User Manual
sonnenBatterie eco
This manual refers to:

Hardware version: 1.1
Software version: 5.00 (370)

Latest revision: 08/05/16

If you need help or service, contact the company that commissioned your storage system. You can find the contact address on the inside of the door of the storage system or on the commissioning protocol.
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About this manual

This manual describes the operation of the sonnenBatterie eco storage system. Read this manual carefully and keep it near the storage system.

Target audience

This document is intended for the following audiences:

• Operator and end user of the storage system

Symbols used

**WARNING WORD**

Warnings are indicated by this symbol and a warning word, which indicates the severity of the danger. Along with the warning are instructions for avoiding the danger.

Structure of warnings

The following warning words are used:

• **CAUTION** indicates a possible hazardous situation which could result in minor or moderate injury.

• **WARNING** indicates a possible hazardous situation which could result in death or serious injury.

• **DANGER** indicates an imminent hazardous situation which will result in death or serious injury.

Material damage

Attention

Possible material damages are indicated in this document with the warning word “Attention.”

Important information

Important information without danger to injury, death, or material damage is indicated by this symbol.

Actions

Actions to be taken are marked with a ➤. For example:

➤ Read all instructions before operating the storage system.
Safety

Intended use

Any use of the system other than the intended use can cause serious injury, death, and damage to the product or other assets.

- The storage system must only be used to store electrical power.
- The storage system must only be used with the battery modules provided.
- The storage system is intended for indoor use only.
- The intended use includes knowledge and application of the information in this installation and operating manual as well as all delivered product documentation.

Failure to comply with the warranty conditions and the information listed in this installation and operating manual will void any warranty claims.

Prohibited uses

DANGER

Danger to life due to electric shock!

Even if the utility grid fails, the storage system will continue delivering power. If the storage system requires service:

▶ Turn off the storage system.
▶ Turn off the main disconnect circuit breaker.

Only authorized electrically qualified persons can perform work on electrical parts.

- Do not use the storage system in vehicles.
- Do not use the storage system in wet locations.
- Do not use the storage system in areas at risk of explosion (flour dust, sawdust, etc.).
- Do not expose the storage system to direct sunlight.
- Do not use the storage system in areas where the ammonia content of the air exceeds 20 ppm.
- Do not use the storage system when corrosive gases are present.
- Do not use the storage system higher than 9,842 feet (3,000 meters) above sea-level.
- Do not operate the storage system at temperatures outside of the allowed ambient temperature range of 32 °F - 113 °F (0 °C - 45 °C).
- Do not operate the storage system at a humidity higher than 90%.
General safety instructions

- Do not modify the storage system.
- Do not use the storage system if it has been damaged.
- Ensure that all safety systems are in perfect working order.
- Read this manual with care.

General warnings

Attention

**Damaging of the battery modules by deep discharge!**

If the battery modules are disconnected from a power source for longer than six months, they can be damaged by excessive discharge.

- If the storage system has been disconnected from the utility grid, PV system, or other sufficient power source for six months, connect it to the utility grid and allow it to charge the battery modules.
- If a battery module has been disconnected from the storage system for six months, install it in the storage system and charge it.
## Description and Specifications

<table>
<thead>
<tr>
<th></th>
<th>eco 4</th>
<th>eco 6</th>
<th>eco 8</th>
<th>eco 10</th>
<th>eco 12</th>
<th>eco 14</th>
<th>eco 16</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Usable capacity</strong>&lt;br&gt;(100% DOD)</td>
<td>4 kWh</td>
<td>6 kWh</td>
<td>8 kWh</td>
<td>10 kWh</td>
<td>12 kWh</td>
<td>14 kWh</td>
<td>16 kWh</td>
</tr>
<tr>
<td><strong>Maximum storage power rating</strong>&lt;br&gt;(at 25 deg C)</td>
<td>3kW</td>
<td>4kW</td>
<td>4kW</td>
<td>7kW</td>
<td>8 kW</td>
<td>8 kW</td>
<td>8 kW</td>
</tr>
<tr>
<td><strong>Dimensions</strong>&lt;br&gt;W”/H”/D”&lt;br&gt;(approx.)</td>
<td>26x55 x14</td>
<td>26x55 x14</td>
<td>26x55 x14</td>
<td>26x75 x14</td>
<td>26x75 x14</td>
<td>26x75 x14</td>
<td>26x7” x14</td>
</tr>
<tr>
<td><strong>Weight</strong>&lt;br&gt;(approx.)</td>
<td>377 lbs.</td>
<td>437 lbs.</td>
<td>496 lbs.</td>
<td>622 lbs.</td>
<td>683 lbs.</td>
<td>741 lbs.</td>
<td>800 lbs.</td>
</tr>
<tr>
<td><strong>Nominal current</strong></td>
<td>16.7A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>33.3A</td>
</tr>
<tr>
<td><strong>Cell chemistry</strong></td>
<td>Lithium iron phosphate (LiFePO₄)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Nominal voltage</strong></td>
<td>120/240VAC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Device protection</strong></td>
<td>Short circuit, overload, over temperature</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Acceptable ambient temperature</strong></td>
<td>32 °F - 113 °F (0 °C - 45 °C)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Maximum Humidity</strong></td>
<td>90%, non-condensing</td>
<td></td>
<td></td>
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<tr>
<td><strong>Applications</strong></td>
<td>self-consumption, backup</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Grid integration</strong></td>
<td>AC coupled</td>
<td></td>
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<td></td>
<td>eco 4</td>
<td>eco 6</td>
<td>eco 8</td>
<td>eco 10</td>
<td>eco 12</td>
<td>eco 14</td>
<td>eco 16</td>
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<tr>
<td><strong>On-grid specifications</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Nominal power</td>
<td>3kW</td>
<td>4kW</td>
<td>4kW</td>
<td>7kW</td>
<td>8kW</td>
<td>8kW</td>
<td>8kW</td>
</tr>
<tr>
<td>Nominal AC current</td>
<td>12.5A</td>
<td>16.67A</td>
<td>16.67A</td>
<td>29.16A</td>
<td>33.33A</td>
<td>33.33A</td>
<td>33.33A</td>
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<tr>
<td><strong>Off-grid specifications</strong></td>
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<tr>
<td>Nominal power</td>
<td>3kW</td>
<td>4kW</td>
<td>4kW</td>
<td>7kW</td>
<td>8kW</td>
<td>8kW</td>
<td>8kW</td>
</tr>
<tr>
<td>Nominal AC current</td>
<td>12.5A</td>
<td>16.67A</td>
<td>16.67A</td>
<td>29.16A</td>
<td>33.33A</td>
<td>33.33A</td>
<td>33.33A</td>
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<tr>
<td>Max power</td>
<td>100 ms – 8.5KVA</td>
<td></td>
<td></td>
<td>100 ms – 16.97KVA</td>
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<tr>
<td></td>
<td>5s – 6KVA</td>
<td></td>
<td></td>
<td>5s – 12KVA</td>
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<tr>
<td></td>
<td>30m – 4.5KVA</td>
<td></td>
<td></td>
<td>30m – 9KVA</td>
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</tr>
<tr>
<td>Max AC current (charge/discharge)</td>
<td>1 ms – 50A</td>
<td></td>
<td></td>
<td>1 ms – 100A</td>
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<tr>
<td></td>
<td>100 ms – 35.35A</td>
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<td></td>
<td>100 ms – 70.7A</td>
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<td></td>
<td>5s – 25A</td>
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<td>5s – 50A</td>
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<tr>
<td></td>
<td>30m – 18.75A</td>
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<td>30m – 37.5A</td>
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</tr>
<tr>
<td>Overcurrent protection needed</td>
<td>30A</td>
<td></td>
<td></td>
<td>50A</td>
<td></td>
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## General specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>eco 4</th>
<th>eco 6</th>
<th>eco 8</th>
<th>eco 10</th>
<th>eco 12</th>
<th>eco 14</th>
<th>eco 16</th>
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</thead>
<tbody>
<tr>
<td><strong>Transfer switch</strong></td>
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<td></td>
<td>Automatic, integrated</td>
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<tr>
<td><strong>Backup capacity</strong></td>
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<tr>
<td></td>
<td>2 kilowatt-hours per battery module, up to 16 kilowatt-hours</td>
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<tr>
<td><strong>Certifications</strong></td>
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<tr>
<td></td>
<td>UL Recognized Components: Battery modules – UL1973; Inverter – UL1741; ATS – UL1008; AC Breaker – UL489</td>
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<tr>
<td><strong>Warranty</strong></td>
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<td></td>
<td>Inverter, 10 years; battery modules, 10 years or 10,000 cycles; cabinet and components, 1 year</td>
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<tr>
<td><strong>Inverter efficiency</strong></td>
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<tr>
<td></td>
<td>92.5% CEC weighted, 95.0% peak</td>
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<tr>
<td><strong>Roundtrip Eff% (Grid &lt;&gt; Battery)</strong></td>
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<td>&gt;= 86%</td>
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<tr>
<td><strong>Comm. ports</strong></td>
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<tr>
<td></td>
<td>Serial, Ethernet</td>
<td></td>
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<tr>
<td><strong>Comm. protocols</strong></td>
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<td></td>
<td>Modbus, Z-Wave</td>
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<tr>
<td><strong>Comm. and control standards</strong></td>
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<td></td>
<td>Open ADR 2.0, SunSpec Alliance</td>
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</tr>
<tr>
<td><strong>EMC / EMI protection</strong></td>
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<tr>
<td></td>
<td>FCC Part 15B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total harmonic distortion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;5% L1-L2, &lt;2% L-N</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Cooling Method</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Forced air</td>
<td></td>
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<tr>
<td><strong>Noise emission</strong></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>&lt; 35dBA</td>
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</tbody>
</table>
## AC Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC input rated current</td>
<td>Pass through: 200 amps @ 240VAC&lt;br&gt;Power plant: 33.33 amps @ 240VAC</td>
</tr>
<tr>
<td>AC output voltage</td>
<td>120/240 volts</td>
</tr>
<tr>
<td>AC grid voltage</td>
<td>120/240 volts</td>
</tr>
<tr>
<td>Nominal frequency</td>
<td>60 Hz</td>
</tr>
<tr>
<td>Adjustable frequency range</td>
<td>+/- 0.7 Hz from nominal</td>
</tr>
<tr>
<td>Metering capability</td>
<td>Power meter for load and PV production; +/- 0.5 RDG (current/voltage)</td>
</tr>
<tr>
<td>Tare losses (W)</td>
<td>60 watts</td>
</tr>
<tr>
<td>Transient protection</td>
<td>IEEE C62.41 Class B</td>
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</tbody>
</table>

## Transfer switch specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current rating</td>
<td>200 amps switching and overcurrent protection</td>
</tr>
<tr>
<td>Voltage rating</td>
<td>120/240 VAC</td>
</tr>
<tr>
<td>Contacts</td>
<td>Silver-plated</td>
</tr>
<tr>
<td>Certification</td>
<td>UL Recognized Component</td>
</tr>
</tbody>
</table>
## Fault Current @ 240VAC

- **eco 4**: 22,000 amps

---

## Battery specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voltage</strong></td>
<td>48-56 VDC</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td>4-16kWh (2 kWh per module)</td>
</tr>
<tr>
<td><strong>Charge current</strong></td>
<td>30A per module nominal, 70A per module max</td>
</tr>
<tr>
<td><strong>Cell discharge</strong></td>
<td>100% DoD</td>
</tr>
<tr>
<td><strong>Overcharge Protection</strong></td>
<td>Fuse protection</td>
</tr>
</tbody>
</table>

## Sizing requirements in relation to PV inverter

<table>
<thead>
<tr>
<th>eco</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum PV size</strong></td>
<td>1.6 KW</td>
<td>2.4 KW</td>
<td>3.2 KW</td>
<td>4 KW</td>
<td>4.8 KW</td>
<td>5.6 KW</td>
<td>8 KW</td>
</tr>
<tr>
<td><strong>Ideal PV size</strong></td>
<td>4 KW</td>
<td>4 KW</td>
<td>4 KW</td>
<td>8 KW</td>
<td>8 KW</td>
<td>8 KW</td>
<td>8 KW</td>
</tr>
</tbody>
</table>
The sonnenBatterie eco is an intelligent storage system that monitors and controls energy production, consumption, and storage in the house.

The sonnenBatterie eco can work with existing or newly installed PV systems. The solar inverter and eco storage system connect to the same distribution panel. Solar modules do not connect to the sonnenBatterie directly.

The storage system uses two power meters to monitor solar power production and energy consumption. When production is higher than consumption, such as at midday, the eco stores the excess energy in its lithium iron phosphate (LiFePo$_4$) battery modules. When consumption is higher than production, such as in the evening, the storage system releases the energy. In doing so, the storage system allows you to use solar power at night, reducing your power bill and increasing the value of your investment in renewable energy.

The storage system also acts as a backup power supply, meaning that if the utility grid goes out, your appliances will remain powered.

Fig. 1 Energy flow

The above illustration shows the storage system manages solar power (1) and power from the utility grid (2) to maximize your energy independence and savings on your power bill.
The sonnenBatterie eco offers two complementary modes of operation: Self-consumption and Backup. Self-consumption mode ensures that you are using the power you generated even when the utility grid power is available; backup mode makes that self-generated power available in the event of a grid power outage.

Many utility companies are moving to a Time of Use-based billing scheme, in which electricity costs more during high-demand time periods. The sonnenBatterie eco can maximize your cost savings by using employing “rate arbitrage” — using your stored battery power during the high-cost part of the day and recharging from solar and optionally with electricity purchased from the grid at the lowest offered rates.

**Self-consumption mode**

The following illustrates the interaction between the storage system, the PV system, and the utility grid in self-consumption mode:

![Diagram](image.png)

*Fig. 2 Self-consumption mode*

The DC power that is generated by the PV array (A) is converted to AC power by means of an inverter (B). The meters (C) and (D) measure the current electrical power in watts. The production meter (C) measures the power production, the consumption meter (D) measures the power consumption in the house. If the production is higher than the consumption, the surplus
will be stored in the battery modules (E). The storage system’s inverter (F) converts the AC power to DC power while the battery modules (E) are charging.

When the production is lower than the consumption, electric power will be released from the battery modules. The storage system’s inverter (F) converts the DC power of the battery modules (E) to AC power. The utility’s power meter (G), measures the power supply and the power fed back to the grid (if applicable).

**Backup mode**

In backup mode, the house is powered by the energy stored in the battery modules and generated by the PV array. During that time, the power from the PV array powers the house or charges the battery modules, depending on production and consumption levels. The storage system can also turn the PV array off if the battery modules become fully charged.

*Fig. 3 Backup mode*
Turning the system on and off

In most cases, you will not need to turn the storage system on or off. If you do need to turn the system on or off, follow the directions below.

Turning the storage system on

The main DC circuit breaker F1 and the switch S1, located in the interior of the main cabinet, control power to the system.

Attention

**Damage of the storage system by high currents!**

High currents can damage components of the storage system if the process is not followed properly.

- Turn on the storage system only according to the steps below.

1. Make sure the emergency switch is turned on (if available).
2. Press switch S1 for at least 30 seconds and keep it pressed.
3. Turn on main circuit breaker F1 of the main cabinet.

After that, the storage system will boot up and perform a self-test.

Attention

**Damage of the battery cells by deep discharge!**

If the storage system is not connected to the utility grid, PV system, or other sufficient power source, the battery modules can be damaged by excessive and prolonged discharge.

- Do not leave the storage system disconnected for longer than six months.
Shutting the storage system down

Attention

Damage of system parts by forced disconnect!
If there is no emergency:

- Shut the storage system down.

If there is no emergency, do not turn off the storage system by forcibly removing power, by turning off the DC circuit breaker, or by using the battery emergency switch, as these methods may result in undesirable behavior.

Shut down the storage system

Follow these steps to shut the storage system down properly:

1. Press power-off button
   - Press the red-framed power-off button in the upper right corner of the start screen.

2. Confirm shut-down
   - Press again to confirm shut-down.
   The shut down takes approximately 30 seconds.

Emergency switch-off

In case of an emergency, the storage system can be switched off by the main circuit breaker F1 or the emergency switch (if installed).

Fig. 5 Circuit breaker
(S1) Switch
(F1) Main circuit breaker

- In case of an emergency, switch off the main circuit breaker F1 in the interior of the main cabinet or the external emergency switch (if installed).
- Only switch off the main circuit breaker F1 if it can be reached without danger.
The sonnenBatterie eco is designed to run without user intervention in most cases. However, there are settings available on the touchscreen interface to customize the storage unit for your needs.

**Menu screen**

The menu screen provides access to the three areas of the interface:

1. Function
2. Switch load
3. Settings

Pressing one of the buttons will load the corresponding screen.

**Function screen**

The Function screen allows you to dictate how the storage
system will operate.

1. The large button lets you choose whether the storage system will maximize backup readiness or self-consumption.

2. In Standby mode, the unit will keep the battery modules charged, without providing power for household load.

3. In Charge, then Standby mode, the unit will bring its battery modules to full charge, then maintain the charge in the event of power loss.

4. In Charge, then Auto mode, the unit will bring its battery modules to full charge, then provide power for self-consumption.

Switch load screen

Fig. 8 Touchscreen switch load screen

In switched load settings screen, you can manually set the digital output high to activate a contactor connected to a high-power device, such as a water pump or heater, or set the unit to auto mode, in which it will turn the output high and therefore activate the device when the surplus power reaches a specified level (see "Load screen" on page 20 for more information).
Behavior screen

The Product info tab on the Behavior screen lists information about the storage unit. This information will be set during commissioning and should not normally be changed.

Fig. 9 Touchscreen behavior screen

The Behavior tab displays at what temperatures the case fan will activate.

Fig. 10 Touchscreen Behavior tab
Charge behavior screen

The General tab on the Charge behavior screen shows the current that will be used to charge the batteries in manual charge mode.

Fig. 11 Touchscreen charge behavior screen

In the Offgrid tab, you can determine how much charge is reserved for when the storage system is needed for backup power. When the storage system is configured to maximize backup power reliability, it will not discharge the battery system below this setpoint.

Fig. 12 Touchscreen offgrid tab
In the PV tab on the Producer screen, you can see the nominal power of your solar panel system, whether it is a single-phase system, and how much power you can output to the utility grid.

On the CHP tab, you can see settings related to your connected generator, if applicable.
Load screen

Fig. 15 Touchscreen load screen

On the load screen, you can see how much surplus power production is required to activate self-consumption features and the minimum time self-consumption mode will be active before checking the surplus power level again.

BMS screen

Fig. 16 Touchscreen BMS screen

The Battery Management System screen provides information about your battery modules. These values are read from the installed battery modules.
Touch Panel screen

Fig. 17  Touchscreen Touchpanel screen
On the Time & Language tab of the Settings screen, you can configure the time and language of the touchscreen interface.

Fig. 18  Touchscreen display tab
On the Display tab, you can configure the touchscreen’s backlight, enable or disable the child safety lock to prevent accidental changes, and calibrate the touch sensitivity of the panel.
Fig. 19  Touchscreen passwords tab

On the Passwords tab, you can change your password. The default password for the “user” account is 1010, which can be changed if desired.

If you change your password, please write it down.
Maintenance and care

To ensure failure-free operation, safety, reliability and longevity, you must perform periodic cleaning and function control of the storage system.

Function control

Every two weeks, check if messages are shown on the screen.

Care of the storage system

Attention

Risk of damage by improper cleaning utensils!

- Only use cleaning solutions and tools listed in this chapter.
- Do not use high-pressure cleaning equipment.
- Do not use abrasive cleaners.

Cleaning the screen

- When the screen appears dirty, clean it carefully with a damp cloth with a small amount of dish liquid.

Cleaning the enclosure

- When the cabinet appears dirty, clean the exterior with a soft, damp cloth. Do not clean the interior of the cabinet.

Checking the storage unit

Monthly:

- Check the area around storage unit for safety hazards or potential maintenance issues, including debris and chemical vapors that can degrade electrical insulation.
### Error Messages

<table>
<thead>
<tr>
<th>Error message</th>
<th>User Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check battery module communication cables and addresses</td>
<td>Contact your installer’s customer service department</td>
</tr>
<tr>
<td>Check DC cabling of battery modules</td>
<td>Contact your installer’s customer service department</td>
</tr>
<tr>
<td>CommBoard communication problem</td>
<td>Contact your installer’s customer service department</td>
</tr>
<tr>
<td>Check battery module addresses!</td>
<td>Contact your installer’s customer service department</td>
</tr>
<tr>
<td>Unsupported battery module installed</td>
<td>Contact your installer’s customer service department</td>
</tr>
<tr>
<td>Unsupported number of battery modules</td>
<td>Contact your installer’s customer service department</td>
</tr>
<tr>
<td>Backup power has been stopped: Max. BMS discharge current exceeded</td>
<td>Normally, this message appears when the load exceeds the capability of the storage system’s battery modules. Reduce the load on the storage system.</td>
</tr>
<tr>
<td>Backup power has been stopped: Battery state of charge is low.</td>
<td>The battery modules have reached too low of a state of charge and must be charged before they can provide backup power.</td>
</tr>
<tr>
<td>Emergency backup power overload</td>
<td>Turn off non-essential devices.</td>
</tr>
<tr>
<td>Inverter communication error</td>
<td>Contact your installer’s customer service department</td>
</tr>
<tr>
<td>Server unreachable. Check Internet connection.</td>
<td>The storage system cannot reach sonnenBatterie’s Internet services. Check the storage system’s Ethernet cable.</td>
</tr>
<tr>
<td>Mains fault. Grid measurement values are not within the range prescribed by the regulations (VDE-AR-N 4105). Check mains fuses!</td>
<td>Ensure the grid is providing power.</td>
</tr>
<tr>
<td>Modbus error</td>
<td>Contact customer service if persists</td>
</tr>
</tbody>
</table>

### Warning Messages

<table>
<thead>
<tr>
<th>Warning message</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. BMS charge current exceeded: Disabled microgrid power production</td>
<td>The storage system is still providing backup power, but the battery modules cannot be charged further until their state of charge is reduced</td>
</tr>
<tr>
<td>High SOC: Disabled microgrid power production</td>
<td>The battery modules cannot be charged further until their state of charge is reduced</td>
</tr>
</tbody>
</table>
**Nameplate**

**Manufacturer**
Sonnen Inc  
10800 Burbank Blvd., Suite C  
Los Angeles, California 91601

<table>
<thead>
<tr>
<th>Product name</th>
<th>Manufacturer</th>
<th>UL Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>SonnenBatterie eco</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SKU: 38154 / 38161</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial number:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Version:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated feed-through current:</td>
<td>200A</td>
<td></td>
</tr>
<tr>
<td>Mains voltage/frequency:</td>
<td>120/240 VAC 60Hz</td>
<td></td>
</tr>
<tr>
<td>Backup output current:</td>
<td>50A</td>
<td></td>
</tr>
<tr>
<td>Active power:</td>
<td>max. 4000W / 8000W</td>
<td></td>
</tr>
<tr>
<td>Protection class / protection:</td>
<td>NEMA 12</td>
<td></td>
</tr>
<tr>
<td>Battery voltage:</td>
<td>nom. 51.2V</td>
<td></td>
</tr>
</tbody>
</table>

The critical components included are all components certified by these UL standards.

Made in North America
Sequence of operations

Grid-Tied Operation

1. The photovoltaic system is generating power and the Automatic Transfer Switch detects that the utility grid is active.
2. The sonnenBatterie eco storage system monitors solar power production levels and load consumption levels.
3. Solar power production exceeds load consumption.
4. The storage system charges its battery modules.
5. The battery modules reach full charge.
6. The Solar panels continue to generate power at least 1000 W (adjustable) over load consumption.
7. The Storage system activates the 24V digital signal for the optional self-consumption circuit for a preset time (30 minutes, adjustable).
8. The Storage system activates desired Z-Wave self-consumption outlets for a preset time (30 minutes, adjustable).
9. The preset self-consumption time elapses.
10. The storage system compares power production to consumption.
11. If power production exceeds consumption by present amount (1000 watts, adjustable), the storage system does nothing. If production is less than the threshold, the storage system deactivates 24V digital signal and Z-Wave outlets.
Off-Grid Operation

1. The automatic transfer switch detects that the utility grid has gone down and/or the storage system detects that the utility grid is no longer present.
2. The storage system informs the automatic transfer switch that it is ready to provide power.
3. The automatic transfer switch connects the main service panel to the storage system by disconnecting the utility grid first.
4. The main service panel is powered by the storage system now.
5. After the reconnection delay of five minutes, the PV system starts generating power.
6. If the solar panels' power generation drops below load consumption, the storage system powers the main service panel from energy stored in its battery modules. Otherwise, the PV system powers the main service panel and the excess production is stored in the storage system.
7. If the state of charge is below a series of critical limits, non-essential loads identified by the customers will be disconnected from the micro-grid to extend the utilization time of the energy stored.
8. If power production exceeds consumption the storage system and the battery modules are fully charged, the system shuts down the PV inverter power source and provides power to the loads via the battery modules. After a period of time, the system allows for the PV system to reconnect.
9. Grid power is restored.
10. The automatic transfer switch senses that the utility grid is now active.
11. The automatic transfer switch connects the main service panel to the utility grid after 5 minutes of stable grid presence.
12. The storage system's inverter reconnects after a stable grid has been detected.
13. The storage system begins charging its battery modules, if needed.
Glossary

**Appliances**: Devices that consume power. These may include small appliances, such as a blender, or large ones, such as a water heater.

**Backup mode (or offgrid mode)**: A mode of operation in which the sonnenBatterie eco provides power stored in its battery modules when the utility grid power is unavailable.

**Backup readiness**: When the storage system emphasizes backup readiness, it maintains a specified state of charge, such as 85%, in its battery modules to be ready to provide power in the event of an outage.

**Battery modules**: The energy storage modules in the sonnenBatterie eco.

**Capacity**: The amount of energy that can be stored in the sonnenBatterie eco, measured in kilowatt-hours.

**Consumption**: The amount of power being used by appliances.

**Deep discharge**: Bringing the battery module’s charge to such a low level that it damages the battery. For the modules used by the eco, this requires leaving a module at an extremely low level (0%-1%) for weeks or months.

**Discharge**: When the storage system provides power to your house or building.

**Feed-In**: When the storage system provides power to the utility grid.

**Grid**: The power source provided by utility companies, as opposed to self-generated power.

**Kilowatt-hour**: A measurement of energy equal to one kilowatt delivered for one hour.

**Load-shedding**: The method of removing power to appliances either to keep the load within power requirements or to maximize battery time.

**Main disconnect circuit breaker**: A circuit breaker that cuts all power to and from the storage system when opened.

**Main service panel**: The main panel to which all appliances are connected.

**Microgrid**: The grid created by your power generation system, as opposed to the utility grid.

**Modbus**: A serial protocol that enables communications between smart devices.

**Photovoltaic**: A photovoltaic system of solar-power panels.

**Production**: The power generated by your solar panels.

**Protected loads panel**: A panel providing power to the most important appliances in the house or building, such as a refrigerator, freezer, or heater. This subpanel is isolated from the main service panel by a switch to prevent electrical feedback.

**Self-consumption**: The method of using solar power to power appliances rather than using grid power.

**State of charge**: The percentage of charge available in the storage system’s battery modules.

**Storage system**: The sonnenBatterie eco, which combines an inverter, battery modules, and other hardware and proprietary algorithms to make solar power an even more cost-effective power source.

**Transfer switch**: A switch, either manual or automatic, that changes the power source from the utility grid to self-generated power in the event of a loss of power.
Fire-related instructions

Despite all of the care that goes into the design of the storage system, fires are still possible. A fire can release substances contained in the battery modules.

In the event of a fire in the storage system or its surroundings:

- Only fire fighters wearing proper protective clothing (including gloves, masks, and breathing apparatus) may enter the room with the burning storage system.
- A fire in the storage system can be extinguished by conventional agents.
- The use of water is advisable to cool the battery modules and thus prevent the thermal runaway of modules that are still intact.

Pertinent information on battery modules include:

- The battery modules have a rated voltage of 51.2 VDC and are thus in the range of protective extra-low voltage (below 60 VDC).
- The battery modules contain no metallic lithium.

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**CAUTION**

**Risk of injury from escaping electrolyte**

The battery modules in the storage system are protected by a number of security devices for safe operation. Despite diligent construction, cells inside the battery modules can still degrade or catch fire in the event of mechanical damage, heat, or a fault. Possible effects include:

- Heating of battery modules.
- Escaping electrolyte, which can ignite and produce an explosive flame.
- Smoke, which can irritate skin, eyes, and throat.

Consequently:

- Do not open battery modules.
- Do not physically damage battery modules (puncture, deform, disassemble, etc).
- Do not modify battery modules.
- Keep battery modules away from water (except to extinguish a fire in the storage system).
- Do not allow battery modules to heat up.
- Only operate battery modules in the allowed temperature range.
- Do not short circuit battery modules or bring them into contact with metal.
- Do not use a battery module after it has short-circuited.
- Do not exhaustively discharge battery modules.

If contents escape:

- Do not enter the room.
- Avoid contact with the escaping electrolyte.
- Contact your fire department.