Backup-System

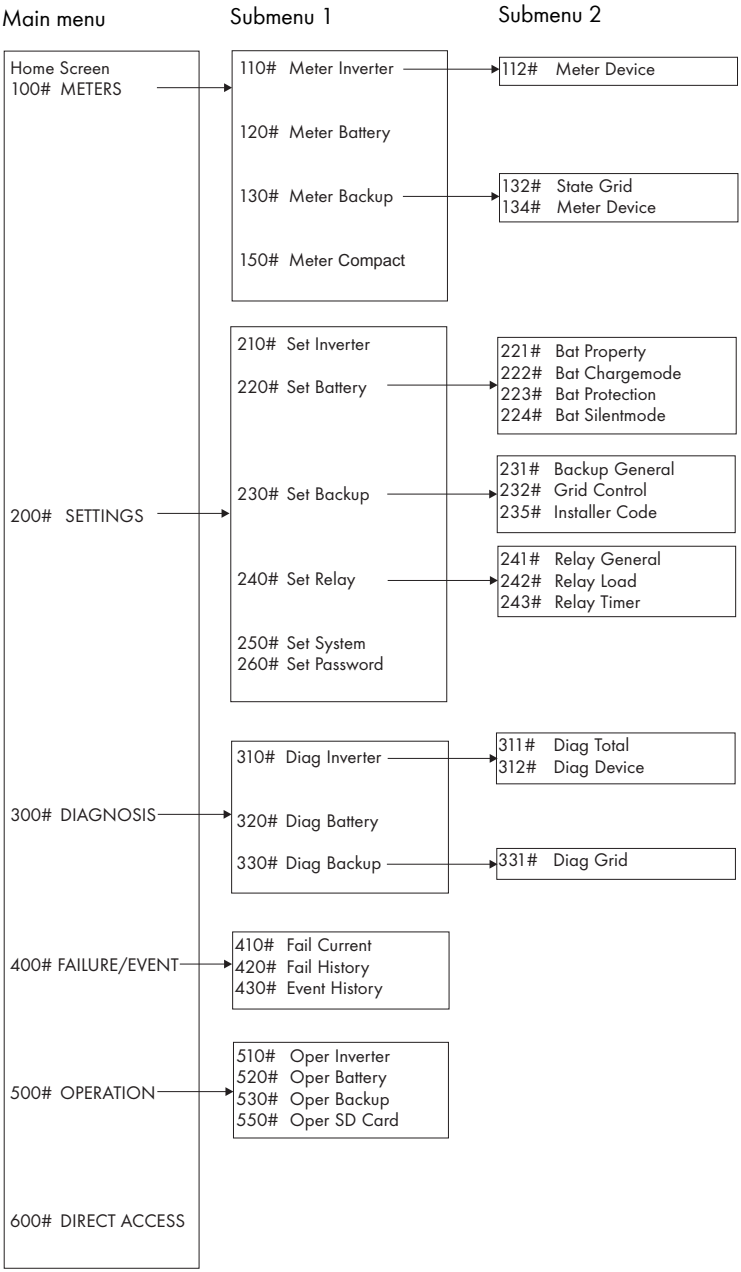
SUNNY BACKUP SYSTEM S

Technical Description

SBU2200-TEN083320 | IMEN-SBU2200 | Version 2.0

EN

Overview of the Navigation Area:



1 Notes on this Manual

These technical instructions address themselves to the installer as well as the operator of the Backup System S. It explains the operating principle as well as the correct mounting, installation and operation of a Sunny Backup System S.

Information regarding the following subjects can be found in the specified sections:

- Installation starting in section 2 „The Sunny Backup System S“ (11)
- Commissioning starting in section 9 „Control Elements“ (82)
- Functions starting in section 14 „Inverter Operation“ (119)
- Appendix starting in section 19 „Maintenance and Care“ (137)

1.1 Validity

This technical description applies to the Sunny Backup System S, which includes the Sunny Backup 2200 (SBU 2200) inverter, the Automatic Switch Box S (AS-Box-S.1) switching device, the external Sunny Remote Control 1 (SRC-1) display as well as the external BatFuse A.01 DC fuse.

The technical description applies to the Sunny Backup 2200 with the firmware version 1.0 and higher.

You can read the the firmware version of your Sunny Backup 2200 on the display using the "312.02 FwVer" parameter (see section 20.3 „Diagnostics“ (148)).

The Sunny Backup System S devices may only be operated in the intended area of application provided in this documentation.

- Using a Sunny Backup System S as a system to supply power to life-sustaining medical devices is prohibited.
- The Sunny Backup 2200 has been designed for use at elevations up to 2600 m above sea level. Please contact SMA Solar Technology AG before using the device at elevations above 2600 m.

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

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

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

1.2 Storage of this Manual

Store the manuals of the Sunny Backup System S and the installed components in the immediate vicinity of the Sunny Backup 2200 so that they are accessible at all times.

1.3 Symbols Used

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

DANGER!

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

WARNING!

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

CAUTION!

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

NOTICE!

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

Information

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

1.4 Syntaxes

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

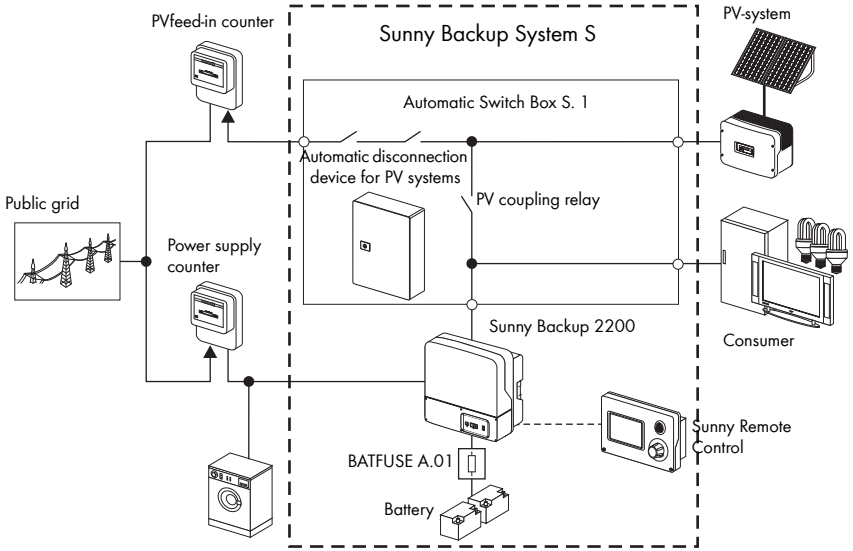
Menu: menu number, hash, and menu name (150# Grid Meters)

Parameters: menu number, dot, parameter number and parameter name (150.01 GdRmgTm)

2 The Sunny Backup System S

2.1 Properties

The Sunny Backup System S consists of one Sunny Backup 2200 in combination with one Automatic Switch Box S (AS-Box-S.1), one external Sunny Remote Control 1 (SRC-1) display and one external BatFuse A.01 DC fuse. This system is specially designed for backup applications and enables, in compliance with all standard requirements, continued operation of a grid-connected PV system in the event of grid failure. Thus, this system does not replace the conventional Sunny Boy (PV inverter), but is installed additionally. In the event of grid failure, the Sunny Backup System S first ensures safe disconnection of the loads and the PV system from the public grid, and subsequently forms a stable stand-alone grid, into which the Sunny Boy can then feed solar energy. The maximum period of interruption for the loads is approximately 50 ms, which for most loads is equivalent to uninterrupted operation.



The Sunny Backup System S is suitable for use in conjunction with the Sunny Boy PV inverters from SMA Solar Technology AG. The Sunny Backup System S can be integrated into new PV system installations, and can also be retrofitted onto existing PV systems.

Along with the Sunny Backup 2200 and the automatic switching device AS-Box-S.1, a battery is necessary as a short-term storage device, for reliable operation. During grid failure, the battery has the task of correcting the imbalance between generation and consumption. Whenever less energy is being generated than consumed (e.g. at night), the battery is discharged. Whenever more energy is being generated than consumed (e.g. during the day), the battery is charged.

The intelligent battery management built into the Sunny Backup 2200 protects the battery from overcharging and deep discharge. This ensures that the battery service life stipulated by the battery manufacturer can be achieved.

As an external DC fuse, the BatFuse A.01 protects the battery connections of the Sunny Backup 2200. Additionally, the BatFuse A.01 enables the DC-side disconnection of the Sunny Backup 2200.

The Sunny Backup 2200 performs the entire controlling and regulation of the system. If the system is in grid-parallel operation, the Sunny Backup 2200 ensures standard-compliant grid monitoring and battery-preserving charging. The Sunny Backup 2200 is extremely quick to detect any failure of the public grid and disconnects the system from the grid. After approx. 50 ms, the loads will be already supplied with electricity again, from the battery. After a matter of seconds, the PV system switches to this stand-alone grid, and either powers the loads, or is used for recharging the batteries. The efficiency during charging, regardless of whether from the grid, or from the PV system, and during discharging, is up to 93 %. Due to the 's very high overload capability of up to 3.8 kW for 5 minutes, and the integrated smooth startup of the Sunny Backup 2200, critical loads with very high start currents can also be started safely. Thus, over-dimensioning of the Sunny Backup 2200 is not necessary.

Requirement according to VDE 0126-1-1 and guidelines of other countries

The Sunny Backup System S meets all requirements of the VDE 0126-1-1 guidelines that are required in Germany for feeding PV electricity into the grid as well as guidelines of other countries. The switching devices for PV feeding are implemented redundantly, and are monitored. The safety of this system has been inspected and certified by the German Professional Association for Precision Engineering and Electrotechnology.

Information

The Sunny Backup System S is only intended for use in TN systems!

Despite the complex functions of the Sunny Backup system, it can be installed and configured with ease. All special material required for installation is included in the delivery. Additional sub-distribution units are generally not necessary. The safety and fuse protection concept on the consumer side, and that of the PV system, are generally not impaired by the Sunny Backup 2200, and do not need to be adapted.

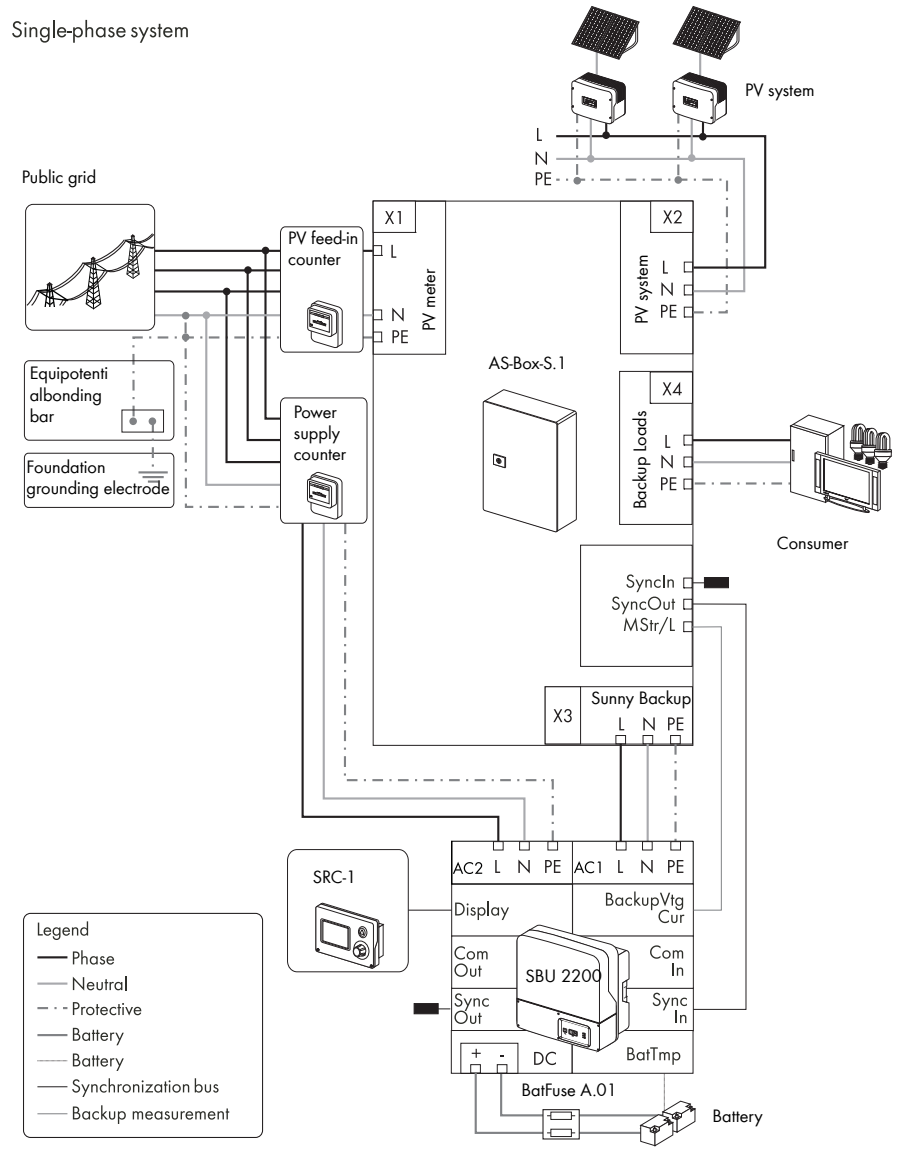
All the settings required for operation can be quickly and easily programmed in six steps using the "Quick Configuration Guide" of the Sunny Backup 2200. The easy-to-understand menu navigation allows quick access to all important data, even while the system is running. An MMC/SD card provides uncomplicated system control, and thus makes any service work easier.

Saving data and events

Always use the MMC/SD card to save data and events. This is necessary in order for SMA Solar Technology AG to be able to help you in the event of a fault.

2.2 System constellation

The Sunny Backup 2200 can be integrated into different system constellations. The following graphic illustrates the wiring of the individual components in the backup system.



3 Safety Instructions

Please follow all operating and safety instructions in this manual. Failure to follow these instructions could result in damage to the device or the system and cause personal injury. Store the manual at an easily accessible location.

DANGER!

Risk of lethal electric shock when opening the devices.

- The devices of the backup system may only be installed and repaired by qualified electricians.
- Observe all provisions and safety notices.
- Before working on all live components, switch them off using the line circuit breaker.
- Secure the line circuit breaker against being switched back on.

Information

Be sure to observe all applicable regional standards and guidelines.

4 Unpacking

Before installing the Sunny Backup 2200 and the Automatic Switch Box S make sure that all parts are included in the delivery.

- Carefully check the packaging, the Sunny Backup 2200 and the Automatic Switch Box S for any signs of damage.

  Ensure that all parts are included in the delivery (see section 4.1 „Packing List“ (16)).

If something is missing or the Sunny Backup 2200 or the Automatic Switch Box S has been damaged during transport, contact your dealer immediately. For more information, please see section 24 „Contact“ (169).

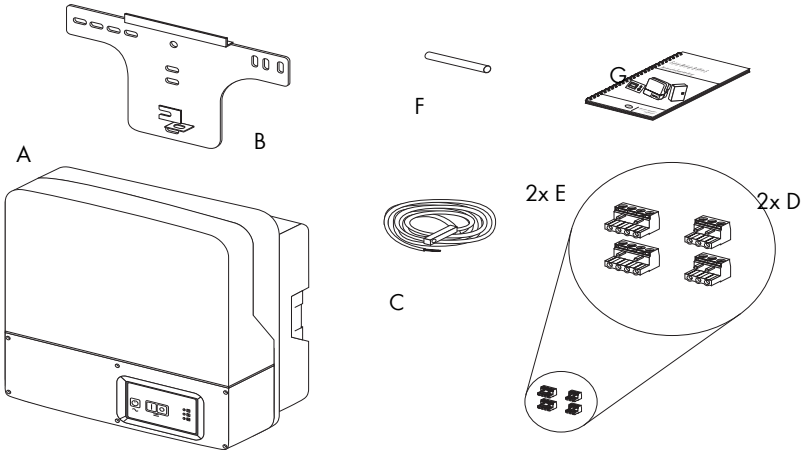
Information

Keep the packaging in case you need to return the Sunny Backup 2200, the Automatic Switch Box S or their accessories.

4.1 Packing List

4.1.1 Sunny Backup 2200

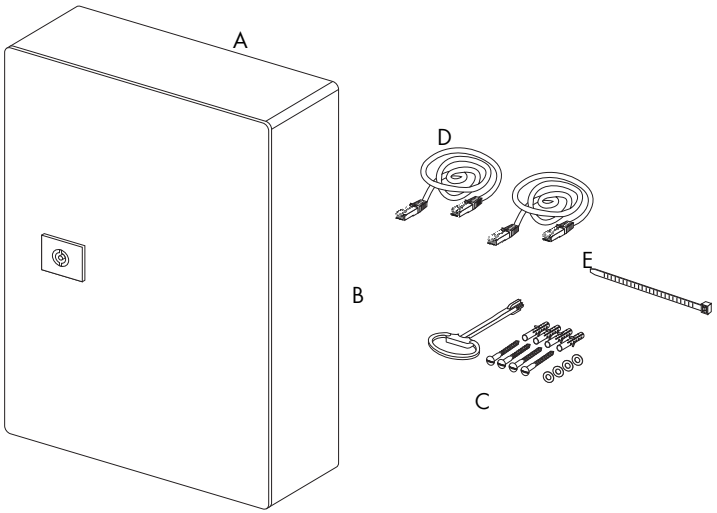
The following elements are included:



A	1	Sunny Backup 2200 with cover
B	1	Wall bracket
C	1	Battery temperature sensor
D	2	3-pole print terminals (for connecting relays 1 & 2)
E	2	4-pole print terminals (e.g. for connecting battery temperature sensor)
F	1	Silicone tube 10 mm x 0.5 m
G	1	Technical description (manual)

4.1.2 Automatic Switch Box S

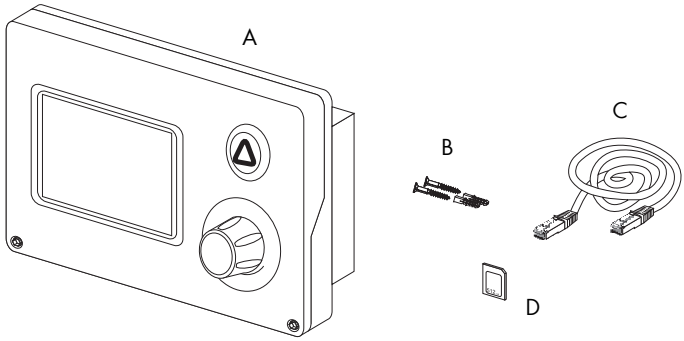
The following elements are included:



A	1	Automatic Switch Box S (AS-Box-S.1)
B	1	Socket wrench for housing cover
C	1	Set for wall mounting • 4 x wall anchors (6 mm) • 4 x screws • 4 x rubber washers
D	2	CAT5e-FTP patch cables (1 x red and 1 x black with two RJ45 plugs each)
E	1	Cable ties

4.1.3 Sunny Remote Control 1

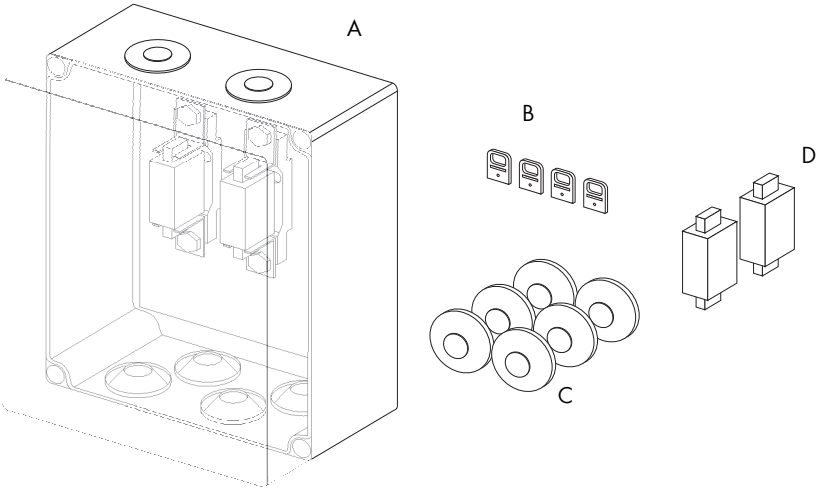
The following elements are included:



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

4.1.4 BatFuse A.01

The following elements are included:



A	1	DC fuse BatFuse A.01
B	4	Wall mounting plate
C	6	Double membrane adapter
D	2	Fuse plug 125 A NH-00

4.2 Required Tools and Resources

You require the following tools and materials in order to mount and install the Sunny Backup System S:

Tools (not included in delivery)

Stripping pliers

Cable end sleeves

Drill

Drill (e.g. stone drill), from Ø 6 mm to 10 mm

Torque wrench (4 Nm to 10 Nm), socket wrench, 13 mm

Hexagon (allen) key, 4 mm

Cable knife

Combination pliers

Phillips screwdriver, PH1 and PH2

Cable

Open-end/ring wrenches, 13 mm

Multimeter

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

Diagonal cutting pliers

Spirit level

Ratchet

Ratchet extension

NH handle (as per VDE 0680-4)

Material (not included in delivery)

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

Cable ties

Heat shrink tubing

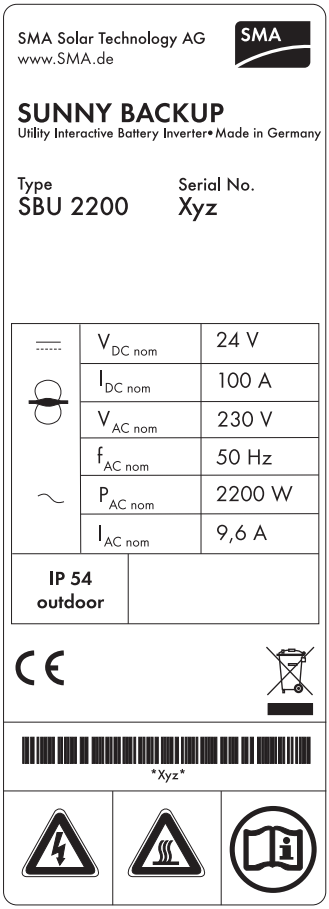
Hexagon bolts, 8 x 60 mm, washers

4.3 Type Label/Firmware Version

4.3.1 Sunny Backup 2200

You can identify the Sunny Backup 2200 by the type label and the firmware version.

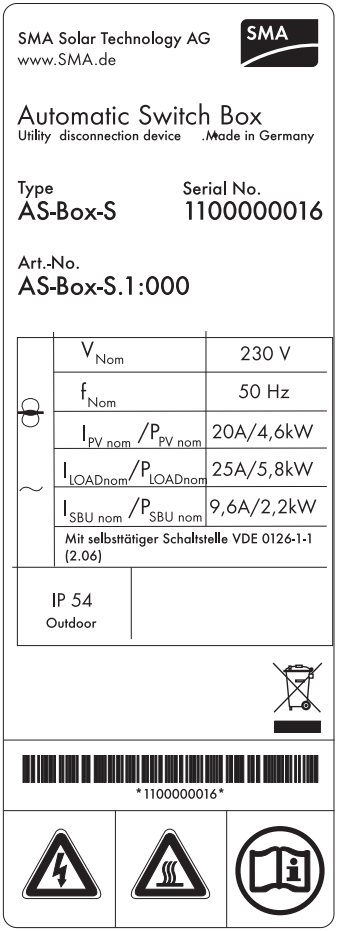
- The type label is located outside on the right side of the housing.
- You can read the the firmware version of your device on the display using the "312.02 FwVer" parameter (see section 20.3 „Diagnostics“ (148)).



4.3.2 Automatic Switch Box S

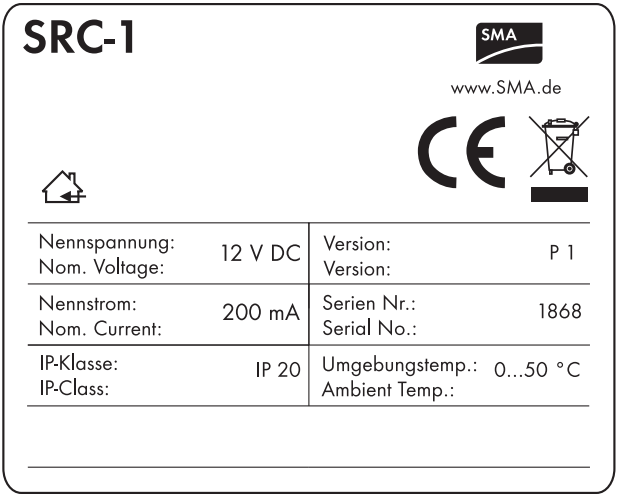
You can identify the Automatic Switch Box S by the type label.

The type label is located outside on the right side of the housing.



4.3.3 Sunny Remote Control 1

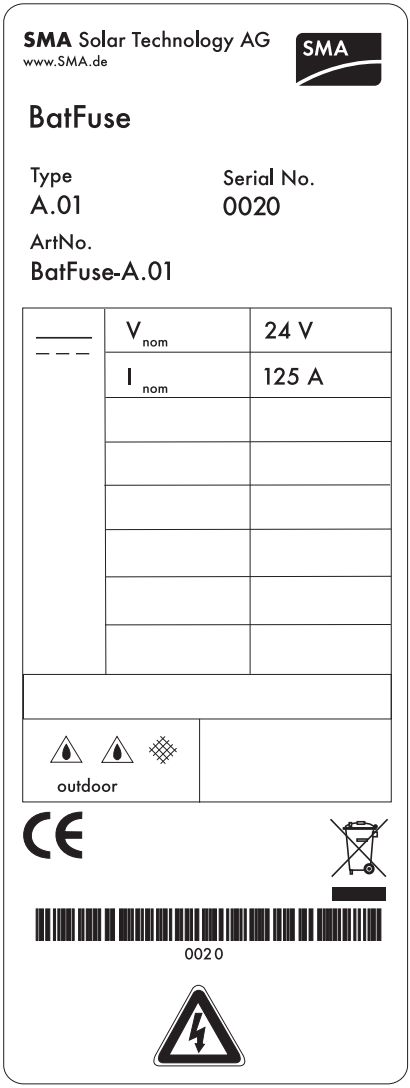
You can identify the display from the type label. The type label is located on the rear side of the Sunny Remote Control 1.



4.3.4 BatFuse A.01

You can identify the DC fuse by the type label.

The type label is located inside on the right side of the housing.



5 Mounting

Take note of the required installation conditions listed below before mounting, installing and commissioning the Sunny Backup 2200 and the Automatic Switch Box S.

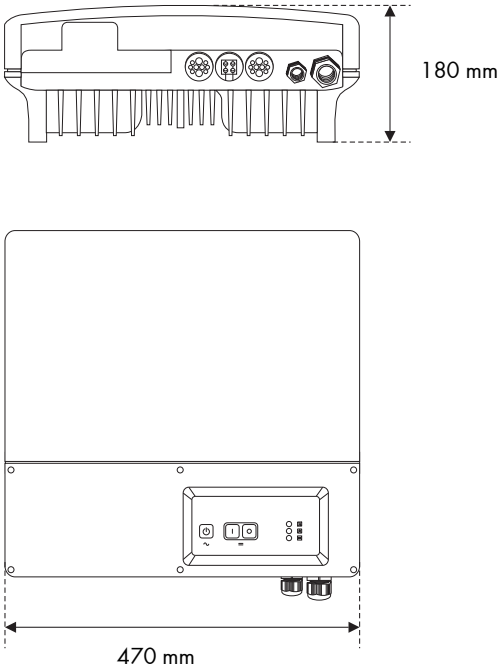
Information

When selecting the mounting location, you must observe the applicable building regulations (e. g. the German model cable/pipe system directive MLAR). During planning, clarify the provisions for stairwells or escape routes with the respective fire protection authority.

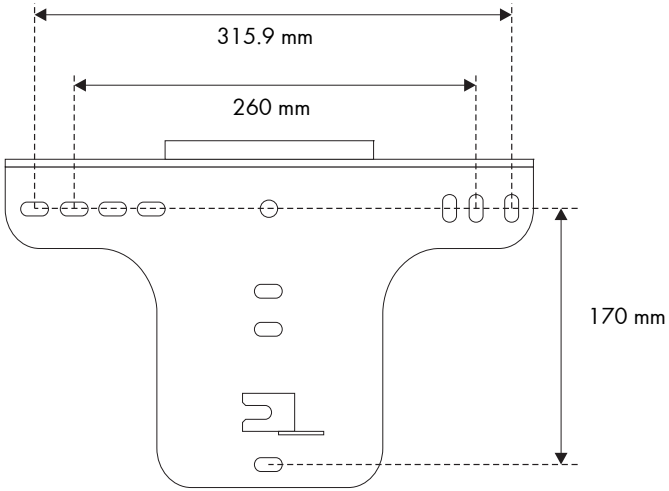
5.1 Sunny Backup 2200

5.1.1 Dimensions

Housing:



Wall bracket:



5.1.2 Selecting the Mounting Location

DANGER!

Danger to life due to fire or explosion.

During operation, the temperature of the housing may exceed 60 °C.

Do not install the device

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

CAUTION!

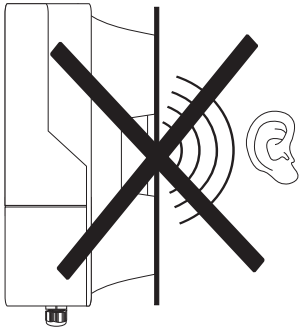
Touching could result in burns.

During operation, the temperature of the housing may exceed 60 °C.

- Mount the device such that it cannot be touched inadvertently.

- The mounting location and mounting method must be suitable for the weight (approx. 18 kg) and dimensions.
- Select a solid surface for mounting the device.
- The mounting location must be accessible at all times (do not mount in inaccessible locations).
- An ambient temperature between –25 °C and +60 °C ensures optimum operation.
- Do not expose the device to direct sunlight. Due to overheating, power reductions may occur.
- In a living area, do not mount the unit on plasterboard etc. walls as otherwise audible vibrations are likely to result.

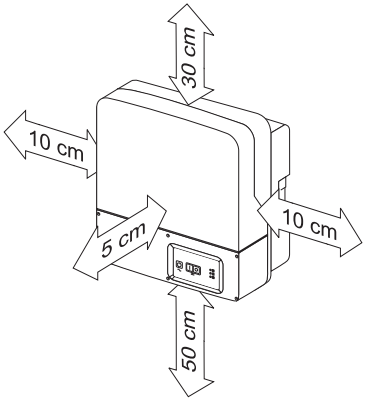
  The Sunny Backup 2200 can make noises when in use which can be seen as a nuisance when installed in a living area.



5.1.3 Observe Minimum Clearances

Observe the following minimum clearances to walls, other devices or objects, in order to guarantee sufficient heat dissipation.

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



Direction	Minimum clearance
Sides	10 cm
Top	30 cm
Below	50 cm
Front	5 cm

Sufficient Ventilation

When installing the Sunny Backup 2200 in smaller rooms, make sure that adequate ventilation is available. The device produces heat when operating that must be removed.

5.1.4 Mounting Position

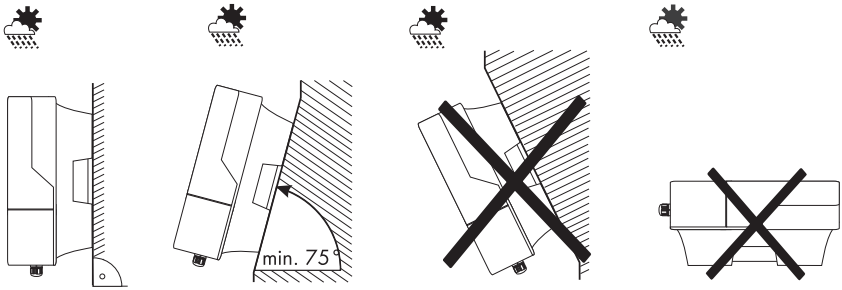
NOTICE!

Short circuit due to condensation.

Condensation water can build up if the device is operated in a horizontal position.

- Only operate the device when it is in a vertical position hanging on a wall.

- Mount the device vertically on a wall or tilted backwards at a maximum of 15°!
- Mount the device at eye level.



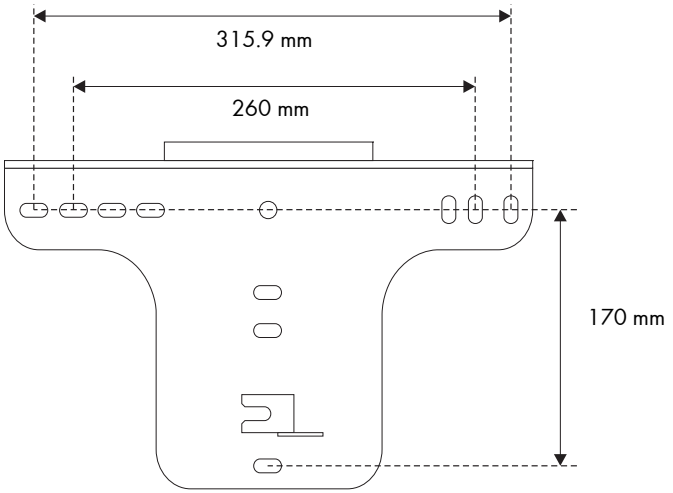
- Never install the device with a forward tilt!
- Do not install horizontally!

5.1.5 Mounting the Sunny Backup 2200 using the wall mounting bracket

1. Use the wall bracket as a drilling template.

Number of drill holes used

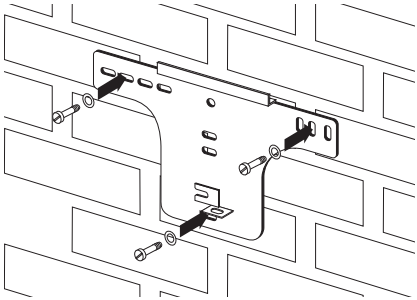
- When wall mounting the unit, use at least two of the horizontal holes and the lowest hole in the middle.
- When mounting the device on a post, use at least three of the holes located in the center (always use the top holes).



Mounting Material

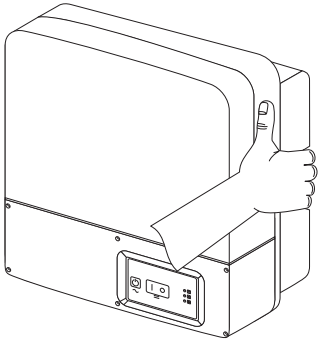
When mounting the wall bracket, use fastening material suitable for the mounting surface. Observe the weight of the Sunny Backup 2200 (approx. 18 kg).

2. Mount the wall bracket.



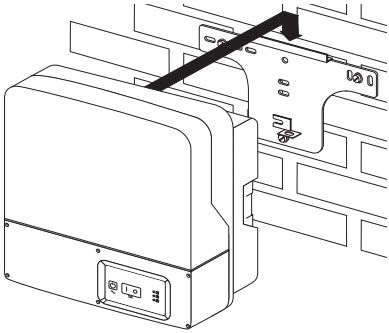
Transporting the Sunny Backup 2200

When transporting and mounting the Sunny Backup 2200, use the ergonomic handles at the sides of the housing.

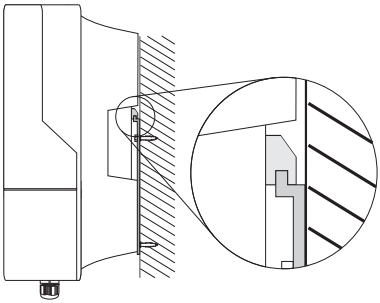


3. Attach the device to the wall mounting bracket slightly to the left using its mounting plate.

   The right edge of the rear wall of the device must be flush with the right edge of the wall bracket.

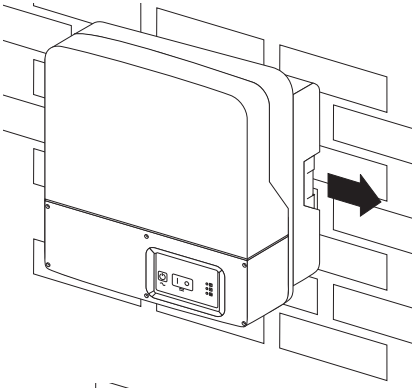


4. Check both sides to ensure that it is correctly in place.

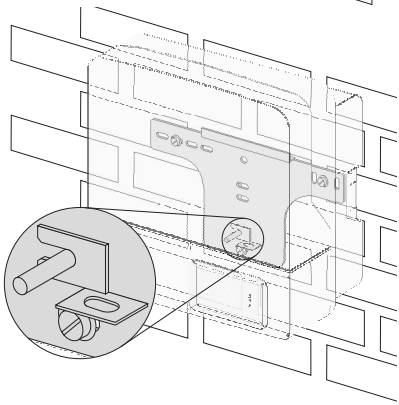


5. Secure the housing in position.

   Push the Sunny Backup 2200 to the right on the wall bracket, until the Sunny Backup 2200 locks into place with the locking bolt on the rear wall.

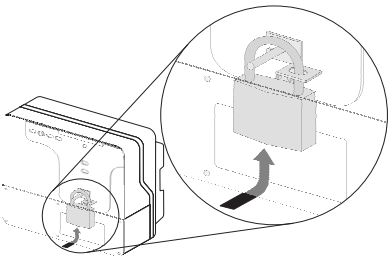


6. Ensure that it is correctly in place.



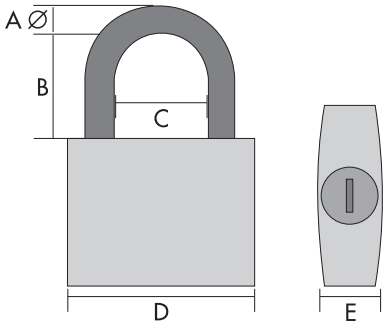
Optional Anti-theft Protection

Protect the device against theft. Secure the Sunny Backup 2200 using a lock on the wall mounting bracket.



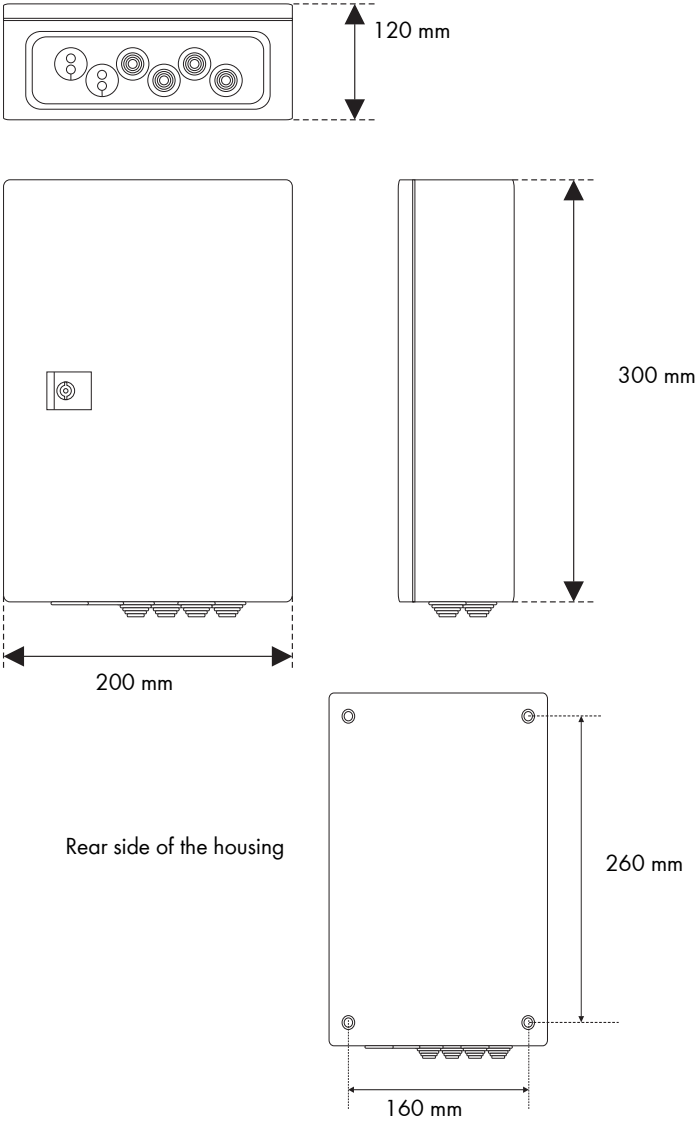
The lock must meet the following requirements:

- Size:
  A: 6 - 10 mm in diameter
  B: 21 mm – 35 mm
  C: 20 mm – 33 mm
  D: 40 mm – 60 mm
  E: 13 mm – 21 mm
- Stainless steel
- Hardened steel shackle
- Secured lock cylinder



5.2 Automatic Switch Box S

5.2.1 Dimensions



5.2.2 Selecting the Mounting Location

DANGER!
Danger to life due to fire or explosion.

Do not install the device

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

- The mounting location and mounting method must be suitable for the weight (approx. 4.5 kg) and dimensions.
- Select a solid surface for mounting the device.
- The mounting location must be accessible at all times (do not mount in inaccessible locations).
- An ambient temperature between -25 °C and +60 °C ensures optimum operation.
- Do not expose the device to direct sunlight.

5.2.3 Wall Mounting

NOTICE!

Short circuit due to condensation.

Condensation water can build up if the device is operated in a horizontal position.

- Only operate the device when it is in a vertical position hanging on a wall.

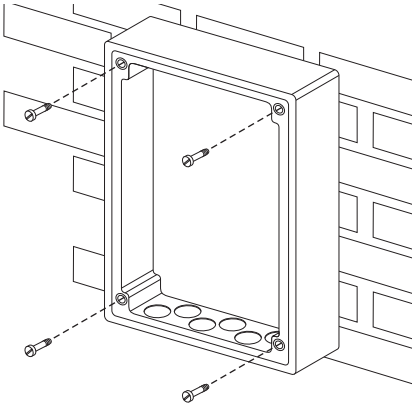
Mounting Material

When mounting the device, use fastening material suitable for the mounting surface.

1. Use the housing as a drilling template.
2. Fasten the device on the wall using four screws.

   Mount the device using the provided rubber washers!

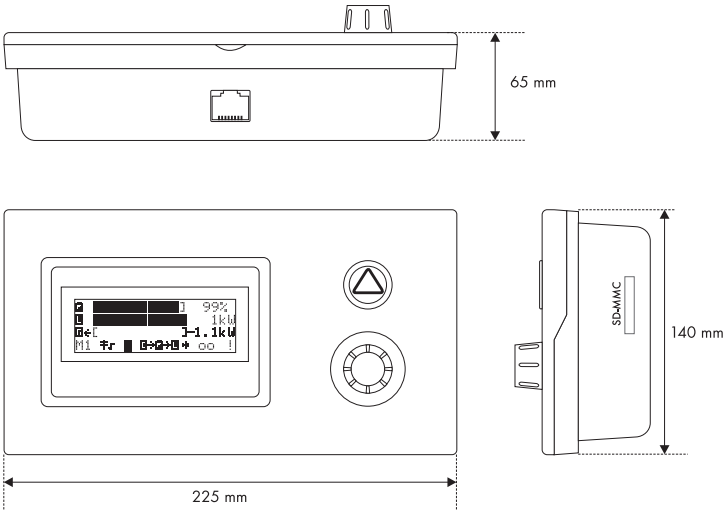
   They seal the mounting holes (8 mm diameter) in the rear housing wall (IP 54).
3. Tighten the screws evenly.
4. Ensure that it is securely in place!



5.3 Sunny Remote Control 1

5.3.1 Dimensions

The external display (Sunny Remote Control 1) has the following dimensions:



5.3.2 Selecting the Mounting Location

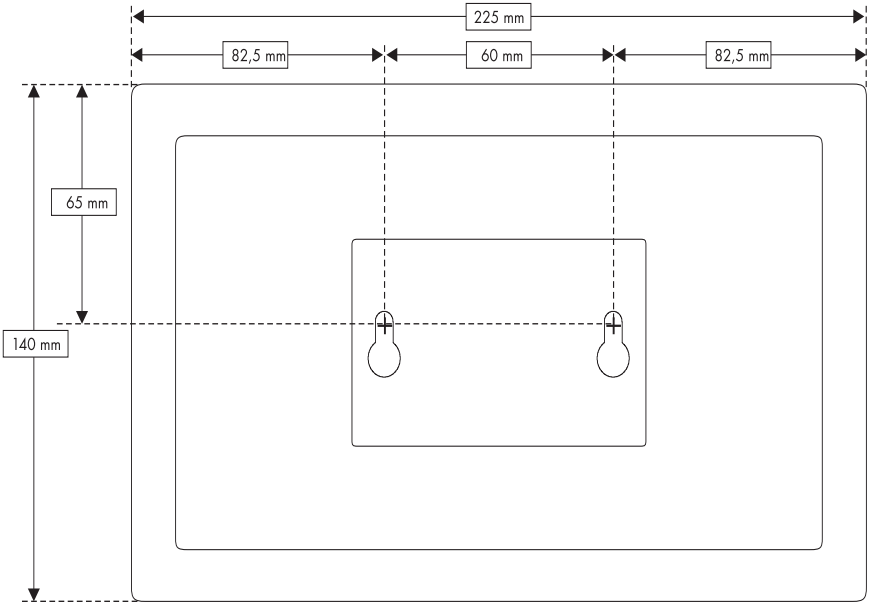
- Select a solid surface for mounting the device.
- Protect the Sunny Remote Control 1 from dust, wet conditions, aggressive substances and vapors.
- The mounting location must be conveniently accessible.

  Using the display, you control the Sunny Backup 2200 and the Sunny Backup System S.
- An ambient temperature between 0 °C and 50 °C ensures optimum operation.
- Do not expose the device to direct sunlight.

5.3.3 Wall Mounting

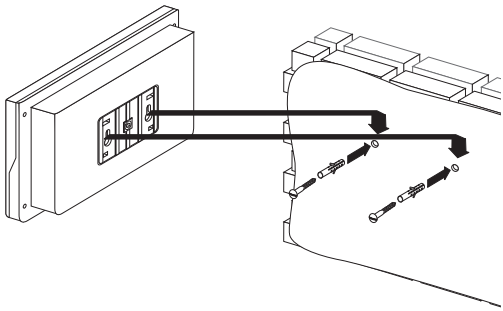
Mount the Sunny Remote Control 1 on the wall near the Sunny Backup 2200. Proceed as follows:

1. Allow for sufficient space for installing the communication cable and MMC/SD card.
2. Use the drilling template to determine the position of the two drill holes.



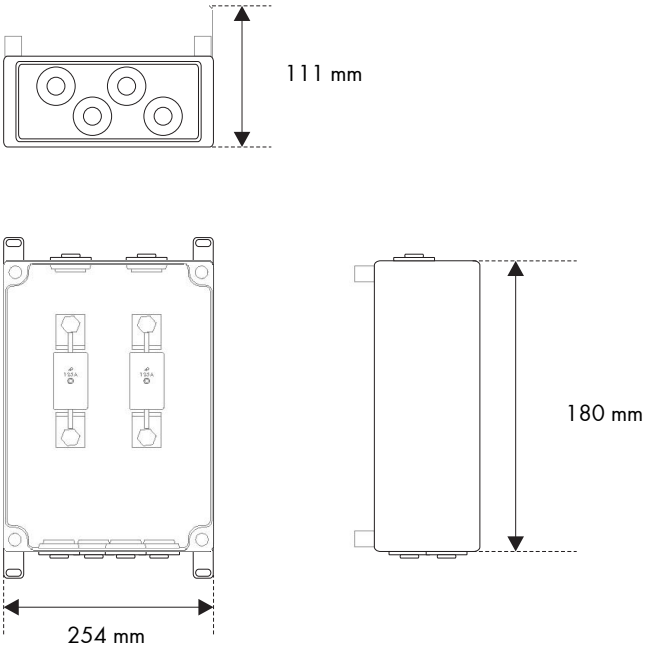
3. Mark the positions of the drill holes.
4. Drill the holes.
5. Mount the wall anchors and screws provided.

   Leave about a 6 mm clearance between the screw head and the wall.
6. Attach the display on the screws.
7. Ensure the unit is correctly in place.



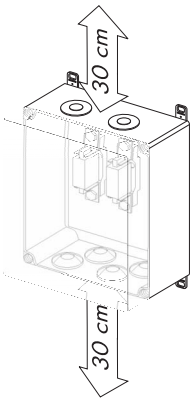
5.4 BatFuse A.01

5.4.1 Dimensions



5.4.2 Observe Minimum Clearances

Observe the following clearances when mounting the device:



5.4.3 Wall Mounting

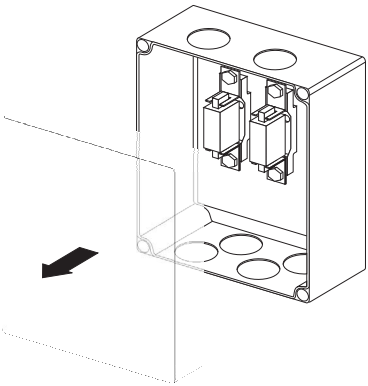
DANGER!
Danger to life due to fire or explosion.

Do not install the device

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

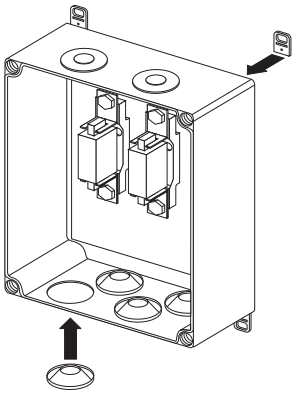
Mount the BatFuse A.01 on the wall. Proceed as follows:

1. Remove the cover.

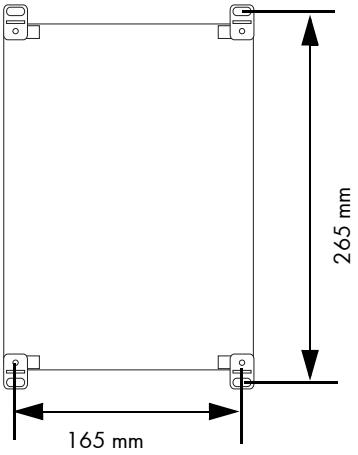


2. Insert the double membrane adapter.
3. Insert wall mounting plates.

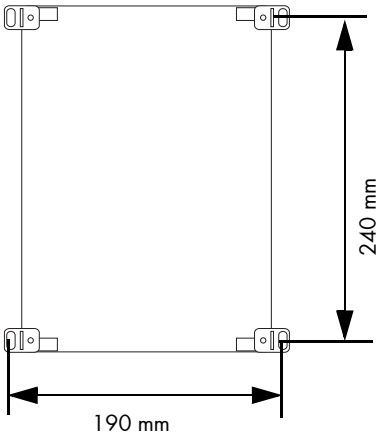
   There are two options for aligning the mounting plates (see the following illustrations):



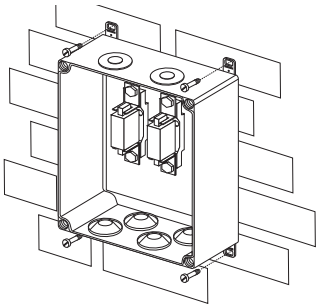
1.



2.



4. Mark drill holes on the wall.
5. Drill the holes.
6. Feed the screws through the wall mounting plate.
7. Fasten housing on the wall.



The mounting of the DC fuse is complete.

5.5 Installing Batteries

Information

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

DANGER!

Danger to life due to fire.

- Smoking prohibited!

  Do not allow open flames, embers, or sparks near the battery!

DANGER!

Danger to life due to short circuit.

Metal components of batteries are always energized.

- Do not place foreign objects or tools on the battery!
- Only perform work on the battery using insulated tools!

DANGER!

Danger to life due to leaking electrolyte.

IDuring normal operation, it is not possible to accidentally touch the electrolyte.

- Do NOT irreparably damage the battery housing!
- Immediately replace a battery with defective housing!

Batteries must be accommodated in protected rooms, and sufficient ventilation of the installation location must be ensured. Due to the safety extra-low voltage, battery systems that are only connected to one Sunny Backup 2200 do not require protection against direct and indirect contact.

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

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

- Nominal battery voltage = 24 V
- Battery type: closed lead acid batteries (VRLA)
- Max. charging voltage = 2.4 V/cell

as follows:

$Q = 0.0048 \times C_{10}$ [m³/h]

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

The cross-sectional area of the ventilation inlets and outlets is calculated according to the following formula:

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

In the area near the battery, it is not always ensured that the explosive gases are sufficiently diluted. For this reason, a clearance distance is to be observed in which no equipment which causes sparks or smoldering is permitted.

The clearance distance is calculated as follows:

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

The following table provides the required air

volume flows, ventilation cross-sectional areas and safety clearances for various closed lead acid batteries (gel and AGM batteries).

Battery capacity [Ah]	**Air volume flow for room ventilation [m³/h]**	**Ventilation cross-sectional area for natural air inlet and air outlet [cm²]**	**Clearance distance [cm]**
100 Ah	0.48 m³/h	13 cm²	27 cm
142 Ah	0.68 m³/h	19 cm²	31 cm
284 Ah	1.36 m³/h	38 cm²	38 cm
426 Ah	2.04 m³/h	57 cm²	44 cm

FLA battery

For closed lead acid batteries with the same charging voltages, the ventilation requirements are higher. The requirements exceed the specifications listed here by a factor of 5. As closed lead acid batteries are generally charged with even higher charging voltages, the ventilation requirements increase even further.

The batteries can either be installed directly on the ground, or on a special battery mount.

Installing a battery with liquid electrolyte

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

Finally, install the battery bank in accordance with the installation instructions provided by the battery manufacturer.

6 Opening and Closing

Do not remove the housing cover of the Sunny Backup 2200, or open the door of the Automatic Switch Box S, unless during installation of the device, or maintenance or repair work.

DANGER!
Risk of lethal electric shock.

High voltages are present in the device!

- Only qualified electricians are permitted to open the devices!
- Follow the instructions!

1. Switch off the Sunny Backup 2200.
2. Disconnect the Sunny Backup 2200 and the Automatic Switch Box S from all voltage sources (battery, grid) (see sections 11.2 „Stopping“ (93) and 11.3 „Deactivation“ (95)).
3. Wait 15 minutes (discharge time of the capacitors).
4. Secure the backup system against being inadvertently switched back on.

6.1 Sunny Backup 2200

Opening the Sunny Backup 2200

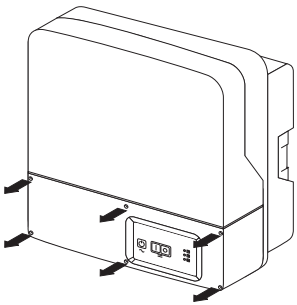
NOTICE!

Potential damages to the internal components of the Sunny Backup 2200 (e.g., communication interface) due to electrostatic discharge.

- When working on the Sunny Backup 2200 or handling the module assemblies, be sure to observe all ESD safety regulations.
- Discharge any static electricity by touching the grounded metal housing.
- Work can begin once all static electricity has been discharged.

1. Loosen the six non-removable hexagon socket screws of the lower cover.
2. Carefully remove the cover.
3. Remove the display cable from the cover. (No cable is installed if the device is new.)

   Now remove the cover from the housing.
4. Store the cover in a safe place.

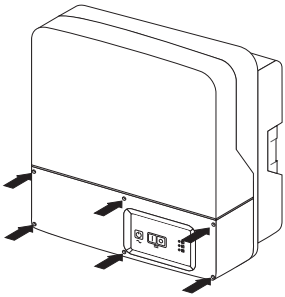


Information

The cover screws are non-removable screws that can be loosened, but not removed.

Closing the Sunny Backup 2200

1. Check whether all cables are safely installed and that all tools were removed from the housing of the Sunny Backup 2200 (see section 7 „Electrical Connection of the Sunny Backup 2200“ (46)).
2. Securely install the display cable on the cover.
3. Starting from the front, place the cover evenly on the housing.
4. Screw in all six screws, one after another, into the screw thread (one to two turns).
5. Then, tighten the screws crosswise using a torque of 2.5 Nm.



6.2 Automatic Switch Box S

Opening the Automatic Switch Box S

Proceed as follows:

1. Remove the cabinet key (double-bit) provided with the Automatic Switch Box S.
2. Loosen the housing cover lock by turning the key 90° to the right (clockwise).
3. Open the cover.

Closing the Automatic Switch Box S

1. Check whether all cables are safely installed and that all tools were removed from the housing of the Automatic Switch Box S (see section 8 „Electrical Connection of the Automatic Switch Box S“ (69)).
2. Close the housing cover.
3. Lock the housing using the cabinet key.

6.3 BatFuse A.01

The housing of the BatFuse A.01 has a removable cover. Remove this cover only when installing the device, for disconnecting the Sunny Backup 2200 from the battery or for required maintenance or repair work.

Opening the BatFuse A.01

1. Loosen the four screws on the housing cover.
2. Pull the housing cover forward smoothly.
3. Remove the cover and store it in a safe place while mounting, installing or repairing the device.

Closing the BatFuse A.01

1. Check whether all cables are safely installed and that all tools were removed from the housing of the BatFuse A.01 (see section 7.2.2 „BatFuse A.01 (DC fuse)“ (51)).
2. Place the housing cover on the housing.
3. Tighten the four screws on the housing cover.

7 Electrical Connection of the Sunny Backup 2200

DANGER!

Risk of death by electric shock due to improperly wired connections

- Only qualified electricians are permitted to install the electrical connections of the devices.
- Install a line circuit breaker with the characteristics: B, 25 A or a thermal fuse with a nominal current of 25 A upstream from the Sunny Backup system on the grid side (see figure page 56).
- Follow all the safety instructions provided in this section during installation work.

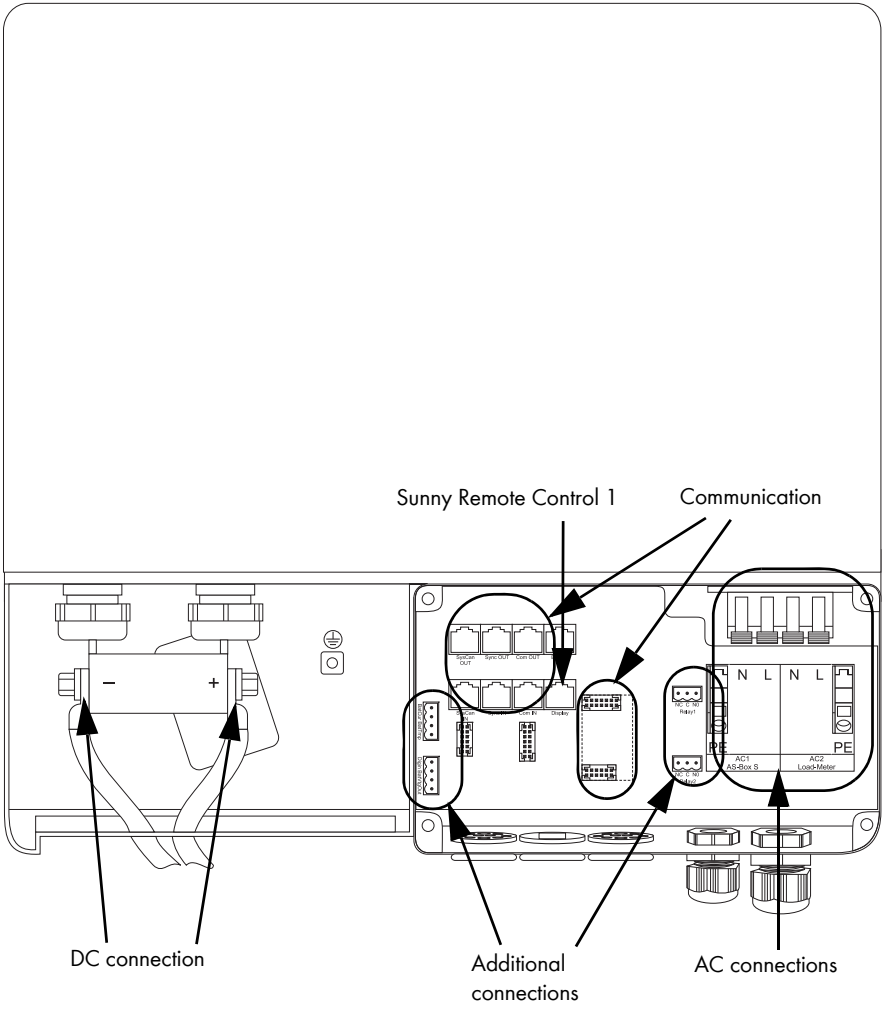
NOTICE!

Potential damages to the internal components of the Sunny Backup 2200 (e.g., communication interface) due to electrostatic discharge.

- When working on the Sunny Backup 2200 or handling the module assemblies, be sure to observe all ESD safety regulations.
- Discharge any static electricity by touching the grounded metal housing.
- Work can begin once all static electricity has been discharged.

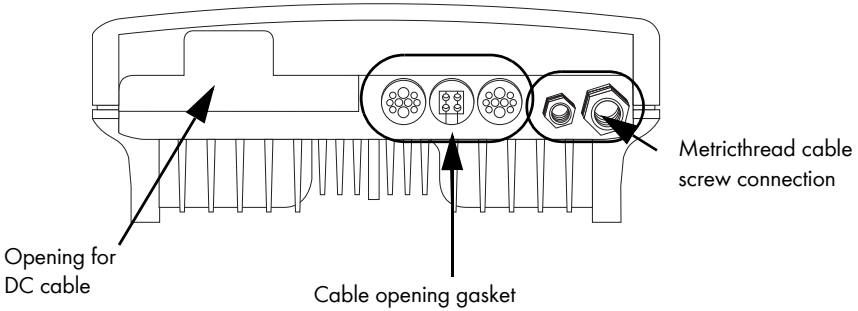
7.1 At a Glance

The following figure gives you an overview of all the Sunny Backup 2200 connections:



Cable Openings in the Housing

All cables are fed through the openings located under the device and then inserted into the appropriate connection terminals in the Sunny Backup 2200.



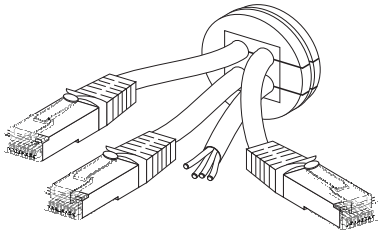
Metric-thread Cable Screw Connection

Use the metric-thread cable screw connections to fasten the AC cables in the Sunny Backup 2200 housing in a manner conforming to the appropriate standards. The metric-thread cable screw connections guarantee a dust-free and waterproof installation of the cables in the housing and also provide strain relief for the cable connection.

Close all unused openings in the housing using the appropriate dummy plugs.

Cable Opening Gasket

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



NOTICE!

Potential damage to device caused by penetrating moisture.

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

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

Obtain an overview of the various components and connection areas of the Sunny Backup 2200 (see section 7.1 „At a Glance“ (47)).

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

- DC connection (section 7.2 „DC Connection“ (50))
- AC connection (section 7.3 „AC Connection“ (55))
- Grounding (section 7.3.1 „Grounding“ (56))
- Sunny Remote Control 1 (section 7.4 „Sunny Remote Control 1“ (60))
- Battery temperature sensor (section 7.6.1 „Battery Temperature Sensor“ (64))
- Multi-function relay 1 and 2
  (section 7.6.2 „Multi-function Relay 1 and 2“ (65))
- External communication
  (section 7.5 „Communication“ (61))
- Automatic Switch Box S connection
  (section 8 „Electrical Connection of the Automatic Switch Box S“ (69))

7.2 DC Connection

WARNING!

The Sunny Backup 2200 does not have an internal DC fuse.

- Install an external DC fuse with 125 A between the Sunny Backup 2200 and the battery.

7.2.1 Grounding

External grounding

The external grounding of the battery's negative pole is normally possible since the batteries and the grid side are galvanically isolated from one another in the Sunny Backup 2200. In this case, make sure that the high currents that may occur under fault conditions can be adequately discharged.

If a ground connection is necessary, it must be established separately by an installer outside of the Sunny Backup 2200.

Calculating the Protective Earth Conductor Cross-section

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

Determining the cross-section

Exact calculation of the protective earth 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) protective earth conductor can be calculated using the following formula. Trigger times of about 25 ms are typical for short-circuit currents between 2000 A and 10000 A.

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

t = Short-circuit duration in seconds

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

S = Cable cross-section in square millimeters

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

7.2.2 BatFuse A.01 (DC fuse)

The BatFuse A.01 DC fuse is installed between the Sunny Backup 2200 and the battery. You can connect up to two batteries to the BatFuse A.01. The capacity of both battery sets may not exceed 3000 Ah.

DANGER!
Risk of lethal electric shock.

- Only qualified electricians are permitted to install the electrical connections.
- Make sure the cross-section of the cables is adequate and the polarity of the cables leading to the Sunny Backup 2200 and the battery is correct.
- Insert the NH fuse into the BatFuse A.01 bracket only after all installation work in the backup system has been completed (see pages 7 to 9).

Information

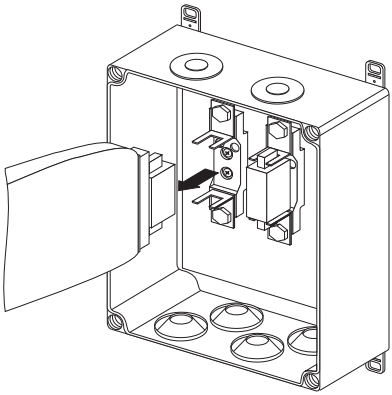
The battery cables should be as short as possible. Long cables and insufficient cable diameters reduce the system efficiency as well as the overload capabilities.

Do not lay the battery feed cables under plaster or in armored plastic pipes. Since large currents flow through them, the battery cables can become very warm.

Use a cable cross-section of 35 mm². The maximum current-carrying capacity is 125 A.

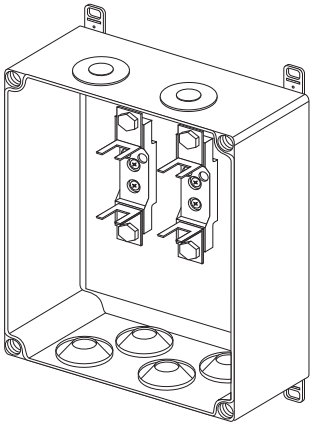
How to connect the BatFuse A.01:

1. Remove the housing cover.
2. Pull the NH fuse plugs from the bracket using the NH handle (as per VDE 0680-4).



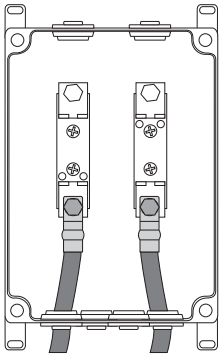
3. Remove the external membrane of requisite double membrane glands with the aid of a knife.
4. Cut the DC cables (35 mm² cross-section) to length and strip the insulation.
5. Feed the DC cables into the housing through the double membrane glands.

   Connect the Sunny Backup 2200 on top of the housing (two cable openings) and the battery to the bottom (four cable openings).
6. Attach a suitable conduit lug to the exposed cable ends.



7. Screw the conduit lug to the appropriate connection terminal and tighten each screw at 4 Nm.

   Make sure the polarity of the cables is correct!



DANGER!

Risk of lethal electric shock.

- Insert the NH fuse into the BatFuse A.01 bracket only after all installation work in the Backup System S has been completed (see pages 7 to 9).

  You can therefore skip the following paragraphs and continue with section 7.2.3 „Connecting the Battery“ (53).

7.2.3 Connecting the Battery

Connect a suitable battery to the DC side (see section 23 „Technical Data“ (163)).

DANGER!

Risk of death by electric shock while battery is connected.

- First complete all installation work in the backup system before inserting the NH fuse into the BatFuse A.01 bracket.

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

DANGER!

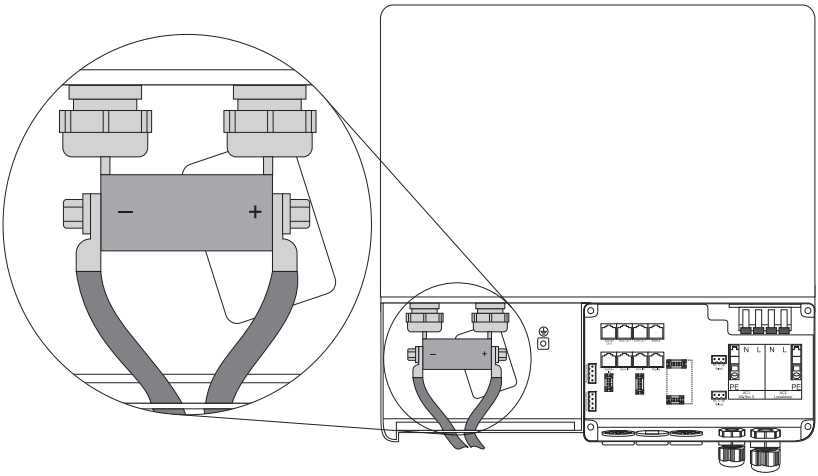
Risk of burns or death from arcing and short-circuiting when connecting the battery.

- Follow all safety and maintenance instructions provided by the battery manufacturer!
- Use a specialized (insulated) tool for attaching and installing the battery.
- Make sure the cross-section of the cables is adequate and the polarity of the cables leading to the battery is correct.

7.2.4 Connecting the Sunny Backup 2200

There is a "DC –" and a "DC +" connection available for each conduit lug (max. 95 mm²) for the battery feed cables in the Sunny Backup 2200.

Install the DC connections in the following sequence:



Information

The Sunny Backup System S set contains fully-assembled battery cables. If you have the complete set, you can continue the installation at Number 3.

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

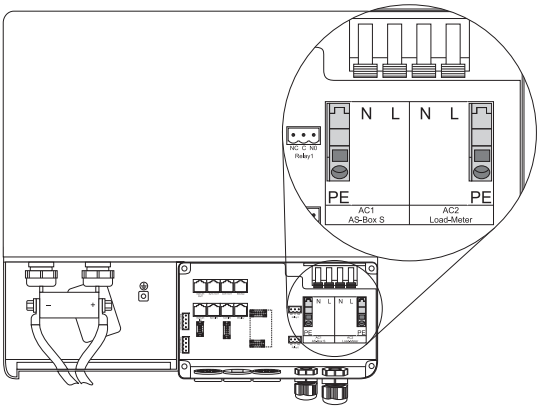
7.3 AC Connection

Information

In a stand-alone grid, the (protective) ground of the Sunny Backup 2200 and its individual components must be wired as a TN system only. All valid standards and guidelines must be taken into account!

Connect the Sunny Backup 2200 to the Automatic Switch Box S using the AC1 connection terminals with three conductors (see section 7.3.2 „AC1 (AS-Box-S.1)“ (57)). Connect the AC2 connection terminals of the Sunny Backup 2200 to the public grid via a 25 A fuse (see section 7.3.3 „AC2 (Load Meter)“ (59)).

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



7.3.1 Grounding

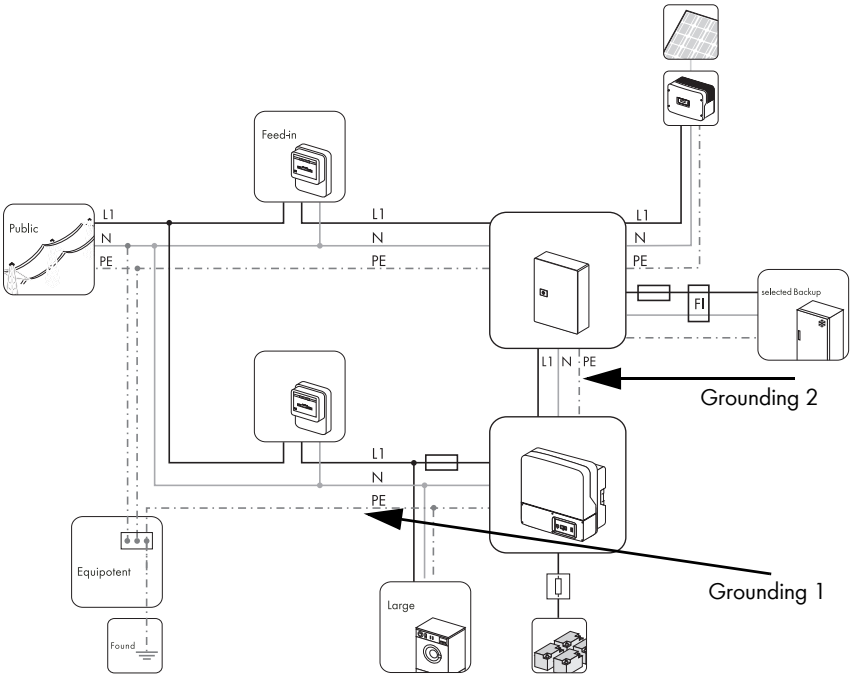
CAUTION!

Risk of injury from high leakage currents against PE.

The N connection of the Sunny Backup 2200 has NOT been connected with PE by default.

- Before commissioning the Sunny Backup 2200, be sure to externally ground the Sunny Backup System S (see section7.3.3 „AC2 (Load Meter)“ (59)).
- For safety reasons (leakage currents exceeding 3.5 mA), connect two protective earth conductors (redundant grounding).

Redundant grounding is only available if the Sunny Backup System S is properly installed.



1. The first ground connection is made using the protective earth conductor from the PV feed-in counter to the Sunny Backup 2200 via the Automatic Switch Box S.
2. The second ground connection is routed as a protective earth conductor from the power supply counter to the Sunny Backup 2200.

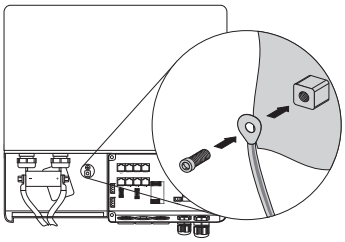
Route the two separate protective earth conductors in the electrical distribution to the equipotential bonding bar.

Additional Grounding of the Housing

If the Sunny Backup 2200 is used in a country that requires a second protective earth conductor (e.g., Switzerland), you can ground the housing using an additional connection terminal.

Proceed as follows:

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

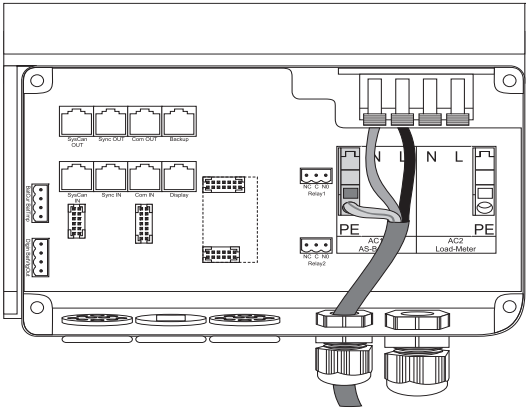


7.3.2 AC1 (AS-Box-S.1)

The AC1 connection of the Sunny Backup 2200 is connected to the Automatic Switch Box S via three conductors (see section 8.2.3 „Sunny Backup 2200 (X3/Sunny Backup)“ (76)).

Method for connecting the Sunny Backup 2200:

1. Loosen the metric-thread cable screw connection on the right bottom of the housing and remove the dummy plug from the cable opening.
2. Pull the three-core conductor through the screw connection.
3. Pull the conductor into the housing.
4. Flip open the terminals of the AC1 through terminals (N and L conductors) all the way.



DANGER!

Risk of lethal electric shock.

Incorrectly installed cables may become detached from the through terminal.

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

5. Remove the protective insulation from the three conductors.

6. Connect the N and L conductors to the AC1 through terminals as labeled.
   L and N may not be swapped!

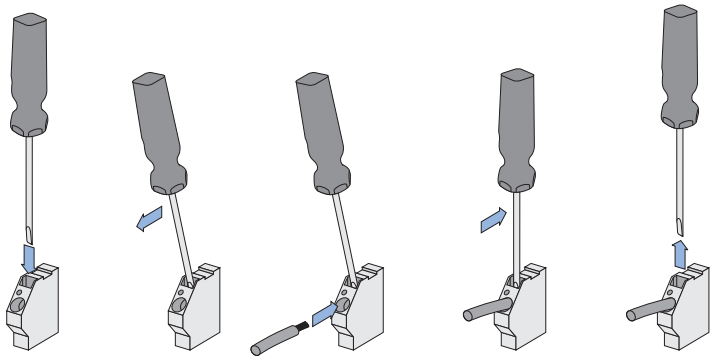
CAUTION!

Danger of crushing when the through terminals snap closed.

The terminals snap down rapidly and hard when closing.

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

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



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

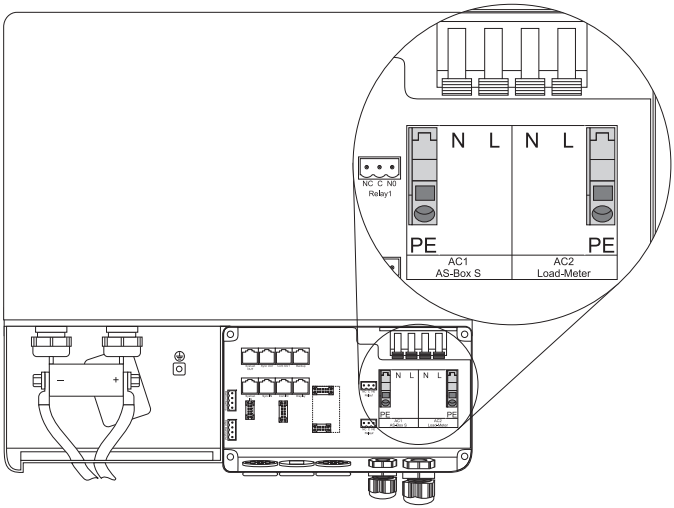
8. Tighten the counter nut of the cable screw connection.

7.3.3 AC2 (Load Meter)

Connect the Sunny Backup 2200 to the public grid via the distribution. Connect the AC2 connection terminals to the electricity meter.

Installation instructions

- Do not install a RCD switch (or similar switching element) in the grid-side supply cable of the Sunny Backup System S.
- Ground the grid-side PEN conductor from the energy supplier (before or while separating into N and PE conductors) in the main distribution box.



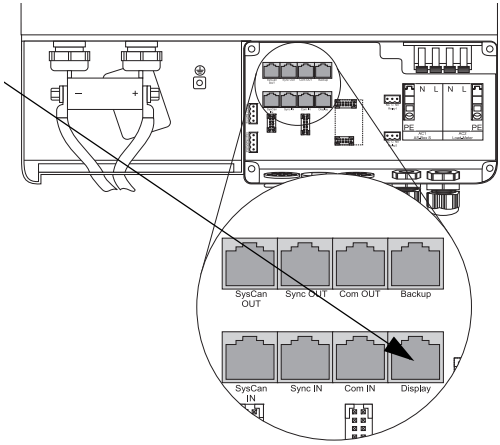
Cable protection

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

Wire the AC2 cable as described in section 7.3.2 „AC1 (AS-Box-S.1)“ (57).

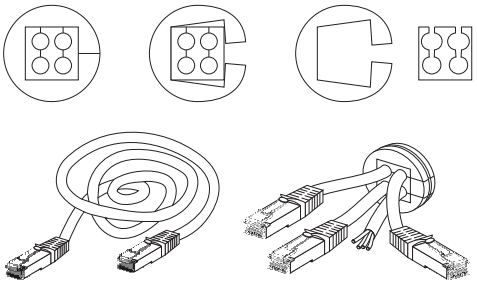
7.4 Sunny Remote Control 1

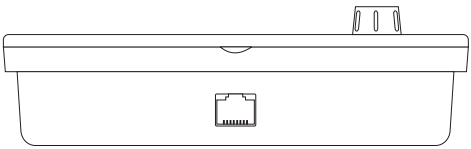
The Sunny Remote Control 1 is connected to the "Display" connection terminal in the Sunny Backup 2200.



1. Loosen the preinstalled plug feed-through on the base of the housing.
2. Take the entire feed-through element out of the installation opening.
3. Place the cable equipped with the RJ45 plugs into a hollowed out section of the internal rubber insert.

   Make sure the cable is long enough to reach from the housing opening to the desired "Display" connection socket on the circuit board.
4. Install all communication cables (see section 7.5 „Communication“ (61)) before assembling the feed-through element and then re-inserting it into the installation opening on the Sunny Backup 2200.
5. Insert the RJ45 plug into the "Display" connection socket on the Sunny Backup 2200. The plug will audibly snap into place.
6. Connect the second RJ45 plug of the cable (outside of the Sunny Backup 2200) to the connection socket of the Sunny Remote Control 1 display.





7.5 Communication

7.5.1 SBU 2200 and Automatic Switch Box S

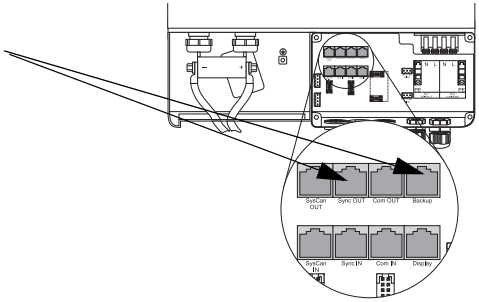
Information on installation

1. The communication cable must always be installed separately from the AC cables.
2. Do NOT route the communication cables with the plugs through the membranes. Threading the plug through would widen the membrane to the point where there would no longer be a tight seal around the thinner cable.
3. If the provided communication cable is not long enough, then use a standard Cat5e FTP cable (single shield) with gold contacts instead.
4. The maximum cable length is 30 m. The minimum cable cross-section is AWG26/7.

The Sunny Backup 2200 communicates with the Automatic Switch Box S via two CATe-FTP patch cables (with two RJ45 plugs each).

These patch cables will be referred to as communication cables below.

The Sunny Backup 2200 controls the Automatic Switch Box S via a CAN bus. Connect the "SyncOut" connection socket of the Sunny Backup 2200 with the "SyncIn" connection socket of the Automatic Switch Box S.



The Sunny Backup 2200 receives the voltage and current measurement signals of the Automatic Switch Box S through the second communication cable. Connect the "Backup" connection sockets of both devices using the red communication cable that is provided.

To install the two communication cables, proceed as follows:

1. Place each communication cable into a separate hollowed out section of the internal rubber insert.

   Make sure the cable is long enough to reach from the housing opening to the desired "SyncOut" or "Backup" connection socket on the circuit board of the Sunny Backup 2200.
2. Pull the communication cables into the housing from the outside.
3. Insert the RJ45 plug of the black communication cable into the "SyncIn" connection socket on the Sunny Backup 2200. The plug will audibly snap into place.
4. Insert the RJ45 plug of the red communication cable into the "Backup" connection socket on the Sunny Backup 2200. The plug will audibly snap into place.

5. If applicable, install the communication cables of the external communication device (see section 7.5.2 „SBU 2200 and an External Communication Device“ (62)) before assembling the feed-through element and then re-inserting it into the installation opening on the Sunny Backup 2200.
6. Connect the second RJ45 plug of the cables (outside of the Sunny Backup 2200) with the corresponding connection sockets on the circuit board of the Automatic Switch Box S (see section 8.3 „Communication“ (79)).

7.5.2 SBU 2200 and an External Communication Device

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 Sunny Backup 2200 devices can be detected at once. Detailed information on this topic can be found in the communication device manual, the software or on the Internet at www.SMA.de.

You can install the RS485 communication interface in the Sunny Backup 2200.

Information

Communication via Powerline/Powerline modem (NLM) is not possible in the Sunny Backup System S.

A detailed wiring diagram for the communication interfaces can be found in the communication device manual. This wiring diagram includes the following information:

- Details on the required cable type
- Which connections of the Sunny Backup 2200 are used
- Whether or not the communication cables must be terminated
- Whether the cable shield needs to be connected to the protective earth conductor

NOTICE!

Potential damage to the internal components of the Sunny Backup 2200 (e.g., communication interface) due to electrostatic discharge.

- When working on the Sunny Backup 2200 or handling the module assemblies, be sure to observe all ESD safety regulations.
- Discharge any static electricity by touching the grounded metal housing.
- Work can begin once all static electricity has been discharged.

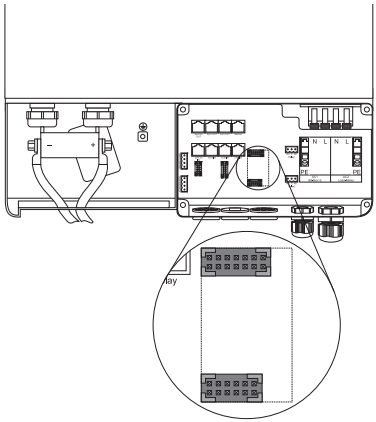
To install the communication interface, proceed as follows:

1. Insert the communication cable of the interface into the last available hollowed out section of the internal rubber insert.

   Make sure the cable is long enough to reach from the housing opening to the desired "ComOut" connection socket on the circuit board of the Sunny Backup 2200.
2. Pull the communication cable into the housing from the outside.
3. Insert the RJ45 plug of the communication cable into the "ComOut" connection socket on the Sunny Backup 2200. The plug will audibly snap into place.
4. Re-assemble the feed-through element and insert it in the installation opening on the base of the Sunny Backup 2200 housing.
5. Connect the other end of the communication cable on the communication device.

   The installation guide of the communication device specifies which three pins should be connected.

   The following table shows the assignment of these pins to the corresponding pins of the RJ45 socket.



Interface port RS485 (Piggy-Back)

WebBox pin assignment	RS485	RJ45 socket
2	A (Data+)	3
7	B (Data-)	6
5	GND	2

6. Terminate the Sunny Backup 2200 at RS485.

   In the Sunny Backup 2200, the RS485 data bus is terminated using a plug. This plug is already pre-installed in the Sunny Backup 2200. Please only remove the plug if you want to connect another communication device.
7. Plug the communication interface into the socket on the board.

The Sunny Backup 2200 can use various data transmission speeds (1200 to 19200 bps) to communicate with external devices. To allow such communication, the "250.06 ComBaud" parameter must be set accordingly.

Setting the batteries

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

The Sunny Backup 2200 uses the SMA-Net protocol for communication.

7.6 Additional Connections

7.6.1 Battery Temperature Sensor

The battery temperature sensor measures the temperature of the connected battery. This is necessary since the optimum charging voltage for a battery strongly depends on the temperature. Further information is provided in section 16.4 „Charge Control“ (125). A battery temperature sensor is included with the Sunny Backup 2200 (see packing list).

Defective battery temperature sensor

If the battery temperature sensor fails (e.g., due to a short circuit or cable break), the Sunny Backup 2200 will run in a safe setting that will drain the battery over time. A warning will appear in the display of the Sunny Backup 2200 if this occurs.

- Replace the defective battery temperature sensor as soon as possible.
- Always run the Sunny Backup 2200 with a battery temperature sensor (included in delivery).

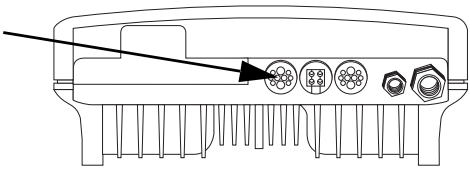
NOTICE!

Damage to battery due to installation error.

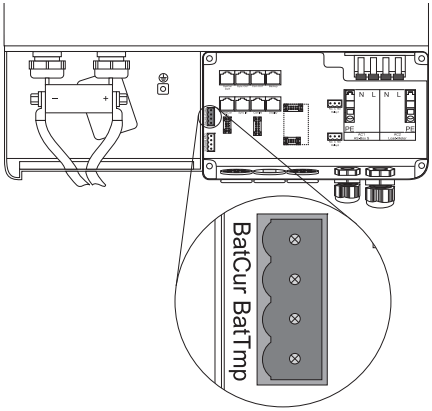
- Be sure to install the battery temperature sensor included in the delivery.
- Do not drill holes into the battery when installing the battery temperature sensor!
  - Attach the battery temperature sensor externally to one of the battery cells.
  - Select the space between two cells or the middle area of the battery bank where the most heat is generated during operation.

Proceed as follows when connecting the battery temperature sensor:

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



4. Insert one wire into each "BatTmp" connection terminal of the 4-pole print terminal included in the delivery.
5. Tighten the screws of the connection terminals.



Installation instructions

The polarity of the two conductors has no influence on the function of the battery temperature sensor.

6. Push the 4-pole print terminal into the "BatCur BatTmp" socket.

7.6.2 Multi-function Relay 1 and 2

DANGER!

Risk of death due to faulty insulation.

- Securely disconnect the relay cable from the communication area.
- Strip the wires of the relay cable.
- Attach the silicone tube included in the delivery to each wire.
- Do not operate the device without the silicone tube.

The Sunny Backup 2200 provides you with several options to control internal and external operations. Two multi-function relays that can be assigned functions via the "241.01 Rly1Op" and "241.02 Rly2Op" parameters in the 241# Relay General menu are included in the device for this specific purpose (see section 17 „Relay“ (131)).

Operating principle of the relays

The relays are designed as changeover contacts that can be used as either a break contact or a NO contact.

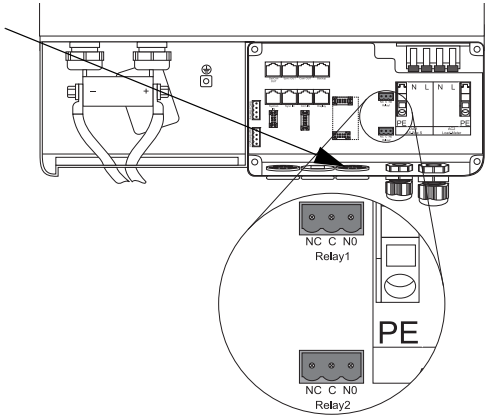
The relay functions are listed as NO contact functions, in other words, the contact is closed if the relay is activated by selecting the function. For the exception "Alm" (alarm), the relay has a break function. This means that the relay is normally activated and opens the contact. Only when a fault occurs does the relay deactivate and close the contact (and switches on a warning light, for example).

Function of the relay

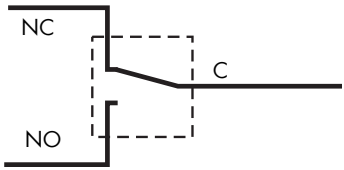
You can only assign one function to each relay.

Proceed as follows when installing the relay connections:

1. Pierce the rubber plug with a pin-shaped object.
2. Attach cable end sleeves to the conductors.
3. Route both conductors through the opening from the outside.
4. Insert the wires into the "Relay1" or "Relay2" connection terminals of the 3- pole print terminals included in the delivery.
5. Tighten the screws of the connection terminals.



6. Note how the pins are labeled:
   - NC: Normally closed (closed when in standby)
   - C: Contact (operating contact)
   - NO: Normally opened (open when in standby)



7. Push the 3-pole print terminal into the appropriate socket.

Switching processes of the relay

Information on the switching capacities of the relays is provided in section 23 „Technical Data“ (163).

Load Shedding

The Sunny Backup 2200 can automatically switch off loads to protect the battery from deep discharge. To do so, an external (AC or DC) power contactor must be installed between the Sunny Backup 2200 and the loads (see also section 22.1 „Accessories (Optional)“ (162)).

NOTICE!

The loads are no longer supplied.

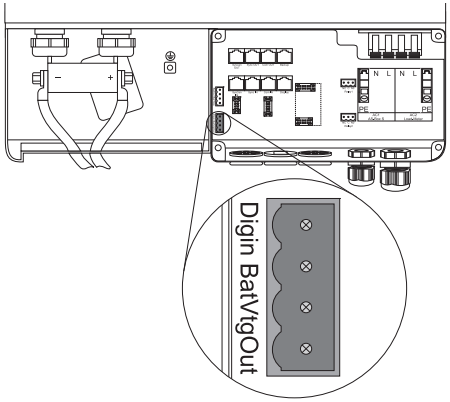
If a relay is used for load shedding, the loads connected to the load breaker will no longer be supplied with electricity in the event of a fault in the Sunny Backup System S. This occurs even if grid power is available.

7.6.3 BatVtgOut Power Supply

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

Proceed as follows when connecting the power supply:

1. Pierce the rubber plug with a pin-shaped object.
2. Attach cable end sleeves to the conductors.
3. Route both conductors through the opening from the outside.
4. Insert one wire into each "BatVtgOut" connection terminal of the 4-pole print terminal included in the delivery.
5. Tighten the screws of the connection terminals.

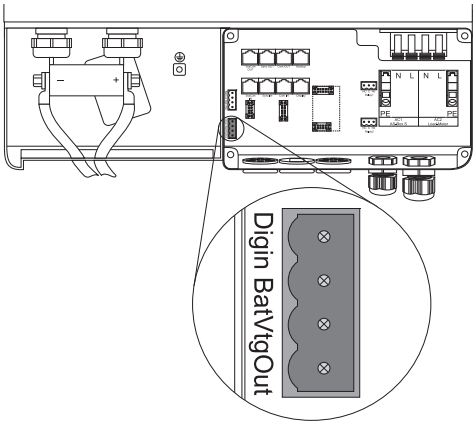


7.6.4 Digital Input, DigIn

These terminals are used a digital input for external electrical sources.

Proceed as follows when connecting the digital input:

1. Pierce the rubber plug with a pin-shaped object.
2. Attach cable end sleeves to the conductors.
3. Route both conductors through the opening from the outside.
4. Insert one wire into each "DigIn" connection terminal of the 4-pole print terminal included in the delivery.
5. Tighten the screws of the connection terminals.
6. Push the 4-pole print terminal into the "DigIn BatVtgOut" socket.



Concluding Tasks

1. Check to see if all the feed-throughs on the device are tightly sealed and no unsealed openings remain.
2. Make sure all of the inserted cables are strain-relieved and the communication cables inside the Sunny Backup 2200 cannot come into contact with the stripped 230 V wires.
3. Close the Sunny Backup 2200 as described in section „Closing the Sunny Backup 2200“ (44).

Information

When routing cables between the Sunny Backup 2200 and the Automatic Switch Box S, only permanent cable installation and strain-relieved cables are permissible.

Use sheathed cables (doubly insulated conductors)!

The installation of the Sunny Backup 2200 is complete. You can now install the Automatic Switch Box S (see section 8 „Electrical Connection of the Automatic Switch Box S“ (69)).

8 Electrical Connection of the Automatic Switch Box S

The Automatic Switch Box S is the automatic switching device of the Sunny Backup system.

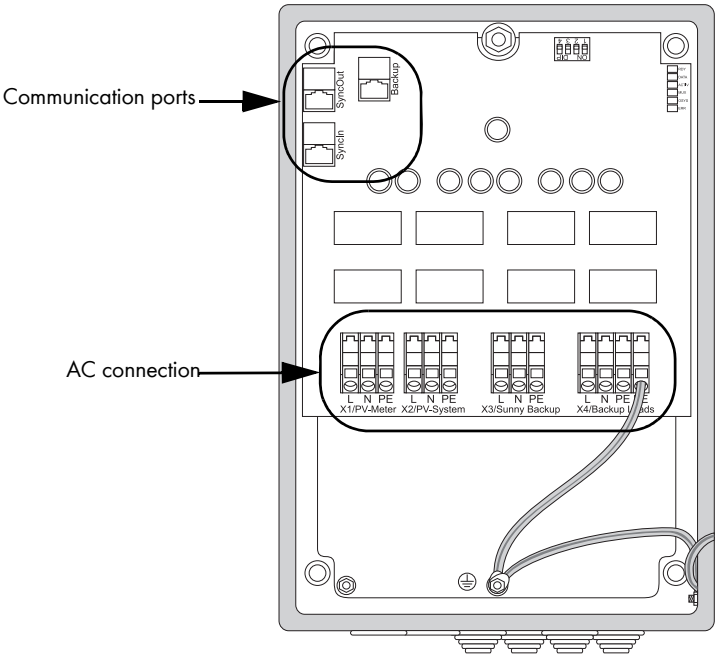
DANGER!

Risk of death by electric shock due to improperly wired connections.

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

8.1 At a Glance

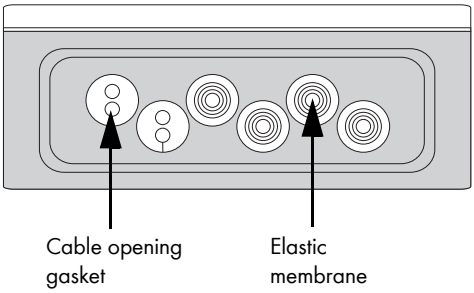
All connection terminals for external AC cables are located on the bottom row of the mounting plate. The connection sockets for the communication cables are on the upper left section in the housing.



All cables are fed into the housing from underneath.

On the bottom of the housing there are four elastic rubber membranes for installing the AC cables.

The fully-assembled communication cables (with RJ45 plugs) are routed through the cable opening gaskets.



NOTICE!

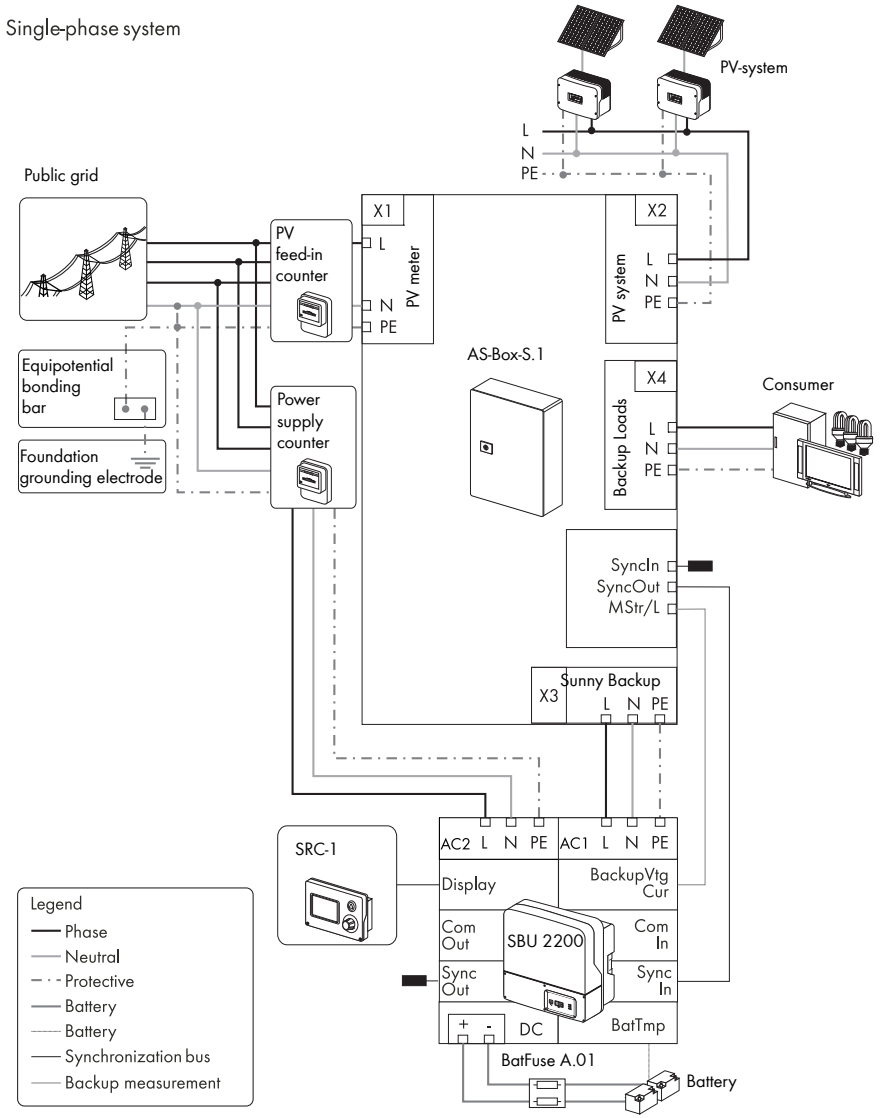
Potential damage to device caused by penetrating moisture.

- Properly mount the elastic membrane and the cable opening gasket.
- Close all unused openings.

If properly installed, the rubber membrane and cable opening gasket guarantee IP54 protection.

8.2 AC Connection

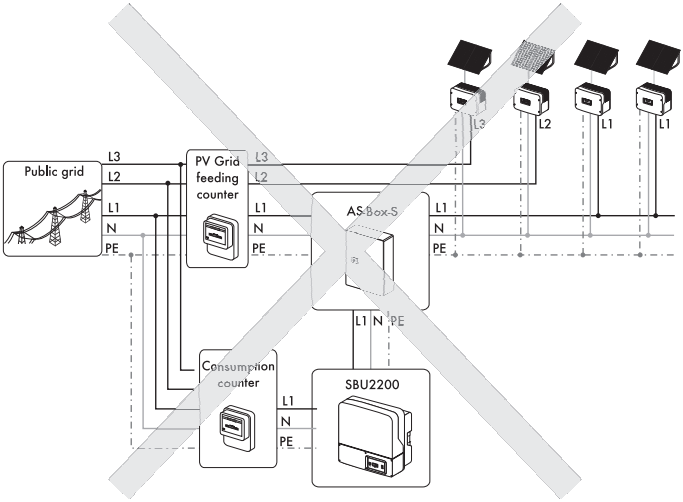
The figures below show how a single-phase system is connected to the Automatic Switch Box S. A description of how the individual AC cables are installed will then be provided using the X1/PV Meter connection as an example (see section 8.2.1 „PV Feed-In Counter (X1/PV Meter)“ (73)).



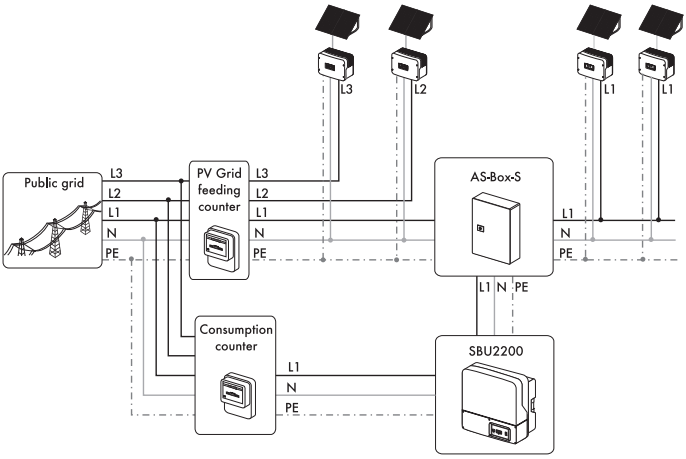
When installing the Sunny Backup System S, note the following:

- Connect up to two Sunny Boys to the Automatic Switch Box S at the same time (max. 4.6 kW).
- Route the N conductor through the Automatic Switch Box S.
- Connect both Sunny Boys "behind" the box to a **single** phase (e.g., L1) and the N conductor.
- Always install additional Sunny Boys to the remaining phases (here: L2, L3) and the N conductor "upstream" from the Automatic Switch Box S on the grid side.

Incorrect installation:



Correct installation:

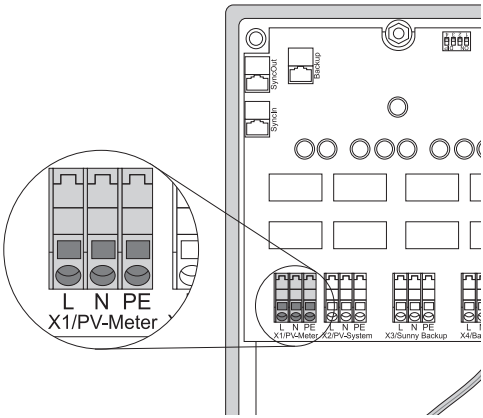


8.2.1 PV Feed-In Counter (X1/PV Meter)

Connect the X1/PV Meter connection to the feed-in counter for the PV system.

The cross-section of the cables depends on the upstream fuse. Use a conductor cross-section of max. 6 mm². The terminals are designed as spring-type terminals. The nominal AC current is 20 A.

The protective earth conductor (PE) is inserted into the PE terminal of the X1/PV Meter in order to connect the Automatic Switch Box S to the equipotential bonding bar of the building.

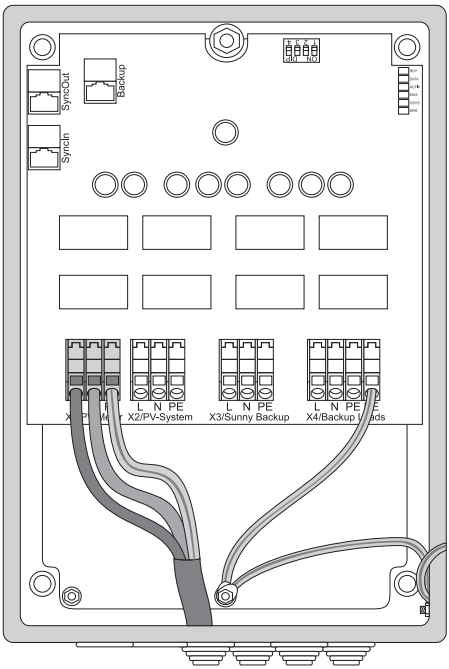


To feed in and connect the AC cables, proceed as follows:

1. Select a suitable cable opening on the bottom of the housing.
2. Strip away the outer sheath of the cable to the point where it matches the cable length to be installed in the device.
3. Use a pin-shaped object to prick a hole in the rubber membrane at the feed-through position.

   Do not use a knife or cutting pliers for this.
4. Thread the prepared cable through the small hole you just made in the elastic membrane.

   The membrane must tightly reseal around the cable sheath.
5. Establish a suitable level of strain relief for the cable outside of the Automatic Switch Box S.
6. Route the wires to the connection terminals.
7. Strip the insulation from the conductor ends.

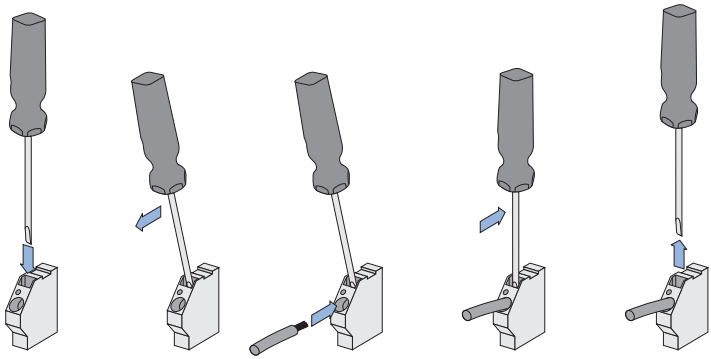


DANGER!
Risk of lethal electric shock.

The conductor ends can become detached from the spring-type terminal over time.

- Do not use cable end sleeves when connecting the AC cable.
- Observe the specified length to be stripped (13–15 mm for 6 mm² spring-type terminals).

8. Attach the L, N and PE conductors as labeled on the spring-type terminals.
   L and N may not be swapped!
   Use a flathead screwdriver for this purpose (see figure below).

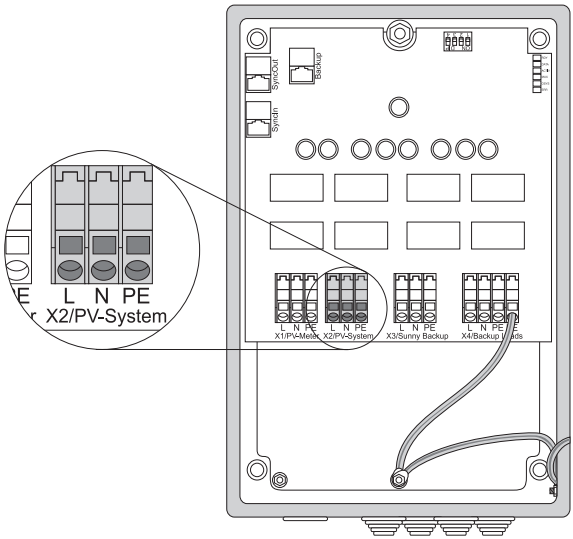


   – Insert the screwdriver into the slit of the spring-type terminal.
   – Push the screwdriver down.
   – The spring-type terminal is now open.
   – Push the stripped conductor into the terminal (round opening).
   – Bring the screwdriver back to its original position.

   The spring-type terminal is closed and the conductor is fixed in place.

8.2.2 PV System (X2/PV System)

Connect the X2/PV System connection to the PV system. Use a conductor cross-section of max. 6 mm². The terminals are designed as spring-type terminals. The nominal AC current is 20 A.



Due to the multitude of possible configurations (e.g., one Sunny Boy per phase), the Automatic Switch Box S is not intended to serve as a distributor cabinet or fuse box for the Sunny Boys.

Number of PV inverters

Connect up to two Sunny Boys to the Automatic Switch Box S at the same time. Additional measures are required if you want to connect more Sunny Boys. If necessary, contact SMA Solar Technology AG (see section 24 „Contact“ (169)).

Do not bridge the neutral conductor

Connect up to two Sunny Boys to the Automatic Switch Box S at the same time. Additional measures are required if you want to connect more Sunny Boys. If necessary, contact SMA Solar Technology AG (see section 24 „Contact“ (169)).

The dimensioning of the output cable is to be selected according to the routing conditions, the PV power output and the upstream fuse on the grid side (see also X1/PV Meter connection).

With regard to short-circuit protection, the Sunny Boys and Sunny Backup 2200 devices do not need to be taken into account as, due to their design, they cannot endanger the cables if a short circuit occurs. In the event of a short circuit, only short-circuit currents from the grid require fuse protection. Overload protection is always guaranteed if, as can be assumed, the cables which you route to the PV system are designed for at least the feed-in power of the PV system.

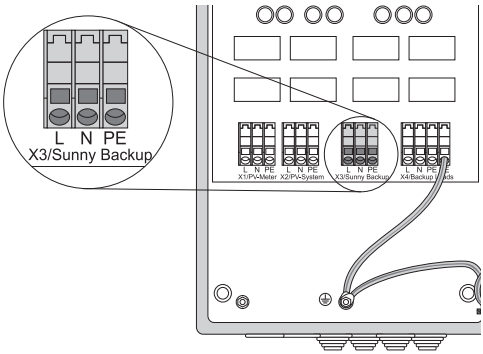
NOTICE!

Device fault due to incorrect connection of other feed-in generators.

Only Sunny Boys, and no other feed-in generators, may be connected to the X2/PV System terminal strip if the Automatic Switch Box S is connected via X1/PV Meter to a feed-in counter which is tariffed for PV power. It is also not allowed to connect loads to the X2/PV System terminal strip, or to the cable which runs from this terminal strip to the PV system.

8.2.3 Sunny Backup 2200 (X3/Sunny Backup)

Connect the X3/Sunny Backup connection to the Sunny Backup 2200. Use a conductor cross-section of max. 6 mm². The terminals are designed as spring-type terminals. The nominal AC current is 25 A.



8.2.4 Consumer System (X4/Backup Loads)

Connect the X4/Backup Loads connection to the loads. Use a conductor cross-section of max. 6 mm². The terminals are designed as spring-type terminals. The nominal AC current is 25 A.

DANGER!

Risk of death from feedback into the public grid.

If three-phase loads are connected in the backup system, feedback into the public grid via one of the L conductors may occur in the event of a grid failure.

- Only run single-phase loads in a Sunny Backup System S.

DANGER!

Risk of death from leakage currents.

Install a RCD switch between the Automatic Switch Box S and the loads.

NOTICE!

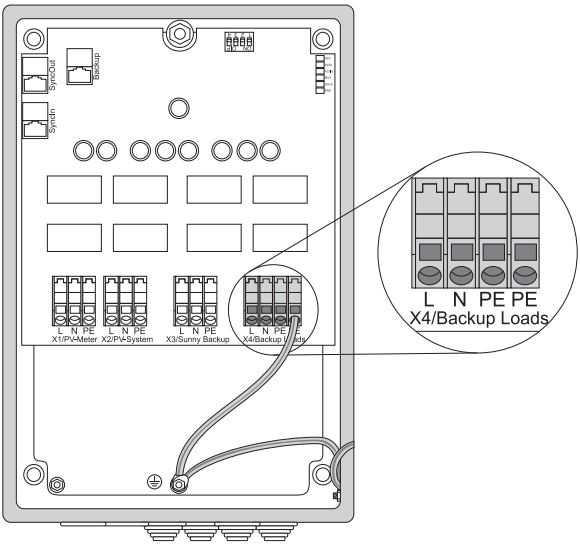
Device fault due to overcurrents.

The grid current and the current from the Sunny Backup 2200 can combine with each other and exceed the permitted 25 A limit.

- Install a 25 A fuse between the Automatic Switch Box S (X4/Backup Loads connection terminal) and the loads.

Due to its design, the Sunny Backup can only deliver limited current in the event that body contact is made with the device. This current cannot trigger a 16 A line circuit breaker commonly used in building installations. Therefore, a RDC must be installed.

However, if all load circuits are protected with line circuit breakers with a maximum rating of B6, the Sunny Backup can provide corresponding current. If the present form of the standard in the respective country allows, the RCD is not required.



Installation instructions

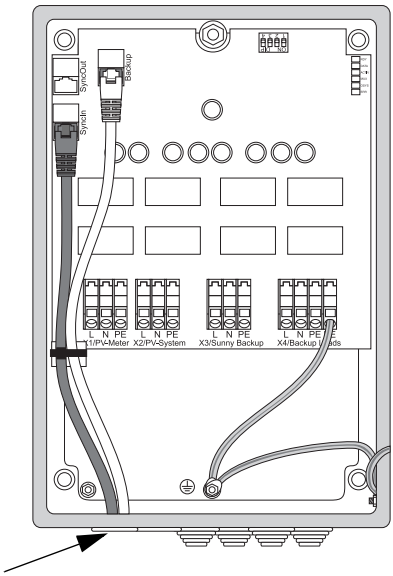
Do not install a galvanic connection (bridge) between the N conductors of the X2/PV System connections and the X4/Backup Loads. If this is done the Sunny Backup System S will not be able to start.

8.3 Communication

Terminating the CAN bus

The CAN bus must be terminated at both ends with terminating plugs. The "SyncOut" socket on the circuit board of the Automatic Switch Box S comes with a pre-installed terminating plug for this reason. The other end of the bus is located on the connected Sunny Backup 2200.

The Automatic Switch Box S is connected to the Sunny Backup 2200 via two communication cables. This is also explained in section 7.5.1 „SBU 2200 and Automatic Switch Box S“ (61).



Install the communication cables as follows:

1. Loosen the preinstalled cable opening gasket on the lower left corner of the base of the housing.
2. Take the entire feed-through element out of the installation opening.
3. Place each cable end equipped with an RJ45 plug into one of the hollowed out sections of the internal rubber insert.

   Make sure the cable is long enough to reach from the bottom of the housing to the desired connection sockets.

4. Insert the RJ45 plug of the black communication cable into the "SyncIn" connection socket. The plug will audibly snap into place.
5. Insert the RJ45 plug of the red communication cable into the "Backup" connection socket. The plug will audibly snap into place.
6. Re-assemble the feed-through element and insert it in the installation opening on the housing.

Concluding Tasks

Check to see if all the feed-throughs on the devices are tightly sealed and no unsealed openings remain.

Make sure all of the inserted cables are strain-relieved and the communication cables inside the Automatic Switch Box S cannot come into contact with the stripped 230 V wires.

Information

When routing cables between the Sunny Backup 2200 and the Automatic Switch Box S, only permanent cable installation and strain-relieved cables are permissible.

Use sheathed cables (doubly insulated conductors)!

The installation of the Automatic Switch Box S is now complete.

Inserting the NH Fuse

NOTICE!

Inserting the NH fuse.

- When inserting the NH fuse, always use an NH handle and wear gloves!
- Observe all relevant safety guidelines set forth by the professional association.

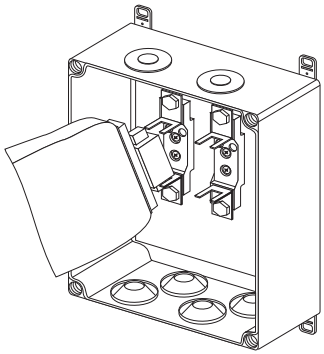
Method for inserting the NH fuse:

Information

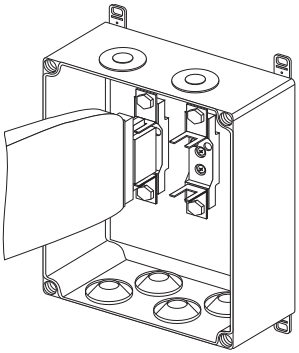
When starting up the device for the first time or if the device has been disconnected from the battery for an extended period, a current flow may occur when inserting the NF fuses, even if the Sunny Backup 2200 is switched off.

Such a current flow does not pose a danger and is caused by the charging current in the input capacitors of the device.

7. Place the bottom of the NH fuse plug on the bracket using the NH handle (as per VDE 0680 4).



8. Now quickly push the NH fuse into the bracket.



The Sunny Backup 2200 is connected to the battery.
You can now turn on the Sunny Backup System S.

9 Control Elements

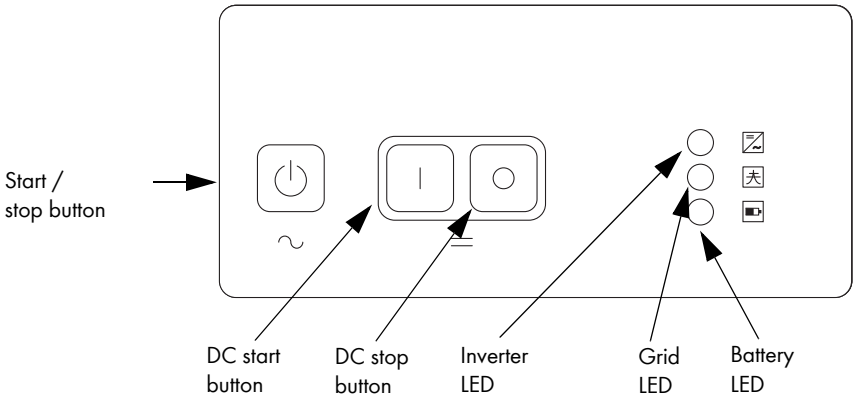
Before commissioning the Sunny Backup System S, be sure to read the operating manual first.

The Sunny Backup 2200 is operated via the device display using the default settings only (the default values are listed in section 20.2 „Adjustable System Parameters“ (142)).

To change the parameter settings of the Sunny Backup 2200, you need the Sunny Remote Control 1 (SRC-1).

9.1 Display of the Sunny Backup 2200

The figure below describes the control elements of the device display:



Explanation of the LEDs

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

- inverter (Sunny Backup 2200)
- grid
- battery

The LEDs will glow green, red or yellow, or remain inactive, depending on the status message.

The meaning of the inverter LED colors is described in the following table

Green	Red	Yellow	Sunny Backup 2200 operating mode
–	–	–	off (no inverter operation)
–	–	ON	standby
ON	–	–	operation
–	ON	–	failure or fault

The meaning of the grid LED colors is described in the following table:

Green	Red	Yellow	Grid operating mode
–	–	–	no grid if applicable (third party access possible)
–	–	ON	synchronization with the external grid
ON	–	–	backup system operating via an external grid
–	ON	–	failure or fault

The meaning of the battery LED colors is described in the following table:

Green	Red	Yellow	Battery charge state
–	–	–	off (no inverter operation)
ON	–	–	100 % – 50 %
–	–	ON	50 % – 20 %
–	ON	–	20 % – 0 %

Buttons on the Device Display

The display on the Sunny Backup 2200 has three buttons

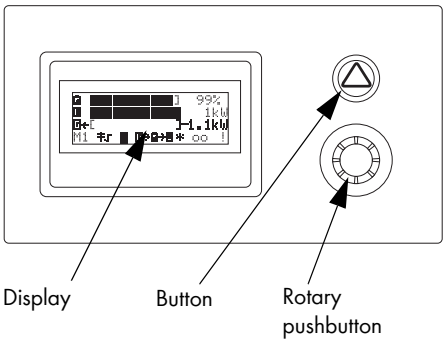
- DC start turns on the device.
- DC stop turns off the device.
- Start / stop turns on the Sunny Backup 2200 (see also section 11 „Activating and Deactivating the Backup System“ (91)).

9.2 Sunny Remote Control 1

You can use the external display (Sunny Remote Control 1) to navigate through the menus of the Sunny Backup 2200.

The Sunny Remote Control 1 consists of one

- rotary pushbutton
- display
- button



Rotary Pushbutton

The Sunny Remote Control 1 is controlled via a rotating push button. The rotating push button allows you to easily navigate through the menus of the Sunny Backup 2200 (see section 12.1 „Navigation Area“ (97)).

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

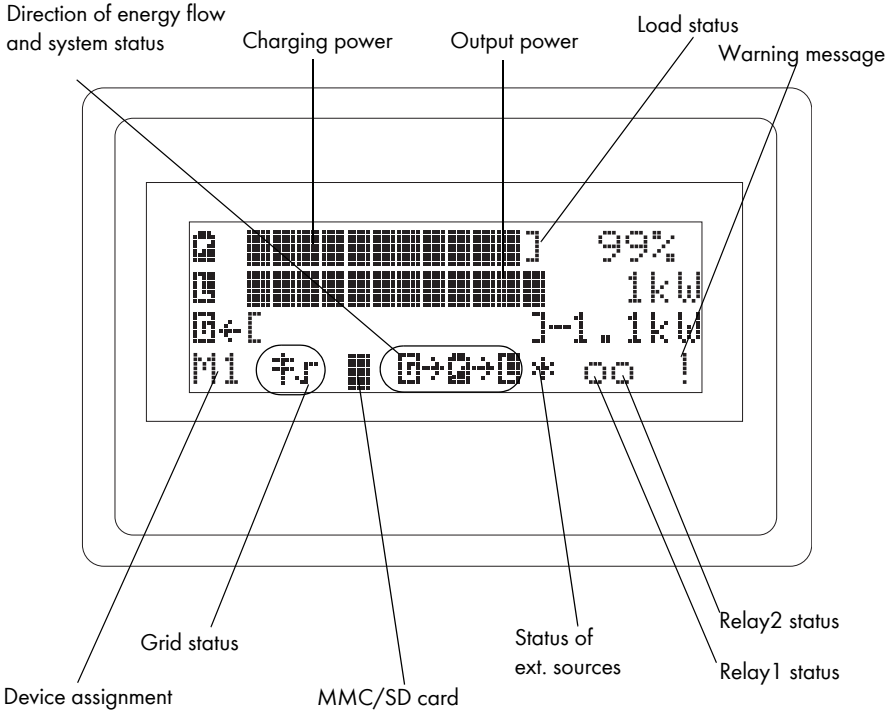
- Rotating:
  - Move up or down in the menu
  - Enter values
- Push:
  - Open/close menu
  - Select/cancel function
  - Select value
  - Confirm entry
  - Answer YES/NO
  - Start the device (when held down)
  - Stop the device (when held down)

Section 12 „Using the Sunny Backup 2200“ (97) provides a detailed description of how to control the Sunny Backup 2200 using the rotating push button on Sunny Remote Control 1.

The rotating push button will be referred to simply as the button throughout the rest of the manual.

Display Messages

The display of the Sunny Remote Control 1 shows four lines with 20 characters each. For details on the display symbols, see section 12.1.1 „Home Screen“ (100).



Button

If a device error occurs, the background of the button will glow red.

Push the button to acknowledge the error and the pilot light will then switch off (see also chapter 21.1 „Error Confirmation“ (152)).

MMC/SD Card

The Sunny Remote Control 1 features an MMC/SD card for firmware updates or as a service interface. For details, please see section 13 „Storing Data on an MMC/SD Card“ (112).

10 (First) Commissioning

10.1 Requirements

Check connections

Before starting the commissioning process, make sure all electrical connections have the correct polarity and are connected according to the instructions in sections 7 „Electrical Connection of the Sunny Backup 2200“ (46) and 8 „Electrical Connection of the Automatic Switch Box S“ (69).

Always save data

Always use the MMC/SD card to save data and events. This is necessary in order for SMA Solar Technology AG to be able to help you in the event of a fault.

The Quick Configuration Guide (QCG) allows you to quickly and easily commission your Sunny Backup System S.

- Select the system you need in the menu for the Sunny Backup 2200.
  - Start System
  - New System
  - New Battery
- Read and "answer" the special queries using the Sunny Remote Control 1.
- Set the parameters for the particular system you want to use.

QCG requires the Sunny Remote Control 1

You need the Sunny Remote Control 1 in order to read the menus and error lists or set the parameters!

The Sunny Backup 2200 can also be started without the Sunny Remote Control 1, but then the device will only run with the factory default parameters (see section 9 „Control Elements“ (82)).

10.2 Starting the Quick Configuration Guide (QCG)

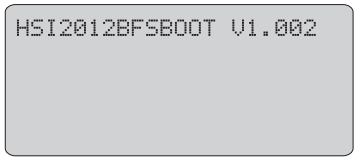
Information

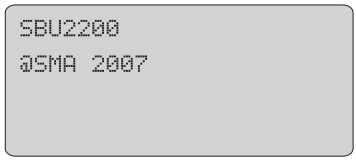
When starting the QCG, all parameter values are automatically preset! This makes efficient operation possible with very little effort.

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

1. Insert the NH fuse into the BatFuse or connect the DC disconnector of the BatFuse.
2. Turn on the Sunny Backup 2200.

   Push the DC start button on the Sunny Backup 2200.
3. The Sunny Backup 2200 initiates the startup phase. Wait for the following displays.



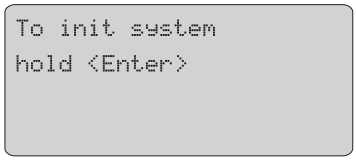


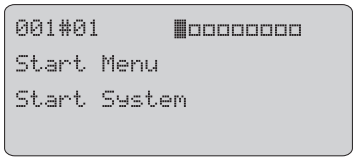
Initial Start-up

When starting the Sunny Backup 2200 for the first time, the QCG will be activated automatically. If this is the case, please skip down to item 6; otherwise, follow the list provided below.

4. As soon as the startup phase is finished, the message "To init system hold <Enter>" is displayed.
5. Press the button of the Sunny Remote Control 1 and hold it until three acoustic signals have been emitted.
6. Release the button.
7. You are now in the Quick Configuration Guide (QCG).

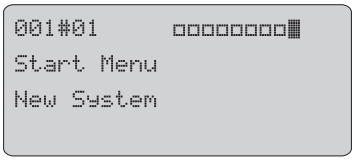
   You can choose between the following options by turning the button:





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

- **"New System"** (if you would like to start the system or perform changes to the system configuration)



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

(default setting shown in bold)

Country configuration: 003#01 Country (**GER/VDE0126-1-1,** GR_PCC, GR_INSULAR)

Date : 003#02 Dt (dd.mm.yyyy)

Time: 003#03 Tm (hh:mm:ss)

Battery type: 003#04 BatTyp (**VRLA**, FLA, NiCd)

Battery capacity: 003#05 BatCpyNom (50 Ah to 10,000 Ah, **140 Ah**)

Nominal grid current: 003#06 GdCurNom (0 A to 25 A, **16A**)

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

"New Battery"

The "New Battery" option is required whenever you want to install a new battery in the backup system.

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

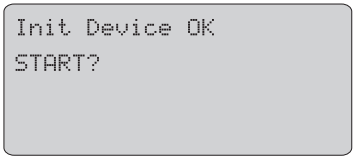
The following parameters must be set when **"New Battery"** is selected:

(default setting shown in bold)

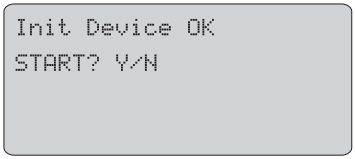
Battery type: 003#04 BatTyp (VRLA, FLA, NiCd)

Battery capacity: 003#05 BatCpyNom (50 Ah to 3,000 Ah, **140 Ah**)

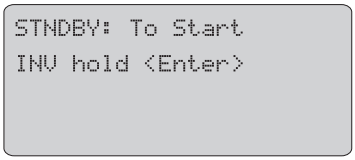
8. The following message appears after the button has been turned again.



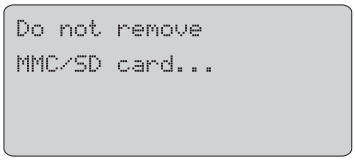
9. Press the button and confirm or cancel.
   (Confirm: Y(es), cancel: N(o))



10. After confirming, the Sunny Backup 2200 is in standby mode.
    The inverter LED and the battery LED illuminate yellow.

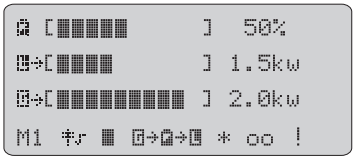


11. The Sunny Backup 2200 now creates a daily file and writes it on the MMC/SD card.



12. Once the file has been saved, the Sunny Backup 2200 can be started by pressing and holding the button. A bar, which decreases in length, will appear on the display during this process. The inverter LED changes its color from yellow to green.

13. The Sunny Backup 2200 starts (an acoustic signal is emitted). After the Sunny Backup 2200 has connected to the grid, the color of the grid LED changes from yellow to green.



Error messages

If the device unexpectedly displays an error, it must be remedied before the device can be operated. For this purpose, refer to section 21 „Troubleshooting/Problem Solving“ (152).

Parameter lists

For more information on adjustable parameters, see section 20 „Parameter Lists“ (139).

Note that you must first enter the installer password before some parameters can be changed (see section 12.2.2 „Setting the Installer Password“ (106)). In addition, some parameters can only be changed in standby mode (see section 11.2 „Stopping“ (93)).

11 Activating and Deactivating the Backup System

11.1 Activation / Startup

WARNING!

Risk if Sunny Backup System connections are incorrect.

Only qualified electricians are permitted to start up the device for the first time. Before startup, check the Sunny Backup System S for

- correct electrical connections and proper device connection
- voltages and polarities

Information

The Sunny Backup System S can also be started without the Sunny Remote Control 1, but then the device will only run with the factory default parameters.

Starting the Backup System via the Sunny Backup 2200

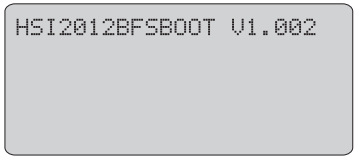
It is possible to start the Sunny Backup System without the Sunny Remote Control 1, but doing so will limit the inverter to the factory default parameters (default values, see section 20.2 „Adjustable System Parameters“ (142)).

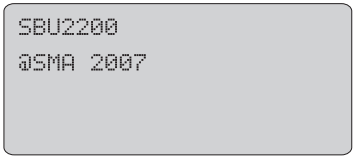
Proceed as follows:

1. Insert the NH fuse into the BatFuse A.01(see „Inserting the NH Fuse“ (80)).
2. Push the DC start button on the Sunny Backup 2200.
   The Sunny Backup 2200 turns on.
3. Push and hold the start / stop button on the Sunny Backup 2200.
   During the startup process, the LED switches from yellow to green.
4. Release the start / stop button.
   The inverter LED continuously glows green.
   The Sunny Backup 2200 starts.

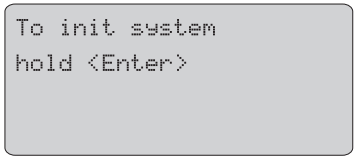
Starting the Backup System with the Sunny Remote Control 1

1. Insert the NH fuse into the BatFuse A.01(see „Inserting the NH Fuse“ (80)).
2. Push the DC start button on the Sunny Backup 2200.
   The Sunny Backup 2200 turns on.
3. The Sunny Backup 2200 initiates the startup phase.
   Wait for the following displays.

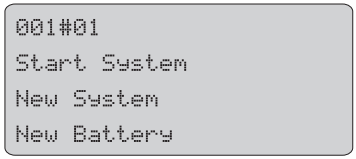




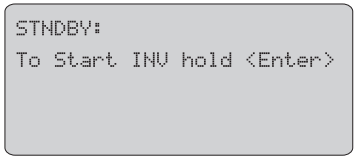
4. As soon as the startup phase is finished, the message "To init system hold <Enter>" is displayed



5. If you want to access the QCG, push and hold the button on the Sunny Remote Control 1.
   The screen to the right will appear (to learn how to proceed further, see section 10.2 „Starting the Quick Configuration Guide (QCG)“ (87)).



6. If you do **not** push the button within 5 seconds, the Sunny Backup 2200 will skip the QCG and show the following message.



7. Push and hold the button on the Sunny Remote Control 1.
   During the startup process, the inverter LED on the Sunny Backup 2200 switches from yellow to green.
8. The Sunny Remote Control 1 starts to beep.

9. The Sunny Backup 2200 starts.

   The inverter LED on the Sunny Backup 2200 continuously glows green.

10. Release the button.

    The Sunny Backup 2200 is running.

Starting the Sunny Backup 2200 automatically

Even if the "250.01 AutoStr" parameter is enabled, the Sunny Backup 2200 must be manually started in the inverter mode using the start / stop button each time the device is switched on (DC start).

Error messages

If the device unexpectedly displays an error, it must be remedied before the device can be operated again. For this purpose, refer to section 21 „Troubleshooting/Problem Solving“ (152).

11.2 Stopping

Stopping the Backup System Using the Sunny Backup 2200

Set the Sunny Backup 2200 to standby mode.

Proceed as follows:

1. Push and hold the start / stop button on the Sunny Backup 2200 until the inverter LED glows yellow continuously.

   During the stopping process, the LED switches from green to yellow.

2. Release the start / stop button.

   The Sunny Backup 2200 stops running.

   The device is now in standby mode.

Stopping the Backup System with the Sunny Remote Control 1

Set the Sunny Backup 2200 to standby mode using the external display.

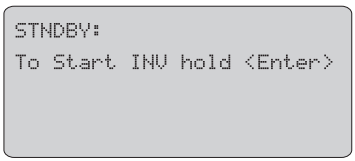
Proceed as follows:

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

   The following message appears.

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

3. The screen changes.



4. Release the button.
5. The Sunny Backup 2200 stops running.

DANGER!

Danger to life due to high voltages.

The Sunny Backup System S is in "Standby" mode! Voltage is still present in the Sunny Backup 2200 (both DC and AC sides).

- Turn off the Sunny Backup 2200.
- Disconnect the Sunny Backup 2200 from any voltage sources.

Operating consumption

Even in standby mode, the Sunny Backup 2200 still requires about 4 W of power from the battery.

11.3 Deactivation

To switch off the Sunny Backup 2200, proceed as follows:

1. Set the Sunny Backup 2200 to standby mode (see section 11.2 „Stopping“ (93)).
2. Push the DC stop button on the Sunny Backup 2200.

   The Sunny Backup 2200 switches off.

DANGER!
Danger to life due to high voltages.

The Sunny Backup System S is switched off! Voltage is still present in the Sunny Backup 2200 (both DC and AC sides).

- Disconnect the Sunny Backup 2200 from any voltage sources.

Information

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

Wait before restarting the device

Wait at least 30 seconds before restarting the device. This wait is necessary to ensure that the Sunny Backup 2200 functions properly.

11.4 Disconnecting the Device from Voltage Sources

1. Turn off the Sunny Backup 2200 (see section 11.3 „Deactivation“ (95)).
2. Remove the NH fuse from the BatFuse A.01.

   The Sunny Backup 2200 is disconnected from the battery.
3. Disconnect the Sunny Backup 2200 from all AC voltage sources.
4. Check to see if the Sunny Backup 2200 has been safely disconnected from all voltage sources.
5. Wait at least 15 minutes.

   The capacitors discharge and the voltage in the device drops down to a safe level.
6. The Sunny Backup 2200 is completely free of voltage.
7. You can now open the device.

11.5 Reactivating the Device Following Automatic Shutdown

NOTICE!

System will shut down if device settings are incorrect.

- Check the entire backup system for errors before and after you reactivate the device.
  - Incorrect wiring?
  - Component failure?
  - Incorrect parameter settings for the Sunny Backup 2200?
- Correct any errors found.

If the Sunny Backup 2200 shut down due to critically low battery power, reactivate it as follows:

1. Push the DC stop button on the Sunny Backup 2200.

Wait

Wait about a minute before switching the Sunny Backup 2200 on again with the DC start button. The capacitors need to discharge first.

2. Switch on the Sunny Backup 2200 after waiting one minute.

   Push the DC start button on the Sunny Backup 2200.

Information

If, in rare cases, you are unable to restart the device after a minute, wait a little longer and try it again. This may result due to component tolerances.

3. Start up the Sunny Backup 2200 (see section 11.1 „Activation / Startup“ (91)).

Charge the battery

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

4. Use the Sunny Remote Control to monitor the process in which the Sunny Backup 2200 switches to charge mode.
5. Make sure all other energy generators in the backup system are functioning properly.

Disconnect the loads if the Sunny Backup 2200 starts the battery preservation mode after being restarted

- Check the availability of grid power.
- Check the Automatic Switch Box S for proper functioning.
- Only reconnect loads when the Sunny Backup 2200 is in charge mode.

12 Using the Sunny Backup 2200

Information

The Sunny Backup 2200 is controlled using the Sunny Remote Control 1.

12.1 Navigation Area

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

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

The main menus are divided into several submenus.

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

NOTICE!

Incorrect parameters may cause system damage.

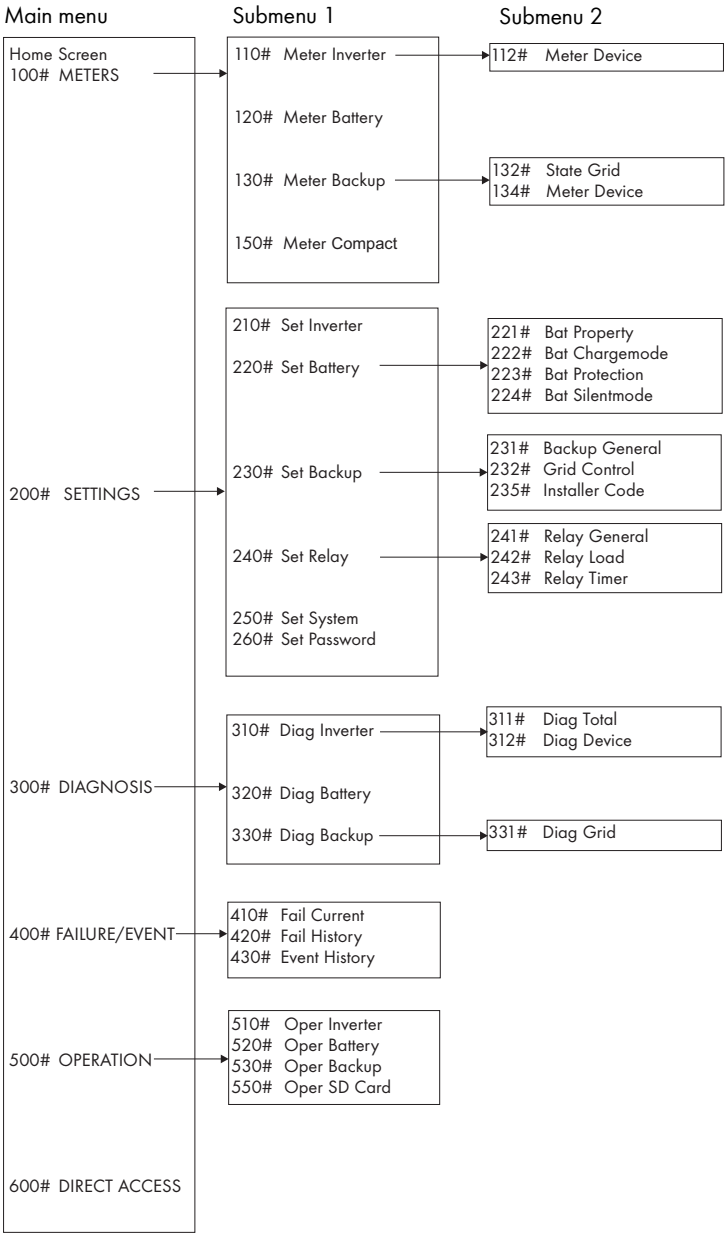
- Only qualified electricians are permitted to set and adjust system parameters.

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

- User level
- Installer level (password required)

Menus which allow you to change system parameters can only be accessed after entering the installer password (see section 12.2.2 „Setting the Installer Password“ (106)).

Overview of the Navigation Area:



100# Meters - Display values: This menu contains the display values for the following backup system components:

- 110# Meter Inverter - Sunny Backup 2200
- 120# Meter Battery
- 130# Meter Backup - Backup system
- 150# Meter Compact - Compact view of values for commissioning

You can view the parameters (e.g., the "112.03 InvVtg" parameter) by opening the appropriate submenu or secondary submenu.

200# Settings: The following submenus allow you to view and adjust the system parameters:

- 210# Set Inverter - Sunny Backup 2200
- 220# Set Battery
- 230# Set Backup - Backup system
- 240# Set Relay
- 250# Set System
- 260# Set Passwort - Password entry

300# Diagnosis: The following submenus allow you to view system data:

- 310# Diag Inverter - Device data (Sunny Backup 2200)
- 320# Diag Battery - Battery data
- 330# Diag Backup - Backup system data

400# History - Lists: The following submenus contain various error and event lists:

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

500# Operation - Operating functions: The following submenus allow you to view and adjust operating parameters:

- 510# Oper Inverter - Sunny Backup 2200
- 520# Oper Battery
- 530# Oper Backup
- 550# Oper SD Card - MMC/SD card

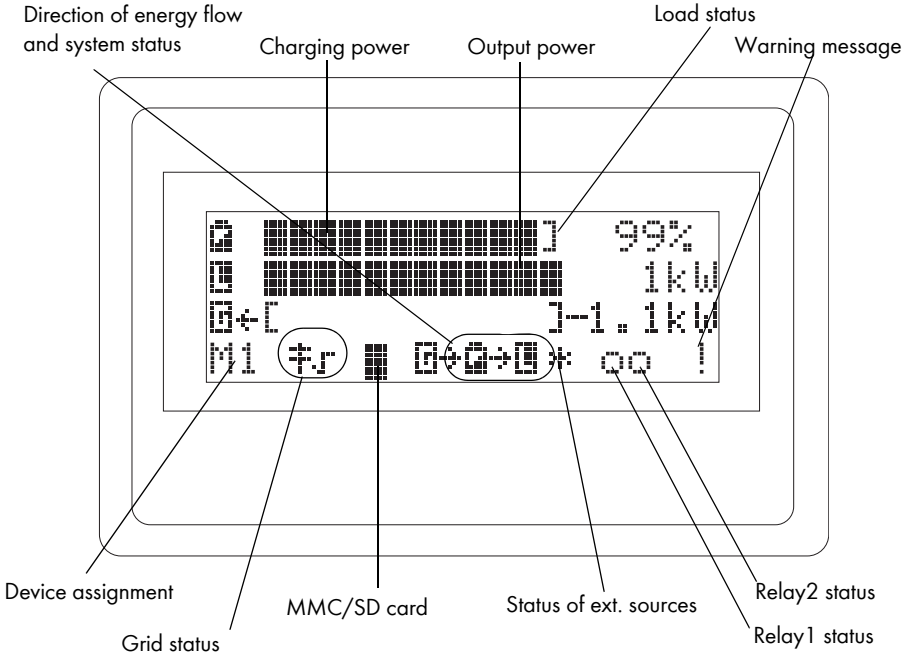
600# Direct Access: This is a main menu that gives you direct access to the settings and display values (see section 12.2.4 „Directly Accessing the Parameters“ (110)).

12.1.1 Home Screen

The Home Screen displays the operating status of the Sunny Backup 2200

- battery charging power
- output power

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



1. row:

- This status bar displays the SOC in [%].
- The symbol to the right of the bar indicates the load status: "]" stands for the nominal power.
- The charging power level is also indicated as a symbol on the right side.

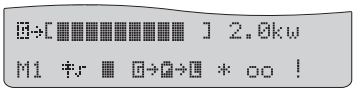
2. row:

- The bar next to the symbol for the load side specifies the direction of energy flow.
- The status bar displays the level of total output power in [kW] that is used to supply the loads.
- The level of total output power in [kW] is also indicated as a symbol on the right side.

3. row (generator power, grid)

No information is provided on the Home Screen.

4. row (status bar):



Icon	Explanation
M1	Device assignment (here: master)
	Connection to the public grid. The Sunny Backup 2200 is functioning within the limits of the public grid.
	Connection to the public grid. The Sunny Backup 2200 is functioning outside the limits of the public grid.
	Power from the public grid is available, but the Sunny Backup 2200 does not have to be connected to it.
	MMC/SD card: The symbol indicates that the memory card is inserted in the Sunny Remote Control 1.
	MMC/SD card: The symbol indicates that the memory card is not inserted in the Sunny Remote Control 1.
	Generator
	Battery
	Load side ("Loads/Sunny Boys")
	The direction of energy flow between generator, battery and load side.
	Relay (solid circle = relay activated/empty circle = relay deactivated)
!	Warning. The symbol blinks until you have seen the warning in the "410# Fail Current" or "420# Fail History" menu.

Switching to the Home Screen

If you do not press a button for more than five minutes (inactivity), the display will automatically switch back to the Home Screen.

Display illumination

After a brief period of inactivity, the background illumination of the display switches off. To reactivate it, simply turn the button. Turning the button only reactivates the display illumination and has no effect on the settings.

Display of messages

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

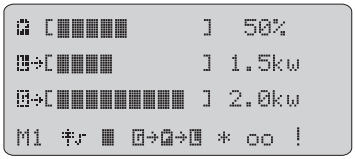
12.1.2 Selecting a Menu

Use the button on the Sunny Remote Control 1 to navigate through the menus of the Sunny Backup 2200.

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

Example:

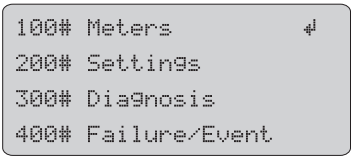
The Home Screen is displayed. Browse through the main menu by turning the button to the right or left.



1. Turn the button to the right.

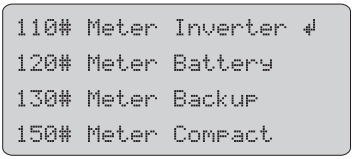
   The display illumination switches on.
2. Turn the button to the right.
3. The following screen appears:

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



4. Push the button.

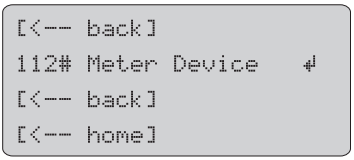
   The arrow jumps to the submenu of the "100# Meters" main menu.



5. Push the button.

   The arrow jumps to the next menu level. You now have three options:

   - Push the button. The arrow jumps to the next level. You can view the parameters assigned to this menu.
   - Select "back". To do so, turn the button forwards (or backwards) until the enter arrow appears in the appropriate row. Push the button. The enter arrow jumps to the previous submenu (see item 4).
   - Select "home". Push the button. The Home Screen is displayed.



Order of menu items

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

12.1.3 Selecting Parameters

Parameters are displayed as follows:

- The menu and parameter numbers are listed on the left and a status bar indicating the currently requested value appears on the right.
- The parameter name is shown on the left and the enter arrow appears on the right. The arrow indicates an adjustable parameter.
- Value / readout (time) and unit.

Document syntax

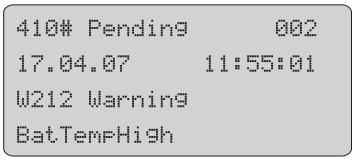
The syntaxes specified here for menus and parameters apply to the entire document.

A menu is denoted by a menu number, a hash and a menu name (130# Meter Backup).

A parameter is denoted by a menu number, a decimal point (hash in the display) and a parameter number and name (131.01 TotExtPwrAt).

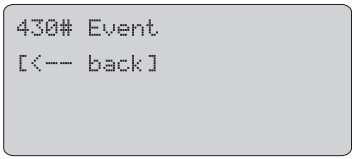
12.1.4 Selecting Events

Events are displayed as follows:



- The menu number and name are indicated on the left and the serial number (quantity) of the event appears on the right.
- Date and time.
- Event and number (see section 21.5 „Events“ (154)).
- Description of the event.

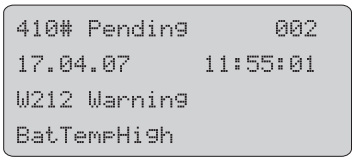
Navigating back to the previous menu level:



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

12.1.5 Selecting Warnings and Errors

Warnings and errors are displayed as follows:



- The menu number and name are indicated on the left and the serial number (quantity) of the warning or error appears on the right.
- Date and time.
- Warning or error and number 21.6 „Error Categories“ (155). The enter arrow indicates that the error needs to be resolved and then confirmed. This is necessary before you can restart the Sunny Backup 2200.
- Description of the warning or error.

A "!" on the right side of the top row indicates when the warning or error occurred.

A "C" on the right side of the top row indicates when the warning or error was acknowledged or cleared.

12.2 Adjusting Settings

12.2.1 Setting Parameters

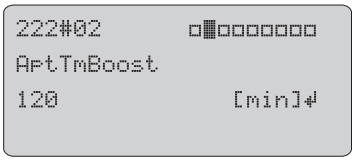
Use the button on the Sunny Remote Control 1 to navigate through a menu and select the parameter you want.

When the relevant parameter appears on the display, you can read its present value.

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

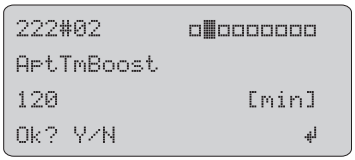
1. Push the button.
2. An arrow appears after the unit and flashes.
3. Turn the button to the left or right and the value will decrease or increase accordingly.
4. If the value you want is displayed, save it. Push the button.

   "Ok? Y(es)/N(o)" and the enter arrow appear in the display.



5. Turn the button and select Y or N. The selected letter will start to flash.

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



6. Push the button.

   This parameter is set.

7. Return to the parameter list in the submenu. Push the button.

Setting parameters in standby mode

Note that some parameters can only be changed when the device is in standby mode. The parameters for which this applies can be found in the tables in sections 20.2 „Adjustable System Parameters“ (142) and 20.5 „Functions in Operation“ (150).

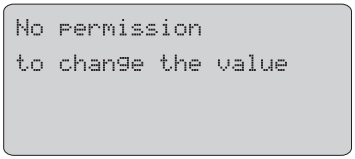
The Sunny Backup 2200 will display a message notifying you of parameters that can only be changed in standby mode or with a password.

The following message is displayed:

- This parameter can only be changed in standby mode.
- Stop the Sunny Backup 2200 (see section 11.2 „Stopping“ (93)).
- You can now change the parameter.

The following message is displayed:

- Incorrect operating level (user level).
- The installer password is required to make changes in this menu area.
- Follow the instructions in section 12.2.2 „Setting the Installer Password“ (106).



12.2.2 Setting the Installer Password

NOTICE!

Incorrect parameters may result in system errors.

All parameters that can affect the operating safety of the backup system are protected/ locked by an installer password.

- Only qualified electricians are permitted to set and adjust system parameters.
- Enter password.

Do not disclose the password to unauthorized persons

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

Entering the password

You can enter the password when the Sunny Backup 2200 is either in standby mode or in normal operation.

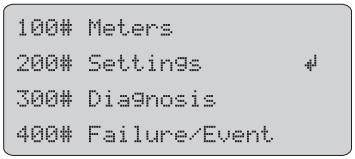
The password required to access all "Installer Level" parameters depends on the operating-hours counter.

- **Password = sum of digits of the operating hours**

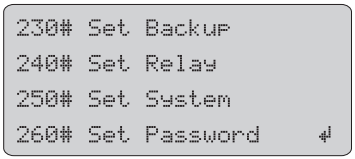
Proceed as follows to enter the installer password:

The Home Screen is displayed.

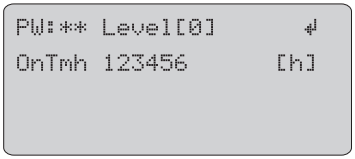
1. Select the "200# Settings" menu.
2. Push the button.



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



The following screen appears:



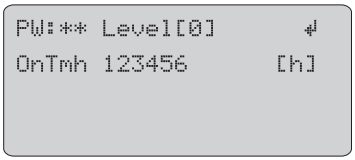
- Two placeholders for the password (PW)
- Level [0] = user level
- Operating hours (OnTmh)
- Sum of all operating hours

5. Determining the password

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

   1 +2 + 3 + 4 + 5 + 6 = 21
6. Push the button. The placeholders start to blink.
7. Enter the password ("21" in this example).

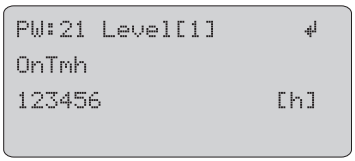
   Turn the button to the right or left to increase or decrease the value.



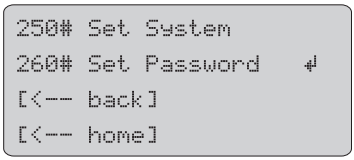
8. Confirm the password. Push the button.

   The password is confirmed.

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



9. Exit menu.



Switching operating levels

If the password is incorrect, the Sunny Backup 2200 will not switch to the installer level. In this case, recalculate and re-enter the installer password as described in this section.

The installer level is switched back to the user level if

- the Sunny Backup 2200 is turned off and on again
- parameters that require a restart are entered (e.g., the "510.01 InvRs" parameter)
- an incorrect password is entered or if
- no button is pressed for 5 minutes.

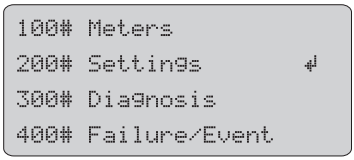
12.2.3 Setting the Installer Identification

SMA grid guard

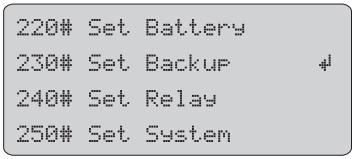
Some safety-related parameters regarding the SMA grid guard are specially protected, and cannot be altered with the normal installer password. In order to adjust these grid monitoring parameters, you must request your individual SMA grid guard password on the SMA Hotline.

Proceed as follows:

1. Open the "200# Settings" menu.



2. Enter the installer password (see section 12.2.2 „Setting the Installer Password“ (106)).
3. Open the "230# Set Backup" menu.



4. Open the "235# Installer Code" menu.
5. Enter the 10-digit code (SMA grid guard).

   Turn the button until the number you want is displayed. Confirm each number individually (push the button). The cursor automatically jumps to the next digit.

6. Finish entering the code.

   Push the button.

   This confirms that you have entered the 10-digit code.
7. The device is now unlocked.
8. Open the "232# Grid Control" menu.

Safety-relevant parameters for grid monitoring

These parameters are safety-related grid monitoring parameters. To change the SMA grid guard parameters, you must enter your personal SMA grid guard password (installer code). Call the SMA Hotline to obtain your personal SMA grid guard password.

You can now change the following parameters:

- 232.01 GdVtgMin
- 232.02 GdVtgMax
- 232.05 GdFrqMin
- 232.06 GdFrqMax

9. Set the parameters.

12.2.4 Directly Accessing the Parameters

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

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

- ManChargSel: manual initiation of an equalization charge (see section 16.4.3 „Equalization Charge“ (127))
- BkupTst: initiation of a backup system test (see section 19.4 „Function Testing“ (137))

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

Example

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

The direct access must be entered as a five-digit number, for example, 22201. Here, the first 3 digits describe the menu number and the last two describe the parameter number.

Exit the menu level after the parameter has been set.

12.2.5 Meter Compact

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

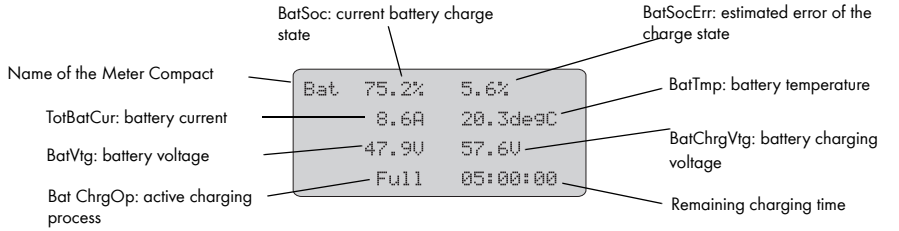
- Battery
- Inverter (AC values)
- Backup system (AC values)
- Inverter status

Selecting the area

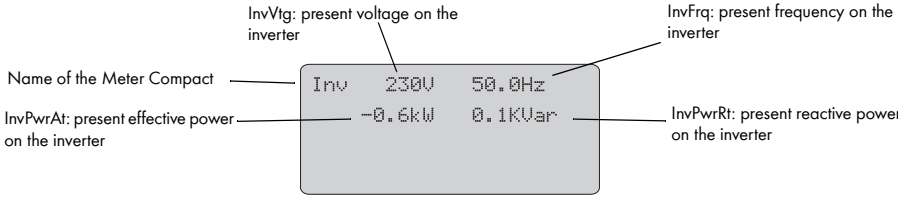
Select the various Meter Compact screens by turning the button to the right or left.

Exit the menu by pressing the button.

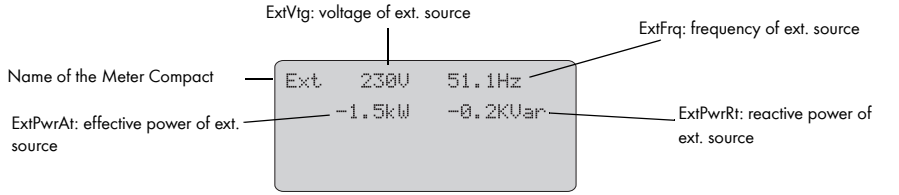
Bat1 (battery values 1)



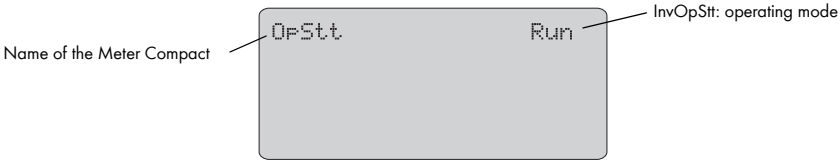
Inv (AC values of inverter)



Ext (backup AC values)



OpStt (inverter and generator status)



13 Storing Data on an MMC/SD Card

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

Format example

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

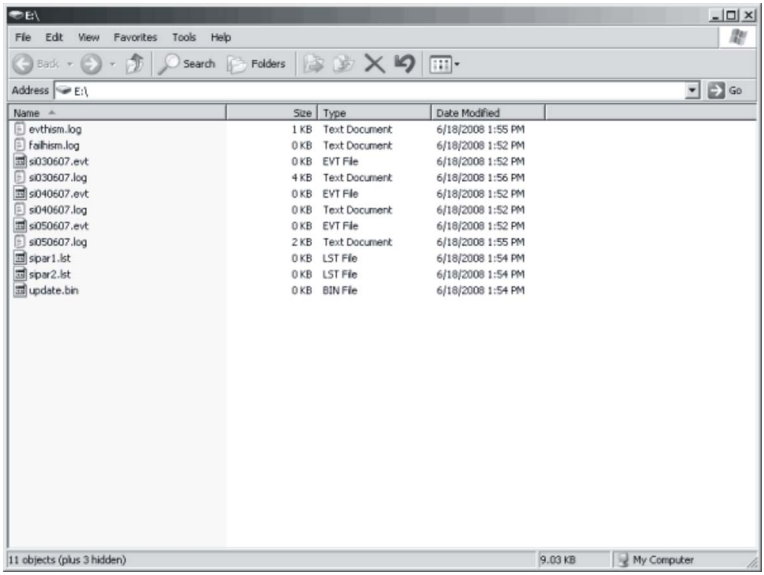
8.3 is the "old" MS-DOS format with a file name that has a maximum of 8 characters before and 3 characters after the dot.

Type of memory card

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

If you use a memory card from another manufacturer, check whether the card is FAT16-formatted. If necessary, format the card. Note that this causes any data already stored on the card to be lost.

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



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

File name	Meaning
evthism.log (evthisN.log for SlaveN)	event history of the device, saved by means of parameter "550.01 CardFunc", option StoEvtHis
failhism.log (failhisN.log for SlaveN)	failure history of the device, saved by means of parameter "550.01 CardFunc", option StoFailHis
si030607.evt	event/failure history for the day (format DDMMYY)
si030607.log	data archive for the day (format DDMMYY)
sipar1.lst	parameter list of the device, created by means of parameter "550.02 ParaSto", option Set1
sipar2.lst	parameter list of the device, created by means of parameter "550.02 ParaSto", option Set2
update.bin	software for the device

Information

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

The firmware of the Sunny Backup 2200 expects device-specific data in the main directory of the MMC/SD card. This data includes a new firmware version, parameters and measuring data. The firmware ignores non-device-specific data in the main directory.

The Sunny Backup 2200 uses the MMC/SD card in the Sunny Remote Control 1 to save and load device parameters.

The Sunny Backup 2200 supports the acquisition of measured data on the MMC/SD card. It saves this data in a special file. This contains, among other things, a header, time stamp, date and data type. There are three types of log data:

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

The Sunny Island 2200 supports the acquisition of measured data from the following areas:

- Battery
- Inverters
- System
- External source
- Loads

Always save data

Always use the MMC/SD card to save data and events. This is necessary in order for SMA Solar Technology AG to be able to help you in the event of a fault.

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

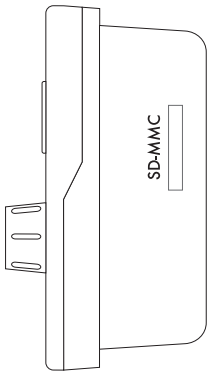
The first 14 lines of the file are used for information (file header) and then two column heading lines follow. The remaining data are separated by a semicolon. Decimals points are displayed as a dot, the date format is dd.mm.yyyy and the time format is hh:mm.

Log data

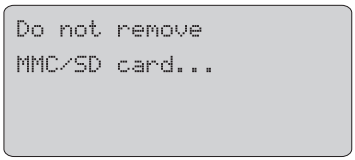
For additional information on processing the log data, please refer to the manual of the data processing software you use.

13.1 Inserting the Card

1. Push down the slanted corner of the MMC/SD card into the card slot of the external display.



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

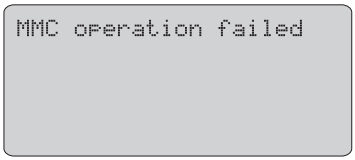


3. The initialization of the MMC/SD card takes several minutes.

   During this time the buttons are disabled.

   3 dots flash consecutively in the bottom row of the display.

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



13.2 Removing the Card

To ensure that all log data is saved during shutdown, write all unsaved data from the buffer to the MMC/SD card by selecting the "ForceWrite" option in the "550.01 CardFunc" parameter.

Data loss

If you remove the MMC/SD card without first activating the "550.01 CardFunc" parameter, you will lose all data that has not yet been recorded on the card since the last save (max. 15 minutes).

13.3 Saving and Loading Parameters

The "550.02 ParaSto" parameter allows you to save the current parameter settings. Previously saved parameters can be loaded using the "510.08 ParaLod" parameter.

Saving optimal settings

Once the system is working optimally, it is a good idea to save these settings. This is especially useful if you try something new and then later wish to reset the Sunny Backup 2200 back to the previous settings.

You have the following selection options when saving the parameters:

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

You have the following selection options when loading the parameters:

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

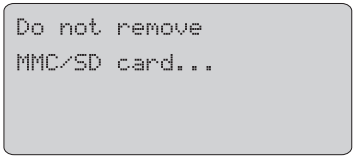
Write protection

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

13.4 Writing Log Data

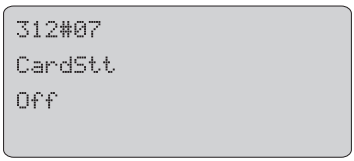
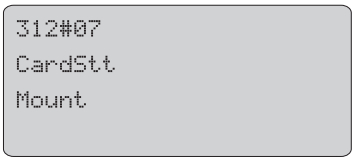
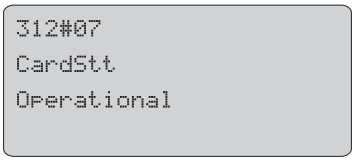
Using the "550.02 DatLogEna" parameter, you can activate the function for writing log data to your MMC/SD card (activated by default).

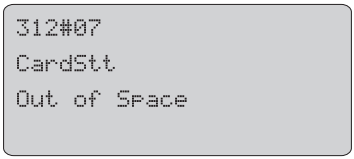
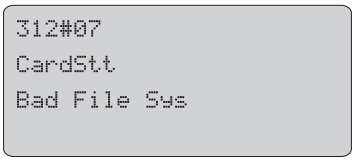
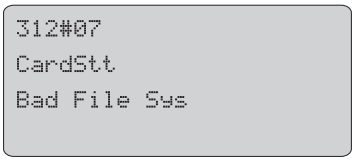
You will be prohibited from removing the card if the Sunny Remote Control 1 is writing data to the MMC/SD card. The following message is displayed:



13.5 Displaying the Status

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

Display screen	Meaning
	MMC/SD card is deactivated.
	MMC/SD card initializes.
	MMC/SD card is activated.

Display screen	Meaning
	The memory capacity of the MMC/SD card is full.
	MMC/SD card has an invalid file format.
	MMC/SD card is not compatible.

Fault correction

For help on troubleshooting, refer to section 21.8 „Troubleshooting“ (157).

13.6 Updating Firmware

The firmware of the Sunny Backup 2200 can be updated using the MMC/SD card. During startup and MMC/SD card detection, the Sunny Backup 2200 checks the MMC/SD card for any special update files. If the memory card contains new files, the Sunny Backup 2200 will perform an update once it is in standby mode.

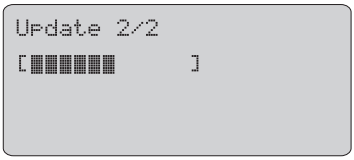
New MMC/SD card

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

Updating the firmware:

1. Set the Sunny Backup 2200 to standby mode.
2. Insert the MMC/SD card into the card slot in Sunny Remote Control 1.

3. While the Sunny Backup 2200 performs the update, the following messages are displayed:



Mandatory reset

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

4. The Sunny Backup 2200 remains in standby mode after the reset.
5. Start up the device manually (see section 11.1 „Activation / Startup“ (91)).

Settings remain the same

Individual parameters and settings are retained during a firmware update.

14 Inverter Operation

14.1 Overload and Short-circuit Behavior

The Sunny Backup 2200 can be temporarily operated under overload conditions. It can also supply short-circuit currents.

If an overload exists, the Sunny Backup 2200 will supply 2900 W of power for a period of 30 minutes. The device can increase its power output to 3800 W for a period of one to five minutes.

If a short circuit occurs, the Sunny Backup 2200 provides current of max. 30 A (for 100 ms). This is sufficient to trigger commercial 6 A B-type circuit breakers.

14.2 Device Faults and Autostart

If a critical fault occurs, the Sunny Backup 2200 will automatically shut down and show the cause of the fault on the display. If the autostart function ("250.01 AutoStr" parameter) is enabled, the Sunny Backup 2200 can automatically confirm any category 2 or 3 faults (see section 21.6 „Error Categories“ (155)) and then restart on its own. If the fault remains, the Sunny Backup 2200 will not start automatically. Correct the fault.

Display

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

15 Grid

The backup systems are designed to provide seamless backup power for operation on the public grid. Here, a distinction is made between two main states:

- Public grid present
- Grid failure (stand-alone grid operation)

The status of the grid determines the operating mode of the Sunny Backup 2200. If the public grid is available, the loads in the main power grid are supplied with electricity while the Sunny Backup 2200 charges its batteries or keeps them fully charged. The PV system feeds into the public grid via a dedicated meter.

In the event of grid failure, the Sunny Backup System S disconnects the public grid from the loads in less than 50 ms and then powers these loads with grid-quality voltage. The Sunny Backup 2200 is responsible for powering the loads while the grid is down (stand-alone grid operation).

The Automatic Switch Box S switches the PV system to the load side. The electricity from the PV system is then fed into the stand-alone grid. If the PV system is generating more PV energy than needed, the surplus power is stored in the battery. If more energy is being consumed than the PV system can generate, the extra energy required is taken from the battery.

15.1 Conditions

The standard applicable at the installation location (e.g. for Germany: DIN VDE 0126-1-1) and the voltage and frequency threshold values as stipulated by the standard must be continuously monitored for operation on the public grid. If these thresholds are breached, the Sunny Backup System S will disconnect from the grid in less than 200 ms.

Switching times during grid failure

During these 200 ms, the loads continue to be powered, as although the grid voltage or frequency breaches the thresholds, there is still sufficient voltage and frequency available. If the voltage fails completely, the backup system will be disconnected from the grid within 50 ms.

Adjusting specified limit value

In certain cases it may be necessary to adjust the voltage and frequency limits to the grid situation in order to prevent grid disconnections from occurring too frequently. In such instances it is imperative that you consult your energy supply company. To adjust these limits in the "232# Grid Control" menu, you must first enter your personal SMA grid guard password (see section 12.2.3 „Setting the Installer Identification“ (108)).

15.2 Operating on the Public Grid

In grid operation, the loads and the Sunny Backup 2200 are connected to the public grid. In this case, the voltage and frequency in both grids are identical. In grid operation, grid monitoring checks for breaches of the permissible limits for voltage and frequency (see Grid Reconnection), and for grid failure. If the thresholds are breached, or in the event of a complete grid failure, the public grid is disconnected, and operation continues almost uninterruptedly as a stand-alone grid. In grid operation the battery is normally charged or kept fully charged.

15.3 Grid Failure

A grid fault is characterized by the voltage or frequency being outside of the permissible limits (see section 15.5 „Grid Reconnection“ (122)) or the main power grid being disconnected. In this case, the time limits are relevant: Smaller deviations are permitted for longer than large deviations. In the event of a grid fault/
failure, the public grid is disconnected and the Sunny Backup 2200 starts up if it is not already running (silent mode).

Extended switching times during grid failure

If the Sunny Backup 2200 is in silent mode when a grid failure occurs, a long interruption time may result. Other operating conditions are described in section 15.1 „Conditions“ (120).

15.4 Stand-Alone Grid Operation

The public grid is down and the loads are powered by the Sunny Backup 2200 in stand-alone grid operation. The system waiting for the grid to reconnect is an indication of this state. As long as the battery has a sufficient charge level, the loads are powered. In stand-alone operation, the battery is charged by the PV system if applicable.

15.5 Grid Reconnection

In stand-alone operation, the Sunny Backup 2200 constantly checks whether the grid has been reconnected (see above). If the voltage and frequency of the main power grid are within the permissible range of parameters "232.01 GdVtgMin" and "232.02 GdVtgMax" for time "232.07 GdVldTm" and the frequency is within the permissible range of parameters "232.05 GdFrqMin" and "232.06 GdFrqMax" (see section 15.1 „Conditions“ (120)), the stand-alone grid is synchronized with the main power grid and then connected.

If the battery is fully charged, the frequency limits the power output of the AC feed-in generators (Sunny Boy) in the stand-alone grid. If the grid is now reconnected, the frequency would be lowered if necessary in the course of synchronizing the Sunny Backup 2200 with the grid. The AC feed-in generators (Sunny Boy) would then feed additional energy into the system and possibly overload the batteries. In order to prevent this during such conditions, the stand-alone grid frequency is temporarily increased ("231.04 AcSrcFrqDel" parameter), in line with the synchronization, until the AC feed-in generators (Sunny Boy) are disconnected from the stand-alone grid as a result of the grid limits being exceeded.

Grid limits in stand-alone grid operation

The thresholds are cutoff limits; due to internal hysteresis, the reconnection limits are set somewhat more narrowly.

15.6 Limits and Power Adjustment

The Sunny Backup 2200 loads the public grid with the current specified in the "232.03 GdCurNom" parameter. The power that is not directly used by the loads flows into the battery for charging. The limits for the AC charging current limit ("210.02 InvChrgCurMax" parameter) on the Sunny Backup 2200 and the DC charging current limit ("222.01 BatChrgCurMax" parameter) are active at the same time. If the battery voltage reaches the charging voltage nominal value, it is also reduced (see section 16.4 „Charge Control“ (125)). If the current set using the "232.03 GdCurNom" parameter is not sufficient for powering the loads, the battery provides support.

16 Battery Management

The battery management of the Sunny Backup 2200 supports the following three battery types ("221.01 BatTyp" parameter):

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

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

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

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

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

The Sunny Backup 2200 is designed and preset for a nominal battery voltage ("221.03 BatVtgNom" parameter) of 24 V (12 cells with 2 V each) with lead acid batteries (FLA and VRLA) and 22.8 V (19 cells with 1.2 V each) with nickel cadmium batteries.

16.1 Battery Temperature

The Sunny Backup 2200 continuously monitors the battery temperature using the provided battery temperature sensor. A warning message is displayed once the battery temperature drops 5 °C below the maximum permissible temperature ("221.04 BatTmpMax" parameter).

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

The battery temperature is taken into consideration when the charging voltage is calculated (see section 16.4 „Charge Control“ (125)).

NOTICE!

Damage to battery due to incorrect measurement of battery temperature.

If the battery temperature sensor is missing or defective, the Sunny Backup 2200 will assume the battery temperature is 40 °C and continue running. Over time this leads to insufficient battery charging.

- Note the relevant warning messages of the Sunny Backup 2200.
- Connect the battery temperature sensor.
- Replace the defective battery temperature sensor.

16.2 Start Options

If the battery is replaced in a system, the battery management system must be restarted and reconfigured. This can be done using the "Quick Configuration Guide QCG" (see section 10.2 „Starting the Quick Configuration Guide (QCG)“ (87)).

16.3 State of Charge/SOC and SOH

The Sunny Backup 2200 has a very precise internal charge level calculation (display value "120.01 BatSoc"). The operation for calculating the charge level is based on balancing the ampere hours. This means: all currents flowing in and out of the battery are added together and based on the nominal capacity. In order to take into consideration faults caused by self discharge and charging losses caused by gassing, these losses are already internally omitted. Unlike other operations, no fixed charging factor must be set.

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

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

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

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

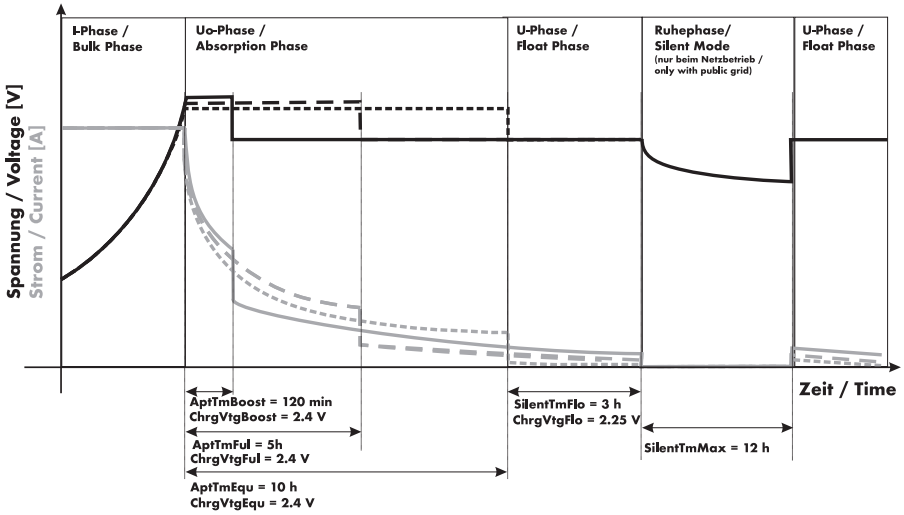
Only when the battery is new does its usable capacity correspond to the capacity specified by the battery manufacturer. As the battery ages and as a result of frequent insufficient charging, the battery’s useable capacity may decrease considerably on a permanent or only a temporary basis.

The battery's state of health (display value "342.01 Soh") is a percentage measurement for the present useable capacity relative to the nominal capacity. 100 % means that the entire nominal capacity can still be utilized. At 50 %, only half of the original nominal battery capacity can be utilized. The battery's state of health is also calculated using a self-adapting method that requires several charging cycles before it can produce accurate and precise values.

The present capacity for the Sunny Backup 2200 is automatically adjusted downwards for temperatures <20 °C, since the useful capacity of batteries is significantly reduced in temperatures below the nominal temperature. For all lead acid batteries, the nominal capacity is amended by a fixed factor of –1 %/°C. For NiCd batteries a factor of –0.75 %/°C is used.

16.4 Charge Control

The Sunny Backup 2200 performs charge control in 3 phases using the IUoU process. When the device operates with the public grid, there is also an optional fourth phase called silent mode.

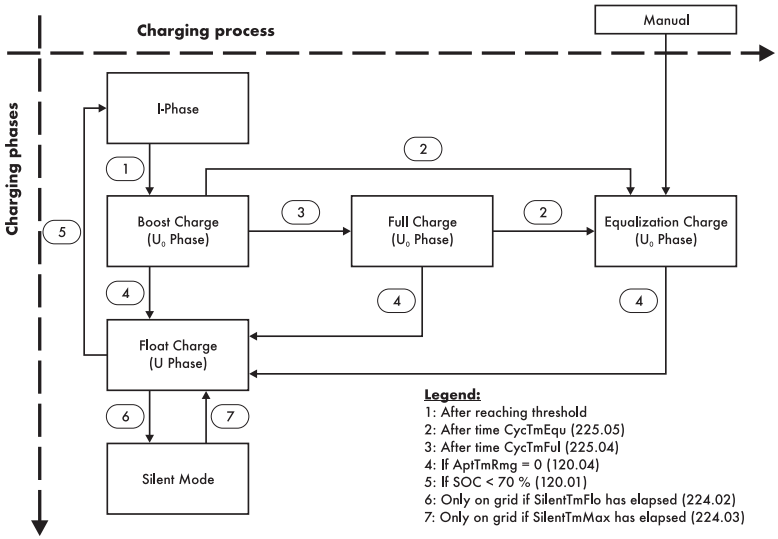


The I stands for the constant voltage phase (I phase). In this phase, the charging process is limited by the maximum specified battery current ("222.01 BatChrgCurMax" parameter), the nominal grid current ("232.03 GdCurNom" parameter) or the maximum AC charging current of the Sunny Backup 2200 ("210.02 InvChrgCurMax" parameter). The respective value reached first is the limiting value. During this phase the battery voltage increases as the battery is charged.

Once the battery voltage reaches the predefined value for the second phase Uo ("222.07 – 222.09", ChrgVtgBoost or ChrgVtgFul or ChrgVtgEqu parameters), the constant voltage charging (absorption phase) begins. In this phase, the battery voltage is maintained at a constant level, resulting in a continually decreasing battery current. The Sunny Backup 2200 remains in this phase for the defined period of time ("222.01 – 222.03", AptTmBoost or AptTmFul or AptTmEqu" parameters).

For this charging phase, the Sunny Backup 2200 automatically selects one of the three possible charging processes (boost, full, equalizing) that are described in more depth between sections 16.4.1 „Boost Charge“ (127) and 16.4.3 „Equalization Charge“ (127). The remaining charging time (display value "120.04 AptTmRmg") of this phase and the current process (display value "120.05 BatChrgOp") can be read on the display.

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



Once this constant voltage phase is finished, the Sunny Backup 2200 switches to float charge which again carries out constant voltage charging but at a greatly reduced charging voltage ("222.10 ChrgVtgFlo" parameter). The purpose of the float charge is to keep the battery in a fully charged state without causing premature aging through overcharging. The Sunny Backup 2200 remains in this phase until either more than 30 % of the nominal capacity (all discharges are added together) has been used or the charge state is less than 70 %. When the Sunny Backup 2200 is operating on the public grid, it can also switch from the float charge into silent mode.

Changing the charging voltage

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

The charging capability of batteries is heavily dependent on the battery temperature. For temperatures <20 °C, the charging voltage must be slightly increased, and for temperatures >20 °C it must be slightly decreased. This is necessary to prevent overcharging and insufficient charging reliably at any battery temperature.

For this reason, the Sunny Backup 2200 is equipped with automatic temperature compensation of the charging voltage. The charging voltage is adjusted by 4 mV/°C and cell for battery types VLA and FRLA as well as by 0 mV/°C and cell with NiCd batteries. The temperature compensation value can be set using the "222.11 BatTmpCps" parameter.

Charging behavior of the Sunny Backup 2200

If a Sunny Backup system is newly installed, the Sunny Backup 2200 will initially perform a full charge and then switch to float charge. Thus, the battery is always kept at a high charge level of 95 % to 100 %. Only after a grid failure during which the battery is discharged by more than 30 % is the battery recharged with one of the other charging processes (boost charge, full charge, or equalization charge).

16.4.1 Boost Charge

The boost charge enables the battery to be charged to approximately 85 % to 90 % by means of a high charging voltage for a short period.

The boost charge is active whenever grid failures occur in relatively short succession. The battery is recharged as quickly and efficiently as possible during the periods when the grid is available.

16.4.2 Full Charge

After a discharge of more than 30 %, the Sunny Backup 2200 automatically initiates a full charge if more than 14 days (parameter "222.05 CycTmFul“) have passed since the previous grid failure. The objective is to recharge the battery to a charge level of at least 95 %.

16.4.3 Equalization Charge

After a discharge of more than 30 %, the Sunny Backup 2200 automatically initiates an equalization charge if more than 180 days (parameter "222.06 CycTmEqu") have passed since the previous grid failure. The objective is to recharge the battery to a charge level of at least 95 % to 100 %.

During this process, the Sunny Backup 2200 performs controlled overcharging of the battery bank to ensure that even the weaker cells are fully recharged. The equalization charge is simultaneously a type of battery maintenance, and extends the battery service life.

16.4.4 Silent Mode

Only during operation on the public grid and at times when PV grid feeding is not possible, can the silent mode be used alongside the float charge. Silent mode causes the system's operating consumption to go down.

Silent mode is activated by means of the "224.01 SilentEna" parameter. The parameters "231.01 PvFeedTmStr" and "231.02 PvFeedTmStp" stipulate the times between which the PV system can feed; i.e. silent mode is possible in the remaining time window (PvFeedTmStp -> PvFeedTmStr).

System behavior in silent mode

During this period, the PV system is disconnected from the public grid, and cannot feed. Ensure that the only period stipulated here is one in which the PV system is also unable to generate energy (night).

The Sunny Backup system remains in silent mode for a fixed time ("224.03 SilentTmMax" parameter) or until the battery voltage per cell is 0.14 V lower than the set voltage ("222.10 ChrgVtgFlo" parameter). This ensures that the battery is always fully charged, even in silent mode.

If a grid failure is detected while in silent mode, the Sunny Backup 2200 restores power supply within approximately 6 seconds.

16.4.5 Manual Equalization Charge

An equalization charge can be manually triggered for the Sunny Backup 2200 at any time using the "520.01 ManChrgSel" parameter. The equalization charge is activated once the manual equalization charge has been confirmed.

NOTICE!

If not charged for long periods of time, the battery ages prematurely due to outgassing (sulfation).

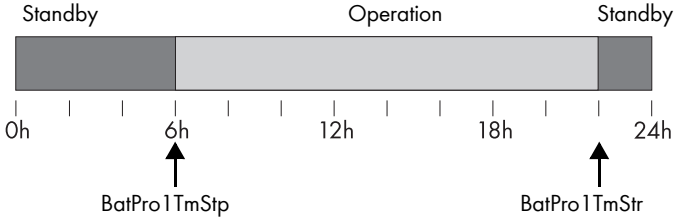
- Carry out a manual equalization charge at least once a year.

16.5 Battery Preservation Mode

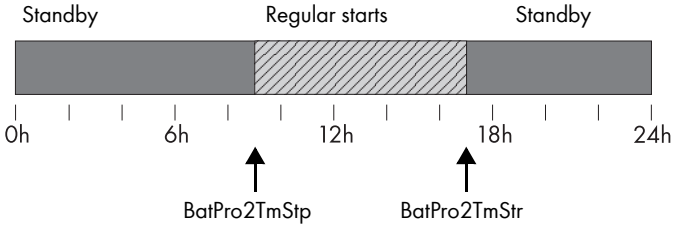
The Sunny Backup 2200 has a sophisticated battery preservation mode. The battery preservation mode prevents the battery from being deeply discharged, as much as possible, when the energy supply is low and thus prevents a total system failure as well as damage to the battery.

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

Level 1: The first level is used to switch the Sunny Backup 2200 to standby mode at times when energy is not absolutely necessary (e.g., at night). You define the start time using the "223.01 BatPro1TmStr" parameter and define the stop time using the "223.02 BatPro1TmStp" parameter.



Level 2: The second level of the battery preservation mode ensures that the Sunny Backup 2200 regularly starts every two hours, but only during the window of time in which an energy supply is expected, and attempts to charge the battery from the AC side. For photovoltaic systems, this occurs during the day. In this case, you define the start time using the "223.03 BatPro2TmStr" parameter and the stop time using the "223.04 BatPro2TmStp" parameter.



Level 3: The third level ensures that the battery is protected from deep discharge and thus protected against damage. In this case, the Sunny Backup 2200 is switched off completely. To start the inverter, see section 11.5 „Reactivating the Device Following Automatic Shutdown“ (96).

During all three levels, the Sunny Backup 2200 is only stopped if no battery current flows within 5 minutes (limit 3 A charging current).

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

Information

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

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

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

The battery preservation mode on the Sunny Backup 2200 can be exited by manually starting the device. If, within 5 minutes (see above), charging current is detected, the Sunny Backup 2200 continues to operate; otherwise, it switches off again.

16.6 Battery Diagnostics

The "320# Diag Battery" menu displays several values that provide information on the past operational behavior of the battery. These values are helpful in checking the efficiency of the set parameters and in viewing the typical operating conditions of the battery (see section 20.3 „Diagnostics“ (148)).

17 Relay

The Sunny Backup 2200 provides you with various options to control internal and external operations. For this purpose, two relays are integrated into the device with which you can assign functions using the "241.01 Rly1Op" and "241.02 Rly2Op" parameters. Information on the connection of both relays is provided in section 7.6.2 „Multi-function Relay 1 and 2“ (65). The different settings have the following meanings:

Function/ settings	Meaning	Functional description
Off	off	relay remains permanently switched off (deactivated)
On	on	relay remains permanently switched on (e.g. relay function test during commissioning)
AutoLodExt	automatic load shedding with regard to an external source	automatic connection / disconnection of loads connection only occurs if the device is connected to an external source (e.g. generator), or if the absorption phase is active
AutoLodSoc1	Auto LoadShedding Soc1	automatic connection / disconnection of loads load is only connected if SOC limit 1 has exceeded the set value again
AutoLodSoc2	Auto LoadShedding Soc2	automatic load disconnection load is only connected if SOC limit 2 has exceeded the set value again
Tm1	timer 1 (time-controlled switching of relay 1)	programmable timer 1 (once, daily, weekly) with duty cycle
Tm2	timer 2 (time-controlled switching of relay 2)	programmable timer 2 (once, daily, weekly) with duty cycle
Apt-Phs	absorption phase active	relay is switched if battery charging is in the absorption phase
ExtVfOk	external voltage and frequency is OK	external voltage and frequency are within the valid range for connection
GdOn	public grid	relay is switched if public grid is available and connected
Alm	alarm	Sunny Backup 2200 has a fault; in case of fault, contact is open (relay is deactivated)
Rn	run	Sunny Backup 2200 is in operation, contact is closed (relay is activated) if the device is running in inverter operation
BatFan	battery fan	relay is used for automatic battery room ventilation (switching the fan)
AcdCir	acid circulation	relay is used for automatic acid circulation (switching the electrolyte pump)

Assignment of relays

You can only assign one function to each relay.

Operating principle of the relays

The relays are changeover contacts. They can be used as either a break contact or a NO contact.

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

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

Relay when a fault occurs

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

18 Sunny Boy

The following section provides information for configuring the Sunny Boy inverter in Sunny Backup systems. The Sunny Backup 2200 works with a variety of inverters.

Compatible Sunny Boys

The Sunny Backup System S is compatible with all Sunny Boys offered by SMA Solar Technology AG. Sunny Boys SB 2500, SB 2800 and SB 3000 are the exceptions to this. The system only works with the models that were delivered from May 2005.

18.1 Setting the Stand-alone Grid Parameters

Sunny Boy with stand-along grid parameters

Once you have set the Sunny Boy to stand-alone parameters, the device no longer complies with the standard applicable in the installation country (for Germany: DIN VDE 0126-1-1) and may not be operated directly on the grid. The Automatic Switch Box S combined with the Sunny Backup 2200 ensures that the PV system can be safely disconnected from the public grid.

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 18.2 „Frequency Shift Power Control (FSPC)“ (135)).

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

Access permission

For changing the grid relevant parameters in the Sunny Boy inverter you need a special access code, the installer code. To obtain your personal code, contact the Sunny Island Hotline by calling +49 561 9522 399 or sending an e-mail to SunnyIsland.Service@SMA.de.

Required communication accessories

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

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

Additional information on communication can be found in section 7.5 „Communication“ (61).

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

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

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

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

DANGER!

Risk of lethal electric shock.

Risk of feedback if the public grid is down.

- Never operate the Sunny Boy directly on the grid using these settings.
- Only run the Sunny Boys in the Sunny Backup System S using the Automatic Switch Box S connections specifically provided for this purpose (see section 8.2.2 „PV System (X2/PV System)“ (75)).

Using the communication bus

If a Sunny Boy and Sunny Backup 2200 are operated together on a communication bus, the "270.06 ComBaud" parameter in the Sunny Backup 2200 must be set to "1200" (default).

The Sunny Backup 2200 only communicates through the SMA-Net protocol; Sunny-Net is not supported.

Setting older SMA inverters

It may happen that older SMA inverters cannot yet be set to "Offgrid" (stand-alone grid) via the "Default" parameter. In this case, the values 1 - 6 in the table must be set individually.

18.2 Frequency Shift Power Control (FSPC)

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

FSPC

The frequency shift power control only works in stand-alone grid operation!

Sunny Boy without FSPC

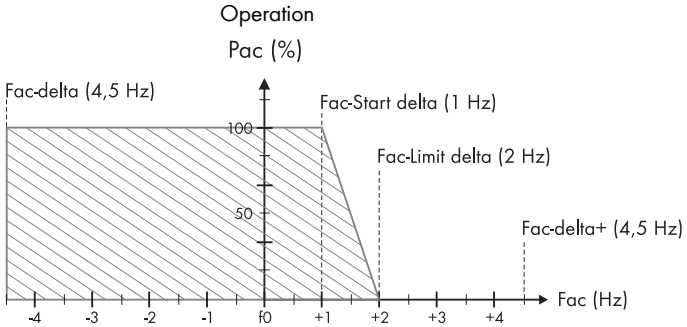
This function is neither supported by the SMA PV inverters SB2100TL, SB3300TL, SB4200TL and SB5000TL, nor by older models in the SWR series. These Sunny Boys can nevertheless be used in backup systems.

If the current battery voltage exceeds the nominal battery voltage, the above-mentioned Sunny Boys will be disconnected from the stand-alone grid present at that time and then reconnected only after the battery has been discharged by at least 5 %.

If Sunny Boys are connected in stand-alone operation, then the Sunny Backup 2200 must be capable of limiting their output power. This kind of situation arises, for example, when the Sunny Backup 2200 battery is fully charged and the (solar) power available from the PV system exceeds the power required by the connected loads.

To prevent the excess energy from overcharging the battery, the Sunny Backup 2200 recognizes this situation and changes the frequency at the AC output. This frequency adjustment is analyzed by the Sunny Boy. As soon as the grid frequency increases beyond the value specified by "Fac-Start delta" the Sunny Boy limits its output power accordingly.

This function is shown in the following figure:



The data in the above figure have the following meanings:

- f_0 refers to the base frequency of the stand-alone grid (50 Hz in this example).
- Fac-delta– and Fac-delta+ refer to the maximum range in which the Sunny Boy is active relative to f_0.
- Fac-start delta refers to the frequency increase relative to f_0, at which point the power adjustment via frequency begins.
- Fac-Limit delta refers to the frequency increase relative to f_0, at which point the power adjustment via frequency ends. The power of the Sunny Boy is 0 W in this example.

If the value is below the Fac-delta– limit or exceeds the Fac-delta+ limit, the Sunny Boys disconnect from the backup system.

Frequency shutdown of the Sunny Boys

The Sunny Backup 2200 temporarily increases the frequency if it is going to be synchronized to the public grid and the current battery voltage (V_{Bat}) exceeds the nominal battery voltage ($V_{Bat\ nom}$).

The Sunny Backup 2200 disconnects the Sunny Boys using this frequency shutdown method (overfrequency) and then synchronizes itself with the external source.

The Sunny Boys automatically switch back on once the grid frequency returns to within the limit values.

19 Maintenance and Care

19.1 Housing

Check that every housing of the Sunny Backup System S is mechanically sound. If damage (e.g. cracks, holes, missing covers) endangers the operating safety, the Sunny Backup 2200 must be deactivated immediately.

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

19.2 Device Display

NOTICE!

Unintentionally starting the Sunny Backup 2200 when cleaning the membrane buttons by accidentally pressing them!

- Only clean the membrane keypad when the device is deactivated.

19.3 Sunny Remote Control 1

Clean the control elements with a soft, damp cloth. Solvents, abrasives or corrosive materials must not be used for cleaning!

NOTICE!

Unintentionally starting the device when cleaning the button by accidentally pressing or turning it!

- Switch off the device before cleaning it.

19.4 Function Testing

Check regularly whether error messages are present. If an error message is displayed for which you cannot identify any apparent cause, the backup system must be inspected by an installer. To ensure optimal operation, the operator should regularly check the entries in the Sunny Backup 2200 error list at short intervals (monthly, or even weekly), especially during the first months after commissioning. This can help to discover hidden faults in the installation or errors in the configuration.

Checking the ground connection

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

Check that the Sunny Backup System S functions properly at least once a year. Thus, the Sunny Backup 2200, the Automatic Switch Box S, and the battery are tested for correct functionality. Despite the available grid, you can start the backup operation using the "530.02 BkupTst" function implemented in the Sunny Backup 2200.

The Automatic Switch Box S then disconnects the loads from the grid, and subsequently connects the PV system to the consumer grid. Thus, the loads are no longer powered by the public grid, but instead by your backup system. You can also stop this test with the same function "530.02 BkupTst", and the system returns to grid-parallel operation.

Abnormalities during testing

During the functionality test, fluorescent tubes or bulbs may flicker. This only occurs when testing.

During real operation, you will hardly notice when the Sunny Backup 2200 switches from grid operation to stand-alone operation.

No remuneration during the test phase

Note that during the test, your PV system does not feed any power into the grid via the feed-in counter, and therefore earns no remuneration.

If possible, conduct the test when radiation is low.

If you do not manually stop the test, once the battery charge level reaches 50 %, the system automatically returns to grid-parallel operation, and recharges the battery.

19.5 Battery

NOTICE!

The battery may be damaged if regular inspections and maintenance are not conducted!

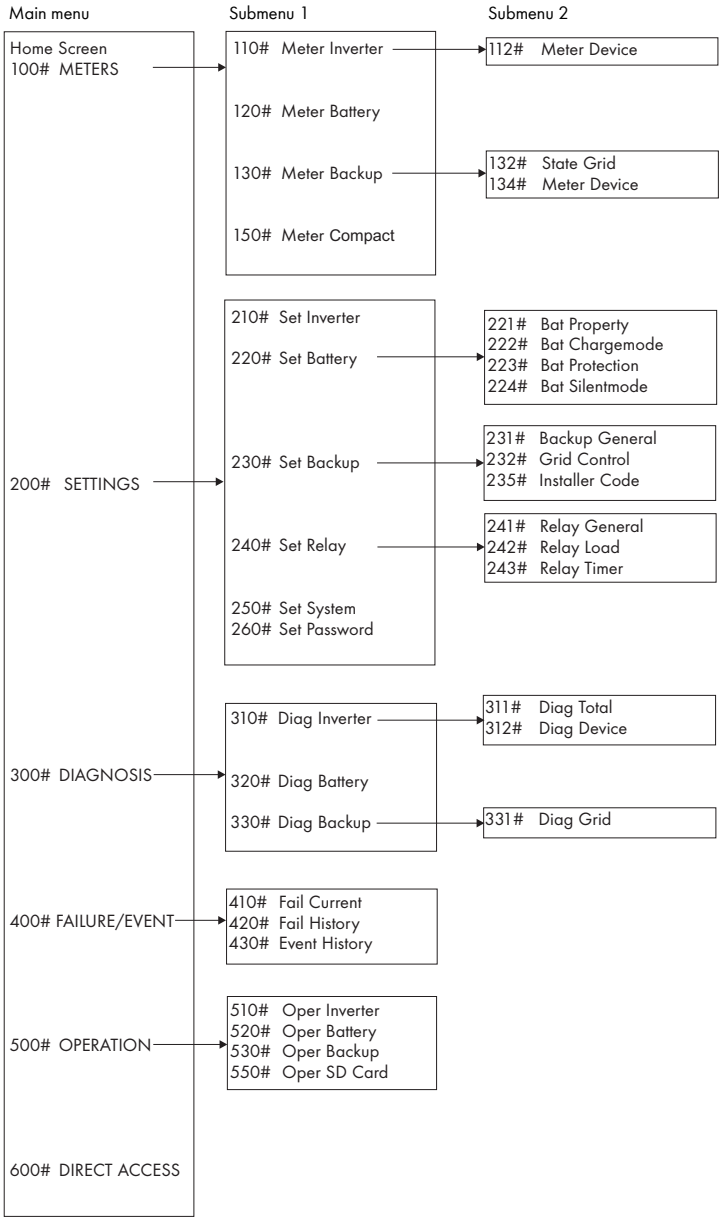
- In this regard, observe the battery manufacturer's specifications.

19.6 Disposal

Dispose of the devices at the end of their service life in accordance with the disposal regulations for electronic scrap which apply at the installation site at that time. Alternatively, send the devices back to SMA Solar Technology AG with shipping paid by sender, and labeled "FOR DISPOSAL" (see section 24 „Contact“ (169)).

20 Parameter Lists

Overview of the Navigation Area:



Only parameters in the menu branches "200# Settings" and "500# Operation" can be changed. All other values are only displayed. All menu items that can only be changed after entering the installer password are shaded in gray in the following tables.

Incorrect parameter settings can lead to faulty operation of the Sunny Backup 2200

- Be careful when setting parameters!
- Take note of the original values of all parameters that you change.

Storing settings on an MMC/SD card

Once the system is working optimally, i.e. the selected settings have proven effective, then you can save the saved values on the MMC/SD card using the "510.02 ParaSto" parameter (see section 13 „Storing Data on an MMC/SD Card“ (112)).

Afterwards, you can perform new settings. If you would like to reject these settings again, restore the system to its previous state using the "510.08 ParaLod" parameter.

Designation of the parameters

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

20.1 Display Values

110# Meter Inverter

Menu no.	Parameter no.	Parameter name	Range/unit	Description
112# Meter Device				
112	01	InvOpStt	–,Init,Standby, Operate,Error	operating mode
112	02	InvPwrAt	kW	inverter effective power
112	03	InvVtg	V	inverter voltage
112	04	InvCur	A	inverter current
112	05	InvFrq	Hz	inverter frequency
112	06	InvPwrRt	kVAr	inverter reactive power
112	09	Rly1Stt	–,Off,On	state of relay 1
112	10	Rly2Stt	–,Off,On	state of relay 2

120# Meter Battery

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

130# Meter Backup

Menu no.	Parameter no.	Parameter name	Range/unit	Description
132# State Grid				
132	01	GdRmgTm	hhmmss	remaining time of GdValTm parameter (valid grid time) (hhmmss)
134# Meter Device				
134	01	ExtPwrAt	kW	effective power of external source
134	02	ExtVtg	V	voltage of external source
134	03	ExtCur	A	current of external source
134	04	ExtFrq	Hz	frequency of external source
134	05	ExtPwrRt	kVAr	reactive power of external source

The **"150# Meter Compact"** menu is described in detail in section 12.2.5 „Meter Compact“ (110).

20.2 Adjustable System Parameters

NOTICE!

Damage caused by incorrect values.

Once the button is pressed, operating data values can immediately change to their new settings. Incorrect values in these parameters can probably not be corrected quickly enough.

- Only qualified electricians are permitted to set and adjust system parameters.
- Parameters marked with **(Stby)** are to be changed only when the inverter is in standby mode.

Parameter changes

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

All parameters can be set using a connected PC/laptop with the Sunny Data Control software, a Sunny WebBox or a Sunny Boy Control (see section 7.5 „Communication" (61)).

210# Set Inverter

Menu no.	Parameter no.	Parameter name	Range/unit	Default value	Description
210	01	InvVtgNom	V	230	nominal inverter voltage
210	02	InvChrgCurMax	A	9.6	maximum AC charging current
210	03	InvFrqNom	Hz	50	nominal inverter frequency:
210	04	InvVtgMin	V	172.5	minimum inverter voltage:
210	05	InvVtgMax	V	264.5	maximum inverter voltage:
210	06	InvFrqMin	Hz	40	minimum inverter frequency
210	07	InvFrqMax	Hz	70	maximum inverter frequency

220# Set Battery

Menu no.	Parameter no.	Parameter name	Range/unit	Default value	Description
221# Bat Property					
221	01	BatTyp	VRLA FLA NiCd	VRLA	battery type: = valve regulated lead acid = flooded lead acid = nickel cadmium can only be changed in QCG
221	02	BatCpyNom	Ah	140	Nominal battery capacity (E:C10/U:C20)
221	03	BatVtgNom	V	24	nominal battery voltage

Menu no.	Parameter no.	Parameter name	Range/unit	Default value	Description
221	04	BatTmpMax	degC	40	maximum battery temperature
221	05	BatTmpStr	degC	35	battery restart temperature following stop due to overtemperature
222# Bat Chargemode					
222	01	BatChrgCurMax	A	80	battery charging current limit (depends on nominal battery capacity), 60 % of the nominal battery capacity (221#02)
222	02	AptTmBoost	min	120	absorption time for normal charge 120 = VRLA 90 = FLA 300 = NiCd depending on the setting in QCG
222	03	AptTmFul	h	5	absorption time for full charge 5 = VRLA 5 = FLA 7 = NiCd depending on the setting in QCG
222	04	AptTmEqu	h	10	absorption time for equalization charge 10 = VRLA 10 = FLA 10 = NiCd depending on the setting in QCG
222	05	CycTmFul	d	14	full charge cycle time
222	06	CycTmEqu	d	180	equalization charge cycle time
222	07	ChrgVtgBoost	V	2.4	cell voltage nominal value for normal charge 2.4 = VRLA 2.55 = FLA 1.65 = NiCd depending on the setting in QCG
222	08	ChrgVtgFul	V	2.4	cell voltage nominal value for full charge 2.4 = VRLA 2.5 = FLA 1.65 = NiCd depending on the setting in QCG
222	09	ChrgVtgEqu	V	2.4	cell voltage nominal value for equalization charge 2.4 = VRLA 2.5 = FLA 1.65 = NiCd depending on the setting in QCG

Menu no.	Parameter no.	Parameter name	Range/unit	Default value	Description
222	10	ChrgVtgFlo	V	2.25	cell voltage nominal value for float charge 2.25 = VRLA 2.25 = FLA 1.55 = NiCd depending on the setting in QCG
222	11	BatTmpCps	mV/degC	4.0	battery temperature compensation 4.0 = VRLA 4.0 = FLA 0.0 = NiCd depending on the setting in QCG
222	12	AutoEquChrgEna	Disable Enable	Enable	activates automatic equalization charge
223# Bat Protection					
223	01	BatPro1TmStr	hhmmss	220000	time for starting battery preservation mode level 1
223	02	BatPro1TmStp	hhmmss	060000	time for stopping battery preservation mode level 1
223	03	BatPro2TmStr	hhmmss	170000	time for starting battery preservation mode level 2
223	04	BatPro2TmStp	hhmmss	090000	time for stopping battery preservation mode level 2
223	05	BatPro1Soc	%	20	SOC limit for preservation mode level 1
223	06	BatPro2Soc	%	15	SOC limit for preservation mode level 2
223	07	BatPro3Soc	%	10	SOC limit for preservation mode level 3
224# Bat Silentmode					
224	01	SilentEna	Disable Enable	Disable	allows silent mode on the grid
224	02	SilentTmFlo (Stby)	h	3	max. time for float charge until transfer into silent
224	03	SilentTmMax (Stby)	h	12	max. time for silent mode until transfer into float

230# Set Backup

Menu no.	Parameter no.	Parameter name	Range/unit	Default value	Description
231# General					
231	01	AcSrcFrqDel	Hz	4,8	frequency increase for disconnecting AC feed-in generators
231	02	PvFeedTmStr	hhmmss	040000	start time for PV grid feeding
231	03	PvFeedTmStp	hhmmss	220000	stop time for PV grid feeding

Menu no.	Parameter no.	Parameter name	Range/unit	Default value	Description
231	04	ExtLkTm	min	20	lock time after reverse power or relay protection
231	09	ExtSrc	Grid	Grid	grid operation
232# Grid Control					
232	01	GdVtgMin *	V	189	minimum grid voltage
232	02	GdVtgMax *	V	259,5	maximum grid voltage
232	03	GdCurNom	A	16	nominal grid current
232	04	GdFrqNom	Hz	50	nominal grid frequency
232	05	GdFrqMin *	Hz	47,65	minimum grid frequency
232	06	GdFrqMax *	Hz	50,15	maximum grid frequency
232	07	GdVldTm	sec	30	minimum time required for grid (voltage and frequency) to be within permissible range for connection
232	08	GdMod *	GridCharge GridFeed	GridCharge	grid interface
232	09	GdRvPwr *	W	100	permissible grid reverse power (effective power)
232	10	GdRvTm *	sec	5	permissible time for grid reverse power
232	15	GdAISns *	Low Medium Normal High	Normal	AI sensitivity
232	37	GdVtgIncProEna *	Disable Enable	Enable	allows voltage rise protection
232	38	GdVtgIncPro	V	253	threshold for voltage rise protection
232	40	Country;–,;0;l;l;Country *	Adjusted Other GER_VDE0126_1_1; GR_PPC; GR_INSULAR	GER_VDE0126-1-1	country selection

Parameters marked with *

Parameters designated with * are safety-related grid monitoring parameters. To change the SMA grid guard parameters, you must enter your personal SMA grid guard password (installer code). Call the SMA Hotline to obtain your personal SMA grid guard password.

240# Set Relay

Menu no.	Parameter no.	Parameter name	Range/unit	Default value	Description
241# Relay General					
241	01	Rly1Op	Off On AutoGn AutoLodExt AutoLod1Soc AutoLod2Soc Tmr1 Tmr2 AptPhs GnRn ExtVfOk GdOn Error Warm Run Ens1 Ens2 BatFan AcdCir	AutoGn	function of relay 1: = switched off = switched on = automatic generator connection = automatic load disconnection, only activated if external sources are present = automatic connection / disconnection of loads due to SOC1 = automatic connection / disconnection of loads due to SOC2 = programmable timer 1 = programmable timer 1 = absorption phase is active = generator is running = ext. voltage and frequency in permissible range = ext. grid is connected = error = warmup = operation (= currently has no function) (= currently has no function) = battery room fan = electrolyte pump
241	02	Rly2Op	see 241.01	AutoLodExt	function of relay 2: for details, see 241.01
242# Relay Load					
242	01	Lod1SocTm1Str	%	30	SOC limit for load shedding 1 start for t1
242	02	Lod1SocTm1Stp	%	50	SOC limit for load shedding 1 stop for t1
242	03	Lod1SocTm2Str	%	30	SOC limit for load shedding 1 start for t2
242	04	Lod1SocTm2Stp	%	50	SOC limit for load shedding 1 stop for t2
242	05	Lod1Tm1Str	hhmmss	0	load shedding 1 time 1 (begin time 1, end time 2)
242	06	Lod1Tm2Str	hhmmss	0	load shedding 1 time 2 (begin time 2, end time 1)
242	07	Lod2SocTm1Str	%	30	SOC limit for load shedding 2 start for t1
242	08	Lod2SocTm1Stp	%	50	SOC limit for load shedding 2 stop for t1

Menu no.	Parameter no.	Parameter name	Range/unit	Default value	Description
242	09	Lod2SocTm2Str	%	30	SOC limit for load shedding 2 start for t2
242	10	Lod2SocTm2Stp	%	50	SOC limit for load shedding 2 stop for t2
242	11	Lod2Tm1Str	hhmmss	0	load shedding 2 time 1 (begin time 1, end time 2)
242	12	Lod2Tm2Str	hhmmss	0	load shedding 2 time 2 (begin time 2, end time 1)
243# Relay Timer					
243	01	RlyTmr1StrDt	yyyymmdd	20060101	start date timer 1
243	02	RlyTmr1StrTm	hhmmss	0	start time for relay control timer 1
243	03	RlyTmr1Dur	hhmmss	0	run time for relay control timer 1
243	04	RlyTmr1Cyc	Single Daily Weekly	Single	repeated cycle time for timer 1
243	05	RlyTmr2StrDt	yyyymmdd	20060101	start date timer 2
243	06	RlyTmr2StrTm	hhmmss	0	start time for relay control timer 2
243	07	RlyTmr2Dur	hhmmss	0	run time for relay control timer 2
243	08	RlyTmr2Cyc	Single Daily Weekly	Single	repeated cycle time for timer 2

250# Set System

Menu no.	Parameter no.	Parameter name	Range/unit	Default value	Description
250	01	AutoStr (Stby)		0	autostart (0 = autostart deactivated)
250	02	Dt	yyyymmdd		date
250	03	Tm	hhmmss		time
250	06	ComBaud	1200 4800 9600 19200 38400 57600 115000	1200	baud rate interface

The **"260# Set Password"** menu is described in detail in section 12.2.2 „Setting the Installer Password" (106).

20.3 Diagnostics

310# Diag Inverter

Menu no.	Parameter no.	Parameter name	Range/unit	Description
311# Diag Total				
311	01	EgyCntIn	kWh	energy absorbed
311	02	EgyCntOut	kWh	energy fed
311	03	EgyCntTm	h	energy metering run time
312# Diag Device				
312	01	Adr	Master	device address (type)
312	02	FwVer		BFR firmware version
312	03	SN		serial number
312	04	OnTmh	h	operating hours
312	06	OpStt	Operating Warning Failure	operating mode (device)
312	07	CardStt	 Off Operational Mount OutOfSpace BadFileSys Incomp Parameter ParamFailed WriteLogData WriteLogFailed	MMC/SD card status message: = no Sunny Backup 2200 = in operation = card initializing = insufficient memory capacity (on card or in main directory) = incorrect file system = incompatible card = parameter update is active = error during parameter update = writing log data to card = error upon writing log data to card
312	08	FwVer2		DSP firmware version
312	09	FwVer3		BFR boot loader
312	10	FwVer4		DSP boot loader

320# Diag Battery

Menu no.	Parameter no.	Parameter name	Range/unit	Description
320	01	Soh	%	state of health (SOH), ratio of current capacity and nominal value
320	02	StatTm	d	statistics metering run time
320	03	ChrgFact		charging factor
320	04	BatEgyCntIn	kWh	energy meter for battery charge

Menu no.	Parameter no.	Parameter name	Range/unit	Description
320	05	BatEgyCntOut	kWh	energy meter for battery discharge
320	06	AhCntIn	Ah	meter for battery charging ampere hours
320	07	AhCntOut	Ah	meter for battery discharging ampere hours
320	08	BatTmpPkMin	degC	minimum battery temperature
320	09	BatTmpPkMax	degC	maximum battery temperature
320	10	EquChrgCnt		equalization charge meter
320	11	FulChrgCnt		full charge meter
320	12	BatCurOfsErr	A	current offset error of battery current
320	13	OcvPointCnt		meter for open-circuit voltage points

330# Diag Backup

Menu no.	Parameter no.	Parameter name	Range/unit	Description
331# Diag Grid				
331	01	GdEgyCntIn	kWh	energy meter for grid feed-in
331	02	GdEgyCntOut	kWh	energy meter for power taken from the grid
331	03	GdEgyTmh	h	run time of grid energy meter
331	04	GdOpTmh	h	operating hour meter for grid operation
331	05	GdCtcCnt		meter for grid connections

20.4 Events, Warnings and Errors (History)

Information on events and error messages **[410# (Fail Current), 420# (Fail History) and 430# (Event History)]**, are provided in section 21.4 „Display of Errors and Events“ (153).

20.5 Functions in Operation

510# Oper Inverter

Menu no.	Parameter no.	Parameter name	Range/unit	Default value	Description
510	01	InvRs (Stby)	Restart	–	triggers inverter reset
510	03	InvTmOpEna	Disable Enable	Disable	activates time-controlled inverter operation
510	04	InvTmOpStrDt	yyyymmdd	20060101	start date of time-controlled inverter operation
510	05	InvTmOpStrTm	hhmmss	0	start time of time-controlled inverter operation
510	06	InvTmOpRnDur	hhmmss	0	run time for time-controlled inverter operation
510	07	InvTmOpCyc	Single Daily Weekly	Single	repeated cycle time for timer 1
510	09	CntRs	Inv Bat Gn Gd All	–	clears selected energy meter

520# Oper Battery

Menu no.	Parameter no.	Name	Range/unit	Default	Description
520	01	ManChrgSel	Idle Start Stop	Idle	triggers equalization charge (manual)

530# Oper Backup

Menu no.	Parameter no.	Parameter name	Range/unit	Default value	Description
530	02	BkupTst	Stop Start		backup system test

550# Oper SD-Card

Menu no.	Parameter no.	Name	Range/unit	Default	Description
550	01	ParaSto	Set1 Set2		saves parameter settings
550	02	ParaLod	Set1 Set2 Factory		loads parameter settings
550	03	CardFunc	 ForcedWrite StoEvtHis StoFailHis		functions for MMC/SD card: = forces writing of data = writes event list = writes error list
550	04	DatLogEna	Off On	On	activates automatic data storage

The **"600# Direct Access"** menu is described in detail in section 12.2.4 „Directly Accessing the Parameters“ (110).

21 Troubleshooting/Problem Solving

In principle, the Sunny Backup 2200 makes a distinction between events and errors. These messages are displayed on the external Sunny Remote Control 1 display.

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

21.1 Error Confirmation

If a fault or an error occurs, the Sunny Backup 2200 switches into standby mode.

Proceed as follows to acknowledge an error:

1. Correct the cause.
2. Confirm the error by pressing the button of the Sunny Remote Control 1.
3. Restart the Sunny Backup 2200.

21.2 Autostart Handling

The Sunny Backup 2200 has an autostart meter that counts down by 1 for each autostart. If the Sunny Backup 2200 runs uninterrupted for over 10 minutes, the autostart meter is reset to its initial value.

If another fault occurs when the autostart meter is at 0, the Sunny Backup 2200 waits for 10 minutes and then attempts to restart. The autostart meter begins to run again.

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

21.3 Handling Pending Errors During the Booting Procedure

During the booting procedure, all pending errors are generally confirmed without an entry being made in the history (see menu "400# Failure/Event"). This way, an error that is still pending after the booting procedure is re-entered or if the system detects that this error has stopped, it is entered as no longer being present.

The Sunny Remote Control 1 displays:

- „!“ for set – the Sunny Backup 2200 has detected an error (again) and enters it in the list.
- "C" for clear – the cause of the error has been successfully corrected; the error is "no longer present".

21.4 Display of Errors and Events

Every error and event is uniquely marked and created according to the parameter/measuring value assignment.

The message has four digits and consists of one letter and three numbers.

1. Depending on the message, it begins with a letter. There are three categories of messages:
   - F = Error/Failure
   - W = Warning
   - E = Event
2. The second position is a number between 1 and 8 that describes the area in which the error, event or warning occurred:
   - y1xx - INV = Inverter
   - y2xx - BAT = Battery
   - y3xx - EXT = External
   - y5xx - GRD = Grid
   - y6xx - RLY = Relay
   - y7xx - SYS = System
   - y8xx - BOX = Automatic Switch Box S
3. The third and
4. fourth positions contain two digits. These numbers provide information on the frequency in which this particular message has occurred.

In addition, the Sunny Remote Control 1 indicates whether the message is still current, i.e. if an action is required or the message has been settled.

- „!" for set – the Sunny Backup 2200 has detected an error (again) and enters it in the list.
- "C" for clear – the cause of the error has been successfully corrected; the error is "no longer present".

21.5 Events

The meaning of events reported by the Sunny Backup 2200 are explained in the following table:

Display no.	Description
Category INV	
E101	wait status
E102	startup process
E103	operation
E110	shutting down due to fault
E118	automatic start
E119	manual start (transfer from standby mode into operation)
E120	manual stop (transfer from operation into standby mode)
E121	energy saving mode 1
Category BAT	
E202	(partial) reset of BMS due to new battery (QCG NewBat)
E203	state change, battery charging algorithm for float (maintenance) charge
E204	state change, battery charging algorithm for boost charge
E205	state change, battery charging algorithm for full charge
E206	state change into silent mode (BMS)
E207	state change, battery charging algorithm for equalization charge
E221	battery preservation mode level 1
E222	battery preservation mode level 2
E223	battery preservation mode level 3
Category REL	
E601	relay 1 off
E602	relay 1 on
E609	transfer relay open (disconnection from grid)
E610	transfer relay closed (connection to the grid)
E617	relay 2 open
E618	relay 2 closed
E625	digital input OFF (Low)
E626	digital input ON (High)
E633	master operating contact on
E634	master operating contact off

Display no.	Description
Category SYS	
E705	device start
E706	date/time changed (entry with "old" time)
E707	new system configured in QCG
E708	part 1 of the firmware updated (entry of the "old" version)
E709	part 2 of the firmware updated (entry of the "old" version)
E711	MMC/SD card inserted
E712	Sunny Remote Control 1: parameter update
E713	start of the relay test for the Automatic Switch Box S
E714	start of the "small" relay test (only in stand-alone operation)
E715	Sunny Remote Control 1 activated

21.6 Error Categories

The Sunny Backup 2200 categorizes errors into five different levels. There is a different behavior depending on the level:

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

21.7 Warnings and Error Messages

The meaning of warnings and errors reported by the Sunny Backup 2200 are explained in the following table:

Displ. no.	Level	Description
Category INV		
F117	2	AC current limit (short-circuit control active for too long)
F121	3	inverter overvoltage
F141	3	overtemperature (inverter)

Displ. no.	Level	Description
F145	3	overtemperature (voltage converter)
Category BAT		
F206	3	battery overtemperature
F208	3	battery overvoltage (internal limit for cell voltage)
W210	1	battery overvoltage warning (depending on charging voltage nominal value)
W211	1	insufficient battery temperature warning
W212	1	high battery temperature warning
Category EXT		
W309	1	relay protection
W315	1	grid disconnection, external voltage too low
W319	1	grid disconnection, external voltage too high
W323	1	grid disconnection, external frequency too low
W327	1	grid disconnection, external frequency too high
W331	1	grid disconnection due to anti-islanding (unwanted stand-alone grid)
W335	1	grid disconnection due to breached voltage limits
W339	1	grid disconnection due to voltage rise protection
W360	1	grid disconnection due to overcurrent
Category RLY		
F605	4	transfer relay does not open
Category SYS		
W702	1	internal restart
F703	3	timeout during internal processing
F705	4	DSP watchdog has been triggered
F706	4	watchdog meter has expired (watchdog triggered several times in succession)
F710	4	autostart meter has expired (several autostarts in succession)
F711	2	DSP hardware error
F712	2	internal electronics monitoring (HTSS error)
W713	1	watchdog has been triggered
F714	2	internal overvoltage
F722	3	short circuit in battery temperature sensor
F723	3	cable break on battery temperature sensor
W738	1	synchronization not successful
F739	3	internal device communication BFR-DSP missing

Displ. no.	Level	Description
F743	3	internal device communication BFR-DSP missing
W753	1	invalid date (date is automatically started during startup)
F754	2	communication with Automatic Switch Box S interrupted
W755	1	battery preservation mode 1
W756	1	battery preservation mode 2
W757	1	battery preservation mode 3
F758	4	short circuit or cable break on temperature sensor/inverter
F762	4	short-circuit or cable break on temperature sensor/voltage converter
W766	1	communication with Automatic Switch Box S interrupted
W770	1	short circuit at the 24 V DC output
F771	4	voltage monitoring algorithm error
Category BOX		
F801	4	plausibility test failed (relay error)
W819	1	Communication errors
W820	1	incorrect box type (Automatic Switch Box)
W821	1	PV system not available for grid feeding
W822	1	PV system not available in the stand-alone grid
W823	1	error detected on the QUPS-Box – enable signal for plausibility test, power supply

21.8 Troubleshooting

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

1. Approval

The grid operator refuses to allow connection of the system to the grid due to concern that this would enable feeding of arbitrary current back through the feed-in counter. Is this legitimate?

No, if all system components are connected correctly, only energy which is fed in at connection X2 / PV System can be forwarded to the output X1 / PV Meter. The software prevents the Sunny Backup 2200 from establishing a connection to the PV feed-in counter. This is confirmed by a certificate from the German Professional Association for Precision Engineering and Electrotechnology (BGFE), which you can acquire from SMA, and present to the grid operator.

2. Installation / Commissioning

Why am I prohibited from installing an RCD switch upstream of the Sunny Backup system?

Because the RCD switch has a protective function (voltage disconnection in the event of a fault) which is rendered ineffective by the Sunny Backup system. In order to preserve this protective function, the RCD switch must be positioned between the Automatic Switch Box S and the loads.

Why do I need the PEN conductor to be grounded upstream of the Sunny Backup system, yet still within the system? The PEN conductor is already grounded in the local grid!

In the event of a deliberate grid shutdown on the part of your distribution grid operator (e.g. for maintenance work), the PEN conductor can be interrupted if the corresponding phase conductors are disconnected. The Sunny Backup system then lacks a ground connection, which is unacceptable, both in terms of functionality and safety. Furthermore, an increase of the PEN conductor's voltage in the grid is prevented in stand-alone operation.

At our site, there is only a TT grid, and my distribution grid operator does not allow the N conductor to be grounded. Can I operate the Sunny Backup system anyway, without grounding the N conductor?

NO, in this form, the system is only certified for TN systems. Consult your energy supply company to ascertain the conditions under which installation is permissible.

Why must I set the Sunny Boy to use "stand-alone grid parameters"? It has operated without problems up to now!

As long as your system is operating on the public grid, the high power output from connected power stations means that the public grid can ensure that voltage and frequency do not change if you connect loads to the grid. In a small stand-alone grid, in which the consumer power is about the same as the installed capacity of the Sunny Backup 2200, such effective adjustment is not possible. Therefore, frequency and voltage are not as constant as in the so-called "rigid grid", so the Sunny Boys in stand-alone grid operation would often interpret these deviations as grid faults and deactivate. To enable practical utilization of the PV system in the event of grid failure, it must also be able to operate in a "soft" grid. This is made possible by means of switching to the so-called "stand-alone grid parameters".

But the Sunny Boy also feeds into the grid. Is that permissible with the "grid parameters" deactivated?

This is permissible for the Sunny Boy or any other PV inverter, but only in conjunction with the upstream Sunny Backup system or an automatic disconnection device certified according to the applicable standard in the installation country (for Germany:). The Sunny Boy may not operate directly on the grid in this manner, because it must adhere to the parameters (voltage and frequency limits) specified in the standard applicable in the installation country and must also contain the automatic disconnection device specified by that standard. The Sunny Boy meets both these requirements with its integrated "SMA grid guard version 2". Only once the Sunny Boy is connected to the Sunny Backup system's X2 / PV System input, may "SMA grid guard version 2" be deactivated. Its functions are then assumed by the control and monitoring within the Sunny Backup System S.

What can I do if the QCG suddenly does not run?

Switch off the Sunny Backup 2200 (section 11.3 „Deactivation“ (95)) and switch it back on (section 11.1 „Activation / Startup“ (91)).

3. Operation

Can I also operate the Sunny Backup 2200 without an external display (Sunny Remote Control 1)?

The Sunny Backup 2200 can be operated without Sunny Remote Control 1.

1. The Sunny Backup 2200 can be started without Sunny Remote Control 1, however, subsequent operation is limited (standard settings only). Set the coded rotary switch on the Sunny Backup 2200 to "4".
2. You can start the Sunny Backup 2200 using the Sunny Remote Control 1 and set the parameters. You then no longer require the Sunny Remote Control 1 for operation. You can remove the external display.

How can a failure of the public grid be signaled?

A light indicator can be controlled via one of the two internal relays of the Sunny Backup 2200 in such a manner that e.g. the light indicator is only activated in the event of a grid failure. For instance, relay 1 can be set to "GdOn" via parameter "241.01 Rly1Op". In turn, an indicator light is switched via the floating contact.

How can it be signaled that the battery's charge level is low?

A light indicator, or similar device, can be controlled via one of the two internal relays of the Sunny Backup 2200 in such a manner that the light indicator is only activated when the battery's charge level is low. For instance, relay 2 can be set to "AutoLodSoc1" via parameter "241.02 Rly2Op". With the parameter "242.01 Lod1SocTmStr", the activation value can be set to 30 %, for example, and with the parameter "242.02 Lod1SocTmStp" the deactivation value can be set to 50 %, for example.

How can I determine whether my Sunny Backup system is operating correctly?

The display on the Sunny Remote Control 1 clearly indicates the system status (see section 12.1.1 „Home Screen“ (100)). In addition, the battery's charge level should be between 95 % and 100 %. If a warning is indicated (exclamation mark "!" in the lower right-hand corner of the display), the status of the Sunny Backup System S must be analyzed in more detail.

How can I determine whether the Sunny Backup system is operating in stand-alone operation?

The display indicates that a grid failure has occurred (see section 12.1.1 „Home Screen“ (100)).

How can I test whether my Sunny Backup system will "jump in" if the grid fails?

The functionality of the Sunny Backup system can be tested at any time with the "Test Backup System" function (see section 19.4 „Function Testing“ (137)).

I have discovered that if I simply switch off the Sunny Backup 2200 while the grid is available, my loads are still powered. But why does my PV system not begin to feed?

In the Sunny Backup System S, grid monitoring is preformed by the Automatic Switch Box S according to the standard applicable in the installation country and not by the Sunny Boy. The Sunny Boy is automatically connected to the Automatic Switch Box S (see section 8.2 „AC Connection“ (71)). Once you switch off the Sunny Backup 2200, you also switch off the Automatic Switch Box S, thus disconnecting your PV system from the public grid.

Why is my battery discharging, even though the grid is available?

The Sunny Backup system limits the power drawn from the grid to the defined maximum grid current (parameter "232.03 GdCurNom"). If the total current of all loads exceeds this value, the loads are supplied with additional power from the battery. If possible, increase the grid current value.

Why is it not possible to change the parameters?

- Has the installer password been entered correctly? Check whether you are actually in "Installer Level" (see section 12.2.2 „Setting the Installer Password“ (106)). If necessary, repeat the calculation and entry of the password.
- You are in the "100-Meters" (measuring data) menu or the "300-Diagnosis" (Diagnosis) menu. You can only read the data values shown here.
- Some parameters can only be changed in standby mode or in the QCG (see e.g. the "242.07 GnStrMod" parameter in section 20.2 „Adjustable System Parameters“ (142)). Stop the Sunny Backup 2200 as described in section 11.2 „Stopping“ (93). Note that this causes the PV system to fail, and grid feeding is not possible.

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

- The Sunny Boy inverter is controlled via the frequency (see section 18.2 „Frequency Shift Power Control (FSPC)“ (135)).
- Power fluctuations cause frequency deviations.

4. Fault

Why is the Sunny Backup System S not starting?

- Check whether there is a galvanic connection between the N conductors between the X2/PV system connections terminals and the X4/backup loads of the Automatic Switch Box S. Remove this bridge, if necessary, and restart the system.

Why is the device display of the Sunny Backup 2200 dark? Why are none of the LEDs illuminated?

- Was the BatFuse A.01 tripped?

  The Sunny Backup 2200 is therefore disconnected from the battery and switched off. Replace DC fuses.
- Is the BatFuse A.01 inserted and functioning properly?
  In this case, the device has switched off to protect the battery against deep discharge (see also section 16.3 „State of Charge/SOC and SOH“ (124)). For information on restarting the Sunny Backup 2200, see section 11.5 „Reactivating the Device Following Automatic Shutdown“ (96).

Why does the "VAC-Low" error (output voltage too low) also occur when the Sunny Backup 2200 is started?

- A permanent short circuit exists in the consumer grid. Check the AC output connections (X3 / Backup-Loads).
- The loads connected during the grid failure are too heavy. The power of the Sunny Backup 2200 is not sufficient to supply the loads. Switch off some of the loads and restart the Sunny Backup 2200.

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

You wanted to perform an action using the MMC/SD card, but it failed (see section 12.1.5 „Selecting Warnings and Errors“ (104)). Check the card (on your PC/laptop) and use a new MMC/SD card, if necessary.

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

Set a longer absorption period.

What do I have to do if the Sunny Backup 2200 continuously goes out after Low Battery Mode (LBM) when restarting the device?

Upon reactivation, ensure that either the public grid is available again, or that battery charging is possible via the PV system. Otherwise, after 5 minutes without a charging current, the Sunny Backup 2200 returns to battery preservation mode, and switches back to standby.

What happens if the card inserted is not FAT16-formatted?

The Sunny Remote Control 1 displays the message "Incomp". Format the card.

22 Optional Devices

22.1 Accessories (Optional)

The following accessories for the Sunny Backup 2200 are also available:

- Separate fuse for the battery (SMA order number: "BatFuse A.01"
  Enables disconnection with cable protection (used with NH fuse) of the Sunny Backup 2200 from the connected battery.
- Battery mount for two batteries

Using communication devices

SMA Solar Technology AG also offers an extensive range of products allowing you to communicate with the Sunny Backup 2200 to query data, and much more. Among these devices are:

- Sunny WebBox
- Sunny Sensor Box

The Sunny Beam and Sunny Matrix communication devices cannot be used. They do not operate with the Sunny Backup 2200!

The software for configuration of your Sunny Backup 2200, and for reading and analyzing the data, can be found at the SMA Solar Technology AG website, at www.SMA.de, and can be downloaded for free (see section 24 „Contact“ (169)).

22.2 SMA Products (Optional)

The Sunny Backup 2200 operates with all the Sunny Boy devices from SMA Solar Technology AG.

23 Technical Data

23.1 Sunny Backup 2200

Output data	
Nominal AC voltage ($V_{AC, nom}$) (adjustable)	230 V (202 to 253 V)
Nominal frequency (f_{nom})	50 Hz (45 to 65 Hz)
Continuous AC output (P_{nom}) at 25 °C	2200 W
Continuous AC output (P_{nom}) at 45 °C	1600 W (- 27 %)
AC output power for 30 min at 25 °C	2900 W
AC output power for 5 min at 25 °C	3800 W
AC output power for 1 min at 25 °C	3800 W
Nominal AC current ($I_{AC, nom}$)	9.6 A
Max. current (peak value) for 3 ms	25 A_{eff} (3 ms)
Harmonic distortion of output voltage (K_{VAC})	< 4 %
Power factor cosϕ	–1 to +1
Input data	
Input voltage ($U_{AC, ext}$) (adjustable)	230 V (172.5 to 250 V)
Input frequency (f_{ext}) (adjustable)	50 Hz (40 to 70 Hz)
Max. AC input current ($I_{AC, ext}$) (adjustable)	25 A
Max. input power ($P_{AC, ext}$)	5.75 kW
Battery data	
Battery voltage ($U_{Bat, nom}$) (adjustable)	24 V (16.8 to 31.5 V)
Max. battery charging current ($I_{Bat, max}$)	90 A
Continuous charging current ($I_{Bat, nom}$)	75 A
Battery capacity	100 to 10000 Ah
Charge control	IV0V process with automatic full and equalization charge
Battery type	VRLA/FLA/NiCd

Efficiency/power consumption	
Max. efficiency	93 %
Operating consumption in standby mode	6 W
Operating consumption with no load in discharging mode	21 W
Operating consumption with no load in float charge mode	35 W
Certification	
EC Declaration of Conformity	enclosed, download area www.SMA.de
Protection rating	
in accordance with DIN EN 60529	IP 54
USA	not available
Device protection	
short circuit overload overtemperature	yes yes yes
Interfaces	
Display: Control elements: Floating control contacts: Communication: External display: with data storage and firmware update:	3 LEDs, 3 buttons 2 multi-function relays, galvanically isolated RS485 (opt.) Sunny Remote Control 1 (SRC-1) 1 MMC/SD card (128MB)
digital input level (DigIn)	high level as of 3 V (up to 32 V), low level 0 to 2 V

Load limits for multi-function relay 1 and 2: - switching of resistive loads - switching of strong inductive loads	 AC1: 6.0 A at 250 V~ AC15: 1.2 A at 250 V~
Interruption time	
max. interruption time	50 ms
Mechanical data	
Width x height x depth	(470 x 445 x 180) mm
Weight	18 kg (approx.)
Ambient conditions	
Ambient temperature	from –25 °C to +60 °C
Miscellaneous	
Guaranty (EU)	5 years
Accessories	
Ext. battery temperature sensor	included

23.2 Automatic Switch Box S

Type S

Input/output data	
Nominal AC voltage	230 V
Nominal frequency	50 Hz
PV nominal AC output power	4600 W
PV nominal AC current	20 A
Loads nominal AC output power	5800 W
Loads nominal AC current	25 A
SBU 2200 nominal AC output power	2200 W
SBU 2200 nominal AC current	9.6 A
Power consumption	
Operating consumption	4 W
Mechanical data	
Width x height x depth	(200 x 300 x 120) mm
Weight	4.5 kg
Ambient conditions	
Ambient temperature	from –25 °C to +60 °C
Certification	
EC Declaration of Conformity	enclosed, download area www.SMA.de
Sunny Backup System S:	BGFE, according to DIN V VDEV 0126-1-1, among others (2006-02)
Protection rating	
in accordance with DIN EN 60529	IP 54

23.3 Sunny Remote Control 1

Interfaces	
DC supply voltage	12 V (from SBU 2200 through communication cable)
Nominal current	200 mA
Data storage and service	128 MB SD/MMC card
Communication	RS 422
Communication cable	CAT5e-FTP patch cables (2 x RJ45 plugs)
Max. cable length	20 m
Display and operation	
Display	4 x 20 characters
Operation	rotary pushbutton (button) illuminated push button (button)
Mechanical data	
Width x height x depth	(225 x 140 x 65) mm
Weight	0.4 kg (approx.)
Ambient conditions	
Ambient temperature	from 0 °C to + 50 °C
Protection rating	
in accordance with DIN EN 60529	IP 20
Certification	
EC Declaration of Conformity	enclosed, download area www.SMA.de
Accessories delivered with the device	
MMC/SD card	128 MB
Communication cable	CAT5e-FTP patch cable, 5 m

23.4 DC fuse (BatFuse A.01)

Output data	
Nominal DC voltage	24 V
Nominal DC current	125 A
Mechanical data	
Fuse	125 A NH00
Width x height x depth	(254 x 180 x 111) mm
Weight	1.5 kg

24 Contact

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

- Inverter type (Sunny Backup 2200, see type label)
- Voltage/frequency type
- Serial number (see type label or parameter "312.03 SN")
- Firmware version (see parameter "312.02 FwVer")
- Error message shown on the display
- Battery type
- Nominal battery capacity
- Nominal battery voltage
- Communication products used
- Type and size of additional energy sources (PV systems, Sunny Boy)

Saving data and events

Always use the MMC/SD card to save data and events. This is necessary in order for SMA Solar Technology AG to be able to help you in the event of a fault.

To ensure that you have saved the present error list and event list on the MMC/SD card, write all data to the MMC/SD card with the parameter "440.01 CardFunc" and the option "ForceWrite".

SMA Solar Technology AG

Sonnenallee 1

34266 Niestetal, Germany

Tel. +49 561 9522 399

Fax +49 561 9522 4697

SunnyIsland.Service@SMA.de

www.SMA.de

25 Glossary

Absorption Phase

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

AC

Abbreviation for "Alternating Current"

AC Coupling

The connection of various loads, generators and storage devices on the AC side.

AGM Battery

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

Ah

Abbreviation for "ampere hours": unit of electrical charge, one ampere hour is the charge provided by a constant current of 1 A over a period of one hour - when two separate charges are connected.

Automatic Disconnection Device

The "automatic disconnection device between a grid parallel power-generating system and the public low voltage grid" is an equivalent replacement for a normal public disconnection device with isolation function which is accessible to the distribution grid operator at any time. This is a mandatory safety device which prevents energy 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 performed by the “SMA grid guard Version 2”. With Sunny Backup 2200, it is integrated in the Automatic Switch Box.

Automatic Switch Box

Switching device which switches a Sunny Backup system between grid operation and stand-alone grid operation. In the Sunny Backup system, during grid operation a PV system is operated via an automatic disconnection device at its own feed-in counter; upon grid failure, it is switched to the stand-alone grid which is disconnected from the public grid. As an option, the box can also integrate a diesel generator into the Sunny Backup system.

Backup System

Backup systems are power supply systems which provide an extra level of security for standard power supply systems. The public grid is usually the standard power supply system, which is backed up by an additional stand-alone grid system in 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 which can release previously stored chemical energy as electrical energy. A distinction is made between non-rechargeable primary elements (often used in (e.g.) consumer markets) and rechargeable secondary elements (accumulators). In stand-alone grid systems, the batteries used as rechargeable secondary elements are almost exclusively lead acid batteries and, very rarely, nickel/cadmium batteries.

Battery Bank

See Battery System.

Battery Charging Mode

A battery inverter operating mode, in which the inverter takes energy from the AC grid to recharge the battery in a controlled fashion. In this operating mode, the battery inverter is primarily responsible for correctly charging the battery, and acts as an independent battery charger.

Battery Inverter

See Battery Power Converter.

Battery Management

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

Battery Power Converter

A bidirectional power converter which can regulate voltage and frequency in a stand-alone grid and is also responsible for correct battery charging.

Battery System

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

Boost Charge

Boost charge: 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 Inverters

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

Charge Level

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

Charge Mode

See Battery Charging Mode.

Charging Throughput

See Nominal Charging Throughput.

Cluster

Several Sunny Island or Sunny Backup inverters which are connected in parallel on the DC side, and which are connected to a shared battery system. On the AC output side, these inverters can also be connected in parallel (single-phase system), or form a multi-phase system. The devices in a cluster must be connected by communication cables, and must be configured in such a manner that one device (-> master) leads the cluster, and all other devices (-> slaves) communicate with the leading device.

C Rate

The nominal capacity specification is always provided along with the discharge time on which the capacity is based. The nominal capacity is the product of the constant charging current I_N and the discharge time t_N, which passes between commencement of discharging the fully charged battery and when the final discharge voltage U_S is reached. For stationary batteries, the C_{10} capacity is usually specified, i.e. a battery with C_{10} = 200 Ah can be discharged for 10 hours at a nominal current of 0.1 × C_{10} = I_{10} = 20 A.

DC

Abbreviation for "Direct Current"

Derating

English for "reduction": a controlled reduction in performance, usually dependent on component temperatures. Compared with the (also common) practice of completely shutting down the device, the effect on the grid is smaller with derating.

DSP

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

Electrolyte

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

EPROM

See Flash EEPROM.

Equalization Charge

See Equalize Charge

Equalize Charge

Equalization 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 individual cells slowly drift apart, which can lead to premature battery bank failure.

Firmware

Firmware is software which is embedded in a chip in various electronic devices, such as hard disk recorders, DVD burners and players, newer television sets, household appliances and computers - in contrast to software, which is stored on hard drives, CD-ROMs or other media. These days, firmware is usually stored in a flash memory or an EEPROM.

FLA

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

Flash EEPROM

The abbreviation EEPROM stands for Electrically Erasable Programmable Read-Only Memory. Flash memories are digital storage devices (chips). The exact designation is “flash EEPROM”. In contrast to "normal" EEPROM memories, in flash EEPROM it is not possible to delete individual bytes (the smallest addressable memory units).

EEPROM is a non-volatile, electronic memory component used (for example) in computer technology, and mainly in embedded systems.

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

Float Charge

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

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 battery aging caused by inadequate charging.

Gel Battery

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

Generator

An electrical generator is an electrical machine which converts kinetic or mechanical energy into electrical energy. Here, not only the electrical generator itself, but also the combustion unit (diesel, petrol, or gas motor) necessary for the power unit is combined together with the electrical generator and simplified under the term “generator”. This is also described colloquially as a power generator.

Grid-connected System

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

Invert Mode

See Inverter Operation.

Inverter Mode

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

Inverters

A device for converting the direct current (DC) from the PV generator into alternating current (AC), which is necessary for connection of most normal household devices and especially for feeding solar energy into an existing supply grid. Inverters for PV systems usually include at least one MPP tracker, store operating data, and monitor the grid connection of the PV system (see also MSD).

Main Cluster

The leading cluster in a multicluster system. The main cluster, for example, has the tasks of voltage and frequency regulation, grid monitoring, generator control, load management, and control of the Automatic Switch Box in a backup system.

Maintenance Charge

See Float Charge.

Master

A configuration setting which assigns the leading role in a cluster to a Sunny Island or Sunny Backup inverter. This stipulates that centralized control and monitoring tasks, which in a cluster must be performed by just one device (e.g., frequency regulation, battery management, generator control, and control of the Automatic Switch Box in the Sunny Backup system) are to be performed by this device. All other inverters of the cluster must be configured so as to leave these tasks to the master, and to be led by the master (-> slaves). The master is also the device at which the cluster's configuration, operation, and data recording occurs in a centralized manner.

Maximum Power Point "MPP"

The operating point (defined current/voltage curve) of a PV generator where the maximum power can be drawn. The actual MMP changes constantly depending, for example, on the level of solar irradiation and the ambient temperature.

MPP Tracker

Regulation of the power drawn so that a PV generator is operated for as long as possible at the MPP. This operating point varies with the solar irradiation and temperature conditions of the modules. MPP tracking optimizes the extraction of electrical power and is a feature of inverters and charge controllers.

MSD

See Automatic Disconnection Device

Multicluster System

Parallel connection of several clusters on the AC output side in a stand-alone grid or backup system. The master devices of the individual clusters must be connected by communication cables, and configured in such a manner that one cluster leads the entire system (see main cluster) and the master devices of all other clusters (see sub-cluster) communicate with the master of the main cluster.

Multi-String Inverter

An inverter which to a great extent combines the advantages of several string inverters (separate MPP tracking of individual strings) and a central inverter (low performance-specific costs).

NiCd

Nickel/cadmium battery, contains nickel, cadmium, and potassium hydroxide as the electrolyte. These require a significantly higher charging voltage, have a lower level of efficiency and are significantly more expensive than lead acid batteries. However, their robustness, cycle resistance and low-temperature capabilities mean that they are used in certain special applications.

NLM

Abbreviation for Powerline modem: communication between SMA inverters and the monitoring devices can be made with a cable, a radio link, or a Powerline modem. Powerline modems use a carrier frequency of approx. 132 kHz modulated onto the AC cables, and data is transferred using FSK (Frequency Shift Keying) of this carrier signal. Details on the Powerline modem can be found (e.g.) in the technical description of the SMA-NLM.

Nominal Charging Throughput

The charging throughput is the cumulative total discharge current over time, measured in ampere hours (Ah). These meters are not automatically reset after charging. The nominal charging throughput is the charging throughput with regard to the nominal capacity of the batteries.

Overload Capability

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

Parallel Connection

Parallel connection of batteries (all positive poles together and all negative poles together) increases the capacity of the battery bank while keeping the voltage constant. 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.

Photovoltaics

See PV.

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 an individual chip. In this case, the chip is removed and the board is plugged into the empty socket.

PLC

Abbreviation for Power Line Communication: describes the process of data transfer over the grid supply cables. The PLC power module is used to amplify the signal and is connected in Multi-String and Sunny Mini Central inverters.

PV

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

PV Generator

Technical device for the conversion of solar energy into electrical energy. This term encompasses all the electrically connected (in series and in parallel) solar modules in a PV system.

PV Module

See Solar Module.

PV System

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

Self Discharge

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

Series Connection

In this case the positive pole of each battery is connected to the negative pole of the next battery. There is only one circuit where current can flow. Series connection increases the voltage of the entire battery bank. If two 24 V batteries with a capacity of 100 Ah each are connected in series, the total voltage is 24 V + 24 V = 48 V, while the total capacity remains at 100 Ah.

Slave

A configuration setting which assigns a subordinate role in a cluster to a Sunny Island or Sunny Backup inverter. Thus, this device is relieved of control tasks and monitoring tasks, which must (or may) only be performed by one device in a cluster (-> master). Slave devices accept the configuration settings, present firmware, and start/stop commands from the master, and report these events, as well as warnings and error messages.

SOC

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

SOH

State of Health: describes the relationship between the present capacity and the battery's nominal value, given as a percentage.

Solar Cell

An electronic component which generates electrical energy when irradiated with sunlight. Since the voltage produced by a single solar cell is very small (approx. 0.5 V), several solar cells are combined to form a solar module. The most common semiconductor material presently used for solar cells is silicon, which is manufactured in different forms (monocrystalline, polycrystalline, amorphous). In addition to vastly different mechanical variations, which are usually designed to increase the level of efficiency, completely new materials are currently being tested (cadmium telluride, cadmium indium sulphide, titanium dioxide and many others).

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 influences.

Stand-Alone Grid System

An energy generation system which 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 excessive yield losses caused by variations in shadowing on different modules.

String Inverter

An inverter concept which avoids the disadvantages of the central inverter concept. The PV generator is split into individual strings, each of which is connected to the external grid by means of its own string inverter. This greatly simplifies installation and reduces the yield losses which can be caused by manufacturing deviations or variations in shadowing on the solar modules.

Sub Cluster (Extension Cluster)

Cluster in a multicluster system which is subordinate to a main cluster, and thus does not lead the entire system.

VRLA

Valve regulated lead acid battery: lead-acid battery with semi-solid electrolyte or closed lead acid battery. Examples of this type of battery are gel batteries and AGM batteries (Absorbent Glass Mat).

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SMA Solar Technology AG

Sonnenallee 1

34266 Niestetal

Germany

Tel. +49 561 9522-0

Fax +49 561 9522-100

www.SMA.de

E-Mail: info@SMA.de

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SMA Solar Technology AG

www.SMA.de

Sonnenallee 1
34266 Niestetal, Germany
Tel.: +49 561 9522 4000
Fax: +49 561 9522 4040
E-Mail: Vertrieb@SMA.de
Freecall: 0800 SUNNYBOY
Freecall: 0800 78669269