

# Sunny Island 3324/4248 Installation Guide





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# 1 Notes on this Manual

This installation manual is intended solely for qualified electricians. Its aim is to help install and set up a Sunny Island 3324/4248 quickly and correctly.

For further operating information, please consult the Sunny Island 3324/4248 user manual.

## 1.1 Validity

This installation manual for the Sunny Island 3324/4248 is valid for all firmware versions up to and including 1.84/1.94.

You can call up the firmware version of your inverter

- by entering the "31-2 FWVers" parameter in the Sunny Island 3324/4248 display (see section 17.2.3 "System and Fault Messages" (Page 140)).
- and also on the EPROM label (see section 16 "Updating Firmware" (Page 127)) in the Sunny Island 3324/4248.

This product may only be used in the intended area of application, i.e. it is only approved for use in 50 Hz grids.

Do not use the Sunny Island 3324/4248 for purposes other than those indicated in this installation manual. Use of the inverter for inappropriate purposes voids the warranty.

For further questions, you can call the Sunny Island hotline at +49 561 95 22 399.

## 1.2 Symbols Used

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

**The symbol "Warning" indicates a danger that, if ignored, can lead to serious injury or death and can also damage the inverter.**



*This symbol indicates a notice.*

*Failure to observe the advice can cause difficulties in the current working step and can possibly also hinder optimum operation of the inverter.*





This symbol identifies an example.

Here you will find further details on the operation and behavior of the inverter.

## 2 The Sunny Island 3324/4248

### 2.1 General Description

The Sunny Island 3324/4248 is a bidirectional battery power converter (battery inverter and charger), ideally suited for use in stand-alone grid operation. This inverter allows you to charge lead acid batteries, using power sources provided on the AC side (e.g. generator, public grid, Sunny Boy). The Sunny Island 3324/4248 creates a 230 V AC stand-alone grid using the energy stored in the batteries, allowing stable operation of connected loads and power generation devices (e.g. PV inverters).

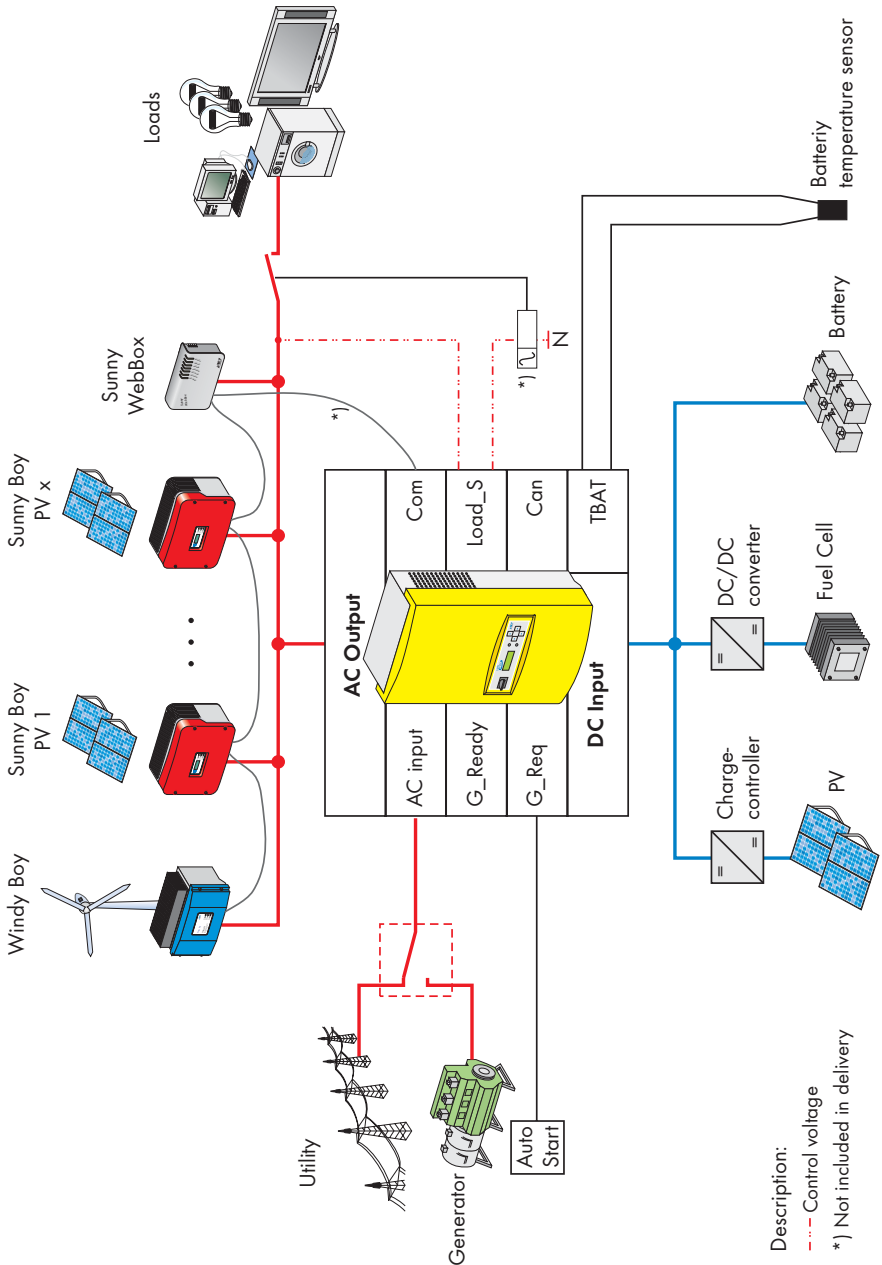
Energy sources can also be connected on the DC side, as long as the specified limits are not exceeded (see section 19 "Technical Data" (Page 149)).

The Sunny Island 3324/4248 is able to control a starter contact for a generator and automatically connect or disconnect it to an AC-grid (see section 12 "Generator" (Page 111)).

The Sunny Island 3324/4248 can also switch off particular loads if the batteries do not have sufficient electrical energy available (see section 5.4.3 "Load shedding" (Page 48)).

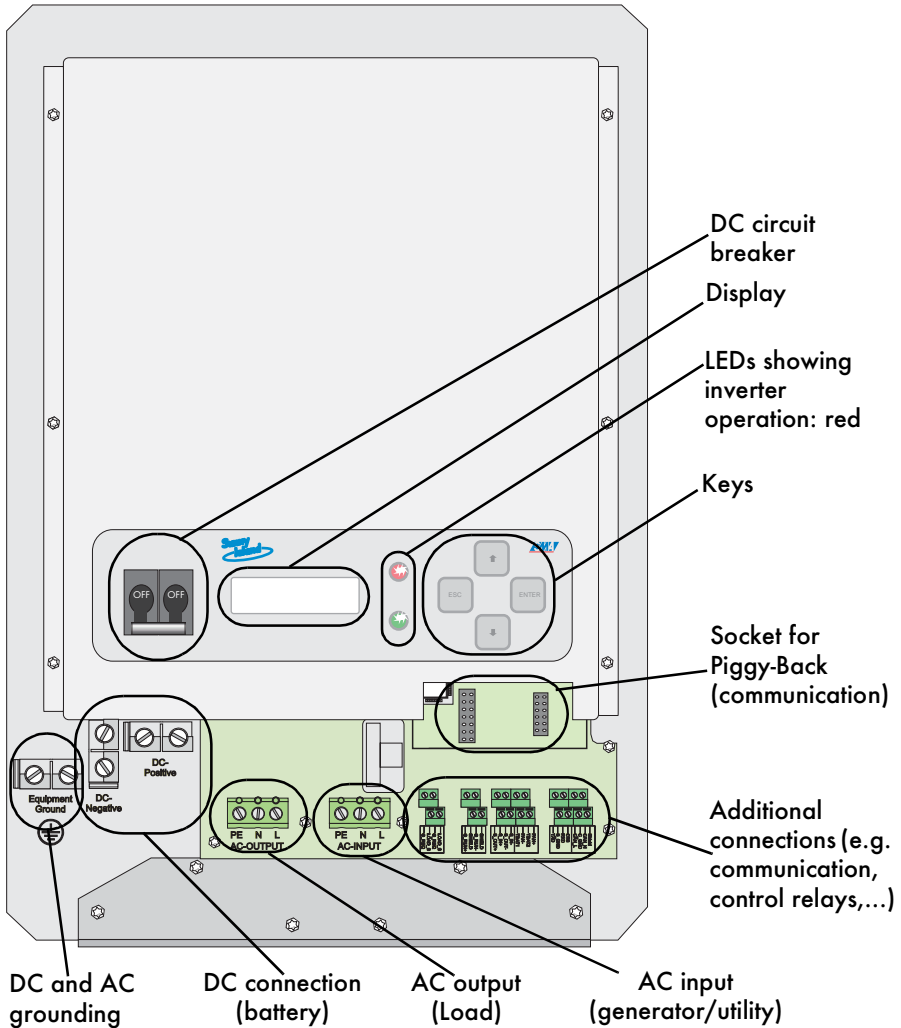
The Sunny Island 3324/4248 can be used in different system configurations. Detailed information on the different stand-alone systems can be found in section 10 "System Examples" (Page 87).

The following figure provides an overview of possible system configurations:



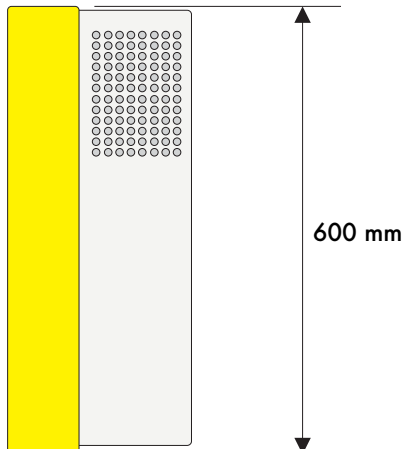
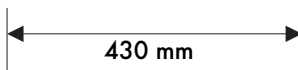
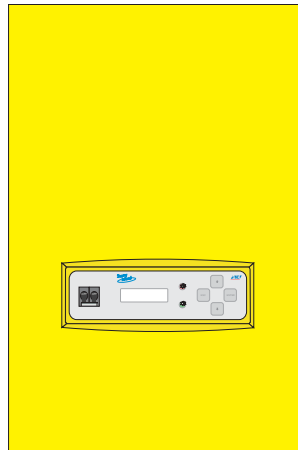
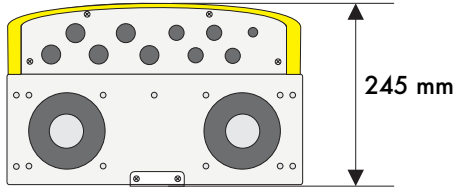
## 2.2 At a Glance

The following figure provides an overview of all control elements and connections of the Sunny Island 3324/4248 (shown with cover removed).



### 2.3 Dimensions

The Sunny Island 3324/4248 housing has the following dimensions:



## 2.4 Scope of Delivery

The following elements are included:

- 1 Sunny Island 3324/4248 with housing cover (not fastened)
- 1 wall bracket
- 1 battery temperature sensor
- 5 cable feed-throughs M25
- 5 nuts M25
- 1 double-hole insert for cable feed-throughs M25
- 4 cable feed-throughs M20
- 4 nuts M20
- 4 double-hole inserts for cable feed-throughs M20 (2 x 6 mm)
- 1 cable feed-through M12
- 1 nut M12
- 4 housing cover screws
- 1 screw for joining the angle bracket to the wall bracket
- 1 installation manual and 1 user manual
- 1 safety instructions (multilingual)
- 1 "Guarantee and Warranty Conditions" form

## 2.5 Required tools and resources

The following tools are recommended for mounting and installing the Sunny Island 3324/4248:

<b>Installation of the Sunny Island 3324/4248 wall bracket:</b>	
1	drill
1	suitable drill (e.g. stone drill), Ø 8 mm
3	wall anchors for the wall bracket (e.g. SX 8)
3	hexagon bolts, 6x50 mm, washers
1	spirit level
	refer to the "Installation" section for any further tools required
<b>Installation of the Sunny Island 3324/4248:</b>	
1	stripping pliers
	cable end sleeves
1	digital multimeter

1	torque wrench with flathead screwdriver adapters: size 10 mm size 5.5 mm size 2.5 mm
1 set	hexagon/Allen keys, 3 mm to 8 mm
	cable ties
1	cable knife
	cable lugs
1	combination pliers
1	Phillips screwdriver, PH1
1	Phillips screwdriver, PH2
	cables (see sections 5.1 "Grounding" (S. 33); 5.2 "DC Connection" (S. 36), 5.3 "AC Connection" (S. 40))
1	10 mm open-end/ring wrenches or socket wrench
1	19 mm open-end/ring wrenches
1	24 mm open-end/ring wrenches
1	30 mm open-end/ring wrenches
1	crimping tool for the cable end sleeves (suitable for cable cross-sections of 2.5 mm <sup>2</sup> , 4 mm <sup>2</sup> , 10 mm <sup>2</sup> to 50 mm <sup>2</sup> )
1	flathead screwdriver, 0.4 x 2.5 mm
1	flathead screwdriver, 1.0 x 10 mm
1	flathead screwdriver, 1.0 x 5.5 mm
	heat shrink tubing
1	diagonal cutting pliers
<b>Installation of the Sunny Boy or Windy Boy:</b>	
1	service cable, to allow settings to be made (see section 2.7 "SMA Products (Optional)" (S. 17))
1	PC/laptop with the Sunny Data software (available as a free download from <a href="http://www.SMA.de">www.SMA.de</a> )
1	access permission: In order to set grid relevant parameters in the Sunny Boy (see section 13.2 "Setting Sunny Boy Parameters" (S. 118)), you need a special access code, the installer code. You can obtain this personal code from the Sunny Boy hotline (telephone: +49 561 9522 499).



## 2.6 Accessories (optional)

The following accessories are not essential for operating a Sunny Island 3324/4248, however they extend the range of possible applications in a stand-alone grid:

- 1 GenMan (generator manager) (SMA order number: "SI-GenMan-TFH-230")  
Allows the Sunny Island 3324/4248 to control generators requiring more than a simple start/stop (2-wire) signal for remote control (see section 12.3 "GenMan" (Page 113)).
- 1 separate load disconnecting switch for the batteries (SMA order number: "SI-BattCase.01-200" for SI4248; "SI-BattCase.01-250" for SI3324)  
Allows rapid, safe isolation of the Sunny Island 3324/4248 from the connected batteries and also provides cable protection (see section 5.2 "DC Connection" (Page 36)).
- 1 service cable for data transfer (SMA order number: "USBPBS-11"-USB-Service-Interface). You also require the free "Sunny Data" software (see below).  
Allows connection of a PC/laptop for communicating with the Sunny Island 3324/4248 in order to set parameters and for data read-outs (see section 15 "Communication Interface" (Page 123)).

**SMA** Technologie AG also offers an extensive range of products allowing you to communicate with the Sunny Island 3324/4248, for data read-outs and much more. Among these devices are:

- Sunny Boy Control
- Sunny Boy Control Plus
- WebBox

The "Sunny Data" and "Sunny Data Control" software, which you can use to make settings in and read/analyze data from your inverter, can be downloaded for free from the **SMA** Technologie AG website at [www.SMA.de](http://www.SMA.de) (see section 20 "Contact" (Page 151)).

## 2.7 SMA Products (Optional)

A stand-alone system using the Sunny Island 3324/4248 as the grid controller can also be fed with other alternative energy sources. **SMA** Technologie AG offers the following inverter products (see figure Page 12):

- 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 6000/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
- Hydro-Boy inverters (for feeding in from fuel cell systems)

## 2.8 Type Plate/Firmware Version

You can identify the Sunny Island 3324/4248 from the type plate and the firmware version.

The type plate is located on the left side of the housing (when the Sunny Island 3324/4248 hangs vertically on the wall bracket).

You can call up the firmware version of your Sunny Island 3324/4248 under the "31-2 FWVers" parameter (see section 17.2.3 "System and Fault Messages" (Page 140)). Information on firmware updates is provided in section 16 "Updating Firmware" (Page 127).

## 3 Safety Instructions

### 3.1 Important Operational Notes

Please follow all operating and safety instructions in this manual. Failure to follow these instructions could result in damage to the inverter and cause personal injury. Carefully read the safety instructions **before** installing and commissioning the inverter.

Ensure that the handbook are stored in an easily accessible location.

**The Sunny Island 3324/4248 may only be installed or opened by qualified personnel (electricians).**



**Never attempt to repair the inverter yourself. Unprofessional repair work can be dangerous. Please consult your dealer or the manufacturer if a fault occurs.**



**Be sure to observe all applicable regional standards and guidelines.**



**The own consumption of the Sunny Island 3324/4248 discharges the batteries, in standby mode (inverter DC disconnect is on, inverter is in STOP mode and must be started manually) this load is about 4 W and in idle mode (inverter is on, in invert mode, no AC loads are present) it is about 22 W. You should take note of this when you**



- **wish to install the Sunny Island 3324/4248 but do not wish to immediately use it,**
- **or when operating the Sunny Island 3324/4248 for longer times without recharge possibilities (e.g. in winter with snow on your modules).**

**In these cases, you should set the Sunny Island 3324/4248 to Stop mode (see section 9.3 "Switching Off" (S. 85)) and disconnect it from the batteries via the DC circuit breaker.**

## 3.2 Potential Hazards

Like any other power converter, the Sunny Island 3324/4248 is an electrical device that presents certain hazards when operated.



**Life-threatening voltages and currents exist within the Sunny Island 3324/4248. Complete protection against accidental contact is only provided when the following points are followed according to the handbook:**

- **the inverter has been mounted correctly**
- **the inverter has been properly grounded**
- **all connections to the inverter are made correctly**
- **the cover of the housing is securely closed**

**Failure to observance of these regulations may result in persons suffering life-threatening injuries due to electric shock or parts of the system being damaged.**

**Before performing any maintenance work, installation work or an EPROM change on the Sunny Island 3324/4248, you must make absolutely sure that all inverters built in or connected to the system are completely isolated from all voltage sources (batteries, (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 the "ESC" key until the "To STOP press ENTER" message appears.**
- **Press "ENTER".**
- **Switch off the Sunny Island 3324/4248 using the DC circuit breaker and also disconnect the inverter from the batteries (e.g. using the optional SI-BattCase load break switch).**
- **Then disconnect the Sunny Island 3324/4248 from the grid/generator.**
- **Make sure that the Sunny Island 3324/4248 has been disconnected from all voltage sources.**
- **Wait at least three minutes to let the capacitors discharge and allow the voltage inside the inverter to drop to a safe level.**
- **Open the housing cover and ensure the inverter is not under voltage.**

**Use only rechargeable lead acid batteries. The use of other types of battery can lead to personal injury and material damage.**



**The Sunny Island 3324/4248 can start up automatically. 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 inverter, please note that some housing components of the Sunny Island 3324/4248 heat up during operation. Temperatures may exceed 60 °C. This represents a risk of burns.**





**This inverter has NOT been designed to supply life-sustaining medical devices. The Sunny Island 3324/4248 may not be used in installations where a power outage could result in personal injury.**



**This inverter is suitable only for installation in enclosed spaces. Therefore, do not expose it to moisture, rain or direct sunshine (IP category 30).**



**The Sunny Island 3324/4248 has been designed for use at elevations up to 2000 m above sea level. Please contact SMA Technologie AG before using the inverter at elevations above 2000 m.**

## 4 Installation

Please take note of the required installation conditions specified in section 4.1 "Preparation" (Page 23) before mounting, installing and commissioning the Sunny Island 3324/4248.

### 4.1 Preparation

#### 4.1.1 Lifting/Moving

**The Sunny Island 3324/4248 weighs 39 kg. Ensure that at least two people are available for installing the inverter. Always wear personal protective equipment (protective clothing, gloves, safety boots) to avoid the danger of injuries.**



#### 4.1.2 Unpacking

Before installing the Sunny Island 3324/4248 make sure that all parts are included in the delivery.

- Carefully check the packaging and the Sunny Island 3324/4248 for any signs of damage. Please note that the housing cover is delivered unmounted. Carefully separately remove the cover and the inverter from the packaging and do not install the cover until the inverter is properly mounted and installed, as described in section 6 "Removing the Cover" (Page 55).
- Ensure that all parts are included in the delivery (see section 2.4 "Scope of Delivery" (Page 15)).
- Enter the type and serial number of the inverter into the "Guarantee and Warranty Conditions" form.
- Keep the documents in a location where they will be easy to find later.

If something is missing or the Sunny Island 3324/4248 has been damaged during shipment, contact **SMA** Technologie AG immediately. Information is provided in section 20 "Contact" (Page 151) of this installation manual.

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



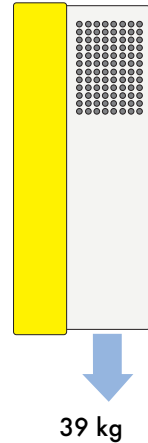
### 4.1.3 Installation Site

The Sunny Island 3324/4248 weighs 39 kg. Please take this weight into account when choosing the installation site and method of installation of the Sunny Island 3324/4248.

Protect the Sunny Island 3324/4248 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.*



**Do not install the Sunny Island 3324/4248**

- **on flammable materials,**
- **in areas where there are easily flammable substances,**
- **in potentially explosive areas!**



**Never install the Sunny Island 3324/4248 in rooms where a danger of explosion exists!**



#### 4.1.4 Minimum Clearance

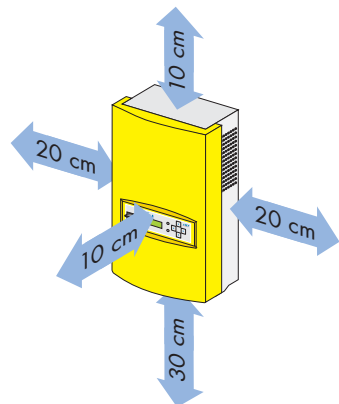
Air enters the Sunny Island 3324/4248 through the underside of the housing and then flows through the inverter before exiting through the air grills on top of the housing.

When installing the inverter, 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 3324/4248.

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

Operation of the inverter and reading the display is much easier when the Sunny Island 3324/4248 is installed with the display at eye-level with at least 50 cm clearance in front. A minimum clearance of at least 10 cm is essential in order to install the housing cover.

	Minimum Clearance
Sides	20 cm
Top	10 cm
Underneath	30 cm
Front	10 cm

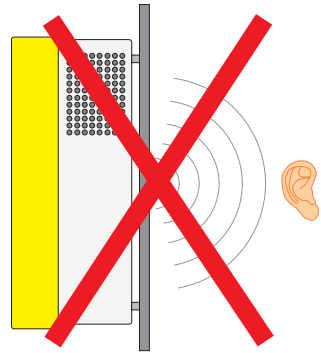


When installing the Sunny Island 3324/4248 in smaller rooms, make sure that adequate ventilation is available. The inverter produces heat when operating that must be removed.



In domestic installations, the inverter should not be mounted on plasterboard walls, wooden boarding or similar as otherwise audible vibrations are likely to result.

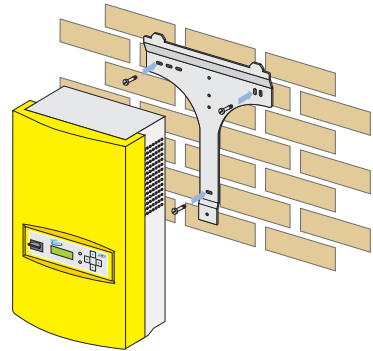
**SMA Technologie AG** recommends securing the Sunny Island 3324/4248 to a solid surface.



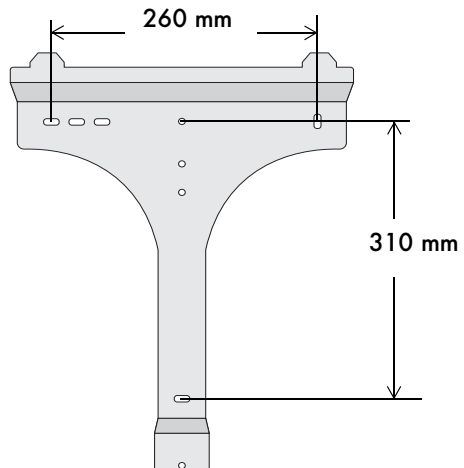
## 4.1.5 Wall Mounting

The Sunny Island 3324/4248 should be operated hanging vertically. To make the job easier, we recommend you use the supplied wall bracket to mount the Sunny Island 3324/4248 and use a spirit level to ensure correct alignment. The condition and type of material used in the mounting surface determines the manner in which the wall mounting is fastened.

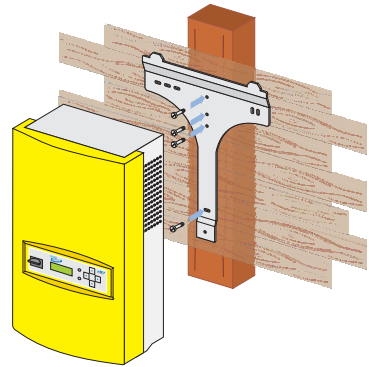
In solid concrete or block walls the wall bracket is fastened using the three outer holes. Use type SX 8 wall anchors and (e. g.) stainless steel hexagon bolts (6 mm x 50 mm) with suitable washers, according to the DIN 571 standard.



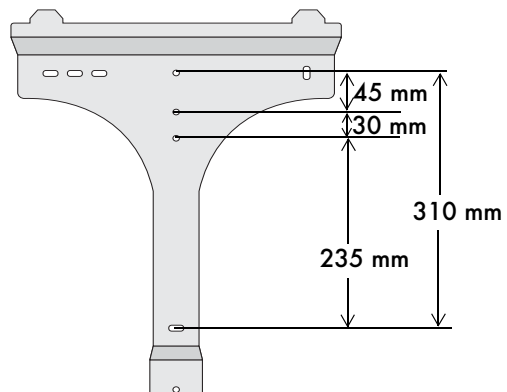
This figure shows a detailed view of the center distances of the holes for the wall bracket or block wall.



If the Sunny Island 3324/4248 is to be installed on laths, then use the four middle holes in the wall bracket. Ensure that the wall bracket is positioned over a wall stud. Make sure that the wall where you intend to install the Sunny Island 3324/4248 is vertical and can carry the weight of the Sunny Island 3324/4248 (39 kg) on a long-term basis. Use (e.g.) stainless steel Phillips screws (6 mm x 50 mm) with suitable washers, according to the DIN 571 standard.



This figure shows a detailed view of the center distances of the holes for the wall bracket when installing on a single wall stud.



## 4.2 Mounting the Sunny Island 3324/4248

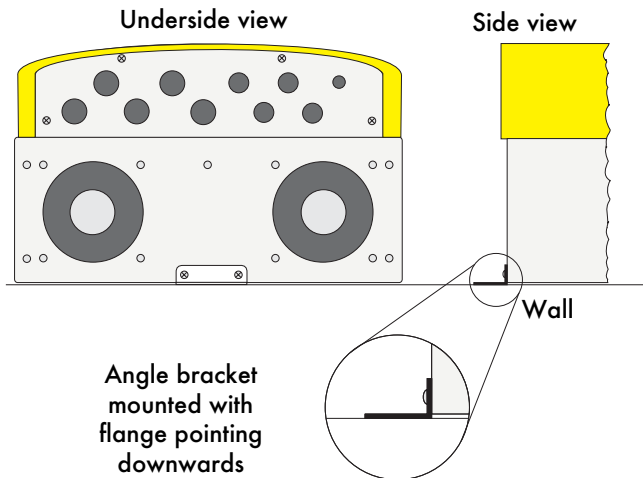
The following section describes the installation of the Sunny Island 3324/4248 in detail. Keep to the order of operations suggested here:

1. Angle bracket on the bottom of the housing
2. Wall bracket

### 4.2.1 Angle bracket on the underside

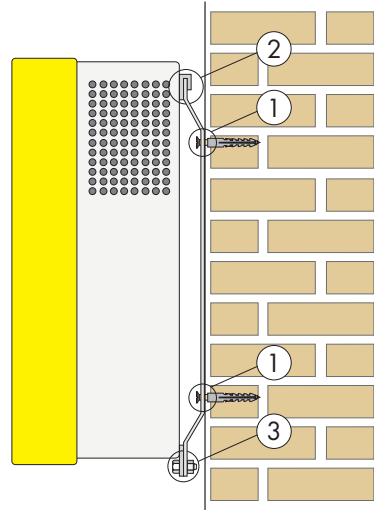
The angle bracket on the underside of the Sunny Island 3324/4248 is mounted backwards on delivery to avoid damage during transport. The angle bracket is used to fasten the inverter to the wall bracket (see section 4.2.2 "Wall Bracket" (Page 30)).

Before installing the inverter, you must first unscrew this angle bracket and then rotate it so that the flange points downwards when the Sunny Island 3324/4248 hangs vertically on the wall. The angle bracket can now be again screwed to the underside of the Sunny Island 3324/4248, at the side of the the inverter that lies against the wall (see figure below).



## 4.2.2 Wall Bracket

1. Mount the wall bracket (1). You can use the wall bracket as a drilling template to mark the positions for drilling the holes.
2. Then hook the Sunny Island 3324/4248 onto the wall bracket (2) at its upper mounting plate so that it cannot be moved sideways.
3. Secure the Sunny Island 3324/4248 against being raised by screwing the angle bracket (see section 4.2.1 "Angle bracket on the underside" (Page 29)) to the lower threaded holes of the wall bracket using the supplied M6 x 10 mm bolt.
4. Make sure the Sunny Island 3324/4248 is positioned securely on the bracket.



## 5 Electrical Connection

This section describes the electrical connection of the Sunny Island 3324/4248 to the existing components of your stand-alone grid.

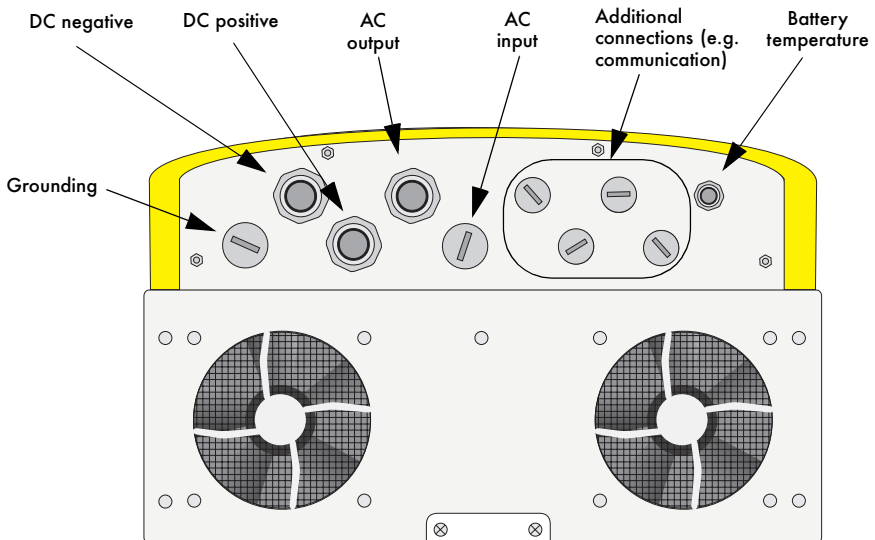
*The electrical installation of the Sunny Island 3324/4248 must be made by trained specialists only. Before beginning to install your Sunny Island 3324/4248, identify any potential hazards and take any necessary precautions (see section 3 "Safety Instructions" (Page 19)).*



**Incorrect connection may result in operational disturbances or cause damage to the inverter or system.**



All connection cables are fed through the feed-throughs on the underside of the inverter (see following figure) and connected to the appropriate connection terminals inside the Sunny Island 3324/4248.



Use the metric-thread cable screw connections provided to fasten the cables inside the Sunny Island 3324/4248 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 terminals. Close all unused openings in the housing using the appropriate dummy plugs (included in delivery) to properly protect the Sunny Island 3324/4248 from dust and water.

You can obtain an overview of the different components and connection areas of the Sunny Island 3324/4248 by referring to the figure on Page 13.

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

- Grounding (section 5.1 "Grounding" (Page 33))
- DC connection (section 5.2 "DC Connection" (Page 36))
- AC connection (section 5.3 "AC Connection" (Page 40))
- inverter fan (section 5.4.1 "Cooling Fans" (Page 45))
- Battery temperature sensor (section 5.4.2 "Battery Temperature Sensor" (Page 46))
- Load shedding (section 5.4.3 "Load shedding" (Page 48))
- Generator start (section 5.4.4 "Generator Start with a Single Contact" (Page 50))
- Generator start return signal (section 5.4.5 "Generator Start Using GenMan" (Page 52))
- Communication (section 5.5 "Connection of the Communication Interface" (Page 54))



## 5.1 Grounding

*In stand-alone configurations, the (protective) ground of the Sunny Island 3324/4248 and its individual components must be wired differently depending on the design of the grid structure. All valid standards and guidelines must be taken into account!*



**Only put the Sunny Island 3324/4248 into operation when it has been properly externally grounded according to the relevant regulations.**



**To allow different types of grounding, the N connection of the Sunny Island 3324/4248 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 inverter.**

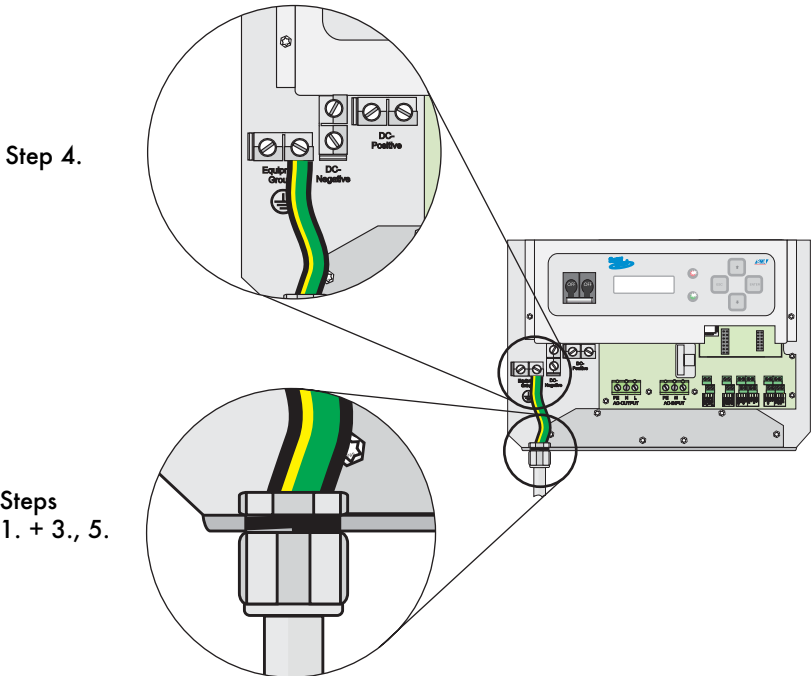
**Due to filter measures in the inverter, increased leakage currents against PE can occur during operation. For this reason, a "fixed connection" of ground must be implemented according to EN 50178. Ground the inverter with a copper conductor (at least 10 mm<sup>2</sup> cross-section), or with two separate copper conductors with a cross-section of at least 4 mm<sup>2</sup> each.**

*External grounding of the negative pole of the batteries is possible, because the batteries and the grid side are galvanically isolated within the Sunny Island 3324/4248. In this case, make sure that the high currents that may occur under fault conditions can be adequately diverted.*



The grounding conductors (DC and AC) must be connected to the connection terminals labeled as "Grounding" (see figure in section 2.2 "At a Glance" (Page 13)).

Installation of the grounding conductors occurs in five steps:



1. Install an M25 metric-thread cable screw connection (included in delivery) in the "Grounding" cable feed-through (see figure Page 31).
  - Remove the dummy plug covering the cable feed-through.
  - Insert the metric-thread cable screw connection into the opening in the housing.
  - Screw the counter-nut onto the cable screw connection thread inside the housing.
2. Remove the protective insulation from the conductor and fit a suitable cable end sleeve to the exposed end of the conductor.
3. Feed the grounding conductor through the metric-thread cable screw connection into the housing of the Sunny Island 3324/4248.
4. Insert the conductor with the cable end sleeve into the ground connection terminal and tighten the screw firmly (torque 4.0 Nm to 5.7 Nm).
5. Then tighten the metric-thread cable screw connection.

## 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 external grounding of the negative pole of the batteries. The conductor dimensions depend on the type of batteries connected, the external fuse (DC side) and the material used in the the grounding conductor.

However, the cross-section can be easily calculated using a formula.

*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 10,000 A.

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

$t$  = Trigger time in seconds (s)  
 $I_{SC}$  = Maximum battery current (short circuit current) in amperes (A)  
 $S$  = Conductor cross-section in square millimeters (mm<sup>2</sup>)

A grounding conductor of 16 mm<sup>2</sup> cross-section is thus adequate for short circuit currents up to 10,000 A.

## 5.2 DC Connection

### 5.2.1 Safety Precautions/Conditions

Connect a suitable battery to the DC side. 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.**



**Working in the vicinity of lead acid batteries is dangerous! Batteries produce explosive gases in normal operation. Ensure that the battery compartment is sufficiently ventilated. If battery boxes are used, the accumulation and concentration of hydrogen gas in "bubbles" in the upper portion of the housing must be prevented. Aerate the battery compartment from the highest point. Open flames or smoking in the vicinity of the battery are NOT permitted under ANY CIRCUMSTANCES!**



**Danger of acid injury:**  
**Battery acid is extremely corrosive. Always wear protective gloves and eye protection. Batteries must not be tilted, since acid may leak out of the ventilation holes.**



**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 an insufficient cable diameter reduce system efficiency and overload capability, thus negatively affecting the battery management function.*

*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.*

*If you do not wish to use the system for an extended period of time, then always disconnect the battery cables from the inverter.*



*The Sunny Island 3324/4248 does not connect either the positive or the negative DC pole to ground. If a connection is required, then this must be made by an installer.*



## 5.2.2 Cable Protection

In addition to the DC circuit breakers within the Sunny Island 3324/4248, install a separate load disconnecting switch as close as possible to your batteries. Install a suitable fuse plug for the load disconnecting switch according to the maximum specified DC current (e.g. NH1 at 200 A for the SI4248 and NH1 at 250 A for the SI3324).

**If no cable protection (load disconnecting switch) exists, then the DC cables must be protected against ground faults and short circuits. The internal DC fuse of the Sunny Island 3324/4248 is designed such that it can interrupt currents of up to 10 kA.**



**For short circuit currents greater than 10,000 A an additional thermal fuse is absolutely essential ("SI-BattCase.01-200" for the SI4248 or "SI-BattCase.01-250" for the SI3324).**

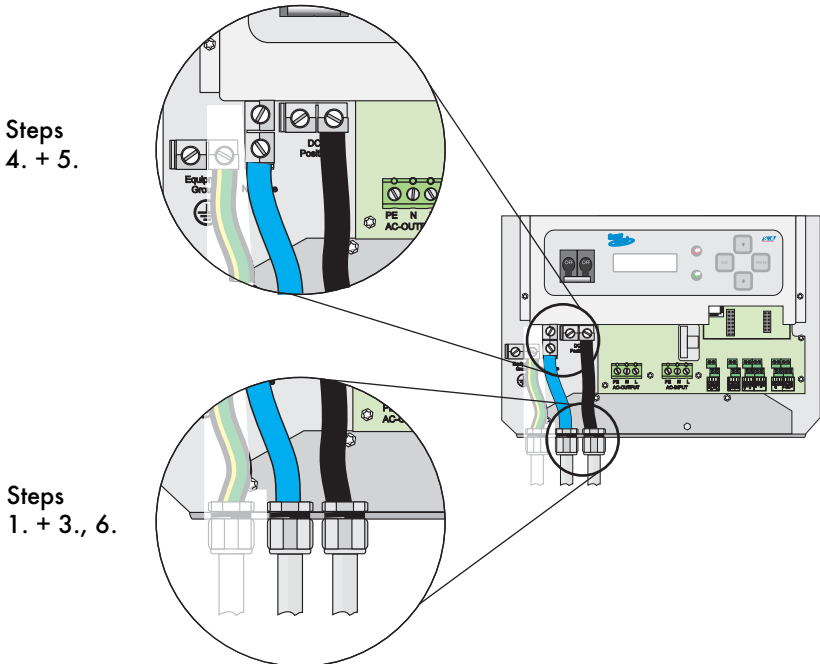
## 5.2.3 Connection



**Only connect the external load disconnecting switch/battery cables to the battery when all other installation work is finished.**

The Sunny Island 3324/4248 has two "DC negative" and two "DC positive" connection terminals (max. 35 mm<sup>2</sup>) for the battery cables.

Install the DC connections in the following sequence:



1. Install an M25 metric-thread cable screw connection (included in delivery) in each of the the "DC negative" and "DC positive" cable feed-throughs (see figure Page 31).
  - Remove the dummy plugs covering the cable feed-throughs.
  - Insert the cable screw connection thread into the opening in the housing.
  - Screw the counter-nut onto the cable screw connection thread inside the housing.

2. Remove the protective insulation from each of the conductors and fit a suitable cable end sleeve to the exposed ends of each conductor.
3. Install the "DC negative" and "DC positive" cables, one after the other. First feed the negative conductor through the metric-thread cable screw connection into the housing of the Sunny Island 3324/4248.
4. Insert the conductor with the cable end sleeve into one of the "DC negative" connection terminals and tighten the retaining screw firmly (torque 4.0 Nm to 5.7 Nm).
5. Then insert the positive conductor through the metric-thread cable screw connection into the "DC positive" terminal of the Sunny Island 3324/4248 and tighten the retaining screw firmly (torque 4.0 Nm to 5.7 Nm).
6. Then tighten both of the metric-thread cable screw connections firmly.

*No other devices should be connected to the cables connecting the batteries with the Sunny Island 3324/4248 DC connection. Connection of other DC devices to the batteries should be done using separate cables leading directly to the batteries.*



## 5.3 AC Connection

### 5.3.1 Cable Protection

A sub-distribution panel must be used to connect the Sunny Island 3324/4248 to the AC loads, a generator or the existing public grid. The sub-distribution panel 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 the Sunny Island 3324/4248 is 56 A.*

Typical color codings for the AC installation are:

- Phase conductor (L conductor): brown
- Neutral conductor (N): blue
- Protective ground conductor (PE): green/yellow stripes

The Sunny Island 3324/4248 may only be used in grids where the N conductor is grounded.

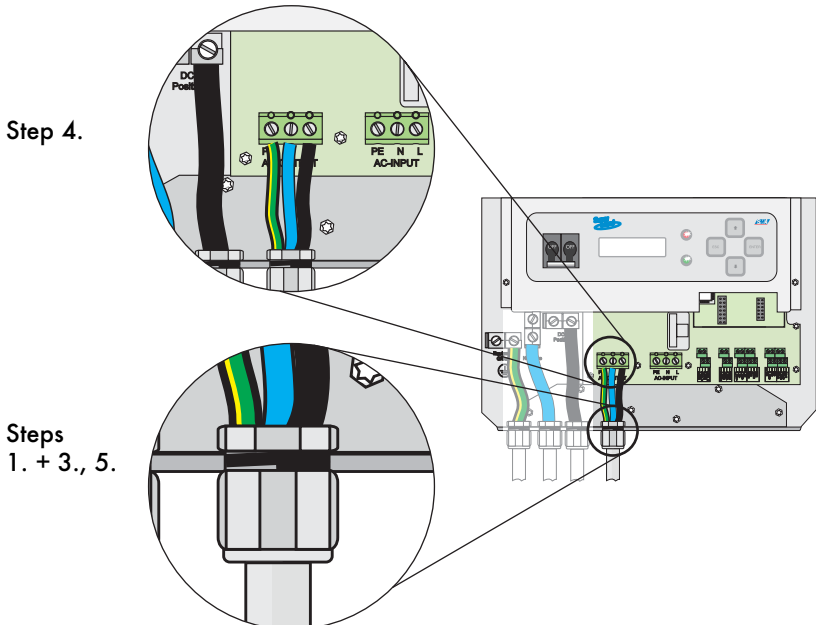


*The neutral conductor (N conductor) is looped through the Sunny Island 3324/4248, i.e. the N connection terminals of AC output and AC input are connected inside the inverter.*



## 5.3.2 AC Output

The stand-alone grid sub-distribution (e.g. loads, PV generator (Sunny Boy), wind turbine (Windy-Boy)) is connected to the AC output of the Sunny Island 3324/4248. If you wish to provide separate protection for an individual load circuit, then use a maximum 16 A, B-type circuit breaker. In the case of a short circuit, the Sunny Island 3324/4248 can still trigger these types of automatic breakers:

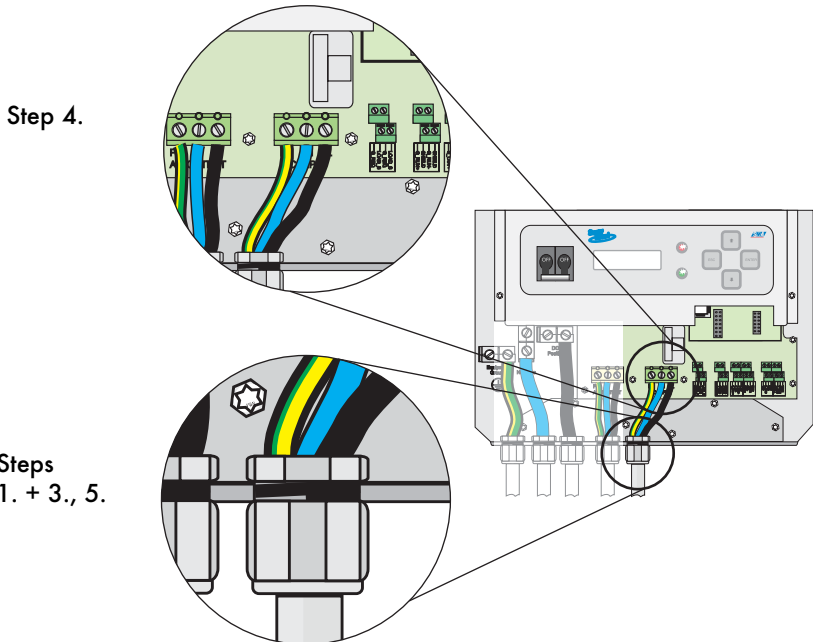


1. Install an M25 metric-thread cable screw connection (included in delivery) in the "AC output" cable feed-through (see figure Page 31).
  - Remove the dummy plug covering the cable feed-through.
  - Insert the metric-thread cable screw connection into the opening in the housing.
  - Screw the counter-nut onto the cable screw connection thread inside the housing.
2. Remove the protective insulation from each of the three conductors and fit a suitable cable end sleeve to the exposed ends of each conductor.
3. Feed the three-conductor cable through the metric-thread cable screw connection into the housing of the Sunny Island 3324/4248.

4. Install the three PE, N and L AC output conductors, one after the other. Insert the appropriate conductor into the appropriate PE, N or L "AC output" connection terminal and tighten the terminal screw firmly (torque 2.0 Nm to 4.0 Nm).
5. Once all three connections have been made, tighten the metric-thread cable screw connections firmly.

### 5.3.3 AC Input

The output of the generator/public grid is connected to the AC input of the Sunny Island 3324/4248. Wire the AC input in the following sequence:



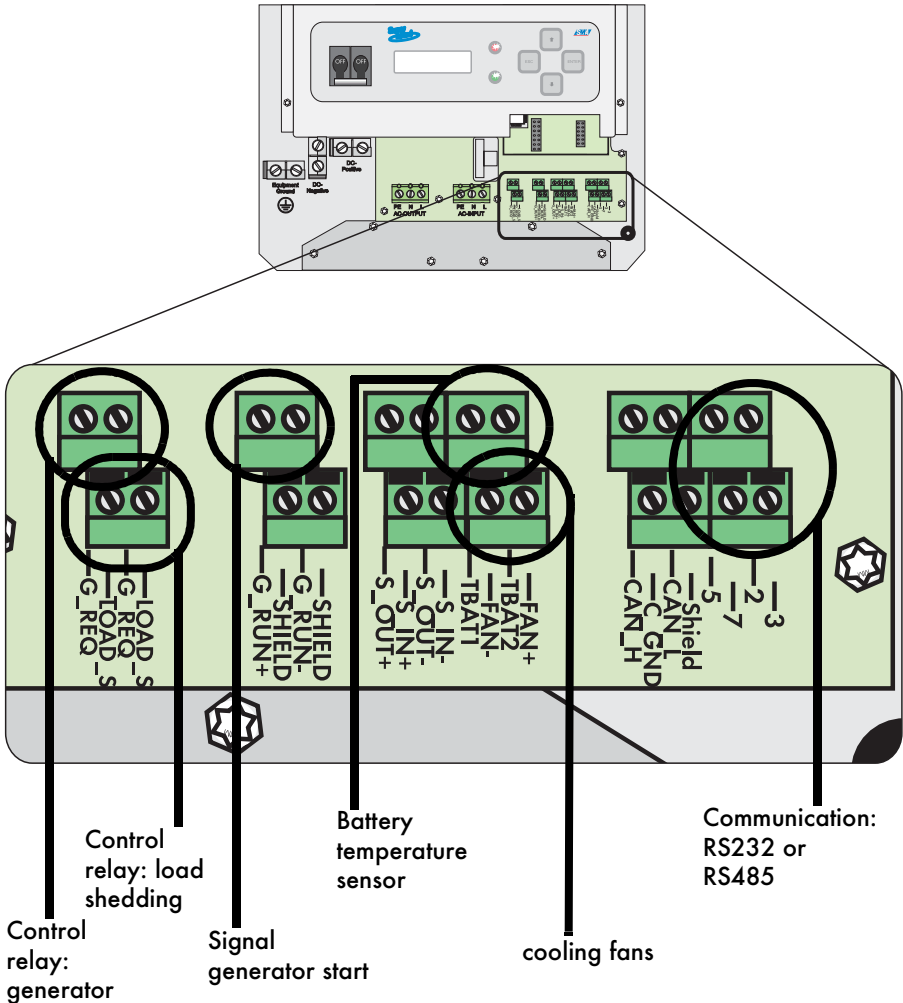
1. Install an M25 metric-thread cable screw connection (included in delivery) in the "AC input" cable feed-through (see figure Page 31).
  - Remove the dummy plug covering the cable feed-through.
  - Insert the metric-thread cable screw connection into the opening in the housing.
  - Screw the counter-nut onto the cable screw connection thread inside the housing.

2. Remove the protective insulation from each of the three conductors and fit a suitable cable end sleeve to the exposed ends of each conductor.
3. Feed the three-conductor cable through the metric-thread cable screw connection into the housing of the Sunny Island 3324/4248.
4. Install the three PE, N and L AC input conductors, one after the other. Insert the appropriate conductor into the appropriate PE, N or L "AC input" connection terminal and tighten the terminal screw firmly (torque 2.0 Nm to 4.0 Nm).
5. Once all three connections have been made, tighten the counter-nut of the metric-thread cable screw connection firmly.

### 5.4 Additional Connections

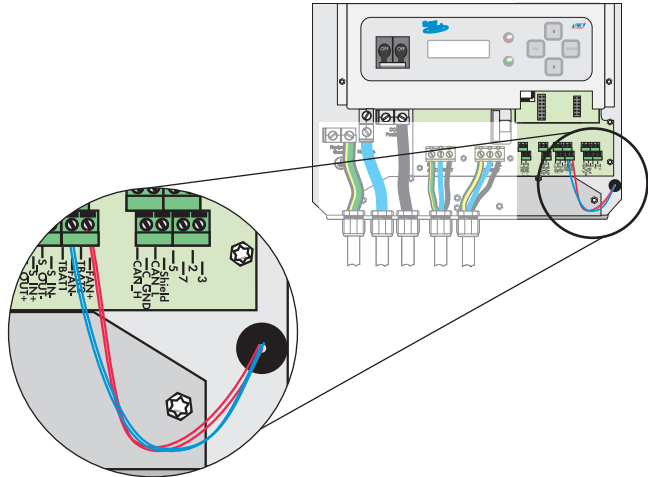
For installing the connections described below (battery temperature sensor, control relays, communication, ...) either one cable with an external diameter between 7 mm and 14 mm, or two cables with an external diameter of 6 mm each, may be used for each cable feed-through in the underside of the housing.

The following figure provides an overview of the additional connection terminals. The two terminal strips for the connections are arranged offset above each other.



### 5.4.1 Cooling Fans

The Sunny Island 3324/4248 has fans allowing the inverter to constantly feed heavy loads even at high ambient temperatures. The fans are located in the rear of the housing (not illustrated) and are already connected on delivery.



## 5.4.2 Battery Temperature Sensor

The battery temperature sensor measures the temperature of the connected battery. This is necessary since the optimum charging voltage for a lead acid battery is heavily temperature-dependent. Further information is provided in section 11.1 "Charge Control" (Page 102).



*The Sunny Island 3324/4248 can only be put into operation once the battery temperature sensor is connected.*



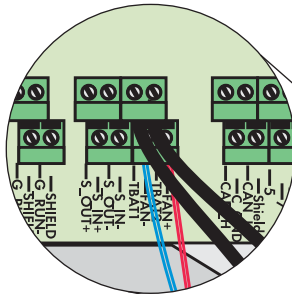
**Only use the battery temperature sensor provided with the delivery.**

**Do NOT extend the battery temperature sensor cable!**

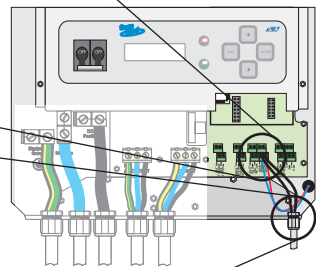
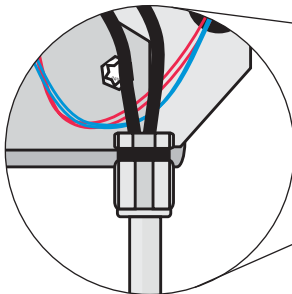
**Do not drill any holes in any part of the battery to mount the sensor.**

Proceed as follows to connect the battery temperature sensor to the Sunny Island 3324/4248:

Steps:  
4. + 5.



Steps:  
1., 3., 6.



1. Install an M12 metric-thread cable screw connection (included in delivery) in the "Battery temperature sensor" cable feed-through (see figure Page 31).
  - Remove the dummy plug covering the cable feed-through in the housing.
  - Insert the metric-thread cable screw connection into the opening in the housing.
  - Screw the counter-nut onto the cable screw connection thread inside the housing.
2. Feed the cable with the cable end sleeves through the metric-thread cable screw connection into the housing of the Sunny Island 3324/4248.
3. Insert the conductor with the cable end sleeve into the "TBat1" connection terminal and tighten the terminal screw firmly. The connection terminal numbering is irrelevant, the polarity does not matter.
4. Then connect the second conductor to the "TBat2" connection terminal.
5. Now tighten the metric-thread cable screw connection firmly.

### **Installation of the Battery Temperature Sensor at the Battery.**

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.

### 5.4.3 Load shedding

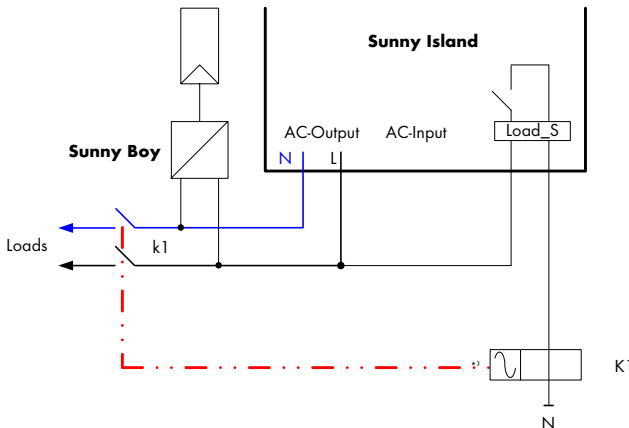
The Sunny Island 3324/4248 can automatically switch off loads to protect the batteries from deep discharge. To do this, an external power contactor, e.g. with a 230 V 16 A NO contact, must be installed between the Sunny Island 3324/4248 and the loads.



*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.*

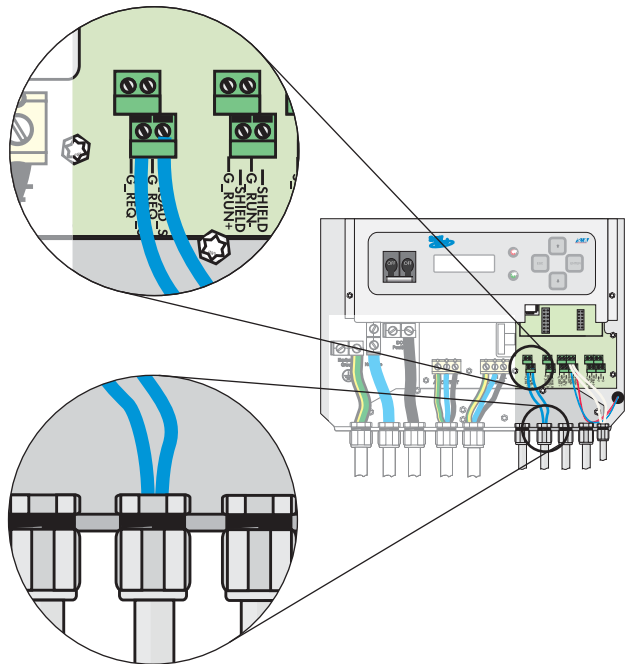
The external contactor is controlled by an internal relay (connection terminal "Load\_S"), which can be controlled using the "40-6 Load\_Shedding" parameter. This parameter is set to "OFF" at the factory. Please read section 8.6 "Automatic Load Shedding Setting" (Page 80) for more information on this topic.

This wiring is shown in the following figure:





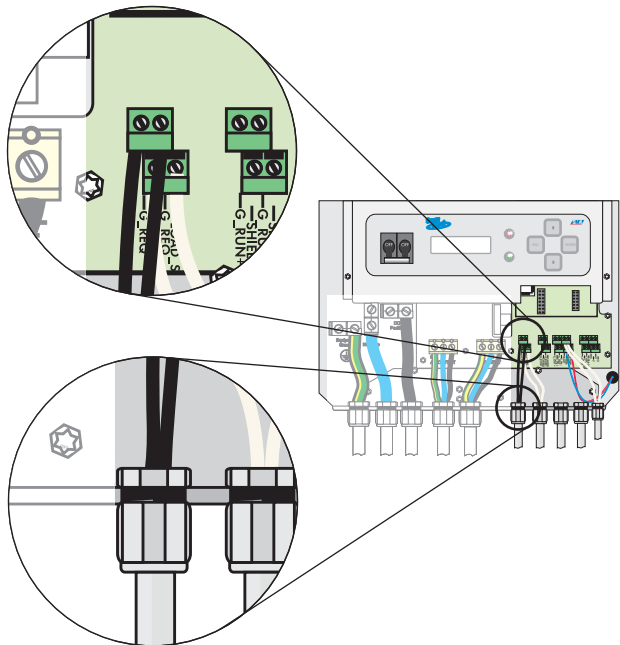
Install the connections to the Sunny Island 3324/4248 as follows:



1. Install an M20 metric-thread cable screw connection (included in delivery) in one of the "Additional connections" cable feed-throughs (see figure Page 31).
  - Remove the dummy plug covering the chosen cable feed-through in the housing.
  - Insert the cable screw connection thread into the opening in the housing.
  - Screw the appropriate M20 counter-nut onto the cable screw connection thread inside the housing.
2. Remove the protective insulation from the conductors and fit a suitable cable end sleeve to the exposed ends of each conductor.
3. Feed the conductors through the metric-thread cable screw connection into the housing of the Sunny Island 3324/4248.
4. Insert the first conductor with the cable end sleeve into one of the "Load\_S" connection terminal and tighten the terminal screw firmly. Then connect the second conductor to the second "Load\_S" connection terminal. The polarity of the two conductors does not matter.
5. Now tighten the metric-thread cable screw connection firmly.

## 5.4.4 Generator Start with a Single Contact

The Sunny Island 3324/4248 can automatically start generators that can be started/stopped using a single contact. This is done by the generator control relay (GenRequest-Relay) integrated into the Sunny Island 3324/4248. The autostart (single contact start) generator is directly connected to the "G\_Req" connection terminals of the Sunny Island 3324/4248. Further information on parameter settings and other methods of starting generators can be found in sections 8.5 "Operation with a Generator" (Page 74) and 10.2 "PV Stand-alone System with Generator" (Page 90).

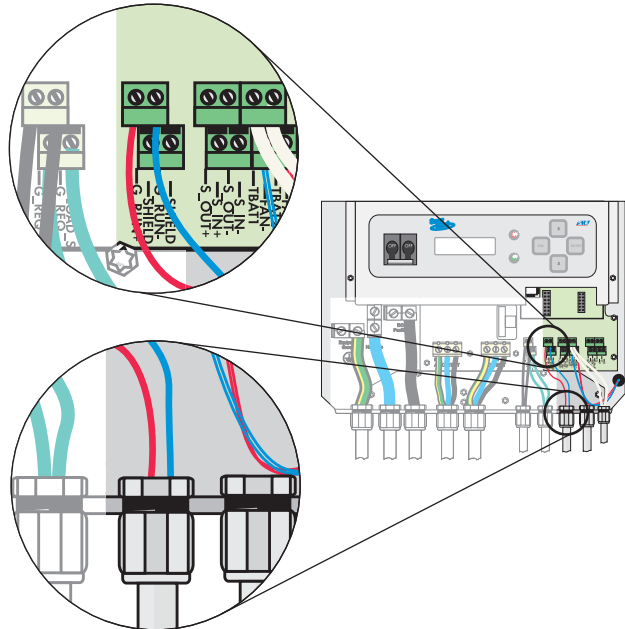


1. Install an M20 metric-thread cable screw connection (included in delivery) in one of the "Additional connections" cable feed-throughs (see figure Page 31).
  - Remove the dummy plug covering the chosen cable feed-through in the housing.
  - Insert the cable screw connection thread into the opening in the housing.
  - Screw the appropriate M20 counter-nut onto the cable screw connection thread inside the housing.
2. Remove the protective insulation from the conductors and fit a suitable cable end sleeve to the exposed ends of each conductor.

3. Feed the conductors through the metric-thread cable screw connection into the housing of the Sunny Island 3324/4248.
4. Insert the first conductor with the cable end sleeve into one of the "G\_Req" connection terminals and tighten the terminal screw firmly. Then connect the second conductor to the second "G\_Req" connection terminal. The polarity of the two conductors does not matter.
5. Now tighten the metric-thread cable screw connection firmly.

### 5.4.5 Generator Start Using GenMan

The Sunny Island 3324/4248 can also automatically start generators having more than a 2-wire start contact by using the optionally available generator manager (GenMan). As soon as the generator has started, the GenMan confirms proper operation by sending a signal to the G\_Run connections of the Sunny Island 3324/4248.



Connection	Function
SHIELD	shield
G_RUN-	connected to Gen Ready- of the GenMan
SCHIRM	shield
G_RUN +	connected to Gen Ready + of the GenMan

Pay attention to the correct connection polarity when installing.

- Connect the GenMan minus output Gen Ready- to the G-RUN- terminal of the Sunny Island 3324/4248.
- Wire the GenMan positive output Gen Ready+ to the G-RUN+ terminal of the Sunny Island 3324/4248.

## 5.4.6 Synchronization

These connections are intended as synchronization connections for possible future communication systems and are not presently used.

**Do not connect anything to these terminals.**

<b>Connection</b>	<b>Function</b>
S_IN -	synchronization INPUT, negative
S_OUT -	synchronization OUTPUT, negative
S_IN +	synchronization INPUT, positive
S_OUT +	synchronization OUTPUT, positive

## 5.5 Connection of the Communication Interface

The following communication interfaces can be built into the Sunny Island 3324/4248:

- RS232
- RS485

The wiring of the Sunny Island 3324/4248 communication interfaces is described in section 15.1 "Connection of the Interface" (Page 124).

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

## 6 Removing the Cover

The Sunny Island 3324/4248 enclosure has a removable cover. Remove this cover only when installing the inverter or for required maintenance or repair work.

### 6.1 Removing the Cover

**The Sunny Island 3324/4248 may only be installed or opened by suitably qualified personnel (electricians).**

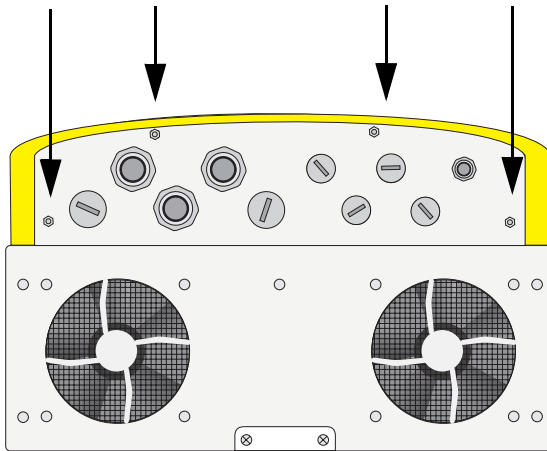


**Switch off the Sunny Island 3324/4248 and disconnect all voltage sources (batteries, generator and any other energy sources).**

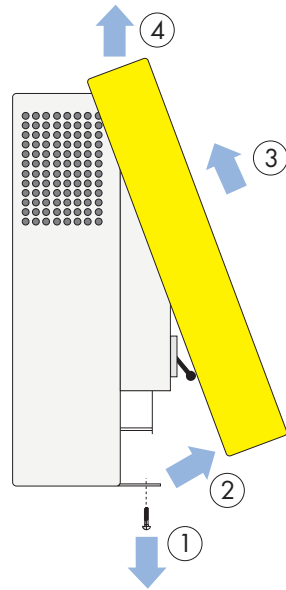
**Ensure that the system cannot be accidentally switched on again.**

Proceed as follows:

1. Stop the Sunny Island 3324/4248 (see section 9.1 "Stopping" (Page 83)).
2. Switch off the inverter, as described in section 9.3 "Switching Off" (Page 85).
3. Remove the four Phillips screws on the underside of the Sunny Island 3324/4248, as shown in the illustration below.



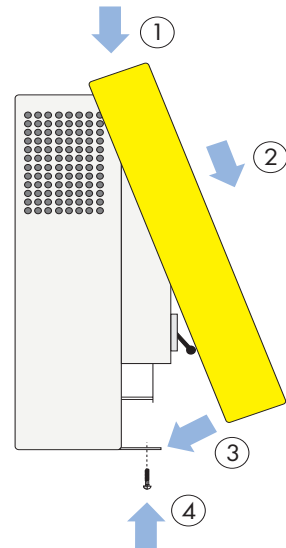
4. Remove the four Phillips screws (1).
5. Carefully pull the lower end of the housing cover until it comes free from the housing (2).
6. When removing the cover be sure that the lower side of the cover is kept away from the DC switch, to be sure that you do not accidentally switch on the inverter.
7. Now slide the housing cover upwards (3).
8. Remove the cover and store it in a safe place while mounting, installing or repairing the inverter.



## 6.2 Installing the Cover


Before installing the housing cover of the Sunny Island 3324/4248, ensure that all cables are properly laid and that all tools have been removed from within the housing (see section 5 "Electrical Connection" (Page 31)).

1. Hold the cover at an angle and hang it on the upper side of the housing (1).
2. Then gently slide the housing cover down (2) and towards the rear of the housing (3).
3. Fasten the housing cover to the Sunny Island 3324/4248 with the four Phillips screws (4) (see figure Page 55). Tighten the screws evenly and firmly.



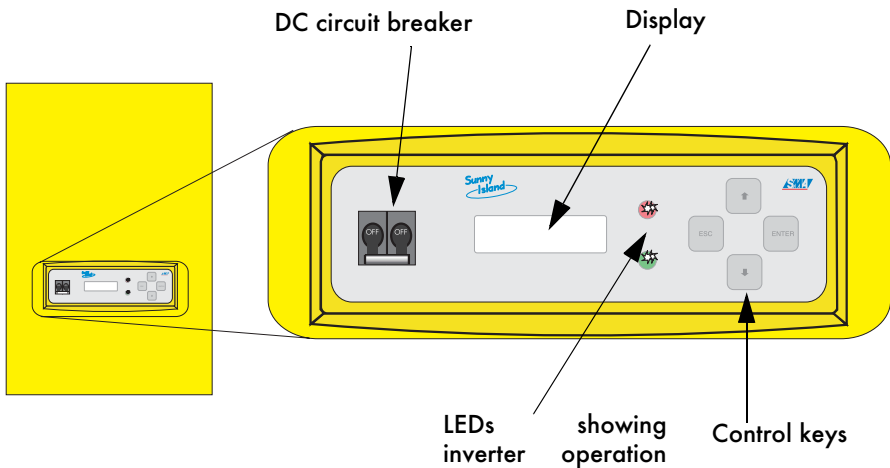


# 7 Operation

Before the first commissioning of the Sunny Island 3324/4248, read this "Operation" section and become familiar with the inverter. 

## 7.1 Control Elements

Functions, operating modes, parameters, data and fault messages are all displayed in the two-line display of the Sunny Island 3324/4248. Use the arrow keys (↑↓), the ESC key, and the ENTER key for navigation. The individual control elements can be seen in the figure below.



The following table shows the key functions:

Key	Function
ESC	cancel, NO response, leave current menu, stop the inverter (hold)
↑	navigate up one menu level, increase data value
↓	navigate down one menu level, decrease data value
ENTER	select a function, select a value, confirm changes, YES response

The DC circuit breaker switches the Sunny Island 3324/4248 on and off. Note that all voltage sources (batteries, (stand-alone) grid, generator) must be disconnected from the Sunny Island 3324/4248 before the inverter is free of voltage (see section 9.3 "Switching Off" (Page 85)).

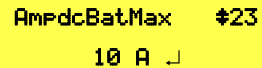
## 7.2 Changing Parameters

Use the <ENTER> key to open a menu. Use the ↑ (upwards) or ↓ (downwards) keys to navigate through the selected menu (see "Menu structure" figure Page 62) in order to view or change parameter values. As soon as the desired parameter appears in the display, you can read the current parameter value.

The display always shows the first two digits of a parameter. The menu structure and the parameter assignment are explained in section 7.5 "Menu Structure" (Page 61).

An "Enter" arrow is displayed next to parameters that you are allowed to change ↵.

Screen display of (e.g.)  
the  
"23-4 AmpdcBatMax"  
parameter:



```
AmpdcBatMax  #23
10 A ↵
```

Note that some parameters can only be changed when the inverter is in standby mode (see section 9.3 "Switching Off" (Page 85)). You can find the parameters for which this applies in the tables in section 17.2.2 "Adjustable System Parameters" (Page 134) and section 17.2.4 "Operation (Operation)" (Page 141).

If you press the <ENTER> key, the "Enter" arrow begins to blink and you can then use the arrow keys (↑ or ↓) to change the current parameter value.

As soon as the desired value appears in the display, press the <ENTER> key to save the new value, or press the <ESC> key to discard the changes and exit the menu.

If you wish to exit the current menu level (e.g. "23-3 AmpHoursBat" parameter) then press the <ESC> key. In this example, the cursor then jumps back to the "23-Battery Settings" menu level.

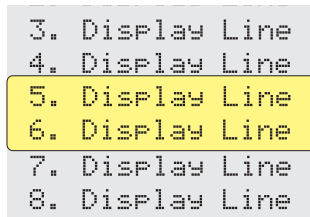
### 7.3 Explanation of the Light-emitting Diodes (LEDs)

A red LED and a green LED are located on the front side of the Sunny Island 3324/4248. The following table explains their meaning:

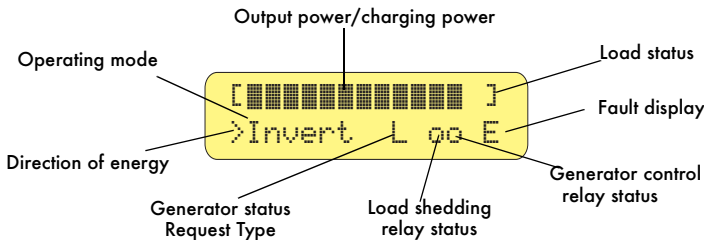
Green LED	Red LED	Operating mode
ON	ON	INIT (initialization phase)
–	–	Standby
ON	–	Operation
BLINKING	–	Derating (power reduction)
–	ON	Fault

### 7.4 Display

Information about the Sunny Island 3324/4248 is shown on the two-line LCD display. Two lines are always shown when navigating up and down the menus.



During normal operation, the Sunny Island 3324/4248 shows the relative output power, the operating mode of the inverter, the generator status (e.g. "L" see section 12.4 "Display Message" (Page 114)), fault messages and the status of the load shedding and generator control relay.





*Explanation of the energy flow direction display:*

">" = DC to AC (discharging mode)

"<" = AC to DC (charging mode)



*Explanation of the load status display:*

"J" = Normal

">" = Overload

You can find further information on the changing generator status display in section 12.4 "Display Message" (Page 114).

## 7.5 Menu Structure

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 8.3 "Password Entry" (Page 69)). Menus protected in this manner are shown with a grey background in the following figure (Installer Level). Menus shown with a white background are on the User Level and can be accessed without a password. These menu parameters are used to monitor and control the Sunny Island 3324/4248 in normal daily operation.

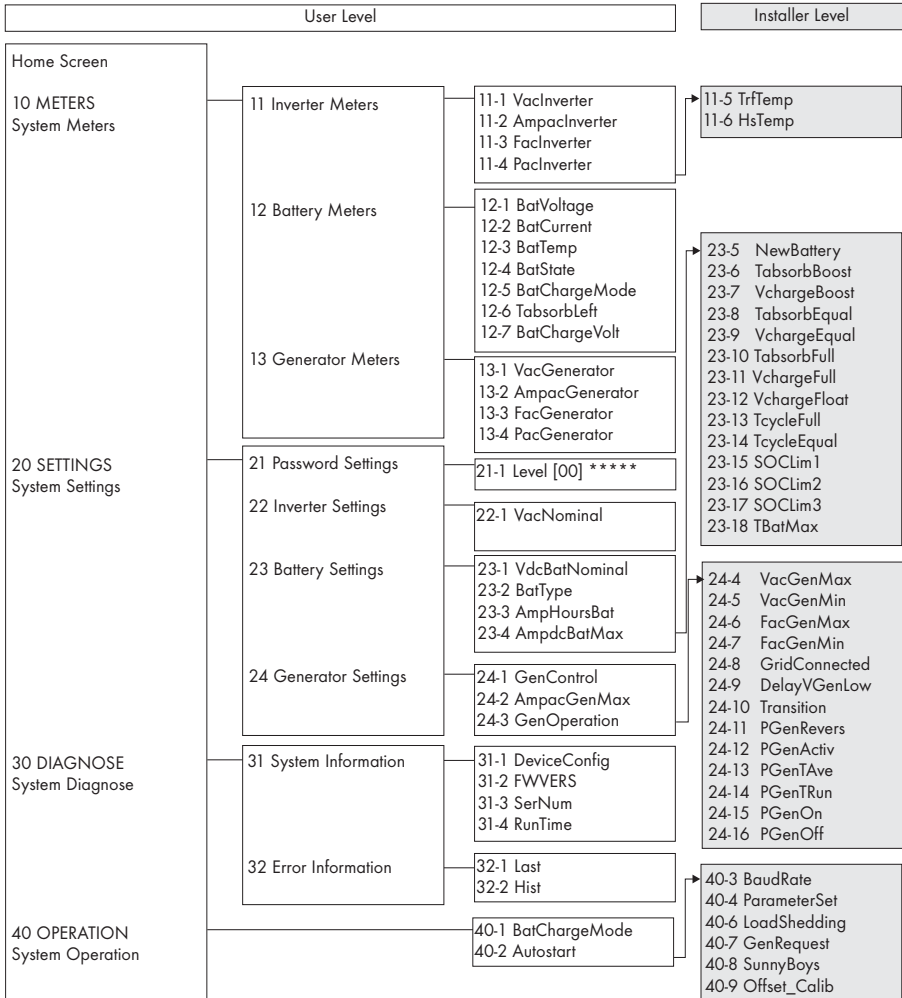
The main menu structure is divided into four different groups, each of which having two subsequent submenus.

1. **Meters:** The "10-Meters" main menu has the following submenus: Sunny Island 3324/4248 measurements ("11-Inverter Meters"), battery measurements ("12-Battery Meters") and generator measurements ("13-Generator Meters"). Individual measurement values can be seen in the next two menu levels.
2. **Settings:** Under the main menu "20-Settings" are four different submenus allowing various system parameters to be viewed and changed. This affects password entry ("21-Password Settings") and all system parameters relating to the Sunny Island 3324/4248 ("22-Inverter Settings"), the batteries ("23-Battery Settings") and the generator ("24-Generator Settings").
3. **Diagnose:** Under the main menu "30-Diagnose" are two different submenus allowing various diagnostic parameters to be viewed. These are system data ("31-System Information"), and fault messages ("32-Error Information").
4. **Operation:** The main menu "40-Operation" allows viewing and changing of the operating parameters (e.g. "40-8 SunnyBoys").

Please consult section 7.2 "Changing Parameters" (Page 58) for information describing how to set the individual parameters.

You will find a tabular list of all parameters in section 17.2 "Menus Requiring the Installer Password" (Page 132).

The following diagram provides an overview of the menu structure:



# 8 Commissioning

## 8.1 Preparation

Before beginning, ensure that all electrical connections have the correct polarity and make sure that everything is connected according to the instructions in section 5 "Electrical Connection" (Page 31).



For commissioning the system you require information on:

- the battery type
- the nominal capacity (C10),
- the generator type,
- the maximum output current that the generator can cope with.

To ensure that these values are available when first commissioning (see section 8.2 "Initialization" (Page 66)), you can note these values here:

**Battery type:** \_\_\_\_\_ sealed battery (Gel/Absorbed Glass Mat (VRLA)) or sealed battery (liquid electrolyte (FLA))

**Battery capacity** \* \*: \_\_\_\_\_ Ah (100 to 6,000)

\* \*The Sunny Island 3324/4248 assumes a C10 value for the capacity (factory setting is 100 Ah).

The battery capacity 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, then calculate this 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	C100/1.25
C10	C20/1.09
C10	C10
C10	C5/0.88
C10	C1/0.61

**Battery charging current:** \_\_\_\_\_ A (100)

If the battery manufacturer recommends a maximum charging current then set this value ("23-4 AmpdcBatMax" parameter). This value often lies around 10–20 A for each 100 Ah nominal capacity. If the manufacturer does not specify a maximum charging current then set the maximum possible charging current at 100 A. The setting of the charging current is described in point 14 of section 8.2 "Initialization" (Page 66).

**Generator:**

- none
- manual (the generator must be manually started)
- two-wire (the generator can be automatically started (with a single contact))
- GenMan option (the generator can be automatically started (with multiple contacts))

**Maximum generator output current:** \_\_\_\_\_A (0.0 to 56.0).



*Make the parameter settings using the sections shown in the process diagram below. Skip all sections that you do not require. Only start the Sunny Island 3324/4248, as described in section 8.9 "Starting after First Commissioning" (Page 81), after you have set all necessary parameters.*



*Note that you must first enter the installer password before some parameters can be changed (see section 8.3 "Password Entry" (Page 69)). You will find an overview of all necessary parameter information in section 17 "Menu Structure and Parameter Lists" (Page 130).*



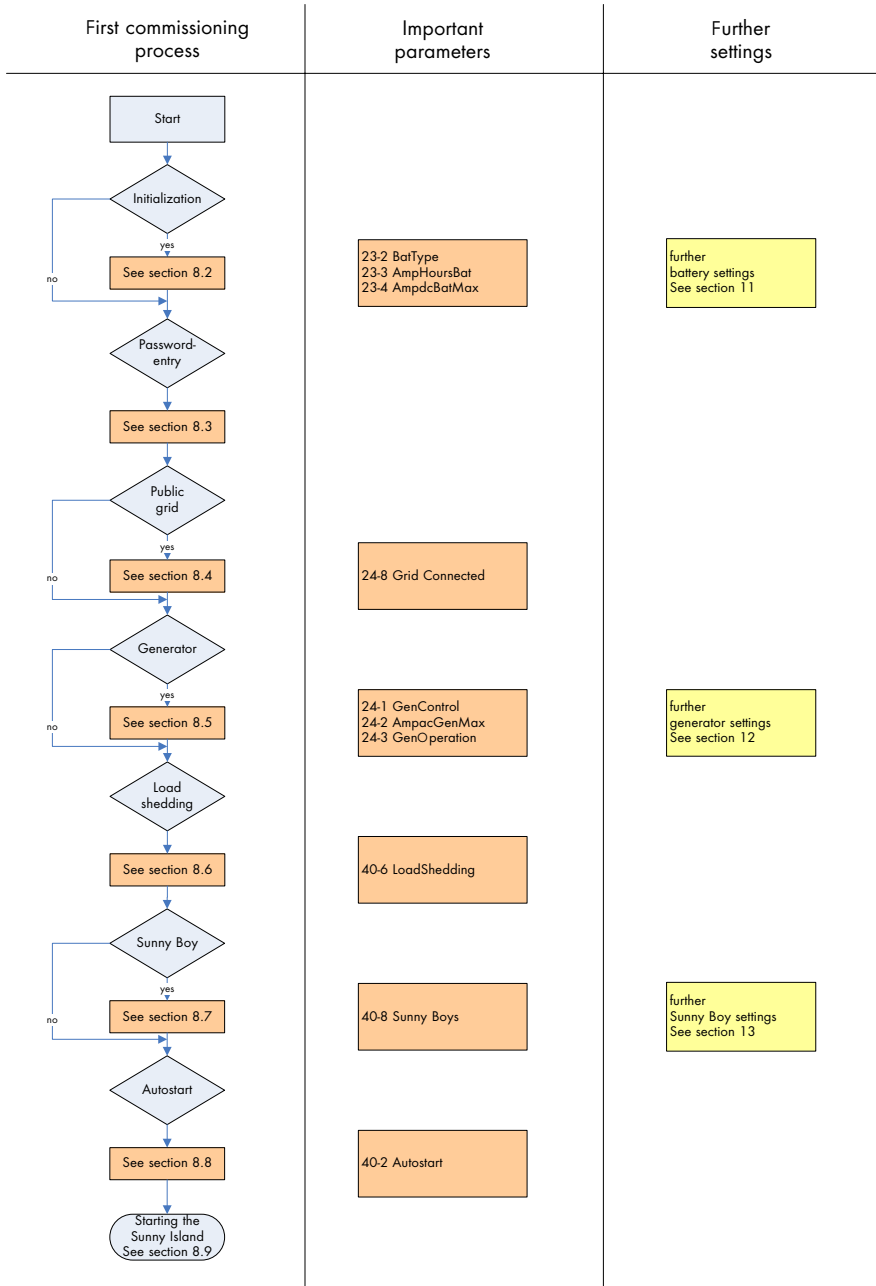
*Comprehensive parameter lists for your system can be obtained from the Sunny Island hotline at*

- (+49) 561 95 22 - 399

*The following information will help our technicians in setting the correct parameter values for your system. Have this information available when you call:*

- *Battery type*
- *Battery capacity*
- *If a generator exists:*
  - *Generator type*
  - *Generator capacity*
- *Is a Sunny Boy inverter connected? Yes/No*





## 8.2 Initialization

The initialization sequence of the Sunny Island 3324/4248 only occurs when the Sunny Island 3324/4248 is switched on for the first time. For this, the installation must be completely finished (see section 5 "Electrical Connection" (Page 31)).



**First commissioning may only be performed by suitable qualified personnel (electricians).**



**Never remove the battery cables during operation. Always switch off the Sunny Island 3324/4248 first. There is a risk of injury due to arcing and electric shock. Use a separate load disconnecting switch (directly at the batteries) for disconnecting the Sunny Island 3324/4248.**

Keep to the following sequence when initializing the Sunny Island 3324/4248. This describes the initialization sequence and provides notes on how the necessary parameter settings are to be performed.

1. Ensure that the the loads are not yet connected.
2. Switch on the Sunny Island 3324/4248 by switching the DC circuit breaker to the "ON" position.
3. The "SMA" greeting appears in the display.

SMA SMA SMA SMA

4. The type of your Sunny Island 3324/4248 is then displayed.

SI4248

5. On the first commissioning, the display then shows "Init".

Init

6. Wait until the message "To init system press <ENTER>" appears in the display.
7. Press <ENTER> to begin the initialization process.
8. Now set the battery type ("23-2 BatType" parameter).
9. Press <ENTER>. The "Enter" symbol begins to blink.
10. Use the arrow keys (↑↓) to select the correct battery type that you noted in section 8.1 "Preparation" (Page 63).
11. Press <ENTER> once more to save the new value.
12. Press the arrow key (↓) to access the parameter for setting the battery capacity in ampere hours ("23-3 AmpHoursBat" parameter).
13. Press <ENTER>. The "Enter" symbol begins to blink.
14. Use the arrow keys (↑↓) to select the correct ampere-hours value (holding down an arrow key causes the display to change more quickly).
15. Press <ENTER> once more to save the new value.
16. Press the arrow key (↓) to reach the parameter for setting the maximum battery charging current ("23-4 AmpdcBatMax" parameter) (see section 8.1 "Preparation" (Page 63)).
17. Press <ENTER>. The "Enter" symbol begins to blink.
18. Use the arrow keys (↑↓) to set the charging current value (holding down an arrow key causes the display to change more quickly).

```
To init system
press <ENTER>
```

```
BatType #23
URLA ↓
```

```
AmpHoursBat #23
100 Ah ↓
```

```
AmpdcBatMax #23
10 A ↓
```

19. Press <ENTER> once more to save the new value.
20. Press <ESC> to end the initialization process.
21. The message "To start press <ENTER>" is displayed.

To start  
press <ENTER>



The Sunny Island 3324/4248 can now be started and the loads supplied from the batteries.

If however the system is to be operated with the public grid, a generator or a PV system with Sunny Boys, then read section 8 on and make the following additional parameter settings.

**SMA** Technologie AG also recommends the installation and use of a load shedding system to protect the batteries (see section 8.6 "Automatic Load Shedding Setting" (Page 80)).



During the "Init" initialization phase, the Sunny Island 3324/4248 performs a number of self-tests to ensure that no faults exist in the system. Once these tests are finished, the display normally shows the message "To init system press <ENTER>". If the inverter detects a fault and shows this in the display, then the fault must be corrected before continuing with first commissioning. Use the information in section 18 "Troubleshooting/Problem Solving" (Page 143). Once all corrective measures have been taken, switch off the Sunny Island 3324/4248, then wait 30 seconds before beginning the first commissioning process anew.

## 8.3 Password Entry

**Sunny Island 3324/4248 parameter settings that affect the operating safety of the inverter are protected/locked by the installer password.**



**These parameters may only be changed by suitably qualified personnel (electricians).**

**Do not provide the following information for calculation and entry of the installer password to unauthorized persons. Unauthorized provision of this information to other persons will lead to invalidation of all SMA Technologie AG guarantee provisions.**



*The password can be entered when the system is in standby mode or in normal operation. Entry of the password in standby mode is described here.*



The password required for access to all "Installer Level" parameters (see figure "Menu structure overview" in section 17.1 "Menu Structure" (Page 130)) depends on the operating-hours counter.

Proceed as follows to calculate and enter the installer password:

1. The Sunny Island 3324/4248 stopped and is now in standby mode. The message "To start press <ENTER>" is shown on the display.

To start  
press <ENTER>

First determine the operational hours of the Sunny Island 3324/4248.

2. Keep pressing the arrow key (↓) until you reach the "30-Diagnose" menu.

DIAGNOSE #30  
System diagnose

3. Press <ENTER> twice. You are now in the "31-System Information" menu. The display shows the name of the inverter and the firmware version.

SI4248  
FW: 1.84 1.94

4. Press the arrow key once (↓). The serial number and the operating-hours counter (RunTime) appear in the display.
5. Note the number of operational hours (384 hours in this example).
6. Calculate the sum of the digits in the operational hours by adding all digits of the number together. In this example, the sum of the digits is "15".
7. Remember that the installer password "15".
8. Press <ESC> twice. You are now back in the "30-Diagnose" menu.

```
SerNo: 123456789
RunTime: 384
```

384 => 3 + 8 + 4 = 15

Now enter the password.

```
DIAGNOSE #30
System diagnose
```

9. Press the arrow key (↑) once to reach the "20-SETTINGS" menu.

```
SETTINGS #20
System settings
```

10. Press <ENTER> three times. The message "EnterPasswd" appears in the display and the cursor (␣) blinks next to the "0".

```
EnterPasswd #21
0 ␣ Lev[00]
```

11. Use the arrow keys (↑ ↓) to enter the password determined in point 7 ("15" in this example).

```
EnterPasswd #21
15 ␣ Lev[01]
```

12. Press <ENTER>. If you have entered the correct password, the Sunny Island 3324/4248 switches from "User Level Lev[00]" to the "Installer Level Lev[01]". At this status level, all parameters can now be changed as described in section 17 "Menu Structure and Parameter Lists" (Page 130).

13. Press the <ESC> key three times to leave the menu. This finishes the entry of the password.

The message "To start press <ENTER>" is displayed (see section 9.2 "Switching On/Starting" (Page 84)).

To start  
press <ENTER>

*It is important to set the parameters correctly before starting the Sunny Island 3324/4248. Continue according to the information in section 8.4!*



*The installer password becomes invalid when:*

- the operating-hours counter "RunTime" is incremented,
- the Sunny Island 3324/4248 is switched off and on again (see section 9 "Switching On and Off" (Page 83)),
- certain parameters are entered (e.g. the "23-5 NewBattery" parameter) that cause a restart,
- no keys are pressed for a period of 10 minutes.



*If the password is invalid, the Sunny Island 3324/4248 does **not** switch from the user level to the installer level (see point 12.). In this case, recalculate and re-enter the installer password as described in this section.*

## 8.4 Operating with the Public Grid

If you wish to integrate a Sunny Island system into the public grid, you must set the type of integration in the Sunny Island 3324/4248 ("24-8 Grid Connected" parameter). To do this, start in the main menu (Home Screen):

1. Keep pressing the arrow key (↓) until you reach the "20-Settings" menu.
2. Press <ENTER> and use the arrow keys (↑ ↓) to scroll to the "24-Generator Settings" menu.
3. Press <ENTER> once more and use the arrow keys (↑ ↓) to scroll to the "24-8 Grid Connected" parameter.

### "GridNone" Setting (Factory Setting)

Select the "GridNone" setting when a generator, a public grid with large frequency and voltage fluctuations, or no device is connected to the AC input of the Sunny Island 3324/4248. The limits for generator voltage and frequency are set using the parameters 24-4 to 24-7 (see also section 17.2.2 "Adjustable System Parameters" (Page 134)).

### "GridCharge" Setting

If only the grid is to be used for charging the batteries, then the parameter should be set to "GridCharge". With this setting, it is not possible to feed the public grid through the Sunny Island 3324/4248. Usually, no Sunny Boy inverters are connected to the system.

Instead of the limits that can be defined using parameters 24-4 to 24-7, the following predefined limits apply:

- Frequency: 49.8 Hz to 50.2 Hz
- Voltage: 190.0 V to 250.0 V



When using the "GridCharge" setting, set the "24-1 GenControl" parameter to "Manual" and "24-3 GenOperation" parameter to "Auto".



The Sunny Island 3324/4248 will often shut down in poor grid quality because the predefined voltage and frequency limits are often exceeded. In this case, set the "24-8 Grid Connected" parameter to "GridNone" (see above), to allow the voltage and frequency limits to be manually set to suit the conditions.



## "GridFeedPV" Setting

Select the "GridFeedPV" setting when you operate the Sunny Island 3324/4248 in parallel to a public grid and want to draw electrical energy from this grid and also feed electrical energy produced in the stand-alone grid (e. g. from a PV generator with a Sunny Boy) back into the public grid.

In this case, instead of the limits that can be defined using parameters 24-4 to 24-7, the following predefined limits apply:

- Frequency: 49.8 Hz to 50.2 Hz
- Voltage: 190.0 V to 250.0 V

*When using the "GridFeedPV" setting, set the "24-1 GenControl" parameter to "Manual" and "24-3 GenOperation" parameter to "Auto".*



*The installer password is required in order to set parameters "24-4 to 24-16" (see section 8.3 "Password Entry" (Page 69)).*



## 8.5 Operation with a Generator

If you wish to use a generator with the system, then you must set the generator type, the type of generator connection and the maximum output current delivered by the generator. To reach the generator menu, start in the main menu (Home Screen) and use the arrow keys to scroll to **Settings (20)**, then press **Enter** and scroll to the **Generator Settings (24)** menu. In this menu, you can change all parameter values relating to a connected generator.



*You require the installer password in order to set parameters "24-4 to 24-16" (see section 8.3 "Password Entry" (Page 69)).*

The following section describes the settings for the following particularly important commissioning parameters in detail:

- "24-1 GenControl" - Selection of the generator type
- "24-2 AmpacGenMax" - Max. generator output current
- "24-3 GenOperation" - Generator request

The remaining parameters of the **Generator Settings (24)** menu are described in section 12 "Generator" (Page 111). You can find information on connecting and setting parameters in your system in section 10 "System Examples" (Page 87)). All adjustable parameters are also listed in tabular form in section 17.2.2 "Adjustable System Parameters" (Page 134).

## 8.5.1 Selection of Generator Control Method

Use "24-1 GenControl" parameter to select the type of generator to be used in your system. Three settings are possible:

### 1. "Manual" Setting (Factory Setting)

"Manual" should be selected when

- no generator is installed in the system (see also section 10.1 "PV Stand-alone System" (Page 88)) or
- the connected generator can only be manually started (directly at the generator) (see also section 10.2.1 "Generators with Manual Start" (Page 91)).

As soon as a voltage at the AC input terminals (generator connection) of the Sunny Island 3324/4248 is within the parameter limits (see parameter 24-2 and 24-4 to 24-7), the Sunny Island 3324/4248 connects to the generator.

The parameter settings are intended for generators that **cannot** be automatically started. Since in these cases the Sunny Island 3324/4248 GenRequest relay is not used for directly starting the generator, it can here provide a signal transmitter for the stand-alone grid user.

A signal light can be connected to the "GenRequest" contact that signals the stand-alone grid user to start the generator when this is required. The signal light is then switched off again via the "GenRequest" contact when the generator is no longer needed. Note that, with these settings, although the signal light has gone out the Sunny Island 3324/4248 will not automatically disconnect from the generator. You must stop the generator manually.



Possible reasons for a generator request are:

- A request by the battery management (low battery voltage)
- A request by the load-dependent generator management (to handle generator peak loads)
- A request by the temperature-dependent generator management (to protect the Sunny Island 3324/4248 against overload)

## 2. "Direct" Setting

If the system uses a generator that can be automatically started using a contact (two-wire autostart generator directly connected to the Sunny Island 3324/4248), set this parameter to the "Direct" setting. The closing of the GenRequest relay (see section 5.4.4 "Generator Start with a Single Contact" (Page 50) for detailed information) provides the start command to the generator from the Sunny Island 3324/4248. When the generator is no longer required, the start contact opens and the start command is revoked.

Possible reasons for a generator start command are:

- A request by the battery management (low battery voltage)
- A request by the load-dependent generator management (to handle generator peak loads)
- A request by the temperature-dependent generator management (to protect the Sunny Island 3324/4248 against overload)
- Manual start of the generator by the user via setting the "24-3 GenOperation" parameter to the value "Start" or "Run1h"



*Note that in this configuration the Sunny Island 3324/4248 will only connect the generator when it requested the generator by closing the "GenRequest" contact.*

*If you wish to start the generator manually, activate the generator using the "24-3 GenOperation" parameter.*

## 3. "GenMan" Setting

The "GenMan" setting must be used for all generators that require more than a single contact for starting. In addition to setting the parameter, the generator must also be integrated into the system using the (optional) GenMan device - SMA order number 'SI GenMan'. Information on installation and parameter settings can be found in the GenMan handbook and also in section 10.2.4 "With GenMan" (Page 95) of this installation manual.

The reasons for a generator request from the Sunny Island 3324/4248 are the same as those listed under "Direct" with these two exceptions:

- The Sunny Island 3324/4248 will only connect the generator when the "GenRun" signal from the GenMan unit is received indicating that the generator is ready.
- With this setting it is not absolutely necessary that the inverter itself has set the "GenRequest" relay before it connects the generator. In normal operation, the inverter will usually set the "GenRequest" relay to request the generator and then connect the generator once the "GenRun" signal has been received from the GenMan. The decisive signal for connecting the generator is however the "GenRun" signal. This allows the generator to be manually started at the GenMan.

## 8.5.2 Setting the Output Current Limit

The "24-2 AmpacGenMax" parameter helps to prevent the generator from overloading or stalling. The Sunny Island 3324/4248 will (e.g.) reduce the battery charging current in charging mode ("Charge" mode) so that the total generator load does not exceed the value defined in this parameter. In inverter mode ("Invert" mode) the Sunny Island 3324/4248 will only connect the generator when the load lies below the value defined here, even if the generator was requested.

To make the best use of the run time and service life of the generator, the value here should be set to about 85 % of the nominal generator current. Please refer to the generator manufacturer's recommendations.

## 8.5.3 Generator Request

The user can use the "24-3 GenOperation" parameter to start the generator directly. Only use the settings 1 – 4 when you have set the "24-1 GenControl" parameter (see section 8.5.3 "Generator Request" (Page 77)) to "Direct" or "GenMan". Setting 5 ("Release") is also useful under the "Manual" setting.

Five different settings are possible for the "24-3 GenOperation" parameter. Take note of the messages in the display (see section 12.4 "Display Message" (Page 114)):

### 1. "Auto" Setting (Factory Setting)

In this configuration, the Sunny Island 3324/4248 will automatically control the generator and start and stop it as needed.

### 2. "Start" Setting

This setting causes an immediate generator request. The "Start" setting is indicated by an "S" in the display (see section 12.4 "Display Message" (Page 114)).

**The Sunny Island 3324/4248 can not automatically stop the generator when you have started it using the "Start" setting.**



**Do not forget to stop the generator when you no longer need it. To do this, set the "24-3 GenOperation" parameter to "Stop" or "Auto".**

### 3. "Stop" Setting

This setting immediately stops the generator, as long as the "24-1 GenControl" parameter is set to "Direct" or "GenMan".



**The Sunny Island 3324/4248 can not start the generator and will not connect an externally started generator if you have switched it off using the "Stop" setting.**

**Remember to reset the "24-3 GenOperation" parameter back to "Auto" if the Sunny Island 3324/4248 should assume control of the generator.**

**Please also note that a generator stopped using the "Stop" setting can also be started by other components in the stand-alone system. For example, the GenMan independently starts the generator as soon as the generator starter battery voltage sinks below a particular value.**

### 4. "Run1h" Setting

This parameter setting can be useful when the batteries should be relieved by the generator for a foreseeable period of time. As soon as the "24-3 GenOperation" parameter is set to "Run1h", the generator is requested for a period of one hour. The "Run1h" setting is indicated by a "T" in the display (see section 12.4 "Display Message" (Page 114)).

After one hour has passed, the Sunny Island 3324/4248 automatically sets the "24-3 GenOperation" parameter back to "Auto".



*Exception:*

*If "Run1h" was selected from the "Stop" mode, after one hour the Sunny Island 3324/4248 returns to this mode (see also 3. "Stop" Setting).*

## 5. "Release" Setting

The "Release" setting releases the 20 minute lockout time triggered when the reverse power limits are exceeded.

The "24-11 PGenReverse" parameter limits the power that may be fed back into the generator for up to five seconds.

If the reverse power exceeds this value then the generator/grid is disconnected and the Sunny Island 3324/4248 switches to stand-alone grid operation. The generator or grid cannot now be reconnected for a period of 20 minutes. Setting the "24-3 GenOperation" parameter to "Release" removes this lockout. After "Release" has been activated, the "24-3 GenOperation" parameter is automatically reset to the "Auto" value and the Sunny Island 3324/4248 can again synchronize to the public grid or the generator.

Further information on generators is provided in section 12 "Generator" (Page 111) of this installation manual.

## 8.6 Automatic Load Shedding Setting

The Sunny Island 3324/4248 can automatically switch off loads if the battery voltage is getting too low. The relay responsible for this is controlled by the "40-6 LoadShedding" parameter, which is set to "OFF" at the factory.

The load shedding relay has a normally closed (NC) contact. If the "40-6 LoadShedding" parameter is set to "Auto" then the contact opens when the battery voltage has decreased to a charge level of "BatState = Low" or "BatState = Critical" (see section 11.3 "Deep Discharge Protection/Battery State" (Page 105)), or the Sunny Island 3324/4248 switches itself off or is stopped. The relay contact can also be closed when the Sunny Island 3324/4248 is stopped by setting the "40-6 LoadShedding" parameter to "ON" (see section 17.1 "Menu Structure" (Page 130)). If the "40-6 LoadShedding" parameter is set to "OFF" then the automatic load shedding is switched off and the relay is opened.

Parameter	Setting	Relay contact
40-6	ON	always closed when the Sunny Island 3324/4248 is running
40-6	OFF	always open
40-6	AUTO	automatic (see above text)



*Load shedding is an important feature for protecting batteries from quick aging caused by deep discharge. This is only activated when, over a longer period of time, more energy is consumed than is generated, or when the generator does not start (lack of fuel, generator fault).*

## 8.7 Operation with Sunny Boy Inverters

Set the "40-8 SunnyBoys" parameter to "Yes". (For further settings relating to operation with PV inverters, see section 13 "Connecting Sunny Boy Inverters" (Page 117)).

## 8.8 Autostart Function

The autostart function allows the Sunny Island 3324/4248 to start automatically. If AutoStart is set to "Off" (default value) then the inverter must always be manually started.

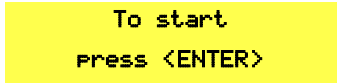
Set the "40-2 Autostart" parameter to "On". (For further settings relating to the autostart function, see section 13 "Connecting Sunny Boy Inverters" (Page 117)).



### 8.9 Starting after First Commissioning

Once all parameters have been set, the Sunny Island 3324/4248 can be put into operation.

Make sure that the message "To start press <ENTER>" appears in the display by pressing <ESC> until you access the main menu and then pressing an arrow key until the "To start press <ENTER>" message appears.

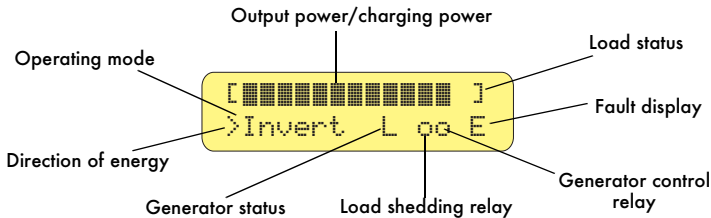
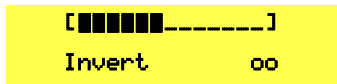


Press <ENTER> and the Sunny Island 3324/4248 will start.

A single beep will be heard.

The green LED on the control panel of the Sunny Island 3324/4248 will illuminate.

Once successfully started, a status overview message appears in the display, showing the current operating mode and the output power (see also figure below):





## 9 Switching On and Off

### 9.1 Stopping

Proceed as follows to place the Sunny Island 3324/4248 in standby mode:

**Note that all connected loads are no longer provided with electrical energy once you have stopped the Sunny Island 3324/4248.**



1. Switch off all loads, as far as this is possible.
2. Press and hold the "ESC" key until the "To STOP press ENTER" message appears.
3. Press "ENTER".
4. The Sunny Island 3324/4248 stops and enters the standby mode.
5. The message "To start press <ENTER>" is displayed. The green LED on the control panel of the Sunny Island 3324/4248 goes out.

To stop  
press <ENTER>

To start  
press <ENTER>

**Note that even in standby mode there is still voltage present in the inverter (DC, AC input).**



*In standby mode the Sunny Island 3324/4248 still requires about 4 W of power from the batteries.*



## 9.2 Switching On/Starting



This step assumes that the Sunny Island 3324/4248 has been checked for

- correct connections,
- voltages and
- polarities

**and has already been commissioned by a qualified electrician.**

Proceed as follows:

1. Switch on the Sunny Island 3324/4248 by switching the DC circuit breaker to the "ON" position.
2. The Sunny Island 3324/4248 begins the initialization phase (INIT), during which a number of self-tests are performed to check that there are no faults in the system.
 

SMA SMA SMA SMA
3. You must wait for this to finish.
4. As soon as the initialization phase is finished, the message "To start press <ENTER>" is displayed.
 

To start  
press <ENTER>
5. Now press <ENTER> and the Sunny Island 3324/4248 will start.
6. A single beep will be heard. The green LED on the control panel of the Sunny Island 3324/4248 will illuminate.



*If the inverter does not display the "To start press <ENTER>" message but displays a fault message instead, then this fault must be corrected before the inverter can be put into operation. Use the information in section 18 "Troubleshooting/Problem Solving" (Page 143). Once all corrective measures have been taken, switch off the Sunny Island 3324/4248, then wait for 30 seconds before beginning anew from point 1.*

## 9.3 Switching Off

To switch off the Sunny Island 3324/4248, follow these steps:

1. Place the Sunny Island 3324/4248 in standby mode (see section 9.1 "Stopping" (Page 83)).
2. Switch the DC circuit breaker of the Sunny Island 3324/4248 to the "OFF" position.

*To prevent possible errors, wait at least 30 seconds before switching the inverter on again.*



## 9.4 Disconnecting the inverter from Voltage Sources

1. Switch off the Sunny Island 3324/4248 (see section 9.3 "Switching Off" (Page 85)).
2. Disconnect the Sunny Island 3324/4248 from the batteries.
3. Then disconnect the Sunny Island 3324/4248 from the grid/generator (AC input) and from all possible sources of AC voltage connected to the AC output terminals (e.g. Sunny Boy PV inverter).
4. Make sure that the Sunny Island 3324/4248 has been disconnected from all voltage sources.
5. Wait at least 1 minute to let the capacitors discharge and allow the voltage inside the inverter to drop to a safe level.
6. The Sunny Island 3324/4248 is now completely free of voltage.

## 9.5 Restarting the Automatic Shutdown

To restart the Sunny Island 3324/4248 after it has switched off due to batteries that are too deeply discharged, proceed as follows:



**A complete shutdown indicates that one or more of the system components have failed or are not working properly. Check the components of the system for possible faults or incorrect parameter settings before attempting to restart the system.**

- Switch off the DC circuit breaker.



**You must wait at least five minutes to allow the capacitors to completely discharge before switching the DC circuit breaker on again.**

- After waiting 5 minutes switch the DC circuit breaker on again. The Sunny Island 3324/4248 runs through the INIT phase.
- Once the INIT phase is finished, the message "To start press ENTER" is displayed. Press the "ENTER" key.



*Once the inverter is switched on again, it is important that the batteries are charged. If an autostart generator exists in the system, the Sunny Island 3324/4248 will start the generator after a few minutes.*

- Monitor the generator start and check that the Sunny Island 3324/4248 switches to "CHARGE" operating mode (battery charging mode).
- Check that all other energy generators in your system are also working correctly.



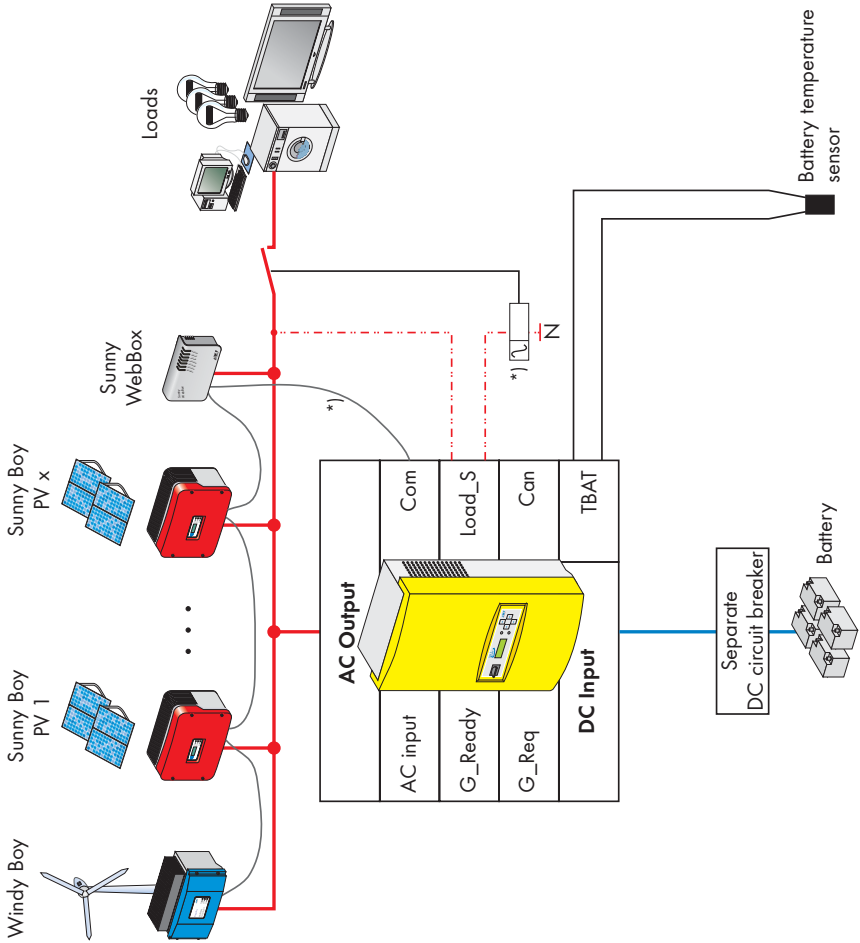
*If the Sunny Island 3324/4248 immediately switches off with the fault "VBatLow" (low battery voltage) after restarting, switch off all loads connected to the AC output. The loads can be reconnected once the Sunny Island 3324/4248 enters the "CHARGE" operating mode. (Provided that a generator capable of providing the required power is connected to the system.)*

## 10 System Examples

The diagrams in the following section illustrate the design, wiring and important parameter settings for the different system configurations of the Sunny Island 3324/4248.

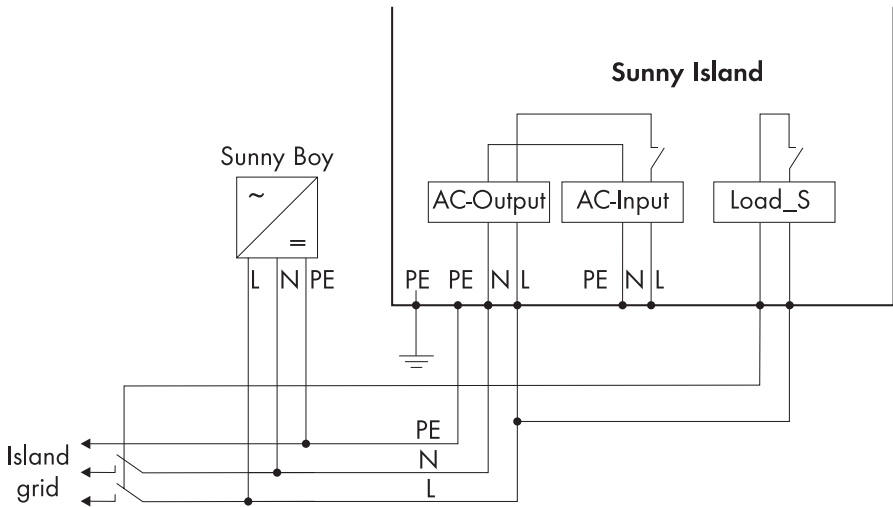
There is a schematic view of the wiring information. Additional measures may also be necessary (e.g. line circuit breakers, special grounding etc.), depending on the applicable local standards and guidelines.

# 10.1 PV Stand-alone System



Description:  
 - - - Control voltage  
 \*) not included in delivery





The following parameters must be set:

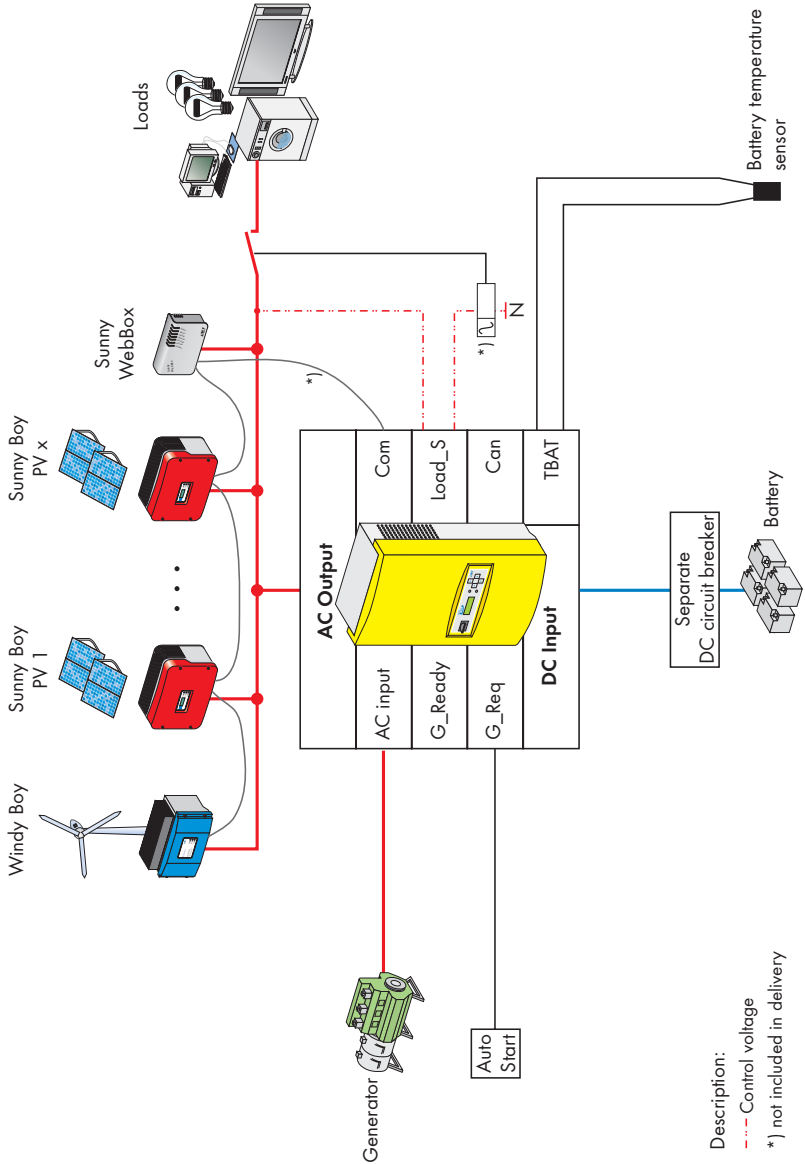
No.	Parameter	Parameter value/unit	Parameter description
23-2	BatType (see section 11.4)	refer to the data sheet provided by the battery manufacturer	The type of battery used in the system. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
23-3	AmpHoursBat (see section 11.4)	refer to the data sheet provided by the battery manufacturer	Battery capacity. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
23-4	AmpdcBatMax (see section 11.4)	refer to the data sheet provided by the battery manufacturer	Max. battery charging current. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
40-2	Autostart	On	The Sunny Island 3324/4248 can restart automatically.
40-6	LoadShedding	Auto	Automatic control of the load shedding relay by the Sunny Island 3324/4248
40-8	SunnyBoys	Yes	Set this parameter to Yes when Sunny Boy inverters are connected to the system.


Other parameters can also be changed for this system. You will find a list of these parameters in section 17.2.2 "Adjustable System Parameters" (Page 134).

*Load shedding is an important feature for protecting batteries from quick aging caused by deep discharge. This is only activated when, over a longer period of time, more energy is consumed than is generated, or when the generator does not start (lack of fuel, generator fault).*



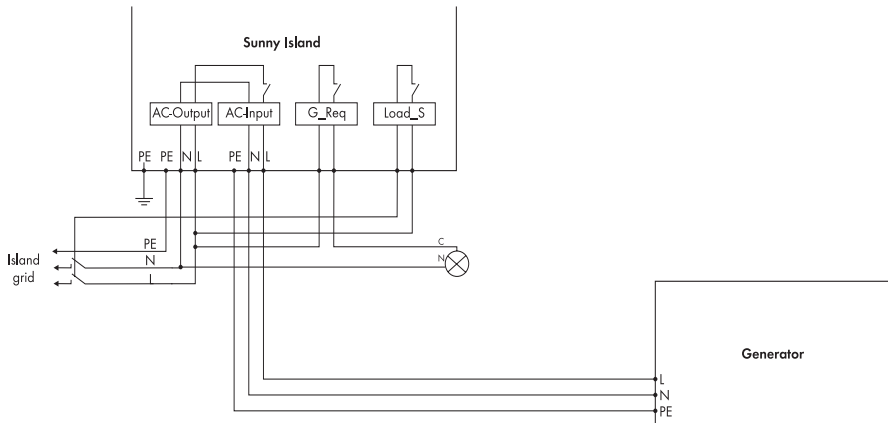
# 10.2 PV Stand-alone System with Generator



The following subsections (10.2.1 to 10.2.4) show you a range of possible ways how the generator connected to your system can be started. 

## 10.2.1 Generators with Manual Start

A generator without an autostart feature must be started manually, i.e. by hand (see section 8.5.3 "Generator Request" (Page 77)). A light can be connected to the system to inform the user that the batteries have reached a critical state (see "12-4 BatState" parameter and section 11.3 "Deep Discharge Protection/Battery State" (Page 105)) and must be charged. The following figure shows the wiring between the generator and the Sunny Island 3324/4248:



The following parameters must be set:

No.	Parameter	Parameter value/unit	Parameter description
23-2	BatType (see section 11.4)	refer to the data sheet provided by the battery manufacturer	The type of battery used in the system. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
23-3	AmpHoursBat (see section 11.4)	refer to the data sheet provided by the battery manufacturer	Battery capacity. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
23-4	AmpdcBatMax (see section 11.4)	refer to the data sheet provided by the battery manufacturer	Max. battery charging current. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
24-2	AmpacGenMax	$0.85 \cdot \text{nominal generator current}$ (see generator datasheet)	Max. generator output current (see section 8.5.2 "Setting the Output Current Limit" (Page 77)).
40-2	Autostart	On	The Sunny Island 3324/4248 can restart automatically.
40-6	LoadShedding	Auto	Automatic control of the load shedding relay by the Sunny Island 3324/4248

No.	Parameter	Parameter value/unit	Parameter description
40-8	SunnyBoys	Yes	Set this parameter only to Yes when Sunny Boy inverters are connected to the system.

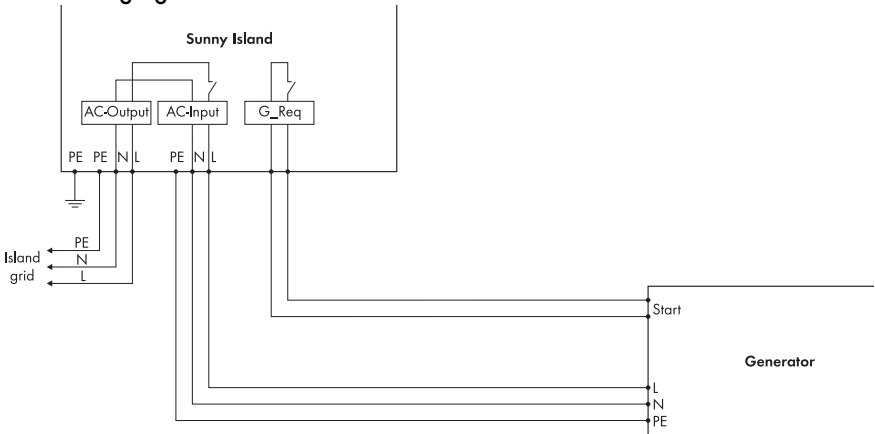
Other parameters can also be changed for this system. You will find a list of these parameters in section 17.2.2 "Adjustable System Parameters" (Page 134).



*Load shedding is an important feature for protecting batteries from quick aging caused by deep discharge. This is only activated when, over a longer period of time, more energy is consumed than is generated, or when the generator does not start (lack of fuel, generator fault).*

### 10.2.2 Generator Start with a Single Contact (2-Wire)

An autostart generator requiring a single contact (see section "2. "Direct" Setting" (Page 76)) is directly connected to the Sunny Island 3324/4248. The wiring is shown in the following figure:



The following parameters must be set:

No.	Parameter	Parameter value/unit	Parameter description
23-2	BatType (see section 11.4)	refer to the data sheet provided by the battery manufacturer	The type of battery used in the system. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
23-3	AmpHoursBat (see section 11.4)	refer to the data sheet provided by the battery manufacturer	Battery capacity. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
23-4	AmpdcBatMax (see section 11.4)	refer to the data sheet provided by the battery manufacturer	Max. battery charging current. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).

No.	Parameter	Parameter value/unit	Parameter description
24-1	GenControl	Direct	Generator type (see section 8.5.3 "Generator Request" (Page 77))
40-2	Autostart	On	The Sunny Island 3324/4248 can restart automatically.
40-6	LoadShedding	Auto	Automatic control of the load shedding relay by the Sunny Island 3324/4248
40-8	SunnyBoys	Yes	Set this parameter to Yes when Sunny Boy inverters are connected to the system.

Other parameters can also be changed for this system. You will find a list of these parameters in section 17.2.2 "Adjustable System Parameters" (Page 134).

*Load shedding is an important feature for protecting batteries from quick aging caused by deep discharge. This is only activated when, over a longer period of time, more energy is consumed than is generated, or when the generator does not start (lack of fuel, generator fault).*



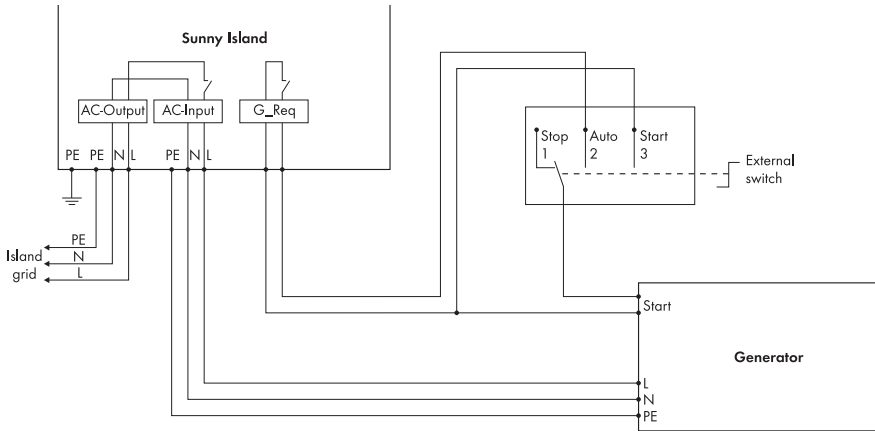
## 10.2.3 With Autostart and External Switch

If the generator is a 2-wire start type and the inverter and batteries are located a distance away from the loads to be supplied, then it can be advantageous to be able to operate the generator via a remote switch located nearby.

The user of the system can install a 3-position switch to place the generator in one of the following 3 modes of operation:

- Switch position 1 "Stop": The generator is manually stopped.
- Switch position 2 "Auto": The generator is automatically started and stopped by the Sunny Island 3324/4248.
- Switch position 3 "Start": Generator is immediately started. This is useful when short-term heavy loads are applied and must be supplied from the generator.

The following figure shows the wiring between the generator and the Sunny Island 3324/4248:



The following parameters must be set:

No.	Parameter	Parameter value/unit	Parameter description
23-2	BatType (see section 11.4)	refer to the data sheet provided by the battery manufacturer	The type of battery used in the system. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
23-3	AmpHoursBat (see section 11.4)	refer to the data sheet provided by the battery manufacturer	Battery capacity. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
23-4	AmpdcBatMax (see section 11.4)	refer to the data sheet provided by the battery manufacturer	Max. battery charging current. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
24-2	AmpacGenMax	0.85 * nominal generator current (see generator datasheet)	Max. generator output current (see section 8.5.2 "Setting the Output Current Limit" (Page 77)).
40-2	Autostart	On	The Sunny Island 3324/4248 can restart automatically.
40-6	LoadShedding	Auto	Automatic control of the load shedding relay by the Sunny Island 3324/4248
40-8	SunnyBoys	Yes	Set this parameter to Yes when Sunny Boy inverters are connected to the system.

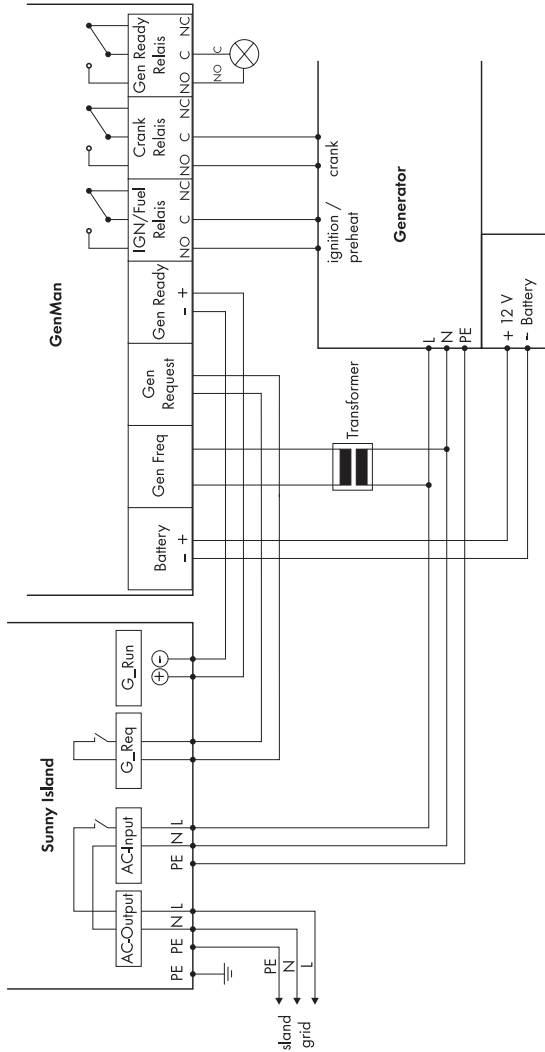
Other parameters can also be changed for this system. You will find a list of these parameters in section 17.2.2 "Adjustable System Parameters" (Page 134).



*Load shedding is an important feature for protecting batteries from quick aging caused by deep discharge. This is only activated when, over a longer period of time, more energy is consumed than is generated, or when the generator does not start (lack of fuel, generator fault).*

## 10.2.4 With GenMan

Autostart generators requiring more than a single control signal for starting and stopping can only be controlled by the Sunny Island 3324/4248 when you connect a GenMan (optional accessory) to the system. Connect the components as shown in the following figure:



The following parameters must be set:

No.	Parameter	Parameter value/unit	Parameter description
23-2	BatType (see section 11.4)	refer to the data sheet provided by the battery manufacturer	The type of battery used in the system. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
23-3	AmpHoursBat (see section 11.4)	refer to the data sheet provided by the battery manufacturer	Battery capacity. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
23-4	AmpdcBatMax (see section 11.4)	refer to the data sheet provided by the battery manufacturer	Max. battery charging current. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
24-1	GenControl	GenMan	Generator type (see section 8.5.3 "Generator Request" (Page 77))
24-2	AmpacGenMax	0.85 * nominal generator current (see generator datasheet)	Max. generator output current (see section 8.5.2 "Setting the Output Current Limit" (Page 77)).
40-2	Autostart	On	The Sunny Island 3324/4248 can restart automatically.
40-6	LoadShedding	Auto	Automatic control of the load shedding relay by the Sunny Island 3324/4248
40-8	SunnyBoys	Yes	Set this parameter to Yes when Sunny Boy inverters are connected to the system.

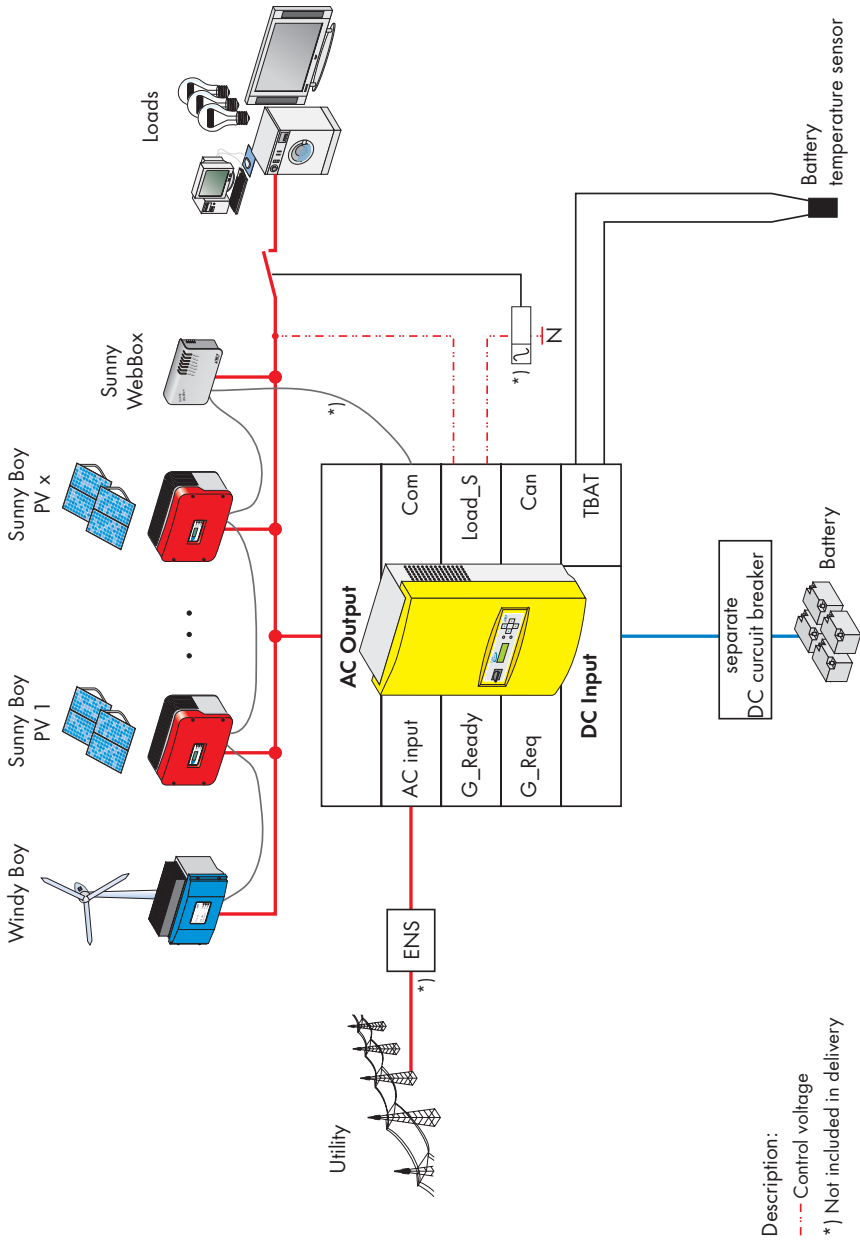
Other parameters can also be changed for this system. You will find a list of these parameters in section 17.2.2 "Adjustable System Parameters" (Page 134).

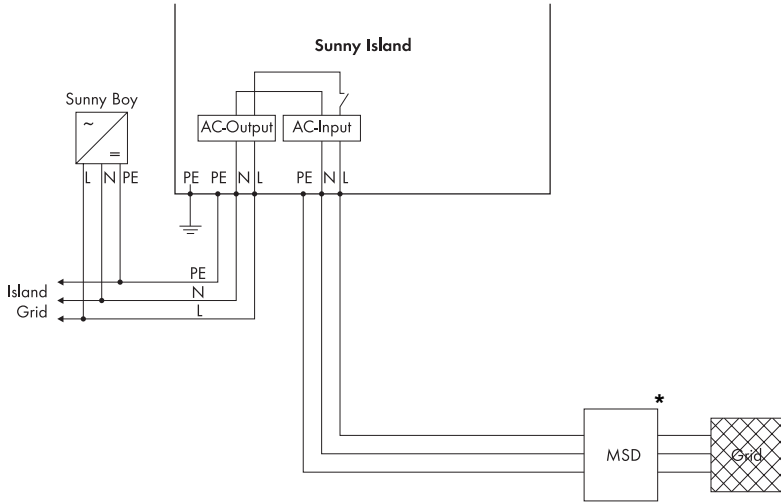


*Load shedding is an important feature for protecting batteries from quick aging caused by deep discharge. This is only activated when, over a longer period of time, more energy is consumed than is generated, or when the generator does not start (lack of fuel, generator fault).*



# 10.3 PV Grid Backup System





\* depending on national requirements  
MSD: see 21 "Glossary" (Page 153)

The following parameters must be set:

No.	Parameter	Parameter value/unit	Parameter description
23-2	BatType (see section 11.4)	refer to the data sheet provided by the battery manufacturer	The type of battery used in the system. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
23-3	AmpHoursBat (see section 11.4)	refer to the data sheet provided by the battery manufacturer	Battery capacity. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
23-4	AmpdcBatMax (see section 11.4)	refer to the data sheet provided by the battery manufacturer	Max. battery charging current. To be set when first commissioning the system (see section 8.2 "Initialization" (Page 66)).
24-2	AmpacGenMax	0.85 * max. grid current fuse	Max. generator output current (see section 8.5.2 "Setting the Output Current Limit" (Page 77)).
24-8	GridConnected <b>(Stby)*</b>	GridCharge (without Sunny Boy inverter); GridFeedPV (with Sunny Boy inverter)	Operating mode of the Sunny Island 3324/4248 when connected to the public grid (see section 8.4 "Operating with the Public Grid" (Page 72)).
40-2	Autostart	On	The Sunny Island 3324/4248 can restart automatically.
40-6	LoadShedding	Auto	Automatic control of the load shedding relay by the Sunny Island 3324/4248
40-8	SunnyBoys	Yes	Set this parameter to Yes when Sunny Boy inverters are connected to the system.

**(Stby)\*** = Parameters that can only be changed after you have placed the Sunny Island 3324/4248 in standby mode (see section 9.3 "Switching Off" (Page 85)).

Other parameters can also be changed for this system. You will find a list of these parameters in section 17.2.2 "Adjustable System Parameters" (Page 134).

*Load shedding is an important feature for protecting batteries from quick aging caused by deep discharge. This is only activated when, over a longer period of time, more energy is consumed than is generated, or when the generator does not start (lack of fuel, generator fault).*





# 11 Battery Management

The service life of batteries in off-grid applications can vary greatly. With proper handling the batteries can last as long as 15 years. The main causes of premature aging are incorrect charging and frequent deep discharge. For these reasons, the Sunny Island 3324/4248 has an intelligent charge control and reliable deep discharge protection. When these features are properly used, the battery service life can be greatly extended in comparison with simpler devices.

When first commissioning the inverter, selection of the correct battery type ("23-2 BatType" parameter), the correct battery capacity ("23-3 AmpHoursBat" parameter), and the maximum battery charging current ("23-4 AmpdcBatMax" parameter) automatically sets all other adjustable battery parameters to sensible values. Further optimization of the charge parameters should not be necessary. However, check the battery manufacturer's recommendations for any special requirements.

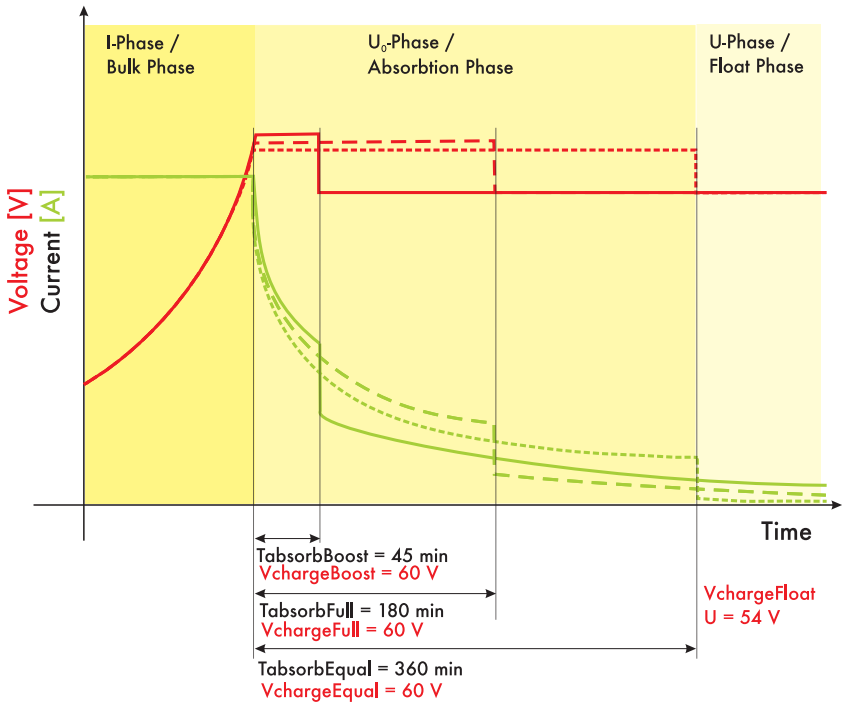
All types of lead acid batteries are supported. The battery management system draws a distinction between sealed lead acid batteries with liquid electrolyte (FLA, **Flooded Lead Acid**) and the sealed lead acid batteries with semi-solid electrolyte (VRLA, **Valve Regulated Lead Acid**). All Gel and Absorbed Glass Mat batteries belong to the last group (AGM, **Absorbent Glass MateSeparator**).

The battery capacity 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, then calculate this 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	C100/1.25
C10	C20/1.09
C10	C10
C10	C5/0.88
C10	C1/0.61

# 11.1 Charge Control

The Sunny Island 3324/4248 has a 3-level charge control using the IV<sub>0</sub>V process.



The I stands for the bulk phase. At this level, the charging is only limited by the defined maximum battery current ("23-4 AmpdcBatMax" parameter) or by the maximum generator current ("24-2 AmpacGenMax" parameter). During this phase the battery voltage increases as the batteries are charged.

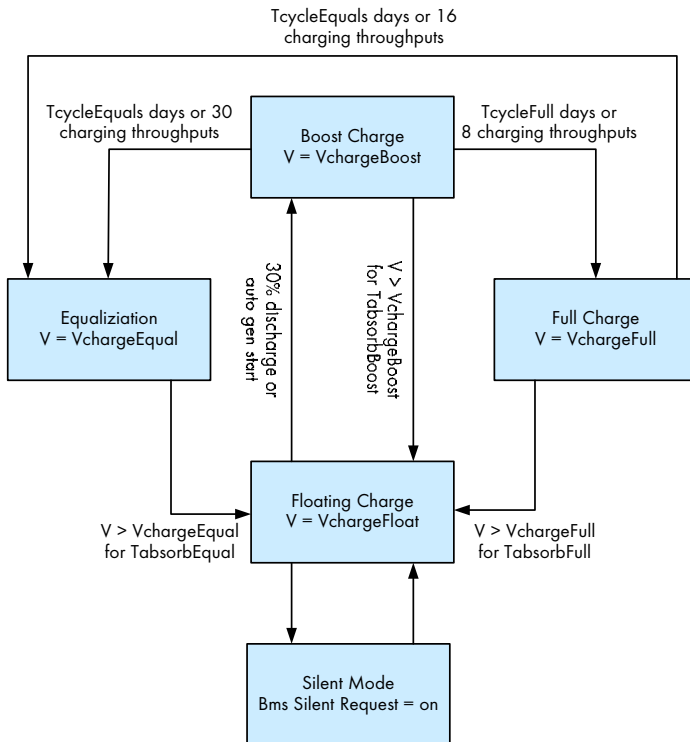
Once the battery voltage has reached the value defined for the second phase V<sub>0</sub> (parameters "23-7 VchargeBoost" or "23-9 VchargeEqual" or "23-11 VchargeFull"), then the constant voltage charging (absorption phase) begins. At this level, the battery voltage is maintained at a constant level, resulting in a continually decreasing battery current. The Sunny Island 3324/4248 remains in this phase for the period of time defined for this phase (parameters "23-6 TabsorbBoost" or "23-8 TabsorbEqual" or "23-10 TabsorbFull").

Once this phase is finished, the Sunny Island 3324/4248 enters the float charge that again provides constant current charging but at a greatly reduced charging voltage ("24-12 VchargeFloat" parameter). If charging is done from a generator, then this is stopped on entry to this phase, thus ending charging of the batteries at this point. The

Sunny Island 3324/4248 remains in this phase until either more than 30 % of the nominal capacity has been used (all discharges are summed) or the generator is automatically restarted (see section 8.5 "Operation with a Generator" (Page 74)).

This means that the battery charging voltage remains below the value set under the parameter "23-12 VchargeFloat" during this time, if (e.g.) further charging via Sunny Boys or a public grid is possible. The purpose of the float charge is to keep the batteries in a fully charged state without causing premature aging through overcharging.

For the second charging level  $V_0$ , the constant voltage charging (absorption phase) for a limited period of time, the Sunny Island 3324/4248 automatically chooses between three different voltages and charging times. These are the boost charge, full charge and equalizing charge. The following figure shows a process diagram of the charging process.



The Sunny Island 3324/4248 most often chooses the boost charge in order to bring the batteries to a reasonable level in a short period of time. This process is optimized to keep the generator run times as short as possible.

The Sunny Island 3324/4248 initiates a full charge every 14 days ("24-13 TcycleFull" parameter) or after every eight charging throughputs, with the aim of fully recharging the batteries to remove any negative effects caused by insufficient charging. Various studies have shown that regular full charging every two to four weeks can double the battery service life in off-grid systems.

A battery bank consists of many series-connected individual battery cells (2 V each), each of which having a slightly different behavior. Over time, this results in different charge levels of the individual cells. This can lead to premature failure of first single cells and then failure of the entire bank.

For this reason, the Sunny Island 3324/4248 automatically performs regular equalization charging every 60 days ("24-14 TcycleEqual" parameter) or after every 30 charging throughputs. The equalization charging uses controlled overcharging of the battery bank to ensure that even the weak cells are fully charged. Equalization charging leads to a further significant increase of battery service life by a factor of up to 50 %.

If equalization charging begins directly after or during a normal or full charge, then the time spent in the absorption phase of the previous charging process is taken into account in the subsequent charging process. The same applies to full charging.

If the batteries are charged by an external charger or charge controller and the criteria for a full charge or equalization charge are satisfied, then the Sunny Island 3324/4248 treats this as if it had performed the full charge or equalization charge itself.

In addition to automatically switching between the charging processes (normal, full, equalization and float charging) you can also manually set the Sunny Island 3324/4248 to use any charging process. This is done using the "40-1 BatChargeMode" parameter in the "Operation" menu.

The charging capability of lead acid batteries is heavily dependent on the battery temperature. For temperatures below 20°C the charging voltage must be slightly increased, and for temperatures above 20°C it must be slightly reduced. This is necessary to avoid overcharging and insufficient charging at all battery temperatures. For this reason, the Sunny Island 3324/4248 is equipped with automatic temperature compensation of the charging voltage. At temperatures below 20°C, the charging voltage is raised by 4 mV/°C and cell (96 mV/°C for a 48 V battery) and reduced by the same amount at temperatures above 20°C. The maximum permissible battery temperature is also monitored and the system switches off with a fault if the limit is exceeded ("23-18 T BatMax" parameter).



## 11.2 Silent Mode

When operating with the public grid, in addition to the float charge a silent mode exists. The main purpose of the silent mode is to save energy in backup systems, where the Sunny Island 3324/4248 spends most of the time in the float charge mode by switching from charging mode to silent mode.

Silent mode is automatically activated when the float charge charging power drawn from the grid and flowing into the batteries is less than 40 W. In this case, one can assume that the batteries are 100 % charged and that further charging is not required in the next few hours.

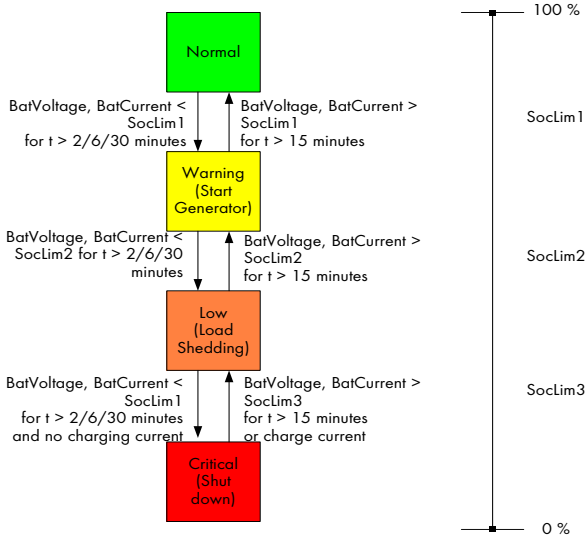
The float charging is automatically reactivated either after twelve hours or when the battery voltage sinks below 50.2 V. This ensures that the batteries are always fully charged, even in silent mode. If a power failure occurs during silent mode, the Sunny Island 3324/4248 switches to invert mode within a few milliseconds. The loads are supplied almost without interruption.

## 11.3 Deep Discharge Protection/Battery State

When deeply discharged, lead acid batteries age 100 times more quickly than when fully charged. Depending on the battery type, one speaks of deep discharge at charge levels of less than 40 %. Reliable protection from deep discharge is essential for a long battery service life. Pure monitoring of the battery voltage with fixed battery voltage limits is not really suitable for this task. Under heavy loads the system is switched off much too early, and under light loads it is switched off much too late. The fault rate can lie above 50 %. For this reason the Sunny Island 3324/4248 uses current-compensated voltage thresholds combined with time delays for deep discharge protection. The different levels, which can be easily set, are used to define the four state of the batteries (BatState):

- Normal operation (BatState = Normal)
- 1st level (BatState = Warning)
- 2nd level (BatState = Low)
- 3rd level (BatState = Critical)

The following figure shows the four battery states:



For deep discharge protection the Sunny Island 3324/4248 monitors both the voltage, the battery current and the time, allowing it to recognize deep discharge and also avoid false alarms and shutdowns.

As long as the Sunny Island 3324/4248 has not detected a deep discharge then it is in the battery state (BatState) Normal.

As soon as the first level of deep discharge is reached, the Sunny Island 3324/4248 switches to the Warning state. This can be used to start a generator.

If the batteries are further discharged despite the warning, then the battery state now jumps to the next deep discharge level Low. If desired, this level can be used to trigger the Sunny Island 3324/4248 relay contact to switch off all or some of the loads ("40-6 LoadShedding" parameter set to "On"; see section 8.6 "Automatic Load Shedding Setting" (Page 80)).

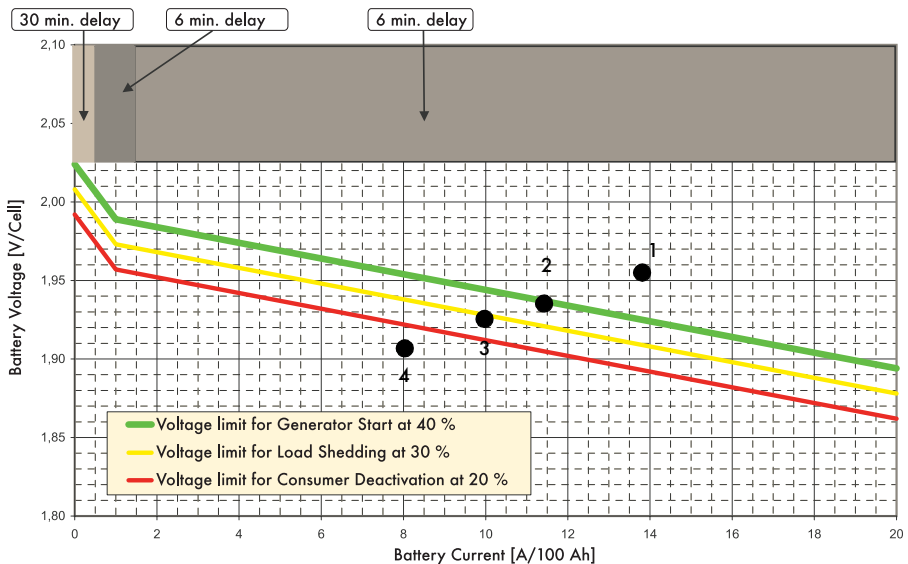
If this is not done and the batteries are still further discharged then the battery state reaches the last level Critical.

If no charging current flows into the batteries within five minutes of entering this state, then the Sunny Island 3324/4248 automatically switches to standby mode to avoid any further deep discharge.

If the battery voltage does not recover within 30 minutes, then the Sunny Island 3324/4248 switches completely off. A complete switch-off can be recognized by the fact that the DC circuit breaker is switched on but the display remains dark and no voltage is present at the AC output terminals.

Once fully switched off, the Sunny Island 3324/4248 can only be manually restarted (see section 9.5 "Restarting the Automatic Shutdown" (Page 86)).

For calculating the discharge mode limits, the current-voltage characteristics of lead acid batteries are reproduced within the Sunny Island 3324/4248. The characteristic curves calculated in this manner can be seen in the following figure.



You can use this graphic chart to determine the current state of your batteries:

1. Determine the voltage of your batteries (see "12-1 BattVoltage" parameter).
2. Read the battery current by selecting the "12-2 BatCurrent" parameter.
3. Reference this value ... A with respect to 100 Ah.



Battery current relative to 100 Ah:

Your batteries have a capacity of 300 Ah.

The "12-2 BatCurrent" parameter shows a value of 30 A.

In order to determine the state of your batteries using the graphic chart (see above) you must reference this battery current (30 A) with respect to 100 Ah.

$$\frac{30 \text{ A} * 100 \text{ Ah}}{300 \text{ Ah}} = 10 \text{ A}$$

The battery current shows a value of 10 A per 100 Ah.

4. You can now determine the state of your batteries from the intersection of the two lines in the coordinate system.

Here are four examples:



1: You measure 1.95 V, the battery current is 14 A/100 Ah: Your batteries are in Normal condition

2: You measure 1.93 V, the battery current is 11.5 A/100 Ah: Your batteries are in a "Warning" condition; the generator is started and loads are disconnected if discharge continues

3: You measure 1.92 V, the battery current is 10 A/100 Ah: Your batteries are in a Low condition, loads are disconnected and if discharge continues then the Sunny Island 3324/4248 enters standby mode

4: You measure 1.90 V, the battery current is 8 A/100 Ah: Your batteries are in a Critical condition; the Sunny Island 3324/4248 switches to standby mode

The Sunny Island 3324/4248 constantly compares the currently measured current/voltage values with the characteristic curves. In order to reach a change in the battery state, the values must remain below the characteristic curve for a certain period of time. If only a very small discharge current is flowing (< 0.5 A/100 Ah), then the jump to the next battery state is delayed for 30 minutes. At a discharge current of 0.5 A/100 Ah to 2 A/100 Ah the time delay is only six minutes and at a discharge current of > 2 A/100 Ah the measured current-voltage value must lie below the characteristic curve for two minutes.

These delays are important to avoid faulty switching of charge states when switching loads on and off. For the jumps back to a higher battery state, there is a voltage hysteresis of 0.05 V/cell and an additional time hysteresis of 15 minutes.

The height of the three characteristic curves can be easily set using the parameters "24-15 SocLim1", "24-16 SocLim2" and "24-17 SocLim3". The charge level values set here are automatically converted into characteristic curves.

The conversion is done using the following formula:

$$V_0 = 1.96 + 0.16 * \text{SocLim}$$

$V_0$  : Single cell open-circuit voltage (battery current = 0)

Since different types of battery also have slightly different current-voltage characteristic curves, the state of charge (SOC) values set here may differ by up to 10 % from a state of charge (SOC) measured using ampere-hour balancing.

To achieve a sensible assignment of the state of charge (SOC) limits, the Sunny Island 3324/4248 firmware assigns your entered values in the following manner:

- Highest value = SocLim1
- Lowest value = SocLim3
- Any other value = SocLim2

If you enter 30 % for SocLim2 and 50 % for SocLim3, the Sunny Island 3324/4248 firmware automatically corrects this and exchanges the values.



## 11.4 Exchanging the Batteries

If you wish to exchange your batteries with new batteries, then the parameters

- "23-2 BatType"
- "23-3 AmpHoursBat"
- "23-4 AmpdcBatMax"
- "23-5 NewBattery"

must be reset to new values, with the inverter in standby mode. Proceed as follows:

1. Set parameter 23-5 to "Reset"
2. The Sunny Island 3324/4248 restarts
3. The message "To init system press <ENTER>" is displayed.
4. Press <ENTER>.

To init system  
press <ENTER>

Set the parameters 23-2, 23-3 and 23-4, one after the other. The exact sequence is described in section 8.2 "Initialization" (S. 66), points 8–21.

5. Now set the battery type ("23-2 BatType" parameter).

```
BatType      #23
             URLA ↓
```

6. Press the arrow key (↓) to access the parameter for setting the battery capacity in ampere hours ("23-3 AmpHoursBat" parameter).

```
AmpHoursBat  #23
             100 Ah ↓
```

7. Press the arrow key (↓) to reach the parameter for setting the maximum battery charging current ("23-4 AmpdcBatMax" parameter) (see section 8.1 "Preparation" (Page 63)).

```
AmpdcBatMax  #23
             10 A ↓
```

8. Press <ESC> to end the initialization process.
9. The message "To start press <ENTER>" is displayed. The Sunny Island 3324/4248 is now ready to start.

```
To start
press <ENTER>
```

Parameter information is also provided in section 17.2.2 "Adjustable System Parameters" (Page 134).

# 12 Generator

The Sunny Island 3324/4248 is suitable for directly controlling remote-controlled generators requiring a single start/stop signal. Generators that must be manually started can also be used. The settings required for integrating a generator into your system can be found in section 8.5 "Operation with a Generator" (S. 74). The wiring required to connect the Sunny Island 3324/4248 to different generators can be found in section 10 "System Examples" (Page 87).

## 12.1 Load-dependent Generator Request

The load-dependent generator request allows occasional or planned times of high consumption in the stand-alone grid to be directly supplied by the generator and to protect the Sunny Island 3324/4248 against overload. Load-dependent generator requests are only activated when the "24-8 GridConnected" parameter is set to "GridNone" and the "24-12 PGenActiv" parameter is set to "ON".

As long as the level of generator current allows this, the Sunny Island 3324/4248 will also use this to charge the batteries, even when it has requested the generator for the purposes of feeding a heavy load (cf. section 8.5.2 "Setting the Output Current Limit" (Page 77)).

The following five parameters can be set under the menu branch "Load-dependent generator request":

*When making settings for load-dependent generator requests, pay attention to the maximum generator current defined under the "24-2 AmpacGenMax" parameter (see section 8.5.2 "Setting the Output Current Limit" (Page 77)). If the power defined for load-dependent generator requests lies above the limit defined in "24-2 AmpacGenMax", then the Sunny Island 3324/4248 will start the generator but will not feed the stand-alone grid.*



### 1. "24-12 PGenActiv" Parameter

If this parameter is set to "On", then load-dependent generator requests and temperature-dependent generator requests are activated (see section 12.2 "Temperature-dependent Generator Request" (S. 113)).

### 2. "24-13 PGenTave" Parameter

This parameter defines the average time for power calculations determining whether the generator is to be switched on or off.

### 3. "24-14 PGenTRun" Parameter

The "24-14 PGenTRun" parameter defines the minimum run time of the generator, after it has been started as the result of a load-dependent or temperature-dependent generator request. Whether the generator stops after the minimum run time or continues to run, depends on the average power, the parameter setting "24-16 PGenOff" and the average time (see "24-13 PGenTAve" parameter). If the average power lies above the value of the "4-16 PGenOff" parameter then the generator continues to run until the power drops below this value.

### 4. "24-15 PGenOn" Parameter

The "24-15 PGenOn" parameter defines the average power that the Sunny Island 3324/4248 must deliver to the stand-alone grid before the generator is started for the time specified in "24-13 PGenTAve".

### 5. "24-16 PGenOff" Parameter

The "24-16 PGenOff" parameter defines the average power at which the generator is switched off. If the load on the stand-alone grid falls below this value then the generator request is revoked. The time defined in "24-13 PGenTAve" is also taken into account here.

The "24-16 PGenOff" parameter can only be defined as a percent value of the "24-15 PGenON" parameter.



With the standard settings for "24-15 PGenOn" and "24-16 PGenOff", a setting of 80 % for "24-16 PGenOff" corresponds to a power of

$$3500 \text{ W} * 80/100 = 2800 \text{ W}$$



## 12.2 Temperature-dependent Generator Request

Activation of load-dependent generator requests (see above - "24-12 PGenActiv" parameter set to "ON") also switches on temperature-dependent generator requests. The operating temperature of the Sunny Island 3324/4248 is used as the measurement value.

When the Sunny Island 3324/4248 is operated under heavy loads for an extended period of time, it may switch off to avoid damage through overheating. In this case, a complete dropout of the stand-alone grid will occur and the loads will no longer be supplied.

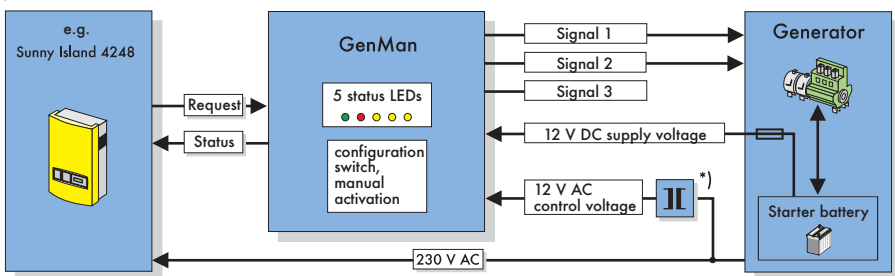
The "Temperature-dependent generator request" function prevents this grid dropout. Before the Sunny Island 3324/4248 must switch off due to overheating, it can request a generator start and switches the stand-alone grid to the generator. The Sunny Island 3324/4248 can now charge the batteries, as long as the temperature allows this. The generator provides the stand-alone grid and provides the loads with electrical energy.

The minimum run time and the switch-off conditions for the generator in this menu match the values for load-dependent generator requests (see section 12.1 "Load-dependent Generator Request" (Page 111)).

## 12.3 GenMan

### Complex Generator Start: GenMan

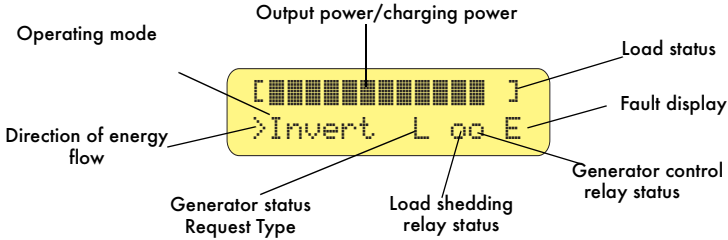
The optional GenMan (SMA order number: SI GenMan) allows the Sunny Island 3324/4248 to control generators requiring more than a simple start/stop signal. You can purchase the GenMan from your local dealer. More information on this SMA product can be found in the GenMan operating manual.



<sup>\*)</sup> Transformer included in delivery GenMan

The connection of a generator using GenMan and the Sunny Island 3324/4248 is described in more detail in section 10 "System Examples" (Page 87).

## 12.4 Display Message



The following table describes the status of the generator voltage and generator frequency, as they are shown in the display:

Display	Description
*	The generator voltage and frequency lie within the defined limits (see Generator Settings: parameters 24-4 to 24-8, installer level).
?	The generator voltage and/or frequency lie outside the defined limits (see Generator Settings: parameters 24-4 to 24-8, installer level). The Sunny Island 3324/4248 will not connect the generator to the stand-alone grid while this situation exists.
!	The maximum permissible generator reverse power ("24-11 PGenReverse" parameter, installer level) has been exceeded. The Sunny Island 3324/4248 has removed the generator from the stand-alone grid. The generator cannot be reconnected to the stand-alone grid for a period of 20 minutes. This lockout can be removed by setting the "24-3 GenOperation" parameter to "Release".

The following table provides information as to the reasons why the generator is being requested. One of the following six letters will appear in the display:

Display	Description
B(attery)	The generator has been requested as a result of the battery management system.
H(eat)	The generator has been started as a result of a temperature dependent request.
L(oad)	The generator has been started as a result of a load dependent request.
R(emote)	<p>The generator was started for one of the following reasons:</p> <ul style="list-style-type: none"> <li>• The user directly started the generator.</li> <li>• The user switched the (optional) GenMan switch to "ON".</li> <li>• The GenMan automatically started the generator due to a too low starter battery voltage.</li> <li>• The Sunny Island 3324/4248 automatically switches to an external voltage source (displayed in backup systems, as long as the public grid is present).</li> </ul> <p>In all three situations the Sunny Island 3324/4248 CANNOT start or stop the generator but may charge the batteries if required.</p>
S(tart)	The generator is requested by the user manually setting the generator request in the Sunny Island 3324/4248 from "Auto" to "Start". The generator is then NO LONGER controlled or switched off by the Sunny Island 3324/4248.
T(ime)	The generator was started for one hour using the "Run 1 h" setting in the Sunny Island 3324/4248. Once this time has passed, the Sunny Island 3324/4248 automatically switches off the generator.

The generator status and the reason for the request are shown (alternating) in the "Generator status" in the display.

If (e.g.) the display changes every 2 seconds from "\*" to "B" then this means that the generator voltage and frequency lie within the specified limits and that the generator was requested by the battery management system.



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



## 13 Connecting Sunny Boy Inverters

The following section provides information for connecting and configuring the Sunny Boy inverter in stand-alone grid systems. You can use the following products with a Sunny Island 3324/4248:

- 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 6000/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
- Hydro-Boy inverters (for feeding in from fuel cell systems)

### 13.1 Sunny Boy Wiring

**Ensure that the entire connection area is free of voltage before installing the Sunny Boy inverter. Please pay attention to section 3 "Safety Instructions" (S. 19).**



1. Connect the Sunny Boy inverter to the grid in accordance with the Sunny Boy installation manual.
2. Wire the AC sub-distribution unit to the AC output terminals of the Sunny Island 3324/4248.
3. Set the Sunny Island 3324/4248 to use Sunny Boy inverters by setting the "40-8 SunnyBoys" parameter to "YES".
4. You must also set some parameters in the Sunny Boy to suit a stand-alone grid so that it works properly together with the Sunny Island 3324/4248. The required values for these settings are described in the following section 13.2 "Setting Sunny Boy Parameters" (Page 118).

*When using Sunny Boy inverters together with the Sunny Island 3324/4248, plan to use batteries with a minimum capacity of 100 Ah per 1,000 W installed PV power.*



For a PV generator with an installed capacity of 5 kW<sub>p</sub>, combined with two Sunny Boy inverters (2,500 W each), you need a battery capacity of at least 500 Ah.



## 13.2 Setting Sunny Boy Parameters



**If you use the Sunny Boys with offgrid parameters in the public utility grid, the inverter no longer meets the requirements of DIN VDE 0126-1-1. Please observe all regionally relevant regulations or 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 13.3 "Frequency Shift Power Control (FSPC)" (Page 120)).

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 Boy hotline (telephone +49 561 9522 499), 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 (see section 2.6 "Accessories (optional)" (S. 17))*
- *Sunny Boy Control*
- *Sunny WebBox*

*Section 15 "Communication Interface" (Page 123) provides comprehensive information on these variants and the components they require.*

1. Establish communication with the Sunny Boy.
2. Go to the parameter settings that are relevant to the type of communication system.
3. Set the parameter "**Default**" to "**Off-Grid**" (stand-alone grid).

The "Off-Grid" parameter setting automatically sets the following Sunny Boy parameters to the following values:

No	Parameter	Unit	Value
1	I-NiTest Testcurrent (UL version)	mA	Off (MSD = 0)

No	Parameter	Unit	Value
2	Uac-Min Vac.Min (UL version)	V	180 107 (UL version)
3	Uac-Max Vac.Max (UL version)	V	260 130 (UL version)
4	Fac-delta-	Hz	- 4.5 (starting from base frequency $f_0$ )
5	Fac-max+	Hz	+ 4.5 (starting from base frequency $f_0$ )
6	dFac-Max	Hz/s	4
7	Fac-start delta	Hz	1 (starting from base frequency $f_0$ )
8	Fac-Limit delta	Hz	2 (starting from base frequency $f_0$ )

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

4. If Sunny Boy inverters are connected to a communications bus, then the "40-3 BaudRate" parameter of the Sunny Island 3324/4248 must be set to "1200".
5. In the Sunny Island 3324/4248, the power adjustment via frequency - FSPC (Frequency Shift Power Control) is activated using the "40-8 SunnyBoys" parameter. Check that the parameter is set to "YES".

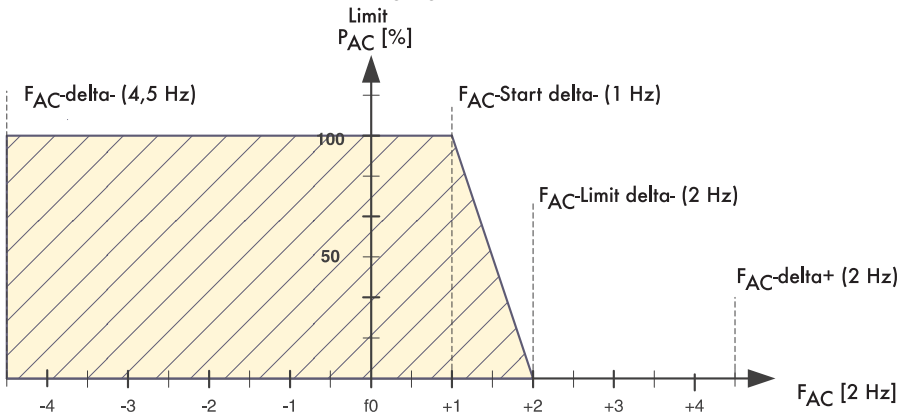
### 13.3 Frequency Shift Power Control (FSPC)

This section describes how the power adjustment via frequency "Frequency Shift Power Control (FSPC)" functions.

If Sunny Boy inverters are connected to the AC output side of a stand-alone grid, the Sunny Island 3324/4248 must be able to limit their output power. This situation can occur when (e.g.) the Sunny Island 3324/4248 batteries are 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 batteries, the Sunny Island 3324/4248 recognizes this situation and changes the frequency of 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 frequency increase is 5 Hz maximum, starting at the nominal frequency  $f_0$ .

When FSPC is activated and the generator is operating in the stand-alone grid, the generator determines the frequency and the Sunny Boys react to changes in the generator frequency. Generators normally 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.



## 14 Additional Functions

### 14.1 Autostart

The "40-2 Autostart" parameter allows the Sunny Island 3324/4248 to restart automatically after a fault. If this value is set to "Off" (factory setting), the Sunny Island 3324/4248 must always be manually started.

### 14.2 ParameterSet

The ParameterSet setting (40-4 parameter) allows the current parameter settings to be saved or stored parameters to be loaded.

With the "None" setting you are operating the Sunny Island 3324/4248 with the current settings.

Select "Save" to save the current settings.

*If 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 wish to reset the inverter back to the previous settings.*



Select "Load" to load stored parameter settings into the Sunny Island 3324/4248.

### 14.3 Offset Calibration

If the "40-9 Offset\_Calib" parameter is set to "Start", the Sunny Island 3324/4248 begins an offset calibration. This is necessary when the "OffsCalib" fault message is shown in the display. This parameter is only possible in standby.

*As soon as the offset calibration has been successfully completed, the "40-9 Offset\_Calib" parameter automatically resets to the value "Stop".*



## 14.4 Automatic Frequency Adjustment

Clocks that depend on the stability of the grid frequency for their accuracy, become increasingly inaccurate when subjected to constant frequency deviations. Frequency fluctuations, i.e. deviations from the nominal frequency (50 Hz) often occur in (e.g.) stand-alone grids that work with a generator.

The "**A**utomatic **F**requency **A**djustment (AFRA)" function of the Sunny Island 3324/4248 allows the use of grid-coupled clocks in these types of stand-alone systems.

By counting all positive zero-crossing points (full waves) at the inverter output of the Sunny Island 3324/4248, in both battery charging operation and inverter operation, the inverter constantly measures the actual frequency. These values are compared with the desired frequency values every twelve hours. If a time difference of five seconds or more exists then a frequency increase or -decrease is activated. This frequency adjustment remains active if the time difference is more than one second.



*AFRA is only activated when the nominal grid frequency of the Sunny Island 3324/4248 is set to 50 Hz.*

# 15 Communication Interface

**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](http://www.SMA.de).

The following communication interfaces can be built into the Sunny Island 3324/4248:

- RS232
- RS485

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

- Information on the type of cables required
- Which of the inverter's connections are used
- Whether or not the communications cables must be terminated
- Whether the PE needs to be connected to the cable shield

The next pages will describe the following:

- The housing feed-throughs for the communication interface
- The permissible cable routes in the Sunny Island 3324/4248
- The location of the sockets for connection of the communication wires
- The location of the interface port

## 15.1 Connection of the Interface



**When opening the Sunny Island 3324/4248, follow all the safety instructions as described in section 3.2 "Potential Hazards" (Page 20).**



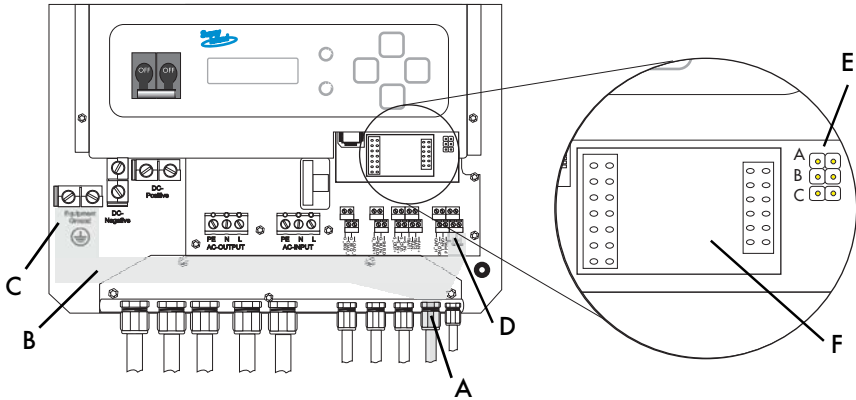
*Electrostatic discharges are an acute danger to the Sunny Island 3324/4248 and to the communication interface. Ground yourself by touching PE before removing the communication interface from the packaging, and before touching any components within the Sunny Island 3324/4248.*



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

1. Open the Sunny Island 3324/4248 as described in section 6.1 "Removing the Cover" (Page 55).
2. Insert the communications cable through the metric-thread cable screw connection.
3. Thread the cable through the cable feed-throughs (A) on the Sunny Island 3324/4248.
4. Now firmly tighten the metric-thread cable screw connection clamp on the Sunny Island 3324/4248.
5. Sheathe the cable inside the Sunny Island 3324/4248 using the silicon tube provided. The silicon tube is imperative for safety reasons. Without this silicon tube, the interface is not to be operated.
6. Lay the cables in the area (B), as shown in the following figure.
7. Ground the cable shield at the PE connector (C) if the terminal connection diagram of the communication device indicates this as necessary.
8. Connect the communication wires to the screw terminal strip (D) as described in the terminal connection diagram of the communication device. Note down the connector color coding for the respective pin numbers. Connecting the receiver incorrectly can cause the devices to be damaged.
  - Pin 2 color: \_\_\_\_\_
  - Pin 3 color: \_\_\_\_\_
  - Pin 5 color: \_\_\_\_\_
  - Pin 7 color: \_\_\_\_\_

9. Connect the jumpers (E) if the terminal connection diagram of the communications device indicates this as necessary. The table in the following section 15.2 "Jumper Functions" (Page 125) provides an overview of the jumper functions.
10. Plug the communication interface into the board (F).
11. Close the Sunny Island 3324/4248 as described in section 6.2 "Installing the Cover" (Page 56).



- A Housing feed-through in the base of the Sunny Island 3324/4248
- B Cable route (grey area)
- C PE connector
- D Screw terminals for connection of the communication cables
- E Jumper slot
- F Interface port

## 15.2 Jumper Functions

	Jumper A	Jumper B	Jumper C
RS232	-	-	-
RS485	termination	bias 1	bias 2

A detailed description of the jumper functions can be found in the communication device manual.



## 15.3 Baud Rate

The Sunny Island 3324/4248 can communicate with external devices at a range of different baud rates (1200 to 19200 bps). The "40-3 BaudRate" parameter must be set appropriately for this.



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

The Sunny Island 3324/4248 uses the SMA-Net protocol for communication.

## 16 Updating Firmware

An update of the Sunny Island 3324/4248 firmware can be easily done at any time by exchanging the Flash EEPROM on the controller board. The full name of these electronic storage components is Flash-EEPROM but these are described as EPROM in the following instructions.

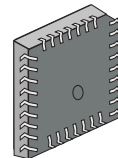
**The Sunny Island 3324/4248 works with high voltages that present particular personal danger. All work on the Sunny Island 3324/4248, especially after opening the housing, may only be carried out by suitably qualified personnel (electricians).**



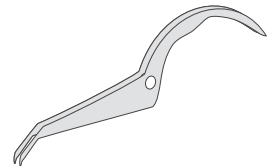
**Work on the Sunny Island 3324/4248 may only be carried out when the inverter is disconnected and free of voltage! Follow all safety instruction described in section 3 "Safety Instructions" (Page 19).**

### Requirements for Replacing the EPROM

- A Phillips screwdriver
- EPROM with new firmware, labeled with "SI-EL Vx.xx" (provided, x.xx identifies the firmware version)



- A PLCC tool (provided) for removing the old EPROM



All orientation information in these instructions ("top", "bottom", "left", "right") relate to the front view of a Sunny Island 3324/4248 properly installed on the wall.

**The supplied EPROM is a component that can be destroyed by electrostatic discharges. Only remove the component from the protective packaging immediately before installing it and observe the following instructions.**



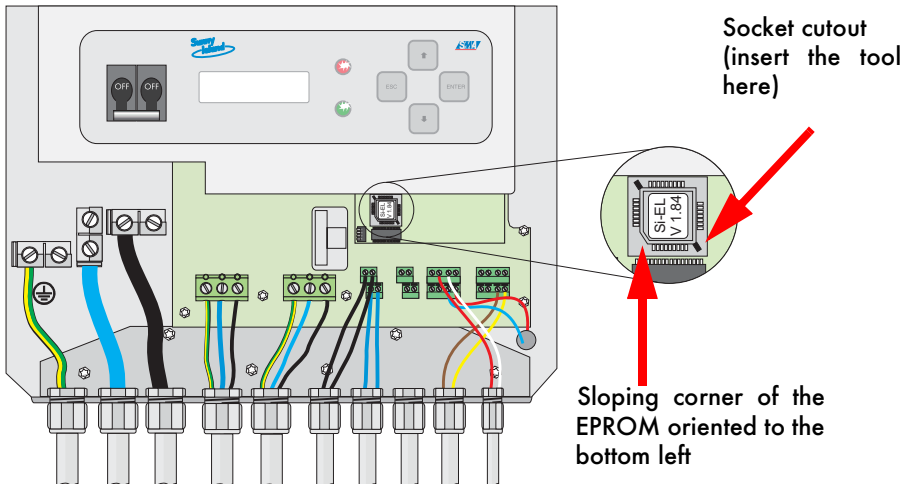
## Replacing the EPROM

Follow the steps in the order below:



Take note of all parameter settings you have made before replacing the EPROM.

1. Stop the Sunny Island 3324/4248 and switch it off as described in section 9.3 "Switching Off" (Page 85) and section 9.3 "Switching Off" (Page 85).
2. Open the housing of the Sunny Island 3324/4248 (see section 6.1 "Removing the Cover" (Page 55)).
3. The EPROM is located in the lower right area of the inverter, in the smaller group of raised components. This exact position can be seen in the following figure:



4. Briefly touch the bare metal of the Sunny Island 3324/4248 housing (for electrostatic discharge).
5. Use the PLCC tool to remove the old EPROM, by carefully inserting the hooked end of the tool into the right-hand cutout in the socket, thus allowing you to lever the EPROM out of the socket at this corner. Carefully slide the tool under the EPROM until you can remove the component from the socket.
6. Remove the new EPROM provided from the protective packaging.



7. Carefully press the new EPROM into the socket, with the angled corner at the bottom left of the socket. The side of the component with the label must be visible.
8. Remove all tools from the Sunny Island 3324/4248.
9. Close the housing cover once more (see section 6.2 "Installing the Cover" (Page 56)).

For the subsequent (re)start, the Sunny Island 3324/4248 requires a few seconds longer than usual for the initialization process. Switch on the Sunny Island 3324/4248 as described in section 8.2 "Initialization" (Page 66).

*Once the Sunny Island 3324/4248 has been switched on again, the measuring channels are recalibrated if necessary. Make sure that the AC input and AC output terminals of the inverter are free of voltage. Once calibration has been successfully completed, the message "Offscalib" appears in the display.*



The following messages appear in the display:

- SMA Logo
  - Updating DSP (the progress bar shows the progress of the update)
  - Update complete
  - SMA Logo
  - To Init System Press <Enter>
10. Check the parameter settings required for first commissioning (see section 8.2 "Initialization" (Page 66)) and set the correct values if necessary.
  11. Press <ESC> to leave the menu.
  12. The Sunny Island 3324/4248 is ready for operation. The message "To start press <ENTER>" is displayed.

To start  
press <ENTER>

# 17 Menu Structure and Parameter Lists

## 17.1 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

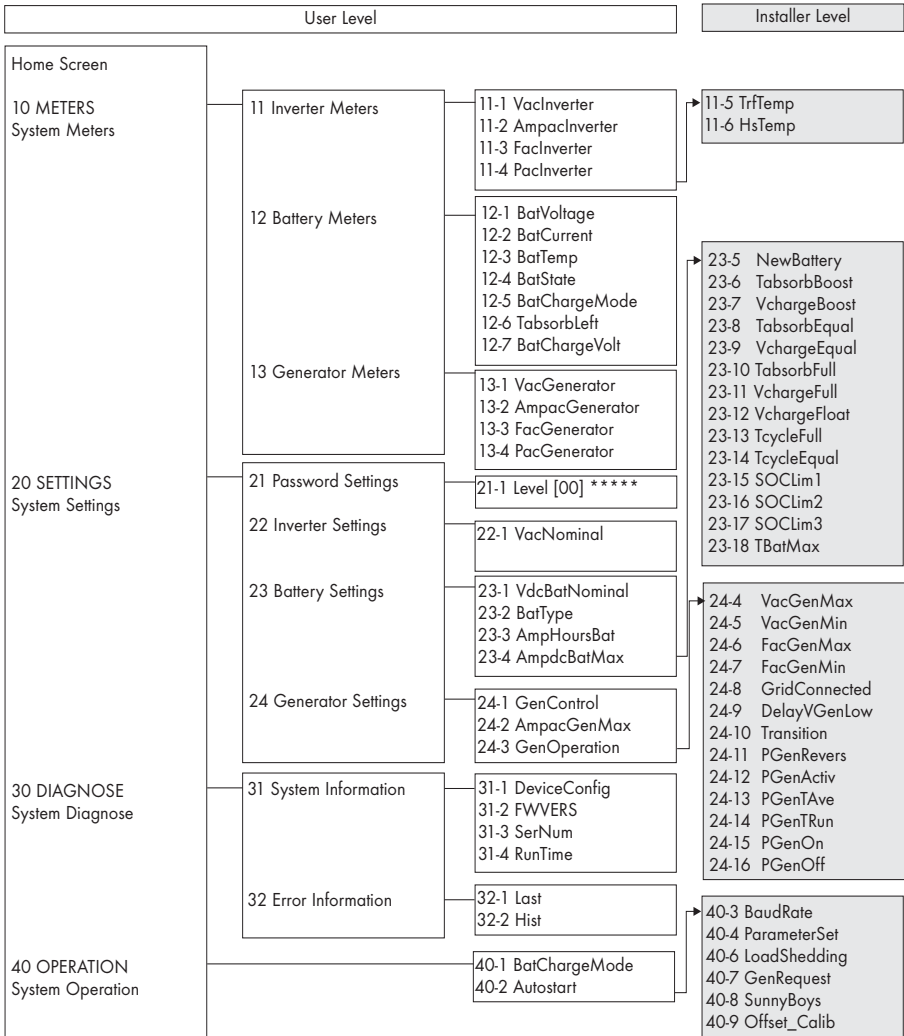
The menus allowing system parameters to be changed can only be reached after entering the installer password (see section 8.3 "Password Entry" (Page 69)). Menus protected in this manner are shown with a grey background in the following figure (Installer Level). Menus shown with a white background are on the User Level and can be accessed without a password. These menu parameters are used to monitor and control the Sunny Island 3324/4248 in normal daily operation.

The main menu structure is divided into four different groups, each of which having two subsequent submenus.

1. **Meters:** The "10-Meters" main menu has the following submenus: Sunny Island 3324/4248 measurements ("11-Inverter Meters"), battery measurements ("12-Battery Meters") and generator measurements ("13-Generator Meters"). Individual measurement values can be seen in the next two menu levels.
2. **Settings:** Under the main menu "20-Settings" are four different submenus allowing various system parameters to be viewed and changed. This affects password entry ("21-Password Settings") and all system parameters relating to the Sunny Island 3324/4248 ("22-Inverter Settings"), the batteries ("23-Battery Settings") and the generator ("24-Generator Settings").
3. **Diagnose:** Under the main menu "30-Diagnose" are two different submenus allowing various diagnostic parameters to be viewed. These are system data ("31-System Information"), and fault messages ("32-Error Information").
4. **Operation:** The main menu "40-Operation" allows viewing and changing of the operating parameters (e.g. "40-8 SunnyBoys").

Please consult section 7.2 "Changing Parameters" (Page 58) for information describing how to set the individual parameters.

The following diagram provides an overview of the menu structure.



## 17.2 Menus Requiring the Installer Password

The cells with a grey background in the following tables show all menu items that can only be changed after entering the installer password. Only parameters in the menu branches "20-Settings" and "40-Operation" can be changed. The other values are only displayed in the Sunny Island 3324/4248 display. Proceed carefully when changing parameter settings, because incorrect settings can lead to undesirable operation of the inverter.



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



The "40-4 ParameterSet" parameter allows all the current parameter settings to be saved. 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 use the "40-4 ParameterSet" to load or discard the stored values in the Sunny Island 3324/4248 (see section 17.2.4 "Operation (Operation)" (Page 141)).

### 17.2.1 Displayed Measurement Values

#### Inverter Meters

No.	Name	Range/ unit	Default	Description
11-1	VacInverter	0 to 300 VAC	N/A	Inverter output voltage
11-2	AmpacInverter	-70 to +70 AAC	N/A	Inverter output current
11-3	FaInverter	0 to 70 Hz	N/A	Inverter frequency
11-4	PaInverter	-10,000 to +10,000 W	N/A	Inverter AC output power
11-5	TrfTemp	- °C	N/A	Transformer temperature
11-6	HsTemp	- °C	N/A	Heat sink temperature

## Battery Meters

No.	Name	Range/unit	Default	Description
12-1	BatVoltage	0 to 80 VDC	N/A	Battery voltage
12-2	BatCurrent	-200 to +200 ADC	N/A	Battery current
12-3	BatTemp	-40 to +200 °C	N/A	Battery temperature
12-4	BatState	Normal Warning Low Critical	N/A	Battery state
12-5	BatChargeMode	Boost Full Float Equalize	N/A	Battery charging process
12-6	TabsorbLeft	0 to max min	N/A	An absorption period is assigned to every charging process. The Sunny Island 3324/4248 must keep the generator running during this time, even when this is only partially loaded. The value of "TabsorbLeft" shows the time remaining for the absorption phase.
12-7	BatChargeVolt	SI 4248 44 to 62.4 VDC		Desired value of the battery charging voltage
		SI 3324 27 to 31.2 VDC		

## Generator Meters

No.	Name	Range/unit	Default	Description
13-1	VacGenerator	0 to 260 VAC	N/A	Inverter input voltage (AC input)
13-2	AmpacGenerat	-60 to +60 AAC	N/A	Inverter input current (AC input)
13-3	FacGenerator	0 to 70 Hz	N/A	Inverter input frequency (AC input)
13-4	PacGenerator	-20 to +20 kWAC	N/A	Inverter input power (AC input)

## 17.2.2 Adjustable System Parameters



Only change parameters marked with **(Stby)**, when the Sunny Island 3324/4248 is in standby mode. Appropriately set operational data can take effect as soon as the "Enter" key is pressed. Incorrect values in these parameters can probably not be corrected quickly enough to avoid potential damage to your system.

All parameters marked with a **(B)** can be set while the system is running.

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 15 "Communication Interface" (Page 123)).

### Inverter Settings

No.	Name	Range/ unit	Default	Description
22-1	VacNominal <b>(B)</b>	200 to 253 VAC	230	Setting of the inverter nominal output voltage

### Battery Settings

No.	Name	Range/ unit	Default	Description
23-1	VdcBatNominal (see section 11.4)	SI4248 42 to 48 VDC	48	Nominal battery voltage
		SI3324 20 to 24 VDC	24	
23-2	BatType (see section 11.4)	VRLA FLA	VRLA	The type of battery used in the system. <b>VRLA</b> = Gel/Absorbed Glass Mat battery <b>FLA</b> = battery with liquid electrolyte These parameters must be set when first commissioning the system. After this, the value can only be changed after you have set the "23-5 New Battery" parameter to the value "Reset". The Sunny Island 3324/4248 will then again run through the INIT phase (see section 8.2 "Initialization" (Page 66)).
23-3	AmpHoursBat (see section 11.4)	100 to 6000 Ah	100	Battery capacity. These parameters must be set when first commissioning the system. After this, the value can only be changed after you have set the "23-5 New Battery" parameter to the value "Reset". The Sunny Island 3324/4248 will then again run through the INIT phase (see section 8.2 "Initialization" (Page 66)).
23-4	AmpdcBatMax <b>(B)</b>	SI4248 0 to 100 ADC	10	Maximum battery charging current
		SI3324 0 to 140 ADC	10	

No.	Name	Range/ unit	Default	Description
23-5	NewBattery (see section 11.4) <b>(Stby)</b>	– Reset	–	Reset the battery data stored in the inverter. This parameter can only be set when the inverter is in standby mode (see section 9.3 "Switching Off" (Page 85)). This parameter should only be set when the batteries have been replaced. The selection of "Reset" causes the Sunny Island 3324/4248 to restart. This is intentional.
23-6	TabsorbBoost <b>(B)</b>	1 to 600 min	60 (VRLA), 45 (FLA)	Absorption period for boost charging
23-7	VchargeBoost <b>(B)</b>	SI4248 44 to 62.4 VDC	56,8 (VRLA), 60 (FLA)	Desired voltage for boost charging
		SI3324 27 to 31.2 VDC	28,8 (VRLA), 30 (FLA)	
23-8	TabsorbEqual <b>(B)</b>	1 to 1200 min	360	Absorption period for equalization charge
23-9	VchargeEqual <b>(B)</b>	SI4248 44 to 62.4 VDC	56,8 (VRLA), 60 (FLA)	Desired voltage for equalization charge
		SI3324 27 to 31.2 VDC	28,8 (VRLA), 30 (FLA)	
23-10	TabsorbFull <b>(B)</b>	1 to 1200 min	180 (VRLA) 180 (FLA)	Absorption period for full charge
23-11	VchargeFull <b>(B)</b>	SI4248 44 to 62.4 VDC	56,8 (VRLA), 60 (FLA)	Desired voltage for full charge
		SI3324 27 to 31.2 VDC	28,8 (VRLA), 30 (FLA)	
23-12	VchargeFloat <b>(B)</b>	SI4248 44 to 62.4 VDC	54 (VRLA and FLA)	Desired voltage for float charge
		SI3324 27 to 31.2 VDC	27 (VRLA and FLA)	

No.	Name	Range/ unit	Default	Description
23-13	TcycleFull (B)	1 to 180 days	14	Number of days after which the next full charge will occur (see also section 11.1 "Charge Control" (Page 102))
23-14	TcycleEqual (B)	7 to 365 days	60	Number of days after which the next equalization charge will occur (see also section 11.1 "Charge Control" (Page 102))
23-15	SOCLim1 (B)	0 to 100 %	40	Charge level at which the generator is started (see section 11.3 "Deep Discharge Protection/Battery State" (Page 105))
23-16	SOCLim2 (B)	0 to 100 %	30	Charge level at which load shedding will occur (see section 11.3 "Deep Discharge Protection/Battery State" (Page 105))
23-17	SOCLim3 (B)	0 to 100 %	20	Charge level at which the Sunny Island 3324/4248 switches off (see section 11.3 "Deep Discharge Protection/Battery State" (Page 105))
23-18	TBatMax (B)	0 to 55 °C	45	Maximum battery temperature

## Generator Settings

No.	Name	Range/ unit	Default	Description
24-1	GenControl (B)	Manual Direct GenMan	Manual	The generator start option to be used in your system (see section 8.5.1 "Selection of Generator Control Method" (Page 75)). <b>Manual:</b> Manual start or no generator connected <b>Direct:</b> Generator start using the Sunny Island 3324/4248 "GenRequest" control relay <b>GenMan:</b> Generator start using the (optional) GenMan
24-2	AmpacGenMax (B)	2 to 56 AAC	10	Max. generator current that the Sunny Island 3324/4248 will demand from the generator (see section 8.5.2 "Setting the Output Current Limit" (Page 77)). <b>Note:</b> If the system load exceeds this value, the Sunny Island 3324/4248 will not switch to the generator, to avoid overloading it. Ensure that a sensible value is entered here!



No.	Name	Range/ unit	Default	Description
24-3	GenOperation (B)	Auto Start Stop Run1h Release	Auto	<p><b>Auto:</b> Automatic start of the generator is activated.</p> <p><b>Start:</b> The generator is immediately started (the display shows "S"). Remember to stop the generator again when you no longer require it (by selecting either "Stop" or "Auto").</p> <p><b>Stop:</b> The generator is immediately stopped. Remember to set the generator back to "Auto" if you want the Sunny Island 3324/4248 to once more assume control.</p> <p><b>Run1h:</b> The generator is immediately started and will run for one hour (the display shows "T"). After this, the Sunny Island 3324/4248 returns to the previously active mode.</p> <p><b>Release:</b> Interrupts the lockout time (20 min) for the generator after a "ReversePower" fault has occurred.</p>
24-4	VacGenMax (B)	230 to 250 VAC	240	<p>Maximum permissible generator voltage. If the generator voltage is higher than this limit, the Sunny Island 3324/4248 does not connect to the generator. If the generator voltage exceeds this limit while being connected to the stand-alone grid, then the Sunny Island 3324/4248 disconnects the generator from the stand-alone grid.</p> <p>Only valid when the "24-8 GridConnected" parameter is set to "GridNone".</p>
		–	(250)	<p>The value in brackets applies when the "24-8 GridConnected" parameter is set to "GridCharge" or "GridFeedPV". This value cannot be changed and is not displayed.</p>
24-5	VacGenMin (B)	172.5 to 230 VAC	200	<p>Minimum permissible generator voltage. If the generator voltage is lower than this value, the Sunny Island 3324/4248 does not connect to the generator. If the generator voltage drops below this value while being connected to the stand-alone grid, then the Sunny Island 3324/4248 disconnects the generator from the stand-alone grid.</p> <p>Only valid when the "24-8 GridConnected" parameter is set to "GridNone".</p>
		–	(190)	<p>The value in brackets applies when the "24-8 GridConnected" parameter is set to "GridCharge" or "GridFeedPV". This value cannot be changed and is not displayed.</p>

No.	Name	Range/ unit	Default	Description
24-6	FacGenMax <b>(B)</b>	50 to 60 Hz	55	<p>Maximum permissible generator frequency. If the generator frequency is higher than this value, the Sunny Island 3324/4248 does not connect to the generator. If the generator frequency exceeds this value while being connected to the stand-alone grid, then the Sunny Island 3324/4248 disconnects the generator from the stand-alone grid.</p> <p>Only valid when the "24-8 GridConnected" parameter is set to "GridNone".</p>
		–	(50,2)	The value in brackets applies when the "24-8 GridConnected" parameter is set to "GridCharge" or "GridFeedPV". This value cannot be changed and is not displayed.
24-7	FacGenMin <b>(B)</b>	40 to 50 Hz	45	<p>Minimum permissible generator frequency. If the generator frequency is lower than this value, the Sunny Island 3324/4248 does not connect to the generator. If the generator frequency falls below this value, the Sunny Island 3324/4248 disconnects the generator from the stand-alone grid.</p> <p>Only valid when the "24-8 GridConnected" parameter is set to "GridNone".</p>
		–	(49,8)	The value in brackets applies when the "24-8 GridConnected" parameter is set to "GridCharge" or "GridFeedPV". This value cannot be changed and is not displayed.
24-8	GridConnected <b>(Stby)</b>	GridNone GridCharge GridFeedPV	Grid- None	<p>Operating mode of the Sunny Island 3324/4248 when connected to the public grid (see section 8.4 "Operating with the Public Grid" (Page 72)).</p> <p>Select "GridNone" when the AC input of the inverter is connected to a generator, a poor quality grid, or to nothing at all.</p> <p>Select "GridCharge" when the grid is only used for charging the batteries.</p> <p>Select "GridFeedPV" when Sunny Boy inverters are present in the system and should feed into the grid.</p>
24-9	DelayVGenLow <b>(B)</b>	0 to 6000 ms	3000	Time period that the Sunny Island 3324/4248 waits before disconnecting the connection, if the generator voltage falls below VacGenMin or the generator frequency falls below FacGenMin.

No.	Name	Range/ unit	Default	Description
24-10	Transition (B)	Ramp Fast	Fast	Manner in which the Sunny Island 3324/4248 switches from charging to inverter operation if a grid or generator fault is detected. If problems occur when operating with Sunny Boys, then select the "Ramp" option here.
24-11	PGenRevers (B)	0 to 1000 W	300	Maximum permissible generator reverse power
24-12	PGenActiv (B)	ON OFF	OFF	Activation of the load-dependent generator request (parameters 24-13 to 24-16 are activated)
24-13	PGenTAve (B)	1 to 60 min	5	Average time after which the generator is switched on or off (depending on "24-15 PGenOn" and the Sunny Island 3324/4248 output power, see "11-4 Paclnverter")
24-14	PGenTRun (B)	1 to 60 min	10	Minimum generator run time (independent of the Sunny Island 3324/4248 output power, see "11-4 Paclnverter"), after it has been switched on as a result of a load-dependent generator request. Once the minimum run time has expired, the generator is again switched according to the value of parameter "24-13 PGenTAve".
24-15	PGenOn (B)	1000 to 6000 W	3500	Output power at which the generator is connected (connection time depends on the "24-13 PGenTAve" parameter)
24-16	PGenOff (B)	1 to 99 %	80	Output power "11-4 Paclnverter" relative to "24-15 PGenOn" at which the generator is switched off (the average value of output power in percent according to the "24-14 PGenTRun" parameter)

## 17.2.3 System and Fault Messages


### System Messages

No.	Name	Range/ unit	Default	Description
31-1	DeviceConfig	N/A	N/A	Name of the inverter
31-2	FWVers	N/A	N/A	Version number of the firmware installed in the inverter
31-3	SerNum	N/A	N/A	Inverter's serial number
31-4	RunTime	Hours	N/A	Inverter's operational hours

### Fault messages

No.	Name	Range/ unit	Default	Description
32-1	Last	N/A	N/A	The last fault that occurred in the system
32-2	Hist	N/A	N/A	The last ten faults that occurred in the system

## 17.2.4 Operation (Operation)

Only change parameters marked with **(Stby)**, when the Sunny Island 3324/4248 is in standby mode. Appropriately set operational data can take effect as soon as the "Enter" key is pressed. Incorrect values in these parameters can probably not be corrected quickly enough to avoid potential damage to your system. 

All parameters marked with a **(B)** can be set while the system is running.

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 15 "Communication Interface" (Page 123)).

No.	Name	Range/ unit	Default	Description
40-1	BatChargeMode <b>(B)</b>	Auto Boost Full Equalize	Auto	Direct triggering of a battery charging process. <b>Auto:</b> The inverter automatically triggers the different battery charging processes. The selection of any other mode causes the inverter to start the selected charging process. Automatic operation is then resumed after this.
40-2	Autostart <b>(B)</b>	Off On	Off	Autostart allows the inverter to automatically restart (e.g. after a fault). If AutoStart is set to "Off", then the inverter must always be manually started.
40-3	BaudRate <b>(B)</b>	1200 2400 4800 9600 19200 bps	1200	Baud rate that the Sunny Boy 5000TL uses to communicate with external devices. The Sunny Island 3324/4248 uses the SMA-Net protocol for communication. If Sunny Boys are connected to the communications bus, then a value of 1200 must be set.
40-4	ParameterSet <b>(B)</b>	None Save Load	None	"ParameterSet" allows the current parameter settings to be saved or stored parameters to be loaded. Select "None" to operate the inverter using the current settings. Select "Save" to save the current settings. Select "Load" to load the stored parameter settings into the Sunny Island 3324/4248.
40-6	LoadShedding <b>(B)</b>	Off On Auto	Off	Operating mode of the load shedding relay. Select "Off" if the load shedding option is not used or to manually open the load shedding relay. Select "On" to manually close the load shedding relay. Select "Auto" to allow the Sunny Island 3324/4248 to automatically control the load shedding relay.

No.	Name	Range/ unit	Default	Description
40-7	GenRequest <b>(B)</b>	Off On Auto	Auto	Operating mode of the generator request relay. Select "Off" if no generator is present or to manually switch off the generator relay. Select "On" to manually switch on the generator relay. Select "Auto" to allow the Sunny Island 3324/4248 to automatically control the generator request relay.
40-8	SunnyBoys <b>(B)</b>	No Yes	No	Select "No" when no Sunny Boys are installed in the system. Select "Yes" when Sunny Boys are used in the same system as the Sunny Island 3324/4248. <b>Note:</b> If Sunny Boys are used in the same system, then special parameters must be set in the Sunny Boy inverters. This is explained in section 13 "Connecting Sunny Boy Inverters" (Page 117).
40-9	Offset_Calib <b>(Stby)</b>	Start Stop	Stop	If this parameter is set to "Start", the Sunny Island 3324/4248 begins an offset calibration. This calibration is necessary when the "OffsCalib" fault message is shown in the display. As soon as the offset calibration has been successfully completed, the "40-9 Offset_Calib" parameter automatically resets to the value "Stop".

# 18 Troubleshooting/Problem Solving

## 18.1 List of Fault Displays

The meaning of fault messages displayed by the Sunny Island 3324/4248 are explained in the following table:

Fault display	Cause	Fault correction
CBT-Open	The battery temperature sensor is missing or not correctly connected.	Connect the battery temperature sensor (see section 5.4.2 "Battery Temperature Sensor" (Page 46)).
	The battery temperature sensor cable is defective.	Change the battery temperature sensor. Warning: Do not shorten the battery temperature sensor cables!
CBT-Short	Short-circuit in the battery temperature sensor.	Change the battery temperature sensor. Warning: Do not shorten the battery temperature sensor cables!
	The battery temperature sensor cable is defective.	Change the battery temperature sensor. Warning: Do not shorten the battery temperature sensor cables!
ChargeLow	This fault occurs when the battery state remains in the critical area for an extended period of time ("Critical"), i.e. the batteries have not been charged in time (see section 11.3 "Deep Discharge Protection/Battery State" (Page 105)). Possible causes:	The Sunny Island 3324/4248 can be started to charge the batteries after the fault has been confirmed. Requirements: The system has enough energy available for charging the batteries from a generator or the public grid.
	The generator does not start when requested by the Sunny Island 3324/4248.	Check the generator fuses. Check the fuel supply (diesel).
	Energy consumption is higher than that provided by the power generator (e.g. PV generator).	Switch off the energy consumers/loads.
CHS-Open	Device fault	Please contact the SMA hotline (see section 20 "Contact" (Page 151)).
CHS-Short	Device fault	Please contact the SMA hotline (see section 20 "Contact" (Page 151)).
CTR-Open	Device fault	Please contact the SMA hotline (see section 20 "Contact" (Page 151)).
CTR-Short	Device fault	Please contact the SMA hotline (see section 20 "Contact" (Page 151)).
FailSet	Device fault	Please contact the SMA hotline (see section 20 "Contact" (Page 151)).
HotACout	The Sunny Island 3324/4248 will not start because voltage already exists on the AC output terminals.	Check for installation faults at the AC connections (see section 5.3 "AC Connection" (Page 40)).
		Installation fault in the stand-alone grid.
		Remove all voltages from the AC output of the Sunny Island 3324/4248. Repeat the start process.

Fault display	Cause	Fault correction
HS-TempOV	Excessive heatsink temperature: The Sunny Island 3324/4248 has been operated under overload conditions for an extended period of time. The ambient temperature is very high while the Sunny Island 3324/4248 is being operated with a heavy load.	The Sunny Island 3324/4248 can only restart when the heatsink has cooled by a minimum of 5 °C. Place the Sunny Island 3324/4248 in standby mode for a few minutes to allow the fans to cool the inverter. Switch off some of the connected loads in the stand-alone grid to avoid immediately overloading the Sunny Island 3324/4248 after a restart. If the "40-2 Autostart" parameter is set to "On", the Sunny Island 3324/4248 automatically starts once the heatsink temperature has sunk by 5 °C.
INTERNAL01	Device fault	Please contact the SMA hotline (see section 20 "Contact" (Page 151)).
INTERNAL02	Device fault	Please contact the SMA hotline (see section 20 "Contact" (Page 151)).
INTERNAL03	Device fault	Please contact the SMA hotline (see section 20 "Contact" (Page 151)).
INTERNAL04	Device fault	Please contact the SMA hotline (see section 20 "Contact" (Page 151)).
INTERNAL05	Automatic confirmation. Restart	If this fault frequently occurs please contact the SMA hotline (see section 20 "Contact" (Page 151)).
INTERNAL06	Device fault	Please contact the SMA hotline (see section 20 "Contact" (Page 151)).
PRevOver	Generator or grid reverse power has exceeded the defined limits ("24-11 PGenRevers" parameter). A "!" appears in the display under 'Generator Run'.	Remove the 20 minute generator/grid lockout by setting the "24-3 GenOperation" parameter to "Release" or wait 20 minutes for the lockout to be automatically released (see also Page 79 under 5. "Release" Setting).
RelayFail	Device fault	If this fault frequently occurs please contact the SMA hotline (see section 20 "Contact" (Page 151)).
TBatHigh	The battery temperature is too high. Cause:	The Sunny Island 3324/4248 can only restart when the batteries have cooled by a minimum of 2 °C. If the "40-2 Autostart" parameter is set to "On", the Sunny Island 3324/4248 automatically starts once the temperature has sunk sufficiently.
	poor battery ventilation	Check the room fan for correct operation.
	high ambient temperatures	Avoid high ambient temperatures in the battery environment. Provide adequate ventilation.
	excessive battery charging current	Reduce the value of the "23-4 AmpdcBatMax" parameter (see section 8.1 "Preparation" (Page 63) and section 17.2.2 "Adjustable System Parameters" (Page 134)).



Fault display	Cause	Fault correction
TR-TempOV	Excessive transformer temperature: The Sunny Island 3324/4248 has been operated under overload conditions for an extended period of time. The ambient temperature is very high while the Sunny Island 3324/4248 is being operated with a heavy load.	The Sunny Island 3324/4248 can only restart when the transformer has cooled by a minimum of 5 °C. Place the Sunny Island 3324/4248 in standby mode for a few minutes to allow the fans to cool the inverter. Switch off some of the connected loads in the stand-alone grid to avoid immediately overloading the Sunny Island 3324/4248 after a restart. If the "40-2 Autostart" parameter is set to "On", the Sunny Island 3324/4248 automatically starts once the transformer temperature has sunk by 5 °C.
VAC-High	Output voltage too high	Check the value of the "22-1 VacNominal" parameter setting (see section 17.2.2 "Adjustable System Parameters" (Page 134)).
VAC-Low	Output voltage too low	Check the value of the "22-1 VacNominal" parameter setting (see section 17.2.2 "Adjustable System Parameters" (Page 134)). For an explanation, refer to point 7 of section 18.2 "Troubleshooting FAQs" (S. 145).
	Short-circuit in the system	Check the system for a possible short-circuit.
VBatHigh	Battery voltage too high:	Check the battery connections (see section 5.2 "DC Connection" (Page 36)).
	External charger with excessive charging voltage	Check the external charger.
	One or more defective batteries with high internal resistance	Check the batteries.
VBatLow	Battery voltage too low: wrong parameter setting	Check the value of the "23-1 VdcBatNominal" parameter setting (see section 17.2.2 "Adjustable System Parameters" (Page 134)).
	Deeply discharged batteries	Recharge the batteries as soon as possible.
	One or more defective batteries	Check the batteries.
Watchdog	Automatic reset	If this fault frequently occurs please contact the SMA hotline (see section 20 "Contact" (Page 151)).

## 18.2 Troubleshooting FAQs

Here you will find answers to frequently asked questions (FAQs):

- The Sunny Island 3324/4248 does not switch to the running generator, even though the generator control relay has closed (Gen\_Request) (the "24-1 GenControl" parameter is set to "Direct", see Page 76).
  - Check the generator fuses.

- The stand-alone grid load current ("11-2 AmpacInverter" parameter) is greater than the maximum generator current ("24-2 AmpacGenMax" parameter). Reduce the stand-alone grid load until the stand-alone grid load current is smaller than the maximum generator current. The Sunny Island 3324/4248 can now switch to the generator.
  - The reverse power that can be fed back into the generator for up to five seconds has been exceeded. A "!" is shown in the display. The generator cannot be connected for a period of 20 minutes. Set the "24-3 GenOperation" parameter to "Release" (see Page 79).
2. The Sunny Island 3324/4248 does not switch to the running generator, the generator control relay (Gen\_Request) is open .
- The generator was manually started, even though the "24-1 GenControl" parameter is set to "Direct" (see Page 76) or "GenMan" (see Page 76).
    - Set the "24-3 GenOperation" parameter to "Run1h" (see Page 78). The Sunny Island 3324/4248 switches to the generator for a period of one hour. After one hour, the generator is automatically switched off by the Sunny Island 3324/4248 and the "24-3 GenOperation" parameter is set to the previous state.
    - You can also set the "24-3 GenOperation" parameter to "Start" (see Page 77). The Sunny Island 3324/4248 will immediately switch to the generator. You must note that the Sunny Island 3324/4248 will no longer switch off the generator. Only when you manually reset the "24-3 GenOperation" parameter back to "Auto" can the Sunny Island 3324/4248 again assume control of the generator.
  - The generator reverse power has been exceeded. A "!" is shown in the display. Set the "24-3 GenOperation" parameter to "Release" (see Page 79), the Sunny Island 3324/4248 will switch to the generator.
3. The DC circuit breaker on the Sunny Island 3324/4248 is set to "On" but the display remains dark.
- The inverter has switched off to protect the batteries from deep discharge (see also section 11.3 "Deep Discharge Protection/Battery State" (Page 105)). To restart the Sunny Island 3324/4248, see section 9.5 "Restarting the Automatic Shutdown" (Page 86).
4. A parameter cannot be changed, even though the installer password has been entered (see section 8.3 "Password Entry" (Page 69)).
- You are in the "10-Meters" (Measuring data) menu or the "30-Diagnose" (Diagnosis) menu. You can only read the data values shown here.
  - Some parameters can only be changed in standby mode (see e.g. the "23-2 BatType" parameter in section 17.2.2 "Adjustable System Parameters" (Page 134)). Stop the Sunny Island 3324/4248 as described in section 9.3

- "Switching Off" (Page 85). Note that this causes a dropout in the stand-alone grid and the loads are no longer supplied.
- You have not correctly entered the installer password. Check whether you are actually in "Installer Level" (see section 8.3 "Password Entry" (Page 69)). If necessary, repeat the calculation and entry of the password.
5. The Sunny Island 3324/4248 only briefly switches to the generator and constantly changes from battery charging mode (Charge mode) to inverter mode (Invert mode).
- The "24-2 AmpacGenMax" parameter (see section 8.5.2 "Setting the Output Current Limit" (Page 77)) is too high. Set the "24-2 AmpacGenMax" parameter to a value that is 85 % of the nominal generator current.
  - The limits for the maximum permissible AC voltage or the minimum permissible frequency of the generator are too strict. Increase the limits for voltage and/or frequency according to the technical data of your generator.
6. The stand-alone grid frequency is not 50 Hz.
- The Sunny Boy inverter is controlled via the frequency (see section 13.3 "Frequency Shift Power Control (FSPC)" (Page 120)).
  - The "AFRA" function of the Sunny Island 3324/4248 is activated (see the Sunny Island 3324/4248 user manual, section "Automatic Frequency Adjustment").
7. The "VAC-Low" fault (output voltage too low) occurs when the Sunny Island 3324/4248 is started.
- A short-circuit exists in the stand-alone grid. Check the AC output connections of the stand-alone grid (see section 5.3 "AC Connection" (Page 40)).
  - The loads connected to the stand-alone grid are too heavy. The power/electrical energy of the Sunny Island 3324/4248 is not sufficient to supply the loads. Switch of some of the loads and restart the Sunny Island 3324/4248.



# 19 Technical Data

	SI 3324	SI 4248
<b>Output data:</b>		
Nominal AC voltage ( $V_{AC, nom}$ ) (adjustable)	230 V (202 to 253 V)	230 V (202 to 253 V)
Nominal frequency ( $f_{nom}$ )	50 Hz	50 Hz
Continuous AC output ( $P_{nom}$ ) at 25 °C	3300 W	4200 W
Continuous AC output ( $P_{nom}$ ) at 45 °C	2300 W	3400 W
AC output for 30 min at 25 °C	4200 W	5400 W
AC output for 5 min at 25 °C	4400 W	6200 W
AC output for 1 min at 25 °C	5000 W	7000 W
Nominal AC current ( $I_{AC, nom}$ )	14.5 A	18 A
Max. current (peak value) for 100 ms	100 A (100 ms)	100 A (100 ms)
Harmonic distortion of output voltage ( $K_{VAC}$ )	< 3 %	< 3 %
Phase shift factor $\cos\varphi$	-1 to +1	-1 to +1
<b>Input data</b>		
Input voltage ( $V_{AC, ext}$ ) (adjustable)	230 V (172.5 to 250 V)	230 V (172.5 to 250 V)
Input frequency ( $f_{ext}$ ) (adjustable)	50 Hz (40 to 60 Hz)	50 Hz (40 to 60 Hz)
Max. AC input current ( $I_{AC, ext}$ ) (adjustable)	56 A (2 to 56 A)	56 A (2 to 56 A)
Max. input power ( $P_{AC, ext}$ )	12.8 kW	12.8 kW
<b>Battery data</b>		
Battery voltage ( $V_{Bat, nom}$ ) (adjustable)	24 V <sub>DC</sub> (21 to 32 V <sub>DC</sub> )	48 V <sub>DC</sub> (41 to 63 V <sub>DC</sub> )
Max. battery charging current ( $I_{Bat, max}$ )	140 A <sub>DC</sub>	100 A <sub>DC</sub>
Continuous charging current ( $I_{Bat, nom}$ )	104 A <sub>DC</sub>	80 A <sub>DC</sub>
Battery capacity	100 to 6000 Ah	100 to 6000 Ah
Charge control	IV <sub>0</sub> V process with automatic full and equalization charge	IV <sub>0</sub> V process with automatic full and equalization charge
<b>Efficiency/power consumption</b>		
Max. efficiency (typical)	94,5 %	95 %
Own consumption (no load/standby)	22 W (< 4 W)	22 W (< 4 W)
<b>German standards</b>		
	DIN EN 50178, DIN EN 61000-3-2 (when charging), DIN EN 61000-6-1, DIN EN 61000-6-2, DIN EN 61000-6-3, DIN EN 61000-6-4	DIN EN 50178, DIN EN 61000-3-2 (when charging), DIN EN 61000-6-1, DIN EN 61000-6-2, DIN EN 61000-6-3, DIN EN 61000-6-4

	<b>SI 3324</b>	<b>SI 4248</b>
<b>Certification</b>		
	CE	CE
<b>Protection degree</b>		
Per DIN EN 60529:	IP 30	IP 30
USA	NEMA1 (indoor)	NEMA1 (indoor)
<b>inverter protection</b>		
	Short-circuit, overload, overtemperature	Short-circuit, overload, overtemperature
<b>Interfaces</b>		
	2 LEDs 4 buttons two-line display 1 relay for load shedding 1 relay for controlling a diesel generator RS485/RS232 galvanically isolated (optional)	2 LEDs 4 buttons two-line display 1 relay for load shedding 1 relay for controlling a diesel generator RS485/RS232 galvanically isolated (optional)
<b>Mechanical data</b>		
Width x height x depth	(390 x 590 x 245) mm	(390 x 590 x 245) mm
Weight	39 kg (approx.)	39 kg (approx.)
<b>Ambient conditions</b>		
Ambient temperature	from -25°C to +50°C	from -25°C to +50°C
<b>Miscellaneous</b>		
Guarantee (EU)	2 years	2 years
<b>Accessories</b>		
Ext. battery temperature sensor	included	included
Generator management (GenMan)	optional	optional

## 20 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:

- Type of inverter
- Serial number of the Sunny Island 3324/4248
- Firmware version
- Fault message shown in the display
- Battery size and battery type
- Type and size of additional energy sources (generators, PV systems, PV inverters)
- Communications products used



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## 21 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  $I_N$  and the discharge time  $t_N$ , that passes between commencement of discharging the fully charged battery until the final discharge voltage  $V_S$  is reached. In permanently on-site batteries, the C10 capacity is usually specified. i.e. a battery with  $C_{10} = 200$  Ah can be discharged for 10 hours at a nominal current of  $0.1 \times C_{10} = I_{10} = 20$  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 MPP 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 array**

See PV generator.

## **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  $4 \times 12 \text{ V} = 48 \text{ V}$ , 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).





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