Str	SOC limit for switching on CHP plant for time 2			40 %
04	ChpSocTm2Stp	SOC limit for switching off CHP plant for time 2			80 %
05	ChpTm1Str	Time 1 for CHP plant request in hours, minutes and seconds Begin: Time 1, End: Time 2			
06	ChpTm2Str	Time 2 for CHP plant request in hours, minutes and seconds Begin: Time 2, End: Time 1			

Number	Name	Description	Value	Explanation	Default Value
07	ChpPwrEna	Activate CHP plant request based on power	Disable	Disable	Enable
			Enable	Enable	
08	ChpPwrStr	Combined heat and power system request switch-on power limit			4 kW
09	ChpPwrStrDly	Time delay for power request for CHP plant			5 min
10	ChpManStr	Manual CHP start	Auto	Automatic	
			Start	Starting	
			Stop	Stop	
11	ChpAddOnTm	Time for the additional CHP request activated			60 sec
12	ChpAddOffTm	Time for the additional CHP request deactivated			120 sec
13	ChpAddSocDel	Distance to the next SOC limit			5 %

19.2.4 Relay Settings (240#)

241# Relay General

Number	Name	Description	Value	Explanation	Default Value
01	Rly1Op	Function of relay 1	Off	Off	AutoGn
			On	On	
			AutoGn	Generator request	
			AutoLodExt	External loadshedding	
			AutoLod1Soc	SOC1 Loadshedding	
			AutoLod2Soc	SOC2 Loadshedding	
			Tmr1	Timer 1	
			Tmr2	Timer 2	
			AptPhs	Absorption phase	
			GnRn	Generator in operation	
			ExtVfOk	External source (voltage and frequency OK)	
			GdOn	Grid in operation (connected)	
			Error	Error	
			Warn	Warning	
			Run	Operation	
			BatFan	Battery ventilation (room)	
			AcdCir	Acid circulation	
			MccBatFan	Multicluster battery room ventilator	
			MccAutoLod	Loadshedding	
			CHPReq	CHP plant request	
			CHPAdd	Additional CHP request	
			SiComRemote	SI Com module	
			Overload	Overload	

Number	Name	Description	Value	Explanation	Default Value
02	Rly2Op	Function of relay 2	Off	Off	AutoLodExt
			On	On	
			AutoGn	Generator request	
			AutoLodExt	External loadshedding	
			AutoLod1Soc	SOC1 Loadshedding	
			AutoLod2Soc	SOC2 Loadshedding	
			Tmr1	Timer 1	
			Tmr2	Timer 2	
			AptPhs	Absorption phase	
			GnRn	Generator in operation	
			ExtVfOk	External source (voltage and frequency OK)	
			GdOn	Grid in operation (connected)	
			Error	Error	
			Warn	Warning	
			Run	Operation	
			BatFan	Battery ventilation (room)	
			AcdCir	Acid circulation	
			MccBatFan	Multicluster battery room ventilator	
			MccAutoLod	Loadshedding	
			CHPReq	CHP plant request	
			CHPAdd	Additional CHP request	
			SiComRemote	SI Com module	
			Overload	Overload	

242# Relay Load

Number	Name	Description	Value	Explanation	Default Value
01	Lod1SocTm1Str	SOC limit for load shedding 1 start for t1			30 %
02	Lod1SocTm1Stp	SOC limit for load shedding 1 stop for t1			50 %
03	Lod1SocTm2Str	SOC limit for load shedding 1 start for t2			30 %
04	Lod1SocTm2Stp	SOC limit for load shedding 1 stop for t2			50 %
05	Lod1Tm1Str	Time 1 for Loadshed 1 in hours, minutes and seconds Begin: Time 1, End: Time 2			
06	Lod1Tm2Str	Time 2 for Loadshed 1 in hours, minutes and seconds Begin: Time 2, End: Time 1			
07	Lod2SocTm1Str	SOC limit for load shedding 2 start for t1			30 %
08	Lod2SocTm1Stp	SOC limit for load shedding 2 stop for t1			50 %
09	Lod2SocTm2Str	SOC limit for load shedding 2 start for t2			30 %
10	Lod2SocTm2Stp	SOC limit for load shedding 2 stop for t2			50 %
11	Lod2Tm1Str	Time 1 for Loadshed 2 in hours, minutes and seconds Begin: Time 1, End: Time 2			
12	Lod2Tm2Str	Time 2 for Loadshed 2 in hours, minutes and seconds Begin: Time 2, End: Time 1			

243# Relay Timer

Number	Name	Description	Value	Explanation	Default Value
01	RlyTmr1StrDt	Start date for timer 1			2010-01-01
02	RlyTmr1StrTm	Start time for relay control timer 1 in hours, minutes and seconds			
03	RlyTmr1Dur	Running time for relay control timer 1 in hours, minutes and seconds			
04	RlyTmr1Cyc	Repetition cycle time for timer 1	Single	One-time	Single
			Daily	Daily	
			Weekly	Weekly	
05	RlyTmr2StrDt	Start date timer 2			2010-01-01
06	RlyTmr2StrTm	Start time for relay control timer 2 in hours, minutes and seconds			
07	RlyTmr2Dur	Running time for relay control timer 2 in hours, minutes and seconds			
08	RlyTmr2Cyc	Repetition cycle time for timer 2	Single	One-time	Single
			Daily	Daily	
			Weekly	Weekly	

244# Relay Slave1

Number	Name	Description	Value	Explanation	Default Value
01	Rly1OpSlv1	Function of relay 1 on slave 1	Off	Off	Off
			On	On	
			AutoGn	Generator request	
			AutoLodExt	External loadshedding	
			AutoLod1Soc	SOC1 Loadshedding	
			AutoLod2Soc	SOC2 Loadshedding	
			Tmr1	Timer 1	
			Tmr2	Timer 2	
			AptPhs	Absorption phase	
			GnRn	Generator in operation	
			ExtVfOk	External source (voltage and frequency OK)	
			GdOn	Grid in operation (connected)	
			Error	Error	
			Warn	Warning	
			Run	Operation	
			BatFan	Battery ventilation (room)	
			AcdCir	Acid circulation	
			MccBatFan	Multicluster battery room ventilator	
			MccAutoLod	Loadshedding	
			CHPReq	CHP plant request	
			CHPAdd	Additional CHP request	
			SiComRemote	SI Com module	
			Overload	Overload	

Number	Name	Description	Value	Explanation	Default Value
02	Rly2OpSlv1	Function of relay 2 on slave 1	Off	Off	Off
			On	On	
			AutoGn	Generator request	
			AutoLodExt	External loadshedding	
			AutoLod1Soc	SOC1 Loadshedding	
			AutoLod2Soc	SOC2 Loadshedding	
			Tmr1	Timer 1	
			Tmr2	Timer 2	
			AptPhs	Absorption phase	
			GnRn	Generator in operation	
			ExtVfOk	External source (voltage and frequency OK)	
			GdOn	Grid in operation (connected)	
			Error	Error	
			Warn	Warning	
			Run	Operation	
			BatFan	Battery ventilation (room)	
			AcdCir	Acid circulation	
			MccBatFan	Multicluster battery room ventilator	
			MccAutoLod	Loadshedding	
			CHPReq	CHP plant request	
			CHPAdd	Additional CHP request	
			SiComRemote	SI Com module	
			Overload	Overload	

245# Relay Slave2

Number	Name	Description	Value	Explanation	Default Value
01	Rly1OpSlv2	Function of relay 1 on slave 2	Off	Off	Off
			On	On	
			AutoGn	Generator request	
			AutoLodExt	External loadshedding	
			AutoLod1Soc	SOC1 Loadshedding	
			AutoLod2Soc	SOC2 Loadshedding	
			Tmr1	Timer 1	
			Tmr2	Timer 2	
			AptPhs	Absorption phase	
			GnRn	Generator in operation	
			ExtVfOk	External source (voltage and frequency OK)	
			GdOn	Grid in operation (connected)	
			Error	Error	
			Warn	Warning	
			Run	Operation	
			BatFan	Battery ventilation (room)	
			AcdCir	Acid circulation	
			MccBatFan	Multicluster battery room ventilator	
			MccAutoLod	Loadshedding	
			CHPReq	CHP plant request	
			CHPAdd	Additional CHP request	
			SiComRemote	SI Com module	
			Overload	Overload	

Number	Name	Description	Value	Explanation	Default Value
02	Rly2OpSlv2	Function of relay 2 on slave 2	Off	Off	Off
			On	On	
			AutoGn	Generator request	
			AutoLodExt	External loadshedding	
			AutoLod1Soc	SOC1 Loadshedding	
			AutoLod2Soc	SOC2 Loadshedding	
			Tmr1	Timer 1	
			Tmr2	Timer 2	
			AptPhs	Absorption phase	
			GnRn	Generator in operation	
			ExtVfOk	External source (voltage and frequency OK)	
			GdOn	Grid in operation (connected)	
			Error	Error	
			Warn	Warning	
			Run	Operation	
			BatFan	Battery ventilation (room)	
			AcdCir	Acid circulation	
			MccBatFan	Multicluster battery room ventilator	
			MccAutoLod	Loadshedding	
			CHPReq	CHP plant request	
			CHPAdd	Additional CHP request	
			SiComRemote	SI Com module	
			Overload	Overload	

246# Relay Slave3

Number	Name	Description	Value	Explanation	Default Value
01	Rly1OpSlv3	Function of relay 1 on slave 3	Off	Off	Off
			On	On	
			AutoGn	Generator request	
			AutoLodExt	External loadshedding	
			AutoLod1Soc	SOC1 Loadshedding	
			AutoLod2Soc	SOC2 Loadshedding	
			Tmr1	Timer 1	
			Tmr2	Timer 2	
			AptPhs	Absorption phase	
			GnRn	Generator in operation	
			ExtVfOk	External source (voltage and frequency OK)	
			GdOn	Grid in operation (connected)	
			Error	Error	
			Warn	Warning	
			Run	Operation	
			BatFan	Battery ventilation (room)	
			AcdCir	Acid circulation	
			MccBatFan	Multicluster battery room ventilator	
			MccAutoLod	Loadshedding	
			CHPReq	CHP plant request	
			CHPAdd	Additional CHP request	
			SiComRemote	SI Com module	
			Overload	Overload	

Number	Name	Description	Value	Explanation	Default Value
02	Rly2OpSlv3	Function of relay 2 on slave 3	Off	Off	Off
			On	On	
			AutoGn	Generator request	
			AutoLodExt	External loadshedding	
			AutoLod1Soc	SOC1 Loadshedding	
			AutoLod2Soc	SOC2 Loadshedding	
			Tmr1	Timer 1	
			Tmr2	Timer 2	
			AptPhs	Absorption phase	
			GnRn	Generator in operation	
			ExtVfOk	External source (voltage and frequency OK)	
			GdOn	Grid in operation (connected)	
			Error	Error	
			Warn	Warning	
			Run	Operation	
			BatFan	Battery ventilation (room)	
			AcdCir	Acid circulation	
			MccBatFan	Multicluster battery room ventilator	
			MccAutoLod	Loadshedding	
			CHPReq	CHP plant request	
			CHPAdd	Additional CHP request	
			SiComRemote	SI Com module	
			Overload	Overload	

19.2.5 System Settings (250#)

Number	Name	Description	Value	Explanation	Default Value
01	AutoStr	Autostart If the value 0 has been set, this means that the autostart is deactivated.	0 ... 10		3
02	Dt	Date			99.99.9999
03	Tm	Time in hours, minutes and seconds			99:99:99
04	BeepEna	Acoustic Button Sounds	Off	Disable	On
			On	Enable	
06	ComBaud	Baudrate	1200		1200
			4800		
			9600		
			19200		
			38400		
			57600		
			115K		
10	SleepEna	Sleep Mode	Disable	Disable	Enable
			Enable	Enable	
11	AfraEna	Tertiary control (AFC - Automatic Frequency Control)	Disable	Disable	Enable
			Enable	Enable	
13	SlpAtNgt	Switch off the slaves at night	Disable	Disable	Disable
			Enable	Enable	
14	SlpStrTm	Start time for switching off at night (sleep mode)			20:00:00
15	SlpStpTm	Stop time for switching off at night (sleep mode)			05:00:00
23	Box	Type of Multicluster Box used	None	None	
			MC-Box-6	Multicluster Box 6.3	
			MC-Box-9	Multicluster Box 9.3	
			MC-Box-12	Multicluster Box 12.3	
			MC-Box-36	Multicluster Box 36.3	

Number	Name	Description	Value	Explanation	Default Value
24	ClstMod	Cluster type in Multicluster operation (system configuration)	SingleCluster		SingleCluster
			MainCluster		
			ExtensionClst 1		
			ExtensionClst 2		
			ExtensionClst 3		
			ExtensionClst N		
25	ClstAdr	Cluster address			
28	ChrgCtlOp	Typ of DC charging device	Auto	Automatic	Auto
			DCOnly	Battery charger only	
			SMA	Sunny Island Charger	
30	RnMod	"Run mode" Reaction in case of failures	RunAlways	Always available	RunAlways
			StopAlways	Stop in case of device failure	

19.2.6 Password Setting (280#)

For detailed information on this menu, see section 10.5 "Entering the Installer Password" (page 76).

19.3 Diagnosis (300#)

19.3.1 Inverter Diagnosis (310#)

311# System Total Diagnosis

Number	Name	Description
01	EgyCntIn	Energy absorbed in kWh
02	EgyCntOut	Energy fed in kWh
03	EgyCntTm	Energy metering run time in hours

312# Inverter Device Diagnosis

Number	Name	Description	Value (plain text no.)	Explanation	Default Value
01	Adr	Device address	Master (1)	Address	Master
			Slave1 (2)	Address	
			Slave2 (3)	Address	
			Slave3 (4)	Address	
02	FwVer	Firmware version of the Sunny Island master			
03	SN	Serial number of the Sunny Island master			
04	OnTmh	Operating hours of the Sunny Island in hours			
05	ClstCfgAt	Set cluster configuration The value is based on the setting in QCG			
06	OpStt	Operating state of the Sunny Island	Operating (1)	Operation	
			Warning (2)	Warning	
			Failure (3)	Error	

Number	Name	Description	Value (plain text no.)	Explanation	Default Value
07	CardStt	SD card status message	Off (1)	None	Off
			Operational (2)	Busy	
			Mount (3)	Initialization	
			OutOfSpace (4)	No storage space available	
			BadFileSys (5)	No filing system recognized	
			Incomp (6)	Incompatible filing system	
			Parameter (7)	Parameter set write access	
			ParamFailed (8)	Parameter set write access failed	
			WriteLogData (9)	Log data write access	
			WriteLogFailed (10)	Log data write access failed	
08	FwVer2	DSP firmware version			
09	FwVer3	BFR boot loader			
10	FwVer4	DSP boot loader			

313# Inverter Slave1 Diagnosis

Number	Name	Description	Value	Explanation
01	FwVerSlv1	Firmware version of the Sunny Island slave 1		
02	SNSlv1	Serial number of the Sunny Island slave 1		
03	OnTmhSlv1	Operating hours of the Sunny Island slave 1 in hours		
04	PhSlv1	Phase of the Sunny Island slave 1	L1	Phase L1
			L2	Phase L2
			L3	Phase L3
05	OpSttSlv1	Operating state of the Sunny Island slave 1	Operating	Operation
			Warning	Warning
			Failure	Error
06	FwVer2Slv1	Firmware version of the Sunny Island slave 1		
07	FwVer3Slv1	BFR boot loader of the Sunny Island slave 1		
08	FwVer4Slv1	DSP boot loader of the Sunny Island slave 1		

314# Inverter Slave2 Diagnosis

Number	Name	Description	Value	Explanation
01	FwVerSlv2	Firmware version of the Sunny Island slave 2		
02	SNSlv2	Serial number of the Sunny Island slave 2		
03	OnTmhSlv2	Operating hours of the Sunny Island slave 2 in hours		
04	PhSlv2	Phase of the Sunny Island slave 2	L1	Phase L1
			L2	Phase L2
			L3	Phase L3
05	OpSttSlv2	Operating state of the Sunny Island slave 2	Operating	Operation
			Warning	Warning
			Failure	Error
06	FwVer2Slv2	Firmware version of the Sunny Island slave 1		
07	FwVer3Slv2	BFR boot loader of the Sunny Island slave 2		
08	FwVer4Slv2	DSP boot loader of the Sunny Island slave 2		

315# Inverter Slave3 Diagnosis

Number	Name	Description	Value	Explanation
01	FwVerSlv3	Firmware version of the Sunny Island slave 3		
02	SNSlv3	Serial number of the Sunny Island slave 3		
03	OnTmhSlv3	Operating hours of the Sunny Island slave 3 in hours		
04	PhSlv3	Phase of the Sunny Island slave 3	L1	Phase L1
			L2	Phase L2
			L3	Phase L3
05	OpSttSlv3	Operating state of the Sunny Island slave 3	Operating	Operation
			Warning	Warning
			Failure	Error
06	FwVer2Slv3	Firmware version of the Sunny Island slave 3		
07	FwVer3Slv3	BFR boot loader of the Sunny Island slave 3		
08	FwVer4Slv3	DSP boot loader of the Sunny Island slave 3		

19.3.2 Battery Diagnosis (320#)

Number	Name	Description	Value	Explanation	Default Value
01	Soh	State of Health (SOH) Ratio of current capacity to its nominal value			100 %
02	StatTm	Statistics metering run time in days			
03	ChrgFact	Charging factor			1.00
04	BatEgyCntIn	Energy meter for battery charge in kWh			
05	BatEgyCntOut	Energy meter for battery discharge in kWh			
06	AhCntIn	Meter for battery charging ampere hours			
07	AhCntOut	Meter for battery discharging ampere hours			
08	BatTmpPkMin	Minimum battery temperature in °C			
09	BatTmpPkMax	Maximum battery temperature in °C			
10	EquChrgCnt	Equalization charge meter			
11	FulChrgCnt	Full charge meter			
12	BatCurOfsErr	Offset error of battery current in A			
13	OcvPointCnt	Meter for open-circuit voltage points			
15	AhCntFul	Meter for battery discharging ampere hours since the last full charge (in Ah/100 Ah)			
16	AhCntEqu	Meter for battery discharging ampere hours since the last equalization charge (in Ah/100 Ah)			
17	BatVtgPk	Maximum battery voltage to have arisen in V			
18	BatCurPkIn	Maximum battery current in the charging direction (in A)			

Number	Name	Description	Value	Explanation	Default Value
19	BatCurPkOut	Maximum battery current in discharging direction (in A)			
20	SocHgm100	Frequency scale of state of charge, in percent, 100 % > SOC >= 90 %			
21	SocHgm090	Frequency scale of state of charge, in percent, 90 % > SOC >= 80 %			
22	SocHgm080	Frequency scale of state of charge, in percent, 80 % > SOC >= 70 %			
23	SocHgm070	Frequency scale of state of charge, in percent, 70 % > SOC >= 60 %			
24	SocHgm060	Frequency scale of state of charge, in percent, 60 % > SOC >= 50 %			
25	SocHgm050	Frequency scale of state of charge, in percent, 50 % > SOC >= 40 %			
26	SocHgm040	Frequency scale of state of charge, in percent, 40 % > SOC >= 30 %			
27	SocHgm030	Frequency scale of state of charge, in percent, 30 % > SOC >= 20 %			
28	SocHgm020	Frequency scale of state of charge, in percent, 20 % > SOC >= 10 %			
29	SocHgm010	Frequency scale of state of charge, in percent, 10 % > SOC >= 0 %			
30	SocHgm000	Frequency scale of state of charge in percent SOC < 0 %			
31	SocVtgCal	Recalibration of state of charge only via open-circuit voltage (in percent)			

Number	Name	Description	Value	Explanation	Default Value
32	ErrSocVtgCal	Estimated error of the voltage-calibrated state of charge			50 %
33	SocChrgCal	Recalibration of state of charge only via full charge			50 %
34	ErrSocChrgCal	Estimated error of the full-charge-calibrated state of charge			50 %
35	OcvGra	Slope of the open-circuit voltage curve			700 Ah/V
36	OcvMax	Maximum open-circuit voltage			2.12 V

19.3.3 External Diagnosis (330#)

331# Grid Diagnosis

Number	Name	Description
01	GdEgyCntIn	Energy meter for grid feed-in in kWh
02	GdEgyCntOut	Energy meter for power taken from the grid in kWh
03	GdEgyTmh	Running time of grid energy meter in hours
04	GdOpTmh	Operating hour meter for grid operation
05	GdCtcCnt	Meter for grid connections
06	TotTmh	Feed-in hours

332# Generator Diagnosis

Number	Name	Description
01	GnEgyCnt	Generator energy meter in kWh
02	GnEgyTm	Running time of generator energy meter in hours
03	GnOpTmh	Operating hour meter for generator
04	GnStrCnt	Number of generator starts

19.4 Events, Warnings and Errors (History)

19.4.1 Failure / Event (400#)

More information on the "410# Failures Current", "420# Failure History" and "430# Event History" menus is provided as of section 10.9 "Display of Warnings and Failures" (page 82).

19.5 Functions in Operation

19.5.1 Operation (500#)

510# Operation Inverter

Number	Name	Description	Value	Explanation	Default Value
01	InvRs	Tripping a restart of the Sunny Island	Restart	Restart	
02	InvTmOpEna	Time-controlled inverter operation	Disable	Disable	Disable
			Enable	Enable	
03	InvTmOpStrDt	Start date for time-controlled inverter operation			2010-01-01
04	InvTmOpStrTm	Start time for time-controlled inverter operation in hours, minutes and seconds		Value can be set freely	
05	InvTmOpRnDur	Running time for time-controlled inverter operation in hours, minutes and seconds		Value can be set freely	
06	InvTmOpCyc	Repetition cycle for time-controlled inverter operation (Tm1)	Single	One-time	Single
			Daily	Daily	
			Weekly	Weekly	

Number	Name	Description	Value	Explanation	Default Value
07	CntRs	Delete energy meter The value indicates which energy meter is to be deleted.	Inv	Sunny Island	
			Bat	Battery	
			Gn	Generator	
			Gd	Grid	
			All	All energy meters	
			Sic1	Sunny Island Charger 1	
			Sic2	Sunny Island Charger 2	
			Sic3	Sunny Island Charger 3	
			Sic4	Sunny Island Charger 4	
			SicAll	All Sunny Island Chargers	
08	TstClstCom	Activates the communication test between the individual clusters:	Off	Off	
			Transmit	Enable	
09	ClstComStt	Communication test status	Wait	Waiting	
			OK	Completed	
10	FrcClstUpd	Manual update of the cluster	UpdateClst	Cluster Update (BFR & DSP)	
			UpdateClstBFR	Cluster Update (BFR)	
			UpdateClstDSP	Cluster Update (DSP)	

520# Operation Battery

Number	Name	Description	Value	Explanation	Default Value
01	ChrgSelMan	Manual Equalization Charge	Idle	Waiting until conditions are met	Idle
			Start	Starting	
			Stop	Stop	

540# Operation Generator

Number	Name	Description	Value	Explanation	Default Value
01	GnManStr	Manual generator start	Auto	Automatic	Auto
			Stop	Stop	
			Start	Starting	
			Run1h	Run for 1 h	
02	GnAck	Error confirmation for generator fault	Ackn	Failure confirmation	

550# Operation MMC

Number	Name	Description	Value	Explanation	Default Value
01	ParaSto	Save parameter settings	Set1	Parameter Set1	
			Set2	Parameter Set2	
02	ParaLod	Load parameter settings	Set1	Parameter Set1	
			Set2	Parameter Set2	
			Factory	Load factory settings	
03	CardFunc	Functions of the SD card	ForcedWrite	Forced writing	
			StoEvtHis	Save event memory	
			StoFailHis	Save error memory	
			StoHis	Save event and error memory	
04	DatLogEna	Automatic data storage	Off	Disable	On
			On	Enable	

560# Operation Grid

Number	Name	Description	Value	Explanation	Default Value
01	GdManStr	Manual grid start	Auto	Automatic	Auto
			Stop	Stop	
			Start	Starting	

19.6 Direct Access to the parameters

19.6.1 Direct Access (600#)

Direct access to parameters is explained in detail in section 10.3 "Direct Access - Direct Access to the Parameters" (page 71).

20 Troubleshooting

In general the Sunny Island distinguishes between events and errors.

- **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.

20.1 Failure Acknowledgement

If there is a failure or an error, the Sunny Island goes into standby.

Proceed as follows to confirm a failure:

1. Remove the cause.
2. Confirm error with <ENTER>.
3. Start the Sunny Island again.

20.2 Autostart Handling

The Sunny Island has an autostart meter which counts down by 1 with every automatic start. After 10 minutes of normal operation of the Sunny Island, the autostart meter is set back to its original value.

If another fault occurs when the autostart meter is at 0, the Sunny Island waits for 10 minutes and then attempts to restart. The autostart meter begins to run again.

The number of the autostarts allowed can be set using the "250.01 AutoStr" parameter (in standby mode).

20.3 Master-Slave Handling

Each device detects the errors separately and saves them. The slaves transfer their errors to the master. The master collects these error messages and enters the slave errors as warnings into its history.

Example:

Slave 1 has detected overtemperature. It enters this error in its history and reports it to the master, which also enters it as a warning into its failure history ("Menu 420# Failure History").

The following message appears in the lower display line on the master.

If warning 138 is still active on slave 1, the Enter symbol appears at the end.

After the warning has been confirmed on the master by pressing the <ENTER> key, it is forwarded to the respective slave.

The master shows the following message after confirmation.

No comparison between master and slave

The failure and event memory are not compared between the master and slaves. The slave device's errors are confirmed when the Sunny Island system is restarted.

20.4 Handling Pending Failures During the Booting Procedure

During the booting procedure, all pending failures are generally confirmed without an entry being made in the history. This way, after the booting procedure failure that is still pending will be re-entered, or if the system detects that this failure has stopped, it is entered as no longer being present.

20.5 Display of Failures and Events

Each failure and each event have a unique three-digit display number that is created according to the parameter/measuring value assignment. The events and failures have the identical numerical range:

- 1xx - INV - Inverter
- 2xx - BAT - Battery
- 3xx - EXT - Extern
- 4xx - GEN = Generator
- 5xx - GRD - Grid
- 6xx - RLY - Relay
- 7xx - SYS - System
- 8xx - AUX - External devices and components

Meaning of the abbreviations

"F" marks a failure, "W" marks a warning and "E" marks an event.

In the event of a failure, and provided it is recorded, "!" is displayed for a failure that has occurred and "C" is displayed for a failure that has stopped.

20.6 Events

The meanings of the events displayed by the Sunny Island are described in the following table:

20.6.1 Category INV

Display no.	Description
E101	Wait status
E102	Startup process
E103	Operation
E104	Operating on the generator (at external input)
E105	Operating on the grid (at external input)
E106	Feeding-in grid operation (at external input)
E107	Sleep mode (slave in single-phase systems)
E108	Silent mode on the grid
E110	Shutting down due to fault
E115	Emergency charge
E118	Automatic start
E119	Manual start (transition from standby mode to operation)
E120	Manual stop (transition from operation to standby mode)
E129	External start (remote)
E130	External stop (remote)
E131	The AFC control engages
E132	The AFC control stops

20.6.2 Category BAT

Display no.	Description
E202	(Partial) reset of BMS due to new battery
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 option
E207	State change, battery charging algorithm for equalization charge

20.6.3 Category GEN

Display no.	Description
E401	Automatic generator start due to set criteria (battery state of charge, power, time, etc.)
E402	Automatic generator stop due to set criteria (battery state of charge, power, time, etc.)
E403	Manual generator start
E404	Manual generator stop
E405	Manual error confirmation of generator fault
E406	Generator request
E407	Generator operation with regulated voltage started
E408	Generator operation with regulated voltage stopped

20.6.4 Category GRD

Display no.	Description
E501	Grrd request due to SOC (insufficient value)
E502	Release of grid due to SOC (exceeds)
E503	Grid request due to exceeding the power limit
E504	Release of grid due to falling below the power limit
E505	Manual grid request
E506	Manual grid release

20.6.5 Category REL

Display no.	Description
E601	Relay 1 off
E602	Relay 1 on
E603	Relay 1 on slave 1 off
E604	Relay 1 on slave 1 on
E605	Relay 1 on slave 2 off
E606	Relay 1 on slave 2 on
E607	Relay 1 on slave 3 off
E608	Relay 1 on slave 3 on
E609	Transfer relay open
E610	Transfer relay closed
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
E615	Transfer relay on slave 3 open
E616	Transfer relay on slave 3 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
E623	Relay 2 on slave 3 open
E624	Relay 2 on slave 3 closed
E625	Digital input OFF (Low)
E626	Digital input ON (High)

20.6.6 Category SYS

Display no.	Description
E705	Device start
E706	Date/time changed
E707	New system configured in QCG
E708	Part 1 of the firmware updated
E709	Part 2 of the firmware updated
E710	Cluster firmware updated
E711	MMC/SD card inserted
E712	Parameters from MMC/SD card loaded
E851	Sunny Island Charger #1 detected
E852	Sunny Island Charger #2 detected
E853	Sunny Island Charger #3 detected
E854	Sunny Island Charger #4 detected

20.7 Failure Categories

The Sunny Island distinguishes between 5 different levels of failures, each requiring different user interaction.

Level	Description	Display on the Sunny Island	Meaning
1	Warning	Warning	Warning, device continues to run. There is an explicit information on the Home Screen that a warning was recorded.
2	Malfunction 1	Malfunction	Failure that can only be detected during operation. Device switches off. Device can be restarted immediately (autostart).
3	Malfunction 2	Malfunction	Failure that can also be detected in standby mode. Device switches off. The device can only be restarted (autostart) once the system detects that the failure has ended.
4	Failure	Failure	Device fault. Device switches off. User interaction required (failure removal, confirmation, manual restart).
5	Device defect	Defect	Device is defect. Device switches off and does not switch on again. Permanent disable. Device must be replaced.

20.8 Warnings and Failure Messages

The meanings of the warnings and failures displayed by the Sunny Island are described in the following table.

20.8.1 Category INV

Display no.	Level	Description
F109	3	Transformer overtemperature
W110	1	Overtemperature on transformer on slave 1
W111	1	Overtemperature on transformer on slave 2
W112	1	Overtemperature on transformer on slave 3
F113	3	Overtemperature on heat sink
W114	1	Overtemperature on heat sink on slave 1
W115	1	Overtemperature on heat sink on slave 2
W116	1	Overtemperature on heat sink on slave 3
F117	2	AC current limit (short-circuit control active for too long)
W118	1	AC current limit (short-circuit control active for too long) on slave 1
W119	1	AC current limit (short-circuit control active for too long) on slave 2
W120	1	AC current limit (short-circuit control active for too long) on slave 3
F121	3	Inverter overvoltage
W122	1	Inverter overvoltage on slave 1
W123	1	Inverter overvoltage on slave 2
W124	1	Inverter overvoltage on slave 3
W137	1	Derating due to temperature (heat sink or transformer)
W138	1	Derating due to temperature (heat sink or transformer) on slave 1
W139	1	Derating due to temperature (heat sink or transformer) on slave 2
W140	1	Derating due to temperature (heat sink or transformer) on slave 3
F141	2	Inverter undervoltage
W142	1	Inverter undervoltage slave 1
W143	1	Inverter undervoltage slave 2
W144	1	Inverter undervoltage slave 3
F158	2	Voltage on output AC1
W159	1	Voltage on output AC1 slave 1
W160	1	Voltage on output AC1 slave 2
W161	1	Voltage on output AC1 slave 3

20.8.2 Category BAT

Display no.	Level	Description
F201	2	Measuring range of battery voltage exceeded
W202	1	Measuring range of battery voltage exceeded on slave 1
W203	1	Measuring range of battery voltage exceeded on slave 2
W204	1	Measuring range of battery voltage exceeded on slave 3
F206	3	Overheating battery
F208	3	Battery excess voltage error
W209	1	Battery overvoltage (fixed limit for cell voltage) not generated by Sunny Island (TotBatCur < 1A)
W210	1	Battery overvoltage warning
W211	1	Low battery temperature warning
W212	1	High battery temperature warning
W213	1	Low battery voltage (fixed limit for cell voltage)
W220	1	Warning SOH < 70 %
F716	2	Measuring range of master battery voltage exceeded
W717	1	Measuring range of battery voltage exceeded on slave 1
W718	1	Measuring range of battery voltage exceeded on slave 2
W719	1	Measuring range of battery voltage exceeded on slave 3

20.8.3 Category EXT

Display no.	Level	Description
W309	1	Relay protection
W310	1	Relay protection on slave 1
W311	1	Relay protection on slave 2
W312	1	Relay protection on slave 3
F314	2	External voltage failure
W315	1	Grid/generator disconnection due to insufficient external voltage
W316	1	Grid/generator disconnection due to insufficient external voltage on slave 1
W317	1	Grid/generator disconnection due to insufficient external voltage on slave 2
W318	1	Grid/generator disconnection due to insufficient external voltage on slave 3
W319	1	Grid/generator disconnection due to excessive external voltage
W320	1	Grid/generator disconnection due to excessive external voltage on slave 1

Display no.	Level	Description
W321	1	Grid/generator disconnection due to excessive external voltage on slave 2
W322	1	Grid/generator disconnection due to excessive external voltage on slave 3
W323	1	Grid/generator disconnection due to insufficient external frequency
W324	1	Grid/generator disconnection due to insufficient external frequency on slave 1
W325	1	Grid/generator disconnection due to insufficient external frequency on slave 2
W326	1	Grid/generator disconnection due to insufficient external frequency on slave 3
W327	1	Grid/generator disconnection due to excessive external frequency
W328	1	Grid/generator disconnection due to excessive external frequency on slave 1
W329	1	Grid/generator disconnection due to excessive external frequency on slave 2
W330	1	Grid/generator disconnection due to excessive external frequency on slave 3
W331	1	Grid/generator disconnection due to anti-islanding
W332	1	Grid/generator disconnection due to violation of anti-islanding on slave 1
W333	1	Grid/generator disconnection due to violation of anti-islanding on slave 2
W334	1	Grid/generator disconnection due to violation of anti-islanding on slave 3
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
W338	1	Disconnection from grid/generator due to violation of voltage limits (redundant measurement), slave 3
W339	1	Grid/generator disconnection due to voltage increase protection
W340	1	Grid/generator disconnection due to voltage increase protection on slave 1
W341	1	Grid/generator disconnection due to voltage increase protection on slave 2

Display no.	Level	Description
W342	1	Grid/generator disconnection due to voltage increase protection on slave 3
W343	1	Disconnection from the external source, because the relation of the external voltage to the battery voltage is too high.
W344	1	Disconnection from the slave 1 external source, because the relation of the external voltage to the battery voltage is too high.
W345	1	Disconnection from the slave 2 external source, because the relation of the external voltage to the battery voltage is too high.
W346	1	Disconnection from the slave 3 external source, because the relation of the external voltage to the battery voltage is too high.
W347	1	Disconnection from external source due to excessive load
W348	1	Disconnection from external source due to excessive load slave 1
W349	1	Disconnection from external source due to excessive load slave 2
W350	1	Disconnection from external source due to excessive load slave 3
W351	1	Disconnection from external source due to external short circuit
W352	1	Disconnection from external source due to external short circuit slave 1
W353	1	Disconnection from external source due to external short circuit slave 2
W354	1	Disconnection from external source due to external short circuit slave 3

20.8.4 Category GEN

Display no.	Level	Description
W401	1	Reverse power protection (generator)
W402	1	FailLock generator state

20.8.5 Category GRD

Display no.	Level	Description
W501	1	Grid reverse current prohibited (quick grid disconnection)
W502	1	Grid reverse current prohibited (quick grid disconnection) on slave 1
W503	1	Grid reverse current prohibited (quick grid disconnection) on slave 2
W504	1	Grid reverse current prohibited (quick grid disconnection) on slave 3

20.8.6 Category RLY

Display no.	Level	Description
F605	4	Generator relay does not open
W606	1	Generator relay does not open on slave 1
W607	1	Generator relay does not open on slave 2
W608	1	Generator relay does not open on slave 3

20.8.7 Category SYS

Display no.	Level	Description
F702	5	DSP reset
F703	2	Timeout during a task
F704	4	Invalid DSP calibration
W705	1	DSP watchdog has been tripped
F706	4	Watchdog meter has expired (watchdog tripped several times in succession)
W707	1	Watchdog meter on slave 1 has expired (watchdog tripped several times in succession)
W708	1	Watchdog meter on slave 2 has expired (watchdog tripped several times in succession)
W709	1	Watchdog meter on slave 3 has expired (watchdog tripped several times in succession)
F710	4	Autostart meter has expired (several autostarts in succession)
W713	1	Watchdog has been tripped
F720	4	Short circuit or cable break on transformer temperature sensor
F721	4	Short circuit or cable break on heat sink temperature sensor
W722	1	Short circuit on battery temperature sensor
W723	1	Cable break on battery temperature sensor
W724	1	Autostart meter has expired slave 1
W725	1	Autostart meter has expired slave 2
W726	1	Autostart meter has expired slave 3
F731	4	Error in the cluster configuration
F732	4	Error in address assignment of cluster devices
F733	4	No message from cluster master (only slave)
W734	1	No message from cluster on slave 1
W735	1	No message from cluster on slave 2
W736	1	No message from cluster on slave 3
W738	1	Synchronization not successful

Display no.	Level	Description
F739	3	Internal communication of the master is interrupted
W740	1	Internal communication of slave 1 is interrupted
W741	1	Internal communication of slave 2 is interrupted
W742	1	Internal communication of slave 3 is interrupted
F743	3	Internal CAN communication of the master is interrupted
W744	1	Internal CAN communication of slave 1 is interrupted
W745	1	Internal CAN communication of slave 2 is interrupted
W746	1	Internal CAN communication of slave 3 is interrupted
W747	1	Short circuit or cable break on transformer temperature sensor slave 1
W748	1	Short circuit or cable break on transformer temperature sensor slave 2
W749	1	Short circuit or cable break on transformer temperature sensor slave 3
W750	1	Short circuit or cable break on heat sink temperature sensor slave 1
W751	1	Short circuit or cable break on heat sink temperature sensor slave 2
W752	1	Short circuit or cable break on heat sink temperature sensor slave 3
W753	1	Invalid system time
F754	2	Communication with Multicluster Box interrupted
W755	1	Battery Preservation Mode 1 (LBM)
W756	1	Battery Preservation Mode 2 (LBM)
W757	1	Battery Preservation Mode 3 (LBM)
F758	2	No output voltage measured from the main cluster
W759	1	No output voltage measured from slave 1 of main cluster
W760	1	No output voltage measured from slave 2 of main cluster
F781	4	Error at a slave which leads to shutdown of the system (for the "RunMod" function)
F782	4	Failure of the grid monitoring
F783	2	Internal device syncpulse master missing
W784	1	Internal device syncpulse missing slave 1
W785	1	Internal device syncpulse missing slave 2
W786	1	Internal device syncpulse missing slave 3
W915	1	Software error

20.8.8 AUX Category

Display no.	Level	Description
F801	4	Plausibility check of the contactors in a Multicluster Box has failed
W802	1	No PV available in Off-Grid mode
W803	1	No PV available in Off-Grid mode (K1 or K2 error)
W804	1	Grid operation not possible
W805	1	Generator operation not possible
F806	4	Multicluster Box settings do not correspond to the software settings.
W807	1	No valid grid voltage with the requested grid operation
W808	1	Fault in Q4 contactor
F809	4	Fault in Q10 contactor (load shedding)
F810	4	Error in 15 V supply of the Multicluster Box
F811	4	Error in 24 V supply of the Multicluster Box
W812	1	Fault in Q1 contactor
W813	1	Fault in Q2 contactor
W814	1	Fault in Q3 contactor
W815	1	Fault in Q5 contactor
F816	2	Fault in Q7 contactor
F818	2	A phase is missing, Multicluster Box goes into "Failure" status
W824	1	Fault in Q4 contactor
W851	1	Pole of battery connection is reversed or short-circuit on the Sunny Island Charger 1
W852	1	Battery overvoltage Sunny Island Charger 1
W853	1	Overvoltage PV generator Sunny Island Charger 1
W854	1	No PV voltage or short-circuit on Sunny Island Charger 1
W855	1	Sensor error (or undertemperature) on Sunny Island Charger 1
W856	1	Overtemperature Sunny Island Charger 1
W857	1	No communication with Sunny Island Charger 1 for more than 24 h
W861	1	Pole of battery connection is reversed or short-circuit on the Sunny Island Charger 2
W862	1	Battery overvoltage Sunny Island Charger 2
W863	1	Overvoltage PV generator Sunny Island Charger 2
W864	1	No PV voltage or short-circuit on Sunny Island Charger 2
W865	1	Sensor error (or undertemperature) on Sunny Island Charger 2
W866	1	Overtemperature Sunny Island Charger 2
W867	1	No communication with Sunny Island Charger 2 for more than 24 h
W871	1	Pole of battery connection is reversed or short-circuit on the Sunny Island Charger 3

Display no.	Level	Description
W872	1	Battery overvoltage Sunny Island Charger 3
W873	1	Overvoltage PV generator Sunny Island Charger 3
W874	1	No PV voltage or short-circuit on Sunny Island Charger 3
W875	1	Sensor error (or undertemperature) on Sunny Island Charger 3
W876	1	Overtemperature Sunny Island Charger 3
W877	1	No communication with Sunny Island Charger 3 for more than 24 h
W881	1	Pole of battery connection is reversed or short-circuit on the Sunny Island Charger 4
W882	1	Battery overvoltage Sunny Island Charger 4
W883	1	Overvoltage PV generator Sunny Island Charger 4
W884	1	No PV voltage or short-circuit on Sunny Island Charger 4
W885	1	Sensor error (or undertemperature) on Sunny Island Charger 4
W886	1	Overtemperature Sunny Island Charger 4
W887	1	No communication with Sunny Island Charger 4 for more than 24 h
W890	2	Fault at the external measuring point of the Multicluster Box
W891	2	Fault at the external measuring point of the Multicluster Box slave 1
W892	2	Fault at the external measuring point of the Multicluster Box slave 2

20.9 Troubleshooting

Answers are provided below for faults that may occur in practice:

Why does the Sunny Island not connect to the running generator?

- Is the fuse on the generator ok?
- Has the power which is allowed to be fed back into the generator during the permissible time been exceeded ("233.14 GnRvTm" parameter)? If yes, "!" is displayed. 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.
- Is a GenMan used in the system?
  - Check the return signal (DigIn)
  - The generator can only be started manually using GenMan.

Why is the display of the Sunny Island dark and why is nothing shown on the display?

- Is the DC circuit breaker on the Sunny Island set to "On"? In this case, the device has switched off to protect the batteries from deep discharge (see also section 13.3 "State of Charge / SOC and SOH" (page 98)). To restart the Sunny Island, see section 9.5 "Reactivating the Device Following Automatic Shutdown" (page 64).
- The external battery fuse may have been tripped.

Why is it not possible to change the parameters?

- Has the installer password been entered correctly? Check whether you are actually in "Installer Level" (see section 10.5 "Entering the Installer Password" (page 76)). 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 for example the parameter "234.07 GnStrMod" in section 19.2 "Adjustable Parameters" (page 158)). Stop the Sunny Island as described in section 9.2 "Stopping the Sunny Island (Standby)" (page 63). Note that this causes a dropout in the stand-alone grid system 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 "233# Generator Control"). Change voltage and/or frequency limiting values while observing the technical data for your generator.

Why does the error F117 (AC voltage too high) also occur when the Sunny Island is started?

- A permanent short-circuit exists in the stand-alone grid system. Check the AC output connections of the stand-alone grid system (see section 6.3 "AC Connection" (page 36)).
- The loads connected to the stand-alone grid system are too heavy. The power/electrical energy of the Sunny Island is not sufficient to supply the loads. Switch off some of the loads and restart the Sunny Island.

What do I do 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 when the QCG does not run?

- Switch off the Sunny Island (see section 9.3 "Switching Off" (page 64)) and restart it (see section 9.1 "Switching On" (page 62)).

What can I do when "MMC operation failed" appears on the display?

- You wanted to perform an action using the SD card, but it failed (see section 10.9 "Display of Warnings and Failures" (page 82)). Check the card (on your PC/laptop) and use a new SD card, if necessary.

Why does my Sunny Island stay on even though I switched the DC circuit breaker to Off?

- Your Sunny Island may be powered by the AC side. Switch off all AC consumers and disconnect them from the Sunny Island (see section 9.4 "Disconnecting the Device from Voltage Sources" (page 64)).

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 tripped.
- The consumer power exceeds the generator power "234.03 GnCurNom".
  - Check error messages Find the cause.

Why is the deactivation defined by the SOC in case of a full or equalization charge and generator start in the second time zone?

- The equalization charge has a higher priority than silent time.

Why is the SOC not at 100 %, even after completion of a full charge?

- 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?

- Recalibrate the battery current sensor using the "225.04 BatCurAutoCal" parameter with the setting "Start".

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 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 SD card and activate them via the "550.02 ParaLod" parameter (see section 11.3 "Saving and Loading Parameters" (page 87).

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 cutoff limit (for voltage or frequency) is now no longer being breached?

- The Sunny Island connects with a so-called hysteresis, i.e., the connection value is slightly below or above the disconnection value. These limiting values are predefined ex-works.

Why is it not possible to set any combinations of voltage and frequency limits?

- The possible ranges for voltage and frequency of the Sunny Island allow the combination of special frequencies and voltages that result in transformer saturation and are therefore not permitted.

Why is it that one (or more) extension clusters remain in standby, although the main cluster is operating properly?

- Is the communication cable between the master devices connected? The main master cannot forward the "Start" command to the extension master. The devices remain in standby.

Why is the Multicluster system not supplying full power output?

- Has an extension cluster's slave failed? The system continues to operate, but with correspondingly lower output on the phase of the failed device.

Why is it that shortly after startup, the slave switches to standby with the failure message F117, but the master continues to operate?

- Are the phases within the cluster, or from the cluster to the Multicluster Box connected the wrong way around? This causes a permanent short-circuit in the cluster, and the slave reports this to the master.

Why is it that high outputs are being transferred back and forth between the clusters in the cluster network?

- The nominal frequencies and voltages are defined differently. Correct this by means of the appropriate parameters.

20.10 What to Do during Emergency Charge Mode

The Sunny Island cannot provide voltage with full amplitude with a deeply discharged battery and can no longer synchronize with an existing grid or generator. Using the emergency charge mode (ECM), it is possible to charge the batteries in current-controlled mode.

To charge the batteries in the emergency charge mode, either bridge the AC1 with AC2 (for a stationary generator) or connect a portable generator directly to AC1.

All loads must be disconnected in emergency charge mode.

Battery Management

The battery management is active and the current set battery parameters and the current charging phase are used. These values can be changed in "normal operation".

Generator and Grid Management

In emergency charge mode, the generator management and grid management are **not** active. Reverse power protection and relay protection are also not active.

AC1 and AC2 are bridged

In case that AC1 and AC2 have been bridged the generator should be connected and then manually started. Otherwise, it is possible that the magnetizing current trips the generator fuse. (This can also happen when connecting the relay without using a bridge.)

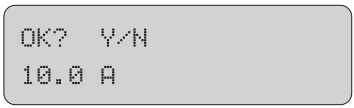
Emergency charge mode is activated in the QCG. For a description how to access the QCG see section 8.2 "Starting the Quick Configuration Guide (QCG)" (page 57). Follow the instructions up to point 2. The emergency charge mode is described below.

1. Choose "Emerg Charge" in QCG with <ENTER>.

2. Confirm the following view with <ENTER>.

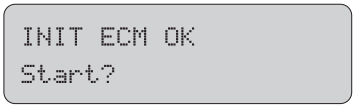
3. Set the maximum external current, e.g., the generator current.

4. Confirm the set value with <ENTER>.

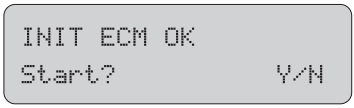


5. Use the down arrow key.

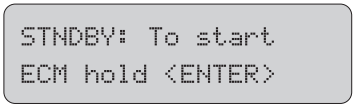
☑ The display on the right appears.



6. Press <ENTER> to confirm.



7. Press <ENTER>.



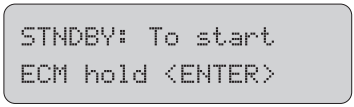
☑ The emergency charge mode is started.

Interrupt the emergency charge mode, e.g., in order to refill diesel:

1. Press <Enter> to stop the Sunny Island.
   ☑ The notification shown here is displayed.

2. Press and hold <ENTER>.
   ☑ The remaining time is displayed as a bar.

☑ The emergency charging mode is interrupted. The notification shown here is displayed.



Prematurely ending the Emergency Charge Mode

In order to exit the emergency charge mode early, the Sunny Island must be restarted with the "510.01 InvRs" parameter.

In emergency charge mode, process values are shown in the display. Parameters cannot be changed during the charging process. If the device is restarted, the settings that were saved before the ECM are loaded.

Bridge between AC1 and AC2

After emergency charge mode has been completed make sure to remove the bridge between AC1 and AC2!

Restarting

Observe information for restarting and wait for five minutes (see also section 9.5 "Reactivating the Device Following Automatic Shutdown" (page 64)).

21 Accessories

You will find the corresponding accessories and replacement parts for your product in the following overview. If needed, you can order these from SMA Solar Technology or your dealer.

Description	Brief description	SMA order number
GenMan	Generator Management Box including transformer (230 V/12 V) for top-hat rail mounting.	SI-GENMAN-TFH230
GenMan	Generator Management Box including transformer (230 V/12 V) as power supply	SI-GENMAN-TFS230
Batfuse-B.01 (250 A)	2-pole NH1 battery fuse-switch-disconnector for up to one Sunny Island, 3 DC input ports (1 x Battery and 2 x Sunny Island Charger), 1 X auxiliary voltage output with 8 A	BATFUSE-B.01
Batfuse-B.03 (250 A)	2-pole NH1 battery fuse switch disconnector for up to 3 Sunny Island, 6 DC input ports (2 x Battery and 4 x Sunny Island Chargers), 1 X auxiliary voltage output with 8 A	BATFUSE-B.03
Load-shedding contactor	3-pole load-shedding contactor with 48 V DC coil for Sunny Island The load-shedding contactor is available in several versions. You can obtain more information from SMA Solar Technology or your dealer.	SI-LSXX
SI-Shunt	Measuring shunts for the battery current detection The measuring shunt is available in several versions. You can obtain more information from SMA Solar Technology.	SI-SHUNTXXX
Sunny Island Charger	Solar charge regulator for Sunny Island systems Battery voltage: 48 V/24 V/12 V Battery current: 40 A at 48 V, 50 A at 12 V/24 V Nominal power: 2000 W at 48 V, max. PV voltage: 140 V	SIC40-MPT
Smart Load 6000	Adjustable dumpload	SL6000
RS485 upgrade kit	RS485 interface	485PB-G3
Multicluster Piggy-Back	Interface for communication between the Sunny Island and the Multicluster Box	MC-PB
Sunny Island Charger Piggy-Back	Interface for communication between the Sunny Island and Sunny Island Charger	SIC-PB

22 Technical Data

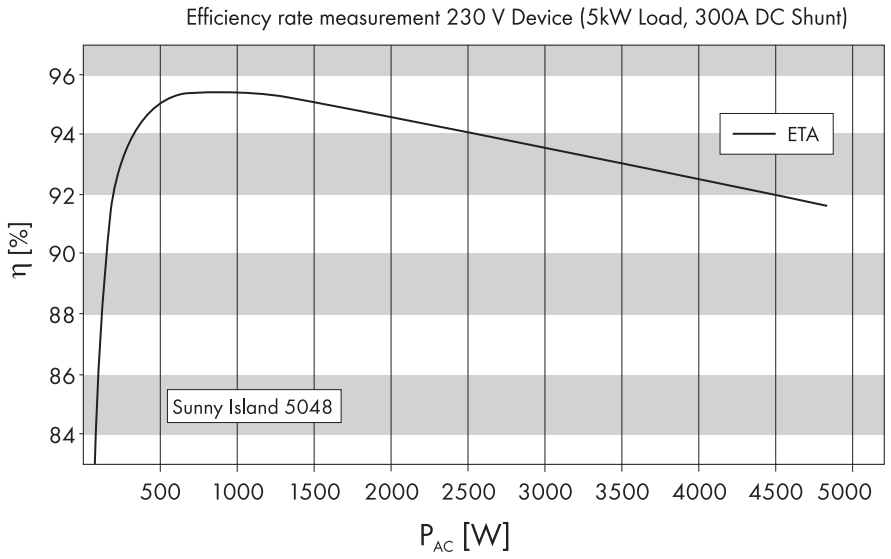
Output values		SI 5048
Nominal AC voltage (adjustable)	UAC, nom	230 V (202 V ... 253 V)
Nominal frequency	f_{nom}	45 ... 65 Hz
Continuous AC output at 25 °C	P_{nom}	5000 W
Continuous AC output at 45 °C	P_{nom}	4000 W
AC output power for 30 min at 25 °C	$P_{30\ min}$	6500 W
AC output power for 1 min at 25 °C	$P_{1\ min}$	8400 W
AC output power for 3 seconds at 25 °C	$P_{3\ sec}$	12000 W
nominal AC current	$I_{AC,\ nom}$	21 A
Maximum current (peak value) for 60 ms	$I_{AC,\ max}$	120 A
Harmonic distortion of output voltage	K_{VAC}	< 3 %
Power factor cosϕ		–1 ... +1

Input data		
Input voltage (adjustable)	$U_{AC,\ ext}$	230 V (172.5 V ... 264.5 V)
Input frequency (adjustable)	f_{ext}	50 Hz (40 Hz ... 70 Hz)
Maximum AC input current (adjustable)	$I_{AC,\ ext}$	56 A (0 A ... 56 A)
Maximum input voltage	$P_{AC,\ ext}$	12.8 kW

Battery Data		
Battery voltage (range)	$U_{Bat,\ nom}$	48 V (41 V ... 63 V)
Maximum battery charging current	$I_{Bat,\ max}$	120 A
Continuous charging current	$I_{Bat,\ nom}$	100 A
Battery capacity	C_{Bat}	100 Ah ... 10000 Ah
Charge control		IUoU procedure with automatic full and equalization charge
Battery type		VRLA / FLA / NiCd

Efficiency / Power consumption		SI 5048
Maximum efficiency		95 % (at 1000 W)
Efficiency > 90 %		5 ... 120 % Pnom

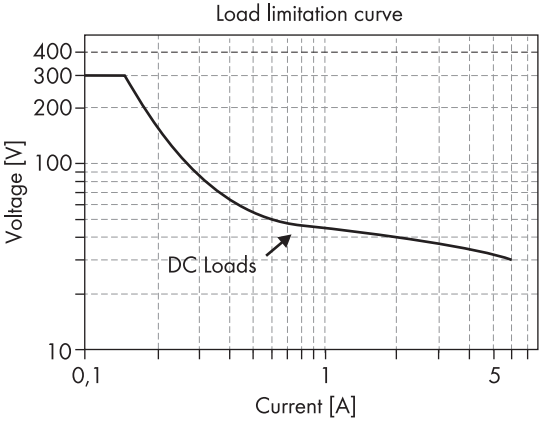
Efficiency / Power consumption		SI 5048
Efficiency curve		
Internal consumption with no load (in standby mode)		25 W (< 4 W)



General Data		
Dimensions (W x H x D in mm)		467 x 612 x 235
Weight in kg		approx. 63
EC Declaration of Conformity		enclosed, download area www.SMA.de/en
Protection rating according to DIN EN 60529 with inserted SD card		IP40
Protection rating according to DIN EN 60529 without inserted SD card		IP30
Device protection		short-circuit, overload, overtemperature
Ambient temperature		– 25 °C ... +50 °C

Interfaces		SI 5048
Number of LEDs		2
Number of buttons		4
Display		2-line display
Multi-function relay		2
Communication		RS485, galvanically insulated (optional)
Memory card		SD Card
Digital input level (Dig-In)		High level as of 9 V (up to 63V), low level 0 V ... 3 V
Load limits for multi-function relays 1 and 2		AC: 1 A at at 250 V DC: see graphic

Load limitation curve



23 Contact

If you have technical problems concerning our products, contact the SMA Serviceline. We need the following information in order to provide you with the necessary assistance:

- Type of the Sunny Island
- Serial number of the Sunny Island
- Firmware version of the Sunny Island
- Displayed error message
- Type of battery connected
- Nominal battery capacity
- Nominal battery voltage
- Communication products connected
- Type and size of additional energy sources
- Type of connected generators
- Power of the connected generator
- Maximum current of the generator
- Interface of the generator

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- Improper or inappropriate use of the product
- Operating the product in an unintended environment
- Operating the product whilst ignoring relevant, statutory safety regulations in the deployment location
- Ignoring safety warnings and instructions contained in all documents relevant to the product
- Operating the product under incorrect safety or protection conditions
- Altering the product or supplied software without authority
- The product malfunctions due to operating attached or neighboring devices beyond statutory limit values
- In case of unforeseen calamity or force majeure

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