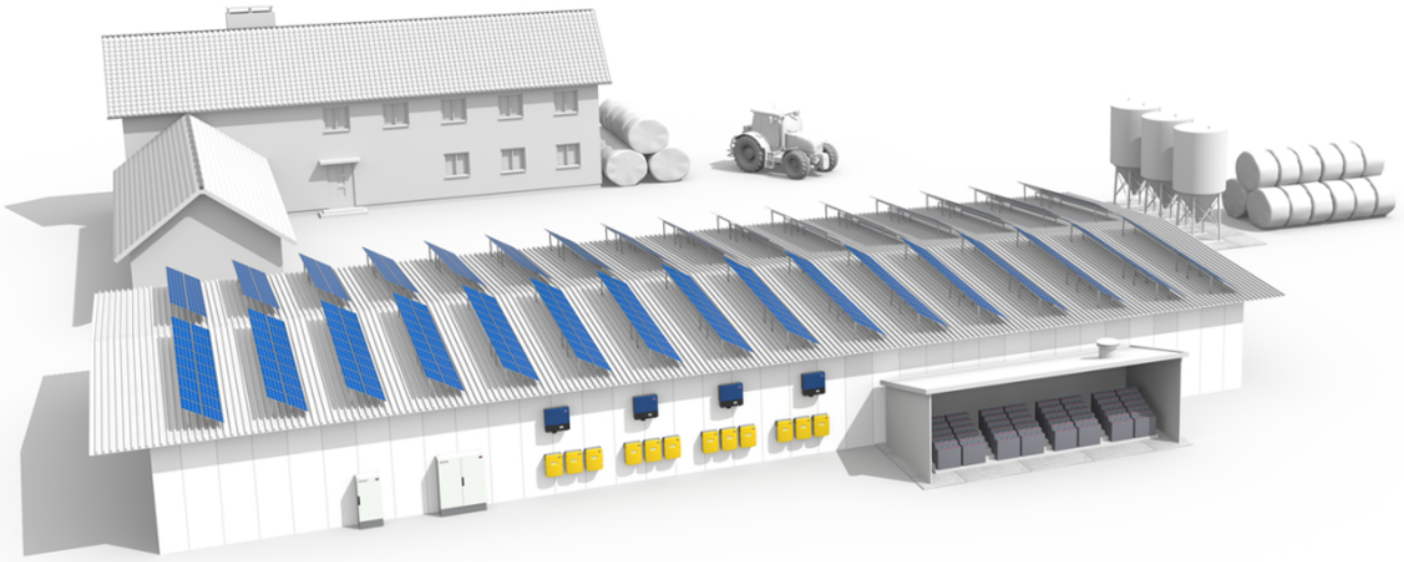
Installation – Quick Reference Guide

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

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



ENGLISH

Multicluster-IS-en-12 | Version 1.2

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1 Information on this Document

1.1 Validity

This document is valid for off-grid systems with the following device types:

- SI6.0H-11 (Sunny Island 6.0H) from firmware version 3.5
- SI8.0H-11 (Sunny Island 8.0H) from firmware version 3.5
- MC-Box-12.3-20 (Multicluster-Box 12)
- NA-Box-12.3-20 (NA-Box 12)
- GRID-Box-12.3-20 (Grid-Connect-Box 12)

1.2 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 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.

1.3 Target group

The tasks described in this document must only be performed by 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 electrical devices
- Knowledge of and adherence to the local standards and directives
- Knowledge of and compliance with the documentation of the Sunny Island inverter with all safety information

1.4 Additional Information

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

Document title and content	Document type
MULTICLUSTER-BOX 12	Installation – circuitry overview
MULTICLUSTER-BOX 12	Operating manual
SUNNY ISLAND 3.0M / 4.4M / 6.0H / 8.0H	Installation manual
NA-BOX 12	Operating manual
GRID-CONNECT-BOX 12	Operating manual

1.5 Symbols

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

Symbol	Explanation
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

1.6 Typographies

Typography	Use	Example
bold	• Display messages • Parameter • Terminals • Slots • Elements to be selected • Elements to be entered	• Connect the grounding conductor to **AC2 Gen/ 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 that is to be selected or clicked on	• Select [**Enter**].

1.7 Nomenclature

Complete designation	Designation in this document
Multicluster system with stand-alone grid	Off-grid system
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
Multicluster-Box 12	Multicluster-Box
Grid-Connect-Box 12	Grid-Connect-Box
NA-Box 12	NA-Box
Sunny Island 6.0H / 8.0H	Sunny Island
Sunny Boy, Sunny Mini Central, Sunny Tripower	PV inverter
Gird-forming generators such as generator or utility grids	External energy source

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

2 Safety

2.1 Intended Use

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. Three 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.

Generators used as external energy sources must always be connected to the Multicluster-Box.

An utility grid connected to the multicluster system must be in any case 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.

The Multicluster-Box, Grid-Connect-Box and NA-Box do not replace the distribution board for the loads or the PV system. You must additionally install the necessary protective devices for the loads and the PV system.

Loads in multicluster systems are not 100% protected against power failure. The multicluster system is not suitable for supplying life-sustaining medical devices.

Only Sunny Island inverters of the same device type may be installed in a cluster: SI6.0H-11 or SI8.0H-11.

The Sunny Island uses lead-acid batteries or lithium-ion batteries for energy storage. Ensure that the battery room is sufficiently ventilated when lead-acid batteries are used (see the battery manufacturer's documentation). If a lithium-ion battery is connected, its battery management must be compatible with the Sunny Island (see the technical information "List of Approved Lithium-Ion Batteries" at www.SMA-Solar.com). The lithium-ion battery must be able to supply enough electric current at the Sunny Island inverter's maximum output power (for technical data, see installation manual of the Sunny Island inverter).

The AC sources in the multicluster system must be suitable for stand-alone mode with Sunny Island (for PV inverters see technical information "PV Inverters in Off-Grid Systems" at www.SMA-Solar.com). The maximum output power of the AC sources in a stand-alone grid must be observed (see installation manual of the Sunny Island inverter).

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 Flexible Storage System with Battery Backup Function" at www.SMA-Solar.com). The maximum output power of the PV system depends on the installation site (see Section 3.4.3, page 19).

Only if multicluster systems with lead-acid batteries are operated as off-grid systems, DC loads or DC charge controllers may be implemented in these multicluster systems. Sunny Island Chargers or charge controllers from third-party suppliers can be used as DC charge controllers. The number of charge controllers Sunny Island Charger is limited to four per cluster. If charge controllers from a third-party supplier or DC loads are installed in a multicluster system, an additional battery current sensor must be installed.

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 NA-Box or 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 this system only in accordance with the information provided in the enclosed documentation and with the locally applicable standards and directives. Any other application may cause personal injury or property damage.

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

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

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

2.2 Safety Information

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

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.

⚠ WARNING

Danger to life from electric shock due to live voltage

High voltages are present in the multicluster system. When covers (e.g. an enclosure lid) are removed, this presents a risk of coming into contact with live components. Contact 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.
- Switch off or disconnect the following components in the following order:
  - Multicluster-Box
  - NA-Box / Grid-Connect-Box
  - PV main distribution board
  - Generator
  - Circuit breaker at the grid connection point
  - All Sunny Island inverters
  - Load-break switch of the battery
- Ensure that the multicluster system cannot be reconnected.
- Open the device and ensure that no voltage is present
- Ground and short-circuit the AC conductors outside the device.
- Cover or isolate any adjacent live components.

⚠ WARNING

Danger to life from electric shock due to damaged components

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

- Only operate the multicluster system when it is technically faultless and in an operationally safe state.
- Check the multicluster system regularly for visible damage.
- Ensure that all safety equipment is freely accessible at all times.
- Make sure that all safety equipment is in good working order.

⚠ WARNING

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

In the stand-alone grid/battery-backup grid, only the circuit breakers that can be tripped by the Sunny Island can be tripped in the event of a grid failure. 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. This can result in death or serious injury.

- 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 breaker that can be tripped, you should also install a residual-current device of type A.

⚠ 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.

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

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

⚠ WARNING

Chemical burns and poisoning due to battery electrolyte

If handled inappropriately, battery electrolyte can cause irritation to the eyes, respiratory system and skin, and it can be toxic. This may result in blindness or serious chemical burns.

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

⚠ WARNING

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.

⚠ WARNING

Risk of crushing injuries due to moving PV array parts

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

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

⚠ CAUTION

Risk of burns due to short-circuit currents on the disconnected Sunny Island

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

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

NOTICE

Damage to the battery due to incorrect settings

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

- 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). Note that the battery charging behavior names used by SMA Solar Technology AG and the battery manufacturer may, in some cases, differ in meaning (for the battery charging behavior of the Sunny Island inverter, see technical information "List of Approved Lithium-Ion Batteries").
- Set the battery capacity for a ten-hour electric discharge (C10). The battery manufacturer specifies the battery capacity in relation to discharge time.

NOTICE

Damage of components due to electrostatic discharges

If enclosure parts are removed, the devices (e.g. Sunny Island or PV inverter) can be damaged or destroyed if electronic components or terminals are touched.

- Do not touch any electronic components in open devices.
- Ground yourself before touching any terminals.

3 Information and System Description

3.1 Design of a Multicluster-Box

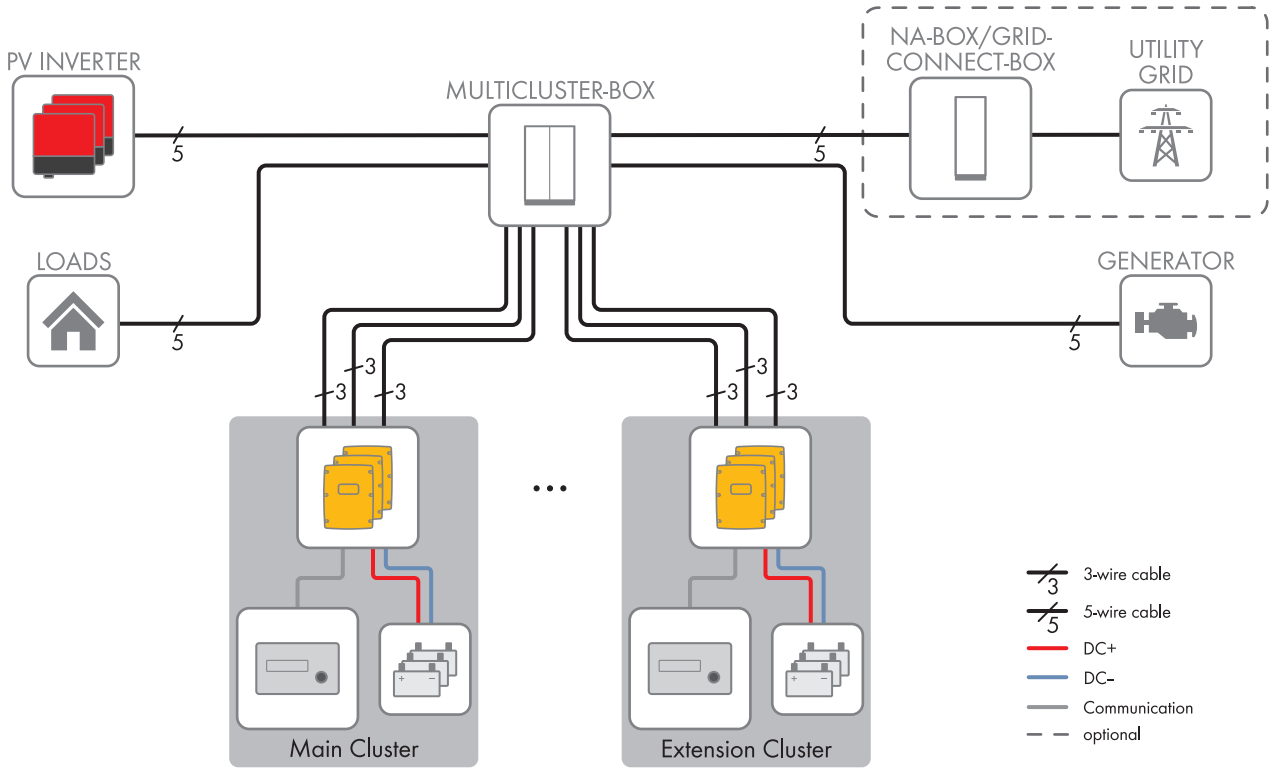


Figure 1: Principle of a multicluster system with Multicluster-Box and NA-Box or Grid-Connect-Box

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. Three 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 an external energy source must be connected only to the Multicluster-Box. To connect the utility grid to the multicluster system, an NA-Box or 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

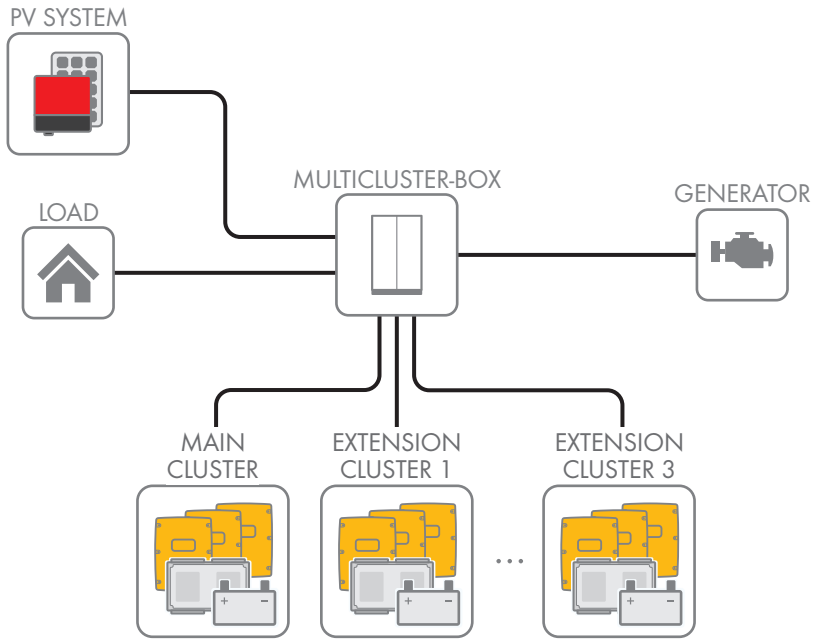


Figure 2: Principle of a multicluster system with Multicluster-Box and generator

If only the generator as external energy source is connected to the Multicluster-Box, the multicluster system must be configured as off-grid system (see Section 5.1.2, page 27).

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

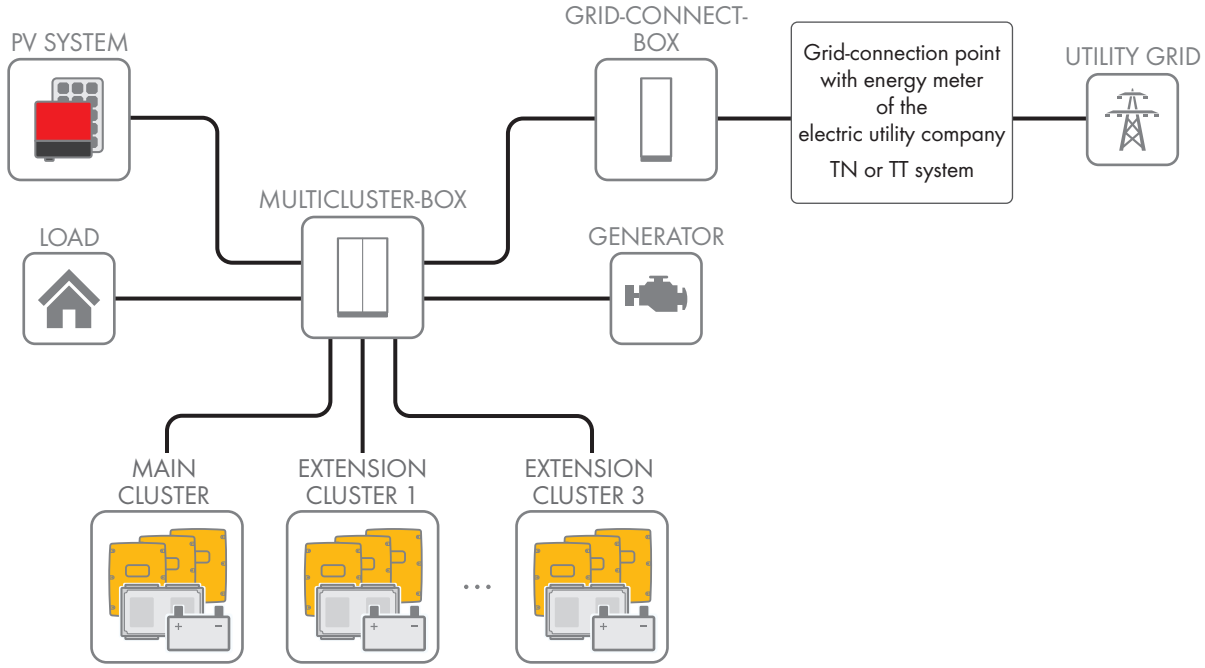


Figure 3: Principle of a multicluster system with Multicluster-Box, Grid Connect Box, utility grid, and generator

The Grid-Connect-Box enables the connection of 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 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 as off-grid system (see Section 5.1.2, page 27).

Multicluster-Box only with Utility Grid

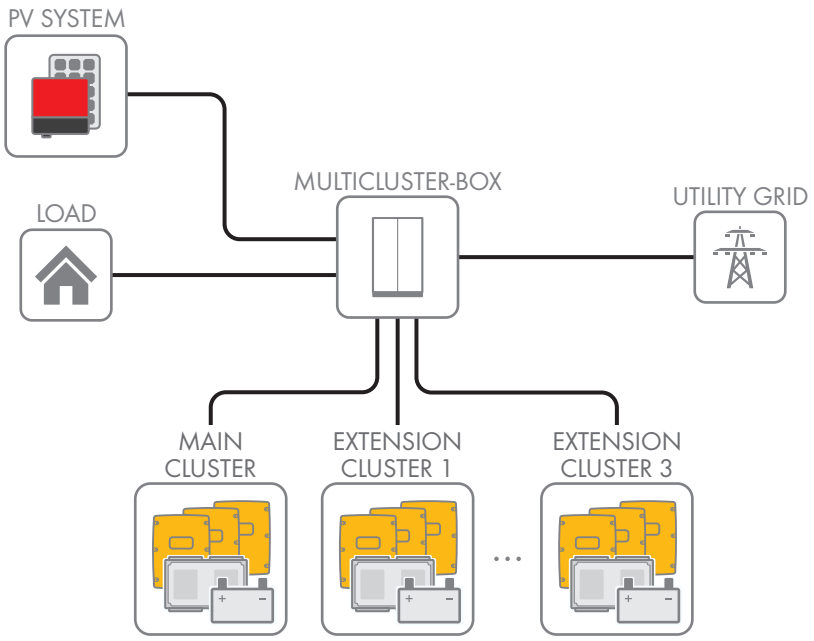


Figure 4: Principle of a multicluster system with Multicluster-Box and utility grid

If the utility grid as external energy source 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 as off-grid system (see Section 5.1.2, page 27).

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

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

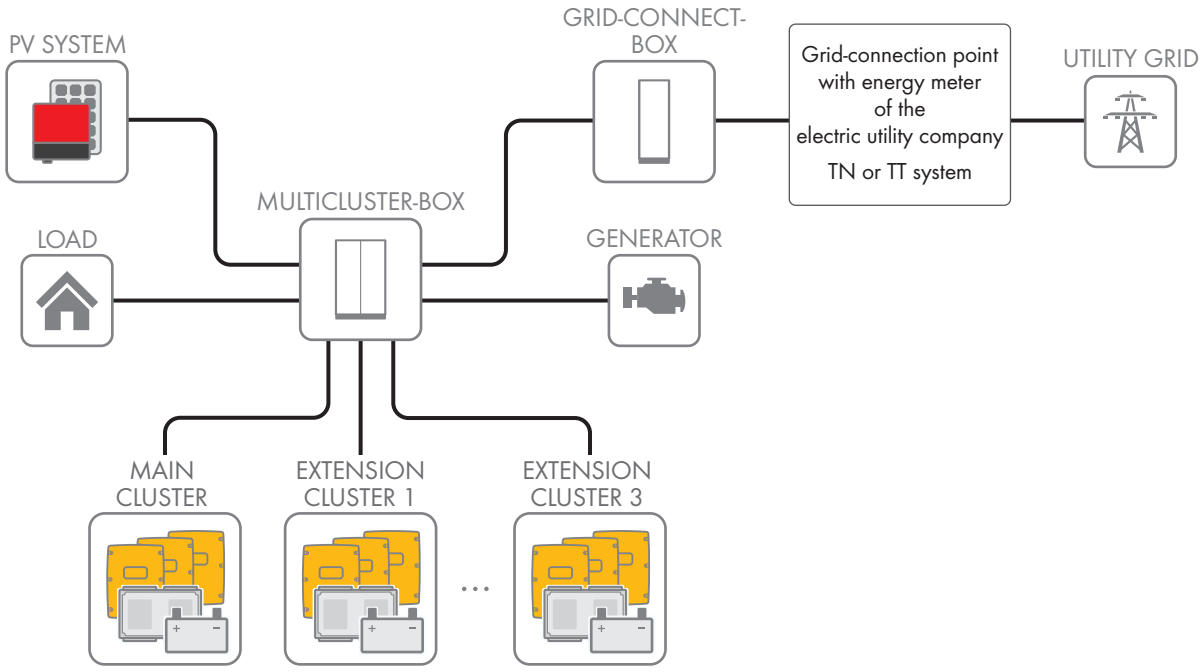


Figure 5: Principle of a multicluster system with Multicluster-Box, Grid Connect Box, utility grid, and generator

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 as system with increased self-consumption and battery-backup function (see Section 5.1.3, page 31).

Multicluster-Box with NA-Box, Utility Grid and Optional Generator

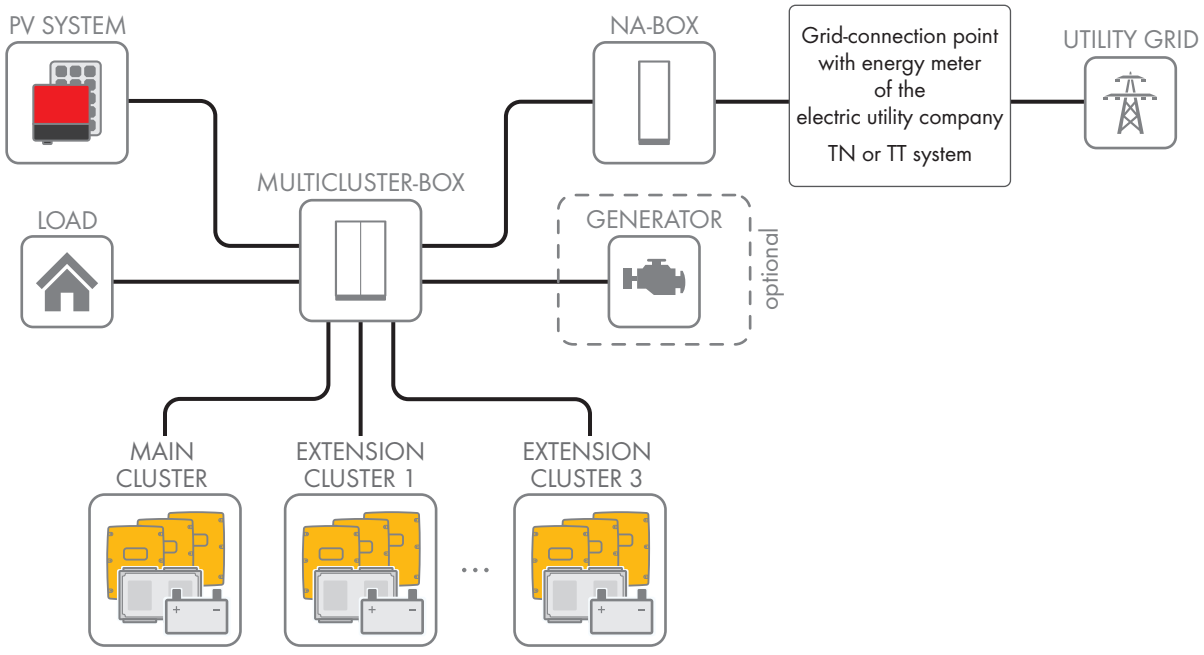


Figure 6: Principle of a multicluster system with Multicluster-Box, NA-Box, utility grid, and optional generator

If the VDE-AR-N 4105 application guide applies to the utility grid (e.g. in Germany and Austria), the multicluster system with NA-Box must be installed. The NA-Box also enables the connection of an utility grid and a generator with a multicluster system.

A multicluster system with NA-Box must be configured as a system with increased self-consumption and battery-backup function (see Section 5.1.3, page 31).

3.3 Off-Grid System

3.3.1 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), from a grid-forming PV array and/or with DC charge controllers (e.g. Sunny Island Charger). As a voltage source, the Sunny Island inverter forms the stand-alone grid. The Sunny Island inverter 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

Battery management of the Sunny Island inverter is based on precise 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 feature of battery management is the extremely gentle charging control. It automatically selects the optimum charging strategy for the battery type and the situation in which it is used. 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).

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 inverter 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)

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.

The AC sources in the stand-alone grid 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. 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 off-grid system for critical loads.

3.3.2 Information on Multicluster Systems with Stand-Alone Grid

Information on Batteries

Lithium-ion batteries in off-grid systems

In order to meet the requirements of off-grid systems, the Sunny Island has a high overload capacity. This overload capacity is subject to the battery being able to supply sufficient current. With lithium-ion batteries, this ampacity cannot be taken for granted.

- Check with the battery manufacturer whether the battery is suitable for off-grid systems with Sunny Island inverters. Pay special attention to the ampacity.

Recommendations for battery capacity

SMA Solar Technology AG recommends the following minimum battery capacities. The sum of the individual battery capacities is the total minimum battery capacity and applies to a ten-hour electric discharge (C10). The minimum battery capacity must be observed to ensure stable operation of the system.

- Minimum battery capacity per Sunny Island inverter:
  - SI6.0H-11: 190 Ah
  - SI8.0H-11: 250 Ah
- Minimum battery capacity per 1000 Wp power of the PV system: 100 Ah

The sum of the individual battery capacities is the total minimum battery capacity and applies to a ten-hour electric discharge (C10). The minimum battery capacity must be observed to ensure stable operation of the system.

Information on Utility Grid Connection

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).

Utility grid connection to the Multicluster-Box

If the utility grid as external energy source 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.

Information on Sunny Island

Device types within clusters

In all multicluster systems, the Sunny Island inverters must be device type SI6.0H-11 or SI8.0H-11. Only Sunny Island inverters of the same device type may be installed in a cluster: SI6.0H-11 or SI8.0H-11.

Information on the PV System

Maximum PV system power

In off-grid systems, the maximum PV system power depends on the total power of the Sunny Island inverters. The maximum output power of the PV system must be observed to ensure stable operation of the off-grid system.

- Maximum output power of the PV system per SI6.0H-11: 9200 W
- Maximum output power of the PV system per SI8.0H-11: 12000 W

The maximum output power of the PV system must be observed to ensure stable operation of the off-grid system.

3.3.3 Optional Devices and Functions

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

Component	Description
External load-shedding contactor	Contactor controlled by the Sunny Island for isolation of loads in the multicluster system during two-level load shedding.
SMA Cluster Controller	Remote monitoring and system configuration of the off-grid system
Sunny Island Charger 50	Charge controller for off-grid systems with lead-acid batteries A maximum of four Sunny Island Charger charge controllers can be connected to a cluster. In multicluster systems, four Sunny Island Charger charge controllers can be connected to each cluster. If lithium-ion batteries are used, no charge controllers can be connected.
Battery current sensor	Shunt for measuring the battery current A battery current sensor is required in off-grid systems with DC loads or with charge controllers from third-party suppliers (see Section 2.1 "Intended Use", page 7).

The Sunny Island inverter offers the following functions for multicluster systems with stand-alone grid via two 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 PV arrays with an electrical remote-start function or connect a signal generator for PV arrays with no autostart function.
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 one multifunction relay or a two-level load shedding with two 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.

Function	Description
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. One of the following operating states and warning messages can be displayed for each multifunction relay: • The PV array is running and is connected. • A Sunny Island displays an error message of level 2 or higher. Only the error messages within a cluster are evaluated here. • A Sunny Island displays a warning. Only the warnings within a cluster are evaluated here.
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 one 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.

3.4 Multicluster System with Increased Self-Consumption and Battery-Backup Function

3.4.1 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 an NA-Box or 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 NA Box or 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 NA Box or Grid Connect Box connects the system with increased self-consumption and battery-backup function to the utility grid.

3.4.2 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 and battery-backup function.
- The system is installed in Germany.

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 Lithium-Ion Batteries" at 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 Sunny Island inverter.

3.4.3 Information on Systems with Increased Self-Consumption and Battery-Backup Function

Information on Batteries

i Lithium-ion batteries in systems with increased self-consumption and battery-backup function

In order to meet the requirements of systems with increased self-consumption and battery-backup function, the Sunny Island has a high overload capacity. This overload capacity is subject to the battery being able to supply sufficient current. With lithium-ion batteries, this ampacity cannot be taken for granted.

- Check with the battery manufacturer whether the battery is suitable for systems with increased self-consumption and battery-backup function. Pay particular attention to the current-carrying ampacity if the battery backup grid is supplied by the Sunny Island in the event of grid failure.

i Recommendations for battery capacity

SMA Solar Technology AG recommends a minimum battery capacity of 100 Ah per 1000 Wp of PV system power. This battery capacity is rated for a ten-hour electric discharge (C10).

The minimum battery capacity must be observed to ensure stable operation of the system

Information on Utility Grid Connection

i Utility grid connection via NA-Box

If the VDE-AR-N 4105 application guide applies to the utility grid (e.g. in Germany and Austria), the NA-Box must be used. In the event of grid failure, the NA-Box always disconnects the multicluster system from the utility grid at all poles.

When the NA-Box is used in accordance with the VDE-AR-N 4105 (e.g. in Germany), it must be ensured that the multicluster system never feeds more than 100 kW into the utility grid.

When using the NA-Box, a generator can be connected in addition to the utility grid (see operating manual of the NA-Box).

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).

Information on the Sunny Island

i Device types within a cluster

In all multicluster systems, the Sunny Island inverters must be device type SI6.0H-11 or SI8.0H-11. Only Sunny Island inverters of the same device type may be installed in a cluster: SI6.0H-11 or SI8.0H-11.

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). 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.

Information on the PV System

Maximum PV system power

In systems with increased self-consumption and battery-backup function, the maximum power of the PV system depends on the automatic transfer switch and the local standards and directives.

- Maximum output power of the PV system when the NA Box is used in accordance with VDE-AR-N 4105 application guide (e.g. in Germany): 100 kW
- Maximum output power of the PV system when the NA-Box is used and VDE-AR-N 4105 application guide is not required: 138 kW
- Maximum output power of the PV system when the Grid-Connect-Box is used: 138 kW

Frequency-dependent control of active power feed-in

In systems with increased self-consumption and battery-backup function, the active power of the PV inverters should be controlled frequency-dependent.

- With existing systems, ensure that the PV inverters are controllable depending on the frequency (see planning guidelines "SMA Flexible Storage System with Battery Backup Function").

Information on the Communication Devices

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

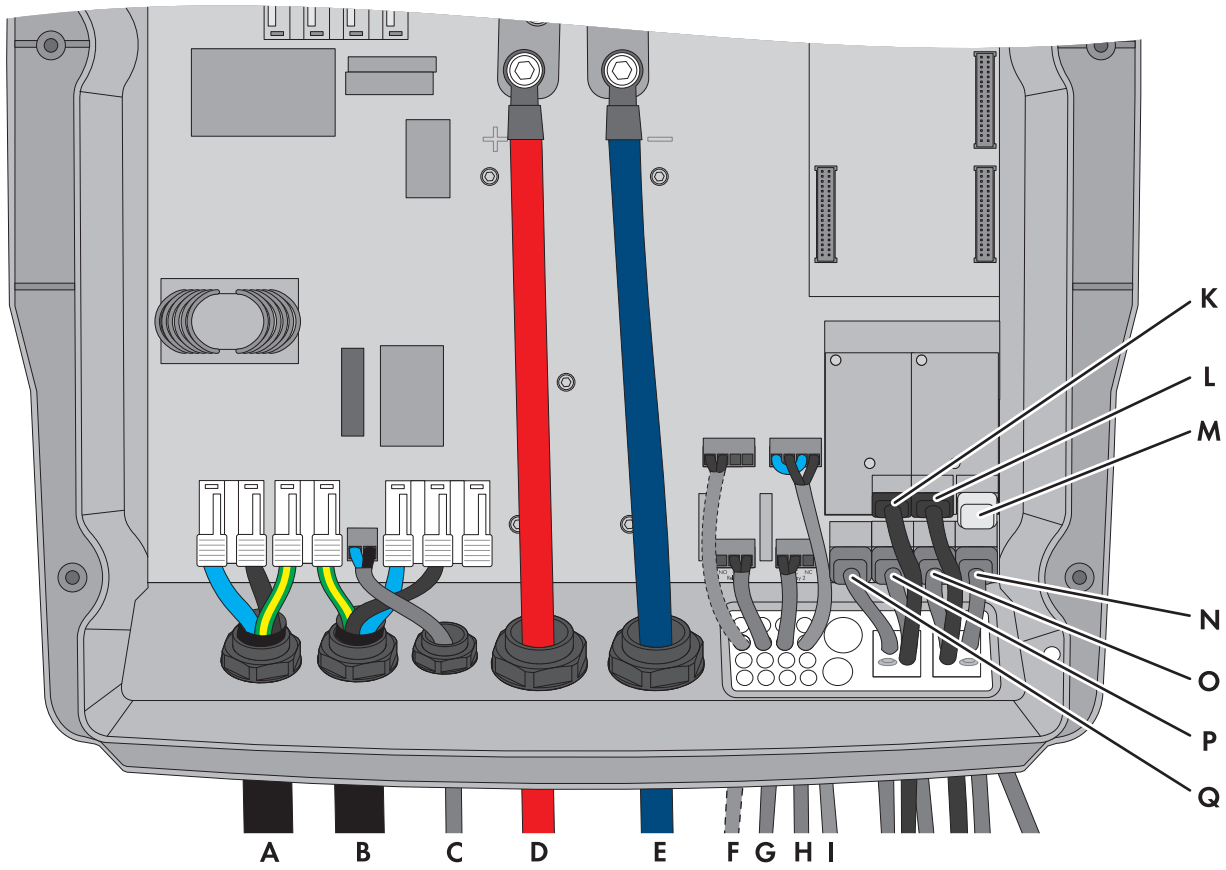


Figure 7: Connecting the master in the main cluster

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

Position	Designation	Description / information
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. Mount the battery temperature sensor in the middle of the battery-storage system, in the upper third of the battery cell.
G	Control cable to the Multicluster-Box	The control cable must be connected if an NA-Box or a Grid-Connect-Box is installed. Sunny Island: connection **Relay1** terminals **C** and **NC** Multicluster-Box: connection **X112** terminals **1** and **2** Conductor cross-section: from 1.5 mm^2 to 2.5 mm^2
H	Control cable to the Multicluster-Box	Sunny Island: connection **Relay2** terminals **C** and **NO** Multicluster-Box: connection **X113** terminals **1** and **2** Conductor cross-section: from 1.5 mm^2 to 2.5 mm^2
I	Control cable to the Multicluster-Box	Sunny Island: connections **DigIn+** und **BatVtgOut+** Multicluster-Box: connection **X113** terminals **3** and **4** Inside the Sunny Island inverter, connect the connections **DigIn–** and **BatVtgOut–**. Conductor cross-section: from 1.5 mm^2 to 2.5 mm^2
K	Speedwire network cable	Terminal **ComETH** In order to connect the router/network switch, the Speedwire data module Sunny Island with the terminal **ComETH** must be mounted in the Sunny Island (see installation manual of the Speedwire data module Sunny Island).
L	Data cable for the communication with the masters of the extension cluster	At SI-SYSCAN.BGx terminal **SysCanIn** Master of the extension cluster: at SI-SYSCAN.BGx Terminal **SysCanOut** The communication bus must be equipped with a terminator on both ends.
M	Terminator	At SI-SYSCAN.BGx terminal **SysCanOut** The communication bus must be equipped with a terminator on both ends.
N	Data cable for communication within the cluster	Sunny Island: terminal **ComSync Out** The communication bus connects the master with the slaves in each cluster and additionally with the Multicluster-Box in the main cluster. The communication bus must be equipped with a terminator on both ends.
O	Data cable for communication within the cluster	Sunny Island: terminal **ComSync In** Multicluster Box: terminal **ComSync Out** The communication bus must be equipped with a terminator on both ends.

Position	Designation	Description / information
P	Data cable to Sunny Remote Control	Sunny Island: terminal **Display**
Q	Measuring cable	Sunny Island: terminal **BackupVtgCur** Multicluster Box: terminal **Mstr./L1**
-	Openings in the cable support sleeves	Unused openings in the cable support sleeves of the Sunny Island inverter must be sealed (see installation manual of the Sunny Island inverter).

4.2 Connecting Slave 1 in the Main Cluster

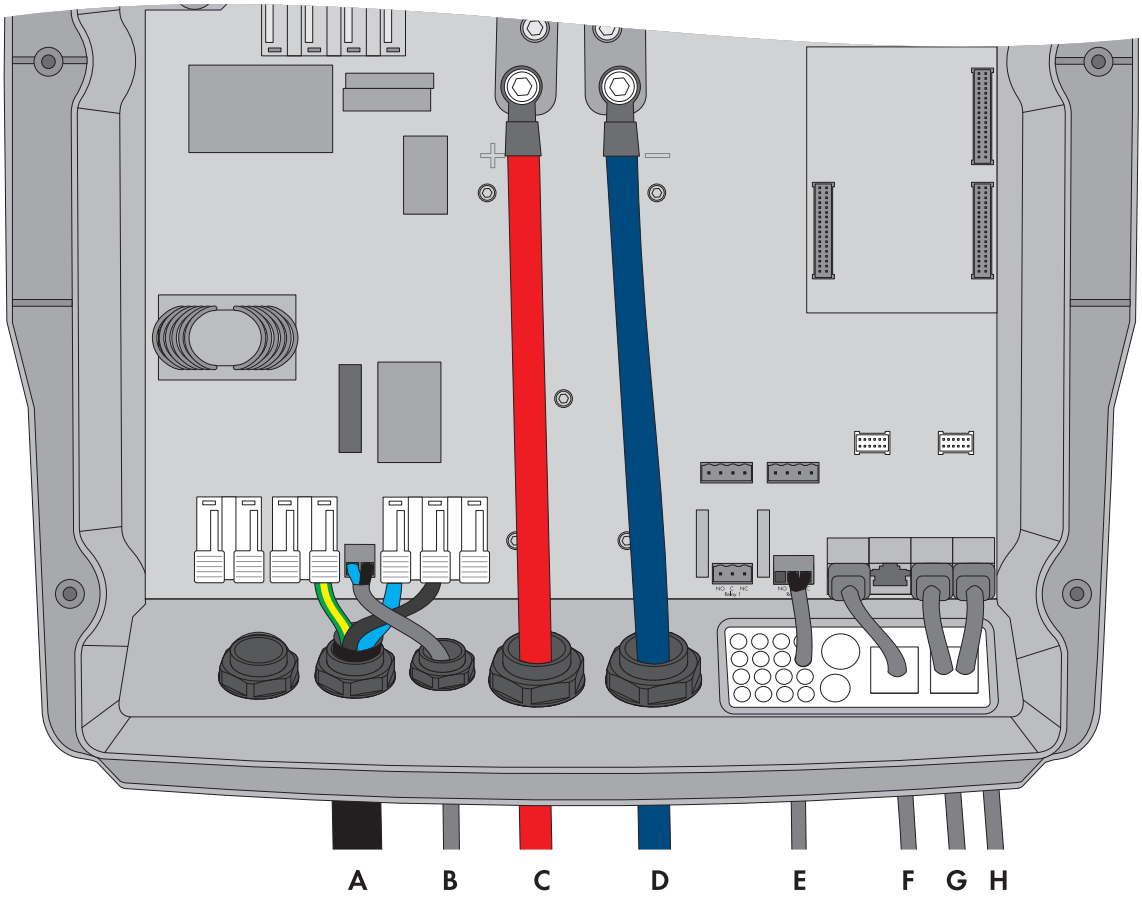


Figure 8: Connecting slave 1 in the main cluster

Position	Designation	Description / information
A	AC power cable	Sunny Island: connection to **AC2 Gen/Grid** terminals **L**, **N** and **grounding conductor** Multicluster-Box: connection **X105** terminals **2**, **5** and **8** Conductor cross-section: from 10 mm^2 to 16 mm^2
B	Measuring cable for voltage measurement	Sunny Island: connection **ExtVtg** terminals **L** and **N** Multicluster-Box: connection **X112** terminals **7** and **8** Conductor cross-section: from 1.5 mm^2 to 2.5 mm^2

Position	Designation	Description / information
C	DC+ cable	Battery connection Conductor cross-section: from 50 mm² to 95 mm² Cable diameters: 14 mm to 25 mm Torque: 12 Nm
D	DC− cable	
E	Control cable to the Multicluster-Box	The control cable must be connected if an NA-Box is installed. Sunny Island: connection **Relay2** terminals **C** and **NC** Multicluster-Box: connection **X112** terminals **5** and **6** Conductor cross-section: 1.5 mm² to 2.5 mm²
F	Measuring cable	Sunny Island: terminal **BackupVtgCur** Multicluster-Box: terminal **Slv.1/L2**
G	Data cable for the internal communication in the cluster	Sunny Island: terminal **ComSync In** Master: terminal **ComSync Out**
H	Data cable for the internal communication in the cluster	Sunny Island: terminal **ComSync Out** Slave 2: terminal **ComSync In**

4.3 Connecting Slave 2 in the Main Cluster

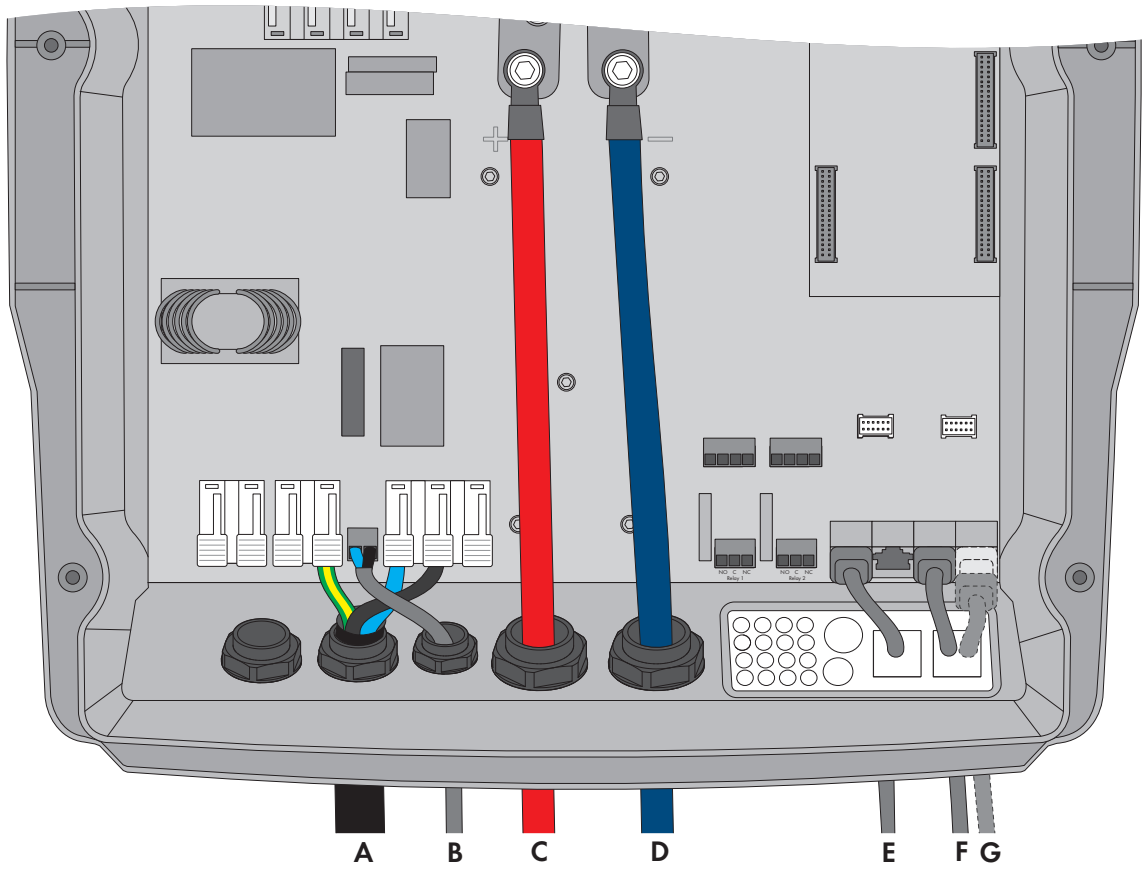


Figure 9: Connecting slave 2 in the main cluster

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

Position	Designation	Description / information
F	Data cable for the internal communication in the cluster	Sunny Island: terminal **ComSync In** Slave 1: terminal **ComSync In**
G	Data cable for the internal communication in the cluster	Terminal **ComSync Out** 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 Multicluster-Box	(see section Section 4.1, page 21)
Slave 1 in extension cluster 1/2/3		(see section Section 4.2, page 23)
Slave 2 in extension cluster 1/2/3		(see section Section 4.3, page 25)

5 Commissioning

5.1 Basic Configuration of Sunny Island Inverters

5.1.1 Basic Configuration Requirements

☐ A Multicluster-Box of the device type MC-Box-12.3-20 must be installed.

☐ The multicluster system must be installed correctly (see Multicluster-Box and NA-Box / Grid-Connect-Box documentation).

☐ In the Multicluster-Box, all circuit breakers of the Sunny Island inverter must be open. This ensures that the Sunny Island inverters are not connected to an AC source.

☐ The Sunny Remote Control must be connected to the master of each cluster. This determines which Sunny Island is the master during the basic configuration.

5.1.2 Performing Basic Configuration of the Off-Grid System

NOTICE

Damage to the battery due to incorrect settings

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

- 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). Note that the battery charging behavior names used by SMA Solar Technology AG and the battery manufacturer may, in some cases, differ in meaning (for the battery charging behavior of the Sunny Island inverter, see technical information "List of Approved Lithium-Ion Batteries").
- Set the battery capacity for a ten-hour electric discharge (C10). The battery manufacturer specifies the battery capacity in relation to discharge time.

Requirements:

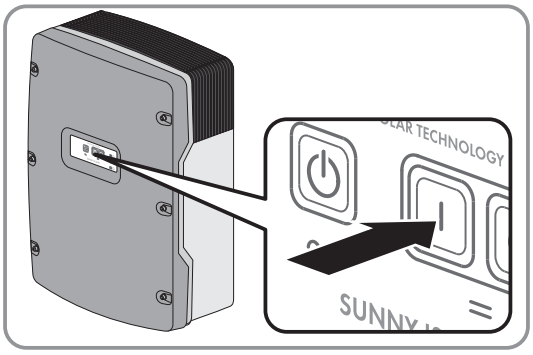
☐ The structure of the multicluster system must be provided for the configuration as off-grid system (see Section 3.2.1, page 12).

☐ Country standards such as VDE-AR-N 4105:2011-08 application guide must not apply.

☐ Increased self-consumption must not apply.

Procedure:

1. Check the wiring (see installation manual of the Sunny Island inverter).
2. Close all devices except the BatFuse. This protects all live components from being touched.
3. Close the BatFuse and press and hold the activation button on each master until you hear an acoustic signal.



4. To start the configuration of a system for the first time, you have to wait until the Sunny Remote Control shows the starting page of the Quick Configuration Guide with date settings.

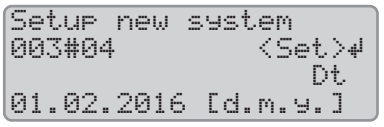
5. To start the configuration of a system yet again or reset the default values of the parameters, you have to wait until the Sunny Remote Control shows **<Init System>**.
6. When the Sunny Remote Control shows **<Init System>**, press and hold the button on the Sunny Remote Control.

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

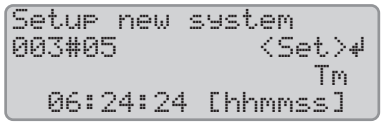
7. Turn the button on the Sunny Remote Control and select **New System**.

8. Press the button. This confirms your selection of **New System**.
   ☑ An entry confirmation appears.

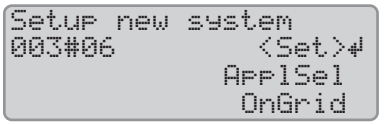
9. Set **Y** and press the button.
   ☑ The Sunny Remote Control shows the starting page of the Quick Configuration Guide with date settings.
10. Set the date.



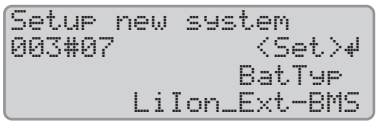
11. Set the time.

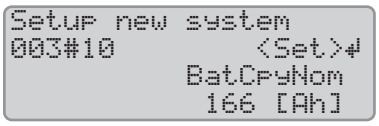


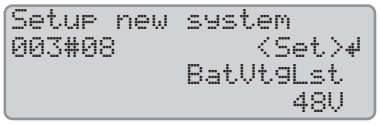
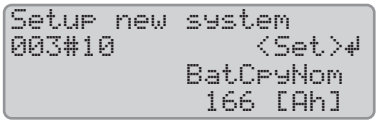
12. Set **OffGrid**.



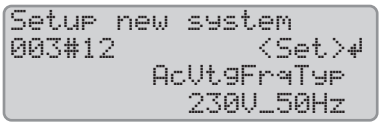
13. Set the battery type:



Battery type	Settings	
LiIon_Ext-BMS: Lithium-ion battery	• Set the battery capacity for ten-hour electric discharge (for determining the battery capacity, see installation manual of the Sunny Island).	

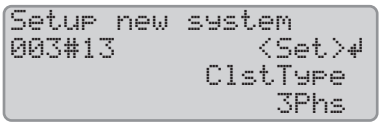
Battery type	Settings	
VRLA lead-acid battery with immobilized electrolyte in AGM (Absorbent Glass Mat Separator) or gel **or** **FLA** lead-acid battery with liquid electrolyte	• Set the nominal voltage of the battery.	
	• Set the battery capacity for ten-hour electric discharge (for determining the battery capacity, see installation manual of the Sunny Island).	

14. Set the grid voltage and power frequency of the stand-alone grid:

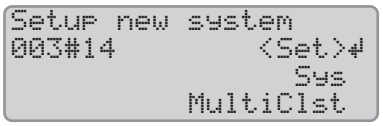


Setting	Description
230V_50Hz	Grid voltage 230 V, power frequency 50 Hz
220V_60Hz	Grid voltage 220 V, power frequency 60 Hz

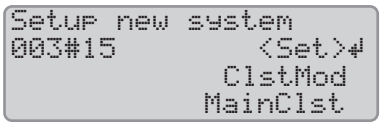
15. Set **3Phase**.



16. Set **MultiClst**.



17. Set the type of cluster:

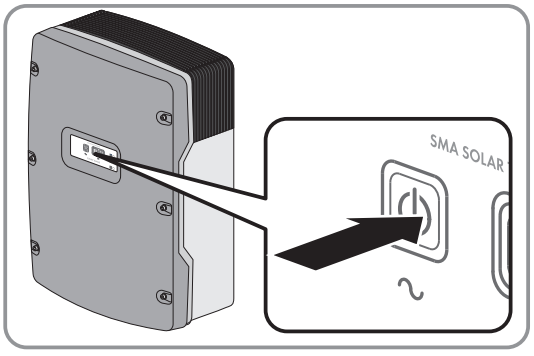


Type of cluster	Settings	
The cluster is a main cluster	• Set **MainClst**.	
	• Set the device type of the Multicluster-Box. Tip: The device type is indicated on the type label of the Multicluster-Box.	Setup new system 003#17 <Set>↵ Box MC-Box-12-2x
	• Set the type of external energy source. **Gen**: Only the generator is connected. **GenGrid**: The utility grid is connected via the Grid-Connect-Box. **Grid**: The utility grid is connected directly to the Multicluster-Box. **PvOnly**: neither generator nor utility grid are connected.	Setup new system 003#21 <Set>↵ ExtSrc GenGrid
	• When **Gen** or **GenGrid** is selected, set the maximum PV array current per line conductor for continuous operation.	Setup new system 003#22 <Set>↵ GnCurNom 160.0 [A]
	• When **Gen** or **GenGrid** is selected, set the maximum line current per line conductor for continuous operation.	Setup new system 003#23 <Set>↵ GdCurNom 160.0 [A]
The cluster is an extension cluster	• Set **ExtnClst**.	
	• Set the address of the extension cluster (e.g. set extension cluster 1 to **1**).	Setup new system 003#16 <Set>↵ ClstAdr 1

18. Confirm the basic configuration with **Y**.

Setup new system
Done ? <accept Y/N>

19. Wait until the upper LED (inverter LED) on slave 1 is flashing and the Sunny Remote Control is displaying **To identify Slave1, press Tss on the Slv**.
20. Press the start-stop button on slave 1.



21. Wait until the inverter LED on slave 2 is flashing and the Sunny Remote Control is displaying **To identify Slave2, press Tss on the Slv**.
22. Press the start-stop button on slave 2.
    ☑ 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 and the SD memory card is integrated in the file system.
23. Configure all other clusters. For this purpose, perform the steps of the Quick Configuration Guide for each master separately.

5.1.3 Execution of the Basic Configuration for a System with Increased Self-Consumption and Battery-Backup Function

NOTICE

Damage to the battery due to incorrect settings

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

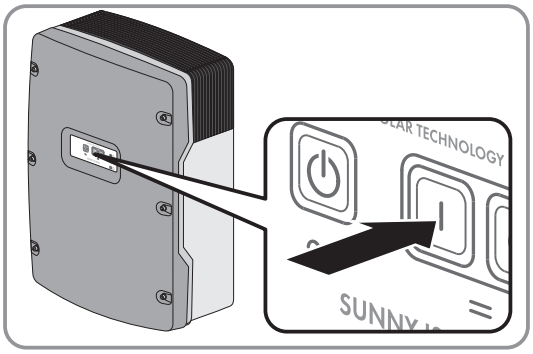
- Ensure that the values recommended by the manufacturer are set for the battery (refer to the technical data of the battery in the manufacturer documentation). Note that the battery charging behavior names used by SMA Solar Technology AG and the battery manufacturer may, in some cases, differ in meaning (for the battery charging behavior of the Sunny Island inverter, see technical information "List of Approved Lithium-Ion Batteries").
- Set the battery capacity for a ten-hour electric discharge (C10). The battery manufacturer specifies the battery capacity in relation to discharge time.

Requirement:

☐ The structure of the multicluster system must be provided for the configuration as system with increased self-consumption and battery-backup function (see Section 3.2.2, page 14).

Procedure:

1. Check the wiring (see installation manual of the Sunny Island inverter).
2. Close all devices except the BatFuse. This protects all live components from being touched.
3. Close the BatFuse and press and hold the activation button on each master until you hear an acoustic signal.



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

5. To start the configuration of a system for the first time, you have to wait until the Sunny Remote Control shows the starting page of the Quick Configuration Guide with date settings.
6. To start the configuration of a system yet again or reset the default values of the parameters, you have to wait until the Sunny Remote Control shows **<Init System>**.

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

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

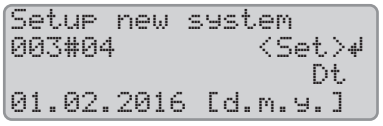
8. Press the button. This confirms your selection of **New System**.

☑ An entry confirmation appears.

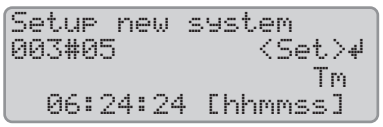
9. Set **Y** and press the button.

☑ The Sunny Remote Control shows the starting page of the Quick Configuration Guide with date settings.

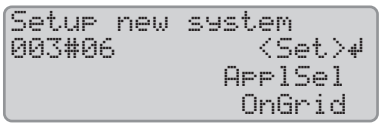
10. Set the date.



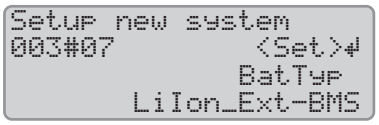
11. Set the time.

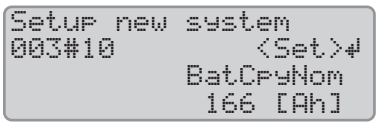
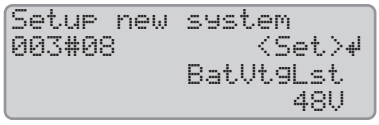
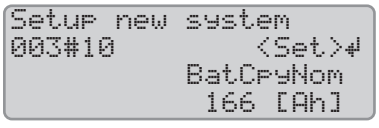


12. Set **OnGrid**.

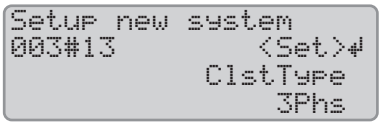


13. Set the battery type:

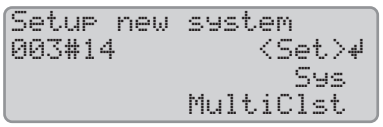


Battery type	Settings	
LiIon_Ext-BMS: Lithium-ion battery	• Set the battery capacity for ten-hour electric discharge (for determining the battery capacity, see installation manual of the Sunny Island).	
VRLA lead-acid battery with immobilized electrolyte in AGM (Absorbent Glass Mat Separator) or gel **or** **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 installation manual of the Sunny Island).	

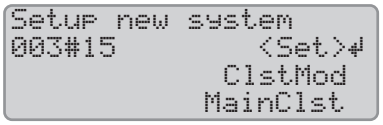
14. Set **3Phase**.

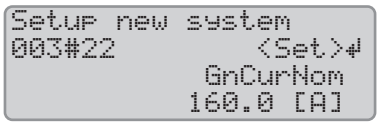
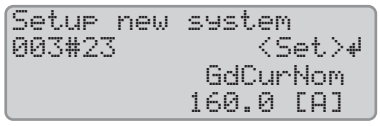
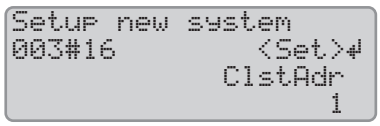


15. Set **MultiClst**.

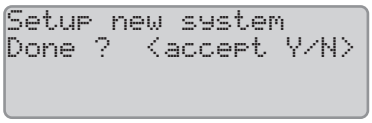


16. Set the type of cluster:

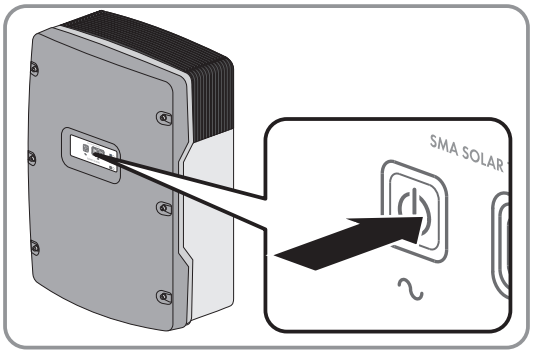


Type of cluster	Settings	
The cluster is a main cluster	• Set **MainClst**.	
	• Set the device type of the Multicluster-Box. Tip: The device type is indicated on the type label of the Multicluster-Box.	
	• Set the maximum generator current per line conductor for continuous operation.	
	If no PV array is connected, select the next parameter.	
	• Set the maximum line current per line conductor for continuous operation.	
The cluster is an extension cluster	• Set **ExtnClst**.	
	• Set the address of the extension cluster (e.g. set extension cluster 1 to **1**).	

17. Confirm the basic configuration with **Y**.



18. Wait until the upper LED (inverter LED) on slave 1 is flashing and the Sunny Remote Control is displaying **To identify Slave1, press Tss on the Slv**.
19. Press the start-stop button on slave 1.



20. Wait until the inverter LED on slave 2 is flashing and the Sunny Remote Control is displaying **To identify Slave2, press Tss on the Slv**.

21. Press the start-stop button on slave 2.
    ☑ 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 and the SD memory card is integrated in the file system.
22. Configure all other clusters. For this purpose, perform the steps of the Quick Configuration Guide for each master separately.

5.2 Testing Communication in the Multicluster System

1. Activate the communication test on any master within the multicluster system:
   - Connect the Sunny Remote Control to the selected master (see the Sunny Island inverter installation manual).
   - Switch to expert mode on the Sunny Remote Control (see the Sunny Island operating manual).
   - Select the parameter **510.08 TstClstCom** and set it to the value **Transmit**.
2. Check the status of the communication test on the master within the multicluster system For this, execute the following steps:
   - Connect the Sunny Remote Control to the selected master (see the Sunny Island inverter installation manual).
   - Switch to expert mode on the Sunny Remote Control (see the Sunny Island operating manual).
   - Select the parameter **510.09 ClstComStt** and read off the value.

   ☑ The parameter **510.09 ClstComStt** has the value. **OK**. The communication test is completed on the respective master.

   ✖ The parameter **510.09 ClstComStt** has the value **Wait**?

   It is possible that the wiring of the communication bus is faulty.
   - Ensure that the cable length for the multicluster communication is not exceeded.
   - Ensure that all cables of the multicluster communication are correctly connected (see installation manual of the Sunny Island inverter).
   - Ensure that the terminators for the multicluster communication are correctly inserted (see installation manual of the Sunny Island inverter).
3. When the communication test on each master within the multicluster system is completed, deactivate the communication test:
   - Reconnect the Sunny Remote Control to the master on which the communication test has been activated (see the Sunny Island inverter installation manual).
   - Switch to expert mode on the Sunny Remote Control (see the Sunny Island operating manual).
   - Select the parameter **510.08 TstClstCom** and set it to the value **Off**.

5.3 Commissioning an Off-Grid System

5.3.1 Commissioning Procedure for an Off-Grid System

Procedure		Explanation	See
1	Check the residual-current devices in the Multicluster-Box.	Prior to commissioning, ensure that the residual-current devices are tripping properly.	Operating manual for the Multicluster-Box
2	Commission the multifunction relays.	-	Section 5.3.2, page 35
3	Start the off-grid system.	-	Section 5.3.3, page 35

Procedure		Explanation	See
4	Test the battery current sensor.	-	Quick reference guide "Off-Grid Systems" of Sunny Island
5	Test the generator.	-	Quick reference guide "Off-Grid Systems" of Sunny Island
6	Test the load shedding.	-	Section 5.3.4, page 36
7	Commission the PV system.	-	PV inverter documentation
8	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).	-	
9	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.	-	Quick reference guide "Off-Grid Systems" of Sunny Island

5.3.2 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 installation manual of the Sunny Island inverter). For this, use the Sunny Remote Control.

5.3.3 Starting the System

Requirements:

☐ All Sunny Island inverters must be switched on.

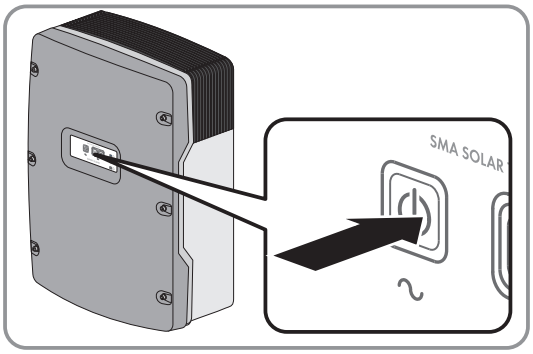
☐ The circuit breakers for the AC sources in the stand-alone grid must be switched off in the AC distribution board.

☐ The load-break switch of the PV array must be open.

☐ The circuit breakers for the charge controllers must be switched off in the DC distribution board.

Procedure:

- Press the start-stop button on the Sunny Island and hold it until an acoustic signal sounds.
  or
  Press and hold the button on the Sunny Remote Control until an acoustic signal sounds.
  ☑ The inverter LED on each Sunny Island is glowing green.



5.3.4 Testing the Load Shedding

Requirements:

☐ The additional load-shedding contactor is connected to a multifunction relay in the master of the extension cluster.

☐ The Sunny Island must be in operation (see Section 5.3.3 "Starting the System", page 35).

Procedure:

1. Select the parameter of the multifunction relay for the load-shedding contactor, e.g., on the Sunny Remote Control **241.02 Rly2Op** for the **Relay2** multifunction relay of the master.
2. Note the parameter value.
3. Set the parameter to **Off**.
   ☑ The load-shedding contactor sheds the loads.
   ✖ Does the load-shedding contactor not shed the loads?
   The multifunction relay for triggering the load-shedding contactor was incorrectly configured or the wiring of the load-shedding contactor is faulty.
   - Check the configuration and eliminate the fault.
   - Ensure that the multifunction relay is correctly wired.
4. Set the parameter to the setting that has been noted down.

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

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

Procedure		Explanation	See
1	Check the residual-current devices in the Multicluster-Box.	Prior to commissioning, ensure that the residual-current devices and tie switches are tripping properly.	Operating manual for the Multicluster-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
	If an NA-Box has been installed, check the tie switches and residual current protective devices in the NA-Box.		Operating manual for the NA-Box
3	Adjust the configuration of the Sunny Island inverter.	-	Section 5.4.2, page 37
4	Adjust the configuration of the PV inverters.	-	Section 5.4.3, page 37
5	Attach the labels.	-	Section 5.4.4, page 38

Procedure		Explanation	See
6	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 5.4.5, page 38
7	To use PV system monitoring, register your multicluster system in Sunny Portal.	-	Section 5.4.6, page 39

5.4.2 Adjusting the Configuration of the Sunny Island Inverter

In the system with increased self-consumption and battery-backup function, the Sunny Island inverters are connected with the utility grid and must fulfill the requirements of the grid operator. The Sunny Island inverters fulfill the requirements of application guide VDE-AR-N 4105:2011-08. The standard country data set of the Sunny Island inverters is set to VDE-AR-4105 by default.

Settings that differ from the application guide may be adjusted only on request or with the permission of the grid operator (see operating manual of the Sunny Island).

Use in other countries is possible with the agreement of the grid operator. Consult the grid operator on whether adjustment is necessary.

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 according to the VDE-AR-N 4105:2011-08 application guide.
2. Coordinate the parameter adjustment with the grid operator.
3. Log in to the communication product as **Installer** (see the user manual of the communication product) or switch to expert mode on the Sunny Remote Control (see operating manual of the Sunny Island inverter).
4. Select the parameter **Set country standard** / **232.01 Country** and set it to the value **VDE-AR-N4105-MC**.
5. To adjust the parameters for grid monitoring on the Sunny Island, carry out the following steps:
   - Enter the SMA Grid Guard Code (see installation manual of the Sunny Island inverter).
   - Adjust the parameters for grid monitoring as agreed with the grid operator (see operating manual of the Sunny Island inverter). As a result, the parameter value is changed from **Set country standard** / **232.01 Country** to **Adjusted-MC**.

5.4.3 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 (see planning guidelines "SMA Flexible Storage System with Battery Backup Function"). If your grid operator prohibits control of active power feed-in in the case of overfrequency, you can also use the PV inverters without changing the configuration. SMA Solar Technology AG recommends activating the frequency-dependent control of the PV inverters.

i Frequency-dependent control of active power in accordance with application guide AR-N 4105

The country data set **VDE-AR-4105** complies with application guide AR-N 4105 and is equipped with a frequency-dependent control of active power.

- If the country data set **VDE-AR-4105** is selected, no further adjustments are necessary.

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 Flexible Storage System with Battery Backup Function" at www.SMA-Solar.com).

☐ You must be authorized 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.

Procedure:

1. For the planned installation site, check whether parameters of the PV inverter must be adjusted for frequency-dependent active power limitation (see the quick reference guide ""SMA Flexible Storage System with Battery Backup Function" of the Sunny Island inverter).
2. Coordinate the parameter adjustment with the grid operator.
3. If the grid operator approved the activation of the frequency-dependent active-power limitation, set the parameters of the PV inverters to the following values (see the documentation of the communication product).

Parameter	Value*
P-WCtlHzMod Operating mode of active power limitation in the case of overfrequency P(f)**	**On** or **WCtlHz**
P-WGra Active power gradient, linear instantaneous power gradient configuration**	40
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**	0.2
P-HzStopWGra Active power gradient after reset frequency, linear instantaneous power gradient configuration**	10

* The adjustments are based on the requirements for PV inverters from application rule "VDE-AR-N 4105:2011-08".
** Menu **Equipment & device control system**

5.4.4 Attaching the Labels

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

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

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

The intermediate storage of PV energy is activated automatically.

Regarding the system with increased self-consumption and battery-backup function, the parameter **ApplSel** must be set to **OnGrid** during basic configuration (see Section 5.1.3, page 31). The intermediate storage of PV energy is thereby activated automatically.

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). 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.

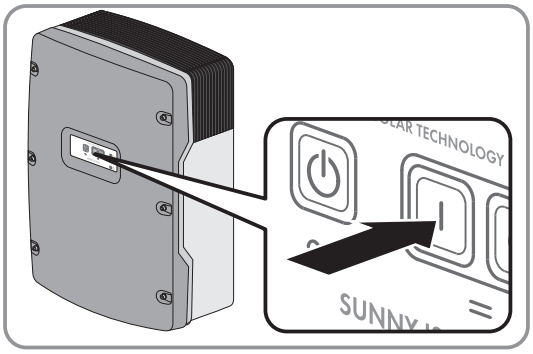
☐ The preparations for commissioning at the NA-Box / Grid-Connect Box must be completed (see the operating manual for the Multicluster-Box and operating manual for the NA-Box or Grid-Connect-Box).

☐ 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 NA-Box or Grid-Connect-Box).

☐ The basic configuration of the Sunny Island inverters must be completed (see Section 5.1.3, page 31).

Procedure:

1. Commission the PV system.
2. To deactivate the intermediate storage of PV energy, select the parameter **261.01 SlfCsmpIncEna** on every master of the multicluster system and set to **Disable**.
3. Press the start-stop button on the master of the main cluster or the Sunny Remote Control button and hold it until a signal sounds.



4. 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).

5.4.6 Registering the Multicluster System in Sunny Portal

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

Requirement:

☐ A SMA Cluster Controller must be installed in the multicluster system.

Procedure:

- Register the SMA Cluster Controller in Sunny Portal (see user manual of the SMA Cluster Controller).

6 Contact

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

- Type of system installed (e.g., three-phase single-cluster system)
- Number and type of the Sunny Island inverters
- Serial number of the Sunny Island inverters
- Firmware version of the Sunny Island inverters
- Error message displayed
- Type of battery connected
- Nominal battery capacity
- Nominal battery voltage
- Type of the communication products connected
- Type and size of additional energy sources
- If a generator is connected:
  - Type
  - Power
  - Maximum current
- If a Multicluster-Box is connected, device type of the Multicluster-Box

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 during commissioning and made available to Service (for information sheet see www.SMA-Solar.com).

Danmark Deutschland Österreich Schweiz	SMA Solar Technology AG Niestetal SMA Online Service Center: www.SMA-Service.com Sunny Boy, Sunny Mini Central, Sunny Tripower: +49 561 9522-1499 Monitoring Systems (Kommunikationsprodukte): +49 561 9522-2499 Fuel Save Controller (PV-Diesel-Hybridsysteme): +49 561 9522-3199 Sunny Island, Sunny Backup, Hydro Boy: +49 561 9522-399 Sunny Central: +49 561 9522-299	Belgien Belgique België Luxemburg Luxembourg Nederland	SMA Benelux BVBA/SPRL Mechelen +32 15 286 730
		Česko Magyarország Slovensko	SMA Service Partner TERMS a.s. +420 387 6 85 111
		Polska	SMA Polska +48 12 283 06 66
France	SMA France S.A.S. Lyon +33 472 22 97 00	Ελλάδα Κύπρος	SMA Hellas AE Αθήνα +30 210 9856666
España Portugal	SMA Ibérica Tecnología Solar, S.L.U. Barcelona +34 935 63 50 99	United Kingdom	SMA Solar UK Ltd. Milton Keynes +44 1908 304899

Bulgaria Italia România	SMA Italia S.r.l. Milano +39 02 8934-7299		
United Arab Emirates	SMA Middle East LLC Abu Dhabi +971 2234 6177	India	SMA Solar India Pvt. Ltd. Mumbai +91 22 61713888
ไทย	SMA Solar (Thailand) Co., Ltd. กรุงเทพฯ +66 2 670 6999	대한민국	SMA Technology Korea Co., Ltd. 서울 +82-2-520-2666
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