Installation - Quick Reference Guide

BATTERY BACKUP SYSTEM

Battery Backup Systems with Sunny Island 6.0H / 8.0H

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1 Information on this Document

Validity

This document is valid for battery backup systems with the following Sunny Island device types as of firmware version 3.1:

- SI8.0H-11
- SI6.0H-11

Content and Structure of the Document

The document summarizes the specific information on battery backup systems with Sunny Island. Circuitry overviews provide you with a basis for setting up a battery backup system. The structure of the document specifies the chronological sequence for configuration and commissioning. The document does not replace the documentation of the individual products. You will find details and help in the event of difficulties in the documentation of the respective product.

Target Group

This document is intended for qualified persons. Only persons with the appropriate skills are allowed to perform the tasks described in this document (see Section 2.2 "Skills of Qualified Persons", page 8).

Additional Information

Links to additional information can be found at www.SMA-Solar.com:

Document title	Document type
SMA Flexible Storage System with Battery Backup Function	Planning Guidelines

Symbols for Information

Symbol	Explanation
⚠ DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury
⚠ WARNING	Indicates a hazardous situation which, if not avoided, can result in death or serious injury
⚠ CAUTION	Indicates a hazardous situation which, if not avoided, can result in minor or moderate injury
NOTICE	Indicates a situation which, if not avoided, can result in property damage
i	Information that is important for a specific topic or goal, but is not safety-relevant
☐	Indicates a requirement for meeting a specific goal
☑	Desired result
✖	A problem that might occur

Typographies

Typography	Usage	Example
bold	• Display messages • Parameters • Terminals • Slots • Elements to be selected • Elements to be entered	• Connect the grounding conductor to **AC 2Gen/Grid**. • Select the parameter **235.01 GnAutoEna** and set to **Off**.
>	• Several elements that are to be selected	• Select **600# Direct Access > Select Number.**
[**Button/Key**]	• Button/key on the inverter to be selected or pressed	• Press [**ENTER**].

Nomenclature

Complete designation	Designation in this document
Sunny Boy, Sunny Mini Central, Sunny Tripower	PV inverter
Grid failure or deviation from the country-specific limiting values for voltage and frequency	Grid failure

The term parameter includes parameters with configurable values as well as parameters for displaying values.

2 Safety

2.1 Intended Use

In the event of grid failure, a battery backup system with Sunny Island supplies loads with energy and a grid-tie PV system with voltage. In the event of grid failure, an automatic transfer switch disconnects the battery backup grid from the utility grid. After disconnection, the loads and the PV system have no supply for approximately five seconds, until the battery backup system can provide active and reactive power again. The battery backup system supplies the loads and the PV system can synchronize with the battery backup grid and feed in.

The battery backup system should only be used in countries for which it is licensed or for which it is released by SMA Solar Technology AG and the grid operator. To fulfill the technical connection requirements of the grid operator and the local standards and directives, you must select one of the following basic structures:

- Battery backup system with all-pole disconnection

  In the event of grid failure, a tie switch disconnects all line conductors and the neutral conductor from the utility grid. The tie switch has a redundant set-up. If the technical connection requirements of the grid operator or the local standards and directives call for or allow all-pole disconnection, you must install this basic structure. In Germany, you must install all-pole disconnection.

- Battery backup system without all-pole disconnection

  In the event of grid failure, a tie switch disconnects all line conductors from the utility grid. The neutral conductor of the battery backup grid remains permanently connected to the utility grid. If the technical connection requirements of the grid operator or the local standards and directives prohibit disconnection of the neutral conductor, you must install this basic structure.

Each basic structure can be set up as a three-phase battery backup grid or as a single-phase battery backup grid. Single-phase battery backup grids can be connected to three-phase utility grids.

In a three-phase battery backup system, in the event of grid failure, three Sunny Island inverters supply all line conductors with the corresponding line conductor. The three Sunny Island inverters are connected in parallel on the DC side and form one cluster. Only Sunny Island inverters of the same device type are permitted to operate in one cluster. In a three-phase battery backup system, both single-phase and three-phase PV inverters can be connected. Multiple clusters must not be connected together.

In a single-phase battery backup system, in the event of grid failure, one Sunny Island supplies the battery backup grid. Grid failure is recognized at the line conductor which is connected to the Sunny Island. In the event of grid failure, only single-phase PV inverters can feed into a single-phase battery backup grid. A phase coupling, in the event of grid failure, enables combination of the line conductors to a single-phase distribution grid. With phase coupling, all the loads in the battery backup grid must be single-phase. No more than one Sunny Island may be connected in a single-phase battery backup system.

In the battery backup grid, a PV system can be connected. The PV system must be suitable for use in battery backup systems (see Planning Guidelines "SMA Flexible Storage System with Battery Backup Function" at www.SMA-Solar.com). The power of the PV system must not exceed double the rated power of all Sunny Island inverters in the system.

The automatic transfer switch is not a distribution board for the loads or the PV system. The loads and the PV system must be secured with protective devices in accordance with the local standards and directives. Grid-forming electric current sources (e. g. PV arrays) must not be connected.

The utility grid connected to the automatic transfer switch must be a TN or TT system. The battery backup system is not suitable for supplying life-sustaining medical devices.

In battery backup systems, the Sunny Island uses lead-acid batteries or lithium-ion batteries for energy storage. In the case of lead-acid batteries, you must ensure that the battery room is sufficiently ventilated (see the battery manufacturer's documentation). If lithium-ion batteries are connected, the battery management of the lithium-ion battery must be compatible with the Sunny Island (see the Planning Guidelines "SMA Flexible Storage Systems with Battery Backup Function" at www.SMA-Solar.com). The lithium-ion battery must be able to supply sufficient electric current at maximum output power of the Sunny Island (for technical data, see the Sunny Island installation manual).

In single-phase battery backup systems, the multifunction relays of the Sunny Island cannot be configured. In three-phase battery backup systems, the slaves can control components in the system (e. g. load-shedding contactors) by means of two multifunction relays in each case. The multifunction relays of the master cannot be configured.

The automatic transfer switch must be connected in accordance with this documentation. The equipment or components of the automatic transfer switch must satisfy protection class II and be operable by lay persons.

In battery backup systems, the following products must not be connected:

- Sunny Island Charger or other DC charge controllers
- DC loads

The individual products in the battery backup system must be used for their intended purpose (see documentation of each product). Any use of the system other than that described in the Intended Use section does not qualify as appropriate.

The enclosed documentation is an integral part of the products. Keep the documentation in a convenient place for future reference and observe all instructions contained therein.

2.2 Skills of Qualified Persons

Qualified persons must have the following skills:

- Training in how to deal with the dangers and risks associated with installing and using electrical devices and batteries
- Training in the installation and commissioning of electric devices
- Knowledge of and adherence to the local standards and directives
- Knowledge of and adherence to the Sunny Island documentation and all safety precautions
- If lithium-ion batteries are being used, knowledge of possible dangers, transport, storage and disposal of lithium-ion batteries

2.3 Safety Precautions

This section contains safety precautions that must be observed at all times when working on or with the system. To prevent personal injury and property damage and to ensure long-term operation of the system, read this section carefully and follow all safety precautions at all times.

⚠ WARNING

Danger to life due to incompatible lithium-ion battery

An incompatible lithium-ion battery can lead to a fire or an explosion. With incompatible lithium-ion batteries, it is not ensured that the battery management will protect the battery.

- Ensure that the battery is from one of the following manufacturers and has been approved for Sunny Island inverters by the manufacturer:
  - Akasol
  - Dispatch Energy
  - LG Chem
  - Leclanché
  - SAFT
  - Samsung
  - Sony

This list is updated regularly (see Planning Guidelines "SMA Smart Home" at www.SMA-Solar.com).

⚠ WARNING

Danger to life due to explosive gases

Explosive gases may escape from the battery and cause an explosion. This can result in death or serious injury.

- Protect the battery environment from open flames, embers or sparks.
- Install, operate and maintain the battery in accordance with the manufacturer's specifications.
- Do not heat or burn the battery above the temperature permitted.
- Ensure that the battery room is sufficiently ventilated.

Danger to life from electric shock due to circuit breakers that cannot be tripped

In the battery backup grid, in the event of grid failure, circuit breakers with trip characteristic B16 (B16A) or circuit breakers with trip characteristic C6 (C6A) at maximum can be tripped. Circuit breakers with a higher operating current cannot be tripped. Under fault conditions, lethal voltage can be present for several seconds in touchable parts. This can result in death or serious injury.

- If a circuit breaker is greater than B16A or C6A, you should install an additional residual-current device.

Danger to life from electric shock due to damaged devices

Operating a damaged device can lead to hazardous situations that result in death or serious injuries due to electric shock.

- Only use the battery backup system when it is technically faultless and in an operationally safe state.
- Ensure that all safety equipment is freely accessible at all times.
- Make sure that all safety equipment is in good working order.

Danger to life from electric shock due to live voltage

High voltages are present in the battery backup system. When covers are removed (e. g. an enclosure lid), live components can be touched. Touching can result in death or serious injury due to electric shock.

- When carrying out any work on the electrical installation, wear suitable personal protective equipment.
- Turn off or disconnect the following devices from voltage sources in the given order:
  - Sunny Island
  - At the grid-connection point, the circuit breaker of the battery backup system
  - In the automatic transfer switch, all circuit breakers
  - Load-break switch of the battery
- Ensure that the battery backup system cannot be reconnected.
- Open the enclosure lid of the Sunny Island and ensure that no voltage is present.
- Ground and short-circuit the AC conductors outside the automatic transfer switch.
- Cover or shield any adjacent live components.

⚠ WARNING

Chemical burns and poisoning due to battery electrolyte

If handled inappropriately, electrolyte from the battery can burn the eyes, respiratory system and skin, and emit toxic fumes. This may result in blindness and serious chemical burns.

- Protect the battery enclosure against destruction.
- Do not open or deform the battery.
- When working on the battery, wear suitable personal protective equipment such as rubber gloves, apron, rubber boots and goggles.
- Rinse acid splashes thoroughly with clear water for a long time and consult a doctor.
- Install, operate, maintain and dispose of the battery according to the manufacturer's specifications.

Risk of injury due to short-circuit currents

Short-circuit currents in the battery can cause heat build-up and electric arcs. Burns or eye injuries due to flashes may result.

- Remove watches, rings and other metal objects.
- Use insulated tools.
- Do not place tools or metal parts on the battery.

NOTICE

Damage to three-phase loads during phase coupling

If three-phase loads are connected to a single-phase utility grid during phase coupling, SMA Solar Technology AG cannot rule out damage to the three-phase loads.

- Ensure that, during phase coupling, only single-phase loads are connected to the battery backup grid.

Damage to the battery due to incorrect settings

Incorrect settings lead to premature aging of the battery. Settings of the parameters in the menu **220# Battery** influence the charging behavior of the Sunny Island.

- Ensure that the values recommended by the battery manufacturer are set for the battery (refer to the technical data of the battery in the manufacturer's documentation).

Damage to the tie switch due to incorrect design

If the ampacity of the tie switch is not sufficient, the tie switch becomes overloaded and is damaged.

- Adjust the ampacity of the tie switch in accordance with the requirements on site. The tie switch must be designed for at least the operating range of the upstream fuse or the maximum short-circuit current of the PV system.

Destruction of components due to electrostatic discharge (ESD)

Having removed parts of the enclosure, you can damage or destroy components (e. g. Sunny Island or PV inverters) by touching electronic components or connections.

- In opened components, do not touch electronic components.
- Ground yourself before touching a terminal.

3 General Information and System Description

3.1 General Information

Information on batteries

Lithium-ion batteries in battery backup systems

In order to meet the requirements of battery backup systems in the event of grid failure, the Sunny Island has a high overload capacity. A prerequisite for this overload capacity is that the battery can supply sufficient current. In the case of lithium-ion batteries, this current-carrying capacity cannot be a prerequisite.

- Clarify with the battery manufacturer whether the battery is suitable for battery backup systems with Sunny Island. Note especially the current-carrying capacity if, in the event of grid failure, the battery backup grid is supplied by the Sunny Island.

Recommendations for battery capacity

SMA Solar Technology AG recommends the following minimum battery capacities. The battery capacities apply for a ten-hour electric discharge (C10).

- Single-phase battery backup system with SI6.H: 120 Ah
- Single-phase battery backup system with SI8.0H: 160 Ah
- Three-phase battery backup system with three SI6.0H: 360 Ah
- Three-phase battery backup system with three SI6.0H: 480 Ah

Observance of the minimum battery capacity is a prerequisite for stable operation of the system.

Information on the automatic transfer switch

Wiring and connection of automatic transfer switches

- Do not bridge the neutral conductors of terminals **X1** to **X5**. If the neutral conductor terminals are bridged, residual-current devices could trip.
- Label the equipment and components of the automatic transfer switch in accordance with the schematic diagrams. This makes installation and commissioning easier and simplifies the support process in the event of service.
- Only install an SMA Energy Meter if the systems have increased self-consumption.

  Install the SMA Energy Meter in such a way that it can measure the total purchased electricity and grid feed-in.

Connection of automatic transfer switches for single-phase battery backup systems

- With single-phase battery backup systems, connect circuit breaker **F1** and the Sunny Island to the same phase. Ensure that only this line conductor of the Sunny Island is monitored for grid failure.
- Connect the PV inverter and the Sunny Island to the same line conductor if possible. This way, in the event of grid failure, the PV inverters are supplied with voltage directly and then can feed in even if phase coupling is deactivated.

Information on the Sunny Island

Connection of the neutral conductor

At AC2, there are terminals **N** and $\mathbf{N_{TT}}$ for connecting the neutral conductor.

- In battery backup systems, at terminal **AC2**, always connect the neutral conductor to terminal $\mathbf{N_{TT}}$.

This way, the Sunny Island is disconnected at all poles.

Device types within a cluster

All Sunny Island inverters must be of the same device type.

Requirements of the router and the network switch

Systems for increased self-consumption place the following requirements on the communication devices:

- All Speedwire devices must be connected to the same router or network switch.
- The router or network switch must support Multicast.
- The router must support "Internet Enabled Devices" with the interfaces SIP and STUN.

The most common routers and network switches support Multicast and "Internet Enabled Devices".

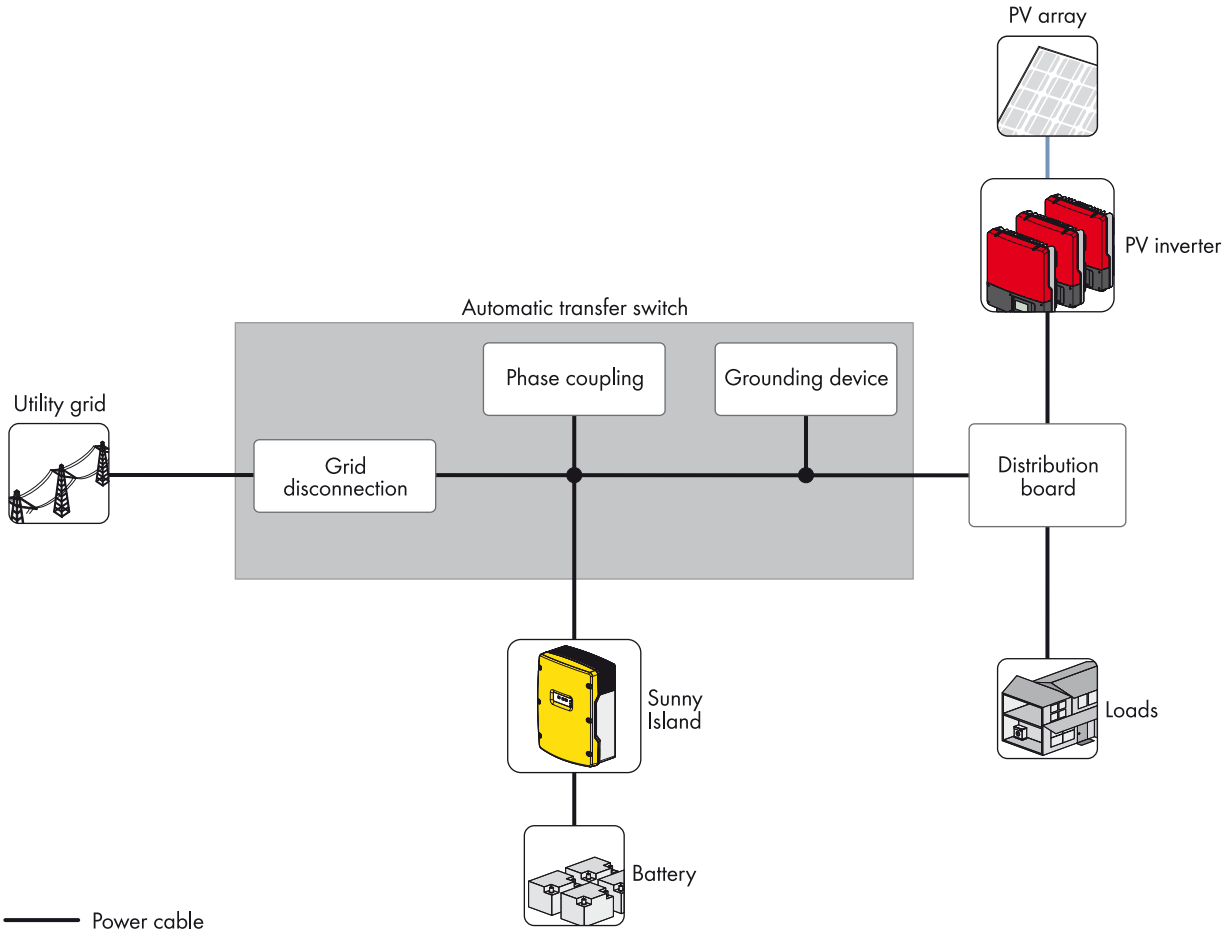
Maximum power of the PV system

In battery backup systems, the maximum power of the PV system depends on the total power of the Sunny Island.

- Maximum output power of the PV system per SI6.0H: 9,200 W
- Maximum output power of the PV system per SI8.0H: 12,000 W

Observance of the maximum output power of the PV system is a prerequisite for stable operation of the battery backup system during a grid failure.

3.2 Design and Functions of the Battery Backup System



*The indicated values are recommended by SMA Solar Technology AG. The electrical components must be designed in accordance with the locally applicable standards and directives.

Figure 1: Block circuit diagram of a single-phase battery backup system

In the event of grid failure, a battery backup system with Sunny Island supplies loads with energy and a grid-tie PV system with voltage. In the event of grid failure, an automatic transfer switch disconnects the battery backup grid from the utility grid. After disconnection, the loads and the PV system have no supply for approximately five seconds, until the battery backup system can provide active and reactive power once more. The battery backup system supplies the loads and the PV system can synchronize with the battery backup grid and feed in.

When the utility grid is available again, the battery backup system synchronizes the battery backup grid with the utility grid. Following successful synchronization, the automatic transfer switch connects the battery backup grid to the utility grid.

You can set up and wire the automatic transfer switch yourself or acquire it pre-wired from another provider (see Planning Guidelines "SMA Flexible Storage Systemw with Battery Backup Function" at www.SMA-Solar.com).

Connection of loads and the PV system

The automatic transfer switch is not a distribution board for the loads or the PV system. You must also install the necessary protective devices for the loads and the PV system.

3.3 Design and Functions of the Automatic Transfer Switch

3.3.1 Components of the Automatic Transfer Switch

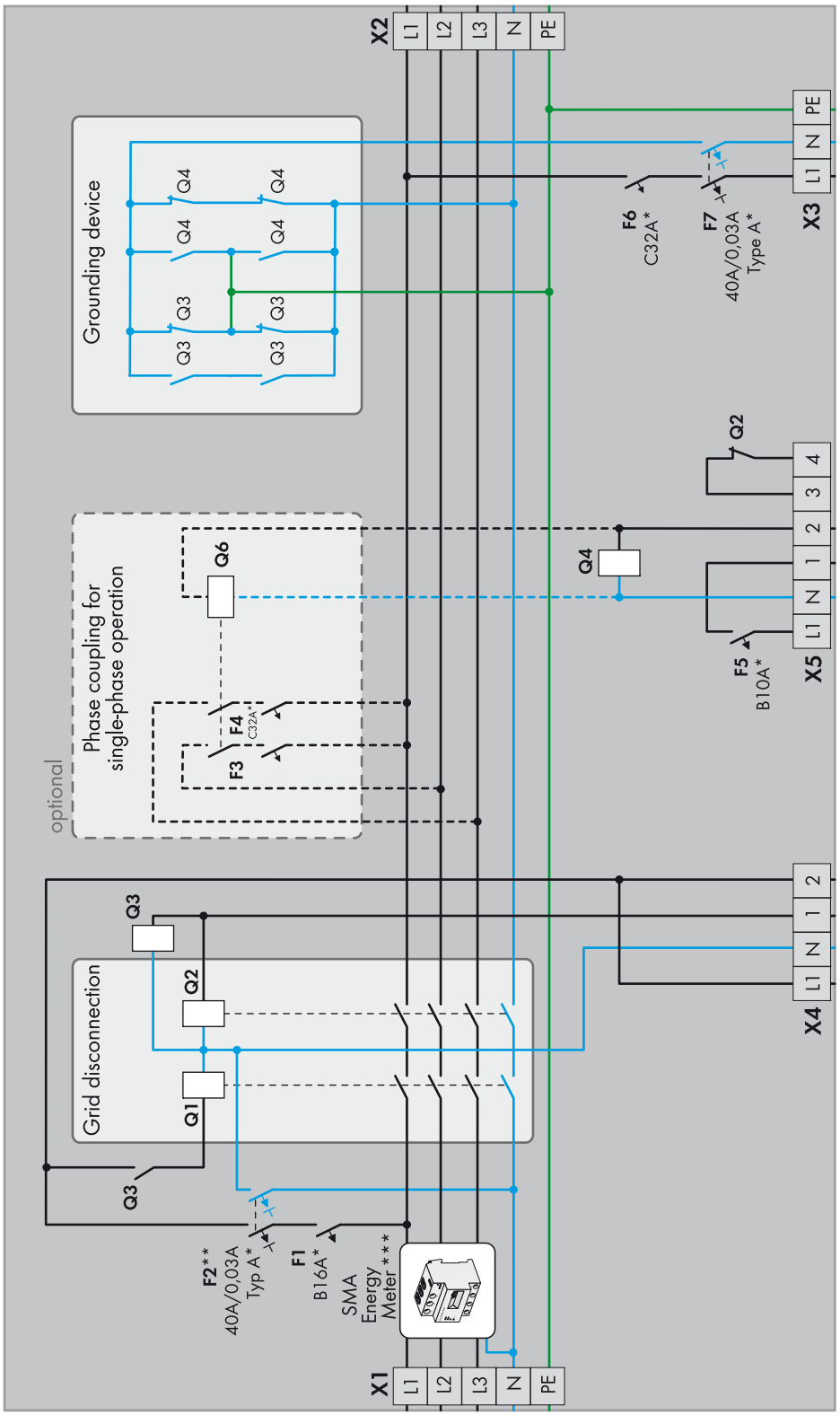


Figure 2: Schematic diagram of a single-phase automatic transfer switch with all-pole disconnection and SMA Energy Meter for increased self-consumption (example)

An automatic transfer switch provides the following functions:

- Grid disconnection isolates the battery backup grid from the utility grid.
- The grounding device grounds the battery backup grid after it has been disconnected from the utility grid.

  The grounding device is only required in systems with all-pole disconnection.
- The phase coupling connects the line conductors of the battery backup system to a single-phase distribution grid.

  The phase coupling is a function for single-phase battery backup systems if the installation of the battery backup grid is three-phase.
- The SMA Energy Meter measures the grid feed-in and the purchased electricity.

  The SMA Energy Meter is only required in systems for increased self-consumption (see Section 4 "Increased Self-Consumption", page 18).

3.3.2 Grid Disconnection

Within the automatic transfer switch, a tie switch disconnects the battery backup grid from the utility grid. The conditions at the tie switch differ depending on the installation site. SMA Solar Technology AG offers two basic structures for grid disconnection and these differ as far as the tie switch is concerned:

- Grid disconnection with all-pole isolation of the battery backup grid from the utility grid

  In the event of grid failure, a tie switch disconnects all line conductors and the neutral conductor from the utility grid. If the technical connection requirements of the grid operator or the local standards and directives call for or allow all-pole disconnection, you must install this basic structure. In Germany, you must install all-pole disconnection.
- Grid disconnection without all-pole disconnection of the battery backup grid from the utility grid

  In the event of grid failure, a tie switch disconnects all line conductors from the utility grid. The neutral conductor of the battery backup grid remains permanently connected to the utility grid. If the technical connection requirements of the grid operator or the local standards and directives prohibit disconnection of the neutral conductor, you must install this basic structure.

Independent of the basic structure, you must adjust the ampacity of the tie switch in accordance with the requirements on site. The tie switch must be designed for at least the operating range of the upstream fuse or the maximum short-circuit current of the PV system.

The circuitry of the automatic transfer switch is designed in such a way that the tie switch disconnects only in the event of a grid failure. If you stop or switch off the Sunny Island, the battery backup grid remains connected to the utility grid. This means that you can carry out maintenance work on the battery without the supply to the loads being interrupted.

Circuit Description of the Tie Switch with All-Pole Disconnection*

The tie switch with all-pole disconnection consists of contactors **Q1** and **Q2**. The tie switch disconnects the battery backup grid from the utility grid in the event of a grid failure or if the utility grid is outside the limiting values for voltage and frequency.

The control voltage of contactors **Q1**, **Q2** and **Q3** is the voltage of a line conductor of the utility grid. This means that the tie switch can only activate if line voltage exists. An auxiliary contact of contactor **Q3** locks contactor **Q1**. Contactors **Q3** and **Q2** are controlled by the multifunction relay **Relay1** of the Sunny Island. If the multifunction relay **Relay1** is in non-operative mode, contactors **Q2** and **Q3** activate. If contactor **Q3** goes into non-operative mode, then contactor **Q1** also goes into non-operative mode and is locked.

In the event of a total grid failure, contactors **Q1, Q2** and **Q3** go into non-operative mode due to lack of control voltage and they disconnect the battery backup grid with all poles from the utility grid. The Sunny Island also measures the voltage of the utility grid. For this, the Sunny Island is connected with the same line conductor as the control voltage of contactors **Q1**, **Q2** and **Q3**. If there is a deviation from country-specific limiting values for voltage and frequency of the utility grid, the multifunction relay **Relay1** is activated. Contactors **Q1**, **Q2** and **Q3** remain in non-operative mode or go into this mode.

* The explanation is based on a single-phase battery backup system with one Sunny Island. Three-phase battery backup systems behave in the same way.

When the utility grid is available again, the Sunny Island detects this. The Sunny Island synchronizes the battery backup grid with the utility grid. Following successful synchronization, the multifunction relay **Relay1** goes into non-operative mode and contactors **Q2** and **Q3** are activated. Contactor **Q3** unlocks contactor **Q1** and **Q1** activates. The battery backup grid is again connected to the utility grid.

Circuit Description of the Tie Switch without All-Pole Disconnection*

The tie switch without all-pole disconnection consists of contactor **Q2** (see Section 6.1.1 "Schematic Diagram of the Automatic Transfer Switch", page 29). The tie switch disconnects the battery backup grid from the utility grid in the event of grid failure or if the utility grid is outside the limiting values for voltage and frequency.

The control voltage of contactor **Q2** is the voltage at the line conductor L1 of the utility grid. This means that the tie switch can only activate if line voltage exists. Contactor **Q2** is controlled by the multifunction relay **Relay1** of the Sunny Island. If the multifunction relay **Relay1** is in non-operative mode, contactor **Q2** activates.

In the event of a total grid failure, contactor **Q2** goes into non-operative mode due to lack of control voltage and disconnects the battery backup grid from the line conductors of the utility grid. The Sunny Island also measures the voltage of the utility grid. For this, the Sunny Island is connected to the same line conductor as the control voltage of contactor **Q2**. If there is a deviation from country-specific limiting values for voltage and frequency of the utility grid, the multifunction relay **Relay1** is activated. Contactor **Q2** remains in non-operative mode or goes into non-operative mode.

When the utility grid is available again, the Sunny Island detects this. The Sunny Island synchronizes the battery backup grid with the utility grid. Following successful synchronization, the multifunction relay **Relay1** goes into non-operative mode and contactor **Q2** activates. The battery backup grid is again connected to the utility grid.

3.3.3 Grounding Device for the Battery Backup Grid

With TN and TT systems, the neutral conductor must be grounded for protection in the case of indirect contact with live components. Grounding in the utility grid is usually achieved at the local grid transformer. If the neutral conductor of the battery backup grid is connected to the utility grid, there must be no further grounding in the battery backup grid.

With automatic transfer switches with all-pole disconnection, all poles of the battery backup grid are disconnected from the utility grid in the event of grid failure. As a result of the disconnection, the neutral conductor in the battery backup grid is not grounded. Therefore, in automatic transfer switches with all-pole disconnection, a grounding device must ground the neutral conductor in the event of grid failure. The grounding device enables the required protection in the event of indirect contact with live components. The grounding device is set up for fail-safe operation.

Circuit Description of the Grounding Device

Contactors **Q3** and **Q4** form the grounding device (see Section 5.1 "Single-Phase Battery Backup System", page 20). Contactors **Q3** and **Q4** are controlled by both multifunction relays of the Sunny Island. Triggering of contactor **Q3** occurs in parallel way to contactor **Q2** of the tie switch. If contactor **Q2** deactivates and the tie switch opens, contactor **Q3** connects the neutral conductor in the battery backup grid to the grounding conductor. In addition, the Sunny Island uses the multifunction relay **Relay2** to control contactor **Q4**. If the multifunction relay **Relay2** activates, contactor **Q4** activates and also connects the neutral conductor to the grounding conductor. This arrangement ensures that the neutral conductor of the battery backup grid is always connected to ground.

* The explanation is based on a single-phase battery backup system with one Sunny Island. Three-phase battery backup systems behave in the same way.

3.3.4 Phase Coupling for Single-Phase Battery Backup Systems

In single-phase battery backup systems, in the event of grid failure, the battery backup grid is single-phase. If the installation of the battery backup grid is three-phase, only one part of the loads can continue to be supplied.

Phase coupling enables combination of the line conductors in the battery backup grid. As a result, the other two line conductors are also supplied with voltage. This means that, in the event of grid failure, a three-phase battery backup grid becomes a single-phase distribution grid.

Phase coupling can be switched on independently for the other line conductors. Phase coupling is only suitable for battery backup grids with single-phase PV inverters and single-phase loads.

Circuit Description of the Phase Coupling

Contactor **Q6** forms the phase coupling. If the multifunction relay **Relay2** activates on the Sunny Island, contactor **Q6** activates and connects the unsupplied line conductors via circuit breakers **F3** and **F4** with the supplied line conductor.

In the event of grid failure, the line conductor that is connected with the Sunny Island is supplied with voltage first. Then the phase coupling combines the two other line conductors. When the utility grid is available again, the phase coupling disconnects the combined line conductors. Only the line conductor, which is connected to the Sunny Island, is not interrupted on connection to the utility grid.

4 Increased Self-Consumption

4.1 Requirements of the "VDE Forum Network Technology / Network Operations (FNN)"

This information is only required for battery backup systems with the following characteristics:

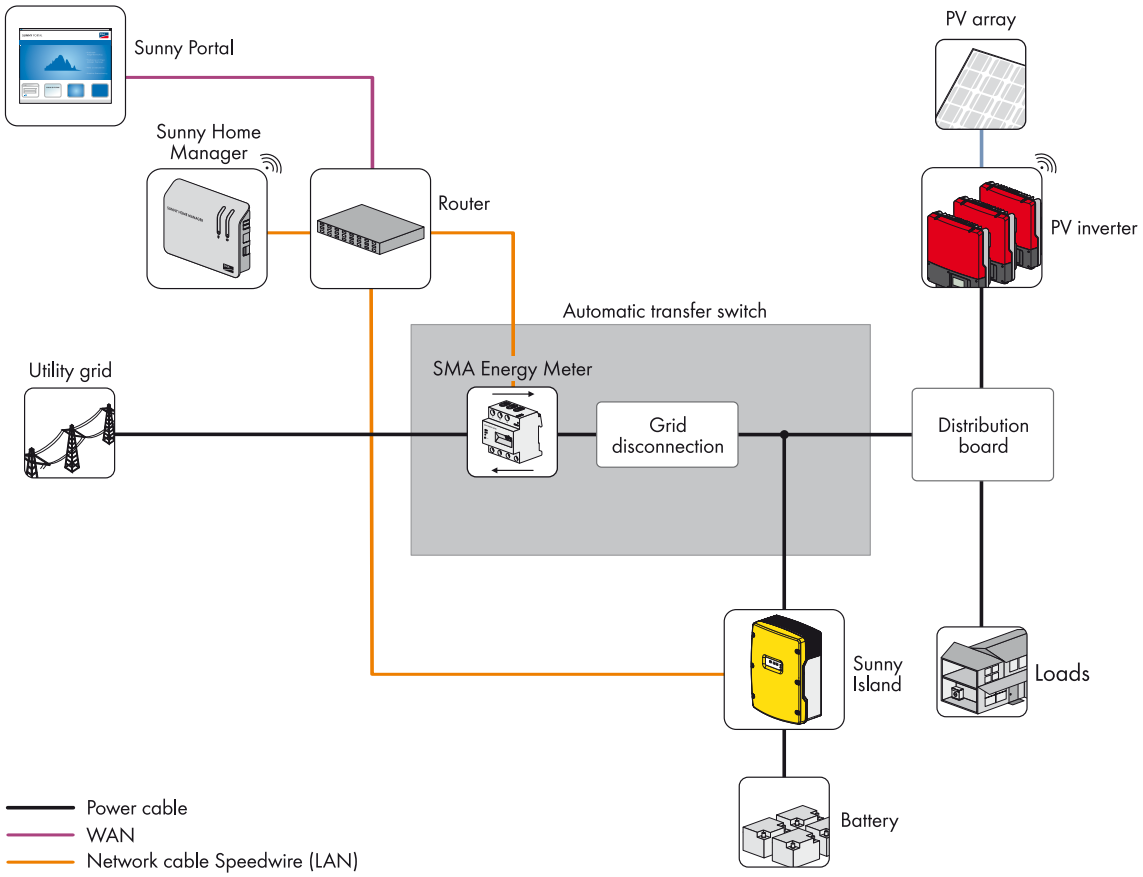
- The battery backup system is used for increased self-consumption.
- No more than one Sunny Island is connected in the battery backup system.
- The grid operator requires compliance with the Technical Information "Connection and Operation of Storage Units" of the FNN. Currently, only the grid operators in Germany require compliance with the above mentioned Technical Information (status: June 2014).

In these systems, the Sunny Island must be connected to a line conductor supplied by a single-phase PV inverter. If only three-phase inverters are connected, the Sunny Island can be connected to any line conductor.

The requirements of the Technical Information "Connection and Operation of Storage Units" published by the FNN influence the discharge behavior of the Sunny Island. In systems with one Sunny Island and single-phase PV inverters, the maximum discharge power of the Sunny Island is reduced by the battery backup system, if necessary (for examples of correct connection of the PV inverters, see the Quick Reference Guide "SMA Flexible Storage Systems").

4.2 Installing a Battery Backup System with Increased Self-Consumption

You can use the battery backup system for increased self-consumption. With increased self-consumption, you can use the battery of the battery backup system to increase the self-consumption quota.



*The indicated values are recommended by SMA Solar Technology AG. The electrical components must be designed in accordance with the locally applicable standards and directives.

Figure 3: Battery backup system with increased self-consumption

Additional components required:

- ☐ 1 SMA Energy Meter
- ☐ 1 Speedwire data module Sunny Island
- ☐ 1 Sunny Home Manager

Requirements:

- ☐ The electric utility company must use cumulative energy meters for billing.
- ☐ The Sunny Home Manager must be able to communicate with each PV inverter via Speedwire or *Bluetooth*.
- ☐ The router or network switch must support Multicast.*
- ☐ The router must support "Internet Enabled Devices" with the interfaces SIP and STUN.*

The installation process:

- Install the battery backup system (see Section 5, page 20 or Section 7, page 38).
- Install additional components. Tip: Connect the electricity supply of the Sunny Home Manager, of the router and of the network switch to the battery backup grid.

The commissioning process:

- Carry out the basic configuration of the Sunny Island (see Section 7.1, page 38).
- Test the automatic transfer switch (see Section 7.2, page 42).
- Attach the warning label (see Section 7.4, page 45).
- Prepare *Bluetooth* communication (see Section 7.6.1, page 46).
- For PV inverters with integrated *Bluetooth* interface that communicate via Speedwire, deactivate the *Bluetooth* interface (see Section 7.6.1, page 46).
- Register the Sunny Home Manager in the Sunny Portal (see Section 7.6.2, page 46).

* The most common routers and network switches support Multicast and "Internet Enabled Devices".

5 Battery Backup Systems with All-Pole Disconnection (e. g. for Germany)

5.1 Single-Phase Battery Backup System

5.1.1 Schematic Diagram of the Automatic Transfer Switch

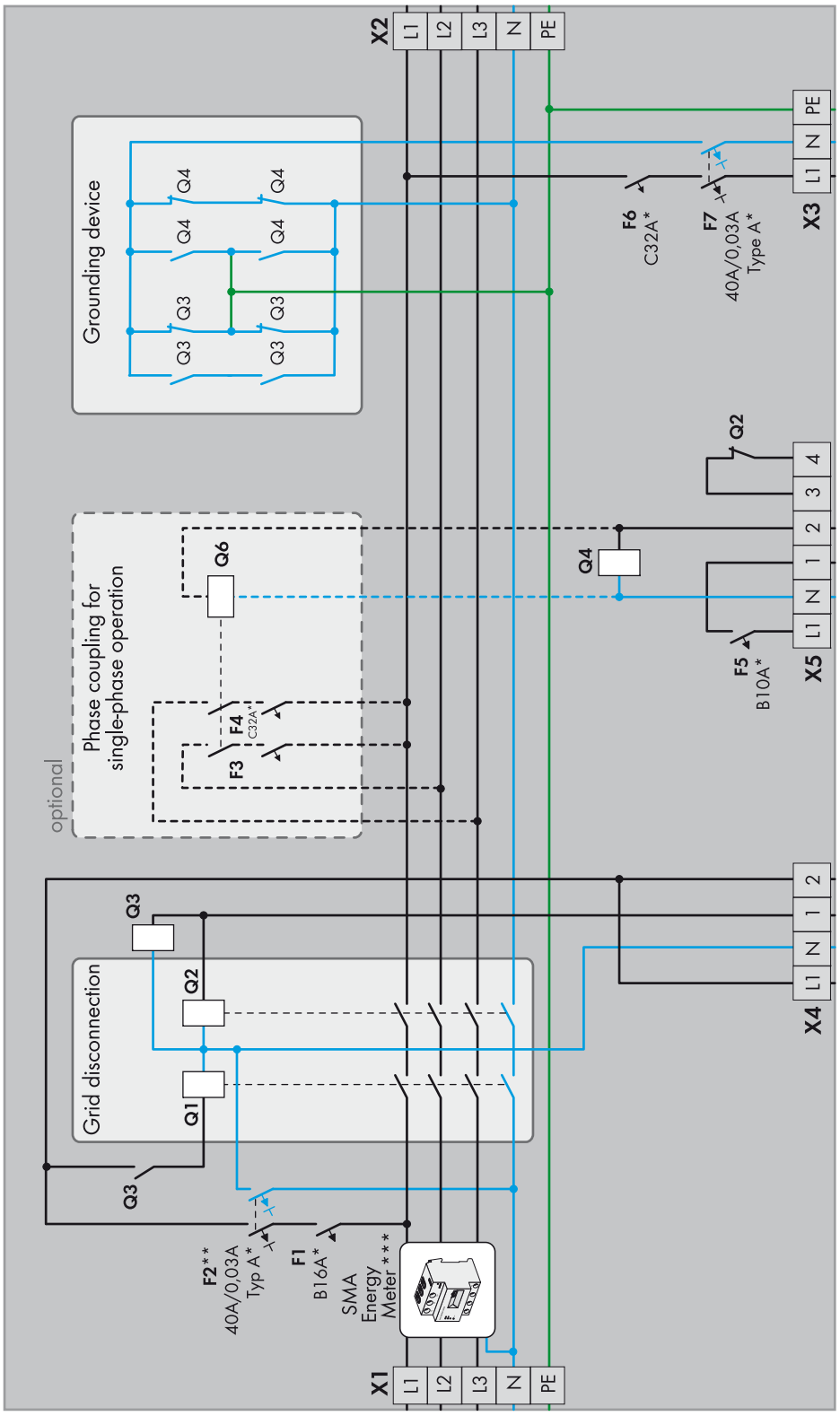


Figure 4: Schematic diagram of the single-phase automatic transfer switch with all-pole disconnection and optional SMA Energy Meter

5.1.2 Circuitry Overview

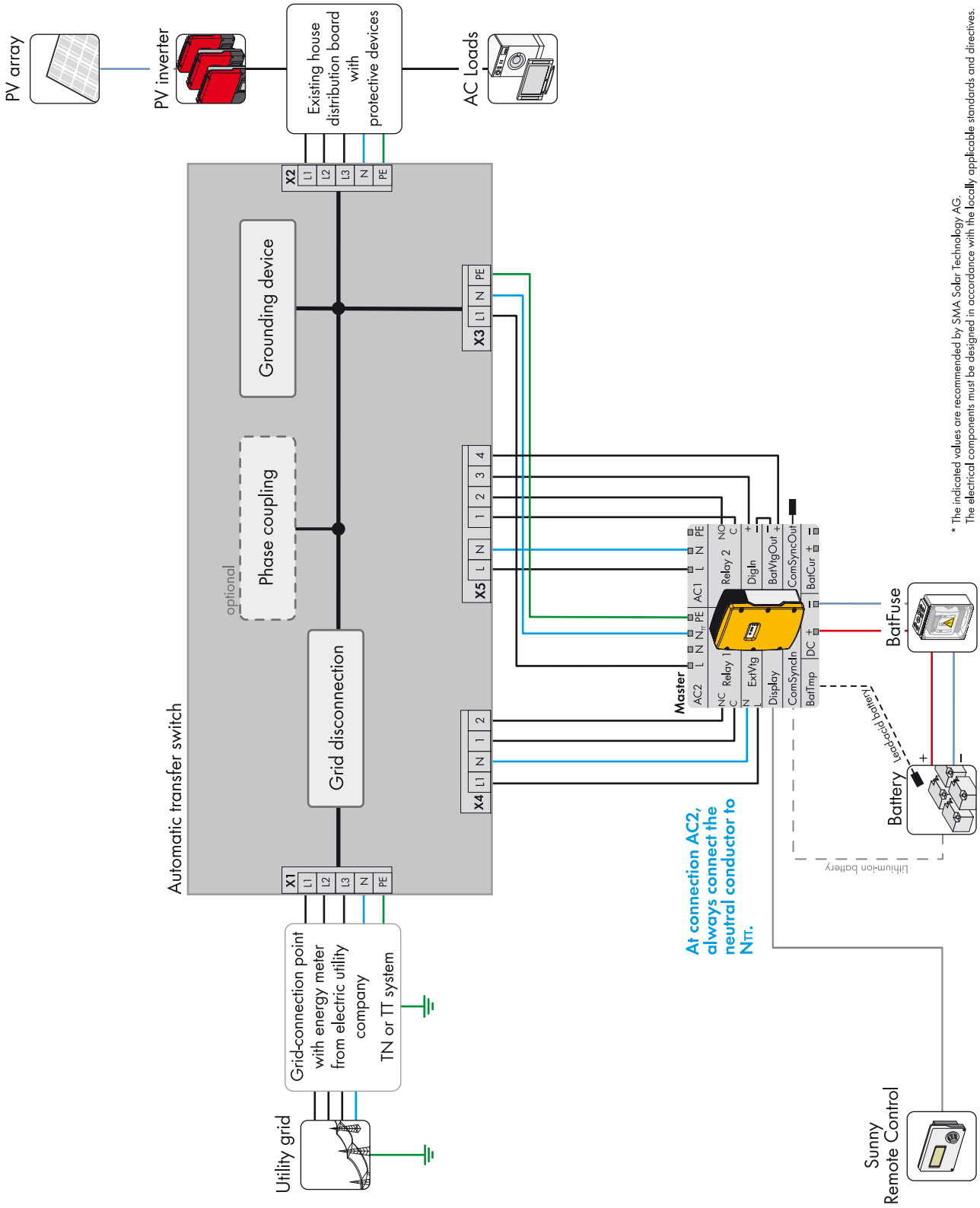


Figure 5: Connection of the automatic transfer switch with all-pole disconnection (e. g. for Germany)

5.1.3 Connecting the Sunny Island

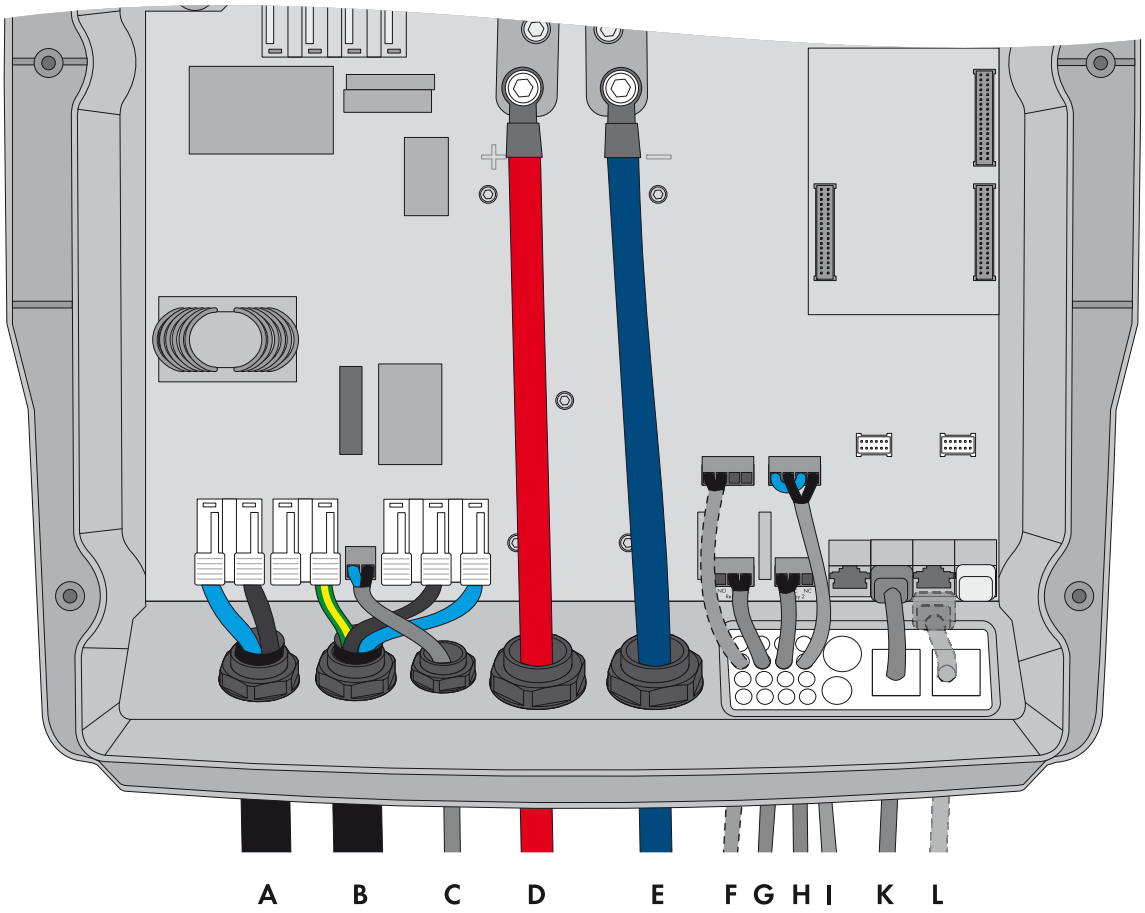


Figure 6: Connecting the Sunny Island

Position	Designation	Description / information
A	Cable for the control voltage	Sunny Island: connection **AC1 Loads/SunnyBoys** terminals **L** and **N** Automatic transfer switch: connection **X5** terminals **L** and **N** Conductor cross-section: 2.5 mm² to 16 mm²
B	AC power cable	Sunny Island: Connection **AC2 Gen/Grid** terminals **L**, **N_{TT}** and **PE** Automatic transfer switch: Connection **X3** terminals **L1**, **N** and **PE** Conductor cross-section: 10 mm² to 16 mm²
C	Measuring cable for voltage measurement	Sunny Island: Connection **ExtVtg** terminals **L** and **N** Automatic transfer switch: Connection **X4** terminals **L1** and **N** Conductor cross-section: 1.5 mm² to 2.5 mm²
D	DC+ cable	Battery connection Conductor cross-section: 50 mm² to 95 mm²
E	DC − cable	
F	Measuring cable of the battery temperature sensor	Sunny Island: Connection **BatTmp** You only have to connect a battery temperature sensor if lead-acid batteries are used. The battery temperature sensor must be mounted in the middle of the battery storage system, in the upper third of the battery cell.

Position	Designation	Description / information
G	Control cable of the tie switch	Sunny Island: Connection **Relay1** terminals **C** and **NC** Automatic transfer switch: Connection **X4** terminals **1** and **2** If the multifunction relay activates, the contactors of the tie switch deactivate. Conductor cross-section: 1.5 mm² to 2.5 mm²
H	Control cable of contactors **Q4** and **Q6**	Sunny Island: Connection **Relay2** terminals **C** and **NO** Automatic transfer switch: Connection **X5** terminals **1** and **2** If the multifunction relay activates, the contactors activate. Conductor cross-section: 1.5 mm² to 2.5 mm²
I	Measuring cable for monitoring the tie switch	Sunny Island: Connections **DigIn+** and **BatVtg+** Automatic transfer switch: Connection **X5** terminals **3** and **4** Within the Sunny Island, connect the terminals **DigIn** − and **BatVtg** − . Conductor cross-section: 0.2 mm² to 2.5 mm²
K	Data cable to Sunny Remote Control	Sunny Island: Connection **Display**
L	Data cable for battery management	Sunny Island: Connection **ComSync In** Only if lithium-ion batteries are used, you must connect a data cable to the battery. The communication bus must be equipped with a terminator at the first and last nodes.

5.2 Three-Phase Battery Backup System

5.2.1 Schematic Diagram of the Automatic Transfer Switch

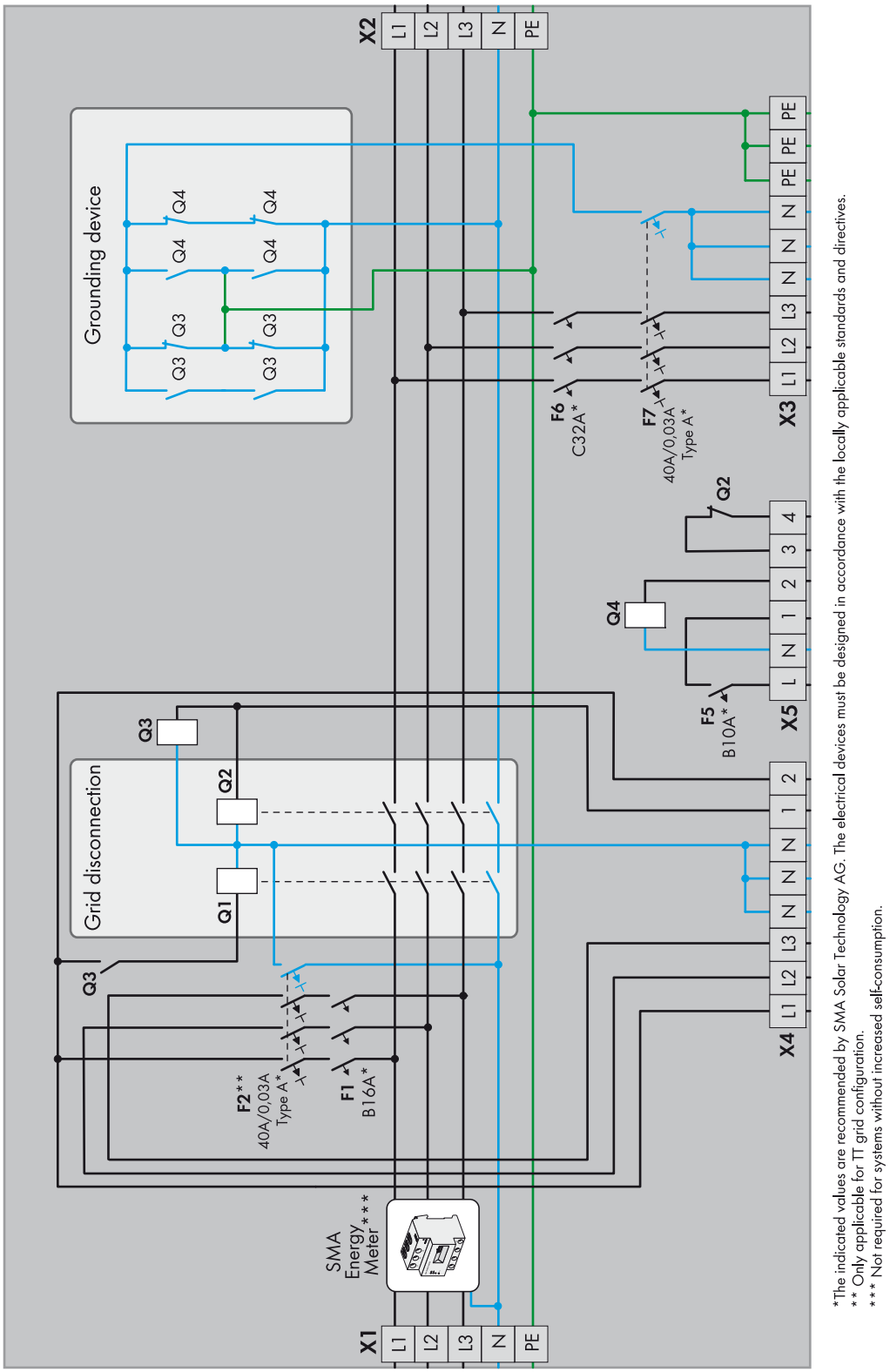


Figure 7: Schematic diagram of the three-phase automatic transfer switch with all-pole disconnection and optional SMA Energy Meter

5.2.2 Circuitry Overview

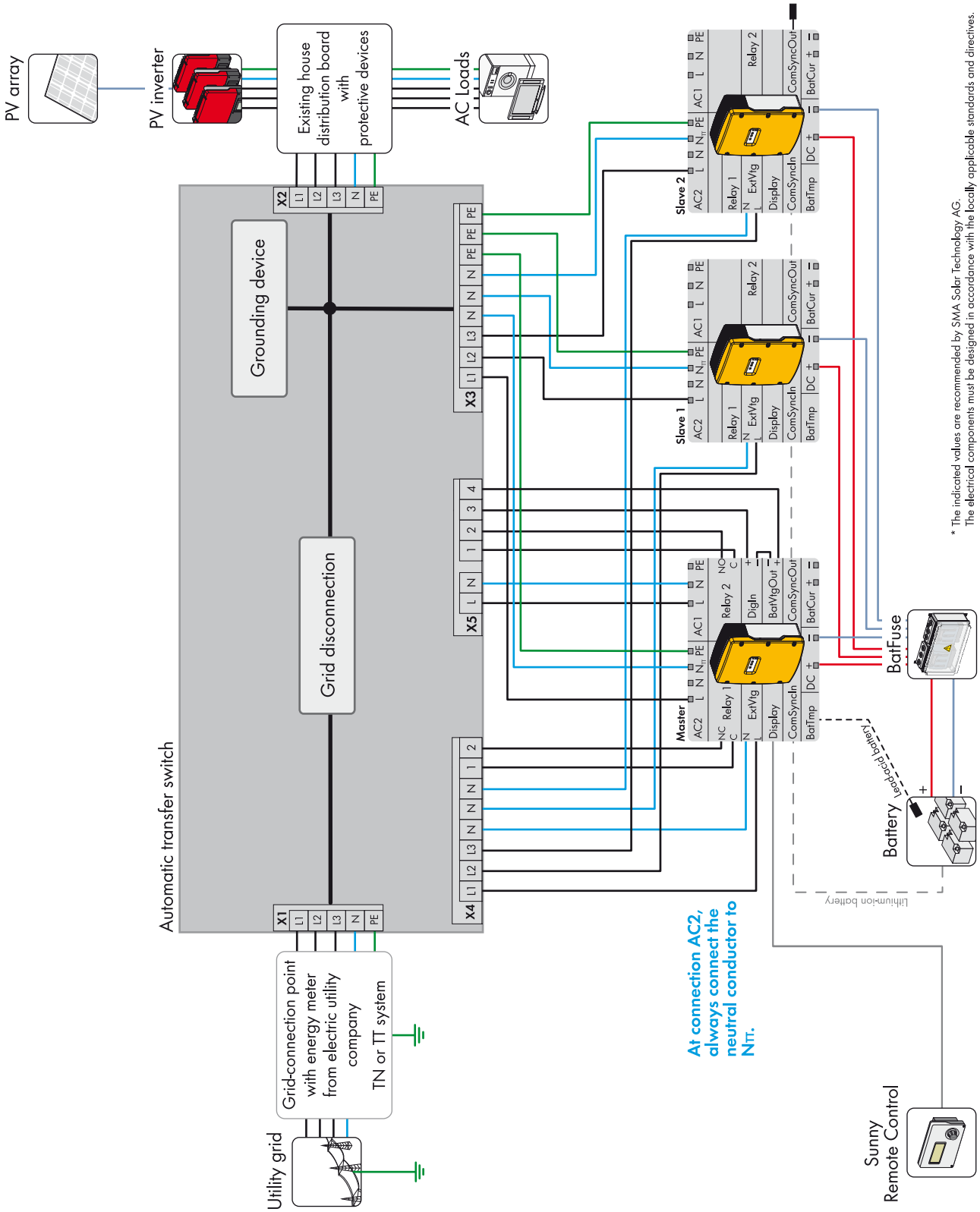


Figure 8: Connection of the automatic transfer switch with all-pole disconnection (e. g. for Germany)

5.2.3 Connecting the Master

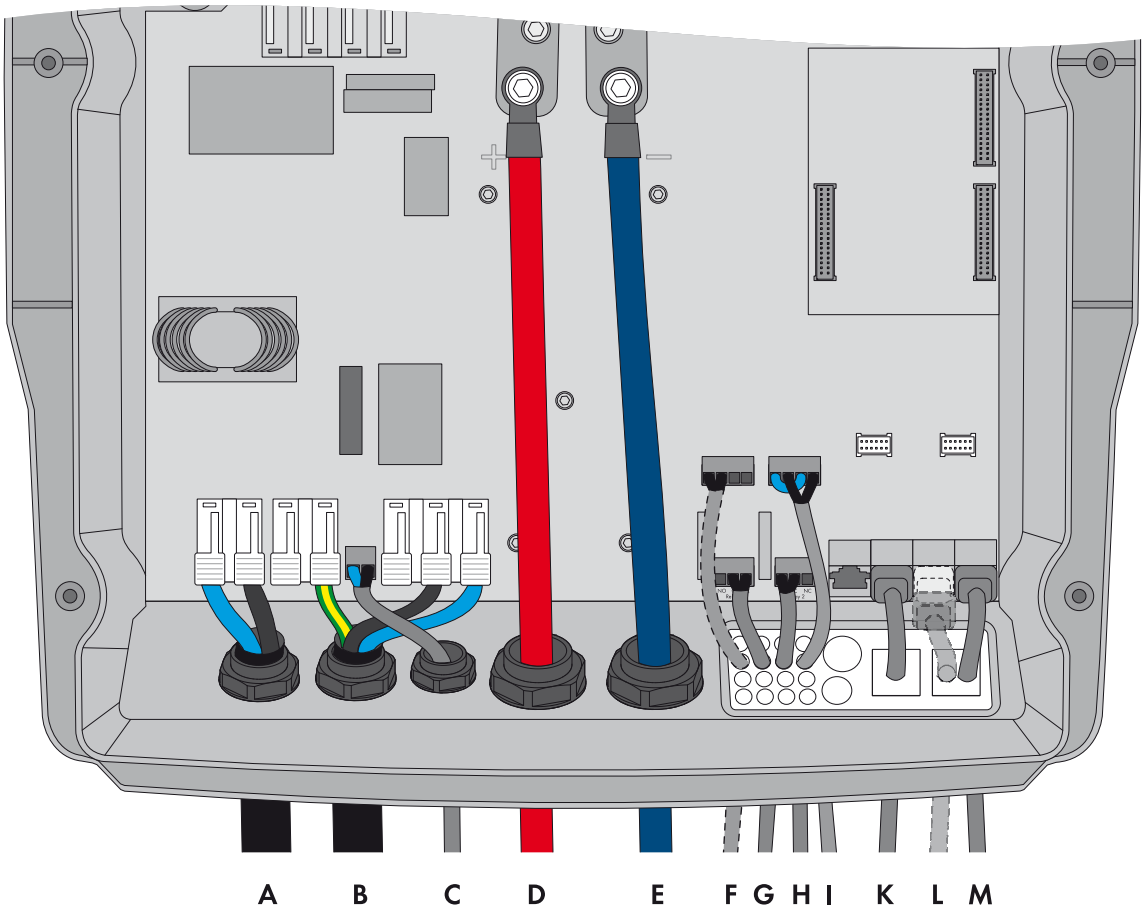


Figure 9: Connecting the master

Position	Designation	Description / information
A	Cable for the control voltage	Sunny Island: Connection **AC1 Loads/SunnyBoys** terminals **L** and **N** Automatic transfer switch: Connection **X5** terminals **L** and **N** Conductor cross-section: 2.5 mm² to 16 mm²
B	AC power cable	Sunny Island: Connection **AC2 Gen/Grid** terminals **L**, N_{TT} and **PE** Automatic transfer switch: Connection **X3** terminals **L1**, **N** and **PE** Conductor cross-section: 10 mm² to 16 mm²
C	Measuring cable for voltage measurement	Sunny Island: Connection **ExtVtg** terminals **L** and **N** Automatic transfer switch: Connection **X4** terminals **L1** and **N** Conductor cross-section: 1.5 mm² to 2.5 mm²
D	DC+ cable	Battery connection Conductor cross-section: 50 mm² to 95 mm²
E	DC − cable	
F	Measuring cable of the battery temperature sensor	Sunny Island: Connection **BatTmp** You only have to connect a battery temperature sensor if lead-acid batteries are used. The battery temperature sensor must be mounted in the middle of the battery storage system, in the upper third of the battery cell.

Position	Designation	Description / information
G	Control cable of the tie switch	Sunny Island: Connection **Relay1** terminals **C** and **NC** Automatic transfer switch: Connection **X4** terminals **1** and **2** If the multifunction relay activates, the contactors of the tie switch deactivate. Conductor cross-section: 1.5 mm² to 2.5 mm²
H	Control cable of contactor **Q4**	Sunny Island: Connection **Relay2** terminals **C** and **NO** Automatic transfer switch: Connection **X5** terminals **1** and **2** If the multifunction relay activates, contactor **Q4** activates. Conductor cross-section: 1.5 mm² to 2.5 mm²
I	Measuring cable for monitoring the tie switch	Sunny Island: Connections **DigIn+** and **BatVtg+** Automatic transfer switch: Connection **X5** terminals **3** and **4** Within the Sunny Island, connect the terminals **DigIn** − and **BatVtg** − . Conductor cross-section: 0.2 mm² to 2.5 mm²
K	Data cable to Sunny Remote Control	Sunny Island: Connection **Display**
L	Data cable for battery management	Sunny Island: Connection **ComSync In** Only if lithium-ion batteries are used, you must connect a data cable to the battery. The communication bus must be equipped with a terminator at the first and last nodes.
M	Data cable for the internal communication in the cluster	Sunny Island: Connection **ComSync Out** Connection of internal communication bus of slave 1

5.2.4 Connecting the Slaves

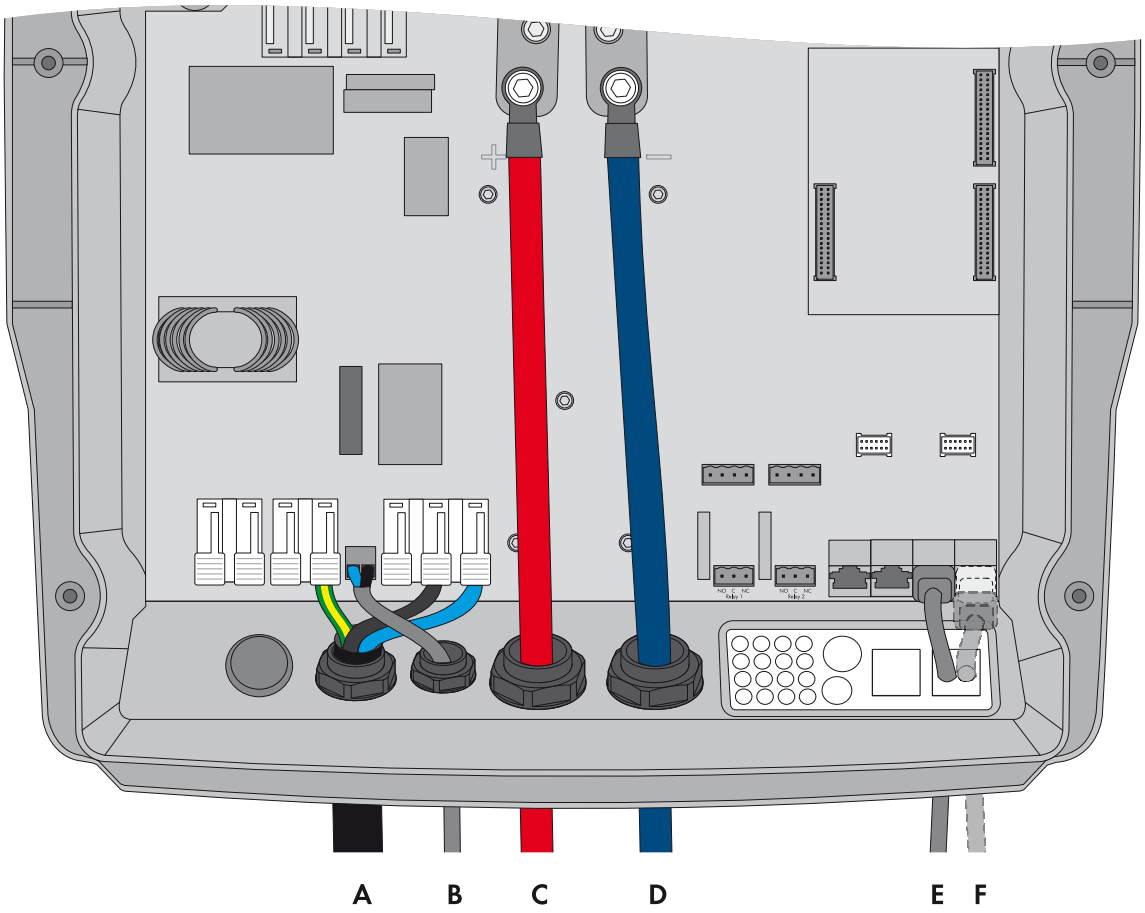


Figure 10: Connecting the slaves

Position	Designation	Description / information
A	AC power cable	Sunny Island: Connection **AC2 Gen/Grid** terminals **L**, **N_{TT}** and **PE** Automatic transfer switch: Connect slave 1 to **X3** terminals **L2**, **N** and **PE**. Connect slave 2 to **X3** terminals **L3**, **N** and **PE**. Conductor cross-section: 10 mm² to 16 mm²
B	Measuring cable for voltage measurement	Sunny Island: Connection **ExtVtg** terminals **L** and **N** Automatic transfer switch: Connect slave 1 to **X4** terminals **L2** and **N**. Connect slave 2 to **X4** terminals **L3** and **N**. Conductor cross-section: 1.5 mm² to 2.5 mm²
C	DC+ cable	Battery connection Conductor cross-section: 50 mm² to 95 mm²
D	DC − cable	
E	Data cable for the internal communication in the cluster	Sunny Island: Connection **ComSync In** With slave 1, connection of internal communication bus of master With slave 2 connection of internal communication bus of slave 1
F	Data cable for the internal communication in the cluster	Sunny Island: Connection **ComSync Out** With slave 1, connection of internal communication bus of slave 2 With slave 2, leave the terminator plugged in. Slave 2 is connected to slave 1 only.

6 Battery Backup Systems Without All-Pole Disconnection (e. g. for Australia)

6.1 Single-Phase Battery Backup System

6.1.1 Schematic Diagram of the Automatic Transfer Switch

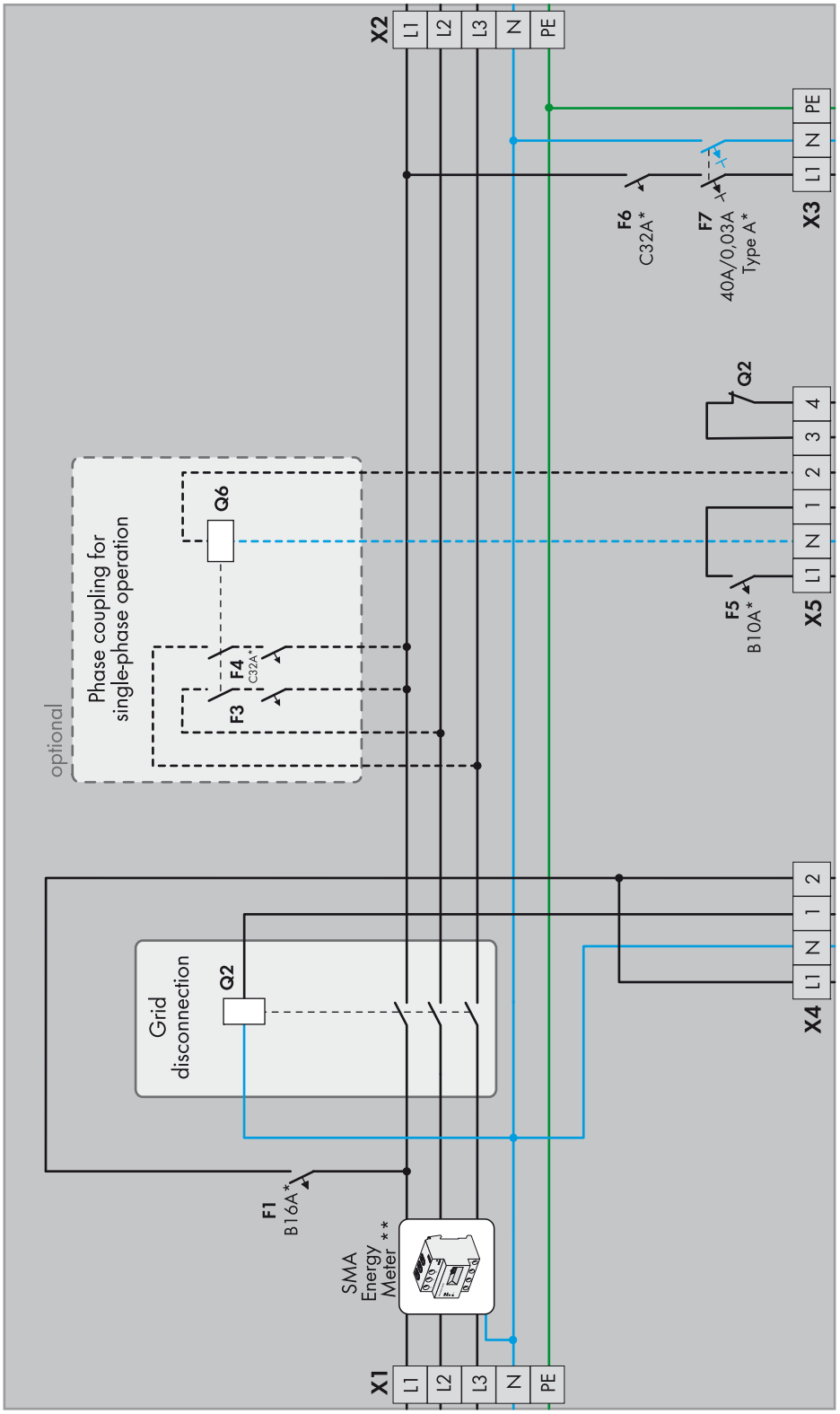


Figure 11: Schematic diagram of the single-phase automatic transfer switch without all-pole disconnection and optional SMA Energy Meter

6.1.2 Circuitry Overview

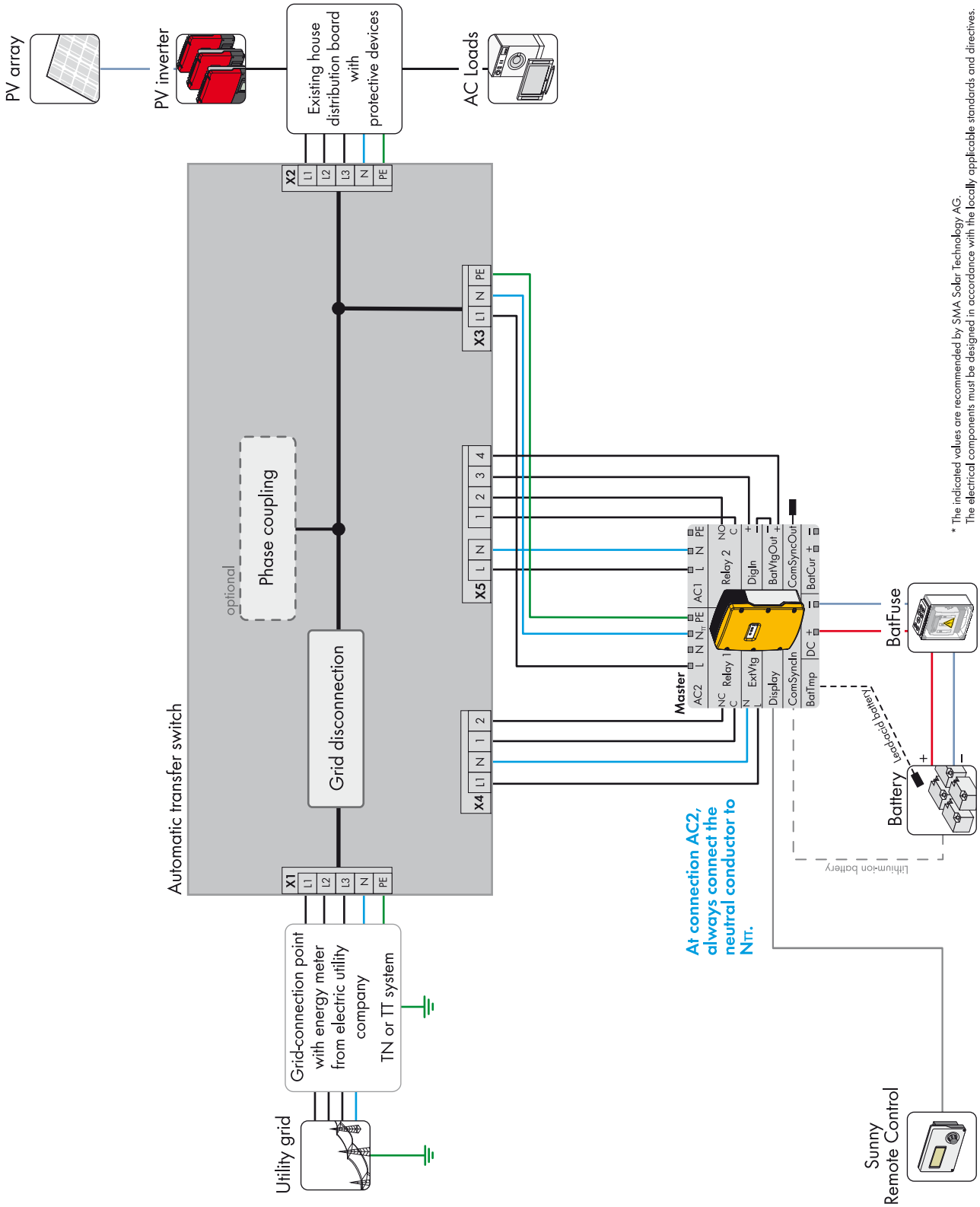


Figure 12: Connection of the automatic transfer switch without all-pole disconnection (e. g. for Australia)

6.1.3 Connecting the Sunny Island

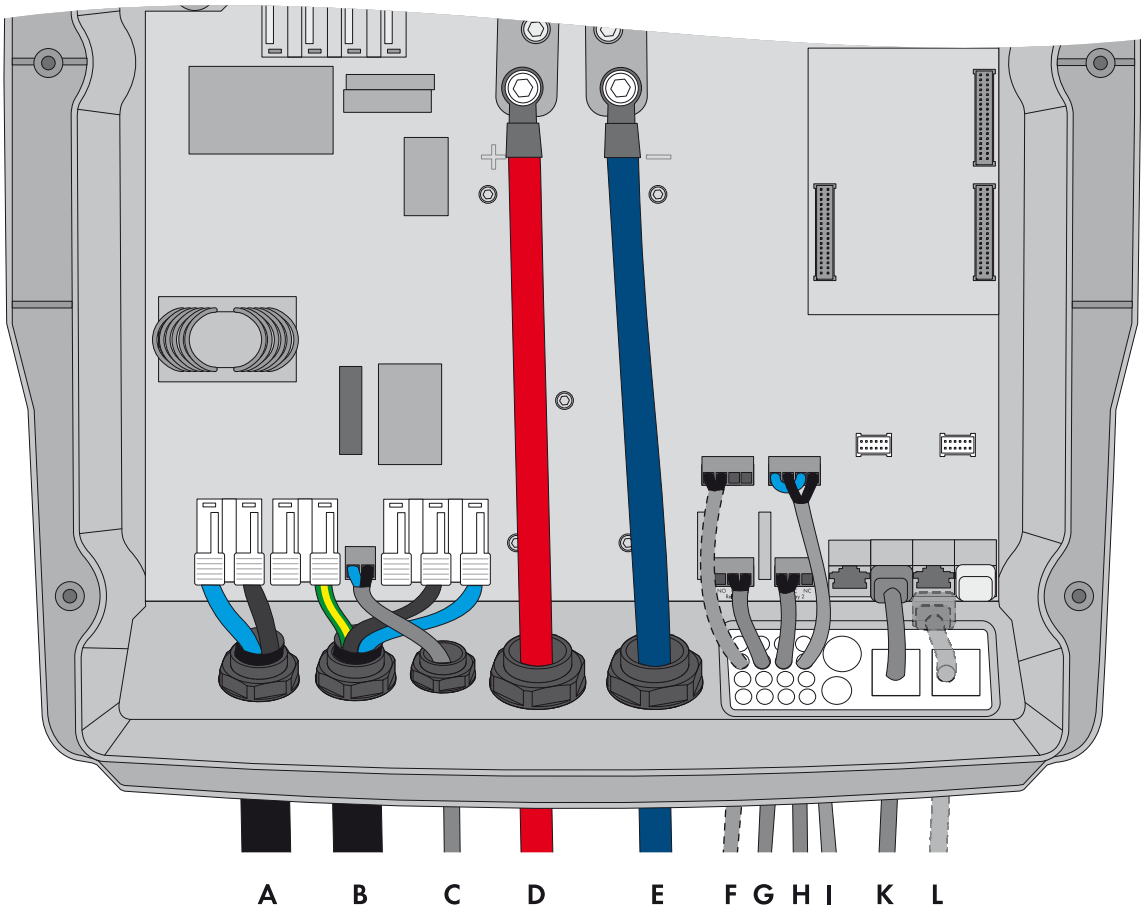


Figure 13: Connecting the Sunny Island

Position	Designation	Description / information
A	Cable for the control voltage	Sunny Island: Connection **AC1 Loads/SunnyBoys** terminals **L** and **N** Automatic transfer switch: Connection **X5** terminals **L** and **N** This cable is only required for phase coupling. Conductor cross-section: 2.5 mm² to 16 mm²
B	AC power cable	Sunny Island: Connection **AC2 Gen/Grid** terminals **L**, **N_{TT}** and **PE** Automatic transfer switch: Connection **X3** terminals **L1**, **N** and **PE** Conductor cross-section: 10 mm² to 16 mm²
C	Measuring cable for voltage measurement	Sunny Island: Connection **ExtVtg** terminals **L** and **N** Automatic transfer switch: Connection **X4** terminals **L1** and **N** Conductor cross-section: 1.5 mm² to 2.5 mm²
D	DC+ cable	Battery connection Conductor cross-section: 50 mm² to 95 mm²
E	DC − cable	
F	Measuring cable of the battery temperature sensor	Sunny Island: Connection **BatTmp** You only have to connect a battery temperature sensor if lead-acid batteries are used. The battery temperature sensor must be mounted in the middle of the battery storage system, in the upper third of the battery cell.

Position	Designation	Description / information
G	Control cable of the tie switch	Sunny Island: Connection **Relay1** terminals **C** and **NC** Automatic transfer switch: Connection **X4** terminals **1** and **2** If the multifunction relay activates, the contactor of the tie switch deactivates. Conductor cross-section: 1.5 mm² to 2.5 mm²
H	Control cable of contactor **Q6**	Sunny Island: Connection **Relay2** terminals **C** and **NO** Automatic transfer switch: Connection **X5** terminals **1** and **2** If the multifunction relay activates, the contactor activates. This cable is only required for phase coupling. Conductor cross-section: 1.5 mm² to 2.5 mm²
I	Measuring cable for monitoring the tie switch	Sunny Island: Connections **DigIn+** and **BatVtg+** Automatic transfer switch: Connection **X5** terminals **3** and **4** Within the Sunny Island, connect the terminals **DigIn** − and **BatVtg** − . Conductor cross-section: 0.2 mm² to 2.5 mm²
K	Data cable to Sunny Remote Control	Sunny Island: Connection **Display**
L	Data cable for battery management	Sunny Island: Connection **ComSync In** Only if lithium-ion batteries are used, you must connect a data cable to the battery. The communication bus must be equipped with a terminator at the first and last nodes.

6.2 Three-Phase Battery Backup System

6.2.1 Schematic Diagram of the Automatic Transfer Switch

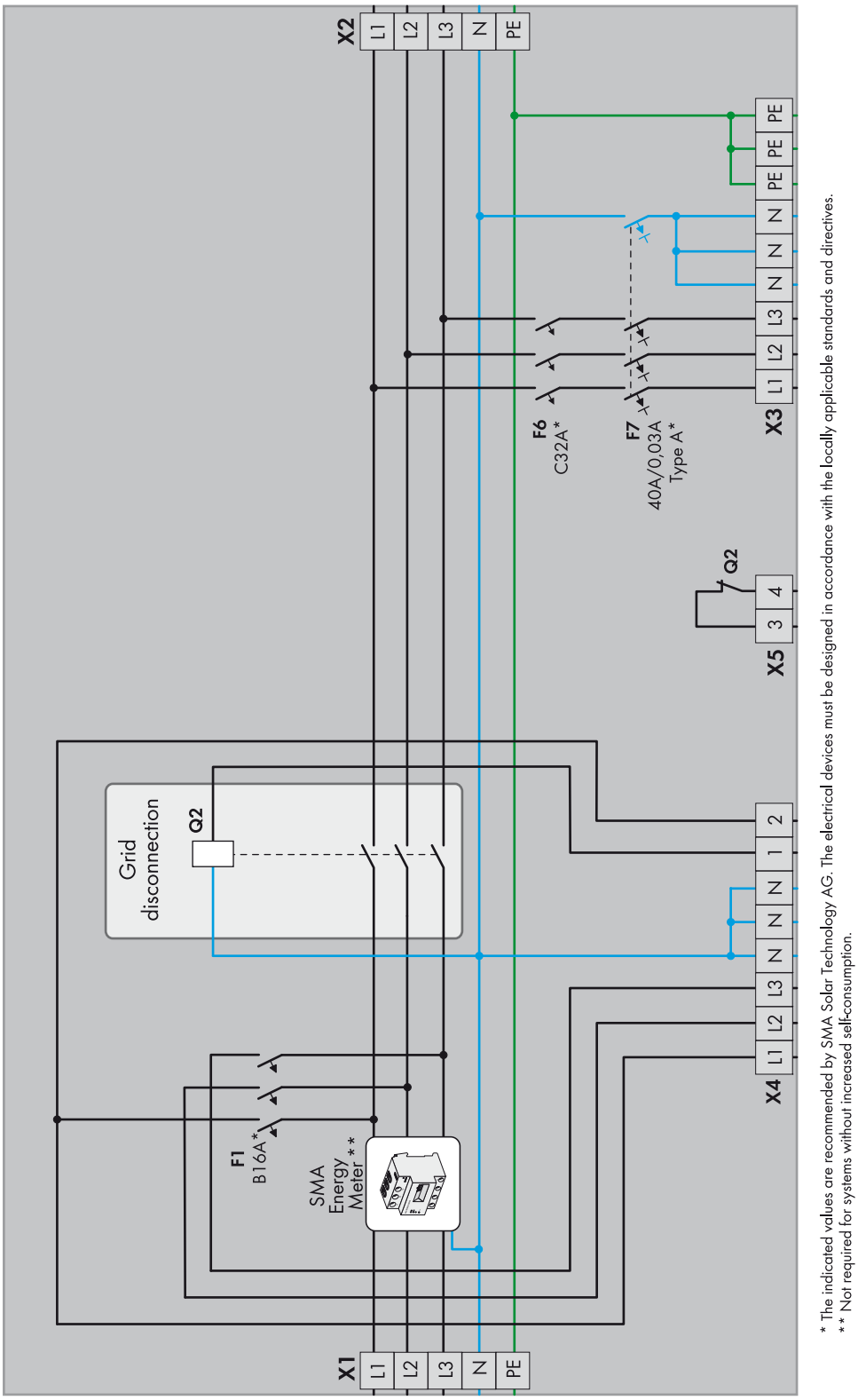


Figure 14: Schematic diagram of the three-phase automatic transfer switch without all-pole disconnection and optional SMA Energy Meter

6.2.2 Circuitry Overview

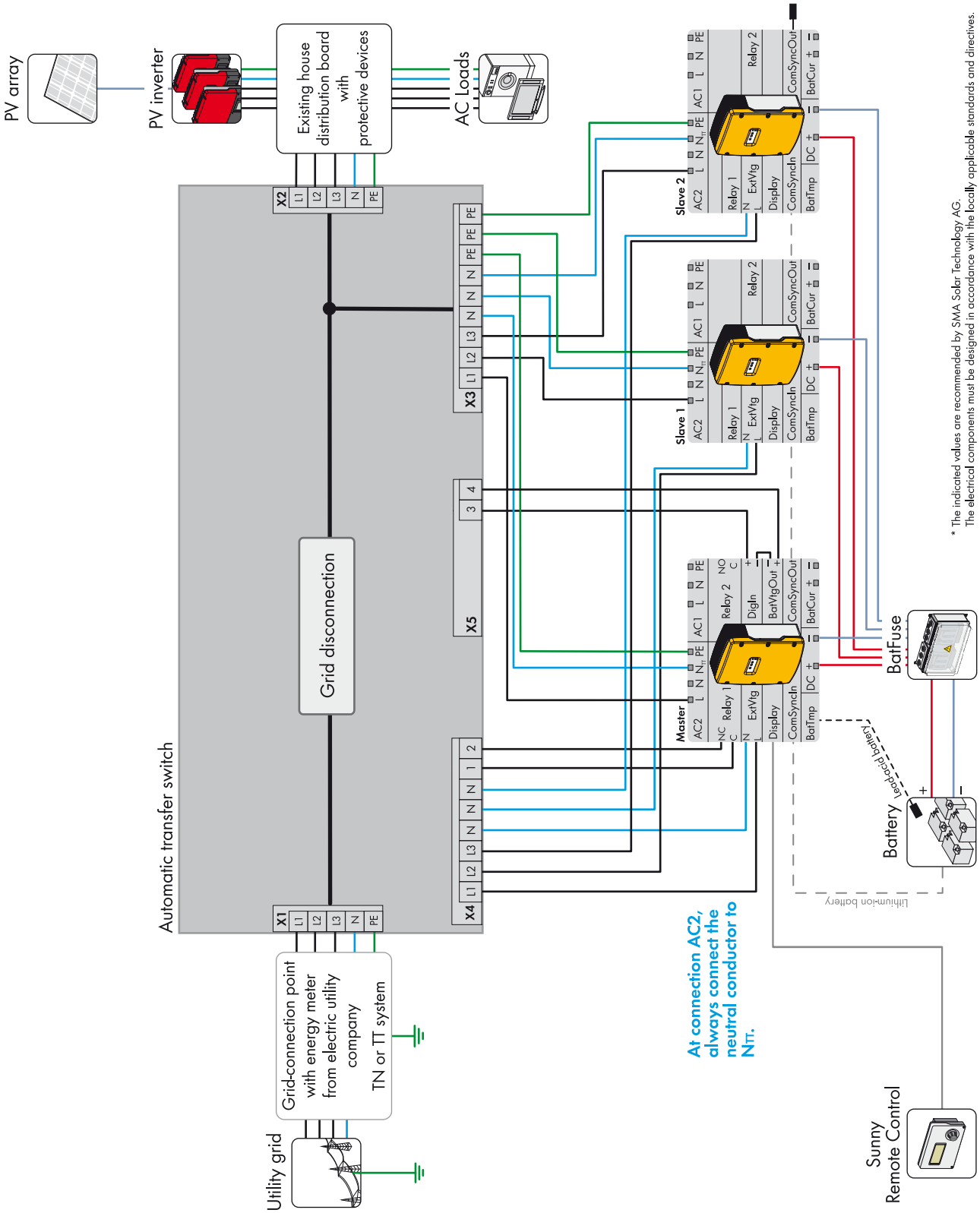


Figure 15: Connection of the automatic transfer switch (e. g. for Australia)

6.2.3 Connecting the Master

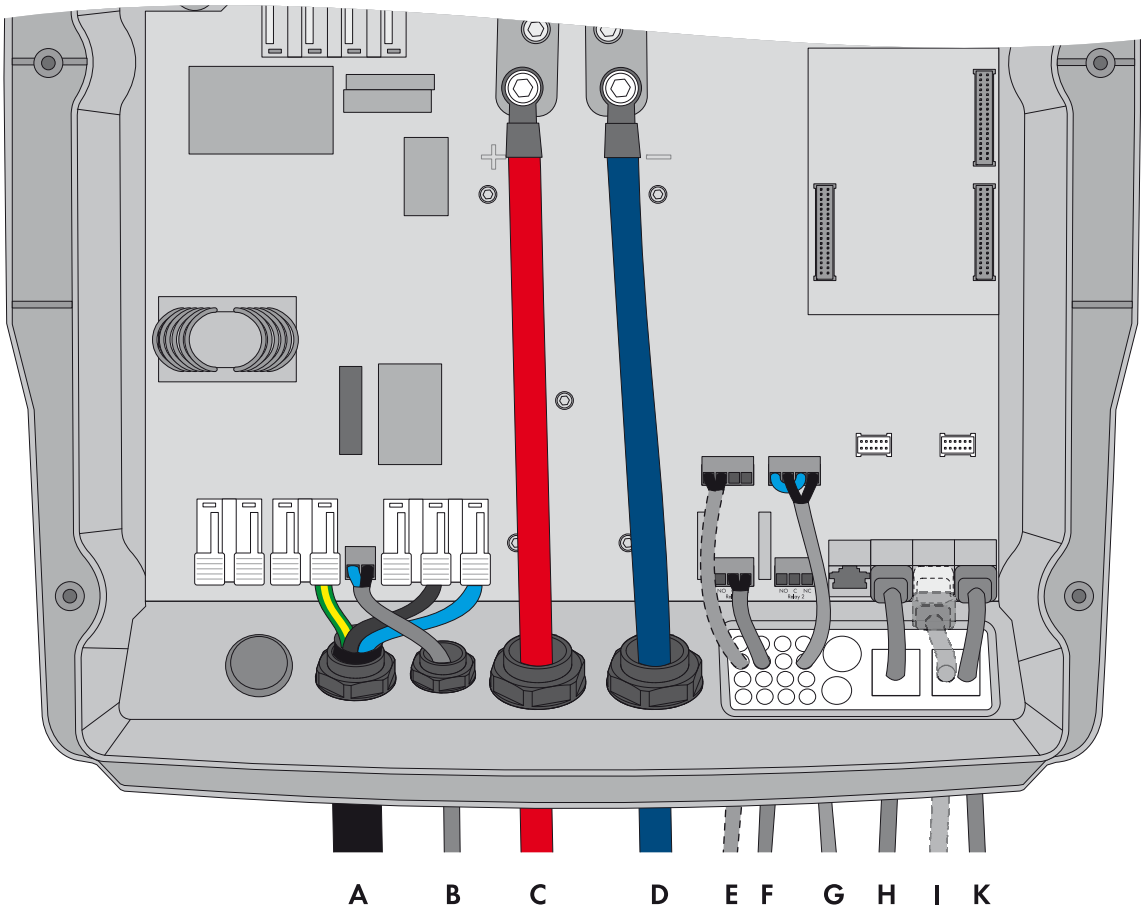


Figure 16: Connecting the master

Position	Designation	Description / information
A	AC power cable	Sunny Island: Connection **AC2 Gen/Grid** terminals **L**, **N_{TT}** and **PE** Automatic transfer switch: Connection **X3** terminals **L1**, **N** and **PE** Conductor cross-section: 10 mm² to 16 mm²
B	Measuring cable for voltage measurement	Sunny Island: Connection **ExtVtg** terminals **L** and **N** Automatic transfer switch: Connection **X4** terminals **L1** and **N** Conductor cross-section: 1.5 mm² to 2.5 mm²
C	DC+ cable	Battery connection Conductor cross-section: 50 mm² to 95 mm²
D	DC − cable	
E	Measuring cable of the battery temperature sensor	Sunny Island: Connection **BatTmp** You only have to connect a battery temperature sensor if lead-acid batteries are used. The battery temperature sensor must be mounted in the middle of the battery storage system, in the upper third of the battery cell.

Position	Designation	Description / information
F	Control cable of the tie switch	Sunny Island: Connection **Relay1** terminals **C** and **NC** Automatic transfer switch: Connection **X4** terminals **1** and **2** If the multifunction relay activates, the contactor of the tie switch deactivates. Conductor cross-section: 1.5 mm² to 2.5 mm²
G	Measuring cable for monitoring the tie switch	Sunny Island: Connections **DigIn+** and **BatVtg+** Automatic transfer switch: Connection **X5** terminals **3** and **4** Within the Sunny Island, connect the terminals **DigIn** − and **BatVtg** − . Conductor cross-section: 0.2 mm² to 2.5 mm²
H	Data cable to Sunny Remote Control	Sunny Island: Connection **Display**
I	Data cable for battery management	Sunny Island: Connection **ComSync In** Only if lithium-ion batteries are used, you must connect a data cable to the battery. The communication bus must be equipped with a terminator at the first and last nodes. If no data cable is plugged in, plug the terminator into **ComSync In**.
K	Data cable for the internal communication in the cluster	Sunny Island: Connection **ComSync Out**

6.2.4 Connecting the Slaves

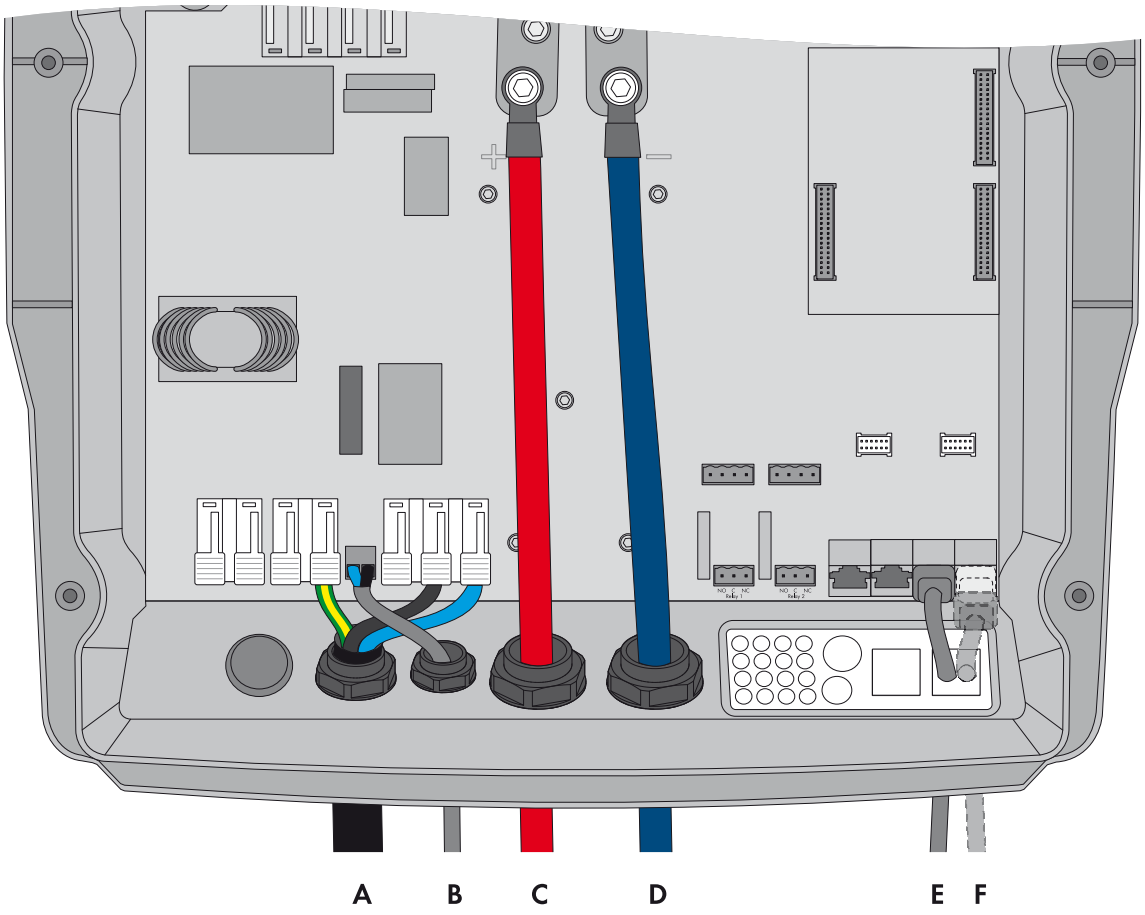


Figure 17: Connecting the slaves

Position	Designation	Description / information
A	AC power cable	Sunny Island: Connection **AC2 Gen/Grid** terminals **L**, **N_{TT}** and **PE** Automatic transfer switch: Connect slave 1 to **X3** terminals **L2**, **N** and **PE**. Connect slave 2 to **X3,** terminals **L3**, **N** and **PE**. Conductor cross-section: 10 mm² to 16 mm²
B	Measuring cable for voltage measurement	Sunny Island: Connection **ExtVtg** terminals **L** and **N** Automatic transfer switch: Connect slave 1 to **X4** terminals **L2** and **N**. Connect slave 2 to **X4** terminals **L3** and **N**. Conductor cross-section: 1.5 mm² to 2.5 mm²
C	DC+ cable	Battery connection Conductor cross-section: 50 mm² to 95 mm²
D	DC − cable	
E	Data cable for the internal communication in the cluster	Sunny Island: Connection **ComSync In**
F	Data cable for the internal communication in the cluster	Sunny Island: Connection **ComSync Out** With slave 2, leave terminator plugged in. Slave 2 is connected to slave 1 only.

7 Commissioning

7.1 Basic Configuration of the Sunny Island

⚠ WARNING

Danger to life due to incompatible lithium-ion battery

An incompatible lithium-ion battery can lead to a fire or an explosion. With incompatible lithium-ion batteries, it is not ensured that the battery management will protect the battery.

- Ensure that the battery is from one of the following manufacturers and has been approved for Sunny Island inverters by the manufacturer:
  - Akasol
  - Dispatch Energy
  - LG Chem
  - Leclanché
  - SAFT
  - Samsung
  - Sony

This list is updated regularly (see Planning Guidelines "SMA Smart Home" at www.SMA-Solar.com).

NOTICE

Damage to the battery due to incorrect settings

Aging of the battery will be accelerated by incorrect settings of the parameters for battery type, nominal voltage and battery capacity. The battery parameters influence the charging behavior of the Sunny Island.

- During the basic configuration, ensure that you configure the battery values recommended by the battery manufacturer (for the battery technical data, see the documentation of the battery manufacturer).
- In the basic configuration, configure the battery capacity for a ten-hour electric discharge (C10). For this purpose, the battery manufacturer specifies the battery capacity in relation to discharge time.

Requirements:

☐ With a three-phase system, the Sunny Remote Control must be connected to the master. The master is thus defined during basic configuration.

☐ In the automatic transfer switch, all circuit breakers must be open. This means that the Sunny Island is not connected to any PV inverter.

Procedure:

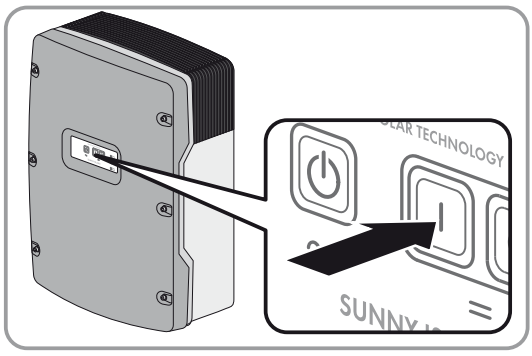
Check the wiring (see the Sunny Island installation manual).

↓

Close all components except for the BatFuse.
This means that all live components are protected against contact.

↓

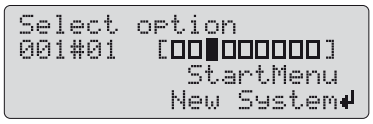
Close the BatFuse and switch on all Sunny Island inverters:
For systems with one Sunny Island, press the "On" button.
For systems with three Sunny Island inverters,
press and hold the "On" button on the master until an acoustic signal sounds.



When the Sunny Remote Control shows **<Init System>**,
press and hold the button on the Sunny Remote Control.

☑ An acoustic signal sounds three times and the
Sunny Remote Control displays the
Quick Configuration Guide.

Turn the button on the Sunny Remote Control and select
New System.



Press the button. This sets the selection to **New System**.

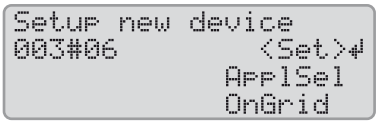
☑ A confirmation message appears.

Set **Y** and press the button.

Set the date.

Set the time.

Set **OnGrid**.



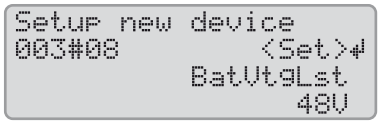
Set the battery type.

LiIon_Ext-BMS: lithium-ion battery

Set the battery capacity for ten-hour electric discharge (for determining the battery capacity, see the Sunny Island installation manual).

VRLA: lead-acid battery with electrolyte absorbed in glass mat or immobilized in gel
FLA: lead-acid battery with liquid electrolyte

Set the nominal voltage of the battery:



Set the battery capacity for ten-hour electric discharge (for determining the battery capacity, see the Sunny Island installation manual).

Also, during the first ten operating hours, set the country data set:

AR-N4105: Configuration in accordance with the application rule VDE-AR-N 4105
AS4777: Configuration in accordance with the standard AS4777

```
Setup new device
003#11          <Set>↵
             Country
          VDE-AR-4105
```

Set increased self-consumption:

BackupOnly: System without increased self-consumption
SelfConsBackup: System with increased self-consumption

```
Setup new device
003#13          <Set>↵
          SysFncSel
         BackupOnly
```

Set the number of Sunny Island inverters in the system:

```
Setup new device
003#14          <Set>↵
           ClstType
               1Phs
```

Single-phase: System with one Sunny Island

Three-phase: System with three Sunny Island inverters

If the country data set of the Sunny Island is **VDE-AR-4105** and the system optimizes self-consumption (**SelfConsBackup**), set the type of feed-in of the PV system (see Section 4.1, page 18).

If the system does not optimize self-consumption (**BackupOnly**) or the country data set of the Sunny Island is **AS4777**, confirm the basic configuration with **Y**.

Confirm basic configuration with **Y**.

```
Setup new system
003#15          <Set>↵
           EZAType
         Asymmetric
```

```
Setup new system
Done ?  <accept Y/N>
```

```
Setup new system
Done ?  <accept Y/N>
```

Asymmetric: The installation site is located in Germany and at least one PV inverter feeds in asymmetrically on a single line conductor.

Symmetric: The installation site is either located outside of Germany or all PV inverters feed in symmetrically on three line conductors.

Wait until the upper LED (inverter LED) of slave 1 is flashing and the Sunny Remote Control shows the message **To identify Slave1 press Tss on the Slv**.

Set the line conductor to which the Sunny Island is connected:

```
Setup new system
003#16        <Set>↵
           MsPhSel
                 L1
```

L1: connection to line conductor L1
L2: connection to line conductor L2
L3: connection to line conductor L3

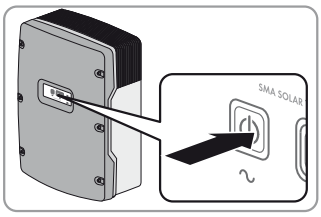
Confirm the basic configuration with **Y**.

```
Setup new system
Done ?  <accept Y/N>
```

Confirm basic configuration with **Y**.

```
Setup new system
Done ?  <accept Y/N>
```

Press the start-stop button on slave 1.



Wait until the upper LED (inverter LED) of slave 2 is flashing and the Sunny Remote Control shows the message **To identify Slave2 press Tss on the Slv**.

☑ The basic configuration is complete.

If an SD memory card is inserted into the Sunny Remote Control, the message "**Do not remove MMC/SD memory card ...**" appears.

Close the circuit breaker **F1** and the residual-current device **F2** in the distribution board and leave the Sunny Island switched on, but do not start it.

7.2 Testing the Automatic Transfer Switch Function

⚠ WARNING

Danger to life from electric shock due to live voltage

During the test, high voltages are present in the automatic transfer switch. Touching live components can result in death or serious injury.

- Ensure that you do not touch any live components while measuring and testing.
- Disconnect the automatic transfer switch from voltage sources while you are eliminating any faults.

The sequence of the test applies to all types of automatic transfer switches and is independent of the automatic transfer switch installed. Ignore tests for non-existent components.

Requirements:

☐ In the automatic transfer switch, all circuit breakers **F1**, **F3**, ..., **F6** must be open.

☐ The residual current protective devices **F2** and **F7** must be closed.

☐ All Sunny Island inverters must be switched on but not operational.

☐ PV system and all loads at connection **X2** must be disconnected from voltage sources.

Procedure:

1. Open the automatic transfer switch and ensure that at terminal **X1**, there is voltage present and a right-hand rotating magnetic field.
2. Measure whether the individual terminals are voltage-free:

Measuring point	Task
Connection **X2**	If AC voltage is present, correctly wire contactors **Q1** and **Q2**.
Connection **X3**	If AC voltage is present, stop the Sunny Island.
Connection **X4**	If AC voltage is present, correctly wire circuit breaker **F1**.
Connection **X5**, terminals **L1**, **N**, **1** and **2**	If AC voltage is present, stop the Sunny Island.
Connection **X5**, terminals **3** and **4**	If DC voltage is present, correctly wire contactor or auxiliary contact **Q2**.

3. Check whether the grounding device is correctly wired:

Measuring point	Task
Contactors **Q3** and **Q4**	Ensure that the wiring is correct.
Connection **X2**, terminals **N** and **PE**	Ensure that no voltage is present between the terminals and that conductivity can be measured.

4. Close circuit breaker **F1** and check the following:

Measuring point	Task
Contactors **Q1**, **Q2** and **Q3**	Check whether the contactors activate and whether there is voltage present and a right-hand rotating magnetic field at connection **X2**. If the contactors do not activate or no voltage is present at connection **X2**, ensure the following: • At the master, ensure that the control cable is correctly connected to connections **Relay1 C** and **Relay1 NC**. • Ensure that, in the automatic transfer switch, contactors **Q1**, **Q2** and **Q3** are correctly wired.
Connection **X2**	

5. Close circuit breaker **F6**.

   ☑ Voltages are present at connection **X3**.
6. Check whether the residual-current devices trip correctly and are correctly wired:

Measuring point	Task
Residual-current device **F7**	Press the test button and measure whether there is voltage present at connection **X3**. If voltage is present, correctly wire residual-current device **F7**.
	Switch on residual-current device **F7** again.
Residual-current device **F2**	Press the test button and check if contactors **Q1**, **Q2** and **Q3** go into non-operative mode. If the contactors do not deactivate, wire the residual-current device **F2** correctly.
	Switch on residual-current device **F2** again.

7. Start the Sunny Island. Press and hold the button on the Sunny Remote Control until you hear an acoustic signal.

8. Check whether error messages are displayed on the Sunny Remote Control.

   If the error message **F365 VAcExtPhsFail** is displayed, correctly connect connection **ExtVtg** on the Sunny Island.

   If the error message **F367 ExtCtcNotOpen** is displayed, correctly connect connections **DigIn** and **BatVtgOut** on the Sunny Island.
9. Close circuit breaker **F5** and check whether contactors **Q4** and **Q6** remain in non-operative mode.

   If the contactors activate, correctly wire connections **Relay2 C** and **Relay2 NO** on the Sunny Island.
10. Simulate a grid failure. To do this, open circuit breaker **F1**. As a result, contactors **Q1**, **Q2** and **Q3** deactivate.
11. Check whether contactors **Q4** and **Q6** activate approximately five seconds after circuit breaker **F1** is opened.

    If the contactors do not activate, correctly wire the control cables of the contactors and correctly connect connections **Relay2 C** and **Relay2 NO** to the master.
12. Check whether the grounding device switches correctly.
    - Ensure that no voltage is present at connection **X2** between terminals **N** and **PE** and that conductivity can be measured.
    - Open circuit breaker F5.
    - Ensure that no voltage is present at connection **X2** between terminals **N** and **PE** and that conductivity can be measured.
    - Close circuit breaker **F5**.
13. Check whether the phase coupling switches correctly. To do this, close circuit breakers **F3** and **F4** and check the following

Measuring point	Task
Connection **X2**	Measure if there is voltage present between the line conductors and the neutral conductor.
	If no voltage is present, correctly wire contactor **Q6**.
	Ensure that no voltage is present between the line conductors.

14. Switch on circuit breaker **F1**.
    - Contactors **Q4** and **Q6** deactivate within five minutes and the tie switch then connects the battery backup grid to the utility grid.

7.3 Changing the Configuration of the PV Inverters (only for Australia)

In battery backup systems, the active power of the PV inverters must be controllable depending on the frequency (see Planning Guidelines "SMA Flexible Storage System with Battery Backup Function"). With the Australian country data set AS 4777 for SMA PV inverters, the frequency-dependent active power reduction is deactivated.

Frequency-dependent active power reduction is not a requirement of the product standard AS 4777 2005. The adjustments are based on the requirements applicable to PV inverters from the product standard AS 4777 2014.

Requirements:

☐ The grid operator must be informed of the adjustment and have no objections to it.

☐ You must have authorization to change Grid Guard parameters. You can find the application form at www.SMA-Solar.com in the download area of the relevant PV inverter.

☐ The firmware version of the PV inverter must support the frequency-dependent active power reduction (see Planning Guidelines "SMA Flexible Storage System with Battery Backup Function" at www.SMA-Solar.com).

Procedure:

1. With existing PV systems, make sure that the firmware of the installed PV inverters supports frequency-dependent active power reduction (see the Planning Guidelines "SMA Flexible Storage System with Battery Backup Function" at www.SMA-Solar.com).
2. Set the following parameters of the PV inverters to the specified value (see the documentation of the communication product).

Parameters	Value
P-WCtlHzMod Operating mode of active power reduction in case of overfrequency P(f)*	On or WCtlHz
P-WGra Active power gradient, linear instantaneous power gradient configuration*	*77*
P-HzStr Difference between starting frequency and power frequency, linear instantaneous power gradient configuration*	0.2
P-HzStop Difference between reset frequency and power frequency, linear instantaneous power gradient configuration*	0.05
P-HzStopWGra Active power gradient after reset frequency, linear instantaneous power gradient configuration*	10

* Menu **Equipment & device control system**

7.4 Attaching the Labels

The warning label for battery backup systems is included in the scope of delivery of the Sunny Island.

- Attach the warning label "Battery Backup System" to the AC main distributor from the outside.

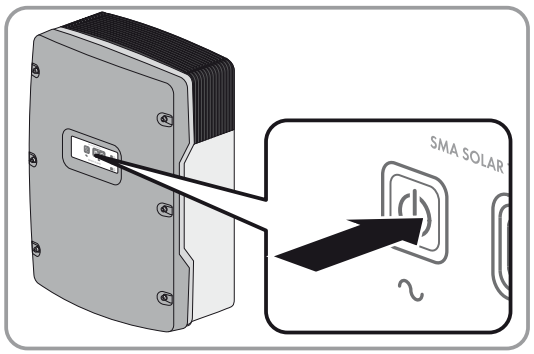
7.5 Operation of a System Without Increased Self-Consumption

Requirement:

☐ The functionality of the automatic transfer switch must be checked (see Section 7.2, page 42).

Procedure:

- Commission the PV system (see PV inverter documentation).
- To start the system, press and hold the "On" button on the Sunny Island until an acoustic signal sounds.



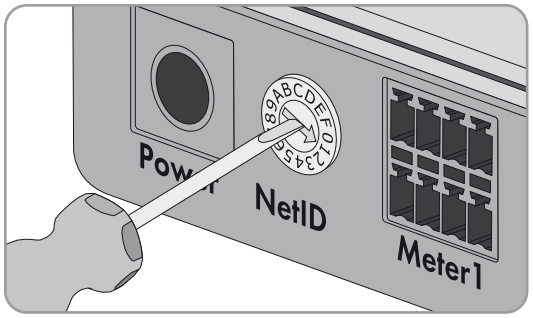
7.6 Commissioning of a System with Increased Self-Consumption

7.6.1 Preparing *Bluetooth* Communication

In order that SMA *Bluetooth* devices in the battery backup system can communicate with each other, all devices must be set to the same NetID. Systems with SMA *Bluetooth* operating in close proximity to one another are distinguished by their individual NetID.

Procedure:

1. For PV inverters with integrated *Bluetooth* interface that communicate via Speedwire, set NetID **0** (see PV inverter installation manual). This deactivates communication via *Bluetooth*.
2. Determine the NetID of the *Bluetooth* system.
   - Install Sunny Explorer on a computer. Either run the installation file on the CD provided or download free of charge at www.SMA-Solar.com.
   - Determine a free NetID for the *Bluetooth* system using Sunny Explorer (see Sunny Explorer user manual).
   - Quit Sunny Explorer. This will ensure that the *Bluetooth* network is set up via the Sunny Home Manager.
3. Set the determined NetID on the Sunny Home Manager and on all devices with active *Bluetooth* interface (see documentation of the *Bluetooth* devices). Observe that the NetID must not be set to **1** if the Sunny Home Manager is intended to communicate with more than one *Bluetooth* node.



7.6.2 Commissioning a System with Increased Self-Consumption

Deactivation of intermediate storage of PV energy during certain charging procedures

To increase the service life of the battery, the system regularly carries out full charges and equalization charges (see Technical Information "Battery Management" at www.SMA-Solar.com). During these charging procedures, the intermediate storage of PV energy is deactivated and this can result in purchased electricity through the full charges and the equalization charges.

Required data for registration in Sunny Portal:

Device / customer data	Required data and explanation
Sunny Home Manager	• Serial number (PIC) and registration ID (RID) Register the new system in Sunny Portal using the PIC and RID.
SMA Energy Meter	• Only if two SMA Energy Meters are installed, note down the serial number and purpose (e. g. PV production meter) in each case. This way you can identify the energy meters in the Sunny Portal.

Device / customer data	Required data and explanation
PV inverter	• PV system password The PV system password is the same as the device password for the user group "Installer". All devices in a PV system must be set to the same password (for user groups and safety concept, see the Sunny Explorer user manual). The default password is 1111. • Serial number of the PV inverters You can uniquely identify the PV inverters in the Sunny Portal using the serial number. • PV array power in kWp
SMA radio-controlled socket	• The serial number and connected load of each SMA radio-controlled socket In Sunny Portal, configure the SMA radio-controlled socket in accordance with the requirements of the connected load. To do so, you require the serial number of the SMA radio-controlled socket.
Customer data	• E-mail address • Password for Sunny Portal access • Address of the PV system • Electricity tariff data – Electricity price for purchased electricity – Tariff times, if available (e.g., for tariffs with peak and off-peak tariff) – Feed-in tariff – Self-consumption tariff, if available

Requirements:

☐ The basic configuration of the Sunny Island must be implemented (see Section 7.1, page 38).

☐ The functionality of the automatic transfer switch must be checked (see Section 7.2, page 42).

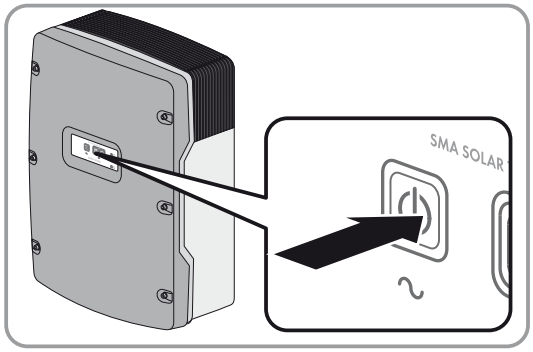
☐ The Sunny Home Manager, the Sunny Island and all other Speedwire devices must be connected to the same router or network switch.

☐ DHCP must be enabled for the router of the system.

☐ The router of the system must have an Internet connection.

Procedure:

1. In the distribution board, switch on circuit breaker **F1** and residual-current device **F2**.
2. Commission the PV system (see PV inverter documentation).
3. On the Sunny Island, press and hold the "On" button until you hear an acoustic signal. This starts the system.



4. Only if two SMA Energy Meters are installed in the local network, assign them to the Sunny Island with Sunny Explorer grid feed-in and purchased electricity meter. Also enter the serial number of the grid feed-in and purchased electricity meter (see the Sunny Explorer user manual).

5. Open Sunny Portal via www.SunnyPortal.com/Register and run the PV System Setup Assistant. The required data for registration in Sunny Portal must be at hand.

   Display of the Sunny Island in Sunny Portal

   In Sunny Portal, the Sunny Island inverters are always displayed as one device even if the system consists of three Sunny Island inverters. If three Sunny Island inverters are used, the data is aggregated.

6. In the Sunny Portal, activate the automatic update of the Sunny Home Manager and the PV system.
7. For systems with active power limitation, ensure that the limitation of active power feed-in is configured and working in Sunny Portal ("Configuring Limitation of active power feed-in" see user manual "SUNNY HOME MANAGER in Sunny Portal" at www.SunnyPortal.com).

7.7 Activating Phase Coupling in Single-Phase Battery Backup Systems

With phase coupling it is possible, in the event of utility grid failure, to supply loads which are not connected to the phase of the Sunny Island (see Section 3.3.4 "Phase Coupling for Single-Phase Battery Backup Systems", page 17). As soon as the utility grid returns, the contactor disconnects the coupled line conductors again. The switchover times for the loads to the coupled line conductors are longer than to the line conductors of the Sunny Island. The switchover times are a matter of seconds.

Disconnection of the Sunny Island as a result of overload:

The Sunny Island switches itself off when overloaded. Only activate phase coupling for line conductors whose loads do not exceed the maximum AC power of the Sunny Island (for technical data, see the Sunny Island installation manual).

NOTICE

Damage to three-phase loads during phase coupling

If three-phase loads are connected to a single-phase utility grid during phase coupling, SMA Solar Technology AG cannot rule out damage to the three-phase loads.

- Ensure that, during phase coupling, only single-phase loads are connected to the battery backup grid.

Procedure:

- In the automatic transfer switch, switch on circuit breaker **F3** or **F4** or both.

8 Contact

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

- Type of Sunny Island
- Serial number of the Sunny Island
- Firmware version of the Sunny Island
- Displayed error message
- Type of battery connected
- Rated battery capacity
- Nominal battery voltage
- Type of the communication products connected
- Type and size of additional energy sources

Australia	SMA Australia Pty Ltd. Sydney	Toll free for Australia: International:	1800 SMA AUS (1800 762 287) +61 2 9491 4200
Belgien/ Belgique/ België	SMA Benelux BVBA/SPRL Mechelen	+32 15 286 730	
Brasil	Vide España (Espanha)		
Česko	SMA Central & Eastern Europe s.r.o. Praha	+420 235 010 417	
Chile	Ver España		
Danmark	Se Deutschland (Tyskland)		
Deutschland	SMA Solar Technology AG Niestetal	Medium Power Solutions Wechselrichter: Kommunikation: SMA Online Service Center:	 +49 561 9522-1499 +49 561 9522-2499 www.SMA.de/Service
		Hybrid Energy Solutions Sunny Island: PV-Diesel Hybridsysteme:	 +49 561 9522-399 +49 561 9522-3199
		Power Plant Solutions Sunny Central:	 +49 561 9522-299
España	SMA Ibérica Tecnología Solar, S.L.U. Barcelona	Llamada gratuita en España: Internacional:	900 14 22 22 +34 902 14 24 24

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Κύπρος/ Kıbrıs	Βλέπε Ελλάδα/ Bkz. Ελλάδα (Yunanistan)		
Luxemburg/ Luxembourg	Siehe Belgien/ Voir Belgien (Belgique)		
Magyarország	lásd Česko (Csehország)		
Nederland	zie Belgien (België)		
Österreich	Siehe Deutschland		
Perú	Ver España		
Polska	Patrz Česko (Czechy)		
Portugal	SMA Solar Technology Portugal, Unipessoal Lda Lisboa	Isento de taxas em Portugal: Internacional:	800 20 89 87 +351 2 12 37 78 60
România	Vezi Česko (Cehia)		
Schweiz	Siehe Deutschland		
Slovensko	pozri Česko (Česká republika)		
South Africa	SMA Solar Technology South Africa Pty Ltd. Centurion (Pretoria)	08600 SUNNY (08600 78669) International:	 +27 (12) 643 1785
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대한민국	SMA Technology Korea Co., Ltd. 서울	+82 2 508-8599	

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