



Safety Concept Explanation

for the operation of the Sunny Island 4548-US / 6048-US (hereinafter referred to as Sunny Island) together with a battery or a battery system (hereinafter referred to as battery system) for verification of product safety

1. As independent parts of the overall system, the Sunny Island and the battery system are basically responsible for their own device safety and, together, for the performance and the safety of the overall system. This concerns hazards from the overall system and its components before, during and after operation for the purpose of safety for people, the environment and property.
2. For Sunny Island inverters, device safety is verified by certification in accordance with UL 1741 - see www.SMA-America.com.
3. Safety in terms of grid monitoring and grid disconnection by the Sunny Island is proven by means of the following documents for the Sunny Island (see www.SMA-America.com):
 - Certificate of compliance in accordance with UL 1741 and CAN/CSA C22.2 No. 107.1-01 for SI 4548-US-10
 - Certificate of compliance in accordance with UL 1741 and CAN/CSA C22.2 No. 107.1-01 for SI 6048-US-10
4. For the battery system, device safety is verified by the battery manufacturer (declaration, inspection document or test certificate).
5. The measures for safety in the overall system, as ensured by the Sunny Island, are described in the following.
6. The instructions in the technical documentation are to be observed, especially in terms of storage, transport, handling, mounting location, mechanical and electrical installation, commissioning and intended use as well as maintenance/repair and disposal of all components of the overall system. In addition, the requirements of the Battery Recycling Act are to be met.
7. The Sunny Island can be operated with integrated battery management for lead-acid batteries or alternatively with external battery management for lithium-ion batteries via CAN bus connection. The interface specification must be followed for the latter case.
8. Possible hazards when operating the Sunny Island with a battery system are handled by the Sunny Island in accordance with the following table:
 - a. Overcharge of the battery system is prevented by:
 - Battery voltage control to the adjusted setpoint in the Sunny Island
 - Measurement of the battery voltage and transition of the Sunny Island into error state (standby) in case of overvoltage

 - b. Deep discharge of the battery system is prevented by:
 - Monitoring of the battery state of charge (SOC) by the Sunny Island:
 - no further electric discharge for increased self-consumption when the permissible depth of discharge during operation falls below the set limit
 - recharge of the battery for retention of the set value
 - Monitoring of the battery state of charge (SOC) and, if necessary, automatic shutdown of the Sunny Island at a defined state of charge (SOC) of the battery.
 - Undervoltage monitoring and transition of the Sunny Island to standby when the low-voltage limit of the battery is reached.
 - Undervoltage monitoring and, if necessary, automatic shutdown of the Sunny Island if the lower voltage limit of the DC input voltage of the Sunny Island is not reached

- c. Overcurrent and its effects are prevented by:
- Current monitoring and control-oriented limitation to the adjusted setpoint in the Sunny Island and, if necessary, transition of the Sunny Island into standby under fault conditions
 - Installation regulations and required cable protection
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- d. Short circuit of the battery cables and its effects are prevented by:
- Installation regulations and required cable protection
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- e. Other system errors are prevented by:
- Installation regulations for the battery system, battery inverter and other components
 - Specified maintenance
 - Intended use
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9. Possible hazards when operating the Sunny Island with a battery system equipped with its own battery management connected via CAN bus are additionally prevented by the Sunny Island as follows:

- a. Battery overcharge is additionally prevented by:
- Specification of the charging voltage setpoint by the battery management via communication and use by the Sunny Island (see **8a**)
 - Signaling of the overvoltage fault by the battery management via communication and transition of the Sunny Island into error state (standby)
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- b. Deep discharge of the battery is additionally prevented by:
- Signaling of the battery state of charge (SOC) by the battery management via communication and use of information for activation of the battery protection function by the Sunny Island (see **8b**)
 - Signaling of a fault by the battery management via communication and transition of the Sunny Island into error state (standby)
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- c. Overcurrent is additionally prevented by:
- Setpoint of the maximum charge or discharge current limits by the battery management and adherence to the limits by the Sunny Island (see **8c**)
 - Signaling of the overcurrent fault by the battery management via communication and transition of the Sunny Island into error state (standby)
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- d. Short circuit of the battery cables or its effects are additionally prevented by:
- Installation regulations and requirements for cable protection on the battery side
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- e. Other errors of the battery system are additionally prevented by:
- Signaling of errors by the battery management via communication and transition of the Sunny Island into error state (standby)
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- f. Errors in communication with the battery management are prevented by:
- Use of the CAN bus for communication as secure transmission (CRC)
 - Rejection of data outside the permissible range by the Sunny Island and retention of the last value; if necessary, fallback to the set, safe default value
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- g. Loss of and missing communication from the battery management is prevented by:
- Monitoring of communication and transition of the Sunny Island into error state (standby) and, if necessary, automatic shutdown of the Sunny Island
 - Use of default values that prevent operation of the system and lead to automatic shutdown of the Sunny Island
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10. In addition to the measures defined in item 9, possible hazards during operation of the Sunny Island with a battery system with its own battery management connected via CAN bus must be prevented by means of an automatic shutdown of the battery (DC disconnection). This achieves the so-called fail-safe operation.

Supported Sunny Island Inverter Types

Type	Firmware version
Sunny Island 4548-US (SI 4548-US-10)	From version 7.3
Sunny Island 6048-US (SI 6048-US-10)	From version 7.3

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