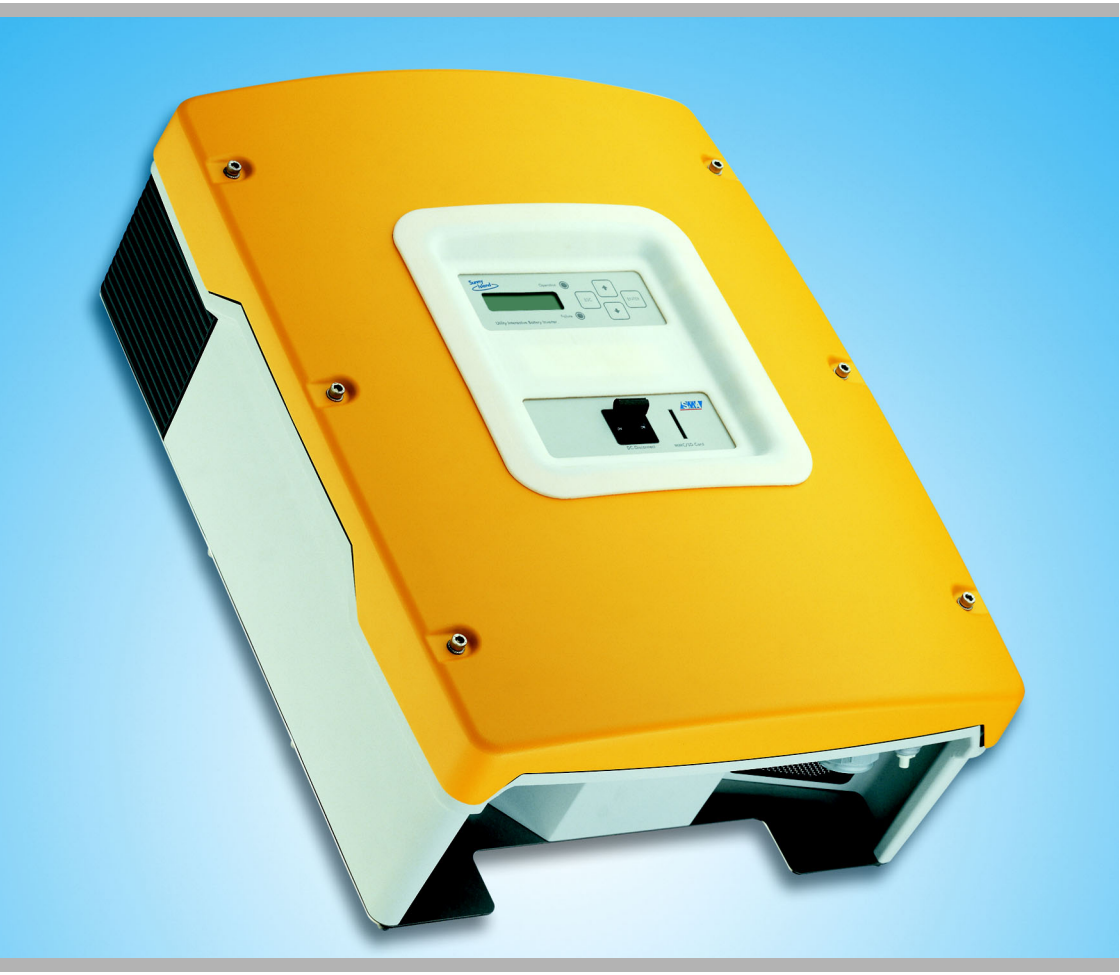
Sunny Island 5048
Installation & Instruction Manual



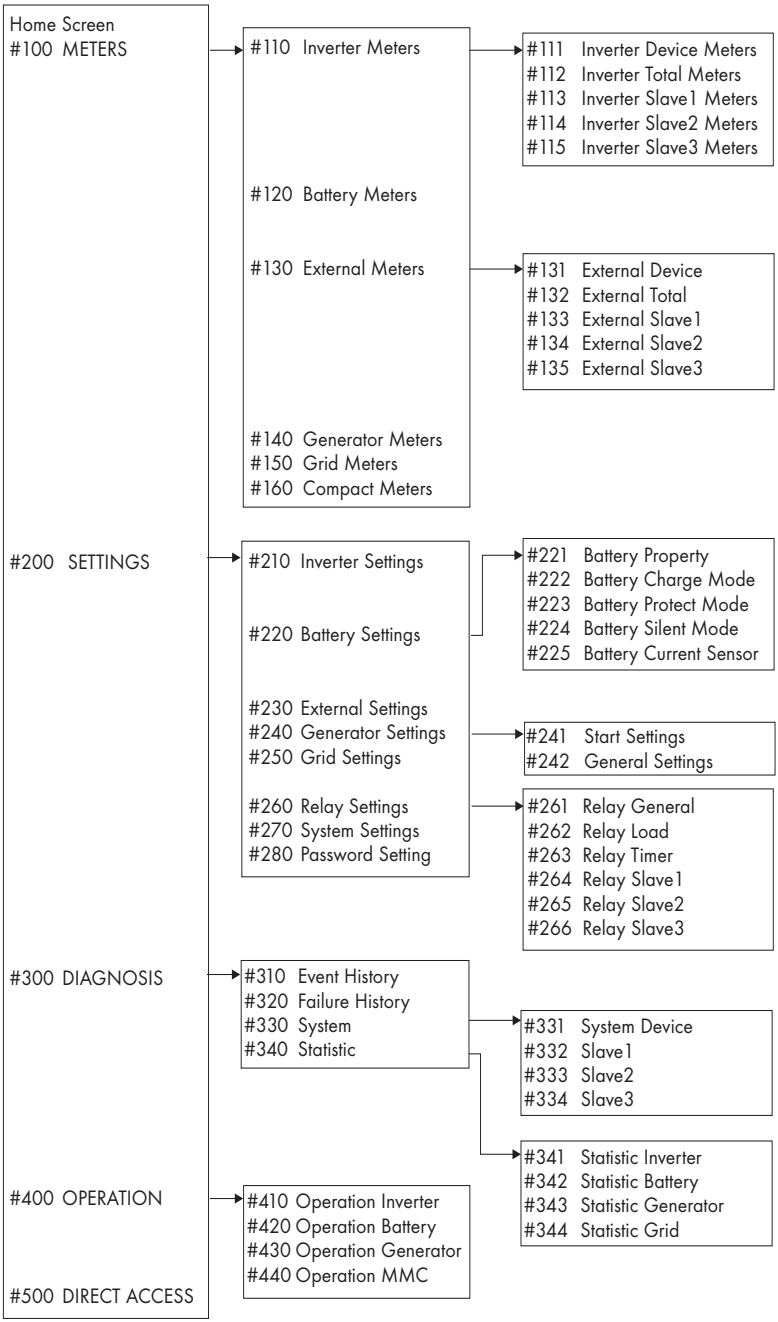

Home Screen
#100 METERS
#110 Inverter Meters
#111 Inverter Device Meters
#112 Inverter Total Meters
#113 Inverter Slave1 Meters
#114 Inverter Slave2 Meters
#115 Inverter Slave3 Meters
#120 Battery Meters
#130 External Meters
#131 External Device
#132 External Total
#133 External Slave1
#134 External Slave2
#135 External Slave3
#140 Generator Meters
#150 Grid Meters
#160 Compact Meters
#200 SETTINGS
#210 Inverter Settings
#220 Battery Settings
#221 Battery Property
#222 Battery Charge Mode
#223 Battery Protect Mode
#224 Battery Silent Mode
#225 Battery Current Sensor
#230 External Settings
#240 Generator Settings
#250 Grid Settings
#241 Start Settings
#242 General Settings
#260 Relay Settings
#270 System Settings
#280 Password Setting
#261 Relay General
#262 Relay Load
#263 Relay Timer
#264 Relay Slave1
#265 Relay Slave2
#266 Relay Slave3
#300 DIAGNOSIS
#310 Event History
#320 Failure History
#330 System
#340 Statistic
#331 System Device
#332 Slave1
#333 Slave2
#334 Slave3
#341 Statistic Inverter
#342 Statistic Battery
#343 Statistic Generator
#344 Statistic Grid
#400 OPERATION
#410 Operation Inverter
#420 Operation Battery
#430 Operation Generator
#440 Operation MMC
#500 DIRECT ACCESS

Table of Contents

1 Notes on this Manual

This technical description is intended for both the installer as well as the end customer. It is intended to assist in correctly mounting, installing and operating as well as understanding the operating principles of a Sunny Island 5048.

1.1 Validity

This technical description applies to firmware versions 1.004 and higher.

You can read the the firmware version of your device on the display using the "#331.02 FwVer" parameter (see section 18.3 "Diagnostics" (Page 138)).

This product may only be operated within the limits and in the intended area of application provided in this document.

Do not use the Sunny Island 5048 for purposes other than those indicated in this technical description. Use of the device for other purposes can void the warranty as well as damage both the device and the system.

If you require further information, please contact the Sunny Island Hotline at the following number +49 561 95 22 399 or by e-mail: SunnyIsland.hotline@SMA.de.

1.2 Symbols Used

To ensure optimum use of these instructions, note the following explanations of symbols used.

This symbol indicates a danger.

If this is ignored, a significant danger of injury or death arises and damage to the device, system or plant may also result.

This symbol indicates a notice.

Failure to observe this notice can make a working step more difficult, and may hinder optimum operation of the device.

This symbol indicates an example.

Here you will find further concrete examples of operations and device behavior.

1.3 Syntax

The syntax specified here for menus and parameters apply to the entire document:

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

Parameter: hash, menu number, dot, parameter number and parameter name (#150.01 GdRmgTm)

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 5048 supplies loads on the stand-alone grid side and charges battery banks with power that is provided by feeding electricity into the grid on the AC side.

The comfortable support of AC and DC coupling, and the extendibility of the systems formed by the Sunny Island 5048 guarantee maximum flexibility. Thanks to innovative technology, the Sunny Island 5048 also achieves a maximum efficiency of more than 95 %. Optimized for operation under partial load, it simultaneously impresses with its low consumption when idle or in standby mode. 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 four devices on a single phase of a battery or three devices on a three-phase system enables the Sunny Island 5048 to setup stand-alone power supplies with outputs ranging from 3 kW to 26 kW (in multicluster operation up to 78 kW).

Thanks to its sophisticated generator management, it can control connected diesel generators in a particularly sparing and fuel-saving manner. It can also be integrated into the public grid. The Sunny Island 5048 can also automatically deactivate loads if the battery does not have sufficient electrical energy available.

The stand-alone grid's critical component, the battery, is monitored diligently and utilized optimally. The intelligent battery management precisely records the battery's charge level. This enables improved utilization of 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 5048 has an intelligent charge control and reliable deep discharge protection. When these functions are properly used, the battery service life can be greatly extended in comparison with simpler devices.

Despite the complex function of this battery inverter, the Sunny Island 5048 is easy to configure. All the settings required for operation can be quickly and easily programmed in ten steps using the "Quick Configuration Guide". By employing the concept of central operation referred to as "Single Point of Operation", the system/cluster parameters are only set on the master device, and all other devices automatically adopt the

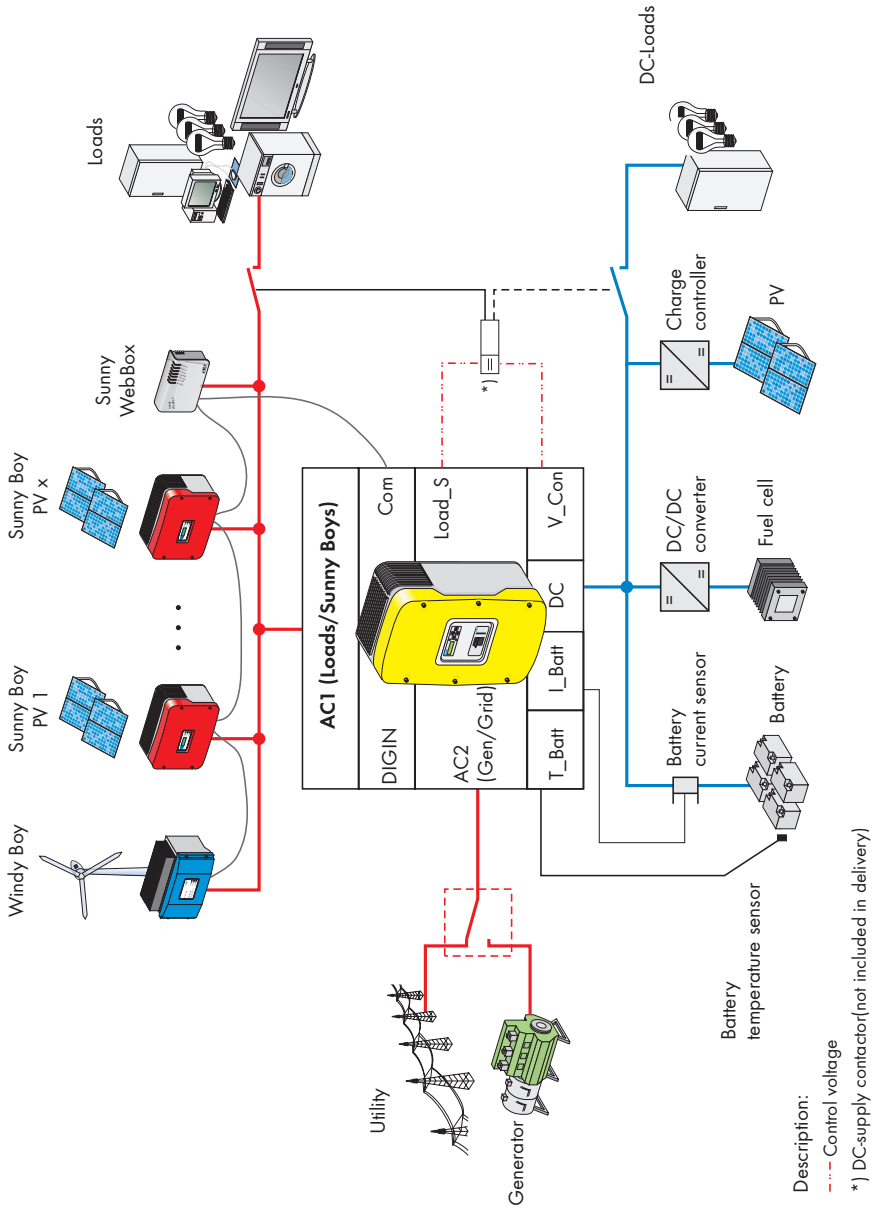
configuration. The easy-to-understand menu navigation allows quick access to all important data, even while the system is running. An MMC/SD card provides uncomplicated system control, and thus makes any service work easier.

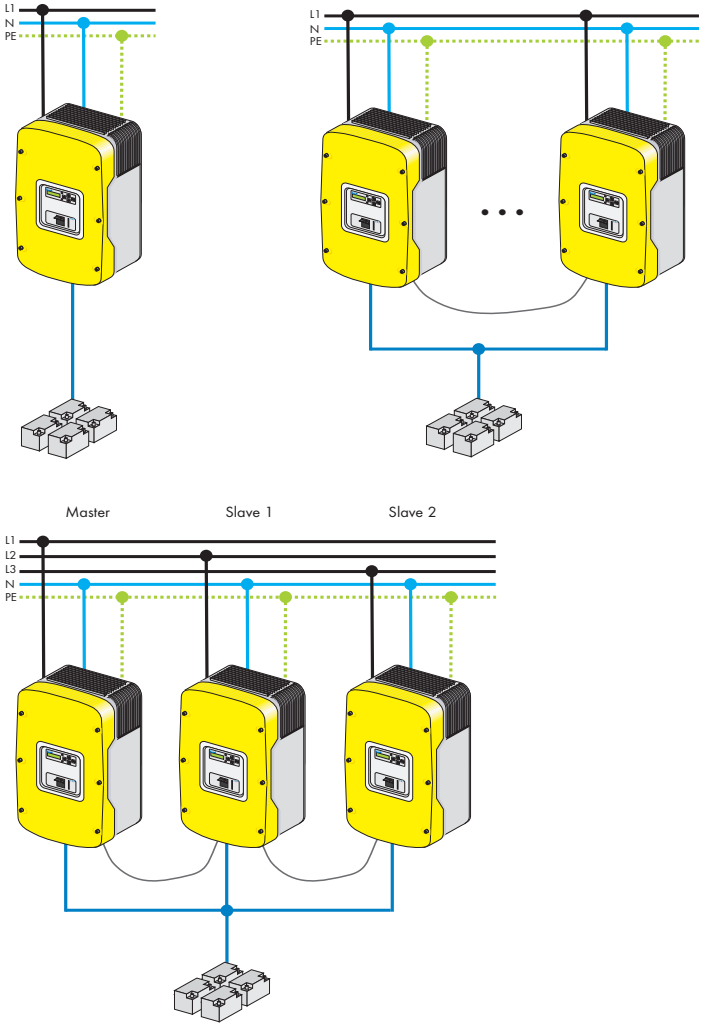
The Sunny Island 5048 monitors the set voltage and frequency limits on the grid and the generator. If these limits are not within the permissible range, it disconnects the external source without interruption and goes into stand-alone grid operation. The Sunny Island 5048 also has an integrated anti-islanding process that prevents a stand-alone grid from accidentally being created on the public grid. If this process is triggered, the system also completely switches into stand-alone mode without interruption.

The Sunny Island 5048 does not meet the VDE 0126-1-1 directive required in Germany and, for legal reasons, it must therefore be MSD-certified (e.g. by UfE GmbH) when operated while connected to the public grid.

The Sunny Island 5048 can be integrated into different system constellations. The graphic on the next page displays which components can be integrated into a Sunny Island system.

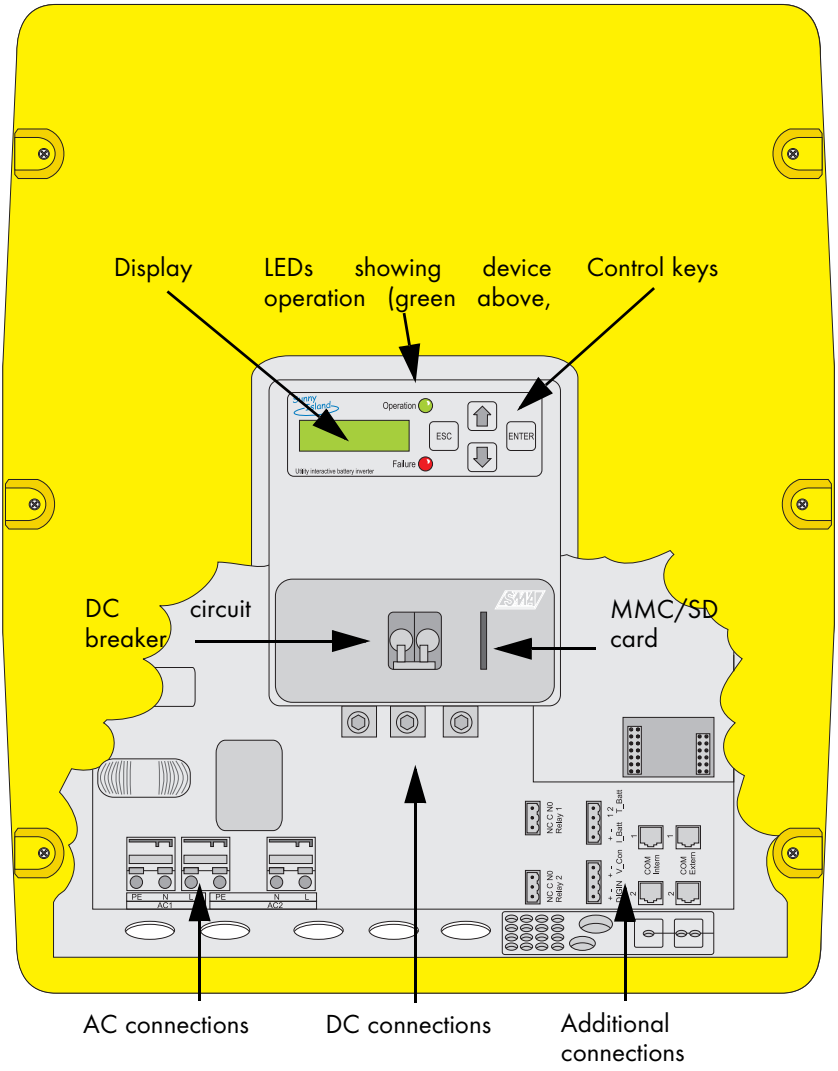
The graphics on the page after next display the different wiring options (1-phase, 1-phase parallel and 3-phase).


Loads
Sunny WebBox
Sunny Boy PV x
Sunny Boy PV 1
Windy Boy
AC1 (Loads/Sunny Boys)
Com
Load_S
V_Con
DC
I_Batt
T_Batt
DIGIN
AC2 (Gen/Grid)
*)
DC-Loads
Charge controller
PV
DC/DC converter
Fuel cell
Battery current sensor
Battery
Battery temperature sensor
Utility
Generator
Description:
Control voltage
*) DC-supply contactor(not included in delivery)

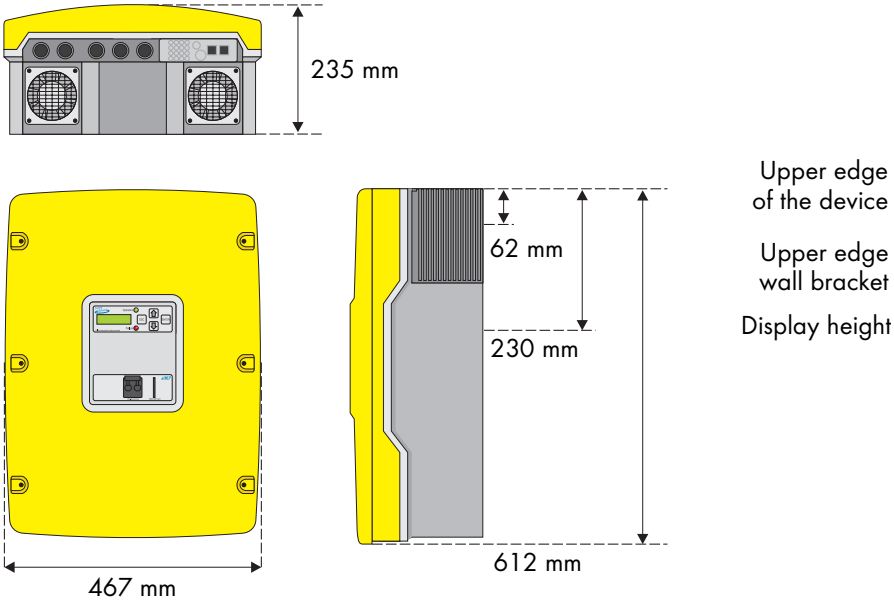

L1
N
PE
Master
Slave
L1
N
PE
Master
Slave 1
Slave 2
L1
L2
L3
N
PE

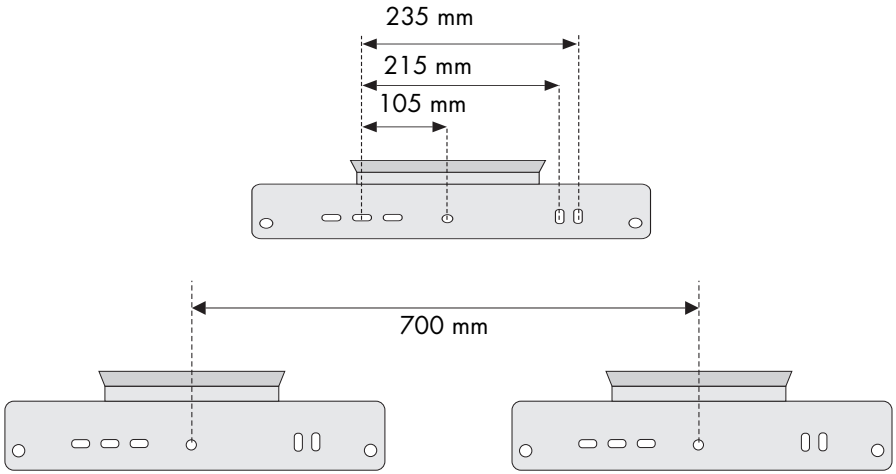
2.2 At a Glance

The following figure provides an overview of all control elements and connections of the Sunny Island 5048:



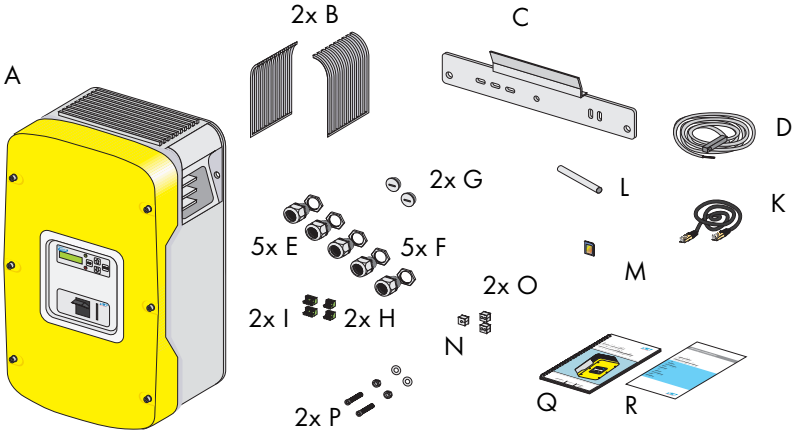
2.3 Dimensions





2.4 Scope of Delivery

The following elements are included:



A	1	Sunny Island 5048 with cover
B	2	air grills
C	1	wall bracket
D	1	battery temperature sensor
E	5	M25 metric-thread cable screw connections
F	5	M25 nuts
G	2	metric-thread dummy plugs
H	2	3-pole print terminals (for connecting relays 1 & 2)
I	2	4-pole print terminals (for connecting battery temperature/electricity sensor)
K	1	RJ45 communication cable (black, 2 m) for internal communication (between several Sunny Island 5048 devices)
L	1	silicone tube 10 mm x 0.5 m
M	1	128 MB SD card
N	1	rubber plug for feed-through of one cable
O	2	rubber plugs for feed-through of two cables

P	2	M6 x 10 mm hexagon socket screws incl. M6 contact disks for connecting the Sunny Island 5048 to the wall bracket
Q	1	installation & instruction manual
R	1	"Warranty and Guaranty Conditions" form

2.5 Required Tools and Resources

You require the following tools and materials in order to mount and install the Sunny Island 5048:

Tools (not included in delivery)

Cable

Cable end sleeves

Cable knife

Combination pliers

Crimping tool for cable lugs (suitable for cable cross-sections of up to 70 mm²)

Diagonal cutting pliers

Drill

Drill (e.g. stone drill), Ø 10 mm

Flathead screwdriver, 0.4 x 2.5 mm/1.0 x 10 mm/1.0 x 5.5 mm

Hexagon/Allen keys, 3 mm to 8 mm

Multimeter

Open-end/ring wrenches or socket wrench in the sizes 10/19/24/30

Phillips screwdriver, PH1 and PH2

Spirit level

Stripping pliers

Torque wrench (4 Nm to 5.7 Nm) with flathead screwdriver adapters in the sizes 10/5.5/2.5 mm

Material (not included in delivery)

Cable ties

Heat shrink tubing

Hexagon bolts, 8 × 60 mm, washers

Ring cable lugs (with hole size for M8 screws)

Material (not included in delivery)

Wall anchors for the wall bracket (e.g. SX 10)

2.6 Accessories (Optional)

The following accessories for the Sunny Island 5048 are also available:

- GenMan (generator manager) (SMA order number: "SI-GenMan-...")
  Enables the Sunny Island 5048 to control generators which require more than a simple start/stop signal for remote control (see section 14.1.1 "Generator Start Options" (Page 95)).
- Separate fuse for the battery (SMA order number: "SI-BATFUSE-..."
  Enables cable protection (used with strip fuse ...-SIBA-...) or disconnection with cable protection (used with NH fuse ...-NH01-...) of the Sunny Island 5048 from the connected battery (see section 6.2.2 "Cable Protection" (Page 36)).
- Separate 48 V DC contactor (SMA order number: "SI-LS-..." (with 25/40/65/95 A))
  Enables load shedding on the AC or DC side (see section 6.4.4 "Multi-function Relay 1 and 2" (Page 47)).
- Separate current shunt for battery current measurement (SMA order number: "SI-SHUNT400-60")
  Enables battery current measurement on the AC or DC side (see section 6.4.2 "Battery Current Sensor" (Page 42)).

SMA Technologie AG also offers an extensive range of products allowing you to communicate with the Sunny Island 5048, to query data, and much more. Among these devices are:

- Sunny Boy Control
- Sunny Boy Control Plus
- Sunny WebBox

The "Sunny Data Control" software, with which you can configure your inverter as well as read out and analyze data, can be downloaded for free from the **SMA** Technologie AG website at www.SMA.de (see section 22 "Contact" (Page 159)).

2.7 SMA Products (Optional)

A stand-alone system using the Sunny Island 5048 as the grid controller can also be fed with electrical energy from feed-in devices which do not require fossil fuels. **SMA** Technologie AG offers the following products for decentralized energy supply of AC loads (see figure on page 13):

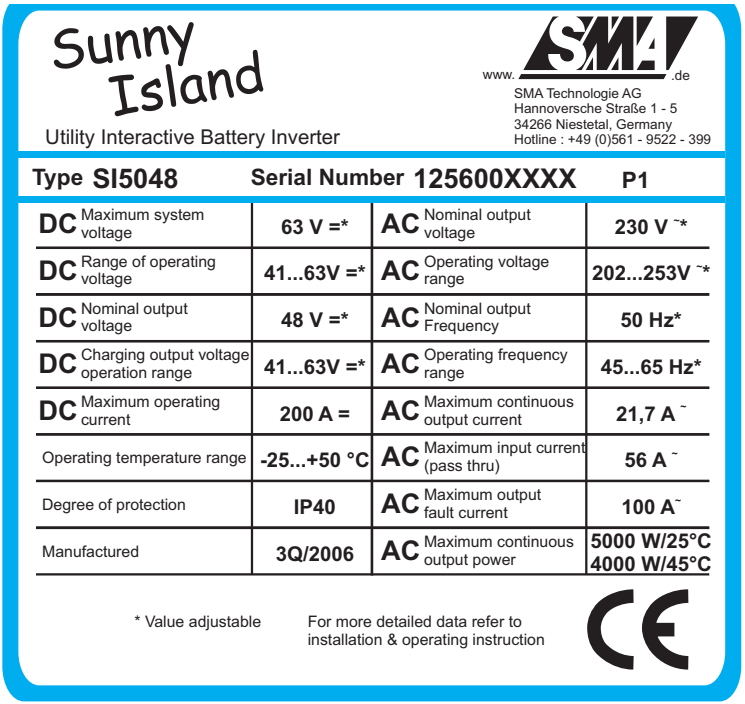
- Sunny Boy inverters (for feeding in from PV systems):
  SB 700 / SB 1100 / SB 1100LV / SB 1700 / SB 2500 / SB 2800i / SB 3000 / SB 3300 / SB 3800 / SMC 5000 / SMC 5000A / SMC 6000 / SMC 6000A / SMC 6000TL / SMC 7000TL / SMC 8000TL
- Windy Boy inverters (for feeding in from wind turbines or hydropower systems):
  WB 1100 / WB 1700 / WB 2500 / WB 2800i / WB 3000 / WB 3300 / WB 3800 / WB 6000
- All Hydro-Boy inverters (for feeding in from fuel cell systems)

You can receive the current list of devices that work together with the Sunny Island 5048 by contacting the Sunny Island Hotline (see section 22 "Contact" (Page 159)).

2.8 Type Plate/Firmware Version

You can identify the Sunny Island 5048 by the type plate and the firmware version.

- The type plate is located on the left side of the housing.
- You can read the the firmware version of your device on the display using the "#331.02 FwVer" parameter (see section 18.3 "Diagnostics" (Page 138)).



A	Maximum DC voltage	Nominal AC voltage	**I**
B	DC voltage range	AC voltage range	**K**
C	Nominal DC output voltage	Nominal frequency	**L**
D	DC charging voltage range	Frequency range	**M**
E	Maximum DC operating current	Maximum continuous AC current	**N**
F	Temperature range	Maximum AC input current	**O**
G	Protection class	Maximum leakage current	**P**
H	Manufacturing date	Maximum output power	**Q**

3 Safety Instructions

3.1 Important Notes Regarding Operation

Please follow all operating and safety instructions 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 through the safety instructions **before** installing and commissioning the device. Store the manual at an easily accessible location.

Be sure to observe all applicable regional standards and guidelines.

The Sunny Island 5048 should only be installed or opened by suitably qualified personnel (qualified electrician).

Never attempt to repair the device yourself. Unprofessional repair work can be dangerous. Please consult your dealer or SMA Technologie AG if a fault occurs.

Risk of irreparable damage!

During installation, make sure that you only use the same type of Sunny Island 5048. Due to the different voltage levels, 230 V and 120 V types may never be operated at once.

The operating consumption of the Sunny Island 5048 discharges the battery. In standby mode this load is about 4 W and in idle mode it is about 25 W. Observe this when you wish to install the Sunny Island 5048

- **, but do not wish to immediately use it or**
- **use it for an extended period of time during the year.**

It may be necessary to set the Sunny Island 5048 to Stop mode (see section 9.3 "Deactivation" (Page 63)) and disconnect it from the battery by means of the DC circuit breaker.

3.2 Potential Hazards

Like any other power converter, the Sunny Island 5048 is an electrical device that presents certain hazards when operated.

The Sunny Island 5048 employs life-threatening voltages and currents. Complete protection against accidental contact is only provided when the following points are followed according to the handbook:

- **the device is mounted correctly,**
- **the device is properly grounded,**
- **all connections to the device are made correctly,**
- **and the housing cover is subsequently securely closed.**

If this is ignored, a significant danger of injury and death arises and damage to the device may also result.

Before performing any maintenance work or installation work on the Sunny Island 5048, you must make absolutely sure that all devices built in or connected to the system are completely isolated from all voltage sources (battery, (stand-alone) grid, generator). Ensure that the system cannot be accidentally switched on again. Proceed in the order given below:

- **Switch off all loads.**
- **Press and hold <ENTER> until the "Hold key to stop" message appears.**
- **Press and hold ENTER until the Sunny Island 5048 stops and "STANDBY–To start press <ENTER>" appears on the display.**
- **Switch off the Sunny Island 5048 using the DC circuit breaker and also disconnect the device from the battery (e.g. using the optional SI-BattCase load disconnecting switch).**
- **Then disconnect the Sunny Island 5048 from the grid/generator and stand-alone grid (AC1 and AC2).**
- **Make sure that the Sunny Island 5048 has been disconnected from all voltage sources.**
- **Wait at least five minutes to let the capacitors discharge and allow the voltage inside the device to drop to a safe level. In order to fully discharge, the capacitors require approximately 30 minutes. Make sure to avoid causing a short circuit on the DC side.**
- **Open the housing cover to ensure the device is not under voltage.**

The Sunny Island 5048 can start on its own. When working on the stand-alone grid, ensure that ALL sources of AC and DC power in the system have been switched off (see above).

When touching the device, please note that some parts of the Sunny Island 5048 housing may heat up during operation. These temperatures may exceed 60 °C. There is a danger of burn injury.

This device was NOT developed to power life-sustaining medical devices. The Sunny Island 5048 may not be used in systems where a power outage could result in personal injury.

This device is suitable only for installation in enclosed spaces. Therefore, do not expose it to moisture, rain or direct sunshine (protection degree IP40).

The Sunny Island 5048 has been designed for use at elevations up to 3000 m above sea level. Contact **SMA** *Technologie AG before using it at an elevation 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!

4 Mounting the Device

Take note of the required installation conditions listed below **before** mounting, installing and commissioning the Sunny Island 5048.

4.1 Preparation

4.1.1 Lifting/Moving

The Sunny Island 5048 weighs 63 kg. Ensure that at least three people are available for installing the device. Always wear personal protective equipment (protective clothing, gloves, safety boots) to avoid the danger of injuries.

The upper black ventilation flaps on the right and left side of the Sunny Island 5048 can be removed for transportation; **carrying handles** *are located under the flaps. The ventilation flaps are not mounted when the device is delivered. They are inserted after the device is installed (they snap on).*

4.1.2 Unpacking

Before installing the Sunny Island 5048 make sure that all parts are included in the delivery.

- Carefully check the packaging and the Sunny Island 5048 for any signs of damage.
- Ensure that all parts are included in the delivery (see section 2.4 "Scope of Delivery" (Page 17)).
- Enter the type and serial number of the device into the "Warranty and Guaranty Conditions" form.
- Keep the documents in a location where they will be easy to find later.

Remove the tape that covers both the outer and inner holes for the cable feed-throughs. It prevents foreign objects from entering the housing during transport.

If something is missing or the Sunny Island 5048 has been damaged during shipment, contact **SMA** Technologie AG immediately. For more information, please see section 22 "Contact" (Page 159).

Keep the packaging in case you need to return the battery inverter or its accessories.

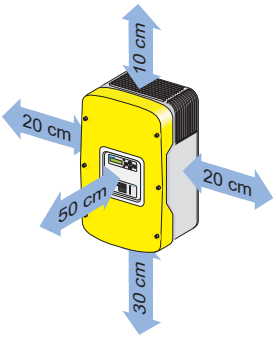
4.1.3 Minimum Clearance

Air enters the Sunny Island 5048 through the underside of the housing and then flows through the device before exiting through the air grills on top of the housing.

When installing the device, a minimum clearance of 20 cm at the sides and 10 cm above the housing must be provided to ensure adequate ventilation of the Sunny Island 5048.

All external cables are connected through the underside of the housing. This requires a minimum clearance of at least 30 cm.

Operation of the device and reading the display is much easier when the Sunny Island 5048 is installed with the display at eye-level with at least 50 cm clearance in front.



When installing the Sunny Island 5048 in smaller rooms, make sure that adequate ventilation is available. The device produces heat when operating that must be removed.

Several Sunny Island 5048 devices can be installed on top of each other without any problems, since the active OptiCool® ventilation system dissipates the heat. The integrated fans are controlled in a temperature-dependent manner.

4.1.4 Wall Mounting

Do not install the Sunny Island 5048

- **on flammable construction materials,**
- **in areas where highly inflammable materials are stored,**
- **in potentially explosive areas!**

The Sunny Island 5048 may only be operated hanging vertically. Since condensation can build up in the device, horizontal operation is not permitted!

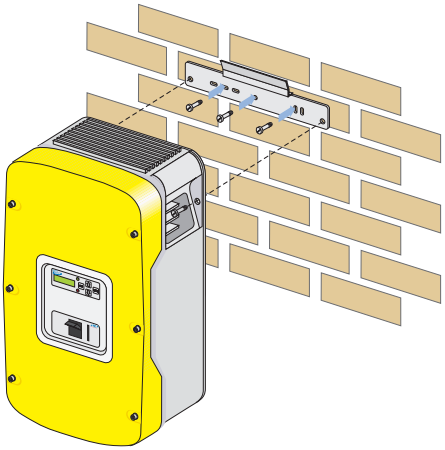
The Sunny Island 5048 weighs 63 kg. Take this weight into account when choosing the installation site and method of installation.

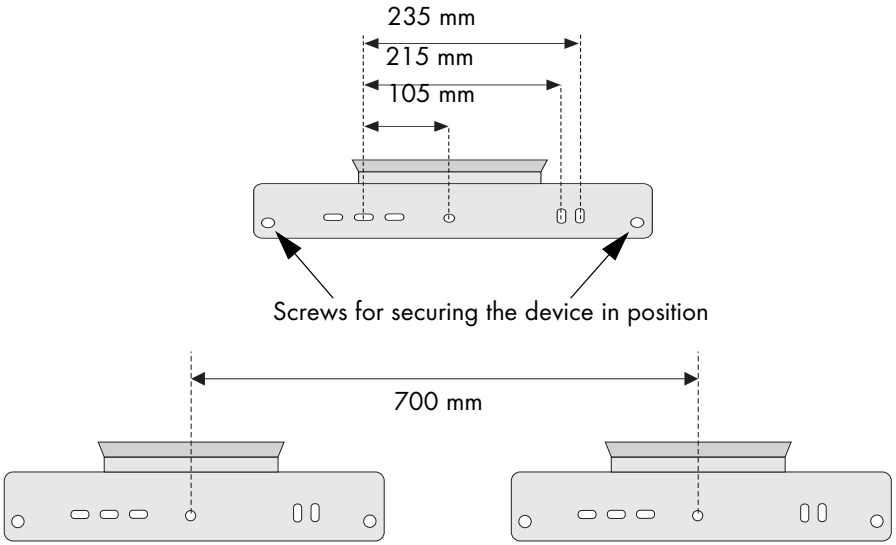
Protect the Sunny Island 5048 from direct sunlight. High temperatures lead to lower performance of the battery inverter.

The ambient temperature must not be outside the -25 °C to +50 °C range.

To make the job easier, we recommend using the supplied wall bracket to mount the Sunny Island 5048 and using a spirit level to ensure correct alignment. Fix the wall bracket using three screws (8 mm diameter).

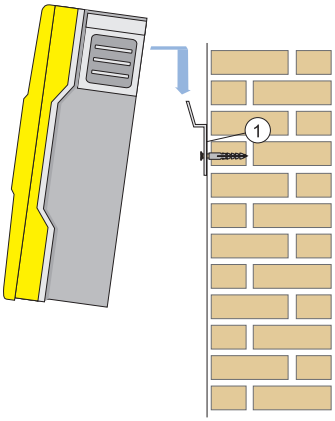
The figure below displays the distances of the drill holes in detail for installing the wall bracket. The two outer screws are used to keep the Sunny Island 5048 securely attached to the wall.



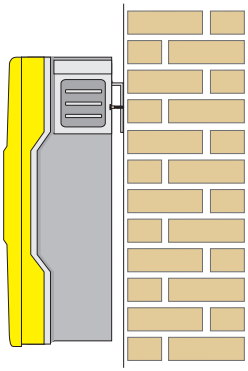


Keep to the following sequence when installing the Sunny Island 5048:

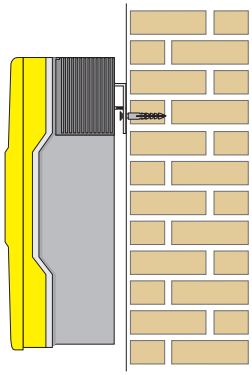
- Mount the wall bracket (1). To mark the positions to drill the holes, you can use the wall bracket as a drilling template.
- Now hang the Sunny Island 5048 onto the wall bracket using its mounting plate so that it cannot be moved sideways.



- Secure the Sunny Island 5048 in position by screwing the supplied screw onto the wall bracket.



- Insert the upper right and left air grills (they only need to be snapped on).
- Make sure that the Sunny Island 5048 is positioned securely on the bracket.



5 Opening and Closing

The housing of the Sunny Island 5048 has a removable cover. Remove this cover only when installing the device or for required maintenance or repair work.

The Sunny Island 5048 should only be installed or opened by suitably qualified personnel (qualified electrician).

Switch off the Sunny Island 5048 and disconnect all voltage sources (battery, (stand-alone) grid, generator), (see sections 9.2 "Stopping" (Page 62) and 9.3 "Deactivation" (Page 63)).

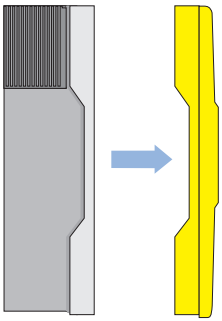
Wait five minutes until the capacitors have discharged.

Ensure that the system cannot be accidentally switched on again.

5.1 Opening the Device

Proceed as follows:

1. Loosen the six Allen screws on the front side of the Sunny Island 5048 to remove the cover.
2. Remove the six Allen screws.
3. Carefully and evenly pull the housing cover until it comes free from the housing.
4. Remove the cover and store it in a safe place while mounting, installing or repairing the device.

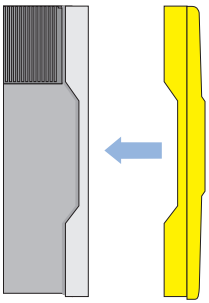


5.2 Closing the Device

When closing the Sunny Island 5048, make sure that the tooth lock washers are under the six Allen screws. They secure the ground connection of the cover.

Before installing the housing cover of the Sunny Island 5048, ensure that all cables are properly laid and that all tools have been removed from within the housing (see section 6 "Electrical Connection" (Page 33)).

1. Starting from the front, place the cover evenly on the housing.
2. Attach the housing cover onto the Sunny Island 5048 using the six Allen screws. Tighten the screws evenly and firmly.

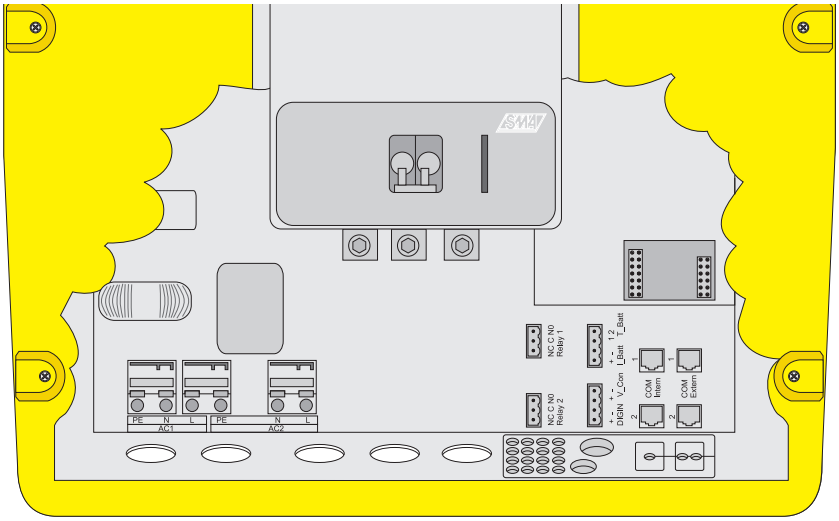


6 Electrical Connection

The electrical installation of the Sunny Island 5048 must be made by suitably qualified personnel only (qualified electrician). Before beginning to install your Sunny Island 5048, identify any potential hazards and take any necessary precautions (see section 3 "Safety Instructions" (Page 23)).

If the device is connected incorrectly, a significant danger of injury or death arises and damage to the device, system or plant may also result.

All connection cables are fed through the feed-throughs on the underside of the device (see following figure) and connected to the appropriate connections inside the Sunny Island 5048.



Use the provided cable screw connections to fasten the cables inside the Sunny Island 5048 housing in a manner conforming to the appropriate standards. The metric-thread cable screw connections guarantee a dust-free and waterproof installation of the cables in the housing and also provide strain relief for the cable connection. Close all unused openings in the housing using the appropriate dummy plugs (the dummy plugs are already installed on AC2 and DC-Ground upon delivery).

Obtain an overview of the different components and connection areas of the Sunny Island 5048 (see section 2.2 "At a Glance" (Page 15)).

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

- Grounding (section 6.1)
- DC connection (section 6.2)
- AC connection (section 6.3)
- Battery temperature sensor (section 6.4.1)
- Battery current sensor (section 6.4.2)
- Communication for multi-device connection (section 6.4.3)
- Multi-function relay 1 and 2 (section 6.4.4)
- External communication (section 6.5)
- GenMan connection (section 6.6)

6.1 Grounding

In stand-alone configurations, the (protective) ground of the Sunny Island 5048 and its individual components must be wired as a TN grid only. All valid standards and guidelines must be taken into account!

Before commissioning the Sunny Island 5048, it must be externally grounded according to the relevant regulations.

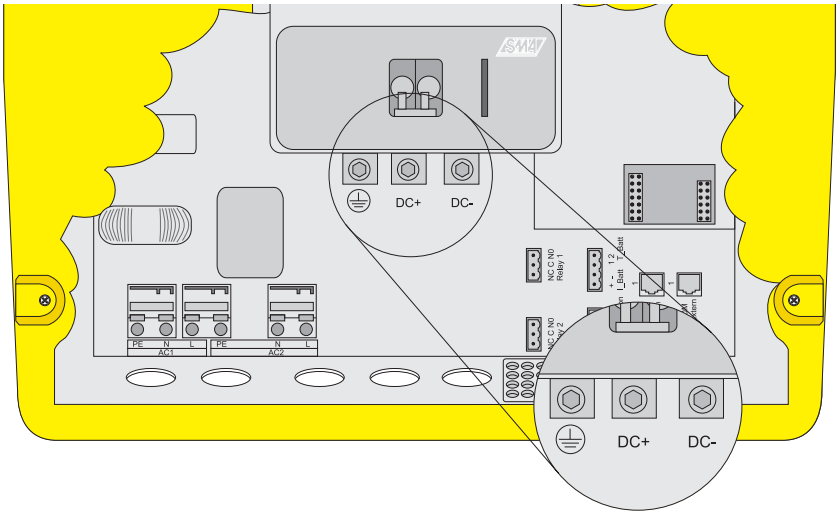
To allow different types of grounding, the N connection of the Sunny Island 5048 is NOT connected to PE at the factory. However, since a connection between N and PE is required for correct operation, this must be done outside of the device.

Due to filter measures in the device, increased leakage currents against PE can always occur. For this reason, a "fixed connection" of ground must be implemented according to EN 50178. Ground the device 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 of the plus or negative pole of the batteries is possible because the batteries and the grid side are galvanically isolated within the Sunny Island 5048. In this case, make sure that the high currents that may occur under fault conditions can be adequately discharged.

If a connection is required, then this must be made by an installer.

The DC grounding conductors must be connected to the connection labeled "Ground". Installation of the grounding conductors occurs in four steps:



1. Sheathe the cable screw connection over the ground conductor and then insert the ground conductor into the housing of the Sunny Island 5048.
2. Install the M25 metric-thread cable screw connection (included in delivery) in the "Grounding" cable feed-through.
   - Insert the metric-thread cable screw connection into the feed-through opening.
   - Screw the counter nut onto the cable screw connection thread inside the housing and tighten it.
3. Remove the protective insulation from the conductor and fit a suitable ring cable lug to the exposed end of the conductor.
4. Attach the conductor with the ring cable lug to the ground connection terminal and tighten the screw firmly (torque 4.0 Nm to 5.7 Nm).

Calculating the Required Grounding Conductor Cross-section

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

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

The required cross-section of a (copper) grounding conductor can be calculated using the following formula. Trigger times, e.g. for the integrated DC circuit breaker, of about 25 ms are typical for short-circuit currents between 2000 A and 10000 A.

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

t = interruption time in seconds
I_{SC} = maximum battery current (short-circuit current) in amperes
S = conductor cross-section in mm²

A grounding conductor of 16 mm² cross-section is thus adequate for short-circuit currents up to 10000 A.

6.2 DC Connection

6.2.1 Safety Precautions/Conditions

Connect a suitable battery to the DC side (see section 20 "Technical Data" (Page 155)). DC must be connected observing all valid regulations (e.g. DIN VDE 0510, Rules for Accumulators and Battery Systems).

All safety and maintenance instructions provided by the battery manufacturer must be heeded.

Use appropriate (insulated) tools for installation and wiring of the batteries (danger of short circuits and arcing).

When connecting the battery, ensure that the cable has sufficient cross-section and that the connections have the correct polarity.

The battery cables should be as short as possible. Long cables and insufficient cable diameters reduce the system efficiency as well as the overload capabilities. Do not lay the battery feed cables under plaster or in armored plastic pipes. Large currents flow through the battery cables so that they can become very warm.

6.2.2 Cable Protection

In addition to the DC circuit breakers within the Sunny Island 5048, install a separate fuse as close as possible to your batteries. Install a suitable fuse plug for the fuse according to the maximum specified DC current (e.g. NH1 with 250 A).

If no cable protection exists, then the DC cables must be protected against ground faults and short circuits. The internal DC fuse of the Sunny Island 5048 is designed such that it can interrupt currents of up to 10000 A.

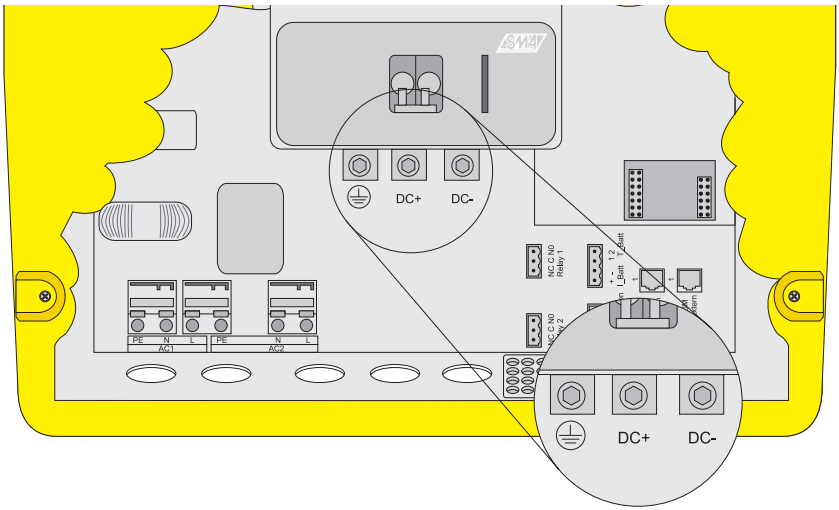
For short-circuit currents greater than 10000 A, an additional thermal fuse is absolutely essential ("SI-BattCase.01-250").

6.2.3 Connection

Only connect the external fuse/battery cables to the battery after all other installation work is finished.

There is a "DC –" and a "DC +" connection available for each ring cable lug (max. 70 mm²) for the battery feed cables in the Sunny Island 5048.

Install the DC connections in the following sequence:



1. First sheathe the cable screw connection over the cables and then insert the cables into the housing of the Sunny Island 5048.
2. Install an M25 metric-thread cable screw connection (included in delivery) on the "DC –" and "DC +" cable feed-through.
   - Insert the cable screw connection thread into the cable feed-through opening.
   - Screw the counter nut onto the cable screw connection thread inside the housing and tighten it.
3. Remove the protective insulation from each conductor and fit a suitable ring cable lug to the exposed end of the conductor.

4. Attach the "DC –" conductor with the ring cable lug to the "DC –" connection and tighten the retaining screw firmly (torque 4.0 Nm to 5.7 Nm).
5. Then attach the "DC +" conductor with the ring cable lug to the "DC +" connection and tighten the retaining screw firmly (torque 4.0 Nm to 5.7 Nm).

Do not connect any other components to the cables that connect the battery to the DC connection of the Sunny Island 5048. Such components must be connected directly to the battery using separate cables.

6.3 AC Connection

6.3.1 Cable Protection

A sub-distribution unit must be used to connect the Sunny Island 5048 to a stand-alone grid, a generator or the public grid.

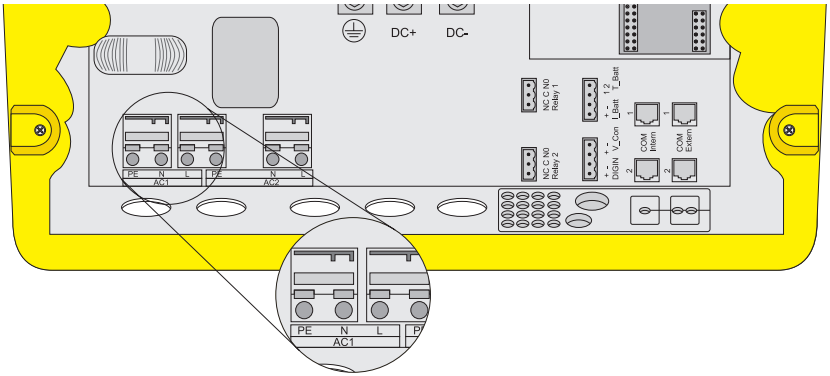
The sub-distribution unit must be equipped with appropriate circuit breakers. Be sure to observe all the applicable regional standards and guidelines.

The maximum permissible current that may flow through the AC input of a Sunny Island 5048 is 56 A.

The Sunny Island 5048 is not equipped with an all-pole isolator: The neutral conductor (N conductor) is looped through the device and the N connection terminals of AC1 and AC2 are connected inside the device.

6.3.2 AC1 (Loads/Sunny Boys)

The stand-alone grid sub-distribution (e.g. load, PV inverter (Sunny Boy), wind turbine (Windy Boy)) is connected to the AC1 output of the Sunny Island 5048. If you wish to provide separate protection for an individual load circuit, then use maximum 16 A, B-type circuit breakers. In the case of a short circuit, the Sunny Island 5048 can still trigger these types of automatic breakers:



1. Sheathe the cable screw connection over the three-conductor cable and then insert the conductor into the housing of the Sunny Island 5048.
2. Install the M25 metric-thread cable screw connection (included in delivery) on the "AC1 – Loads/Sunny Boys" cable feed-through.
   - Insert the cable screw connection thread into the cable feed-through opening.
   - Screw the counter nut onto the cable screw connection thread inside the housing and tighten it.
3. Remove the protective insulation from each of the three wires.
4. Install the three wires PE, N and L onto AC1: Following the specified sequence, insert the appropriate wire into the appropriate PE, N or L "AC1 (Loads/Sunny Boys)" spring-type terminals.

Connecting in a 1-phase parallel system:

Connect all 1-phase parallel Sunny Island 5048 devices with the same cross-sections and cable lengths.

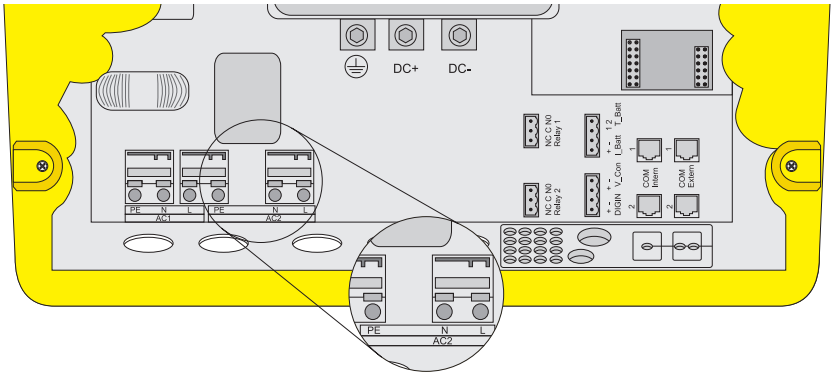
Connecting in a 3-phase parallel system:

Always install the master on phase L1, slave 1 on L2 and slave 3 on L3. This installation has a right-hand rotary field.

If a phase fails within a three-phase grid, the cluster continues to run. In order to protect your loads, you may require phase monitoring or a motor overload switch.

6.3.3 AC2 (Generator/Grid)

The sub-distribution of the generator/public grid is connected to the AC2 output of the Sunny Island 5048. Wire AC2 in the following sequence:



1. Sheathe a cable screw connection over the three-conductor cable and then insert the conductor into the housing of the Sunny Island 5048.
2. Install the M25 metric-thread cable screw connection (included in delivery) on the "AC2 – Generator/Grid" cable feed-through.
   - Insert the metric-thread cable screw connection thread into the cable feed-through opening.
   - Screw the counter nut onto the cable screw connection thread inside the housing and tighten it.
3. Remove the protective insulation from each of the three wires.
4. Install the three wires PE, N and L onto AC2: Following the specified sequence, insert the appropriate wire into the appropriate PE, N or L "AC2 (Generator/Grid)" spring-type terminals.

1-phase parallel system

In 1-phase parallel systems, also connect the generator or the grid to all slave devices on AC2. The cable lengths and cross-sections used must be identical.

3-phase system

Always install phase L1 on the master, L2 on slave 1 and L3 on slave 3.

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

6.4 Additional Connections

For installing the connections described below, feed the cables through the specified holes in the rubber terminal block. Plugs for sealing the RJ45 communication cable for internal and external communication are provided in the rubber terminal block 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

The battery temperature sensor measures the temperature of the connected battery. This is necessary since the optimum charging voltage for a battery strongly depends on the temperature. Further information is provided in section 13.4 "Charge Control" (Page 88).

A battery temperature sensor must be connected for operating the Sunny Island 5048 (included in the delivery).

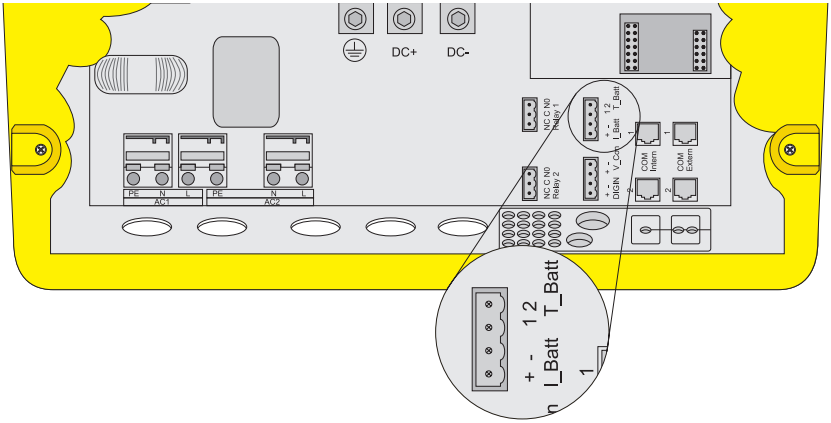
In case of a fault (short circuit, cable break), the Sunny Island 5048 operates in a safe setting, which over time leads to insufficient battery charging. A warning indicating that the defective battery temperature sensor should be replaced immediately is shown on the display.

Only use the battery temperature sensor provided with the delivery.
Never drill any holes in any part of the battery to mount the sensor.

A battery temperature sensor is provided with each Sunny Island 5048.

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

Proceed as follows when installing the battery temperature sensor:



1. Pierce a hole in the rubber terminal area at the corresponding position.
2. Starting from the outside, feed the cable with cable end sleeves through the hole.
3. Insert one wire with the cable end sleeves in each of the "T_Bat" connection terminals of the provided 4-pole print terminals and tighten the screws of these terminals.
4. Insert the 4-pole print terminal into the corresponding (upper) socket.

Fasten the battery temperature sensor to the outside of one of the battery cells. Choose a cell in the middle of the battery bank, the batteries generate the most heat in this region during operation.

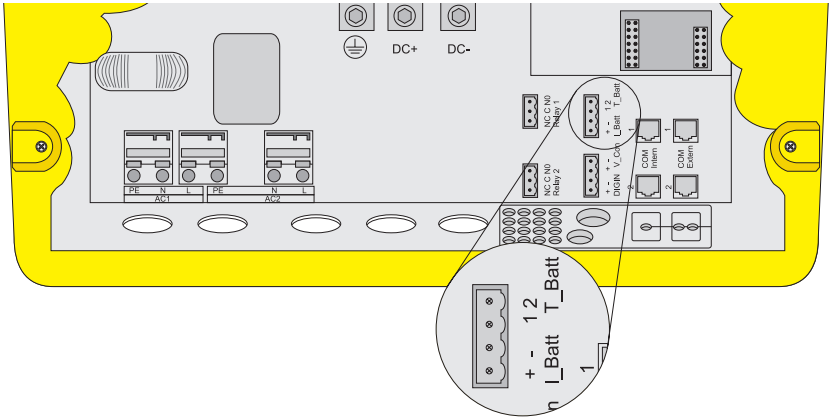
6.4.2 Battery Current Sensor

In addition to internally measuring the current, the battery current can also be measured using a shunt.

The battery current sensor is absolutely necessary if DC generators and DC loads are to be connected. Only one battery current sensor, which is connected to the corresponding master, is required for a cluster.

The current sensor type is set using the "#225.01 BatCurSnsTyp" parameter and the respective measuring range can be set using the "#225.02 BatCurGain60" or "#225.03 BatCurGain50" parameter.

Proceed as follows when installing the battery current sensor:

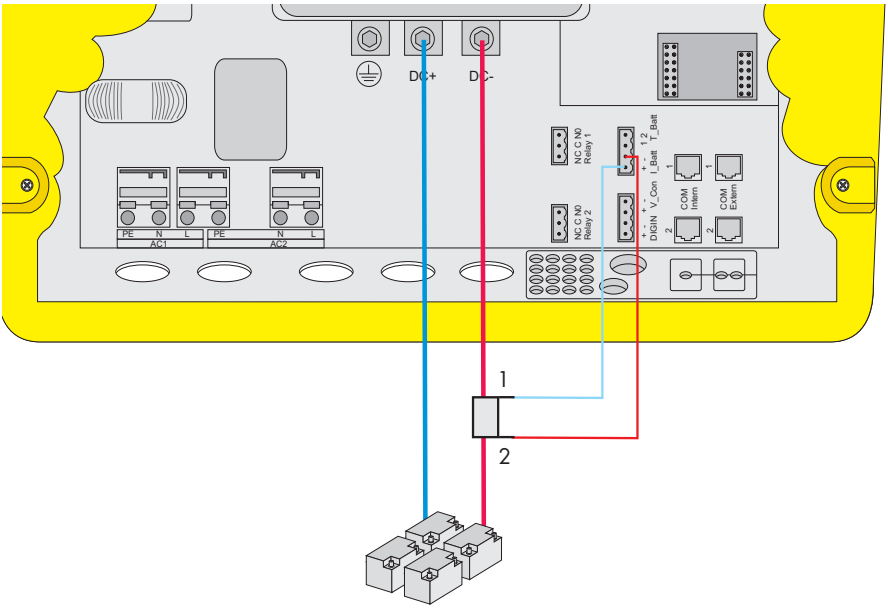


1. Pierce a hole in the rubber terminal area at the corresponding position.
2. Starting from the outside, feed the cable with cable end sleeves through the hole.

The battery current sensor must be looped around the negative pole of the battery. In doing so, the side of the shunt that is connected to the Sunny Island 5048 must be connected to the "I_Bat+" connection terminal.

If the battery current sensor is connected as described above,

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



3. Insert one wire with the cable end sleeves in each of the "I_Bat" connection terminals of the provided 4-pole print terminals and tighten the screws of these terminals.
4. Insert the 4-pole print terminal into the corresponding (upper) socket.

Make sure to use intrinsically safe cable to connect the battery current sensor. Here intrinsically safe means that the cable is double insulated and in the event of a short circuit, the wire melts, but the insulation remains intact. In addition, the cable is not combustible. To avoid measuring errors, make sure to use twisted cable.

6.4.3 Communication for Multi-device Connection

To increase its performance, the Sunny Island 5048 can be connected in parallel or in a 3-phase system with other Sunny Island 5048 devices. The devices communicate with each other through an RJ45 communication cable.

The RJ45 communication cable is a common 1:1 computer cable.

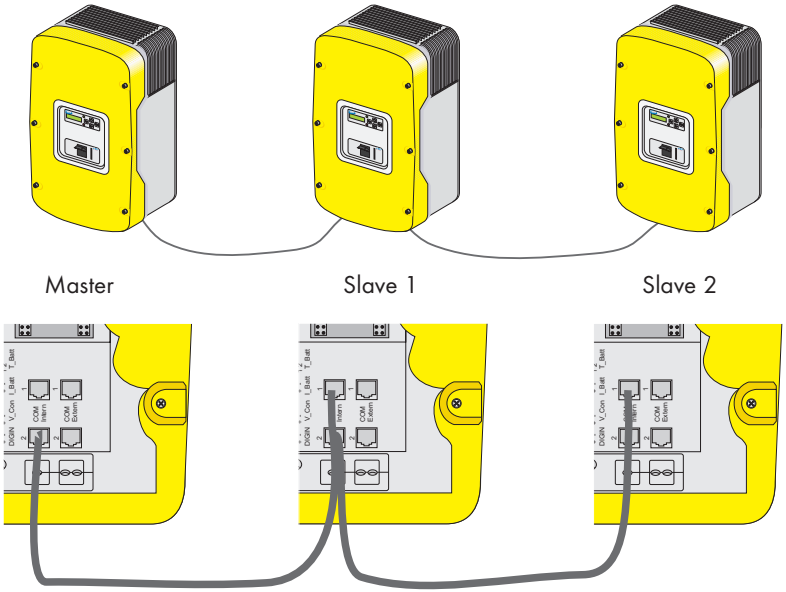
Each Sunny Island 5048 device is delivered with one black and one white RJ45 communication cable.

You require the black cable to establish (internal) communication between several Sunny Island 5048 devices. If you only have one Sunny Island 5048 in your cluster, the cable is not required.

The white cable is used for external communication (via RS232 or RS485), see also section 6.5 "Interface for External Communication" (Page 51).

Make sure that you have selected a multi-phase/parallel configuration in the Quick Configuration Guide (see section 8 "(First) Commissioning" (Page 57)).

Proceed as follows when installing the communication cable:



1. Remove the left of the two plugs in the rubber terminal area.
2. Starting from the outside, feed the RJ45 cable through the hole.
3. Sheathe the cable inside the Sunny Island 5048 using the silicone tube provided. The silicone tube is imperative for safety reasons. Without this silicone tube, the interface is not to be operated.
4. Insert the RJ45 plug into the lower black socket. The terminator plug remains in the upper socket.
5. This cable goes into the upper black socket in the next Sunny Island 5048. Any other additional cable would be inserted into the lower socket and lead to the next Sunny Island 5048 (there in the upper socket). When you have completed this, insert the terminator plug into the lower socket.
6. Wrap the rubber plug (depending on the number of cables with one or two feed-throughs) around the cable.
7. Reinsert the plug in the opening provided in the rubber terminal block.

6.4.4 Multi-function Relay 1 and 2

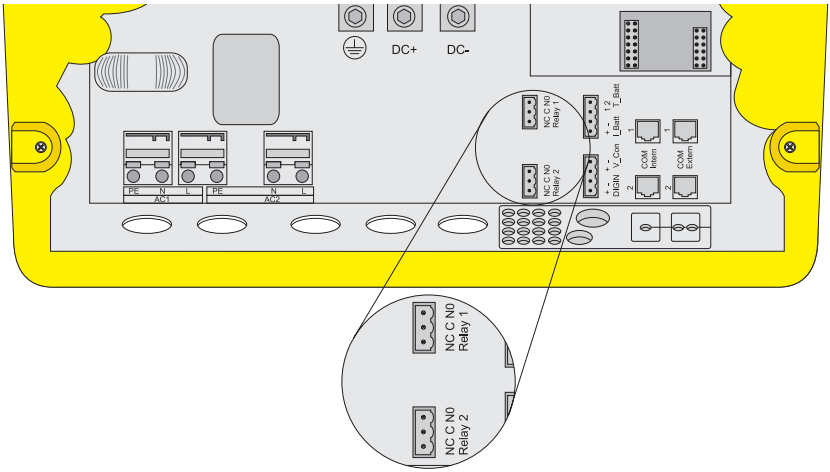
The Sunny Island 5048 provides you with several options to control internal and external operations. For this purpose, two multi-function relays are integrated into the device with which you can assign functions via the #261 menu using the Rly1Op and Rly2Op parameters (see section 15 "Relay" (Page 115)).

The relays are changeover contacts. They have both a break contact as well as a NO contact.

The relay functions are listed as NO contact functions, in other words, the contact is closed if the relay is activated by selecting the function. For the exception "Alm" (alarm), the relay has a break function. This means that the relay is normally activated and opens the contact. It is only deactivated when a fault occurs and then closes the contact (and thus activates a warning light, for example).

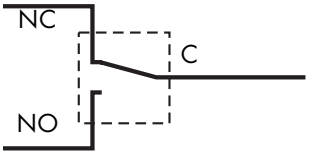
You can only assign one function to each relay. In clusters, the relays of the slaves can also be used. They are set using the master.

Proceed as follows when installing the relay connections:



1. Pierce a hole in the rubber terminal area at the corresponding position.
2. Starting from the outside, feed the cable with cable end sleeves through the hole.
3. Insert the wires with the cable end sleeves in the "Relay1" or "Relay2" connection terminals of the provided 3-pole print terminals and tighten the screws of these terminals. The pins have the following meaning:
   - NC: Normally closed (closed when in standby)

- C: Contact (operating contact)
- NO: Normally opened (open when in standby)



4. Insert the 4-pole print terminal into the corresponding socket.

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.

Information on the switching capacities of the relays is provided in section 20 "Technical Data" (Page 155).

Load Shedding

The Sunny Island 5048 can automatically switch off loads to protect the battery from deep discharge. To do so, an external (AC or DC) power contactor must be installed between the Sunny Island 5048 and the loads (see also section 2.6 "Accessories (Optional)" (Page 19)).

Installation of the load shedding system is strongly recommended in systems with extensive AC-side coupling of solar power or wind power. This is the only way to achieve safe operation of the system, even in cases of low energy generation or very high consumption.

Only switch the loads off, never switch the generators off (e.g. Sunny Boys)!

Generator Start

The Sunny Island 5048 can control generators. It supports generators that can be started and stopped by a single contact and generators that require more than one contact (in combination with the optionally available generator manager (GenMan)).

The two relays, which are integrated in the Sunny Island 5048 and are freely programmed, assume both tasks (depending on the programming in menu #261, parameter Rly1Op and Rly2Op), see also section 15 "Relay" (Page 115).

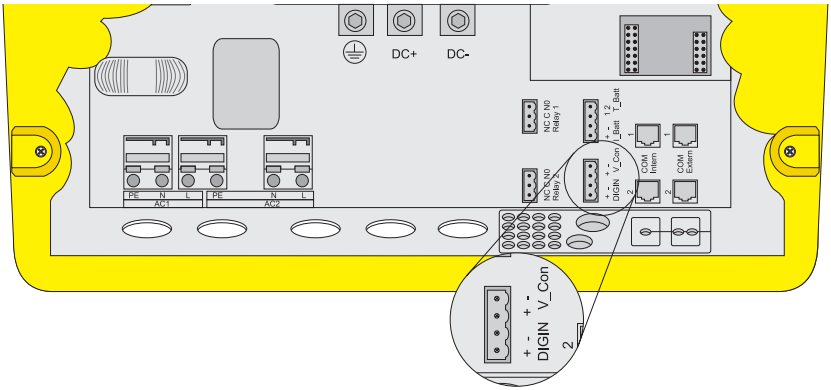
The AutoGn function is pre-configured for Relay1 and the AutoLodSoc function is pre-configured for Relay2.

If you would like to use both functions, connect them accordingly here (properly).

6.4.5 V_Con Power Supply

The battery voltage is conducted to the outside at these terminals. The battery voltage is fused at both poles by NTC thermistors (max. 0.75 A) and can fluctuate depending on the battery status. This connection can, for example, be used to supply a DC contactor for load shedding.

Proceed as follows when installing the power supply:

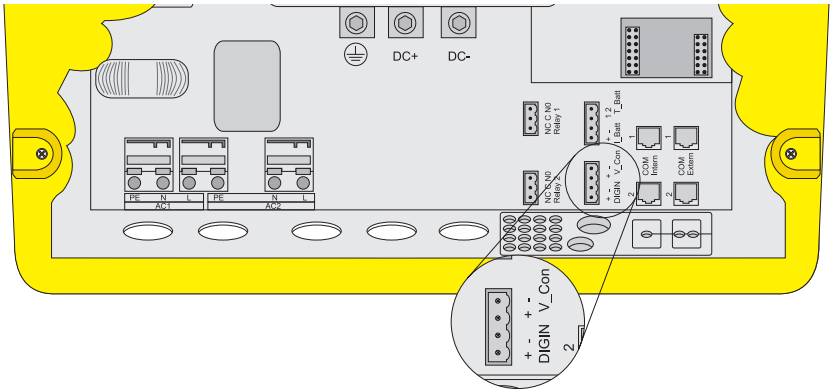


1. Pierce a hole in the rubber terminal area at the corresponding position.
2. Starting from the outside, feed the cable with cable end sleeves through the hole.
3. Insert one wire with the cable end sleeves in each of the "V_Con" connection terminals of the provided 4-pole print terminals and tighten the screws of these terminals.
4. Insert the 4-pole print terminal into the corresponding (upper) socket.

6.4.6 Digital Input, DIGIN

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

Proceed as follows when installing the digital input:



1. Pierce a hole in the rubber terminal area at the corresponding position.
2. Starting from the outside, feed the cable with cable end sleeves through the hole.
3. Insert one wire with the cable end sleeves in each of the "DIGIN" connection terminals of the provided 4-pole print terminals and tighten the screws of these terminals.
4. Insert the 4-pole print terminal into the corresponding (upper) socket.

For more information on connecting and operating the GenMan, please see the corresponding product documentation.

6.5 Interface for External Communication

Installation or replacement of the communication interface is only to be carried out by a trained electrician.

The communication interface is used to communicate with SMA communication devices (e.g. Sunny Boy Control, Sunny WebBox) or a PC with appropriate software (e.g. Sunny Data Control). Depending on the selected communication interface, up to 50 inverters can be interconnected. Detailed information on this topic can be found in the communication device manual, the software, or on the Internet at www.SMA.de.

The following communication interfaces can be integrated into the Sunny Island 5048:

- RS232
- RS485

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

The detailed wiring diagram for the individual communication interfaces can be found in the communication device manual. This wiring diagram includes:

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

The next pages will describe the following:

- The housing feed-throughs for the communication interface
- The permitted cable route in the Sunny Island 5048
- The location of the sockets for connecting the communication wires
- The location of the interface port

6.5.1 Connection of the Interface

When opening the Sunny Island 5048, follow all the safety instructions as described in section 3.2 "Potential Hazards" (Page 24).

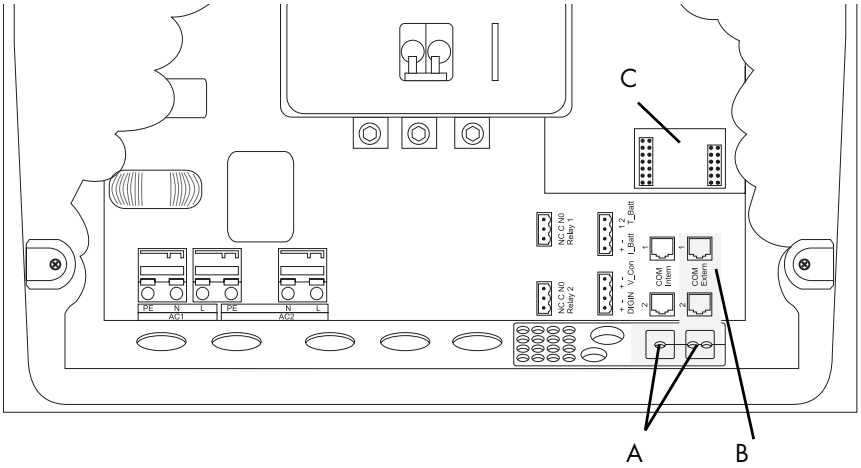
Electrostatic discharges are an acute danger to the Sunny Island 5048 and to the communication interface. Ground yourself by touching PE before removing the communication interface from the packaging, and before touching any components within the Sunny Island 5048.

Read the communication device manual before beginning installation work. Further wiring details can be found there.

1. Remove the right plug of the two plugs in the rubber terminal area.
2. Thread the cable through the cable feed-through (A) from the outside.
3. Sheathe the cable inside the Sunny Island 5048 using the silicone tube provided. The silicone tube is imperative for safety reasons. Without this silicone tube, the interface is not to be operated.
4. Insert the cable into the upper white socket.
5. Place the plug around the cable.
6. Reinsert the plug in the opening provided in the rubber terminal block (A).
7. Lay the cable in area (B) as shown in the figure to the right.
8. The three pins that you are to use are specified in the operating manual for the communication device. The following table displays the assignment of the specified pins for the pins of the RJ45 socket.

Communication device pin (Sub-D 9-pole)	RS232	RS485	RJ45 socket
2	RXD	A	3
5	GND	GND	2
7	RTS	B	6

9. Terminate the Sunny Island 5048 at RS485.
   In the Sunny Island 5048, the RS485 data bus is terminated using a plug. This plug is already pre-installed in the Sunny Island 5048. Please only remove the plug if you would like to connect another Sunny Island 5048 device or a communication device.
10. Plug the communication interface into the board (C).
11. Close the Sunny Island 5048 as described in section 5.2 "Closing the Device" (Page 32).



A Housing feed-through in the base of the Sunny Island 5048

B Cable route (gray surface)

C Interface port

The white communication cable (for external communication between Sunny Island 5048 and communication device(s)) has cable end sleeves and a corresponding label on one side for attaching the individual connecting wires on the communication device (see table on the previous page).

6.5.2 Data Transmission Speed

The Sunny Island 5048 can communicate with external devices at a range of different data transmission speeds (1200 to 19200 bps). The "#270.06 ComBaud" parameter must be set appropriately for this.

If Sunny Boys are connected to the communication bus, then the baud rate must be set to 1200 bps (factory setting). Observe the manufacturer's specification for all other devices.

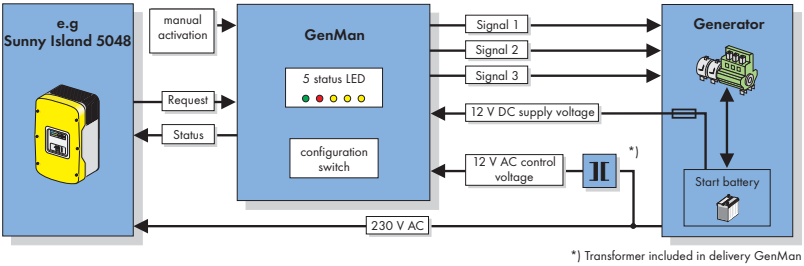
The Sunny Island 5048 uses the SMA-Net protocol for communication.

A detailed wiring diagram for the communication interfaces for the entire communication structure of your system can be found in the handbook for the communication device you have chosen.

6.6 GenMan Connection

When operating a Sunny Island 5048 with GenMan, the following assignment of the interfaces or signals applies:

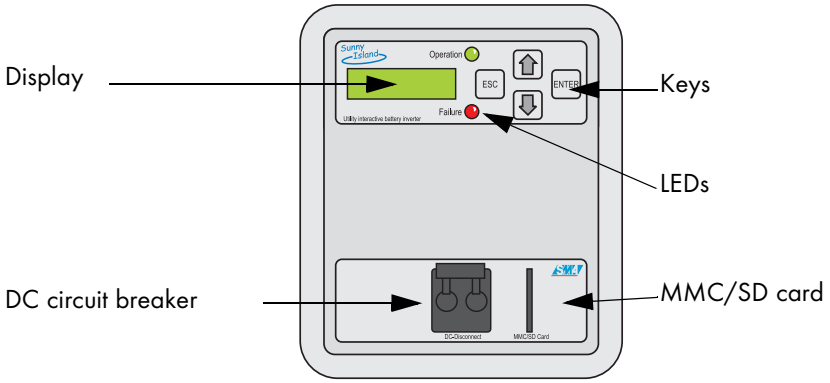
Signal on GenMan	Signal on Sunny Island 5048
GenRq	Relay1, AutoGn function (see 15 "Relay" (Page 115))
GenRn	DIGIN



For more information on connecting and operating the GenMan, please see the corresponding product documentation.

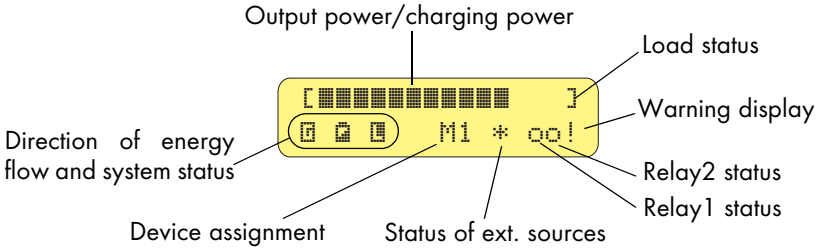
7 Control Elements

In order to commission the Sunny Island 5048, you should familiarize yourself with its operation beforehand. The individual control elements can be seen in the following figure.



7.1 Display Messages

The display of the Sunny Island 5048 has two lines each with 16 characters. For details, please see section 10.6 "Display Messages (Overview)" (Page 73).



7.2 DC Circuit Breaker

The DC circuit breaker is used to switch on/off as well as disconnect the Sunny Island 5048 on the DC side. For details, see section 9 "Activation and Deactivation" (Page 61).

7.3 Keys

The table explains the key functions of the Sunny Island 5048:

Key	Functions
ESC	cancels the selected function answers NO navigates one menu level higher
	navigates up one list element, increases data value
	navigates down one list element, decreases data value
ENTER	selects function selects data value confirms the change answers YES navigates one menu level lower stops device (when held pressed down)

7.4 Explanation of the Light-emitting Diodes (LEDs)

In the Sunny Island 5048 control panel, there is both a green (above) and a red (below) light emitting diode (LED). Their functions are described in the table:

Green LED	Red LED	Operating mode
–	–	standby or off (no inverter operation)
ON	–	operation
–	ON	failure or fault

7.5 MMC/SD Card

The Sunny Island 5048 features an MMC/SD card which can be used for updating firmware and as a service interface. For details, please see section 11 "Archiving Data on an MMC/SD Card" (Page 77).

8 (First) Commissioning

8.1 Precondition

Before beginning with the commissioning, ensure that all electrical connections have the correct polarity and make sure that everything is connected according to the instructions in section 6 "Electrical Connection" (Page 33).

The Quick Configuration Guide (QCG) allows you to quickly and easily commission your Sunny Island 5048. To do so, use the menu to select the 'right' system for you. The display then shows a selection, via which the parameters can be set specifically.

8.2 Starting the Quick Configuration Guide (QCG)

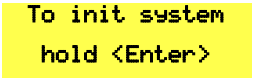
When starting the QCG, useful parameter values are set as default settings!

The QCG is automatically activated during the **initial** startup of the device.

1. Switch on the Sunny Island 5048 by switching the DC circuit breaker to the "ON" position.
2. The Sunny Island 5048 starts the startup phase. Wait for the following displays.

When starting the Sunny Island 5048 for the first time, the QCG is automatically activated. Please continue reading in point 6. Otherwise, follow this list.

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



4. Press and hold down <Enter> until the Sunny Island 5048 beeps three times.

5. You are now in the Quick Configuration Guide (QCG). Here you can select the following:

   - **"Start System"** (if you have accidentally accessed the QCG and only would like to restart the system)
   - **"New System"** (if you would like to start a new system or perform changes to the system configuration)
   - **"New Battery"** (if you would like to change the main battery settings, but retain the system configuration)
   - **"Emerg Charge"** (if you would like to charge a deeply discharged battery using an external source, see section 19.9 "Troubleshooting" (Page 150))

6. The following parameters must be set when **"New System"** is selected:
   - Voltage/frequency type (230V_50Hz, 220V_60Hz), default is "230V_50Hz"
   - System configuration (for this selection, see "System configuration overview:" (Page 59)), default setting is "1phase 1SI PV"
   - Device type (Master, Slave1, Slave2, Slave3)
   - Date
   - Time
   - Battery type (VRLA, FLA, NiCd), default setting is "VRLA"
   - Nominal battery capacity (100 to 10000 Ah), default setting is "100 Ah"
   - Nominal battery voltage (44 to 48 V), default setting is "48.0 V"
   - Maximum generator current (0 to 224 A), default setting is "16 A"
   - Generator interface (Manual, GenMan, Autostart), default setting is "Manual"

   The following parameters must be set when **"New Battery"** is selected:
   - Battery type (VRLA, FLA, NiCd), default setting is "VRLA"
   - Nominal battery capacity (100 to 10000 Ah), default setting is "100 Ah"
   - Nominal battery voltage (44 to 48 V), default setting is "48.0 V"

System configuration overview:

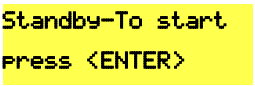
Displayed text	Meaning
1phase 1SI PV	1-phase system, 1 Sunny Island 5048, photovoltaics only
1phase 1SI OG	1-phase system, 1 Sunny Island 5048, offgrid + generator
1phase 1SI GB	1-phase system, 1 Sunny Island 5048, backup on the grid
1phase 2SI PV	1-phase system, 2 Sunny Island 5048 devices, photovoltaics only
1phase 2SI OG	1-phase system, 2 Sunny Island 5048 devices, offgrid + generator
1phase 2SI GB	1-phase system, 2 Sunny Island 5048 devices, backup on the grid
1phase 3SI PV	1-phase system, 3 Sunny Island 5048 devices, photovoltaics only
1phase 3SI OG	1-phase system, 3 Sunny Island 5048 devices, offgrid + generator
1phase 3SI GB	1-phase system, 3 Sunny Island 5048 devices, backup on the grid
1phase 4SI PV	1-phase system, 4 Sunny Island 5048 devices, photovoltaics only
1phase 4SI OG	1-phase system, 4 Sunny Island 5048 devices, offgrid + generator
1phase 4SI GB	1-phase system, 4 Sunny Island 5048 devices, backup on the grid
Three 3SI PV	3-phase system, 3 Sunny Island 5048 devices, photovoltaics only
Three 3SI OG	3-phase system, 3 Sunny Island 5048 devices, offgrid + generator
Three 3SI GB	3-phase system, 3 Sunny Island 5048 devices, backup on the grid

If you have a system with more than one Sunny Island 5048 device, 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!*

If the "New Battery" option is selected, only specific battery settings are reset and set to new values. System settings are not affected.

7. After entering the parameters listed below, the display of the master shows the following message:

8. Press <ENTER> to confirm. The following message then appears on the display.



9. Press <ENTER>. A beep is heard, the Sunny Island 5048 starts and is operating. The green (upper) LED is illuminated.

If only one Sunny Island 5048 is used in the system, the device type is set to "Master" and is not displayed.

If the device unexpectedly displays an error, it must be remedied before the device can be operated. For this purpose, refer to section 19 "Troubleshooting/Problem Solving" (Page 143).

For more details on the adjustable parameters, please see section 18 "Parameter Lists" (Page 123).

Note that you must first enter the installer password before some parameters can be changed (see section 10.5 "Entering the Installer Password" (Page 72)). In addition, some parameters can only be changed in standby mode (see section 9.2 "Stopping" (Page 62)).

For detailed parameter lists for your system, please contact Sunny Island Hotline at the following telephone number (+49) 561 95 22 - 399 or by e-mail at SunnyIsland.hotline@SMA.de.

The following information will help our employees in creating the correct parameter list for your system. Have this information available when you call:

- *Inverter type (Sunny Island 5048, see type plate)*
- *Voltage/frequency type*
- *Serial number (see type plate or parameter "331.03 SN")*
- *Firmware version (see parameter "331.02 FwVer")*
- *Error message shown on the display*
- *Battery type*
- *Nominal battery capacity*
- *Nominal battery voltage*
- *Communication products used*
- *Type and size of the additional energy sources (generators, PV systems, PV inverters)*
- *If a generator exists:*
  - *Generator type*
  - *Generator capacity*
  - *Maximum generator current*
  - *Generator interface*

9 Activation and Deactivation

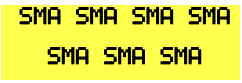
9.1 Activation / Startup

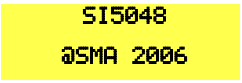
This step assumes that the Sunny Island 5048 has been checked for

- **correct (electrical) connections,**
- **voltages and polarities**

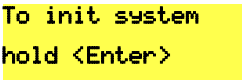
and has already been put into operation by suitably qualified personnel (qualified electrician).

1. Switch on the Sunny Island 5048 by switching the DC circuit breaker to the "ON" position.
2. The Sunny Island 5048 starts the startup phase. Wait for the following displays.



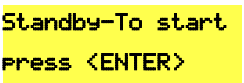


As soon as the startup phase is finished, the message "To init system hold <Enter>" is displayed.



3. If you would like to access the QCG, press and hold <Enter> until the Sunny Island 5048 beeps three times. Then the following display message appears (on how to proceed further, see section 8.2 "Starting the Quick Configuration Guide (QCG)" (Page 57)).

4. If you do **not** press <ENTER> within 5 seconds, the Sunny Island 5048 skips the QCG and shows the following message.



Start the slaves **before** *you start the master device.*

5. After the device has been switched on, the slaves show the following message on the display.

```
STANDBY-To start
press <ENTER>
```

6. Press <ENTER> to start the slave. Then the following message appears (until the master starts).

```
Ready
Wait for Master
```

Even with the "#270.01 AutoStr" parameter set, the Sunny Island 5048 must be manually started each time the device is switched on using the DC circuit breaker.

7. Press <ENTER>. A beep is heard, the Sunny Island 5048 starts and is operating. The green (upper) LED is illuminated.

If the device unexpectedly displays an error, it must be remedied before the device can be operated. For this purpose, refer to section 19 "Troubleshooting/Problem Solving" (Page 143).

9.2 Stopping

Proceed as follows to set the Sunny Island 5048 to standby mode:

Note that all connected loads are no longer provided with electrical energy once you have stopped the Sunny Island 5048.

1. Switch off all loads, as far as this is possible.
2. Press <ENTER> to stop the Sunny Island 5048. The following message appears.

```
Hold key to stop
################
```

3. Hold <ENTER> pressed down and the remaining time is shown using bars on the display.

```
Hold key to stop
##########
```

4. The Sunny Island 5048 has been stopped and the display shows the following message:
   The green (upper) LED goes out.

```
STANDBY-To start
press <ENTER>
```

Note that in standby mode there is still voltage present in the device (DC, AC1, AC2).

Even in standby mode, the Sunny Island 5048 still requires about 4 W of power from the battery.

9.3 Deactivation

To switch off the Sunny Island 5048, proceed as follows:

1. Set the Sunny Island 5048 to standby mode (see section 9.2 "Stopping" (page 62)).
2. Switch the DC circuit breaker of the Sunny Island 5048 to the "OFF" position.

You can only ensure that all internal meter readings/values are saved by using this switching sequence.

You must wait at least 30 seconds before reactivating the device, otherwise proper operation of the Sunny Island 5048 cannot be guaranteed.

9.4 Disconnecting the Device from Voltage Sources

1. Switch off the Sunny Island 5048 (see section 9.3 "Deactivation" (page 63)).
2. Disconnect the Sunny Island 5048 from the battery.
3. Then disconnect the Sunny Island 5048 from all voltage sources (switch off power for AC1 and AC2 and disconnect them both).
4. Make sure that the Sunny Island 5048 has been disconnected from all voltage sources.
5. Wait at least five minutes to let the capacitors discharge and allow the voltage inside the device to drop to a safe level.
6. The Sunny Island 5048 is now completely free of voltage and you can open it.

9.5 Reactivating the Device Following Automatic Shutdown

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

To reactivate the Sunny Island 5048 after it has switched off due to a battery being too deeply discharged, proceed as follows:

1. Switch off the DC circuit breaker.

You must wait at least one minute to allow the capacitors to completely discharge before switching the DC circuit breaker on again.

2. After waiting for one minute, switch on the Sunny Island 5048 by switching the DC circuit breaker to the "ON" position.

If, in rare cases, the device cannot be switched back on, wait a little longer and try it again. This may result due to component tolerances.

3. Now, continue as described in 9.1 "Activation / Startup" (Page 61).

After reactivation, it is important that the batteries are charged. If an autostart generator is present in the stand-alone grid, the Sunny Island 5048 will request the generator after a few minutes.

4. Monitor the generator startup and check that the Sunny Island 5048 switches to charge mode.
5. Check that all other energy generators in your system are also working correctly.

If, after reactivation, the Sunny Island 5048 immediately switches into battery preservation mode (see section 13.5 "Battery preservation mode" (Page 92)), disconnect all loads from the AC output (AC1 and AC2).

The loads can be reconnected once the Sunny Island 5048 enters charge mode. A precondition for this is that a generator capable of providing the required power is connected.

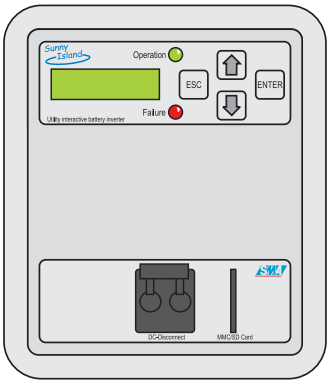
Further information is provided in section 19.10 "Procedure During Emergency Charge Mode" (Page 152).

Installation of the load shedding system is strongly recommended in systems with extensive AC-side coupling of solar power or wind power. This is the only way to achieve safe operation of the system, even in cases of low energy generation or very high consumption.

Only switch the loads off, never switch the generators off (e.g. Sunny Boys)!

10 Operation

The main menu consists of a Home Screen and the other main menu items where branches can be created in the sub menus. Operating modes are displayed on the Home Screen, e.g. the current operating mode, performance, etc. (see section 10.6 "Display Messages (Overview)" (Page 73)).



The menu consists of a main menu and maximum two submenu levels (see also the figure in section 10.1 "Menu Structure" (Page 66)).

Use the up and down arrow keys 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.

If you would like to access submenu 7, go backwards starting from 1 and continue past 9, instead of going six steps forwards.

Once you have reached the desired menu, press <ENTER> to access the menu. Use <ESC> to exit the menu and navigate one level higher.

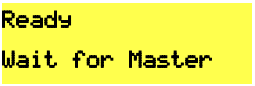
You can skip menu entries. This takes place depending on the level of your password. It ensures that all parameters in the user level that may only be changed by the installer are skipped. The menu numbers are fixed, that means they do not change if an entry (or several entries) are skipped.

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

After 20 seconds of inactivity, the background illumination of the display switches off. You can switch the background illumination back on by pressing one of the four keys. No settings are changed when you press the key, it only activates the display illumination.

The beeping function is always activated by default. To deactivate it, set the "#270.04 BeepEna" parameter to off.

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



The Sunny Island 5048 utilizes an operation concept referred to as **"Single Point of Operation"**. For a system with more than one device, all entries are made on the master. There you configure the entire system, confirm events, warnings as well as errors in the QCG (see section 8 "(First) Commissioning" (Page 57)) and update your firmware when required (see section 11.7 "Firmware Update" (Page 81)).

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

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

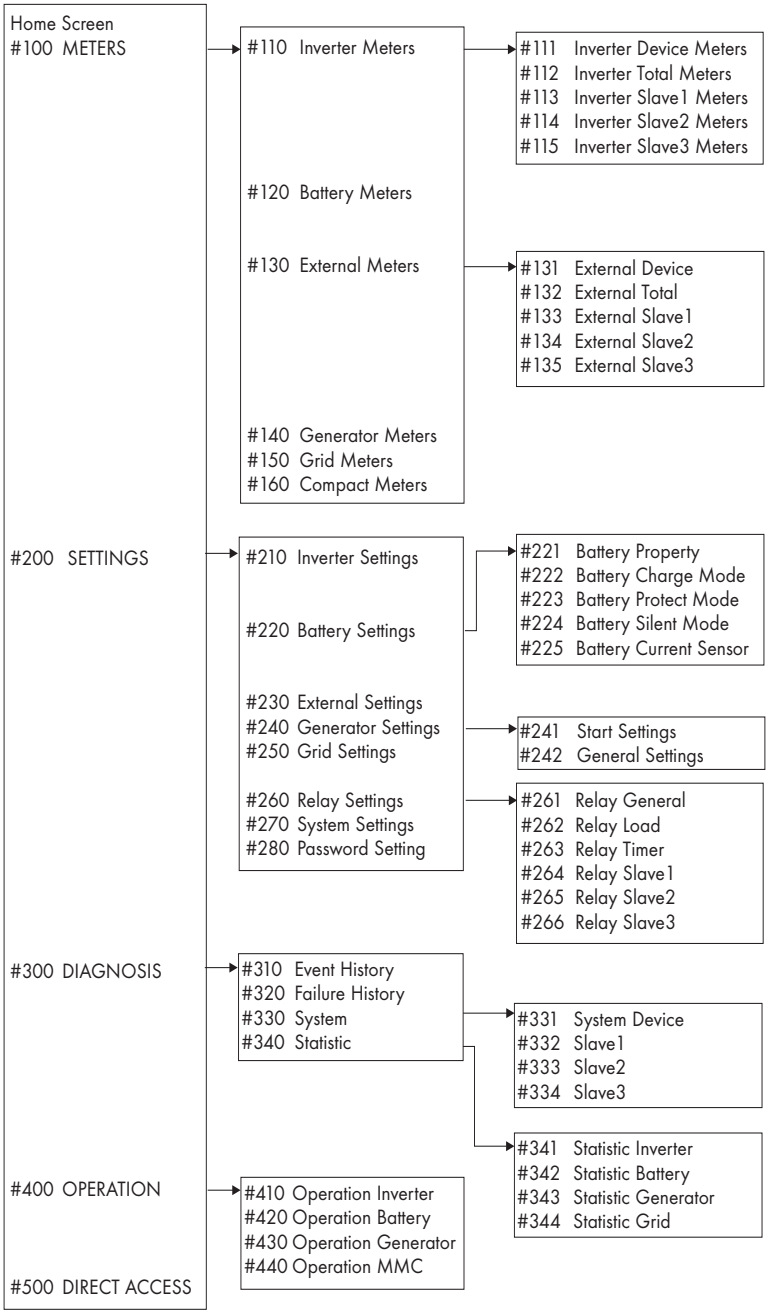
10.1 Menu Structure

Configuration and changes to system parameters may only be performed by suitably qualified personnel (electricians).

The menu structure is divided into two levels:

- User level
- Installer level

The menus allowing system parameters to be changed can only be reached after entering the installer password (see section 10.5 "Entering the Installer Password" (Page 72)). These menu parameters can be used to monitor and control the Sunny Island 5048 in normal daily operation.


Home Screen
#100 METERS
#110 Inverter Meters
#111 Inverter Device Meters
#112 Inverter Total Meters
#113 Inverter Slave1 Meters
#114 Inverter Slave2 Meters
#115 Inverter Slave3 Meters
#120 Battery Meters
#130 External Meters
#131 External Device
#132 External Total
#133 External Slave1
#134 External Slave2
#135 External Slave3
#140 Generator Meters
#150 Grid Meters
#160 Compact Meters
#200 SETTINGS
#210 Inverter Settings
#220 Battery Settings
#221 Battery Property
#222 Battery Charge Mode
#223 Battery Protect Mode
#224 Battery Silent Mode
#225 Battery Current Sensor
#230 External Settings
#240 Generator Settings
#250 Grid Settings
#241 Start Settings
#242 General Settings
#260 Relay Settings
#270 System Settings
#280 Password Setting
#261 Relay General
#262 Relay Load
#263 Relay Timer
#264 Relay Slave1
#265 Relay Slave2
#266 Relay Slave3
#300 DIAGNOSIS
#310 Event History
#320 Failure History
#330 System
#340 Statistic
#331 System Device
#332 Slave1
#333 Slave2
#334 Slave3
#341 Statistic Inverter
#342 Statistic Battery
#343 Statistic Generator
#344 Statistic Grid
#400 OPERATION
#410 Operation Inverter
#420 Operation Battery
#430 Operation Generator
#440 Operation MMC
#500 DIRECT ACCESS

Furthermore, the menu structure is divided into five different main menus with corresponding submenus.

Display values (Meters): The "#100 Meters" main menu displays the most important values in the first submenu:

- Sunny Island 5048 ("#110 Inverter Meters")
- Battery ("#120 Battery Meters")
- Generator and grid ("#130 Extern Meters")
- Generator ("#140 Generator Meters")
- Grid ("#150 Grid Meters")
- Compact messages ("#160 Compact Meters")

There are additional submenus or individual parameters (e.g. "#140.02 GnStt" parameter) on the following second menu level.

Settings: Under the main menu "#200 Settings" are several submenus allowing various system parameters to be viewed and changed:

- Sunny Island 5048 ("#210 Inverter Settings")
- Battery ("#220 Battery Settings")
- Generator and grid ("#230 Extern Settings")
- Generator ("#240 Generator Settings")
- Grid ("#250 Grid Settings")
- Relay ("#260 Relay Settings")
- System ("#270 System Settings")
- Password entry ("#280 Password Setting")

Diagnosis: Under the main menu "#300 Diagnosis" are several submenus allowing various system parameters to be viewed:

- Events ("#310 Event History")
- Warnings and faults ("#320 Failure History")
- System data ("#340 System")
- Statistics ("#350 Statistic")

Functions in operation (Operation): Under the main menu "#400 Operation" are several submenus allowing various system parameters to be viewed or changed:

- Inverter ("#410 Operation Inverter")
- Battery ("#420 Operation Battery")
- Generator ("#430 Operation Generator")
- MMC/SD card ("#440 Operation MMC")

Direct Access: Under the menu "#500 Direct Access", you have direct access to settings and display values.

10.2 Changing Parameters

Using the up and down arrow keys, you navigate through a selected menu (see figure in section 10.1 "Menu Structure" (Page 66)) to view or change a parameter, for example. When the relevant parameter appears on the display, 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 change this parameter value using the up/down arrow keys.

The increment (speed) of the change increases if you hold the key 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 keys to accept or reject the changes.

Afterwards, press <ENTER> again to end the operation and continue working.

Note that some parameters can only be changed when the device is in standby mode (see section 9.2 "Stopping" (Page 62)). You can find the parameters for which this applies in the tables in section 18.2 "Adjustable System Parameters" (Page 129) and 18.4 "Functions in Operation" (Page 141).

The Sunny Island 5048 displays a corresponding message for parameters that can only be changed in standby mode or require a different password level.

Display	Meaning
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 72).
Stop device to change the value	This parameter can only be changed in standby mode. Stop the Sunny Island 5048 to change the parameter (see section 9.2 "Stopping" (Page 62)).

10.3 Direct Access

Depending on the situation, the values that are alternatively shown on the display are shown or hidden. That means that if no generator is connected, no generator values appear on the display.

Under the menu "#500 Direct Access", you have direct access to settings and display values.

Using the menu #500, you can select the "#241.01 GenAutoEna" parameter, for example, to activate the generator autostart.

The direct access must be entered as a five-digit number, for example, 24101. Here, the first 3 digits describe the menu number and the last two describe the parameter number.

Once the parameter has been set, you exit the setting. Using <ESC>, you return to Direct Access and you can make additional changes there.

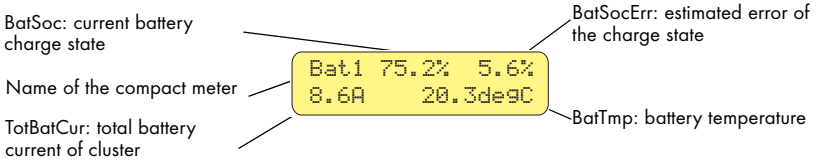
10.4 Compact Meters

In this special menu, the Sunny Island 5048 simultaneously displays a maximum of four values. This menu is primarily intended to facilitate the commissioning for the installer. There is a total of seven different compact meters.

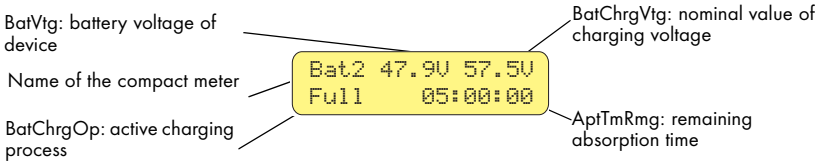
You can select the different displays of the compact meters using the up/down arrow keys . Here, you can also use the "Wrap Around" function.

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

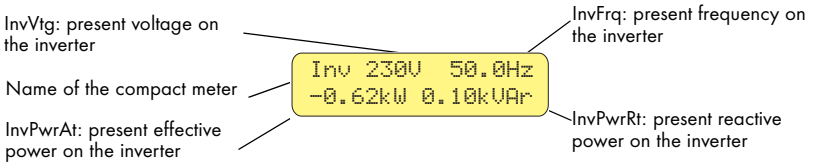
Bat1 (battery values 1)



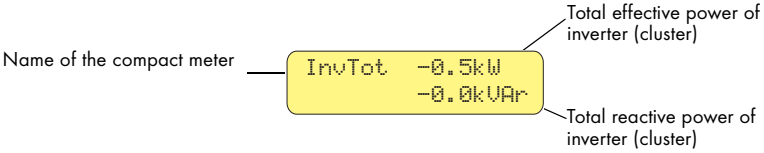
Bat2 (battery values 2)



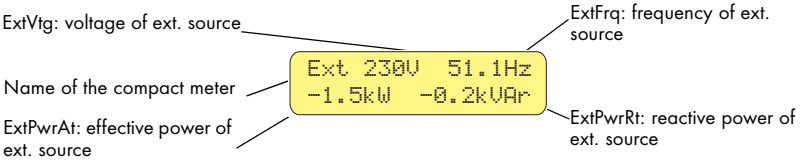
Inv (AC values of inverter)



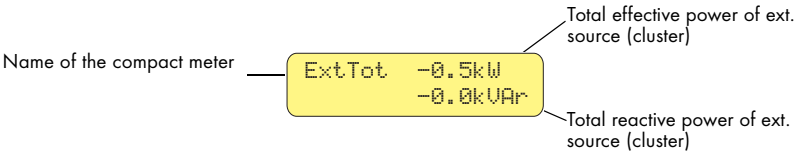
InvTot (total AC values of inverter)



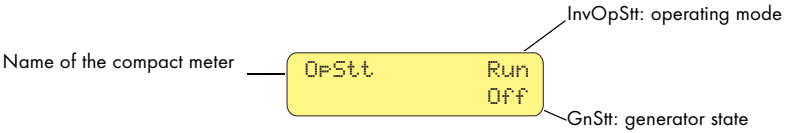
Ext (AC values of external source)



ExtTot (total AC values of external source)



OpStt (inverter and generator status)



10.5 Entering the Installer Password

Sunny Island 5048 parameter settings that affect the operating safety of the stand-alone system are protected/locked by the installer password.

These parameters may only be changed by qualified personnel (qualified electrician).

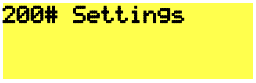
Do not provide the following information for entering the installer password to unauthorized persons. Illegal provision of this information to other persons will lead to invalidation of all SMA Technologie AG guaranty provisions.

The Sunny Island 5048 also allows the password to be entered while in standby mode.

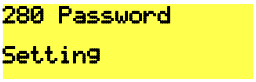
The password required for access to all "Installer Level" parameters (see figure in section 10.1 "Menu Structure" (Page 66)) depends on the operating-hours counter (password = sum of the digits of the operating hours).

Proceed as follows to enter the installer password:

1. You are in the Home Screen. Keep pressing the down arrow key until you reach the menu "#200 Settings". Press <ENTER>.



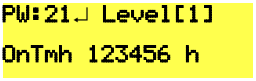
2. Now use the cyclic arrangement function (Wrap around) and press the arrow up key. Doing this opens the menu "#280 Password Setting". Press <ENTER>.



3. You are now in the menu "#280 Password Setting".

4. Press <ENTER>. You can now enter the password by pressing the up/down arrow keys. The password is derived from the sum (of all digits) of the operating hours (OnTmh). In the example that would be 1 + 2 + 3 + 4 + 5 + 6 = 21).

5. Then press <ENTER> to confirm the password. You are now in the installer level [1].



6. Exit the menu by pressing <ESC>.

If the password is not valid, the Sunny Island 5048 does **not** *switch into the installer level. In this case, recalculate and re-enter the installer password as described in this section.*

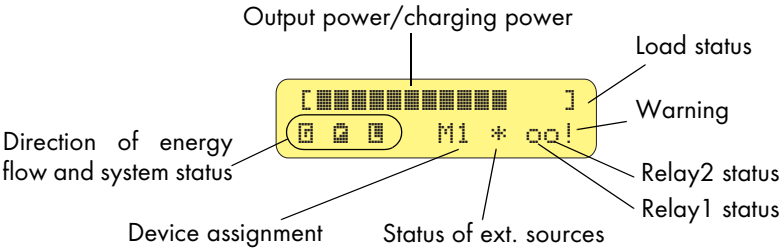
The installer level is switched back to the user level if

- *the Sunny Island 5048 is switched off and on again (see section 9 "Activation and Deactivation" (page 61)),*
- *specific parameters are entered (e.g. the "#270.01 AutoStr" parameter) that cause a restart,*
- *an incorrect password is entered and if*
- *no keys are pressed for a period of 5 minutes.*

10.6 Display Messages (Overview)

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

The following message is displayed in the Home Screen.



In the upper line, a bar graph displays the total output or charging power.

A character to the right of the graph indicates the load status: Here, "]" stands for nominal output. If the nominal load is exceeded, the character appears as ">".

The direction of energy flow and the system status are displayed on the left in the lower line. Here, the symbols stand for the generator side ("generator/grid"), for "battery" and for load side ("loads/Sunny Boys"). The arrows between the symbols indicate the direction of energy flow.

The device assignment follows (master or slave, e.g. M1 or S1).

Next to this assignment, the status of the external sources is indicated with the following symbol meanings:

* Generator voltage and frequency are within the set limits.

? Generator voltage and/or frequency are outside of the set limits. The Sunny Island 5048 will not connect the generator to the stand-alone grid while this situation exists.

! The maximum permissible generator reverse power has been exceeded and the Sunny Island 5048 disconnected the generator from the stand-alone grid.

The following letters indicate why the generator was requested:

B(attery) Generator has been requested as a result of the battery charge level.

L(oad) Generator has been requested as a result of the load-dependent generator request.

S(tart) Generator has been requested by the operator manually setting the generator request in the Sunny Island 5048 from "Auto" to "Start". The generator is then NO LONGER automatically controlled or switched off by the Sunny Island 5048.

T(ime) Generator was started for 1 hour via the "Run1h" setting at the Sunny Island 5048. Once this time has passed, the Sunny Island 5048 automatically switches off the generator.

The generator status and the reason for the request are shown on the display alternatively under "status of external sources".

If, for example, the display changes every 2 seconds from "*" to "B", this means that the generator voltage and frequency lie within the specified limits and that the generator was requested as a result of the battery charge level.

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

The messages for both relays (filled in circle = activated / open circle = deactivated) follows in the lower line.

The line ends with a warning display (!). This symbol blinks until you have viewed the warning in the menu "#300 Diagnosis".

If faults occur, the device switches into standby mode and shows the fault on the display. The fault must be remedied and then confirmed. The Sunny Island 5048 can be restarted thereafter.

In the Home Screen, the Sunny Island 5048 also shows the following values in succession (in 4-second intervals: parameter name for 2 seconds, parameter value for 2 seconds) in the upper line:

- Bar graph for output power or charging power (the direction of energy flow is displayed by the arrows in the lower line)
- Total effective power of inverter (cluster) [TotInvPwrAt]
- Total effective power of external source [TotExtPwrAt]
- Present battery charge state (SOC) [BatSoc]
- Remaining absorption time [AptTmRmg]
- Active charging process [BatChgOp]

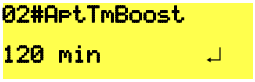
The display of the lower line remains as previously described.

On the slave devices, only the bar graph is displayed for output power or charging power and in the lower line, the device assignment (e.g. S1 for slave 1) and where applicable, the status of external sources (, for a description, please see further above) are displayed.*

10.7 Parameter Display

Parameters on the Sunny Island 5048 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.



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

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

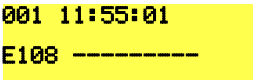
A menu is marked with a hash, menu number and menu name (#150 Grid Meters).

A parameter is marked with a hash, menu number, dot and parameter number (#150.01 GdRmgTm).

10.8 Display of Events

The Sunny Island 5048 can display a list of events:

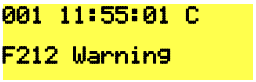
The serial number (quantity) of the events, the time and date display, which changes in 2-second intervals, is in the upper line. The event number is in the lower line.



10.9 Display of Warnings and Errors

The Sunny Island 5048 can display a list of errors and warnings:

The serial number (quantity) of the errors, the time and date display, which changes in 2-second intervals, is in the upper line. The error number and name are in the lower line.



! on the right in the upper line indicates when the warning or the fault occurred.

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

11 Archiving Data on an MMC/SD Card

The Sunny Island 5048 can save firmware, parameters and measuring data on a multimedia card (MMC/SD card) that must be FAT16-formatted and may have a maximum capacity of 2 GB (possible memory capacities are 32/64/128/256/512 MB as well as 1 GB and 2 GB). File names are saved in 8.3 format and files with other names are ignored.

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

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

SMA *Technologie AG recommends using MMC/SD cards made by Transcend.*

The firmware of the Sunny Island 5048 expects device-specific data in the main directory of the MMC/SD card. This data includes a new firmware version, parameters and measuring data. The firmware ignores non-device-specific data in the main directory.

The Sunny Island 5048 uses the MMC/SD card for saving and loading device parameters.

In addition, the Sunny Island 5048 supports the acquisition and archiving of measuring data on the MMC/SD card. It saves this data in a special file. This contains, among other things, a header, time stamp, date and data type. There are three types of log data:

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

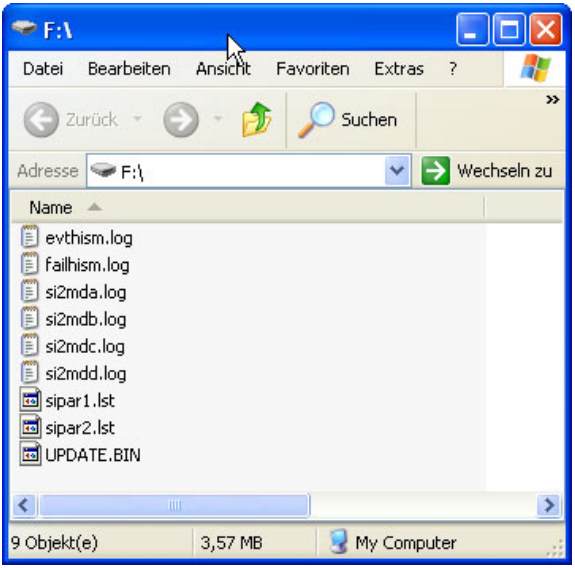
The Sunny Island 5048 supports the acquisition of measurement data with data from the following areas:

- Battery
- Inverter
- System
- External source
- Loads

Such data is recorded over a period of up to four weeks. At the end of four weeks, the oldest data is successively discarded.

11.1 Analysis using a PC

If you have inserted the MMC/SD card in your card reader on your PC, you can (when using WINDOWS) search for the corresponding drive in Explorer. The following data is on this drive (here: G:):



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

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

The first 14 lines of the file are used for information (file header) and then two column heading lines follow. The following data is separated by a semicolon and decimals points are displayed by a dot. The date format is dd.mm.yyyy. The time format is hh:mm.

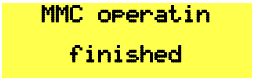
For additional information on processing the log data, please refer to the manual of the data processing software you use.

11.2 Inserting the Card

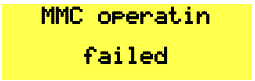
After inserting the MMC/SD card into the Sunny Island 5048, a message appears on the display prohibiting the removal of the card:

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

If the operation was successful, the following is shown on the display:



In case of a fault, the following appears:



11.3 Removing the Card

*In order to ensure that all log data is saved when switching off the device, stop the Sunny Island 5048 (see section 9.2 "Stopping" (Page 62)) and then switch it off using the DC circuit breaker (**9.3 "Deactivation" (Page 63)**). You can also write all unsaved data from the buffer on the MMC/SD card using the "#440.01 CardFunc" parameter and by selecting the "Flush" option.*

11.4 Saving and Loading Parameters

Using the "#410.02 ParaSto" parameter, you can save the current parameter settings and using the "#410.08 ParaLod" parameter, you can load the saved parameters.

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

You have the following selection options when saving the parameters:

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

You have the following selection options when loading the parameters:

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

The write protect function of SD cards (plastic sliding clip on the left side) is not supported by the Sunny Island 5048. Please note this when writing data to your card.

11.5 Writing Log Data

Using the "#440.02 DatLogEna" parameter, you can activate the function for writing log data to your MMC/SD card (activated by default).

If the Sunny Island 5048 is writing data to the MMC/SD card, removing the card is prohibited and the following message appears on the display:

11.6 Status Messages

Using the "#331.07 CardStt" parameter, you can request the status of your MMC/SD card:

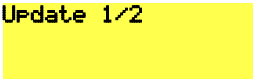
Display	Meaning
Off	Your MMC/SD card is deactivated.
Operational	Your MMC/SD card is activated.
Out of Space	The memory capacity of your MMC/SD card has been exceeded.
Bad File Sys	Your MMC/SD card has an invalid file format.
Incomp	Your MMC/SD card is incompatible.
Parameter	Your Sunny Island 5048 is loading parameters from the MMC/SD card.
ParameterFailed	Loading parameters from your MMC/SD card failed.

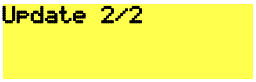
For help on troubleshooting, refer to section 19.9 "Troubleshooting" (Page 150).

11.7 Firmware Update

The firmware of the Sunny Island 5048 can be updated using the MMC/SD card. When the Sunny Island 5048 starts up or when the MMC/SD card is inserted, the Sunny Island 5048 searches for special update files on the MMC/SD card. If it finds such files, it performs an update when the Sunny Island 5048 is in standby mode.

While the master performs its update, the following message is shown on the display:



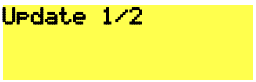


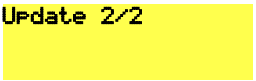
Once the update has been successfully completed, a mandatory reset follows so that the changes take effect.

In a system with several Sunny Island 5048 devices, 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 5048 devices within a system operate with the identical firmware version.

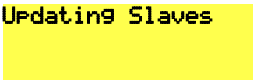
If a slave with a different firmware version is switched on, the master interrupts operation, performs a cluster update and starts up together with the slaves.

While the master updates the slave(s), the slave(s) display the same message as the master.





The following message appears on the master at the same time:



Following a successful update, the slaves must be manually started once (even when the "#270.01 AutoStr" parameter is set).

Individual parameters and settings are retained during a firmware update.

12 Inverter Operation

12.1 Sleep Mode

Using the "270.07 SleepEna" parameter (when set to Enable) allows sleep mode to be activated in 1-phase grids. With sleep mode activated, the master can switch off the slaves as long as the power value allows this.

The values in the Sunny Island 5048 for connecting and disconnecting are set at the factory (optimized to the efficiency).

12.2 Time-controlled Operation

The Sunny Island 5048 can be time-control operated using a timer function (functions like a timer) and supplies power at the planned time using this function.

To do so, you must activate this function using the "#410.03 InvTmOpEna" parameter. Using the "#410.04 InvTmOpStrDt" parameter, you specify the start date and using the "#410.05 InvTmOpStrTm" parameter, you specify the start time. Using the "#410.06 InvTmOpRnDur" parameter, you define the running time and using the "#410.07 InvTmOpCyc" parameter, you can set whether the function is performed once, daily or weekly until or from the specified time (date and time).

12.3 Overload and Short-circuit Behavior

The Sunny Island 5048 can be temporarily operated under overload conditions. It can also supply short-circuit currents.

In case of overload, the Sunny Island 5048 supplies an output of 6500 W for 30 minutes and can supply 7200 W for 5 minutes. The device can even supply 8400 W of output power for one minute.

If a short circuit occurs, the Sunny Island 5048 provides current of max. 100 A (for 100 ms). This is sufficient to trigger commercial 16 A B-type circuit breakers.

12.4 Device Faults and Autostart

If a critical fault or occurs, the Sunny Island 5048 automatically shuts down and displays the reason on the display. If the autostart function ("#270.01 AutoStr" parameter) is activated, the Sunny Island 5048 can automatically confirm the error, where applicable, and can restart on its own. If the fault remains, the Sunny Island 5048 cannot be started.

If the autostart meter has counted down to 0, the Sunny Island 5048 waits for 10 minutes before trying to automatically restart again.

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

12.5 Automatic Frequency Adjustment

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 "**A**utomatic **FR**equency **A**djustment (AFRA)" function of the Sunny Island 5048, also referred to as a tertiary control, allows the trouble-free use of grid-connected clocks in these types of stand-alone systems. This function is activated using the "#270.08 TertCtlEna" parameter (activated by default).

The time difference is somewhat compensated on average.

The internal clock in the Sunny Island 5048 is quartz-controlled and thus operates correctly (within the tolerance limits). The adjustment refers to externally connected clocks that depend on the grid frequency.

13 Battery Management

The battery management of the Sunny Island 5048 supports the following three battery types ("#221.01 BatTyp" parameter):

FLA **F**looded **L**ead **A**cid: Closed lead acid batteries with liquid electrolyte in all standard designs available on the market (grid plate, tubular plate, small, large, etc.)

VRLA **V**alve **R**egulated **L**ead **A**cid: Closed lead acid batteries with immobilized electrolyte in gel or AGM (**A**bsorbent **G**lass **M**at Separator) in all standard designs available on the market (grid plate, tubular plate, small, large, AGM, Gel, etc.)

NiCd **Ni**ckel **Cd**mium: Pocket-type plate or fiber plate closed nickel cadmium batteries

The battery capacity ("#221.02 NomBatCpy" 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 5048 is designed and preset for a nominal battery voltage ("#221.03 BatVtgNom" parameter) of 48 V (24 cells for every 2 V) with lead acid batteries (FLA and VRLA) and 45.6 V (38 cells for every 1.2 V) with nickel cadmium batteries.

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. Up to three individual cells can be removed and the system can still be further operated.

13.1 Battery Temperature

The Sunny Island 5048 continuously monitors the battery temperature using the provided battery temperature sensor. A warning message is displayed once the battery temperature drops 5 °C below the maximum permissible temperature ("221.04 BatTmpMax" parameter).

If the maximum permissible battery temperature is exceeded, the Sunny Island 5048 switches off with a fault. If the battery temperature then drops below the set limit ("#221.05 BatTmpStr" parameter), the Sunny Island 5048 restarts automatically.

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

The battery temperature is taken into consideration when the charging voltage is calculated (see section 13.4 "Charge Control" (Page 88)).

If the battery temperature sensor is not connected or a short circuit or a cable break on the sensor is detected, a warning message is generated; however, the Sunny Island 5048 continues to operate at a fixed set battery temperature of 40 °C. Over time this leads to insufficient battery charging.

13.2 Start Options

If the battery or individual cells are removed from the battery bank in a system, the battery management must be restarted and configured. 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 5048 has a very precise internal charge level calculation (display value "#120.01 BatSoc"). The operation for calculating the charge level is based on balancing the ampere hours. That means that all currents that flow in and out of the battery are added together and based on 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 omitted. Unlike other operations, no fixed charging factor must be set.

If you wish to connect other loads or generators to the battery, whose currents are not detected by Sunny Island 5048, you must connect an external battery current sensor in order for the charge state to be detected correctly. The external battery current sensor also improves the precision of the state of charge (SOC) and the state of health (SOH).

When the fully charged state is reached, the charge state value is set back to 90 %, 95 % or 100 %, depending on how full the battery was actually charged. If the default settings are not changed, a charge state of 90 % is normally reached after a boost charge, a charge state of 95 % is normally reached after a full charge and a charge state of 100 % is normally reached after an equalization charge.

Since fully charged states are only rarely achieved in specific offgrid applications, the operation used here can also utilize the battery voltage during constant discharge phases with low discharge currents to recalibrate the charge state. In most applications, these phases are reached at night. 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 (approx. 4 to 8 weeks). Since many of the battery types on the market today exhibit extremely varied behavior, no values can be determined. The best option is to make adjustments to the respective battery according to the procedures described above.

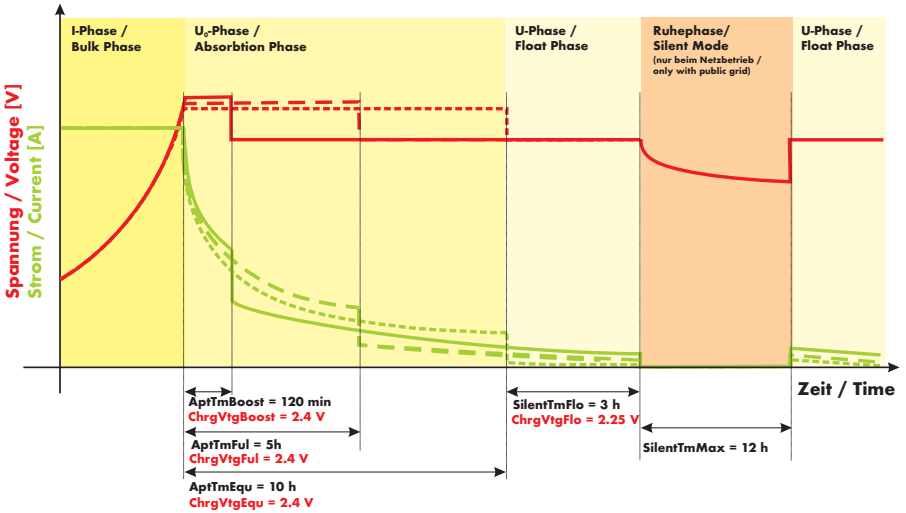
The estimated charge state error (display value "#120.11 BatSocErr") will provide you with continuous information on the accuracy of the battery charge state currently calculated. The average error will continuously diminish as the adjustment to the actual battery increasingly improves.

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 useable capacity may decrease considerably on a permanent or only a temporary basis. The battery's state of health (display value "#342.01 Soh") is a percentage measurement for the current useable capacity relative to the nominal capacity. 100 % means that the entire nominal capacity can still be utilized. At 50 %, only half of the original nominal battery capacity can be utilized. A self-adapting method, which takes between 4 and 8 weeks to produce good and exact values, is also used to calculate the battery's state of health.

The current capacity for the Sunny Island 5048 is automatically adjusted downwards for temperatures <20 °C, since the useful capacity of batteries is significantly reduced in temperatures below the nominal temperature. For all lead acid batteries, the nominal capacity is amended by a fixed factor of –1 %/°C. For NiCd batteries a factor of –0.75 %/°C is used.

13.4 Charge Control

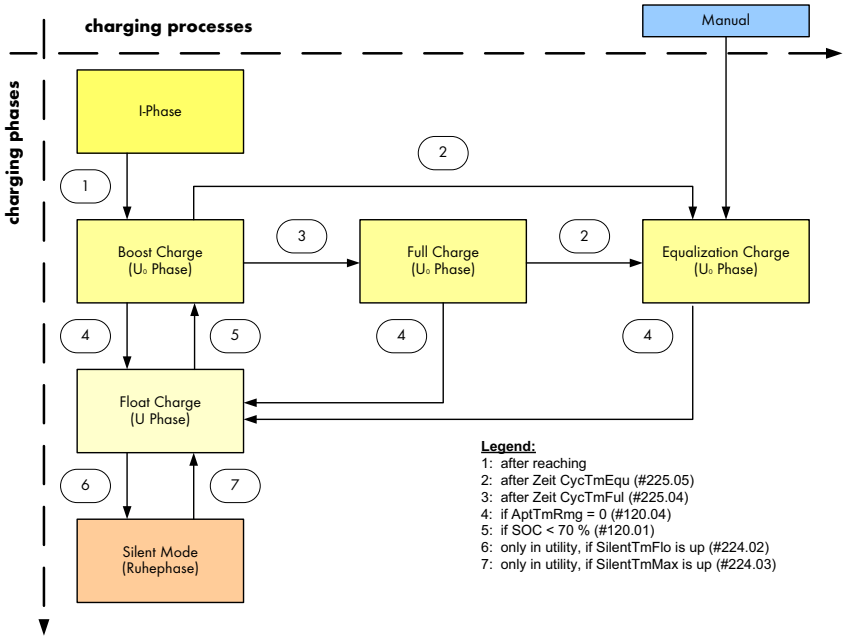
The Sunny Island 5048 performs charge control in 3 phases, using the IV0V process. When the device operates with the public grid, there is also an optional fourth phase called silent mode.



The I stands for the constant current phase (I phase). In this phase, the charging is limited by the maximum defined battery current ("#222.01 BatChrgCurMax" parameter), the nominal generator current ("#242.03 GnCurNom" parameter), the nominal grid current ("#250.03 GdCurNom" parameter) or the maximum AC charging current of the Sunny Island 5048 ("#210.02 InvChrgCurMax" parameter). The respective value reached first is the limiting value. During this phase the battery voltage increases as the battery is charged.

Once the battery voltage reaches the predefined value for the second phase V_0 ("#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 5048 remains in this phase for the defined period of time ("#222.01 – #222.03", AptTmBoost or AptTmFul or AptTmEqu" parameters). For this charging phase, the Sunny Island 5048 automatically selects one of the three possible charging processes (boost, full, equalizing) that are described in more depth between sections 13.4.1 and 13.4.3. The remaining charging time (display value "#120.04 AptTmRmg") of this phase and the current process (display value "#120.05 BatChrgOp") can be read on the display.

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



Once this constant voltage phase is finished, the Sunny Island 5048 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 5048 remains in this phase until either more than 30 % of the nominal capacity (all discharges are added together) has been used or the charge state is less than 70 %. When the Sunny Island 5048 is operating on the public grid, it can also switch from the float charge into silent mode (see section 13.4.5 "Silent Mode" (Page 91)).

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

The charging capability of batteries is heavily 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 reliably prevent overcharging and insufficient charging at all battery temperatures. For this reason, the Sunny Island 5048 is equipped with automatic temperature compensation of the charging voltage. The charging voltage is adjusted by 4 mV/°C and cell for battery

types VLA and FRLA as well as by 0 mV/°C and cell with NiCd batteries. The temperature compensation value can be set using the "#222.11 BatTmpCps" parameter.

13.4.1 Boost Charge

The boost charge is the most common charging process of the Sunny Island 5048. The boost charge ensures a high generator capacity through a high charging voltage over a short period of time. With liquid FLA lead acid batteries, this charge process should be used for gassing and thus compensating the electrolytes. The boost charge process can charge the battery between approx. 85 % and 90 %.

13.4.2 Full Charge

The Sunny Island 5048 initiates a full charge every 14 days ("#222.05 CycTmFul" parameter) or every eight nominal charging throughputs. The objective is to charge the battery to a charge state of at least 95 % and remove any negative effects caused by insufficient charging. Regular full charging approximately every 2 – 4 weeks doubles the service life of the battery.

If, after a specific time of boost charging has elapsed, the Sunny Island 5048 switches to a full charge, the entire elapsed time of boost charging is taken into consideration during the full charge.

If, during a full charge, more than 1 % of the nominal battery capacity is discharged, then 50 % of the elapsed time is taken into consideration during the next constant voltage phase.

If an external charging device or a charge control is connected to the battery and the criteria for a full charge are satisfied by the external charge, then the Sunny Island 5048 treats this as if it had performed the full charge itself.

13.4.3 Equalization Charge

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

The Sunny Island 5048 can automatically perform an equalization charge every 180 days ("#222.06 CycTmEqu" parameter) or every 30 nominal charging 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 switched off, if desired, ("#222.12 AutoEquChrgEna" parameter, activated by default) or manually started ("#420.01 ManChrgSel" parameter).

If, after a specific time of boost charging or full charging has elapsed, the Sunny Island 5048 switches to an equalization charge, all of this time is taken into account during the equalization charge.

If, during an equalization charge, more than 1 % of the nominal battery capacity is discharged, then 50 % of the elapsed time is taken into consideration during the next constant voltage phase.

If an external charging device or a charge control is connected to the battery and the criteria for an equalization charge are satisfied by the external charge, then the Sunny Island 5048 treats this as if it had performed the equalization charge itself.

13.4.4 Manual Equalization Charge

An equalization charge can be manually triggered for the Sunny Island 5048 at any time using the "#420.01 ManChrgSel" parameter. The equalization charge is activated once the manual equalization charge has been manually confirmed. If the generator is connected to the system, it is automatically started and stopped again once the equalization charge has been completed.

An equalization charge should be performed at least once a year. Following a long period of time without charging, for example, with systems that are only operated seasonally, a manual equalization charge must always be performed at the end or beginning of the season.

13.4.5 Silent Mode

In addition to the float charge, the silent mode can only be used when the device is operating on the public grid ("#224.01 SilentEna" parameter). The main purpose of the silent mode is that in grid backup systems, where the Sunny Island 5048 is predominantly in float charge, energy can be saved by switching from charge mode to standby mode.

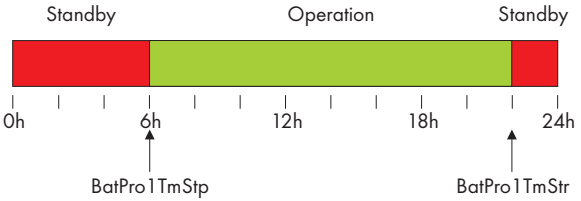
The silent mode is activated if the set time ("#224.02 SilentTmFlo" parameter) for the float charge has expired. The Sunny Island 5048 remains in silent mode for a fixed time ("#224.03 SilentTmMax" parameter) or until the battery voltage per cell is 0.14 V lower than the set voltage ("#222.10 ChrgVtgFlo" parameter). This ensures that the battery is always fully charged, even in silent mode. If a grid dropout is detected during silent mode, the Sunny Island 5048 makes a stand-alone grid available within a few milliseconds. The loads are supplied with power almost without interruption.

13.5 Battery preservation mode

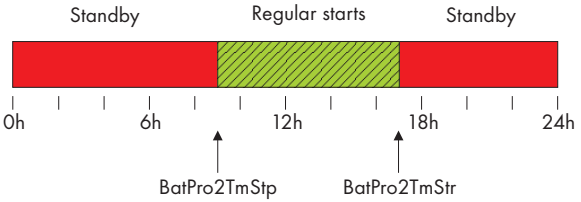
The Sunny Island 5048 has a sophisticated battery preservation mode. The battery preservation mode prevents the battery from being deeply discharged, as much as possible, when the energy supply is low and thus prevents a total system failure as well as damage to the battery.

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

Level 1: The first level is used to switch the inverter into standby mode in times during which the energy is not absolutely necessary (e.g. at night). You define the start time using the "#223.01 BatPro1TmStr" parameter and define the stop time using the "#223.02 BatPro1TmStp" parameter.



Level 2: The second level of the battery preservation mode ensures that the inverter regularly starts every two hours but only during the window of time in which an energy supply is expected and attempts to charge the battery from the AC side. For photovoltaic systems, this occurs during the day. In this case, you define the start time using the "#223.03 BatPro2TmStr" parameter and the stop time using the "#223.04 BatPro2TmStp" parameter.



Level 3: The third level ensures that the battery is protected from deep discharge and thus protected against damage. In this case, the inverter is switched off completely. To start the inverter, please see section 9.5 "Reactivating the Device Following Automatic Shutdown" (Page 63).

During all three levels, the inverter is only stopped if no battery current flows within 5 minutes (limit 3 A charging current).

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

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

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

The battery preservation mode is exited if there is an external voltage source on AC2. However, this function is no longer active if the Sunny Island 5048 has completely switched off in level 3.

The battery preservation mode on the Sunny Island 5048 can be exited by manually starting the device. If, within 5 minutes (see above), charging current is detected, the Sunny Island 5048 continues to operate; otherwise, it switches off again.

In inverter mode, the Sunny Island 5048 charges the battery with 25 W. If the device is in standby mode, only the on-board power supply, which requires approx. 4 W, is powered. This results in a savings of 21 W.

Using the conditions described in level 1 of the battery preservation mode for conversion purposes and assuming an operation time from 6 a.m. to 10 p.m., that results in 336 Wh/day. That in turn corresponds to 7 Ah at 48 V and thus 210 Ah per month (30 days).

13.6 Battery Diagnostics

In the menu "#342 Statistic Battery", many values are displayed 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 18.3 "Diagnostics" (Page 138)).

14 Connecting External Sources

The Sunny Island 5048 supports the integration of external energy sources. Here a distinction is made between the integration of a generator and the integration of the public grid.

Both the generator as well as the public grid are integrated through the AC2 connection of the Sunny Island 5048. A 1-phase and 3-phase connection can be established. During 1-phase operation, the transfer relays are operated at the same time which allows a correspondingly larger current to be employed and therefore allows a correspondingly larger quantity of generator or grid connections.

When installing 1-phase parallel systems, the connection cables for AC1 and AC2 for all Sunny Island 5048 devices must have the same cable cross-sections and cable lengths.

In the parameter settings and display values, a distinction is made between purely generator- and purely grid-relevant settings and values as well as common settings and values (EXT) for the grid and generator. The Sunny Island 5048 has separate parameters for the grid and generator. This generally allows both operating modes to be used without making additional adjustments.

14.1 Generator

Depending on the battery charge state or the consumer power, the Sunny Island 5048 can start a generator and of course stop it again as well. In this case, diverse limits and times are taken into consideration (see limits and power flow controller).

14.1.1 Generator Start Options

The Sunny Island 5048 supports the following options for the generator start that can be adjusted using the "#242.07 GnStrMod" parameter in standby mode:

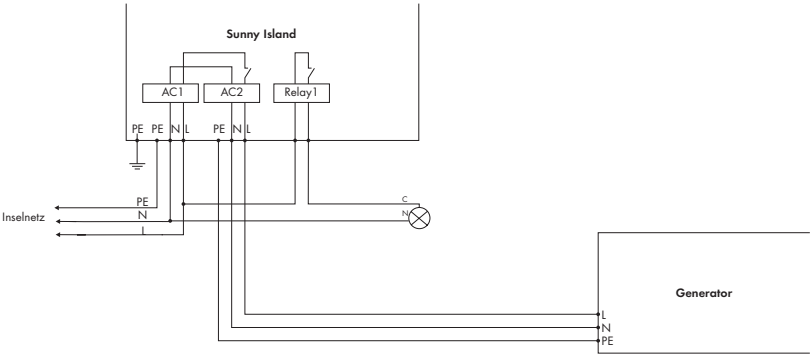
- Manual
- Autostart
- GenMan

Manual

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

In this case, the Sunny Island 5048 has no option to start 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 14.1.5 "Limits and Power Adjustment" (Page 105)), the device is synchronized and switches on following the warm up time.

The following figure principally displays the operation of a generator that has no remote starting options:



The generator is also always switched off manually. The Sunny Island 5048 then automatically switches into the operating mode without the generator.

The GnReq signal (see 15 "Relay" (Page 115)) is set for signaling the generator request and can thus be used as an alarm contact. If no request is pending, the signal is disabled again.

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

A disconnector should be located between the Sunny Island 5048 and the generator. If the generator is to be stopped, the generator is first manually disconnected using the disconnector and then it is stopped. This prevents powering the generator while switching it off.

Autostart

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

The Sunny Island 5048 requests the generator using the GnReq signal. If the generator voltage and frequency are within the set limits (see 14.1.5 "Limits and Power Adjustment" (Page 105)), the device is synchronized and switched on following the warm up time.

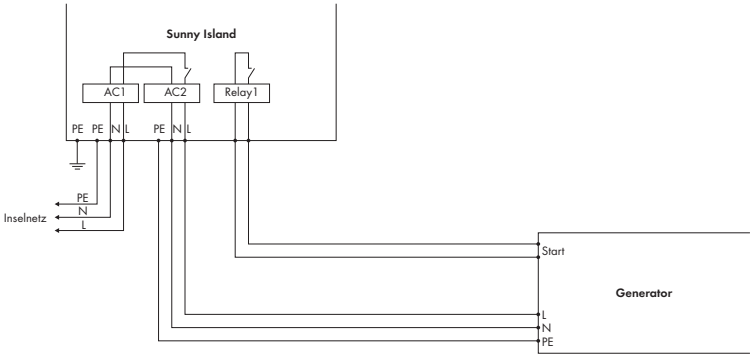
The Sunny Island 5048 keeps the request signal stable until a disconnection is made and the set power down time has expired.

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

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

Time to activation = 10 minutes for GenMan or 2 x "#242.10 GnCoolTm" + 2 minutes for manual and autostart.

The following figure principally displays the generator types that can be automatically started:



If you directly start the generator manually in this operating mode, the Sunny Island 5048 detects the running generator and connects it once the warm up time has expired. If you stop the generator externally, this is detected and the generator is disconnected and the stand-alone grid continues to be powered.

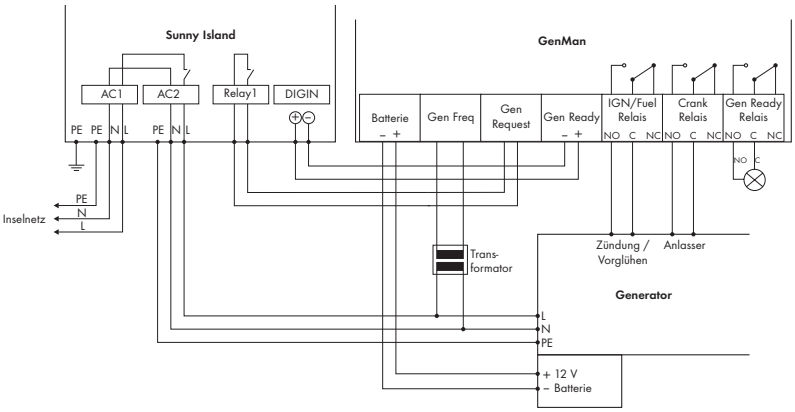
If the generator is running after being externally started and a generator request occurs, the GnReq signal is disabled until the generator is externally stopped again and the stop time has expired.

GenMan

If a GenMan (generator manager) (SMA order number: "SI-GenMan-...") is integrated into the system, it assumes direct control of the generator. It is connected between the Sunny Island 5048 and the generator. The GenMan assumes control of the generator (warm up time, cooling off time and autostart).

Using the GnReq signal, the Sunny Island 5048 requests the generator at the GenMan and keeps this signal stable until the request is successful. The GenMan returns the GENRDY signal via DIGIN (see 6.6 "GenMan Connection" (Page 54)) if the generator is ready for operation. Afterwards, the Sunny Island 5048 can synchronize and connect. If the generator is no longer required, the Sunny Island 5048 disconnects itself and disables the GnReq signal.

The following figure principally displays the generator start using the "GenMan" generator controller.



The GENRDY signal sends a manual generator start at the GenMan to the Sunny Island 5048. The device synchronizes and connects.

If the generator is externally and manually started at the GenMan, Sunny Island 5048 blocks the GnReq signal:

- Manual stop and start are ignored on the Sunny Island 5048 (operated using the display and keyboard).
- Internal requests (e.g. via the battery charge state) are also ignored.

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

The Sunny Island 5048 disconnects the generator if the GenMan has disabled the GENRDY signal.

A manual start directly at the generator is not permitted (see GenMan manual).

14.1.2 Generator Operation

The Sunny Island 5048 allows automatic operation (depending on charge state or load) (see 14.1.4 "Automatic Generator Operation" (Page 101)). In addition, manual operation is also possible.

14.1.3 Manual Generator Operation

The manual operating modes for the generator management are triggered using the "#430.01 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 as a result of the charge state or the consumer power or by a request for a manual equalization charge ("#420.01 ManChrgSel" = Start).

Stop: Manual generator stop if it is manually started. Cancels the current generator request – immediately disconnects from the generator and transitions into the lockout state. Once the lockout time has ended, the generator switches into automatic operation.

Start: Manual generator start – generator runs "continuously" until stop

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

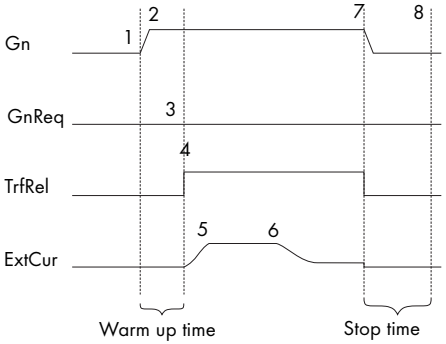
If the generator has been manually started (start), it must be manually stopped (stop).

An equalization charge can be manually started using the "#420.01 ManChrgSel" parameter. This sets the battery management (see 13 "Battery Management" (Page 85)) into the equalization charge state and requests the generator. The request remains stable until the equalization charge has been completed.

The following process diagrams provide an overview on the start/stop behavior of the Sunny Island 5048 during manual generator operation:

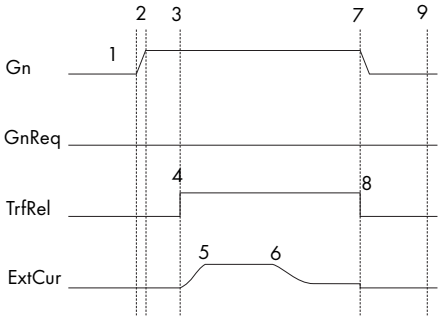
Generator interface #242.07 GnSrtMod manual; start at the generator

1 Manual generator start
2 "Generator operation" detected, warm up phase begins
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, generator is disconnected
8 Minimum stop time has expired



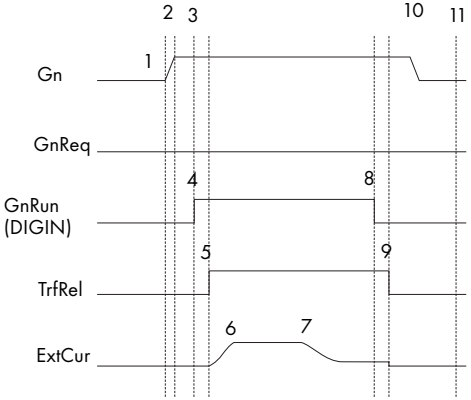
Generator interface #242.07 GnSrtMod autostart; start at the generator

1 Manual generator start
2 "Generator operation" detected, warm up phase begins
3 Warm up phase completed
4 Generator is connected
5 Generator current limit
6 Current is reduced, battery absorption phase
7 Manual generator stop, generator is disconnected
8 Generator is disconnected, stop time begins
9 Stop time ends



Generator interface #242.07 GnSrtMod GenMan; start at the generator

1 Generator start at GenMan
2 GenMan generator warm up phase begins
3 Generator warm up time
4 GenMan sends ready for connection signal
5 Sunny Island 5048 connects generator
6 Current limit
7 Current is reduced, battery absorption phase
8 GenMan sends generator stop signal (man Auto!)
9 Sunny Island 5048 disconnects generator
10 Generator power down time expires, generator stop
11 Stop time has expired



14.1.4 Automatic Generator Operation

In automatic operating mode ("#241.01 GnAutoEna" parameter), the Sunny Island 5048 automatically defines the settings (depending on battery charge state 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

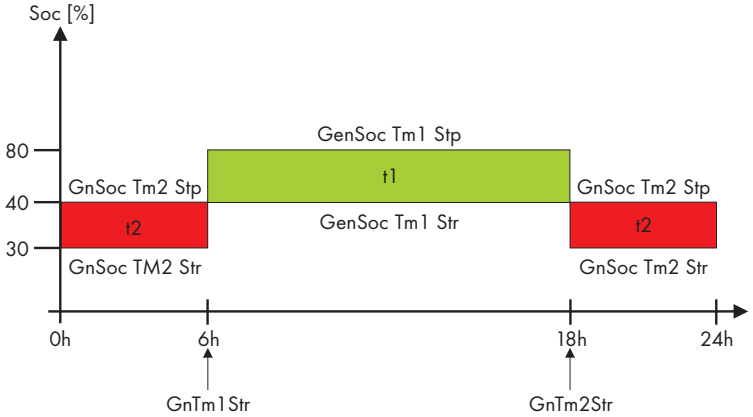
Manual specifications on the Sunny Island 5048 take priority over the automatic operating mode. If the Sunny Island 5048 is manually stopped while the automatic operating mode is activated, the Sunny Island 5048 enters into stop/lock operating mode.

If the generator autostart is activated and all the conditions for automatic operation are satisfied, the Sunny Island 5048 switches back into the start operating mode following the lockout time (or manual confirmation using the "#430.02 GnAck" parameter).

The time periods t1 and t2 are defined using the "#241.07 GnTm1Str" and "#241.08 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.

If GnTm1Str = GnTm2Str, only t1 is activated!

The time intervals t1 and t2 are assigned charge states for start-up and stop using the "#241.03 GnSocTm1Srt", "#241.04 GnSocTm1Stp", "#241.05 GnSocTm2Strt" and "#241.06 GnSocTm2Stp" parameters. GnSocTm1Strt designates the battery charge state at which the generator is started during the t1 time and GnSocTm1Stp designates the charge state at which the generator is switched off during t1. The GnSocTm2Str and GnSocTm2Stp parameters are similarly defined during the time t2.



The graphic displays an example of the settings in case the generator is not to operate during the night. Between 6 a.m. and 10 p.m., the generator is started at a charge state (SOC) of 40 % and by contrast, the battery is discharged to 30 % at night (between 10 p.m. and 6 a.m.) before the diesel generator starts.

If the float charging process (see section 13.4 "Charge Control" (Page 88)) is activated before the cutoff limit (GnSocTm1Stp or GnSocTm1Stp) 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 "#241.04 GnSocTm1Stp" or "#241.06 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 "#241.09 GnPwrEna" parameter. The function is only effective if the "#241.01 GnAutoEna" parameter is simultaneously set to On.

The load limit for the request and the generator stop is configured using the "#241.10 GnPwrStr" and "#241.11 GnPwrStp" parameters. The average time by which an average value for the consumer power is calculated can be set using "#241.12 GnPwrAvgTm". This prevents temporary power consumption peaks that last for several seconds from causing a load dependent generator start.

If the generator has been started due to the load, the generator 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.

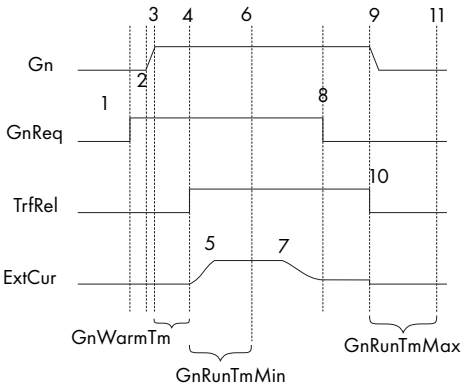
Only the total consumer power of all phases is monitored. Individual phases in a multi-phase system are not monitored.

The consumer power is determined from the inverter power ("#112.01 TotInvPwrAt") and generator power ("#132.01 TotExtPwrAt").

The following process diagrams provide an overview on the start/stop behavior of the Sunny Island 5048 during automatic generator operation:

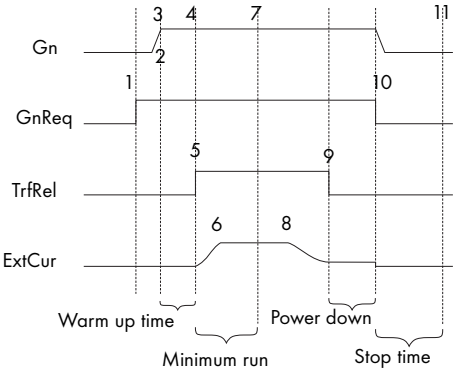
Generator interface #242.07 GnSrtMod manual; request by Sunny Island 5048

1 Generator requested by Sunny Island 5048
2 Manual generator start
3 Generator operation detected, warm up phase begins
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 Minimum run time has expired



Generator interface #242.07 GnSrtMod autostart; request by Sunny Island 5048

1 Generator started by Sunny Island 5048
2 Generator start
3 Warm up time begins
4 Warm up time has expired
5 Generator is connected
6 Current limit
7 Minimum run time has expired
8 Current is reduced, battery absorption phase
9 Loading process is completed, generator is disconnected
10 Generator power down time has expired, generator is disconnected
11 Stop time has expired



Generator interface #242.07 GnSrtMod GenMan; request by Sunny Island 5048

1 Generator started by Sunny Island 5048 at GenMan

2 Generator start through GenMan

3 GenMan warm up time begins

4 GenMan warm up time has expired, connection signaled by GenMan at Sunny Island 5048

5 Sunny Island 5048 connects generator

6 Current limit

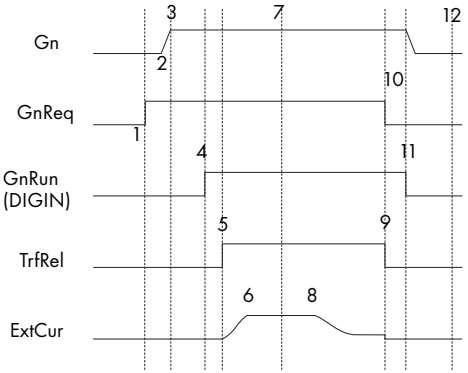
7 Minimum run time (Sunny Island 5048) has expired

8 Current is reduced, battery absorption phase

9 Loading process is completed, generator is disconnected by Sunny Island 5048

10 Signal at GenMan

11 GenMan power down time has expired, generator stopped



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

14.1.5 Limits and Power Adjustment

The voltage limits can be set using the "#242.01 GnVtgMin" and "#242.01 GnVtgMax" parameters and the frequency limits for generator operation can be set using the "#242.05 GnFrqMin" and "#242.06 GnFrqMax" parameters. If the values are outside these permitted limits, the generator is disconnected. Slightly restricted limits are applied to generator connection.

The voltage and frequency limits are monitored in phases. The phase on the master device must at least meet the defined limits to connect the generator. If the limits are not maintained, slave devices, where applicable, connect or disconnect individually.

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

If a slave device disconnects itself from the generator (and the master remains connected to the generator), the slave device can reconnect itself once the detected voltage and frequency are back within the valid range. In this case a monitoring time is running. The slave is only reconnected after the detected voltage and frequency for the "#242.12 GnWarmTm" parameter are within the valid range.

The Sunny Island 5048 charges the generator during each phase using the current specified in the "#242.03 GnCurNom" parameter. The power that is not directly used by the loads flows into the battery for charging. The limits for the AC charging current limit ("#210.02 InvChrgCurMax" parameter) on the Sunny Island 5048 and the DC charging current limit ("#222.01 BatChrgCurMax" parameter) are active at the same time. Low values for this limit may be the reason why the defined generator current cannot be adjusted. If the battery voltage reaches the charging voltage nominal value, it is also reduced (absorption phase, see section 13.4 "Charge Control" (Page 88)).

A sensible value for the "#242.03 GnCurNom" parameter is approximately 80 % of the maximum generator current for each phase.

If the "#242.15 GnCtlMod" parameter is set to CurFrq, the generator is also limited at frequencies lower than the nominal frequency ("#242.04 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 "#242.03 GnCurNom" parameter is not sufficient for powering the loads, the battery provides support ("real generator support").

The "#230.03 RtCurCps" parameter determines the partitioning of the reactive power between the Sunny Island 5048 and generator or grid. In the external setting (default), an attempt is made to provide the full reactive power through the Sunny Island 5048. In the internal setting, an attempt is made to keep the full reactive power away from the Sunny Island 5048. The shared setting divides the reactive power between the Sunny Island 5048 and the generator or grid.

14.1.6 Run Times

If the generator is started (or the Sunny Island 5048 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 of "#242.12 GnWarmTm" + 2 or 10 minutes, the connection process is cancelled and a new attempt is made. After three attempts, the system goes into error state (Fail). Once the 5-minute error wait time has expired, a new attempt is made.

If the generator has been connected, the minimum run time begins ("#242.08 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 expired and a request is no longer pending or the system detects that the set limits have not been maintained, the generator disconnects and transitions into the power down phase (Cool). If this power down phase is completed after the "#242.10 GnCoolTm" time, the generator is stopped.

The power down time ("#242.10 GnCoolTm" parameter) defined on the Sunny Island 5048 should be set equal to or preferably greater than the power down time of the GenMan.

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

Once the stop time ("242.09 GnStpTmMin" parameter) has expired, the generator is ready for the next request.

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

If a generator fault is detected several times and the number of autostarts ("#241.02 GnAutoStr" parameter) has been exceeded, the system transitions into the locked error state. This state lasts for the "#242.11 GnErrStpTm" time. Once this time has expired, the generator is ready for another attempt.

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.

The error state as well as the locked error state can be cancelled by confirming the generator fault ("#430.02 GnAck" parameter).

The "#140.03 GnRmgTm" process 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 time (Warm)
- Remaining minimum run time in operation (Run)
- Remaining run time during the power down time (Cool)
- Remaining stop time after the power down time has expired (Lock)

- Remaining time in the error state (Fail)
- Remaining time in the locked error state (FailLock)

14.1.7 Operation Together With Sunny Boys

If the battery is fully charged, the frequency limits the power output of the AC feed-in generators (Sunny Boys). If the generator is now manually started, for example, the frequency would be lowered, if required, as the Sunny Island 5048 synchronizes with the generator. The AC feed-in generators (Sunny Boys) would then feed additional energy into the system and possibly overload the batteries. In order to prevent this during such conditions, the stand-alone grid frequency is temporarily increased ("#230.04 AcSrcFrqDel" parameter), in line with the synchronization, until the AC feed-in generators (Sunny Boys) are disconnected from the stand-alone grid as a result of the grid limits being exceeded.

14.1.8 Stopping the Generator

If the Sunny Island 5048 (automatically or manually) has started the generator, it can be manually stopped at any time using the "#430.01 GnManStr" parameter. This disconnects the generator (the minimum run time is not taken into account here) and the power down time (Cool) is skipped. Afterwards, the system transitions into the stop time (Lock).

If the generator start is performed directly at the GenMan or the generator, it can only be stopped there again. Triggering a stop here only disconnects the generator and the system transitions into the stop time (Lock).

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

If the generator start is to be disabled after a manual stop, this must be performed by setting the "#241.01 GnAutoEna" parameter to Off.

14.1.9 Stopping the Sunny Island 5048

If the Sunny Island 5048 is stopped by the user, the generator is immediately disconnected. The generator is then stopped (generator request, GnReq, is disabled). The power down phase (Cool) is skipped and the system transitions into the stop time.

If the generator is started directly at the generator management box or the generator, it can only be stopped there again. Stopping the Sunny Island 5048 only disconnects the generator and the system transitions into the stop time (Lock).

14.1.10 Failures

Reverse Power

If the reverse power ("#242.13 GnRvPwr" parameter) set for the "#242.14 GnRvTm" time is exceeded, the generator is disconnected and stopped. The power down time (Cool) is skipped and the system transitions into the minimum stop time (Lock). After reverse power, connection is blocked for at least "#230.02 ExtLkTm" or "#242.09 GnStpTmMin".

Generator Failure

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

Generator Phase Failure

The failure of a phase (e.g. broken fuse) on a slave device is treated as a phase failure. The slave device then disconnects this phase. If the phase is detected as being available again, it is reconnected after the warm up time "#242.12 GnWarmTm" has expired.

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

Slave Device Failure

If a slave device fails, the system continues to operate using both the remaining devices of the cluster as well as those on the generator.

14.2 Grid

The Sunny Island 5048 supports the operation of grid backup systems on the grid. Here, a distinction is made between two main states: either a main power grid and stand-alone grid are connected or a main power grid and stand-alone grid are disconnected. The operating mode of the inverter is derived from this. If the stand-alone grid is disconnected, the inverter is solely responsible for powering this stand-alone grid. If the grid is connected to the stand-alone grid, the stand-alone grid is powered from the main power grid. The voltage and frequency in the stand-alone grid and in the main power grid are identical.

Under specific conditions, the system can also temporarily feed energy from the stand-alone grid into the main power grid in the GridCharge operating mode ("#250.08 GdMod" parameter).

14.2.1 Conditions

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

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*

The Sunny Island 5048 does not meet the VDE 0126-1-1 directive required in Germany and, for legal reasons, it must therefore be MSD-certified (e.g. by UfE GmbH) when operated while connected to the public grid.

14.2.2 Starting the Sunny Island 5048

The Sunny Island 5048 always starts in stand-alone grid operation. Once the device is operating, it checks for the presence and availability (voltage and frequency) of the external grid.

14.2.3 Stand-Alone Grid Operation

The main power grid and stand-alone grid are disconnected and the inverter powers the stand-alone grid. The system waiting for the grid to reconnect is an indication of this state.

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

14.2.4 Grid Reconnection

In stand-alone operation, the inverter constantly checks whether the gird has been reconnected (see above). If the voltage and frequency of the main power grid are within the permissible range of the "#250.01 GdVtgMin" and "#250.02 GdVtgMax" parameters for the "#250.07 GdVldTm" time and the frequency is within the permissible range of the "#250.05 GdFrqMin" and "#250.06 GdFrqMax" parameters (see also section 14.2.1 "Conditions" (Page 110)), the stand-alone grid is synchronized with the main power grid and then connected.

14.2.5 Grid Operation

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

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

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

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

Charge Mode

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

Silent Mode

In order to save energy, the silent mode can be activated using the "#224.01 SilentEna" parameter along with the enable setting (Default Disable). In this case, the Sunny Island 5048 is set into the sleep mode if the charge has been completed and the battery was in float charge for some time (see section 13.4.5 "Silent Mode" (Page 91)).

The silent mode is exited regularly to recharge the battery.

Grid Feeding

Whether energy is fed from the stand-alone grid into the main power grid is controlled using the "#250.08 GdMod" parameter. If GridCharge (Default) is set, no energy is fed into the grid. If GridFeed is set, energy is fed into the grid.

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

AC feed-in generators on the stand-alone grid side (Sunny Boys) can feed their energy into the grid through the internal transfer relay of the Sunny Island 5048, for limitations, see section 14.2.7 "Limits and Power Adjustment" (Page 112).

14.2.6 Grid Failure

A grid fault is characterized by the voltage or frequency being outside of the permissible limits (see section 14.2.4 "Grid Reconnection" (Page 111)) or the main power grid being disconnected. In this case, the time limits are relevant: Smaller deviations are permitted for longer than large deviations (see section 14.2.1 "Conditions" (Page 110)).

In case of a grid fault/failure, the main power grid is disconnected and the inverter starts, if it is not already running (silent mode).

A grid failure occurring while the Sunny Island 5048 is in silent mode can cause a temporary grid failure in the stand-alone grid.

14.2.7 Limits and Power Adjustment

The Sunny Island 5048 charges the generator during each phase using the current specified in the "#242.03 GnCurNom" parameter. The power that is not directly used by the loads flows into the battery for charging. The limits for the AC charging current limit ("#210.02 InvChrgCurMax" parameter) on the Sunny Island 5048 and the DC charging current limit ("#222.01 BatChrgCurMax" parameter) are active at the same time. If the battery voltage reaches the charging voltage nominal value, it is also reduced (see section 13.4 "Charge Control" (Page 88)).

If the current set using the "#250.03 GnCurNom" parameter is not sufficient for powering the loads, the battery provides support.

The "#230.03 RtCurCps" parameter determines the partitioning of the reactive power between the Sunny Island 5048 and generator or grid. In the external setting (default), an attempt is made to provide the full reactive power through the Sunny Island 5048. In the internal setting, an attempt is made to keep the full reactive power away from the Sunny Island 5048. The shared setting divides the reactive power between the Sunny Island 5048 and the generator or grid.

The feedback into the grid must be set to GridFeed using the "#250.08 GdMod" parameter. However, the reverse power is not monitored.

14.2.8 Operation Together With Sunny Boys

Since electricity is fed into the grid through the relay of the Sunny Island 5048, they must be prevented from overloading. For this reason, reverse power monitoring is used that, if required, establishes the connection to the main power grid if the reverse power limit is exceeded or an excessive load is applied to the relay.

If the current flowing through the relay exceeds the maximum permissible current, the grid is disconnected (relay protection). The quantity of PV output installed in the stand-alone grid must not exceed the maximum quantity allowed by the AC input (see section 20 "Technical Data" (Page 155)).

If the battery is fully charged, the frequency limits the power output of the AC feed-in generators (Sunny Boys) in the stand-alone grid. If the grid is now reconnected, the frequency would be lowered, if required, as the Sunny Island 5048 is synchronized with the grid. The AC feed-in generators (Sunny Boys) would then feed additional energy into the system and possibly overload the batteries. In order to prevent this during such conditions, the stand-alone grid frequency is temporarily increased ("#230.04 AcSrcFrqDel" parameter), in line with the synchronization, until the AC feed-in generators (Sunny Boys) are disconnected from the stand-alone grid as a result of the grid limits being exceeded.

15 Relay

The Sunny Island 5048 provides you with many options to control internal and external operations. For this purpose, two relays are integrated into the device with which you can assign functions using the "#261.01 Rly1Op" and "#261.02 Rly2Op" parameters. Information on the connection of both relays is provided in section 6.4.4 "Multi-function Relay 1 and 2" (Page 47). The different settings have the following meanings:

Function/ Settings	Meaning	Functional description
Off		relay is permanently switched off (deactivated)
On		relay is permanently switched on (e.g. relay function test during commissioning)
AutoGn	Auto Generator	automatic generator connection
AutoLodExt	Auto LoadShedding Extern	automatic load disconnection load is connected if sufficient battery charging current flows (by external supplier, e.g. generator)
AutoLodSoc	Auto LoadShedding Soc	automatic load disconnection load is only connected if SOC has exceeded the set value again
Tm1	Timer 1	programmable timer (once, daily, weekly) with duty cycle
Tm2	Timer 2	programmable timer (once, daily, weekly) with duty cycle
Apt-Phs	Absorption phase is active	battery charge is in the absorption phase
GnRn	Generator Run	generator is running (generator is connected)
ExtVfOk	External voltage and frequency is OK	external voltage and frequency are within the valid range for connection
GdOn	Grid On	external grid is connected
Alm	Alarm	Sunny Island 5048 has a fault, in case of fault, contact is open (relay is deactivated)
Rn	Run	Sunny Island 5048 is in operation, contact is closed (relay is activated) if the device is running in inverter operation
BatFan	Battery Fan	switches the battery room fan on
AcdCir	Acid Circulation	activates the electrolyte pump (acid circulation)

You can only assign one function to each relay. If the devices are connected in parallel, the relays of the slaves can also be used. They are set using the master.

The relays are changeover contacts. They have both a break contact as well as a NO contact.

Except for "Alm" (alarm), all relay functions are listed as NO contact functions, in other words, the contact is closed if the relay is activated by selecting the function. For the exception "Alm", the relay has a break function. This means that the relay is normally activated and opens the contact. It is only deactivated when a fault occurs and then closes the contact (and thus activates a warning light, for example).

In case of a fault, the relays go into the safe mode, that means they deactivate.

16 Sunny Boy

The following section provides information for connecting and configuring the Sunny Boy inverter in stand-alone grid systems. At the time this documentation was printed, the following products could be used with a Sunny Island 5048:

- Sunny Boy inverters (for feeding in from PV systems):
  SB 700 / SB 1100 / SB 1100LV / SB 1700 / SB 2500 / SB 2800i / SB 3000 / SB 3300 / SB 3800 / SMC 5000 / SMC 5000A / SMC 6000 / SMC 6000A / SMC 6000TL / SMC 7000TL / SMC 8000TL
- Windy Boy inverters (for feeding in from wind turbines or hydropower systems):
  WB 1100 / WB 1700 / WB 2500 / WB 2800i / WB 3000 / WB 3300 / WB 3800 / WB 6000
- All Hydro-Boy inverters (for feeding in from fuel cell systems)

16.1 Connection to the Stand-alone Grid

Ensure that the entire connection area of the Sunny Island 5048 is free of voltage before installing the Sunny Boy inverter. Please pay attention to section 3 "Safety Instructions" (Page 23).

- Connect the Sunny Boy inverter to the grid in accordance with the Sunny Boy installation guide.
- Wire the AC sub-distribution unit to the AC1 terminals of the Sunny Island 5048.

The Sunny Island 5048 no longer requires a special setting when used with Sunny Boy inverters (this is not the case with the Sunny Island 3324/4248).

- You must set the corresponding parameters in the Sunny Boy to suit a stand-alone grid so that it works properly together with the Sunny Island 5048. The required values for these settings are described in the next section.

For a PV generator with an installed capacity of 5 kWp, combined with two Sunny Boy inverters (2500 W each), you need a battery capacity of at least 500 Ah.

16.2 Setting the Stand-alone Grid Parameters

As soon as you set the Sunny Boy to use stand-alone grid parameters, the device no longer meets the requirements of DIN VDE 0126-1-1. Observe all regionally relevant regulations and discuss this with the local electricity supply company responsible.

Controlled battery charging is needed in a stand-alone grid. Sunny Boy inverters can reduce their feed-in power for this reason. This task is performed by a "Power adjustment via frequency" system (see section 16.3 "Frequency Shift Power Control (FSPC)" (Page 119)).

To activate this adjustment, you must configure the Sunny Boy as follows:

For changing the grid relevant parameters in the Sunny Boy inverter you need a special access code, the installer code. Contact the Sunny Island Hotline at the phone number +49 561 95 22 399 and by e-mail at SunnyIsland.hotline@SMA.de to obtain this personal code.

To set the parameters, a communication channel to the Sunny Boy is required. Install one of these three variants:

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

Additional information on communication can be found in section 6.5 "Interface for External Communication" (Page 51).

1. Establish a communication connection with the Sunny Boy.
2. Navigate to the parameter settings.
3. Set the "Default" parameter to "Offgrid" (stand-alone grid).

When you order Sunny Boys for a stand-alone grid, they are already programmed with the stand-alone grid settings at the factory. No other changes are required.

The "OffGrid" parameter setting automatically sets the following Sunny Boy parameters to the values below:

No.	Parameters	Short descr.	Value
1	I-NiTest	mA	Off (MSD = 0)
2	Uac-Min	V	180

No.	Parameters	Short descr.	Value
3	Uac-Max	V	260
4	Fac-delta- lower range in which the Sunny Boy is active relative to f_0	Hz	–4.5 (starting from the base frequency f_0)
5	Fac-max+ upper range in which the Sunny Boy is active relative to f_0	Hz	+4.5 (starting from the base frequency f_0)
6	dFac-Max max. 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 increase in relation to f_0, at which point the power adjustment via frequency ends. The output of the Sunny Boy at this point is 0 W.	Hz	2 (starting from the base frequency f_0)

This completes the stand-alone grid parameter settings for the Sunny Boy.

If Sunny Boy inverters are operated together with Sunny Island 5048 devices on a communication bus, the "#270.06 ComBaud" parameter in the Sunny Island 5048 devices must be set to "1200" (default).

The Sunny Island 5048 only communicates through the SMA-Net protocol, Sunny-Net is not supported.

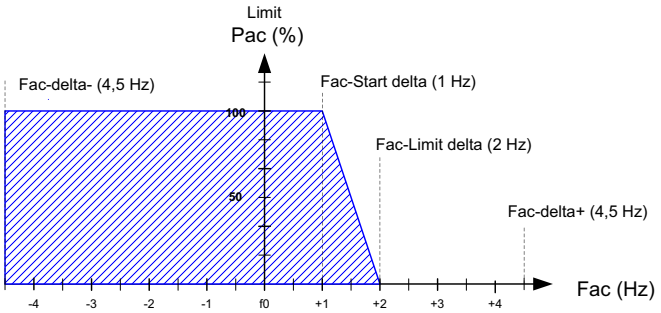
16.3 Frequency Shift Power Control (FSPC)

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

If Sunny Boy inverters are connected to the AC side of the stand-alone grid, the Sunny Island 5048 must be able to limit their output power. This situation can occur when (e.g.) the Sunny Island 5048 battery is fully charged and the (solar) power available from the PV generator 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 Sunny Boy. As soon as the grid frequency increases beyond the value specified by "Fac-Start delta" the Sunny Boy limits its output power accordingly.

This function is shown in the following figure:



The points below have the following meanings:

- f_0 refers to the base frequency of the stand-alone grid
- Fac-delta– and Fac-delta+ refer to the maximum range in which the Sunny Boy is active relative to f_0
- Fac-start delta refers to the frequency increase relative to f_0, at which point the power adjustment via frequency begins
- Fac-Limit delta refers to the frequency increase relative to f_0, at which point the power adjustment via frequency ends. The output of the Sunny Boy at this point is 0 W.

If the value is below the Fac-delta– limit or exceeds the Fac-delta+ limits, the Sunny Boys 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 Sunny Boys 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 Sunny Boys 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 5048 temporarily increases the frequency and disconnects the Sunny Boys using the frequency shutdown method (overfrequency). Afterwards, it synchronizes with the generator.

17 Maintenance and Care

The Sunny Island 5048 has been constructed for low maintenance. Thus, the necessary work is limited to only a few points.

17.1 Housing

Check that the Sunny Island 5048 housing is mechanically sound. If damage (e.g. cracks, holes, missing covers) endangers the operating safety, the Sunny Island 5048 must be deactivated immediately.

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

17.2 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 brush. Clean the fans only when at a standstill. If it is necessary to replace the fans, please contact your installer.

17.3 Display

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

Take care not to accidentally press the membrane keys during cleaning. Only clean the membrane keypad when the device is deactivated.

17.4 Functioning

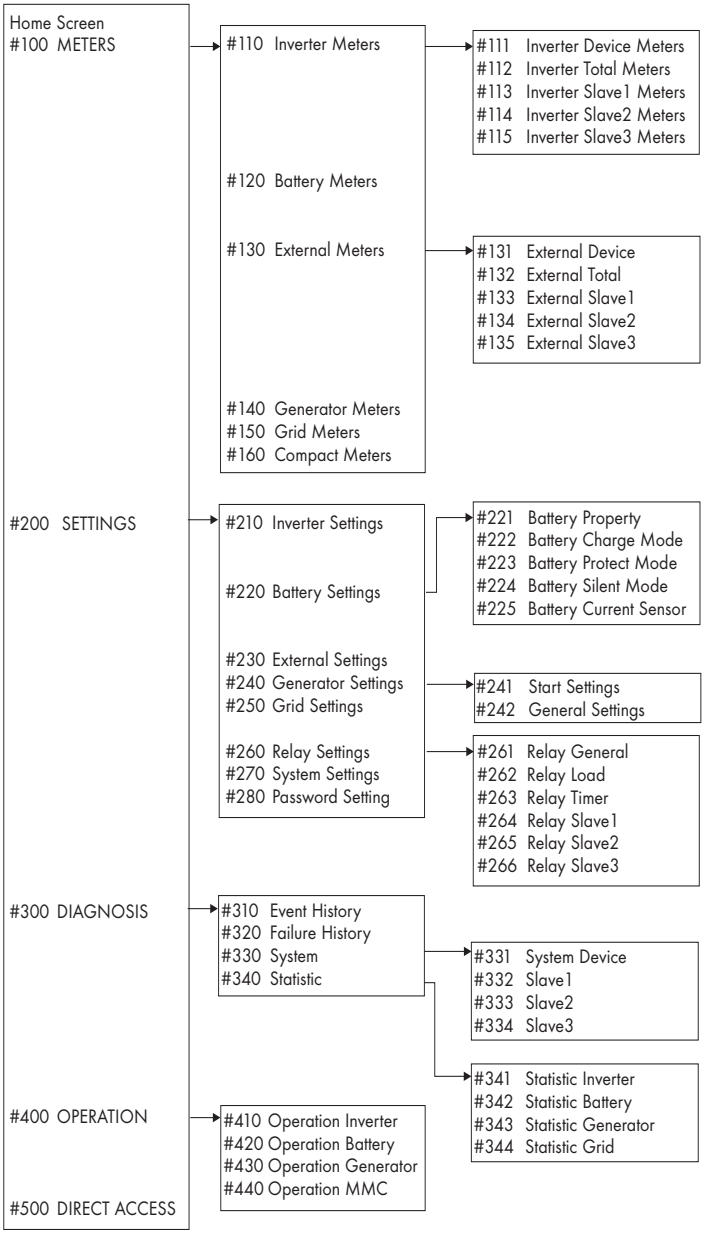
Check regularly whether error messages are present. If an error message is displayed, for which you cannot identify any apparent cause, the stand-alone grid must be inspected by an installer. To ensure optimal operation, the operator should regularly check the entries in the Sunny Island 5048 error list 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.

17.5 Battery

A battery must be checked and maintained regularly. In this regard, observe the battery manufacturer's specifications.

18 Parameter Lists

The following diagram provides an overview of the menu structure.



Only parameters in the menu branches "200-Settings" and "400-Operation" can be changed. All other values are only displayed on the Sunny Island 5048 display. All menu items that can only be changed after entering the installer password are shaded in gray in the following tables.

Depending on the set system configuration, individual menu items may be missing. If you are only operating one Sunny Island 5048 in your system, all menus that affect the slaves are omitted.

Be careful when setting parameters! Incorrect settings can lead to faulty operation of the inverter.

Take note of the original values of all parameters that you change.

The current parameter settings can be saved onto the MMC/SD card using the "#410.02 ParaSto" parameter. This is especially useful if you wish to try out new settings.

Once the system is working optimally, i.e. the selected settings have proven effective, then you can save the saved values on the MMC/SD card using the "#410.02 ParaSto" parameter.

Afterwards, you can perform new settings. If you would like to reject these settings again, you can restore the system to its previous state using the "#410.08 ParaLod" parameter.

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

18.1 Display Values

#110 Inverter Meters

Menu no.	Para-meter no.	Parameter name	Range/ Short descr.	Description
#111 Inverter Device Meters				
#111	01	InvOpStt	Standby Run EmCharge Error Startup KickOff	Operating mode: = standby = operation = emergency charge = error = transfer standby > operation = Sunny Boys are disconnected by frequency increase

Menu no.	Para-meter no.	Parameter name	Range/ Short descr.	Description
#111	02	InvPwrAt	kW	effective power at the inverter
#111	03	InvVtg	V	voltage on the inverter
#111	04	InvCur	A	inverter current
#111	05	InvFrq	Hz	frequency on the inverter
#111	06	InvPwrRt	kVAr	reactive power on the inverter
#111	07	Rly1Stt	Off, On	state of relay 1
#111	08	Rly2Stt	Off, On	state of relay 2
#112 Inverter Total Meters				
#112	01	TotInvPwrAt	kW	total effective power on inverter (cluster)
#112	02	TotInvCur	A	total inverter current (cluster)
#112	03	TotInvPwrRt	kVAr	total reactive power of inverter (cluster)
#113 Inverter Slave1 Meters				
#113	01	InvOpSttSlv1	see #111.01	operating mode of slave 1 for details, see #111.01
#113	02	InvPwrAtSlv1	kW	effective power of inverter on slave 1
#113	03	InvVtgSlv1	V	inverter voltage on slave 1
#113	04	InvCurSlv1	A	inverter current on slave 1
#113	05	InvPwrRtSlv1	kVAr	reactive power of inverter on slave 1
#113	06	Rly1SttSlv1	Off, On	state of relay 1 on slave 1
#113	07	Rly2SttSlv1	Off, On	state of relay 2 on slave 1
#114 Inverter Slave2 Meters				
#114	01	InvOpSttSlv2	see #111.01	operating mode of slave 2 for details, see #111.01
#114	02	InvPwrAtSlv2	kW	effective power of inverter on slave 2
#114	03	InvVtgSlv2	V	inverter voltage on slave 2
#114	04	InvCurSlv2	A	inverter current on slave 2
#114	05	InvPwrRtSlv2	kVAr	reactive power of inverter on slave 2
#114	06	Rly1SttSlv2	Off, On	state of relay 1 on slave 2
#114	07	Rly2SttSlv2	Off, On	state of relay 2 on slave 2
#115 Inverter Slave3 Meters				
#115	01	InvOpSttSlv3	see #111.01	operating mode of slave 3 for details, see #111.01
#115	02	InvPwrAtSlv3	kW	effective power of inverter on slave 3
#115	03	InvVtgSlv3	V	inverter voltage on slave 3

Menu no.	Parameter no.	Parameter name	Range/ Short descr.	Description
#115	04	InvCurSlv3	A	inverter current on slave 3
#115	05	InvPwrRtSlv3	kVAr	reactive power of inverter on slave 3
#115	06	Rly1SttSlv3	Off, On	state of relay 1 on slave 3
#115	07	Rly2SttSlv3	Off, On	state of relay 2 on slave 3

#120 Battery Meters

Menu no.	Parameter no.	Parameter name	Range/Short descr.	Description
#120	01	BatSoc	%	state of battery charge (SOC)
#120	02	BatVtg	V	battery voltage
#120	03	BatChrgVtg	V	nominal value of charging voltage
#120	04	AptTmRmg	hhmmss	remaining absorption time
#120	05	BatChrgOp	Boost Full Equalize Float Silent	Active charging process: = boost charge = full charge = equalization charge = maintenance charge = silent mode
#120	06	TotBatCur	A	total battery current of cluster
#120	07	BatTmp	degC	battery temperature
#120	08	RmgTmFul	d	time remaining until next full charge
#120	09	RmgTmEqu	d	time remaining until next equalization charge
#120	10	AptPhs	Off, On	absorption phase is active
#120	11	BatSocErr	%	estimated error of the charge state

#130 External Meters

Menu no.	Para-meter no.	Parameter name	Range/Short descr.	Description
#131 External Device				
#131	01	ExtPwrAt	kW	effective power of external source
#131	02	ExtVtg	V	voltage of external source
#131	03	ExtCur	A	current of external source
#131	04	ExtFrq	Hz	frequency of external source
#131	05	ExtPwrRt	kVAr	reactive power of external source
#132 External Total				
#132	01	TotExtPwrAt	kW	total effective power of external source
#132	02	TotExtCur	A	total current of external source
#132	03	TotExtPwrRt	kVAr	total reactive power of external source
#133 External Slave1				
#133	01	ExtPwrAtSlv1	kW	effective power of external source on slave 1
#133	02	ExtVtgSlv1	V	voltage of external source on slave 1
#133	03	ExtCurSlv1	A	current of external source on slave 1
#133	04	ExtPwrRtSlv1	kVAr	reactive power of external source on slave 1
#134 External Slave2				
#134	01	ExtPwrAtSlv2	kW	effective power of external source on slave 2
#134	02	ExtVtgSlv2	V	voltage of external source on slave 2
#134	03	ExtCurSlv2	A	current of external source on slave 2
#134	04	ExtPwrRtSlv2	kVAr	reactive power of external source on slave 2
#135 External Slave3				
#135	01	ExtPwrAtSlv3	kW	effective power of external source on slave 3
#135	02	ExtVtgSlv3	V	voltage of external source on slave 3
#135	03	ExtCurSlv3	A	current of external source on slave 3
#135	04	ExtPwrRtSlv3	kVAr	reactive power of external source on slave 3

#140 Generator Meters

Menu no.	Parameter no.	Parameter name	Range/ Short descr.	Description
#140	01	GnDmdSrc	None Bat Lod Tim Run1h Start	Source for generator request: = no request = battery charge state dependent = load dependent = time-controlled = for 1 hour = manually started
#140	02	GnStt	Off Idle Warm Connect Run Retry Disconnect Cool Lock Fail FailLock	Generator state: = switched off = waiting for request (ready) = warming up = connecting = operation = restarting = disconnecting = cooling down = locked after operation = error = locked after error
#140	03	GnRmgTm	hhmmss	remaining generator run time (minimum run time)
#140	04	GnRnStt	Off, On	state of generator return signal on master (Dig-In)

#150 Grid Meters

Menu no.	Parameter no.	Name	Range/ Short descr.	Description
#150	01	GdRmgTm	hhmmss	remaining time of GdValTm parameter (valid grid time)

The "#160 Compact Meters" menu is described in detail in section 10.4 "Compact Meters" (Page 70).

18.2 Adjustable System Parameters

Parameters marked with **(Stby)** *are to be changed only when the Sunny Island 5048 is in standby mode. Once the "ENTER" key is pressed, operating data values can immediately change to their new settings. Incorrect values in these parameters can probably not be corrected quickly enough to avoid potential damage to your system.*

All menu items that can only be changed after entering the installer password are shaded in gray in the following tables.

All parameters can be set using a connected PC/laptop with the Sunny Data Control software, a Sunny WebBox or a Sunny Boy Control (see section 6.5 "Interface for External Communication" (Page 51)).

#210 Inverter Settings

Menu no.	Parameter no.	Parameter name	Range/ Short descr.	Value	Description
#210	01	InvVtgNom	V	230	nominal inverter voltage 230 = 230V_50HZ 220 = 220V_60HZ depending on the setting in QCG
#210	02	InvChrgCurMax	A	22	maximum AC charging current
#210	03	InvFrqNom	Hz	50	nominal inverter frequency 50 = 230V_50HZ 60 = 220V_60HZ depending on the setting in QCG

#220 Battery Settings

Menu no.	Parameter no.	Parameter name	Range/ Short descr.	Default value	Description
#221 Battery Property					
#221	01	BatTyp	VRLA FLA NiCd	VRLA	Battery type: = valve regulated lead acid = flooded lead acid = nickel cadmium can only be changed in QCG
#221	02	BatCpyNom	Ah	100	nominal battery capacity (C10) can only be changed in QCG
#221	03	BatVtgNom	V	48	nominal battery voltage 48 = VRLA 48 = FLA 45.6 = NiCd can only be changed in QCG
#221	04	BatTmpMax	degC	40	maximum battery temperature

Menu no.	Para-meter no.	Parameter name	Range/ Short descr.	Default value	Description
#221	05	BatTmpStr	degC	35	battery restart temperature following stop due to overtemperature
#222 Battery Charge Mode					
#222	01	BatChrgCurMax	A	1200	battery charging current limit (depends on nominal battery capacity)
#222	02	AptTmBoost	min	120	absorption time for normal charge 120 = VRLA 90 = FLA 300 = NiCd depending on the setting in QCG
#222	03	AptTmFul	h	5	absorption time for full charge 5 = VRLA 5 = FLA 7 = NiCd depending on the setting in QCG
#222	04	AptTmEqu	h	10	absorption time for equalization charge 10 = VRLA 10 = FLA 10 = NiCd depending on the setting in QCG
#222	05	CycTmFul	d	14	full charge cycle time
#222	06	CycTmEqu	d	180	equalization charge cycle time
#222	07	ChrgVtgBoost	V	2.4	cell voltage nominal value for normal charge 2.4 = VRLA 2.55 = FLA 1.65 = NiCd depending on the setting in QCG
#222	08	ChrgVtgFul	V	2.4	cell voltage nominal value for full charge 2.4 = VRLA 2.5 = FLA 1.65 = NiCd depending on the setting in QCG
#222	09	ChrgVtgEqu	V	2.4	cell voltage nominal value for equalization charge 2.4 = VRLA 2.5 = FLA 1.65 = NiCd depending on the setting in QCG
#222	10	ChrgVtgFlo	V	2.25	cell voltage nominal value for float charge 2.25 = VRLA 2.25 = FLA 1.55 = NiCd depending on the setting in QCG

Menu no.	Para-meter no.	Parameter name	Range/ Short descr.	Default value	Description
#222	11	BatTmpCps	mV/degC	4.0	battery temperature compensation absorption time for full charge 4.0 = VRLA 4.0 = FLA 0.0 = NiCd depending on the setting in QCG
#222	12	AutoEquChrgEna	Disable Enable	Enable	activates automatic equalization charge
#223 Battery Protect Mode					
#223	01	BatPro1TmStr	h	22	time for starting battery preservation mode level 1
#223	02	BatPro1TmStp	h	6	time for stopping battery preservation mode level 1
#223	03	BatPro2TmStr	h	17	time for starting battery preservation mode level 2
#223	04	BatPro2TmStp	h	9	time for stopping battery preservation mode level 2
#223	05	BatPro1Soc	%	20	SOC limit for preservation mode level 1
#223	06	BatPro2Soc	%	15	SOC limit for preservation mode level 2
#223	07	BatPro3Soc	%	10	SOC limit for preservation mode level 3
#224 Battery Silent Mode					
#224	01	SilentEna	Disable Enable	Disable	allows silent mode on the grid
#224	02	SilentTmFlo **(Stby)**	h	3	max. time for float charge until transfer into silent
#224	03	SilentTmMax **(Stby)**	h	12	max. time for silent mode until transfer into float
#225 Battery Current Sensor					
#225	01	BatCurSnsTyp **(Stby)**	None 60mV 50mV	None	current sensor type (60mV, 50mV)
#225	02	BatCurGain60 **(Stby)**	A/60mV	100	external battery current sensor 60mV type (visible, if selected with #225.01 60mV)
#225	03	BatCurGain50 **(Stby)**	A/50mV	100	external battery current sensor 50mV type (visible, if selected with #225.01 50mV)
#225	04	BatCurSnsOfs **(Stby)**	A	0	battery current sensor, offset error (adjustment)

#230 External Settings

Menu no.	Parameter no.	Parameter name	Range/ Short descr.	Default value	Description
#230	01	GnGdMod **(Stby)**	None Gen Grid GenGrid	None	generator and grid operating mode
#230	02	ExtLkTm	min	20	lock time after reverse power or relay protection
#230	03	RtCurCps	External Internal Shared	External	reactive current compensation = external (generator) = internal (Sunny Island 5048) = shared
#230	04	AcSrcFrqDel	Hz	4.8	frequency increase for disconnecting AC feed-in generators

#240 Generator Settings

Menu no.	Parameter no.	Parameter name	Range/ Short descr.	Default value	Description
#241 Start Settings					
#241	01	GnAutoEna	Off, On	On	activate generator autostart
#241	02	GnAutoStr		3	number of autostarts
#241	03	GnSocTm1Str	%	40	SOC limit for switching on generator for time 1
#241	04	GnSocTm1Stp	%	80	SOC limit for switching off generator for time 1
#241	05	GnSocTm2Str	%	40	SOC limit for switching on generator for time 2
#241	06	GnSocTm2Stp	%	80	SOC limit for switching off generator for time 2
#241	07	GnTm1Str	hhmmss	0	time 1 for generator request (begin time 1, end time 2)
#241	08	GnTm2Str	hhmmss	0	time 2 for generator request (begin time 2, end time 1)
#241	09	GnPwrEna	Off, On	Off	activate generator request as a result of power
#241	10	GnPwrStr	kW	4	activates generator as a result of power limit
#241	11	GnPwrStp	kW	2	deactivates generator as a result of power limit
#241	12	GnPwrAvgTm	sec	60	average time for power-related generator start

Menu no.	Para-meter no.	Parameter name	Range/ Short descr.	Default value	Description
#242 General Settings					
#242	01	GnVtgMin	V	172.5	minimum generator voltage 172.5 = 230V_50HZ 172.5 = 220V_60HZ depending on the setting in QCG
#242	02	GnVtgMax	V	250	maximum generator voltage 250 = 230V_50HZ 250 = 220V_60HZ depending on the setting in QCG
#242	03	GnCurNom	A	16	nominal generator current
#242	04	GnFrqNom	Hz	50	nominal generator frequency (at nominal load) 50 = 230V_50HZ 60 = 220V_60HZ depending on the setting in QCG
#242	05	GnFrqMin	Hz	44.64	minimum generator frequency 44.64 = 230V_50HZ 50 = 220V_60HZ depending on the setting in QCG
#242	06	GnFrqMax	Hz	60	maximum generator frequency 60 = 230V_50HZ 70 = 220V_60HZ depending on the setting in QCG
#242	07	GnStrMod **(Stby)**	Manual Autostart GenMan	Autostart	generator interface
#242	08	GnOpTmMin	min	15	minimum generator run time
#242	09	GnStpTmMin	min	15	minimum generator stop time
#242	10	GnCoolTm	min	5	generator cooling-off time
#242	11	GnErrStpTm	h	6	generator stop time for generator fault
#242	12	GnWarmTm	sec	60	warm up time (minimum time required for generator voltage and frequency to be within permissible range for connection)
#242	13	GnRvPwr	W	100	permissible generator reverse power (effective power)
#242	14	GnRvTm	sec	30	permissible time for reverse power/ reverse current
#242	15	GnCtlMod	Cur CurFrq	Cur	ext. (gen/grid) controller (current and frequency)

#250 Grid Settings

Menu no.	Parameter no.	Parameter name	Range/ Short descr.	Default value	Description
#250	01	GdVtgMin	V	184	minimum grid voltage 184 = 230V_50HZ 194 = 220V_60HZ depending on the setting in QCG
#250	02	GdVtgMax	V	264.5	maximum grid voltage 264.5 = 230V_50HZ 242 = 220V_60HZ depending on the setting in QCG
#250	03	GdCurNom	A	16	nominal grid current
#250	04	GdFrqNom	Hz	50	nominal grid frequency 50 = 230V_50HZ 60 = 220V_60HZ depending on the setting in QCG
#250	05	GdFrqMin	Hz	47.5	minimum grid frequency 47.5 = 230V_50HZ 59.3 = 220V_60HZ depending on the setting in QCG
#250	06	GdFrqMax	Hz	50.2	maximum grid frequency 50.2 = 230V_50HZ 60.5 = 220V_60HZ depending on the setting in QCG
#250	07	GdVldTm	sec	30	minimum time required for grid (voltage and frequency) to be within permissible range for connection 30 = 230V_50HZ 300 = 220V_60HZ depending on the setting in QCG
#250	08	GdMod	GridCharge GridFeed	GridCharge	Grid interface: = charging only (only current from the grid) = feedback also possible
#250	09	GdRvPwr	W	100	permissible grid reverse power (effective power)
#250	10	GdRvTm	sec	5	permissible time for grid reverse power

#260 Relay Settings

Menu no.	Para-meter no.	Parameter name	Range/ Short descr.	Default value	Description
#261 Relay General					
#261	01	Rly1Op	Off On AutoGn AutoLodExt AutoLodSoc Tmr1 Tmr2 AptPhs GnRn ExtVfOk GdOn Error Run Ens1 Ens2 BatFan AcdCir	AutoGn	Function of relay 1: = switched off = switched on = automatic generator connection = automatic disconnection of external loads = automatic disconnection of loads due to SOC = programmable timer 1 = programmable timer 1 = absorption phase is active = generator is running = ext. voltage and frequency in permissible range = ext. grid is connected = error = operation (= currently has no function) (= currently has no function) = battery room fan = electrolyte pump
#261	02	Rly2Op	see #261.01	AutoLodSoc	Function of relay 2: for details, see #261.01
#262 Relay Load					
#262	01	LodSocTm1Str	%	30	SOC limit for load shedding start for t1
#262	02	LodSocTm1Stp	%	50	SOC limit for load shedding stop for t1
#262	03	LodSocTm2Str	%	30	SOC limit for load shedding start for t2
#262	04	LodSocTm2Stp	%	50	SOC limit for load shedding stop for t2
#262	05	LodTm1Str	hhmmss	0	load shedding time 1 (begin time 1, end time 2)
#262	06	LodTm2Str	hhmmss	0	load shedding time 2 (begin time 2, end time 1)
#263 Relay Timer					
#263	01	RlyTmr1StrDt	yyyymmdd	20060101	start date timer 1
#263	02	RlyTmr1StrTm	hhmmss	0	start time for relay control timer 1
#263	03	RlyTmr1Dur	hhmmss	0	run time for relay control timer 1
#263	04	RlyTmr1Cyc	Single Daily Weekly	Single	repeated cycle time for timer 1

Menu no.	Parameter no.	Parameter name	Range/ Short descr.	Default value	Description
#263	05	RlyTmr2StrDt	yyyymmdd	20060101	start date timer 2
#263	06	RlyTmr2StrTm	hhmmss	0	start time for relay control timer 2
#263	07	RlyTmr2Dur	hhmmss	0	run time for relay control timer 2
#263	08	RlyTmr2Cyc	Single Daily Weekly	Single	repeated cycle time for relay 2
#264 Relay Slave1					
#264	01	Rly1OpSlv1	see #261.01	Off	Function of relay 1 on slave 1: for details, see #261.01
#264	02	Rly2OpSlv1	see #261.01	Off	Function of relay 2 on slave 1: for details, see #261.01
#265 Relay Slave2					
#265	01	Rly1OpSlv2	see #261.01	Off	Function of relay 1 on slave 2: for details, see #261.01
#265	02	Rly2OpSlv2	see #261.01	Off	Function of relay 2 on slave 2: for details, see #261.01
#266 Relay Slave3					
#266	01	Rly1OpSlv3	see #261.01	Off	Function of relay 1 on slave 3: for details, see #261.01
#266	02	Rly2OpSlv3	see #261.01	Off	Function of relay 2 on slave 3: for details, see #261.01

#270 System Settings

Menu no.	Parameter no.	Parameter name	Range/ Short descr.	Default value	Description
#270	01	AutoStr **(Stby)**		3	autostart (0 = autostart deactivated)
#270	02	Dt	yyyymmdd		date
#270	03	Tm	hhmmss		time
#270	04	BeepEna	Off On	On	activates beeper
#270	05	ClstCfg			cluster configuration from QCG, read only
#270	06	ComBaud	1200 4800 9600 19200	1200	baud rate interface
#270	07	SleepEna	Disable Enable	Enable	allows sleep mode

Menu no.	Parameter no.	Parameter name	Range/ Short descr.	Default value	Description
#270	08	TertCtlEna **(Stby)**	Disable Enable	Enable	activation of tertiary control (AFRA)

The "#280 Password Setting" menu is described in detail in section 10.5 "Entering the Installer Password" (Page 72).

18.3 Diagnostics

Information on events and error messages (#310 (event history) and #320 (failure history)) are provided as of section 19.6 "Display of Errors and Events" (Page 144).

#330 System

Menu no.	Para-meter no.	Parameter name	Range/ Short descr.	Description
#331 System Device				
#331	01	Adr	Master Slave1 Slave2 Slave3	device address (type) depending on the setting in QCG
#331	02	FwVer		BFR firmware version
#331	03	SN		serial number
#331	04	OnTmh	h	operating hours
#331	05	ClstCfgAt	1Phase1 1Phase2 1Phase3 1Phase4 3Phase	set cluster configuration depending on the setting in QCG
#331	06	OpStt	Operating Warning Failure	operating mode (device)
#331	07	CardStt	Off Operational Mount OutOfSpace BadFileSys Incomp Parameter ParamFailed	MMC/SD card status message: = no card in the Sunny Island 5048 = in operation = card initializing = insufficient memory capacity (on card or in main directory) = incorrect file system = incompatible card = parameter update is active = error during parameter update
#331	08	FwVer2		DSP firmware version
#331	09	FwVer3		BFR boot loader
#331	10	FwVer4		DSP boot loader
#332 Slave1				
#332	01	FwVerSlv1		BFR firmware version on slave 1
#332	02	SNSlv1		serial number on slave 1
#332	03	OnTmhSlv1	h	operating hours of slave 1

Menu no.	Para-meter no.	Parameter name	Range/ Short descr.	Description
#332	04	PhSlv1	L1 L2 L3	phase position on slave 1
#332	05	OpSttSlv1	Operating Warning Failure	operating mode (slave 1)
#332	06	FwVer2Slv1		DSP firmware version on slave 1
#332	07	FwVer3Slv1		BFR boot loader on slave 1
#332	08	FwVer4Slv1		DSP boot loader on slave 1
#333 Slave2				
#333	01	FwVerSlv2		BFR firmware version on slave 2
#333	02	SNSlv2		serial number on slave 2
#333	03	OnTmhSlv2	h	operating hours of slave 2
#333	04	PhSlv2	L1 L2 L3	phase position on slave 2
#333	05	OpSttSlv2	Operating Warning Failure	operating mode (slave 2)
#333	06	FwVer2Slv2		DSP firmware version
#333	07	FwVer3Slv2		BFR boot loader on slave 2
#333	08	FwVer4Slv2		DSP boot loader on slave 2
#334 Slave3				
#334	01	FwVerSlv3		BFR firmware version on slave 3
#334	02	SNSlv3		serial number on slave 3
#334	03	OnTmhSlv3	h	operating hours of slave 3
#334	04	PhSlv3	L1 L2 L3	phase position on slave 3
#334	05	OpSttSlv3	Operating Warning Failure	operating mode (slave 3)
#334	06	FwVer2Slv3		DSP firmware version on slave 3
#334	07	FwVer3Slv3		BFR boot loader on slave 3
#334	08	FwVer4Slv3		DSP boot loader on slave 3

#340 Statistic

Menu no.	Para-meter no.	Parameter name	Range/ Short descr.	Description
#341 Statistic Inverter				
#341	01	EgyCntIn	kWh	energy absorbed
#341	02	EgyCntOut	kWh	energy fed
#341	03	EgyCntTm	h	energy metering run time
#342 Statistic Battery				
#342	01	Soh	%	state of health (SOH), ratio of current capacity and nominal value
#342	02	StatTm	d	statistics metering run time
#342	03	ChrgFact		charging factor
#342	04	BatEgyCntIn	kWh	energy meter for battery charge
#342	05	BatEgyCntOut	kWh	energy meter for battery discharge
#342	06	AhCntIn	Ah	meter for battery charging ampere hours
#342	07	AhCntOut	Ah	meter for battery discharging ampere hours
#342	08	BatTmpPkMin	degC	minimum battery temperature
#342	09	BatTmpPkMax	degC	maximum battery temperature
#342	10	EquChrgCnt		equalization charge meter
#342	11	FulChrgCnt		full charge meter
#342	12	BatCurOfsErr	A	current offset error of battery current
#342	13	OcvPointCnt		meter for open-circuit voltage points
#342	14	SilentReq	Off On	silent mode request
#343 Statistic Generator				
#343	01	GnEgyCnt	kWh	generator energy meter
#343	02	GnEgyTm	h	run time of generator energy meter
#343	03	GnOpTmh	h	operating hour meter for generator
#343	04	GnStrCnt		number of generator starts
#344 Statistic Grid				
#344	01	GdEgyCntIn	kWh	energy meter for grid feed-in
#344	02	GdEgyCntOut	kWh	energy meter for power taken from the grid
#344	03	GdEgyTmh	h	run time of grid energy meter
#344	04	GdOpTmh	h	operating hour meter for grid operation
#344	05	GdCtcCnt		meter for grid connections
#344	06	TotTmh	h	feed-in hours

18.4 Functions in Operation

#410 Operation Inverter

Menu no.	Parameter no.	Parameter name	Range/ Short descr.	Default value	Description
#410	01	InvRs **(Stby)**	Restart	–	triggers inverter reset
#410	02	ParaSto	Set1 Set2	–	Saves parameter settings: = file 1 = file 2
#410	03	InvTmOpEna	Disable Enable	Disable	activates time-controlled inverter operation
#410	04	InvTmOpStrDt	yyyymmdd	20060101	start date of time-controlled inverter operation
#410	05	InvTmOpStrTm	hhmmss	0	start time of time-controlled inverter operation
#410	06	InvTmOpRnDur	hhmmss	0	run time for time-controlled inverter operation
#410	07	InvTmOpCyc	Single Daily Weekly	Single	repeated cycle time for timer 1
#410	08	ParaLod **(Stby)**	Set1 Set2 Factory	–	Loads parameter settings: = file 1 = file 2 = factory settings
#410	09	CntRs	Inv Bat Gn Gd All	–	clears selected energy meter

#420 Operation Battery

Menu no.	Parameter no.	Name	Range/ Short descr.	Default	Description
#420	01	ManChrgSel	Idle Start Stop	Idle	triggers equalization charge (manual)

#430 Operation Generator

Menu no.	Parameter no.	Parameter name	Range/ Short descr.	Default value	Description
#430	01	GnManStr	Auto Stop Start Run1h ManEquChrg	Auto	manual generator start
#430	02	GnAck	Ackn		error confirmation for generator fault

#440 Operation MMC/SD Card

Menu no.	Parameter no.	Name	Range/ Short descr.	Default	Description
#440	01	CardFunc	 Flush StoEvtHis StoFailHis		Functions for MMC/SD card: = writes all buffers to cards = writes event list = writes error list
#440	02	DatLogEna	Off On	On	activates automatic data storage

19 Troubleshooting/Problem Solving

In principle, the Sunny Island 5048 makes a distinction between events and errors.

- **Events** describe state changes or transient states (e.g. generator connection).
- **Errors** describe impermissible or only limited permissible states. This includes warnings, failures and errors. A user interaction is generally required.

19.1 Error Categories

The Sunny Island 5048 categorizes errors into five different levels. There is a different behavior depending on the level:

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

19.2 Error Confirmation

If a fault occurs, the Sunny Island 5048 goes into standby mode and the fault is shown on the display.

You must remedy the cause of the fault using <ENTER> and the Sunny Island 5048 restarts.

19.3 Autostart Handling

The Sunny Island 5048 has an autostart meter that counts down by 1 for each autostart. If the Sunny Island 5048 runs uninterrupted for over 10 minutes, the autostart meter is reset to its initial value.

If another fault occurs when the autostart meter is at 0, the Sunny Island 5048 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 "#270.01 AutoStr" parameter (in standby mode).

19.4 Master Slave Handling

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

Slave 1 has detected an overtemperature fault (F138). It enters this error in its history and reports it to the master that also enters it as a warning into its failure history ("Menu #320 Failure History").

The following message appears in the lower line on the master:

```
F138 S1 Warning↵
```

If error 138 is still active on slave 1, the Enter symbol appears at the end. After confirming the fault on the master using <ENTER>, the fault is forwarded to the corresponding slave.

Display on the master after confirmation:

```
F138 S1 Warning
```

The error and event memory are not compared between the master and slaves.

19.5 Handling Pending Errors During the Booting Procedure

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

19.6 Display of Errors and Events

Each error and each event have a unique three-digit display number that is created according to the parameter/measuring value assignment. The events and errors 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

"F" marks an error and "E" marks an event.

If the event of an error and provided it is recorded, "!" is displayed for an error that has occurred and "C" is displayed for an error that has stopped.

19.7 Events

The meaning of events displayed by the Sunny Island 5048 are explained in the following table:

Display no.	Description
Category INV	
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	feed-in grid operation (at external input)
E107	sleep mode (slave in 1-phase systems)
E108	silent mode on the grid
E110	shutting down due to fault
E115	emergency charge
E118	automatic start
E119	manual start (transfer from standby mode into operation)
E120	manual stop (transfer from operation into standby mode)
Category BAT	
E201	battery management reset due to reconfiguration
E202	(partial) reset of BMS due to new battery
E203	state change, battery charging algorithm for float (maintenance) 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
E208	switch into manual charging (manual charge voltage control)
E222	battery preservation mode level 1

Display no.	Description
E223	battery preservation mode level 2
E224	battery preservation mode level 3
Category GEN	
E401	automatic generator start due to set criteria (battery charge state, power, time, etc.)
E402	automatic generator stop due to set criteria (battery charge state, power, time, etc.)
E403	manual generator start
E404	manual generator stop
E405	manual error confirmation of generator fault
Category REL	
E601	relay 1 off
E602	relay 1 on
E603	relay 1 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)

Display no.	Description
E626	digital input ON (High)
Category SYS	
E705	device start
E706	date, time changed

19.8 Warnings and Error Messages

The meaning of warnings and error messages displayed by the Sunny Island 5048 are explained in the following table:

Displ. no.	Level	Description
Category INV		
F109	3	overtemperature on transformer
F110	3	overtemperature on transformer on slave 1
F111	3	overtemperature on transformer on slave 2
F112	3	overtemperature on transformer on slave 3
F113	3	overtemperature on heatsink
F114	3	overtemperature on heatsink on slave 1
F115	3	overtemperature on heatsink on slave 2
F116	3	overtemperature on heatsink on slave 3
F117	2	AC current limit (short-circuit control active for too long)
F118	2	AC current limit (short-circuit control active for too long) on slave 1
F119	2	AC current limit (short-circuit control active for too long) on slave 2
F120	2	AC current limit (short-circuit control active for too long) on slave 3
F121	3	inverter overvoltage
F122	3	inverter overvoltage on slave 1
F123	3	inverter overvoltage on slave 2
F124	3	inverter overvoltage on slave 3
F137	1	derating due to temperature (heatsink or transformer)
F138	1	derating due to temperature (heatsink or transformer) on slave 1
F139	1	derating due to temperature (heatsink or transformer) on slave 2
F140	1	derating due to temperature (heatsink or transformer) on slave 3
Category BAT		
F201	3	measuring range of battery voltage exceeded
F202	3	measuring range of battery voltage exceeded on slave 1

Displ. no.	Level	Description
F203	3	measuring range of battery voltage exceeded on slave 2
F204	3	measuring range of battery voltage exceeded on slave 3
F206	3	battery overtemperature
F208	3	battery overvoltage (fixed limit for cell voltage)
F210	1	battery overvoltage warning
F211	1	insufficient battery temperature warning
F212	1	high battery temperature warning
Category EXT		
F309	1	relay protection
F310	1	relay protection on slave 1
F311	1	relay protection on slave 2
F312	1	relay protection on slave 3
F314	1	external voltage failure, only operated with regulated voltage
F315	1	grid/generator disconnection due to insufficient external voltage
F316	1	grid/generator disconnection due to insufficient external voltage on slave 1
F317	1	grid/generator disconnection due to insufficient external voltage on slave 2
F318	1	grid/generator disconnection due to insufficient external voltage on slave 3
F319	1	grid/generator disconnection due to excessive external voltage
F320	1	grid/generator disconnection due to excessive external voltage on slave 1
F321	1	grid/generator disconnection due to excessive external voltage on slave 2
F322	1	grid/generator disconnection due to excessive external voltage on slave 3
F323	1	grid/generator disconnection due to insufficient external frequency
F324	1	grid/generator disconnection due to insufficient external frequency on slave 1
F325	1	grid/generator disconnection due to insufficient external frequency on slave 2
F326	1	grid/generator disconnection due to insufficient external frequency on slave 3
F327	1	grid/generator disconnection due to excessive external frequency
F328	1	grid/generator disconnection due to excessive external frequency on slave 1
F329	1	grid/generator disconnection due to excessive external frequency on slave 2
F330	1	grid/generator disconnection due to excessive external frequency on slave 3
F331	1	grid/generator disconnection due to anti-islanding
F332	1	grid/generator disconnection due to anti-islanding on slave 1
F333	1	grid/generator disconnection due to anti-islanding on slave 2
F334	1	grid/generator disconnection due to anti-islanding on slave 3

Displ. no.	Level	Description
Category GEN		
F401	1	reverse power protection (generator)
Category GRD		
F501	1	grid reverse current prohibited (quick grid disconnection)
F502	1	grid reverse current prohibited (quick grid disconnection) on slave 1
F503	1	grid reverse current prohibited (quick grid disconnection) on slave 2
F504	1	grid reverse current prohibited (quick grid disconnection) on slave 3
Category RLY		
F605	4	transfer relay does not open
F606	4	transfer relay does not open on slave 1
F607	4	transfer relay does not open on slave 2
F608	4	transfer relay does not open on slave 3
Category SYS		
F705	4	DSP watchdog has been triggered
F706	4	watchdog meter has expired (watchdog triggered several times in succession)
F707	4	watchdog meter on slave 1 has expired (watchdog triggered several times in succession)
F708	4	watchdog meter on slave 2 has expired (watchdog triggered several times in succession)
F709	4	watchdog meter on slave 3 has expired (watchdog triggered several times in succession)
F710	4	autostart meter has expired (several autostarts in succession)
F713	1	watchdog has been triggered
F716	3	measuring range of battery voltage exceeded
F717	3	measuring range of battery voltage exceeded on slave 1
F718	3	measuring range of battery voltage exceeded on slave 2
F719	3	measuring range of battery voltage exceeded on slave 3
F720	4	short circuit or cable break on transformer temperature sensor
F721	4	short circuit or cable break on heatsink temperature sensor
F722	3	short circuit in battery temperature sensor
F723	3	cable break on battery temperature sensor
F731	3	error in the cluster configuration
F732	3	error in address assignment of cluster device
F733	3	no message from cluster master (only slave)
F734	3	no message from cluster on slave 1
F735	3	no message from cluster on slave 2

Displ. no.	Level	Description
F736	3	no message from cluster on slave 3
F738	1	synchronization not successful
F739	3	internal device communication BFR-DSP missing
F740	3	internal device communication BFR-DSP on slave 1 missing
F741	3	internal device communication BFR-DSP on slave 2 missing
F742	3	internal device communication BFR-DSP on slave 3 missing
F743	3	internal device communication BFR-DSP missing
F744	3	internal device communication BFR-DSP on slave 1 missing
F745	3	internal device communication BFR-DSP on slave 2 missing
F746	3	internal device communication BFR-DSP on slave 3 missing
F747	4	short circuit or cable break on transformer temperature sensor on slave 1
F748	4	short circuit or cable break on transformer temperature sensor on slave 1
F749	4	short circuit or cable break on transformer temperature sensor on slave 2
F750	4	short circuit or cable break on heatsink temperature sensor on slave 2
F751	4	short circuit or cable break on heatsink temperature sensor on slave 3
F752	4	short circuit or cable break on heatsink temperature sensor on slave 3

19.9 Troubleshooting

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

Why is the Sunny Island 5048 not connecting to the running generator?

- Is the fuse on the generator ok?
- Has the power allowed to be fed back into the generator during the permissible time been exceeded ("#242.14 GnRvTm" parameter)?
  If yes, "!" appears on the display. Generator connection is blocked for the set time. Set the "#430.02 GnAck" parameter to Ackn.
- If the generator control relay (GnReq) is open:
  Was the generator started manually ("242.07 GnStrMod" parameter)? Change the setting here to autostart, if required.

Why is the display of the Sunny Island 5048 dark and why is nothing shown on the display?

- Is the DC circuit breaker on the Sunny Island 5048 set to "On"?
  In this case, the device has switched off to protect the battery against deep discharge (see also section 13.3 "State of Charge/SOC and SOH" (Page 86)). For information on restarting the Sunny Island 5048, see section 9.5 "Reactivating the Device Following Automatic Shutdown" (Page 63).

- The battery fuse (NH fuse (DC)) has been triggered.

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 72)). If necessary, repeat the calculation and entry of the password.
- You are in the "100-Meters" (measuring data) menu or the "300-Diagnose" (Diagnosis) menu. You can only read the data values shown here.
- Some parameters can only be changed in standby mode or in the QCG (see e.g. the "242.07 GnStrMod" parameter in section 18.2 "Adjustable System Parameters" (Page 129)). Stop the Sunny Island 5048 as described in section 9.2 "Stopping" (Page 62). Note that this causes a dropout in the stand-alone grid and the loads are no longer supplied.

Why does the Sunny Island 5048 always connect to the running generator for a brief time only?

- The limits for the maximum permissible AC voltage or the minimum permissible frequency of the generator are too strict (parameter in menu "#242 General Settings"). Change voltage and/or frequency limits according to the technical data of your generator.

Why is the stand-alone grid frequency not at 50 Hz?

- The Sunny Boy inverter is controlled via the frequency (see section 16.3 "Frequency Shift Power Control (FSPC)" (Page 119)).
- The "AFRA" function of the Sunny Island 5048 is activated (see section 12.5 "Automatic Frequency Adjustment" (Page 84)).
- Power fluctuations cause frequency deviations.
- Although the generator runs in droop mode at an average of 50 Hz, the Sunny Boys can be shut down by the frequency.

Why does the "VAC-Low" error (output voltage too low) also occur when the Sunny Island 5048 is started?

- A permanent short circuit exists in the stand-alone grid. Check the AC output connections of the stand-alone grid (see section 6.3 "AC Connection" (Page 38)).
- The loads connected to the stand-alone grid are too heavy. The power/electrical energy of the Sunny Island 5048 is not sufficient to supply the loads. Switch off some of the loads and restart the Sunny Island 5048.

What happens when a battery cell can no longer be used?

- Remove the unusable cell from your battery bank. Then start the Sunny Island 5048 and change the battery voltage in the QCG under "New Battery".

What can I do when the QCG does not run once?

- Switch off the Sunny Island 5048 (section **9.3 "Deactivation" (Page 63)**) and switch it back on (section 9.1 "Activation / Startup" (Page 61)).

What happens when "MMC operation failed" appears on the display?

- You wanted to perform an action using the MMC/SD card, but it failed (see section 10.9 "Display of Warnings and Errors" (Page 76)). Check the card (on your PC/laptop) and use a new MMC/SD card, if necessary.

Why does my Sunny Island 5048 stay on even though I switched the DC circuit breaker to Off?

- Your Sunny Island 5048 may be powered by the AC side. Switch off all AC loads and disconnect them from the Sunny Island 5048 (see section 9.4 "Disconnecting the Device from Voltage Sources" (Page 63)).

Why is my battery discharging even though the generator is running?

- The power produced by the generator is not reaching the Sunny Island 5048. Check the voltage and frequency values. The fuses on the generator may have been triggered.

What do I have to do if the Sunny Island 5048 continuously goes out after Low Battery Mode (LBM) when restarting the device?

- Start the generator manually, if required (e.g.: Run1h). Note the warm up times: 5 minutes without charging current in BatProtMode may cause the device to go into standby mode.

19.10 Procedure During Emergency Charge Mode

The Sunny Island 5048 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), you can charge the batteries in the regulated voltage 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.

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

In emergency charge mode, the generator management and grid management are not active. The reverse power protection and relay protection function are not active.

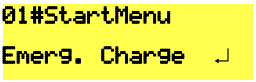
In emergency charge mode, you must disconnect all loads, since a bridge between AC1 and AC2 is not detected and therefore the generator current cannot be limited. When using a bridge, the battery current sensor is not effective.

You must manually start and stop the energy source (diesel/generator), since no generator management device is active.

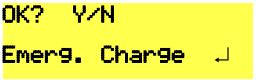
If AC1 and AC2 have been bridged, the generator should first be connected and then started (manually). Otherwise, the magnetizing current could throw the generator fuse. (This can also happen when switching on the relay without using a bridge).

The emergency charge mode is activated in the QCG. See section 8.2 "Starting the Quick Configuration Guide (QCG)" (Page 57) for a detailed description on how to access the QCG. Follow the instructions there up to point 5. The emergency charge mode is described below.

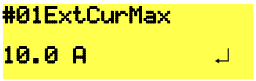
1. You are now in the Quick Configuration Guide (QCG). Here you can select the following:
   - **"Start System"**
   - **"New System"**
   - **"New Battery"**
   - **"Emerg Charge"** (if you would like to charge a deeply discharged battery using an external source, see section 19.9 "Troubleshooting" (Page 150))

2. Select "Emerg. Start" and press <ENTER>. In the following view, confirm using <ENTER>.

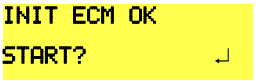
3. Now set the maximum external current, e.g. the generator current.

4. Confirm the value using <ENTER>.

5. If you press the down arrow key, the following message appears:

6. Confirm using <ENTER>.

7. Press <ENTER> again and start the emergency charge mode (ECM).

You can interrupt the emergency charge mode, for example, to refill diesel.

8. Press <ENTER> to stop the Sunny Island 5048. The following message appears.

9. Hold <ENTER> pressed down and the remaining time is shown using bars on the display.

10. The emergency charge mode was interrupted and the display shows the following message:

To prematurely end the emergency charge mode, you must restart the Sunny Island 5048 using the "#410.01 InvRs" parameter.

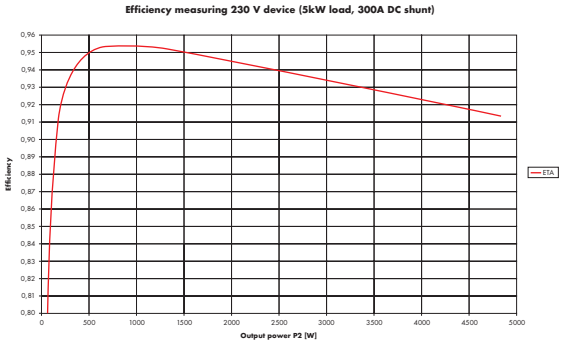
In the emergency charge mode, the process values are shown on the display. Parameters cannot be changed during the charging process.

If the device is restarted, the settings that were saved before the ECM are loaded.

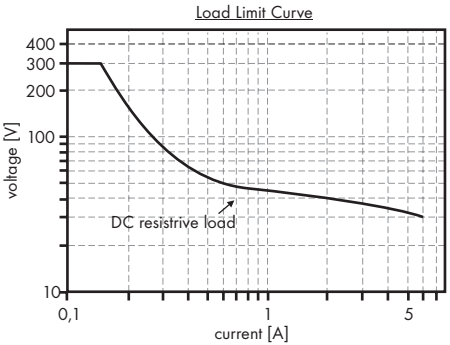
See the instructions for restarting the device and wait five minutes (see also section 9.5 "Reactivating the Device Following Automatic Shutdown" (Page 63).)

20 Technical Data

Output data:	
Nominal AC voltage ($V_{AC, nom}$) (adjustable)	230 V (202 to 253 V)
Nominal frequency (f_{nom})	45 to 65 Hz
Continuous AC output (P_{nom}) at 25 °C	5000 W
Continuous AC output (P_{nom}) at 45°C	4000 W
AC output for 30 min at 25 °C	6500 W
AC output for 5 min at 25 °C	7200 W
AC output for 1 min at 25 °C	8400 W
Nominal AC current ($I_{AC, nom}$)	21 A
Max. current (peak value) for 100 ms	100 A (100 ms)
Harmonic distortion of output voltage (K_{VAC})	< 3 %
Power factor cosφ	–1 to +1
Input data	
Input voltage ($V_{AC, ext}$) (adjustable)	230 V (172.5 to 250 V)
Input frequency (f_{ext}) (adjustable)	50 Hz (40 to 60 Hz)
Max. AC input current ($I_{AC, ext}$) (adjustable)	56 A (2 to 56 A)
Max. input power ($P_{AC, ext}$)	12.8 kW
Battery data	
Battery voltage ($V_{Bat, nom}$) (adjustable)	48 V (41 to 63 V)
Max. battery charging current ($I_{Bat, max}$)	120 A
Continuous charging current ($I_{Bat, nom}$)	100 A
Battery capacity	100 to 10000 Ah
Charge control	IV0V process with automatic full and equalization charge
Battery type	VRLA/FLA/NiCd

Efficiency/power consumption	
Max. efficiency	95 % (at 1000 W)
Efficiency >90 %	5–120 % P_{nom}
	
Operating consumption with no load (in standby mode)	25 W (< 4 W)
German standards	
	DIN EN 50178, DIN EN 61000-3-2 (in charge mode), DIN EN 61000-6-1, DIN EN 61000-6-2, DIN EN 61000-6-3, DIN EN 61000-6-4
Certification	
	CE
Protection degree	
According to DIN EN 60529	IP 40 (with MMC/SD card plugs), otherwise IP 30
Device protection	
	short circuit, overload, overtemperature

Interfaces	
	2 LEDs, 4 keys, two-line display, 2 multi-function relays, RS485/RS232 galvanically isolated (opt.), MMC/SD card
Digital input level (Dig-In)	high level as of 9 V (up to 63 V), low level 0–3 V
Load limits for multi-function relays 1 and 2	AC: 1 A at 250 V~ DC: see graphic



Mechanical data	
Width x height x depth	(467 x 612 x 235) mm
Weight	approx. 63 kg
Ambient conditions	
Ambient temperature	–25 °C to +50 °C
Miscellaneous	
Guaranty (EU)	2 years
Accessories	
Ext. battery temperature sensor	included
Generator manager (GenMan)	optional

21 CE Declaration of Conformity

CE Declaration of Conformity

for off-grid inverters

Product: **Sunny Island**
Type: **SI 5048**

We declare that the above specified device is compliant with the regulations of the European Community, in terms of the design and the version fabricated by SMA. This especially applies for the EMC Regulation defined in 89/336/EWG and the low voltage regulation defined in 73/23/EWG.

The device is compliant with the following standards:

DIN EN 50178 (04.98) (VDE 0160)
DIN EN 61000-3-2: 2001-12
DIN EN 61000-6-1: 2002-08
DIN EN 61000-6-2: 2002-08
DIN EN 61000-6-3: 2002-08
DIN EN 61000-6-4: 2002-08

The above mentioned device is therefore marked with a CE sign.

Note:
This declaration of conformity becomes invalid in case
- the product is modified, complemented or changed,
- and/or components, other than those belonging to the SMA accessories, are installed in the product,
- as well as in case of incorrect connection or inproper usage

without explicit written confirmation by SMA.

Niestetal, 16.10.2006
SMA Technologie AG

i.V. Andreas Berger
(Head of Development)

SI5048-CE-11:BE4006

SMA Technologie AG
Hannoversche Straße 1-5
34266 Niestetal
Tel. +49 561 9522 - 0
Fax +49 561 9522 - 100
www.SMA.de
info@SMA.de

22 Contact

If you have any questions or queries, please contact us. A team of qualified engineers and technicians is at your disposal.

Help us to help you by having the following information ready when you call us:

- Inverter type (Sunny Island 5048, see type plate)
- Voltage/frequency type
- Serial number (see type plate or parameter "331.03 SN")
- Firmware version (see parameter "331.02 FwVer")
- Error message shown on the display
- Battery type
- Nominal battery capacity
- Nominal battery voltage
- Communication products used
- Type and size of the additional energy sources (generators, PV systems, PV inverters)
- If a generator exists:
  - Generator type
  - Generator capacity
  - Maximum generator current
  - Generator interface

Address:
SMA Technologie AG
Hannoversche Strasse 1 - 5
34266 Niestetal
Germany
Tel. (+49) 561 95 22 - 399
Fax (+49) 561 95 22 - 4697
SunnyIsland.hotline@SMA.de
www.SMA.de

23 Glossary

Absorption phase

Constant Voltage phase: A charging phase using constant charging voltage. The charging current constantly decreases in this phase.

AC

Abbreviation for "Alternating Current"

AC coupling

The AC side connection between loads, generators and storage devices.

AGM battery

Absorbent Glass Mat separator battery. This is a battery where the electrolyte (a mixture of water and sulfuric acid) is bound to a glass fiber mat. This is a type of a sealed lead acid battery. A gas mixture (hydrogen and oxygen) is always generated when lead-acid batteries are charged and in normal operation this internally recombines to form water. This removes the need for regularly refilling the battery cells with water, which is why these batteries are often described as "low maintenance" or even "maintenance free". AGM batteries are available from many different manufacturers for a wide range of applications. They usually have very good high current properties but are not very charge-cycle resistant.

Ah

Abbreviation for "Ampere hours". Unit of electrical charge, one ampere hour is the charge provided by a constant current of 1 A over a period of one hour.

Backup system

Backup systems are power supply systems that provide an extra level of security for standard power supply systems. The public grid is usually the standard power supply system and the backup system is provided by an additional stand-alone grid in the case of a power outage. In addition to the backup systems, diesel generators in PV battery systems are also described as backup generators. Here they perform the same task as a backup system for the public grid.

Battery

A battery is an electrochemical storage device that can release previously stored chemical energy as electrical energy. A distinction is made between non-rechargeable primary elements (often used in consumer markets) and rechargeable secondary elements (accumulators). In stand-alone grid systems, lead acid batteries are almost always used and, very rarely, Nickel/Cadmium batteries are used as secondary rechargeable elements.

Battery bank

See Battery system

Battery charge mode

An operating mode of a battery inverter in which the inverter takes energy from the AC grid to charge the batteries in a controlled fashion. In this mode of operation, the battery inverter is responsible for correctly charging the batteries and acts like an independent battery charger.

Battery inverter

See Battery power converter

Battery management

The battery management is responsible for the optimum charging of the battery bank and for protection against deep discharge. This is the only way of ensuring that the battery service life reflects the manufacturer's specifications.

Battery power converter

A bidirectional power converter that can regulate voltage and frequency in a stand-alone grid as well as correctly charging the batteries.

Battery system

Serial and possibly also parallel connection of several identical batteries. Battery banks of 12 V, 24 V, 48 V and 60 V are typical.

Boost charge

Rapid charging: Allows the batteries to be charged to a level of approx. 85 – 90 % in the shortest time and the most efficient manner.

Bulk phase

I-Phase: The charging phase in which charging can be done using the maximum allowable charging current.

Capacity

Describes the storage capability of a cell or battery, specified in Ah (ampere hours). The capacity of a battery is heavily dependent on the charging cycle, the amount of current drawn and the temperature.

Central inverter

An inverter concept, in which all PV modules are connected to each other (in series and/or parallel) and which uses a single inverter for feeding energy into the mains supply grid. The low cost of the inverter is usually offset by the much higher installation efforts required and possible yield losses due to variations in shadowing of different solar modules.

Charge level

Describes the current amount of charge that can be drawn from the battery, in percent of the nominal capacity (100 % = battery full, 0 % = battery empty).

Charge mode

See Battery charging mode

C-rate

The nominal capacity specification is always provided with the discharge time on which the capacity is based. The nominal capacity is the product of the constant charging current IN and the discharge time tN, that passes between commencement of discharging the fully charged battery until the final discharge voltage VS is reached. In permanently on-site batteries, the C_{10} capacity is usually specified. i.e. a battery with C_{10} = 200 Ah can be discharged for 10 hours at a nominal current of 0.1 × C_{10} = I_{10} = 20 A.

DC

Abbreviation for "Direct Current"

Derating

A controlled reduction in performance, usually dependent on component temperatures. Derating is used instead of performing a complete shutdown of the system.

DSP

Abbreviation for Digital Signal Processor. A DSP is a microprocessor chip especially developed for digital signal processing and control.

Electrolyte

Allows the conduction of ions within a battery. In lead acid batteries, the electrolyte is diluted sulfuric acid and is also a reactant in the electrochemical reaction. Nickel/Cadmium batteries use an alkaline electrolyte (potassium hydroxide).

EPROM

See Flash EEPROM

Equalize charge

Equalize charge: Allows multiple series-connected battery cells to be charged to a unified charge level of 95 – 100 %. Without regular equalization charging, the charge states of the various cells slowly drift apart, which can lead to premature battery bank failure.

Firmware

Firmware is software that is stored in a chip in various electronic devices, such as Sunny Island, hard disk recorders, DVD burners and players, newer television sets, household appliances and computers - in contrast to software that is stored on a hard drive, CD-ROM or other media. These days, firmware is usually stored in Flash memory or an EEPROM.

FLA

Flooded Lead Acid battery: A lead acid battery with liquid electrolyte, also often described as a sealed lead acid battery.

Flash EEPROM

The abbreviation EEPROM stands for Electrically Erasable Programmable Read-Only Memory. Flash memory is a digital storage chip, the exact designation is Flash EEPROM. In contrast to "normal" EEPROM storage, individual bytes (the smallest addressable storage units) cannot be deleted.

EEPROM is a non-volatile, electronic storage component that is used in the Sunny Island, the computer industry (among others) and usually in Embedded Systems.

Flash EEPROMs are used where information must be permanently stored in the smallest amount of space, e.g. for storing the firmware.

Float charge

Maintenance charge: Allows the batteries to be slowly charged to a charge level of 100 % without the negative effects of overcharging. Complete charging to 100 % using float charge takes several days. For this reason, float charging is more important for grid backup systems and less important for stand-alone grids.

Full charge

Recharging of the batteries to a level of approx. 95 % on a regular basis (at least once a month). This efficiently avoids premature aging of the batteries caused by inadequate charging.

Gel battery

A type of battery in which the electrolyte (a mixture of water and sulfuric acid) is bound into a gel. This is a type of sealed lead acid battery. A gas mixture (hydrogen and oxygen) is always generated when lead acid batteries are charged, and in normal operation this internally recombines to form water. This removes the need for regularly refilling the battery cells with water, which is why these batteries are often described as "low maintenance" or even "maintenance free" (see also AGM batteries). Gel batteries are available from many different manufacturers for a wide range of applications. There are Gel batteries for high-current applications but also for cycle operation with very high cycle resistance.

Grid-coupled system

PV system that is connected to the power supply grid of an external energy supplier.

Independent disconnection device

The "Independent disconnection device between a grid parallel power generating system and the public low voltage grid" (DIN VDE 0126-1-1) is an equivalent replacement for a normal public disconnection device with isolation function that is accessible to the distribution grid operator at any time. This is a mandatory safety device that prevents

power from a solar power system being fed into an external power grid when the external power generator is not functioning. In the Sunny Boy/Sunny Mini Central, this function is assumed by the "SMA grid guard Version 2".

Inverters

A device for converting the direct current (DC) from the PV generator into alternating current (AC), which is used by most normal household devices and especially for feeding energy into an existing supply grid. Inverters for PV systems usually include one or more MPP trackers, store operating data and monitor the grid connections of the PV system (see also MSD).

Inverter mode

See Inverter operation

Inverter operation

Operating mode of a battery inverter where it supplies the stand-alone grid from the battery energy. In this operating mode, the battery inverter is especially responsible for the control of frequency and voltage in the stand-alone grid.

Maximum Power Point "MPP"

The working point (current/voltage characteristic curve) of a PV generator where the maximum power can be drawn. The actual MMP changes constantly depending (e.g.) on the level of solar irradiation and the ambient temperature.

MPP tracker

Regulation of the power drawn so that a PV generator remains as close as possible to the MPP. This working point varies with the solar irradiation and the temperature conditions of the modules. MPP tracking optimizes the extraction of electrical power and is a feature of inverters and charge controllers.

MSD

See Independent disconnection device

Multi-string inverter

An inverter that combines the advantages of several string inverters (separate MPP tracking of individual strings) and a central inverter (lower performance specific costs).

NiCd

Nickel/Cadmium battery, contains Nickel, Cadmium, and potassium hydroxide as the electrolyte. They require a significantly higher charging voltage, have a lower level of efficiency and are significantly more expensive than lead acid batteries. Their robustness, cycle resistance and low-temperature capabilities allow them to be used in certain special applications.

Overload capability

The overload capability of an inverter describes the ability of the inverter to supply short-term (seconds or minutes) excessive loads, that can be significantly higher than the nominal capacity in battery inverters. The overload capability is important to allow electrical machines with a nominal power output close to the nominal power output of the stand-alone grid inverter to be started, since these machines typically require six times the nominal current when starting.

Parallel connection

Parallel connection of the batteries (all positive poles together and all negative poles together) increases the capacity of the battery bank while keeping the voltage constant. Example: Two 24 V/100 Ah batteries connected in parallel still have a voltage of 24 V, but have a capacity of 100 Ah + 100 Ah = 200 Ah.

Piggy-Back (Board)

A printed circuit board that is plugged into another board to increase performance or expand capabilities. A piggy-back board can also replace a single chip. In this case, the chip is removed and the board is plugged into the empty socket.

PLC

Abbreviation for Power Line Communication: Describes the process of data transfer over the grid supply cables. The PLC power module is used to amplify the signal and is connected in Multi-String and Sunny Mini Central inverters. Powerline communication is not suitable for Sunny Island inverters.

PV

Photovoltaics (PV) is the conversion of solar irradiation into electrical energy using special semiconductors called solar cells.

PV array

See PV generator.

PV generator

Technical device for the conversion of light energy into electrical energy. All the series and parallel mounted and electrically connected solar modules in a PV system are known as the PV generator.

PV module

See Solar module.

PV system

Describes a solar power system for generating electrical power. Describes the complete collection of components needed for the acquisition and utilization of solar energy. As well as the PV generator, this includes the Sunny Boy or Sunny Mini Central, for example, in the case of grid-coupled systems.

Self discharge

Loss of battery charge while it is stored or not used. A higher ambient temperature has a strong influence on self discharge.

Series connection

In this case the positive pole of each battery is connected to the negative pole of the next battery. There is only one circuit where current can flow. Series connection increases the voltage of the entire battery bank. If four 12 V batteries with a capacity of 100 Ah each are connected in series, the total voltage is 4 × 12 V = 48 V, while the total capacity remains at 100 Ah.

SOC

State of Charge: The charge level of the batteries, see Charge level. If (e.g) 25 Ah is taken from a 100-Ah battery, the charge level (SOC) is then 75 %.

Solar energy

"Sun energy", this means energy from sunlight or other solar irradiation (heat and/or UV radiation).

Solar module

Electrical connection of several solar cells encapsulated in a housing to protect the sensitive cells from mechanical stress and environmental effects.

Solar cell

An electronic component that generates electrical energy when irradiated with sunlight. Since the voltage produced by a solar cell is very small (approx. 0.5 V), several solar cells are combined to form a solar module. The most common semiconductor material presently used for solar cells is silicon, which is manufactured in different forms (monocrystalline, polycrystalline, amorphous). In addition to different mechanical variations, that are usually designed to increase the level of efficiency, completely new materials are currently being tested (Cadmium Telluride, Cadmium Indium Sulphide, Titanium Dioxide and many others.)

Stand-alone grid system

An energy generation system that is completely independent of any external power sources.

String

Describes a group of solar modules connected in series. A PV system usually consists of a number of strings, which avoids yield losses due to variations in shading over different modules.

String inverter

An inverter concept that avoids the disadvantages of the central inverter concept. The PV is split into individual strings, each of which is connected to the external mains supply with its own string inverter. This greatly simplifies installation and greatly reduces the yield losses caused by manufacturing deviations or variations in shadowing of the solar modules.

VRLA

Valve Regulated Lead Acid battery: Lead-acid battery with semi-solid electrolyte or sealed lead acid battery. Examples of this type of battery are Gel batteries and AGM batteries (Absorbent Glass Mat).

The information contained in this document is the property of SMA Technologie AG. Publishing its content, either partially or in full, requires the written permision of SMA Technologie AG. Any internal company copying of the document for the purposes of evaluating the product or its correct implementation is allowed and does not require permission.

Exclusion of liability

The general terms and conditions of delivery of SMA Technologie AG shall apply.

The content of these documents is continually checked and amended, where necessary. However, discrepancies cannot be excluded. No guarantee is made for the completeness of these documents. The latest version is available on the Internet at www.SMA.de or from the usual sales channels.

Guarantee or liability claims for damages of any kind are exlcuded if they are caused by one or more of the following:

- 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

Software licensing

The use of supplied software produced by SMA Technologie AG is subject to the following conditions:

This software may be copied for internal company purposes and may be installed on any number of computers. Supplied source codes may be changed or adapted for internal company purposes on your own responsibility. Drivers may also be transferred to other operating systems. Source codes may only be published with the written permission of SMA Technologie AG. Sub-licensing of software is not permissible.

Limitation of liability: SMA Technologie AG rejects any liability for direct or indirect damages arising from the use of software developed by SMA Technologie AG. This also applies to the provision or non-provision of support activities.

Supplied software not developed by SMA Technologie AG is subject to the respective licensing and liability agreements of the manufacturer.

Trademarks

All trademarks are recognized even if these are not marked separately. Missing designations do not mean that a product or brand is not a registered trademark.

SMA Technologie AG

Hannoversche Straße 1-5

34266 Niestetal

Germany

Tel. +49 561 9522-0

Fax +49 561 9522-100

www.SMA.de

E-mail: info@SMA.de

Sales
Solar Technology

www.SMA.de

SMA Technologie AG
Hannoversche Strasse 1–5
34266 Niestetal, Germany
Tel.: +49 561 9522 4000
Fax: +49 561 9522 4040
E-mail: info@SMA.de
Freecall: +800 SUNNYBOY
Freecall: +800 78669269



SMA America, Inc.
Grass Valley, California, USA
E-mail: info@SMA-America.com

SMA Solar Technology China
Beijing, P.R. China
E-mail: info@SMA-China.com

SMA Technology Korea Co., Ltd.
Seoul, Korea
E-mail: info@SMA-Korea.com

SMA Ibérica Tecnología Solar, S.L.
Barcelona, Spain
E-mail: info@SMA-Iberica.com

SMA Italia S.r.l.
Milan, Italy
E-mail: info@SMA-Italia.com

Innovation in Systems Technology
for the Success of Photovoltaics