

## **Multicluster Systems with Stand-Alone Grid or Increased Self-Consumption and Battery-Backup Function**

**Sunny Island 6.0H / 8.0H and Multicluster-Box 12 / Grid-Connect-Box 12**

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# 1 Information on this Document

## 1.1 Validity

This document is valid for multicluster systems with stand-alone grid or increased self-consumption and battery-backup function, in which the following device types are used:

- SI6.0H-13 (Sunny Island 6.0H) from firmware version 1.04.xx.R
- SI8.0H-13 (Sunny Island 8.0H) from firmware version 1.04.xx.R
- MC-BOX-12.3-20 (Multicluster-Box 12)
- GRID-BOX-12.3-20 (Grid-Connect-Box 12)

## 1.2 Target Group

The tasks described in this document must only be performed by qualified persons. Qualified persons must have the following skills:

- Knowledge of how to safely disconnect SMA inverters
- Knowledge of how an inverter works and is operated
- Knowledge of how batteries work and are operated
- Training in the installation and commissioning of electrical devices and installations
- Knowledge of all applicable laws, standards and directives
- Knowledge of and compliance with this document and all safety information
- Knowledge of and compliance with the documents of the battery manufacturer with all safety information

## 1.3 Content and Structure of this Document

This document summarizes the specific information on multicluster systems with Sunny Island inverters and Multicluster-Box 12. The structure of the document specifies the chronological sequence for configuration and commissioning.

This document supplements the documents that are enclosed with each product and does not replace any locally applicable codes or standards. Read and observe all documents supplied with the product.

Illustrations in this document are reduced to the essential information and may deviate from the real product.

## 1.4 Levels of warning messages

The following levels of warning messages may occur when handling the product.

### 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, could result in death or serious injury.










### CAUTION

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

### NOTICE

Indicates a situation which, if not avoided, can result in property damage.

## 1.5 Symbols in the Document

Icon	Explanation
	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.
	Example
 	This information is relevant for systems which are to be operated in parallel with utility grid: <ul style="list-style-type: none"> <li>• System for increased self-consumption (storage system)</li> <li>• Battery-backup system</li> </ul>
	Content is relevant for off-grid systems.
	Section in which the installation and commissioning process is illustrated graphically.

## 1.6 Typographical Elements in the Document

Typographical element	Use	Example
<b>bold</b>	<ul style="list-style-type: none"> <li>• Messages</li> <li>• Terminals</li> <li>• Elements on a user interface</li> <li>• Elements to be selected</li> <li>• Elements to be entered</li> </ul>	<ul style="list-style-type: none"> <li>• Connect the insulated conductors to the terminals <b>X703:1</b> to <b>X703:6</b>.</li> <li>• Enter <b>10</b> in the field <b>Minutes</b>.</li> </ul>
>	<ul style="list-style-type: none"> <li>• Connects several elements to be selected</li> </ul>	<ul style="list-style-type: none"> <li>• Go to <b>Settings &gt; Date</b>.</li> </ul>
[Button] [Key]	<ul style="list-style-type: none"> <li>• Button or key to be clicked on or pressed down</li> </ul>	<ul style="list-style-type: none"> <li>• Select <b>[Enter]</b>.</li> </ul>
#	<ul style="list-style-type: none"> <li>• Placeholder for variable components (e.g., parameter names)</li> </ul>	<ul style="list-style-type: none"> <li>• Parameter <b>WCtHz.Hz#</b></li> </ul>

## 1.7 Designations in the Document

Complete designation	Designation in this document
Grid-Connect-Box 12	Grid-Connect-Box
Multicluster-Box 12	Multicluster-Box

Complete designation	Designation in this document
Multicluster system with increased self-consumption, battery-backup function or increased self-consumption and battery-backup function	Multicluster system with increased self-consumption and battery-backup function, storage system
Multicluster system with stand-alone grid	Off-grid system
Sunny Boy, Sunny Tripower	PV inverter
Sunny Island 6.0H / 8.0H	Sunny Island, battery inverter

## 1.8 Additional Information

For more information, please go to [www.SMA-Solar.com](http://www.SMA-Solar.com).

Title and information content	Type of information
Mounting, installation, commissioning, operation, configuration, troubleshooting and decommissioning of the inverter	Operating manual
"Parameters and Measured Values" Overview of all inverter operating parameters and their configuration options	Technical Information
MULTICLUSTER-BOX 12	Installation - Connection overview
MULTICLUSTER-BOX 12	Operating manual
SUNNY ISLAND 4.0M / 6.0H / 8.0H	Operating manual
GRID-CONNECT-BOX 12	Operating manual

## 2 Safety

### 2.1 Intended Use

The multicluster system forms an AC grid and is made up of several three-phase clusters. Three Sunny Island are connected in parallel on the DC side of each cluster. The multicluster system can be set up as an off-grid system or as a system with increased self-consumption and battery-backup function.

The Multicluster-Box and Grid-Connect-Box do not replace the distribution board for the loads or the PV system. In addition to the Multicluster-Box and Grid-Connect-Box, you must install the necessary protective devices for the loads and the PV system.

Loads connected to the Sunny Island must have an CE, RCM or UL identification label.

The product is not suitable for supplying life-sustaining medical devices. A power outage must not lead to personal injury.

Only device types with the same output power may be installed in a cluster. This means that the device types, such as SI6.0H-12 and SI6.0H-13, may be combined within a cluster. In contrast, device types with different outputs (e.g. SI6.0H-13 and SI8.0H-13) may not be combined. The cluster master must always be an SI6.0H-13 / SI8.0H-13. It must be equipped with the latest firmware version.

An utility grid connected to the multicluster system must be a TN or TT grid configuration. The technical connection requirements of the grid operator and the local standards and directives must be fulfilled. When connecting the multicluster system to the utility grid, all information in this quick reference guide and the instructions provided in the enclosed documentation must be observed.

Generators must be suitable for TN systems and must always be connected to the Multicluster-Box.

The entire battery voltage range must be completely within the permissible DC input voltage range of the Sunny Island. The maximum permissible DC input voltage of the Sunny Island must not be exceeded. The battery must be protected against short circuits. The locally applicable standards and directives must be complied with.

With lead-acid batteries, the battery room must be ventilated in accordance with the requirements of the battery manufacturer and with the locally applicable standards and directives (see documentation of the battery manufacturer).

The following conditions must be satisfied for lithium-ion batteries:

- The lithium-ion battery must comply with the locally applicable standards and directives and must be intrinsically safe.
- The battery management of the lithium-ion battery used must be compatible with the Sunny Island (see the technical information at "List of Approved Batteries").
- The lithium-ion battery must be able to supply enough current at maximum output power of the Sunny Island (for technical data see the Sunny Island operating manual).

The DC terminal of the inverter is exclusively intended for the connection of a battery with external battery fuse. Only DC loads or DC energy sources that are immune to electromagnetic interference must be used.

The AC sources in the multicluster system must be suitable for stand-alone mode with Sunny Island (for PV inverters see planning guidelines "Design of Off-Grid Systems with Sunny Island Devices" at [www.SMA-Solar.com](http://www.SMA-Solar.com)). The maximum output power of the AC sources in a stand-alone grid must be observed (see the operating manual of the Sunny Island).

For a multicluster system with increased self-consumption and battery-backup function, the connected PV system must be suitable for both stand-alone mode and utility grid operation (see the planning guidelines "SMA Energy System Home with Battery-Backup Function" at [www.SMA-Solar.com](http://www.SMA-Solar.com)). The maximum output power of the PV system depends on the installation site (see Section 3.5.3, page 20).

DC charge controllers may not be included in a multicluster system connected to the utility grid.

With the internal measuring device of the Multicluster-Box, the multicluster system detects the electricity fed into and purchased from the grid at the grid connection point of the Grid-Connect-Box. The internal measuring device of the Multicluster-Box does not replace the energy meter of the electric utility company.

For PV system monitoring, only the SMA Cluster Controller is used in multicluster systems.

Use SMA products only in accordance with the information provided in the enclosed documentation and with the locally applicable laws, regulations, standards and directives. Any other application may cause personal injury or property damage.

Alterations to the SMA products, e.g., changes or modifications, are only permitted with the express written permission of SMA Solar Technology AG. Unauthorized alterations will void guarantee and warranty claims and in most cases terminate the operating license. SMA Solar Technology AG shall not be held liable for any damage caused by such changes.

Any use of the product other than that described in the Intended Use section does not qualify as appropriate.

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

This document does not replace any regional, state, provincial, federal or national laws, regulations or standards that apply to the installation, electrical safety and use of the product. SMA Solar Technology AG assumes no responsibility for the compliance or non-compliance with such laws or codes in connection with the installation of the product.

## 2.2 IMPORTANT SAFETY INSTRUCTIONS

Keep the manual for future reference.

This section contains safety information that must be observed at all times when working.

The product has been designed and tested in accordance with international safety requirements. As with all electrical or electronical devices, there are residual risks despite careful construction. To prevent personal injury and property damage and to ensure long-term operation of the product, read this section carefully and observe all safety information at all times.

### DANGER

#### **Danger to life due to electric shock when live components or cables are touched**

High voltages are present in the conductive components or cables of the product. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Disconnect the system from voltage sources and make sure it cannot be reconnected before working on the device.
- Observe all safety information on components associated with the product.
- Wear suitable personal protective equipment for all work on the product.

### DANGER

#### **Danger to life due to electric shock in case of overvoltages and if surge protection is missing**

Overvoltages (e. g. in the event of a flash of lightning) can be further conducted into the building and to other connected devices in the same network via the network cables or other data cables if there is no surge protection. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Ensure that all devices in the same network and the battery are integrated into the existing surge protection.
- When laying the network cables or other data cables outdoors, it must be ensured that a suitable surge protection device is provided at the transition point of the cable from the product or the battery outdoors to the inside of a building.



**⚠ DANGER****Danger to life due to electric shock in case of overvoltages and unsuitable loads**

Overvoltages of up to 1500 V can occur in the stand-alone grid and in the battery-backup grid. If the loads are not suitable for these overvoltages or are not safe to operate, a voltage that poses a danger to life may be present on accessible parts or cables. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Only connect loads that have a CE, RCM or UL designation. These loads are suitable for overvoltages of up to 1500 V.
- Operate the loads only when they are technically faultless and in an operationally safe state.
- Check the loads regularly for visible damage.

**⚠ DANGER****Danger to life due to electric shock when operating a damaged product**

Operating a damaged product can lead to hazardous situations since high voltages can be present on accessible product parts. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Only operate the system when it is in a flawless technical condition and safe to operate.
- Check the system regularly for visible damage.
- Make sure that all external safety equipment is freely accessible at all times.
- Make sure that all safety equipment is in good working order.
- Wear suitable personal protective equipment for all work on the product.

**⚠ WARNING****Danger to life due to fire or explosion**

In rare cases, an explosive gas mixture can be generated inside the inverter under fault conditions. In this state, switching operations can cause a fire inside the inverter or explosion. Death or lethal injuries due to hot or flying debris can result.

- In the event of a fault, do not perform any direct actions on the inverter.
- Ensure that unauthorized persons have no access to the inverter.
- Disconnect the battery from the product via an external disconnection device.
- Disconnect the AC circuit breaker, or keep it disconnected in case it has already tripped, and secure it against reconnection.
- Only perform work on the inverter (e.g., troubleshooting, repair work) when wearing personal protective equipment for handling of hazardous substances (e.g., safety gloves, eye and face protection, respiratory protection).

**⚠ WARNING****Risk of injury due to toxic substances, gases and dusts.**

In rare cases, damages to electronic components can result in the formation of toxic substances, gases or dusts inside the inverter. Touching toxic substances and inhaling toxic gases and dusts can cause skin irritation, burns or poisoning, trouble breathing and nausea.

- Only perform work on the inverter (e.g., troubleshooting, repair work) when wearing personal protective equipment for handling of hazardous substances (e.g., safety gloves, eye and face protection, respiratory protection).
- Ensure that unauthorized persons have no access to the inverter.

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

In off-grid systems and battery-backup systems, the Sunny Island can only trip circuit breakers up to a certain tripping characteristic. Circuit breakers with a higher operating current cannot be tripped. Under fault conditions, a voltage that poses a danger to life may be present on accessible parts for several seconds. Touching live components can result in death or serious injury due to electric shock.

- SI6.0H-13 and SI8.0H-13: Check whether a circuit breaker has a higher trip characteristic than B16 (B16A) or C6 (C6A).
- If a circuit breaker has a higher trip characteristic than the specified circuit breakers that can be tripped, you should also install a residual-current device of type A.

**⚠ WARNING****Risk of crushing injuries due to moving PV array parts**

A generator can be started automatically by the Sunny Island. Moving parts in the PV array can crush or sever body parts.

- Operate the generator only with the specified safety equipment.
- Carry out all work on the generator in accordance with the manufacturer's specifications.

**⚠ CAUTION****Risk of burns due to short-circuit currents on the disconnected inverter**

The capacitors in the DC input area of the inverter store energy. After the battery is isolated from the inverter, battery voltage is still temporarily present at the DC terminal. A short circuit at the DC terminal of the inverter can lead to burns and may damage the inverter.

- Wait 15 minutes before performing any work at the DC terminal or on the DC cables. This allows the capacitors to discharge.

**⚠ CAUTION****Risk of burns due to hot enclosure parts**

Some parts of the enclosure can get hot during operation.

- Mount the inverter in such a way that it cannot be touched inadvertently during operation.

**NOTICE****Damage to the system due to sand, dust and moisture ingress**

Sand, dust and moisture penetration can damage the system and impair its functionality.

- Only open the product if the humidity is within the thresholds and the environment is free of sand and dust.
- Do not open the product during a dust storm or precipitation.

**NOTICE****Damage to the inverter due to electrostatic discharge**

Touching electronic components can cause damage to or destroy the inverter through electrostatic discharge.

- Ground yourself before touching any component.

**NOTICE****Damage to the enclosure seal in subfreezing conditions**

If you open the product when temperatures are below freezing, the enclosure seals can be damaged. Moisture can penetrate the product and damage it.

- Only open the product if the ambient temperature is not below  $-5^{\circ}\text{C}$ .
- If a layer of ice has formed on the enclosure seal when temperatures are below freezing, remove it prior to opening the product (e.g. by melting the ice with warm air).

**NOTICE****High costs due to inappropriate Internet tariff**

Depending on use, the data volume of the product transferred via the Internet may vary in size. The data volume depends, for example, on the number of devices in the system, the frequency of device updates, the frequency of data transfer to Sunny Portal or the use of FTP push. High costs for the Internet connection can be the result.

- SMA Solar Technology AG recommends using an Internet flat rate.

## 2.3 Battery Safety Information

This section contains safety information that must be observed at all times when working on or with batteries.

To prevent personal injury or property damage and to ensure long-term operation of the batteries, read this section carefully and observe all safety information 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 battery management is intrinsically safe and will protect the battery.

- Ensure that the lithium-ion batteries are approved for use with the Sunny Island (see technical information "List of Approved Batteries" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).
- If no lithium-ion batteries approved for the inverter can be used, lead-acid batteries can be used.
- Verify that the battery complies with locally applicable standards and directives and is intrinsically safe.

**⚠ WARNING****Danger to life due to explosive gases**

Explosive gases may escape from the battery and cause an explosion.

- Protect the battery environment from open flames, embers and sparks.
- Install, operate and maintain the battery in accordance with the manufacturer's specifications.
- Do not burn the battery and do not heat it beyond the permitted temperature.
- Additional measures for lead-acid batteries: Ensure that the battery room is sufficiently ventilated.

**⚠ WARNING****Chemical burns due to battery electrolyte**

If handled inappropriately, battery electrolyte can leak from the battery and cause irritation to the eyes, respiratory system and skin.

- Install, operate, maintain and dispose of the battery according to the manufacturer's specifications.
- Whenever working on the battery, wear suitable personal protective equipment such as rubber gloves, an apron, rubber boots and goggles.
- Rinse acid splashes thoroughly for a long time with clear water, and consult a doctor immediately.
- If acid fumes have been inhaled, consult a doctor immediately.

**⚠ WARNING****Danger to life due to burns caused by electric arcs through short-circuit currents**

Short-circuit currents in the battery can cause heat build-up and electric arcs. Heat build-up and electric arcs may result in lethal injuries due to burns.

- Remove watches, rings and other metal objects prior to carrying out any work on the battery.
- Use insulated tools for all work on the battery.
- Do not place tools or metal parts on the battery.
- Observe all safety information of the battery manufacturer.

**⚠ CAUTION****Risk of burns due to hot battery components**

Improper battery connection may result in excessively high transition resistances. Excessive transition resistances give rise to localized heat build-up.

- Ensure that all pole connectors are connected with the connecting torque specified by the battery manufacturer.
- Ensure that all DC cables are connected with the connecting torque specified by the battery manufacturer.

**NOTICE****Damage to the battery due to incorrect settings**

The set battery parameters influence the charging behavior of the inverter. The battery can be damaged by incorrect settings of the battery type, nominal voltage and capacity parameters.

- Set the correct battery type as well as the correct values for nominal voltage and battery capacity when configuring.
- Ensure that the values recommended by the manufacturer are set for the battery (refer to the technical data of the battery in the manufacturer documentation).

## 3 Functions and Design

### 3.1 Design of a Multicluster-Box

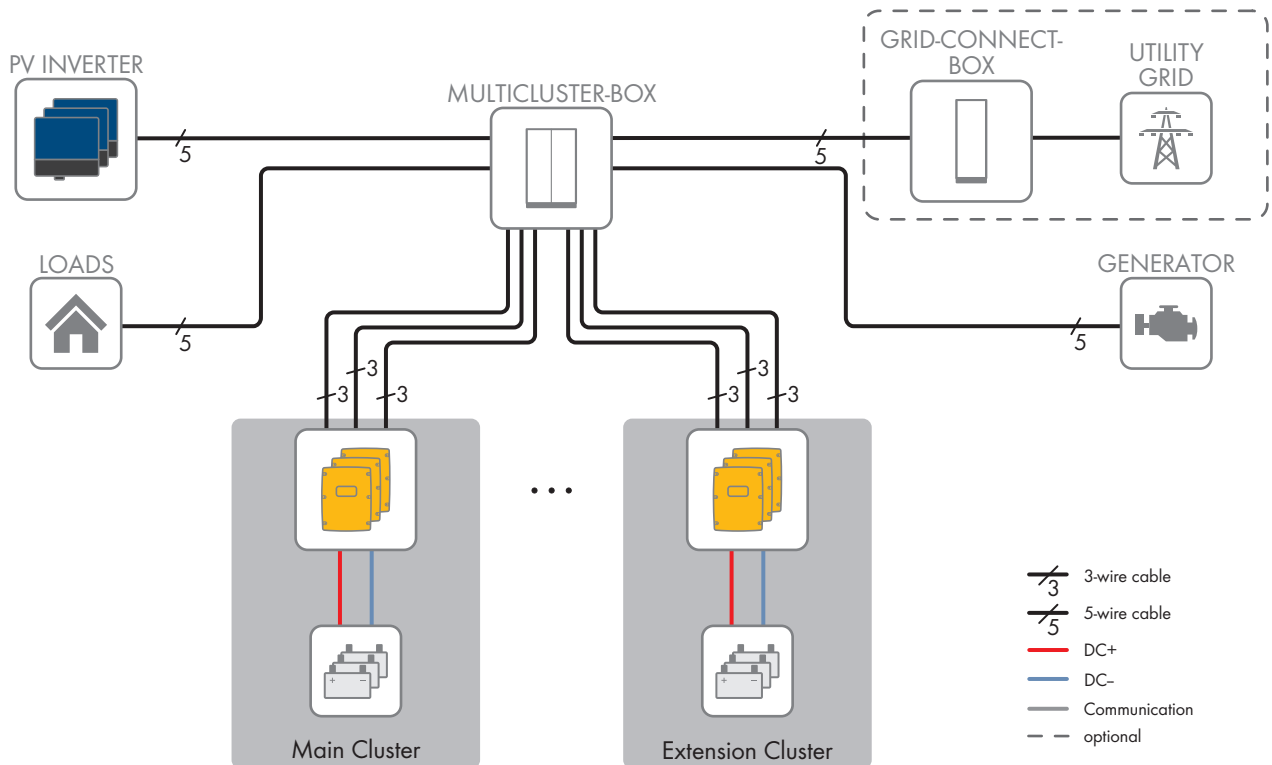


Figure 1: Principle of a multicluster system with Multicluster-Box and Grid-Connect-Box

The Multicluster-Box is the main AC distribution board in a multicluster system. The multicluster system forms an AC grid and is made up of several three-phase clusters. 3 Sunny Island inverters are connected in parallel on the DC side of each cluster. The multicluster system can be set up as an off-grid system or as a system with increased self-consumption and battery-backup function.

The main cluster is the leading cluster in the multicluster system. The extension clusters are subordinate to the main cluster.

PV arrays used as external energy sources must be connected to the Multicluster-Box only. To connect the utility grid to the multicluster system, a Grid-Connect-Box must be installed.

### 3.2 Structures of a Multicluster System

#### 3.2.1 Structures for Off-Grid Systems

##### Multicluster-Box only with Generator

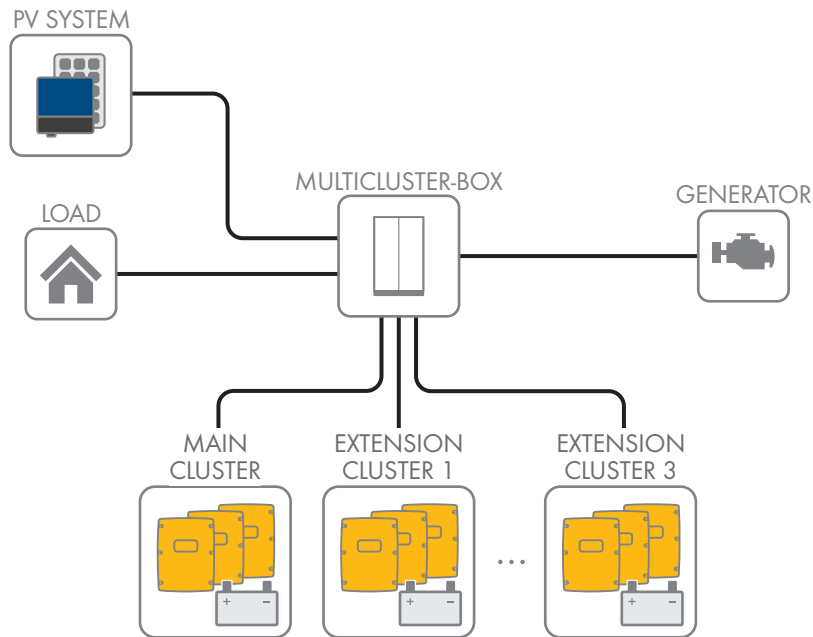


Figure 2: Principle of a multicluster system with Multicluster-Box and generator

If only the generator as external energy source is connected to the Multicluster-Box, the multicluster system must be configured via the installation assistant for **Island mode**.

##### Multicluster-Box with Grid-Connect-Box, Utility Grid and Generator

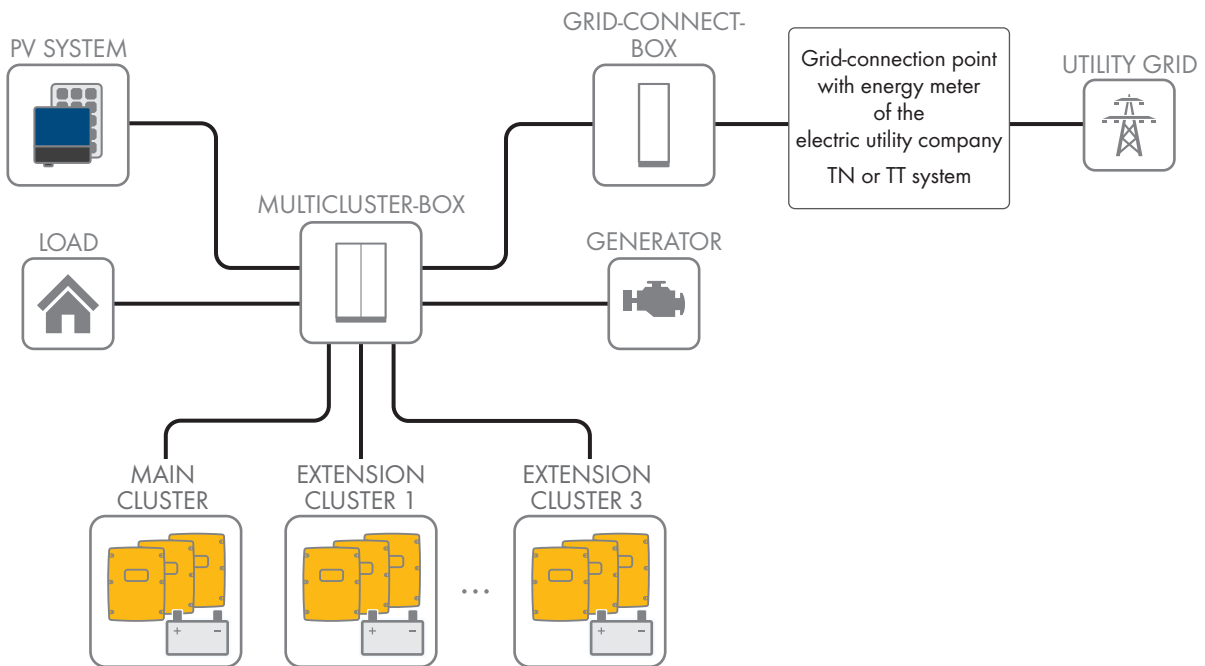


Figure 3: Principle of a multicluster system with Multicluster-Box, Grid Connect Box, utility grid, and generator

The Grid-Connect-Box enables the connection of a multicluster system to utility grids and generators. Multicluster systems with Grid-Connect-Box may not be connected to utility grids that require compliance with the European grid connection conditions in accordance with Regulation (EU) 2016/631 establishing a network code (also known as RfG).

If the utility grid only supports the generator function and no increased self-consumption is to be achieved, the multicluster system with Grid-Connect-Box must be configured via the installation assistant for **Island mode**.

### Multicluster-Box only with Utility Grid

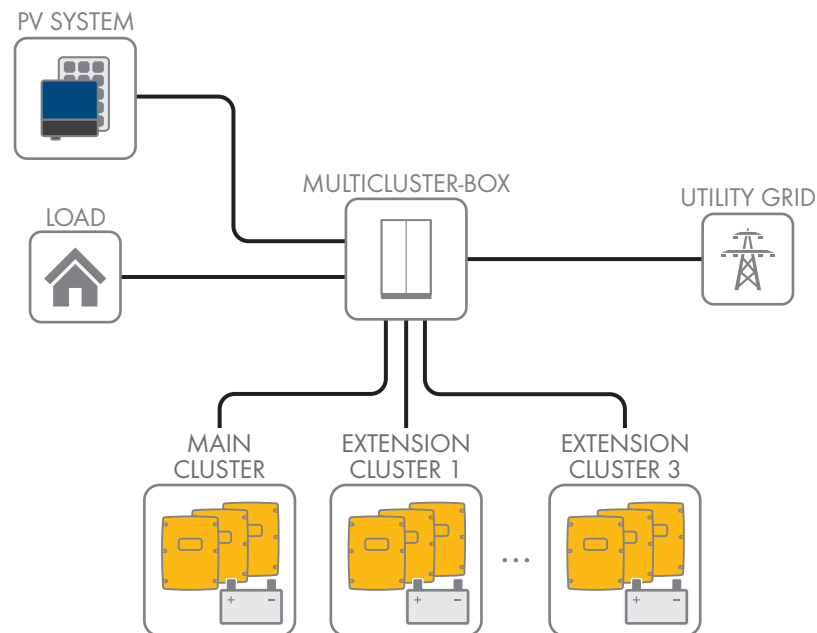


Figure 4: Principle of a multicluster system with Multicluster-Box and utility grid

If the utility grid is directly connected to the Multicluster-Box, no generator is to be installed in the multicluster system. When connecting the utility grid to the Multicluster-Box, the Multicluster-Box terminal provided for the generator must be used (see operating manual of the Multicluster-Box). The installer bears sole responsibility for the grounding configuration and the grid disconnection required for instances of grid failure. Grounding and grid disconnection must be carried out in accordance with local standards and directives and approved by the grid operator.

If the utility grid is used as the only external energy source and directly connected to the Multicluster-Box as well, the multicluster system must be configured via the installation assistant for **Island mode**

### 3.2.2 Structure for Systems with Increased Self-Consumption and Battery-Backup Function

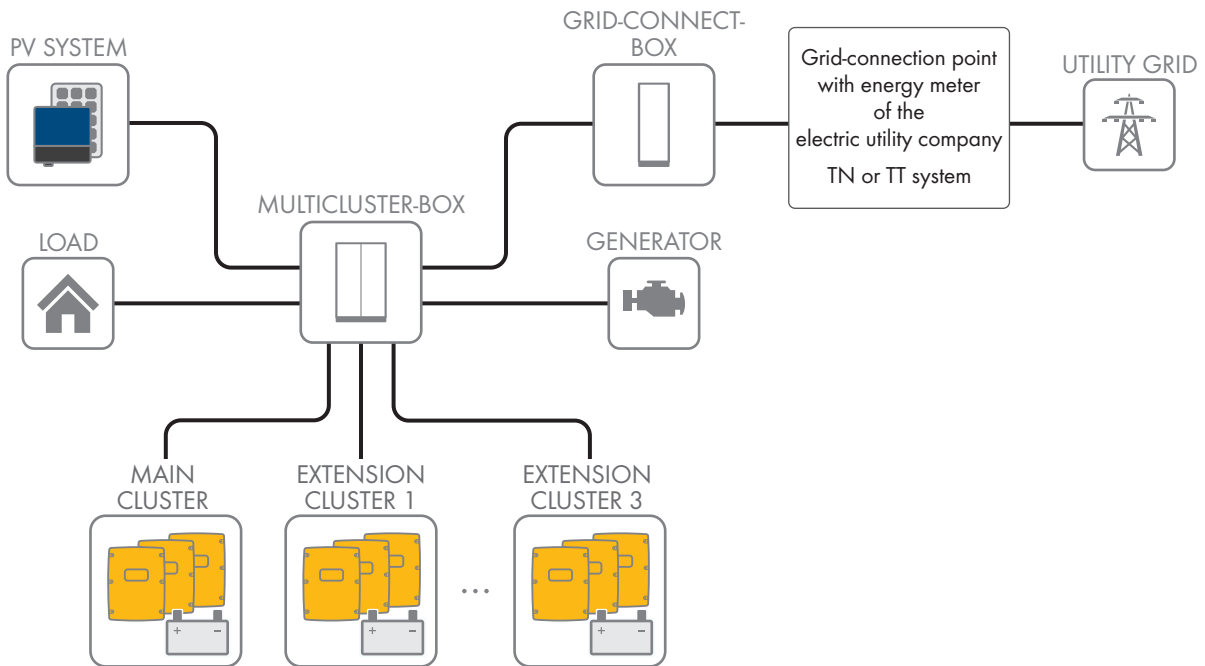


Figure 5: Principle of a multicluster system with Multicluster-Box, Grid Connect Box, utility grid, and generator

The Grid-Connect-Box enables the connection of an utility grid and a generator to one multicluster system. In doing so, the Grid-Connect-Box may only be used where the VDE-AR-N 4105 application guide for utility grids is not required. If increased self-consumption is required, the multicluster system with Grid-Connect-Box must be configured via the installation assistant for **Grid mode**.

## 3.3 Overview of firmware versions

### Systems with parallel operation with the utility grid

The system structure and system configuration (e.g. as battery-backup system) determine the firmware version that is required for commissioning the system.

System setup	Increased self-consumption	Increased self-consumption and battery backup	Battery backup
Single system or single-cluster system	from 3.20.09.R	from 3.20.09.R	from 3.20.09.R
Multicluster system with MC-Box-12.3-20	only with 1.04.00.R	only with 1.04.00.R	only with 1.04.00.R
Multicluster system with MC-Box-12.3-20 and GRID-BOX-12.3-20 <sup>1)</sup>	only with 1.04.00.R	only with 1.04.00.R	only with 1.04.00.R

<sup>1)</sup> GRID-BOX-12.3-20 can only be used in countries where compliance with the European requirements for grid connection as set out in Commission Regulation (EU) 2016/631 for establishing a network code (known as RfG) is **not** required.



## Off-grid system

The system structure and external energy source (e.g. generator) determine the firmware version that is required for commissioning the off-grid system.

System structure	Generator	Utility grid	Generator and utility grid
Single system or single-cluster system	from 3.20.09.R	from 3.20.09.R	from 3.20.09.R <sup>2)</sup>
Multicluster system with MC-Box-12.3-20	from 3.20.09.R	from 3.20.09.R	-
Multicluster system with MC-Box-12.3-20 and GRID-BOX-12.3-20 <sup>1)</sup>	-	-	from 3.20.09.R
Multicluster system with MC-Box-6.3-11 or MC-Box-36.3-11 <sup>3)</sup>	from 3.20.09.R	-	-

## 3.4 Off-Grid System

### 3.4.1 Off-Grid System Functions

Multicluster systems set up as off-grid systems can form self-sufficient utility grids fed with energy from multiple AC sources in the stand-alone grid (e.g. PV inverter) and from grid-forming AC sources (e.g. a generator). The Sunny Island forms the stand-alone grid as a AC voltage source. The Sunny Island regulates the balance between the energy that is fed in and the energy that is used and features a battery, PV array and load management system.

#### Battery Management

Exact determination of the state of charge is a basic requirement for the correct operation of lead-acid batteries.

The Sunny Island battery management system for lead-acid batteries is based on an exact determination of the state of charge. By combining the three most common methods for recording the state of charge, the Sunny Island reaches a measuring accuracy of more than 95%. This way, battery overcharge and deep discharge are avoided.

Another advantage of the battery management system is the very gentle charging control. Depending on the battery type and situation, it selects automatically the optimum charging strategy. This means that overcharging can be reliably prevented and that the battery can be fully charged regularly. The available charge energy is used optimally at all times (see technical information "Battery Management" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

#### Generator Management

The Sunny Island can synchronize with a generator and connect directly, if necessary. When the stand-alone grid is connected to the PV array, the voltage and frequency in the stand-alone grid are regulated by the PV array.

The Sunny Island generator management allows for uninterruptible connection of the stand-alone grid to the generator and uninterruptible isolation from the generator. The generator management controls the generator via a start and stop signal. A generator current control ensures that the generator always remains at the optimum operating point. The generator management allows the use of generators that have a low output power in proportion to the nominal load (see technical document "Sunny Island Generator - Whitepaper" at [www.SMA-Solar.com](http://www.SMA-Solar.com))

#### Load Control

The load control enables control of the AC sources in stand-alone grids, control of a generator, and the specific disconnection of loads.

<sup>2)</sup> An external automatic transfer switching device is required.

<sup>3)</sup> Only suitable for off-grid systems.

The AC sources in the off-grid system are limited in their power output by the stand-alone grid frequency. In case of excess energy, the load control system increases the power frequency of the stand-alone grid. This limits the output power of the PV inverters, for example.

If there is not enough energy available for all loads or the battery is to be preserved, load control can request energy from a generator by means of the generator management. The generator management starts the generator and the off-grid system is supplied with sufficient energy.

If no generator is present in the off-grid system or the energy is not sufficient despite the generator being available, load control turns the loads off using load shedding. All loads are shed simultaneously with one-stage load shedding. A load shedding contactor sheds the noncritical loads during the first stage with two-stage load shedding. The remaining loads are shed during the second stage only when the state of charge declines further. This can further increase the availability of the stand-alone grid for critical loads.

### 3.4.2 Off-Grid System Requirements

#### **i** Utility grid connection via Grid-Connect-Box

The utility grid can support or assume the function of a PV array in, for example, areas with a weak grid structure. To connect the utility grid and generator in parallel to an off-grid system, a Grid-Connect-Box must be installed.

The Grid-Connect-Box may be used only in areas where VDE-AR-N 4105 application guide does **not** apply.

The Grid-Connect-Box is always delivered with all-pole disconnection. If, during a grid failure, the technical connection requirements of the grid operator or the locally applicable standards and directives prohibit disconnection of the neutral conductor, you must deactivate the all-pole disconnection in the Grid-Connect-Box (see operating manual of the Grid-Connect-Box).

#### **i** Utility grid connection to the Multicluster-Box

If the utility grid is directly connected to the Multicluster-Box, no generator is to be installed in the multicluster system. When connecting the utility grid to the Multicluster-Box, the Multicluster-Box terminal provided for the generator must be used (see operating manual of the Multicluster-Box).

The installer bears sole responsibility for the grounding configuration and the grid disconnection required for instances of grid failure. Grounding and grid disconnection must be carried out in accordance with local standards and directives and approved by the grid operator.

### 3.4.3 Optional Devices and Functions

The following devices can be used optionally in an off-grid system:

Component	Description
External load-shedding contactor	Contactors controlled by the Sunny Island for isolation of loads in the multicluster system during two-level load shedding.
Communication product (e.g. SMA Data Manager)	Remote monitoring and system configuration of the off-grid system

The Sunny Island inverter offers the following functions for multicluster systems with stand-alone grid via 2 multifunction relays (see installation manual of the Sunny Island inverter):

Function	Description
Controlling PV arrays	A multifunction relay activates if a PV array request is received from the Sunny Island inverter's generator management system. With the multifunction relay, you can control generators with an electrical remote-start function or connect a signal generator for generators with no autostart function.

Function	Description
Controlling load-shedding contactors	A multifunction relay is activated depending on the state of charge of the battery. Depending on the configuration, you can install a one-level load shedding with 1 multifunction relay or a two-level load shedding with 2 multifunction relays. You can also adjust the thresholds for the state of charge of the battery depending on the time of day.
Time control for external processes	External processes can be time-controlled with a multifunction relay.
Display of operating states and warning messages	You can connect message devices to the multifunction relays to allow operating states and warning messages from the Sunny Island inverter to be output. 1 of the following operating states and warning messages can be displayed for each multifunction relay: <ul style="list-style-type: none"> <li>• The PV array is running and is connected.</li> <li>• A Sunny Island displays an error message of level 2 or higher. Only the error messages within a cluster are evaluated here.</li> <li>• A Sunny Island displays a warning. Only the warnings within a cluster are evaluated here.</li> </ul>
Control of a battery-room fan	The multifunction relay is activated when the charging current causes the battery to emit gasses. A connected battery room fan is switched on for at least 1 hour.
Control of an electrolyte pump	Depending on the nominal energy throughput, the multifunction relay is activated at least once a day.
Use of excess energy	During the constant voltage phase, a multifunction relay is activated and thus controls additional loads that can put any excess energy of AC sources in the stand-alone grid (e.g., of a PV system) to good use.

**Also see:**

> Section 2.1 "Intended Use", page 7

## 3.5 Multicluster System with Increased Self-Consumption and Battery-Backup Function

### 3.5.1 Principle of a System with Increased Self-Consumption and Battery-Backup Function

Multicluster systems with increased self-consumption and battery-backup function (battery-backup systems) are connected to the utility grid via a Grid-Connect-Box.

When the system with increased self-consumption and battery-backup function is connected to the utility grid, Sunny Island inverters can use the batteries for intermediate storage of PV energy. The stored PV energy can then be used by your appliances during the evening and nighttime hours. With this, electricity purchased from the grid can be reduced and self-consumption or internal power supply optimized.

The Grid Connect Box disconnects the system with increased self-consumption and battery-backup function from the utility grid during grid failure. The loads are supplied with power via the battery-backup grid without interruption. The PV system can synchronize with the system with increased self-consumption and battery-backup function and feed in. When the utility grid is available again, the system with increased self-consumption and battery-backup function synchronizes with the utility grid. Following successful synchronization, the Grid Connect Box connects the system with increased self-consumption and battery-backup function to the utility grid.

### 3.5.2 Requirements of VDE Application Guide 2510-2

The requirements below apply only for systems for which the following properties are all applicable:

- The system is a system with increased self-consumption or a system with increased self-consumption and battery-backup function.
- The grid operator or the locally applicable standards and guidelines require compliance with the above-mentioned Application Guide.

Currently, only the grid operators in Germany require compliance with the above-mentioned Application Guide.

In accordance with the scope of VDE application guide 2510-2, a manufacturer's system is regarded as a complete energy storage system only if products are used that have been approved by the manufacturer (see the technical information "List of Approved Batteries" at [www.SMA-Solar.com](http://www.SMA-Solar.com)). If products are used that have not been approved by SMA Solar Technology AG, the installer is deemed to be the manufacturer of the system.

The requirements of VDE application guide 2510-2 are fulfilled if the installation is carried out in the accordance with the technical documentation of the battery inverter.

### 3.5.3 Requirements for Systems with Increased Self-Consumption and Battery-Backup Function

#### **i** Utility grid connection via Grid-Connect-Box

The Grid-Connect-Box may be used only in areas where VDE-AR-N 4105 application guide does **not** apply.

The Grid-Connect-Box is always delivered with all-pole disconnection. If, during a grid failure, the technical connection requirements of the grid operator or the locally applicable standards and directives prohibit disconnection of the neutral conductor, you must deactivate the all-pole disconnection in the Grid-Connect-Box (see operating manual of the Grid-Connect-Box).

#### **i** Electricity supply of communication devices

During a grid failure, only the devices in the battery-backup grid are supplied with current.

- Connect the electricity supply of communication devices to the battery-backup grid.

## 4 Circuitry of Multicluster Systems

### 4.1 Connecting the Master in the Main Cluster

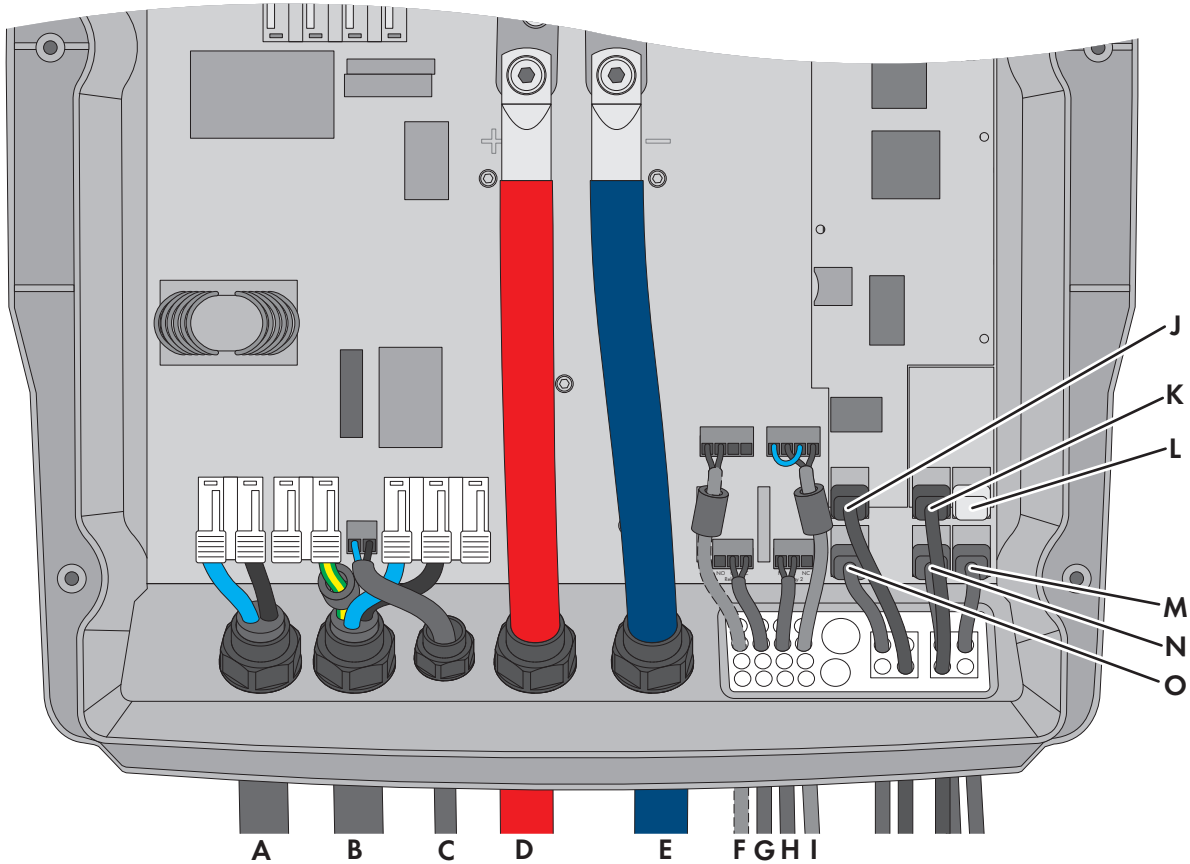


Figure 6: Connection of masters in main cluster (Example for a multicluster system with PV array and utility grid)

Position	Designation	Description / information
A	Cable for the control voltage	Sunny Island: connection <b>AC1 Loads/SunnyBoys</b> terminals <b>L</b> and <b>N</b> Multicluster-Box: connection <b>X106</b> terminals <b>1, 2</b> and <b>4</b> Conductor cross-section: from 1.5 mm <sup>2</sup> to 2.5 mm <sup>2</sup>
B	AC power cable	Sunny Island: connection to <b>AC2 Gen/Grid</b> terminals <b>L, N</b> and <b>grounding conductor</b> Multicluster-Box: connection <b>X105</b> terminals <b>1, 4</b> and <b>7</b> Conductor cross-section: from 10 mm <sup>2</sup> to 16 mm <sup>2</sup> Use the ferrite included in the delivery for the <b>PE</b> .
C	Measuring cable for voltage measurement	Sunny Island: connection <b>ExtVtg</b> terminals <b>L</b> and <b>N</b> Multicluster-Box: connection <b>X112</b> terminals <b>3</b> and <b>4</b> Conductor cross-section: from 1.5 mm <sup>2</sup> to 2.5 mm <sup>2</sup>
D	DC+ cable	Battery connection
E	DC- cable	Conductor cross-section: from 50 mm <sup>2</sup> to 95 mm <sup>2</sup> Cable diameters 14 mm to 25 mm Torque: 12 Nm

Position	Designation	Description / information
F	Measuring cable of the battery temperature sensor	<p>Sunny Island: connection <b>BatTmp</b></p> <p>You only have to connect a battery temperature sensor if lead-acid batteries are used.</p> <p>Mount the battery temperature sensor in the middle of the battery-storage system, in the upper third of the battery cell.</p> <p>Use the ferrite included in the delivery.</p>
G	Control cable to the Multicenter-Box	<p>The control cable must be connected if a Grid-Connect-Box is installed.</p> <p>Sunny Island: connection <b>Relay1</b> terminals <b>C</b> and <b>NC</b></p> <p>Multicenter-Box: connection <b>X112</b> terminals <b>1</b> and <b>2</b></p> <p>Conductor cross-section: from 1.5 mm<sup>2</sup> to 2.5 mm<sup>2</sup></p>
H	Control cable to the Multicenter-Box	<p>Sunny Island: connection <b>Relay2</b> terminals <b>C</b> and <b>NO</b></p> <p>Multicenter-Box: connection <b>X113</b> terminals <b>1</b> and <b>2</b></p> <p>Conductor cross-section: from 1.5 mm<sup>2</sup> to 2.5 mm<sup>2</sup></p>
I	Control cable to the Multicenter-Box	<p>Sunny Island: connections <b>DigIn+</b> und <b>BatVtgOut+</b></p> <p>Multicenter-Box: connection <b>X113</b> terminals <b>3</b> and <b>4</b></p> <p>Inside the Sunny Island, connect terminals <b>DigIn-</b> and <b>BatVtgOut-</b>.</p> <p>Conductor cross-section: from 1.5 mm<sup>2</sup> to 2.5 mm<sup>2</sup></p> <p>The complete DC voltage range is mapped at the terminal <b>BatVtgOut</b>. The connection <b>BatVtgOut</b> is current-limited and protected against short circuits. Use the supplied ferrite for <b>BatVtgOut</b>.</p>
J	Speedwire network cable	Terminal <b>ComETH</b>
K	Data cable for the communication with the masters of the extension cluster	<p>At SI-SYSCAN.BGx terminal <b>SysCanIn</b></p> <p>Master of the extension cluster: at SI-SYSCAN.BGx</p> <p>Terminal <b>SysCanOut</b></p> <p>The communication bus must be equipped with a terminator on both ends.</p>
L	Terminator	<p>At SI-SYSCAN.BGx terminal <b>SysCanOut</b></p> <p>The communication bus must be equipped with a terminator on both ends.</p>
M	Data cable for communication within the cluster	<p>Sunny Island: terminal <b>ComSyncOut</b></p> <p>The communication bus connects the master with the slaves in each cluster and additionally with the Multicenter-Box in the main cluster.</p> <p>The communication bus must be equipped with a terminator on both ends.</p>
N	Data cable for communication within the cluster	<p>Sunny Island: terminal <b>ComSyncIn</b></p> <p>Multicenter-Box: terminal <b>ComSyncOut</b></p> <p>The communication bus must be equipped with a terminator on both ends.</p>

Position	Designation	Description / information
○	Measuring cable	Sunny Island: terminal <b>BackupVtgCur</b> Multicluster Box: terminal <b>Mstr./L1</b>
-	Openings in the cable support sleeves	Unused openings in the cable support sleeves of the Sunny Island must be sealed (see operating manual of the Sunny Island).

## 4.2 Connecting Slave 1 in the Main Cluster

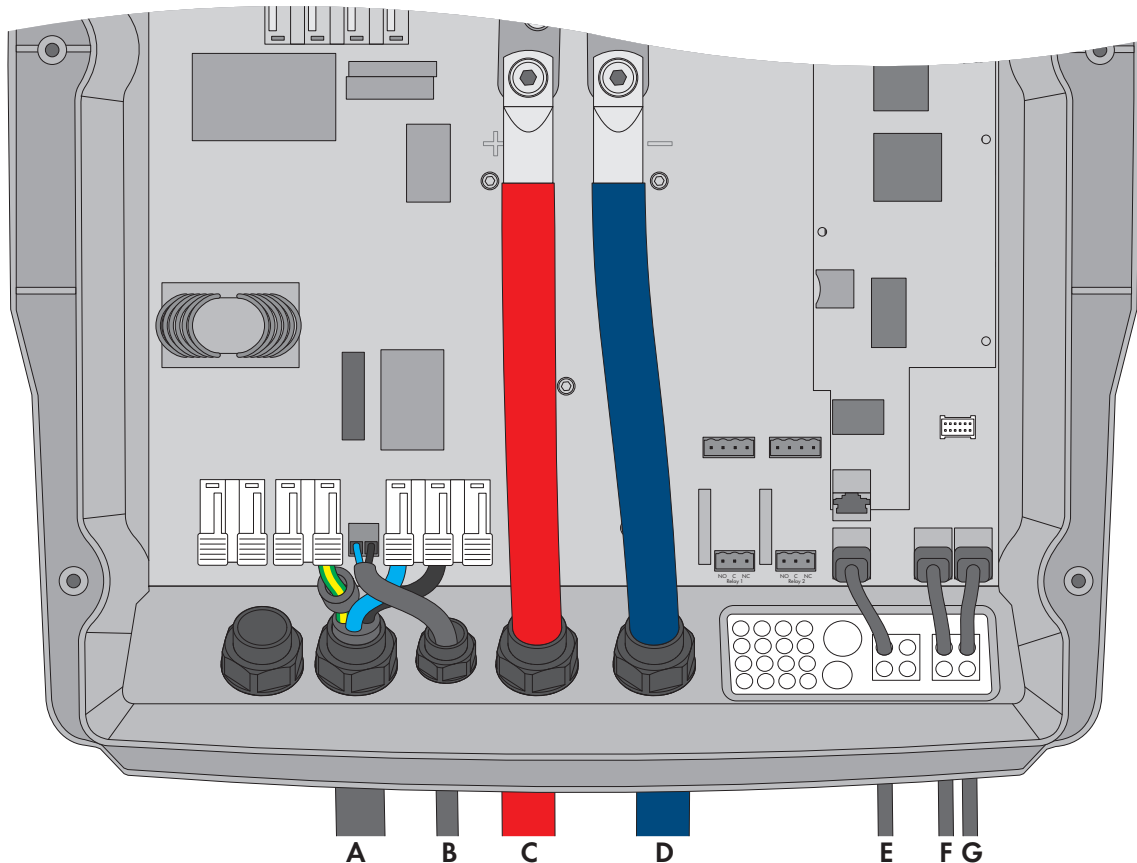


Figure 7: Connection of slave 1 in main cluster (Example for a multicluster system with PV array and utility grid)

Position	Designation	Description / information
A	AC power cable	Sunny Island: connection to <b>AC2 Gen/Grid</b> terminals <b>L, N</b> and <b>grounding conductor</b> Multicluster-Box: connection <b>X105</b> terminals <b>2, 5</b> and <b>8</b> Conductor cross-section: from 10 mm <sup>2</sup> to 16 mm <sup>2</sup> Use the ferrite included in the delivery for the <b>PE</b> .
B	Measuring cable for voltage measurement	Sunny Island: connection <b>ExtVtg</b> terminals <b>L</b> and <b>N</b> Multicluster-Box: connection <b>X112</b> terminals <b>7</b> and <b>8</b> Conductor cross-section: from 1.5 mm <sup>2</sup> to 2.5 mm <sup>2</sup>

Position	Designation	Description / information
C	DC+ cable	Battery connection
D	DC- cable	Conductor cross-section: from 50 mm <sup>2</sup> to 95 mm <sup>2</sup> Cable diameters: 14 mm to 25 mm Torque: 12 Nm
E	Measuring cable	Sunny Island: terminal <b>BackupVtgCur</b> Multicenter-Box: terminal <b>Slv.1/L2</b>
F	Data cable for the internal communication in the cluster	Sunny Island: terminal <b>ComSyncIn</b> Master: terminal <b>ComSync Out</b>
G	Data cable for the internal communication in the cluster	Sunny Island: terminal <b>ComSyncOut</b> With slave 2: terminal <b>ComSyncIn</b>



### 4.3 Connecting Slave 2 in the Main Cluster

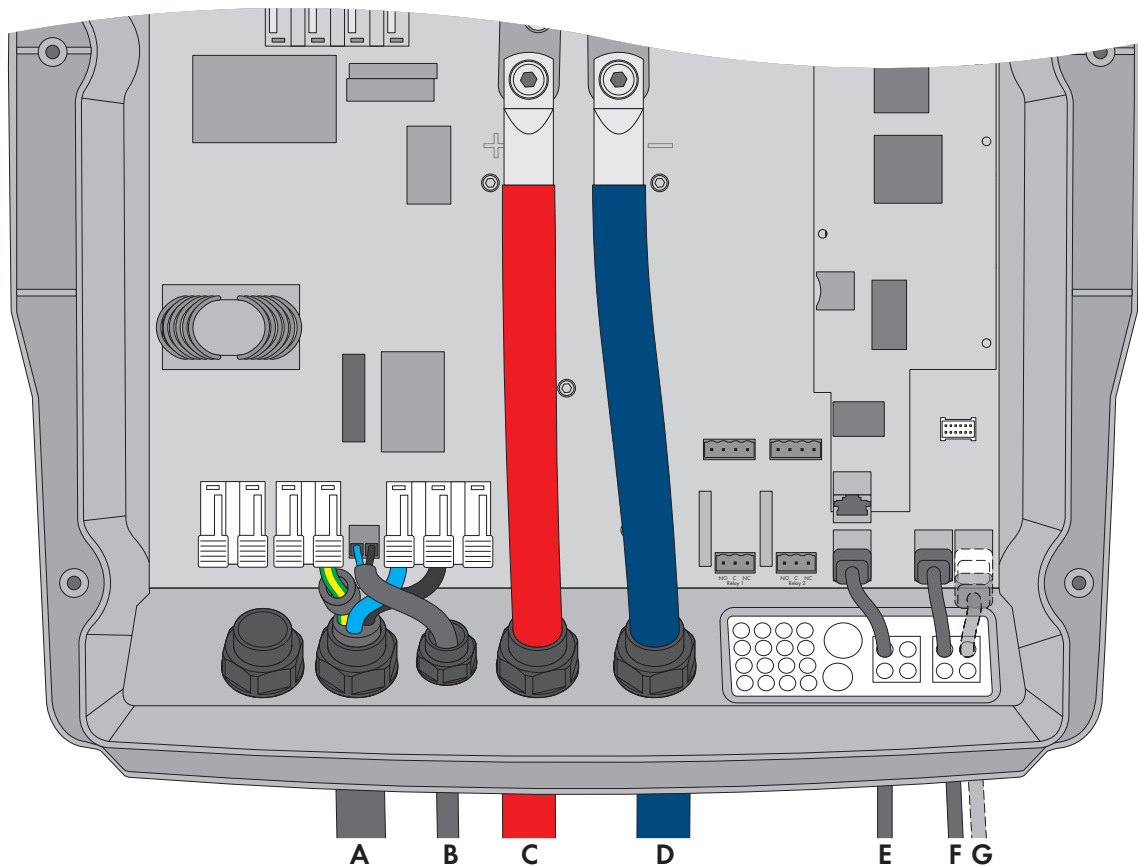


Figure 8: Connection of slave 2 in main cluster (Example for a multicenter system with PV array and utility grid)

Position	Designation	Description / information
A	AC power cable	Sunny Island: connection to <b>AC2 Gen/Grid</b> terminals <b>L, N</b> and <b>grounding conductor</b> Multicenter-Box: connection <b>X105</b> terminals <b>3, 6</b> and <b>9</b> Conductor cross-section: from 10 mm <sup>2</sup> to 16 mm <sup>2</sup> Use the ferrite included in the delivery for the <b>PE</b> .
B	Measuring cable for voltage measurement	Sunny Island: connection <b>ExtVtg</b> terminals <b>L</b> and <b>N</b> Multicenter-Box: connection <b>X112</b> terminals <b>9</b> and <b>10</b> Conductor cross-section: from 1.5 mm <sup>2</sup> to 2.5 mm <sup>2</sup>
C	DC+ cable	Battery connection
D	DC- cable	Conductor cross-section: from 50 mm <sup>2</sup> to 95 mm <sup>2</sup> Cable diameters: 14 mm to 25 mm Torque: 12 Nm
E	Measuring cable	Sunny Island: terminal <b>BackupVtgCur</b> Multicenter-Box: terminal <b>Slv.2/L3</b>

Position	Designation	Description / information
F	Data cable for the internal communication in the cluster	Sunny Island: terminal <b>ComSyncIn</b> Slave 1: terminal <b>ComSyncOut</b>
G	Data cable for the internal communication in the cluster	Terminal <b>ComSyncOut</b> A data cable must be connected to the battery only when lithium-ion batteries are used. The communication bus must be equipped with a terminator on both ends.

#### 4.4 Connecting the Sunny Island Inverters in Extension Clusters

Function of the Sunny Island inverter	Which cables must be connected?	Where must the cables be connected?
Master in extension cluster 1/2/3	See installation - Circuitry Overview of the Multicenter-Box	see (see Section 4.1, page 21)
Slave 1 in extension cluster 1/2/3		see (see Section 4.2, page 23)
Slave 2 in extension cluster 1/2/3		see (see Section 4.3, page 25)

## 5 Commissioning

### 5.1 Commissioning Procedure

#### 5.1.1 Commissioning Procedure for an Off-Grid System

Procedure	See
1. Prior to commissioning, ensure that the residual-current devices and interface switches are tripping properly: Check the residual-current devices in the Multicluster-Box.	Operating manual for the Multi-cluster-Box
2. If a Grid-Connect-Box has been installed, check residual-current devices in the Grid-Connect-Box.	Operating manual for the Grid-Connect-Box
3. Ensure that the inverter is equipped with a firmware version that are suitable for the respective system.	Section 3.3, page 16
4. Commission the inverter.	Sunny Island operating manual
5. Establish a connection to the user interface of the inverter. The following connection options are available to choose from: <ul style="list-style-type: none"> <li>• Direct connection via Wi-Fi</li> <li>• Direct connection via Ethernet</li> <li>• Connection via Ethernet in the local network</li> </ul>	Sunny Island operating manual
6. Log into the user interface.	Sunny Island operating manual
7. Perform basic configuration of the inverter. Note that the personal SMA Grid Guard code for changing the grid-relevant parameters must be available after completion of the first 10 operating hours. You can request the SMA Grid Guard code via the Online Service Center.	Sunny Island operating manual
8. Set the functions of the multifunction relay via the user interface. Tip: The multifunction relays are connected based on the default values of the Sunny Island in the circuitry overviews.	Sunny Island operating manual
9. Start the system.	Sunny Island operating manual
10. Test the battery current sensor.	System description "Off-Grid Systems" of the Sunny Island
11. Test the generator.	System description "Off-Grid Systems" of the Sunny Island
12. Commission the multifunction relays.	Section 5.2.1, page 29
13. Test the load shedding.	Section 5.2.2, page 29

Procedure	See
14. Commission the PV system.	PV inverter documentation
15. If the PV inverters are not configured for stand-alone mode ex works, configure the country standard or country data set of the PV inverters for stand-alone mode (see the PV inverter documentation).	
16. Complete commissioning. Observe that the system data in the information sheet for Sunny Island systems must be recorded to receive services for the Sunny Island system.	System description "Off-Grid Systems" of the Sunny Island

### 5.1.2 Procedure when Commissioning a System with Increased Self-Consumption and Battery-Backup Function

Procedure	See
1. Prior to commissioning, ensure that the residual-current devices and interface switches are tripping properly: <ul style="list-style-type: none"> <li>• Check the residual-current devices in the Multicluster-Box.</li> <li>• If a Grid-Connect-Box has been installed, check residual-current devices in the Grid-Connect-Box.</li> </ul>	Operating manual for the Multicluster-Box  Operating manual for the Grid-Connect-Box
2. Ensure that the inverter is equipped with a firmware version that are suitable for the respective system.	Section 3.3, page 16
3. Commission the inverter.	Installation manual for the Sunny Island
4. Establish a connection to the user interface of the inverter. The following connection options are available to choose from: <ul style="list-style-type: none"> <li>• Direct connection via Wi-Fi</li> <li>• Direct connection via Ethernet</li> <li>• Connection via Ethernet in the local network</li> </ul>	Sunny Island operating manual
5. Log into the user interface.	Sunny Island operating manual
6. Perform basic configuration of the inverter. Note that the personal SMA Grid Guard code for changing the grid-relevant parameters must be available after completion of the first 10 operating hours. You can request the SMA Grid Guard code via the Online Service Center.	Sunny Island operating manual
7. Adjust the configuration of the Sunny Island.	Section 5.3.1, page 29
8. Adjust the configuration of the PV inverters.	Section 5.3.2, page 30
9. Commission the system with increased self-consumption and battery-backup function. Observe that the system data in the information sheet for Sunny Island systems must be recorded to receive services for the Sunny Island system.	Section 5.3.3, page 30
10. To use PV system monitoring, register your multicluster system in Sunny Portal.	Section 5.3.4, page 31

## 5.2 Commissioning an Off-Grid System

### 5.2.1 Commissioning the Multifunction Relays

In multicluster systems with MC-BOX-12.3-20, multifunction relays 1 and 2 in the master of the main cluster and multifunction relay 2 in slave 1 of the main cluster are set permanently. Therefore, optional components and functions can only be controlled via Sunny Island inverters in the extension clusters.

- Set the functions of the multifunction relays in the Sunny Island inverters of the extension clusters (see operating manual of the Sunny Island inverter).

### 5.2.2 Testing the Load Shedding

#### Requirements:

- The additional load-shedding contactor is connected to a multifunction relay in the master of the extension cluster.
- The battery inverter must be in operation (for information on starting the operation see the operating manual of the inverter).

#### Procedure:

1. Activate the user interface of the inverter (see the inverter operating manual).
2. Log in as Installer.
3. Select the parameter **Device > Multifunction relay > Operating mode > Operating mode of multifunction relay**.
4. Note the parameter value of the load-shedding contactor.
5. Set the parameter of the load-shedding contactor to **Off**.
6. If the load-shedding contactor does not shed the loads, check the load shedding configuration and troubleshoot. Ensure that the multifunction relay is correctly wired.
7. Set the load-shedding contactor parameter to the setting that has been noted down.

## 5.3 Commissioning a System With Increased Self-Consumption and Battery-Backup Function

### 5.3.1 Adjusting the Configuration of the Sunny Island

If multicluster systems are used with the Grid-Connect-Box for increased self-consumption and as a battery-backup system, the following must be taken into account: Multicluster systems with Grid-Connect-Box may not be connected to utility grids that require compliance with the European grid connection conditions in accordance with Regulation (EU) 2016/631 establishing a network code (also known as RfG).

#### Procedure:

1. For the planned installation site, check whether parameters of the PV inverter for grid monitoring of the Sunny Island must be set and adjusted.
2. Check the settings with your grid operator.
3. Access the Sunny Island user interface (see user manual of the Sunny Island).
4. Log in as Installer.
5. Select the parameter **Grid Monitoring > Grid monitoring > Country standard > Country standard set** and set it to the value **DE VDE-AR-N4105-MC**.
6. To adjust the grid monitoring parameters on the Sunny Island, enter the SMA Grid Guard code and adjust the grid monitoring parameters as agreed with the grid operator (see Sunny Island operating manual). As a result, the parameter value is changed from **Grid Monitoring > Grid monitoring > Country standard > Country standard set** to **SMA Adjusted-MC**.

### 5.3.2 Adjusting the Configuration of the PV Inverters

In systems with increased self-consumption and battery-backup function, the active power of the PV inverters should be controlled frequency-dependent. The manner of the frequency-dependent active power limitation complies with the locally applicable standards and directives.

#### Requirements:

- The firmware version of the PV inverters must support the frequency-dependent control of active power (for "PV inverters," see the planning guidelines "'SMA Energy System Home with Battery-Backup Function" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

#### Procedure:

1. For the planned installation site, check which country data set of the PV inverter corresponds to the grid operator's requirements and supports frequency-dependent regulation of the active power.
2. Ensure that the country data set has been configured correctly at the PV inverter.

### 5.3.3 Commissioning the System with Increased Self-Consumption and Battery-Backup Function

#### **i** The intermediate storage of PV energy is activated automatically.

Regarding the system with increased self-consumption and battery-backup function, the parameter **Functions for grid/offgrid operation** must be set to **Functions for grid operation** during basic configuration (see Section 5.1.2, page 28). The intermediate storage of PV energy is thereby activated automatically.

#### **i** Deactivation of the intermediate storage of PV energy during certain charging procedures

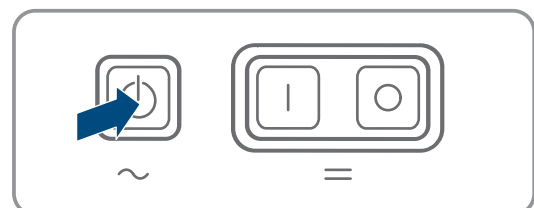
When using lead-acid batteries, the Sunny Island carries out full and equalization charges on a regular basis (see technical information "Battery Management" at [www.SMA-Solar.com](http://www.SMA-Solar.com)). As a result, the service life of the battery is increased. During full and equalization charges, the intermediate storage of PV energy is deactivated and electricity may have to be purchased to perform the full and equalization charges.

#### Requirements:

- The preparations for the commissioning at the Multicluster-Box must be completed.
- The preparations for commissioning at the Grid-Connect Box must be completed (see the operating manual for the Multicluster-Box and operating manual for the Grid-Connect-Box).
- The function of the residual-current devices and the tie switches must be checked (see the operating manual for the Multicluster-Box and operating manual for the Grid-Connect-Box).
- The basic configuration of the Sunny Island must be implemented for **Island mode**.

#### Procedure:

1. Attach a clearly visible information about the installed battery-backup system to the AC main distribution board.
2. Commission the PV system.
3. To deactivate the intermediate storage of PV energy, select in the display group on the master of the main cluster **Device > device > Self-consumption** the parameter **Rise in self-consumption switched on** and set to **No**.
4. Press the start-stop button on the master of the main cluster and hold it until a signal sounds.



5. In order to receive service assignments for the Sunny Island system, all system data must be recorded in the information sheet for Sunny Island systems and made available to Service (for information sheet see [www.SMA-Solar.com](http://www.SMA-Solar.com)).

### 5.3.4 Registering the Multicluster System in Sunny Portal

To use PV system monitoring, register your multicluster system in Sunny Portal powered by ennexOS.

**Requirements:**

- A SMA Data Manager M/L must be installed in the multicluster system.

**Procedure:**

- Register the SMA Data Manager M/L in Sunny Portal (see operating manual of the communication product).

## 6 Contact

If you have technical problems with our products, please contact the SMA Service Line. The following data is required in order to provide you with the necessary assistance:

- Type of system installed (e.g. three-phase single-cluster system)
- Battery inverter:
  - Device type
  - Quantity
  - Serial numbers
  - Firmware version
  - Event message
  - File with event messages for troubleshooting
  - Service files for troubleshooting
- Type of the communication products connected
- Type and size of additional energy sources
- Type, power and maximum current for the generator (if present)
- Batteries:
  - Type
  - Nominal capacity and nominal voltage (with lead-acid batteries)

You can find your country's contact information at:



<https://go.sma.de/service>





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