



Charge controller
SUNNY ISLAND CHARGER
Technical Description



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1 Notes on this Manual

The manual describes how to install, commission and service the Sunny Island Charger.

1.1 Validity

This manual applies to the following Sunny Island Charger type:

- SIC40-MPT

The device type of your charge controller is specified on the type label as shown in section 3.3 "Identification of the Charge Controller" (Page 12).

1.2 Target Group

This manual is intended for installers and users.

1.3 Storage of the Manual

All manuals for the device and for the installed components must be stored in the immediate vicinity of the charge controller, and must be accessible at all times.

1.4 Symbols Used

The following types of warnings and general information appear in this document as described below.



DANGER!

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.



WARNING!

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION!

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

NOTICE!

NOTICE indicates a situation that can result in property damage if not avoided.



Information

Information provides tips that are valuable for the optimal installation and operation of your product.

2 Safety Precautions

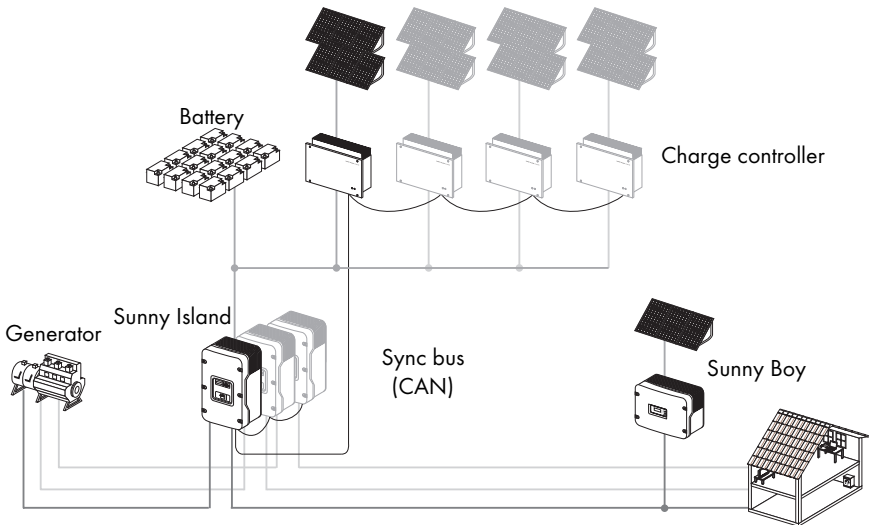
2.1 Appropriate Usage

The charge controller is a DC/DC converter that reduces the direct current of the PV generator to the direct current of a battery in order to charge it.

The charge controller can be operated in two different operating modes:

SMA operation	Stand-alone operation
The "SMA" operating mode must be selected if the charge controller is operated in a system equipped with a Sunny Island 5048/2012 or 2224.	The "Stand-alone" operating mode must be selected if the charge controller is operated in a stand-alone grid system equipped with a Sunny Island 3324/4248 or without a Sunny Island.
Section 6.1.1 "Operating Mode" (Page 31) explains how to set the operating mode.	

Principle of a Sunny Island system equipped with a charge controller



The charge controller may only be operated with PV generators (modules and cabling) of protection class II. Do not connect any energy sources other than PV modules to the charge controller.

As soon as you begin planning the PV system, ensure that the values comply with the permitted operating range of all components at all times.

The maximum open circuit voltage of the PV generator may not be greater than the maximum input voltage of the charge controller (140 V), even at very low ambient temperatures. During operation, the PV generator voltage must always be at least 5 V higher than the battery voltage. The charge controller is suitable for battery currents up to maximum 40 A at 48 V and 50 A at 24 V/12 V nominal battery voltage.

The suitability of a PV generator for the charge controller primarily depends on the output voltage and output power of the PV generator. In this regard, observe the limits specified by the module manufacturer.

Appropriate usage also includes observing all the documentation.

2.2 General Safety Instructions



DANGER!

Danger to life due to high voltages in the charge controller.

- All work on the charge controller must only be carried out by a qualified electrician.



CAUTION!

Danger of burn injuries due to hot housing parts.

- Do not touch the housing of the charge controller during operation.

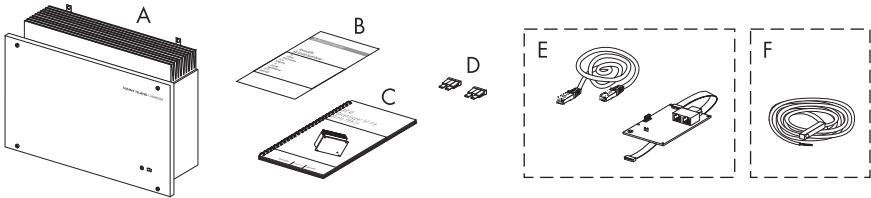


PV generator ground connection

Observe all local requirements for grounding the PV generator. SMA recommends connecting the generator frame and other electricity conducting surfaces such that there is continuous conduction and to connect them to the ground in order to reach maximum protection for property and persons.

3 Unpacking

3.1 Packing List



Object	Number	Description
A	1	Charge controller
B	1	EC Declaration of Conformity
C	1	Technical description
D	2	Thermal fuse (30 A)
E (optional)	1	SIC-PB communication interface and RJ45 cable (5 m)
F (optional)	1	Battery temperature sensor

3.2 Checking for Transport Damage

Check the charge controller for visible external damage, such as cracks in the housing. Please contact your dealer if you find any damage.

3.3 Identification of the Charge Controller

You can identify the charge controller by the type label. The type label is on the right side of the housing.

Device type
Series number

SMA Solar Technology AG
www.SMA.de

SMA

INTELSOLAR

SUNNY ISLAND CHARGER
Made in Germany

Type

SIC40-MPT

Serial No.

1234567890

$U_{PV\ max}$	140 V _{DC}
$I_{PV\ max}$	40 A
P_{nom}	600 W @ 12 V _{DC} $U_{Bat\ nom}$
	1200 W @ 24 V _{DC} $U_{Bat\ nom}$
	2000 W @ 48 V _{DC} $U_{Bat\ nom}$
$U_{Bat\ nom}$	12 / 24 / 48 V _{DC}
$I_{Bat\ nom}$	50 / 50 / 40 A
IP65 Outdoor	

2000165882

4 Mounting

**CAUTION!**

Risk of injury due to the heavy weight of the charge controller.

- Take into account that the charge controller weighs 10 kg.

4.1 Selection of Mounting Location

**DANGER!**

Danger to life due to fire or explosion.

The charge controller housing can become hot during operation.

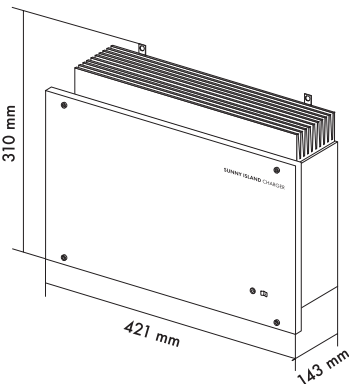
- Do not mount the charge controller on flammable construction materials.
- Do not mount the charge controller in areas where highly flammable materials are stored.
- Do not mount the charge controller in areas where there is a risk of explosion!

**CAUTION!**

Danger of burn injuries due to hot housing parts.

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

4.1.1 Dimensions



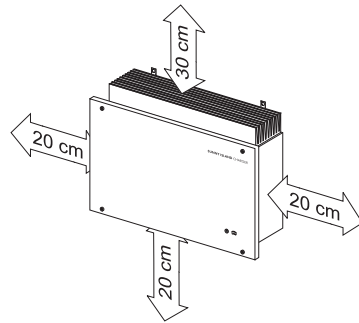
4.1.2 Ambient Conditions

- The mounting location and mounting method must be suitable for the weight and dimensions.
- Mounting on a solid surface.
- The mounting location must be accessible at all times.
- The charge controller must be easy to remove from the mounting location at any time.
- The ambient temperature should be between $-25\text{ }^{\circ}\text{C}$ and $+60\text{ }^{\circ}\text{C}$ to guarantee optimal operation.
- Do not expose the charge controller to direct sunlight to avoid a power reduction due to excessive heating.

4.1.3 Safety Clearances

Observe the following safety clearances to walls, other devices or other objects to ensure sufficient heat dissipation.

Direction	Safety clearance
Sides	20 cm
Top	30 cm
Below	20 cm

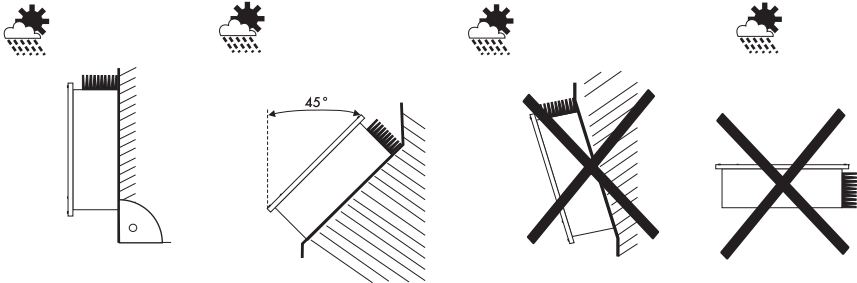


Multiple charge controllers installed in areas with high ambient temperatures

If necessary, increase the clearances between the individual charge controllers, and ensure that there is adequate ventilation to ensure sufficient cooling of the charge controllers.

4.1.4 Position

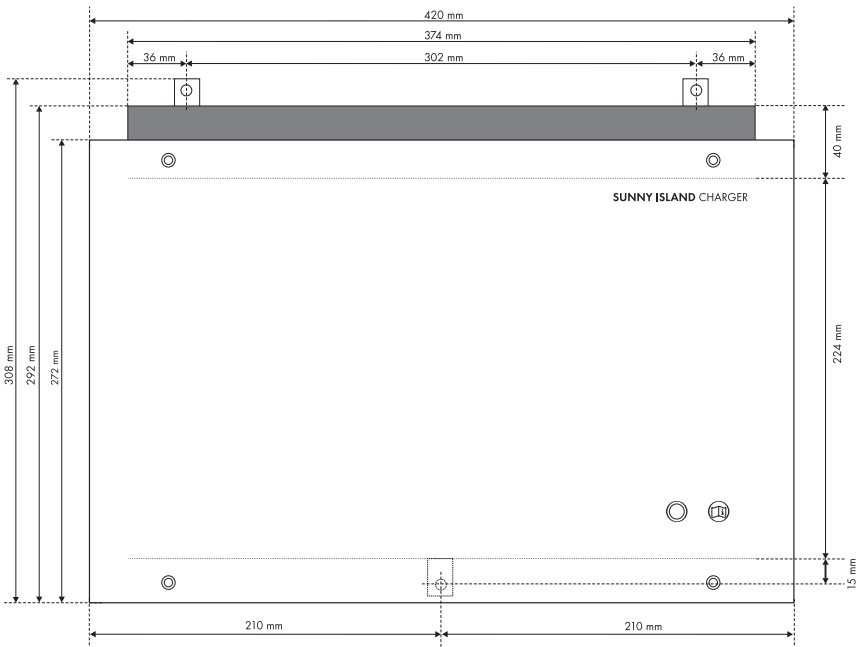
- Vertical installation or tilted backwards by max. 45 °.
- Install at eye level to allow operating modes to be read at all times.



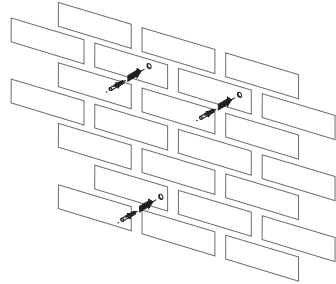
- Never install the device with a forward tilt.
- Do not install horizontally.

4.2 Mounting Instructions

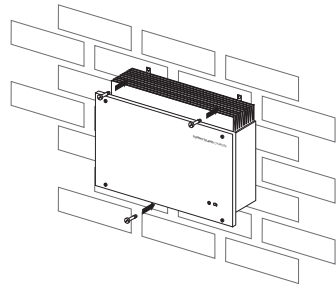
1. Mark the positions of the drill holes.



2. Drill the holes (diameter: at least 8 mm) at the marked positions and use wall anchors (at least M8).



3. Screw the charge controller with its three mounting plates on the wall. Use fastening material suitable for the surface only.



4. Check that the unit is securely in place.

5 Electrical Connection

**WARNING!**

Risk of injury due to electric shock.

If all cables with different voltages are laid parallel to one another, short circuits can result if the cable insulation becomes damaged.

- Lay all cables separately.

NOTICE!

Electrostatic discharges can damage the charge controller.

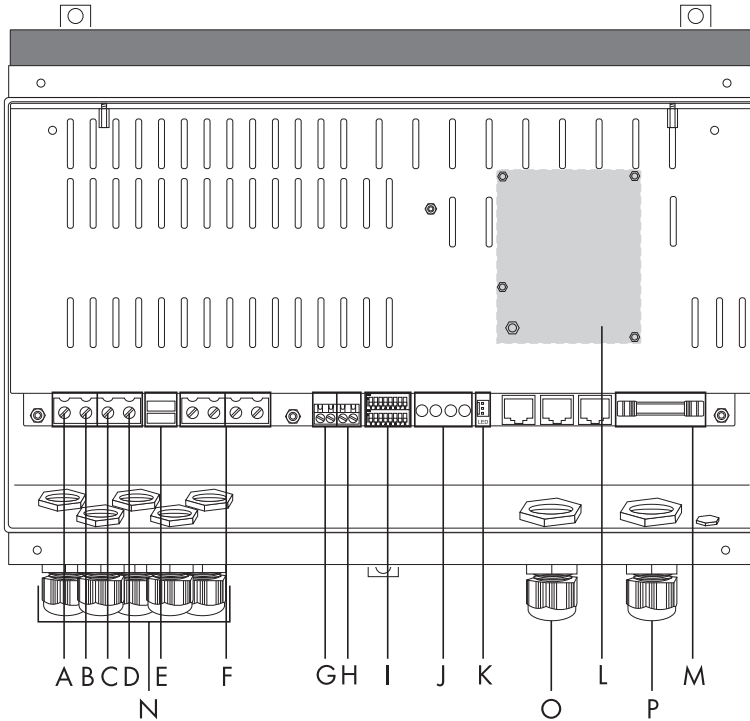
- Ground yourself before touching a component inside the charge controller.

NOTICE!

Overvoltage may irreparably damage the system.

- Use an external overvoltage protector in areas with an increased risk of thunderstorms and lightning.

5.1 Overview of the Connection Area



Object	Description
A	"PV+" connection terminal for "PV+" cable of the PV generator
B	"PV-" connection terminal for "PV-" cable of the PV generator
C	"BAT-" connection terminal for "BAT-" cable of the battery
D	"BAT+" connection terminal for "BAT+" cable of the battery
E	Thermal fuses
F	"EARTH" connection terminal for grounding
G	Connection terminal for the battery temperature sensor cables
H	Connection terminal for the signalling contact cables
I	DIL switch for configuration
J	Internal LEDs (only visible to the installer)
K	LED connection of the multicolored LED in the lid

Object	Description
L	Slot for communication interface
M	Socket for communication interface connection
N	M20 metric-thread cable screw connections for the battery, PV generator and PE cables
O	M25 metric-thread cable screw connection for the signalling contact and the battery temperature sensor cables
P	M25 metric-thread cable screw connection for communication cable

5.2 Grounding



DANGER!

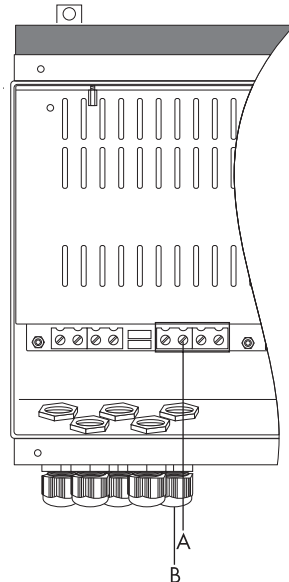
Risk of lethal electric shock.

The charge controller has the protection class I and must be properly grounded.

- Ground the charge controller regardless of whether the battery and PV are grounded.

5.2.1 Grounding the Charge Controller

1. Open the charge controller. Remove the lid screws and the lid.
2. Unscrew the metric-thread cable screw connection's lock nut (A) and slide it over the PE cable.
3. Pull the PE cable through the cable screw connection into the inside of the charge controller and connect it to the "EARTH" connection terminal (B).
4. Tighten the lock nut of the cable screw connection.



5.2.2 Grounding the Battery and the PV System



DANGER!

Danger to life due to high voltages on the negative battery terminal flowing to ground.

- Ground the battery.
A battery ground is not necessary only if the battery connections are safe to touch.

NOTICE!

Grounding the positive pole may irreparably damage the battery.

- Never ground the positive pole of the battery or the PV system.

Cross-section of the Grounding Conductor

SMA Technologie AG cannot calculate generally valid values for the required cross-section of the grounding conductor for the external grounding of the battery. The conductor dimensions depend on the type and size of the battery connected, the external fuse (DC side) and the material used for the grounding conductor.



Determining the cross-section

When determining the cross-section of the grounding conductor, all standards and guidelines that apply at the installation location must be observed.

The required cross-section of the grounding conductor can be calculated using the following formula. Trigger times of about 25 ms are typical for short-circuit currents between 2,000 A and 10,000 A.

$$S = \frac{\sqrt{I_{SC}^2 * t}}{143}$$

t = short-circuit duration in seconds
 I_{SC} = maximum battery current (short-circuit current) in ampere
 S = conductor cross-section in mm²

A grounding conductor with a 16 mm² cross-section is thus adequate for short-circuit currents up to 10,000 A.

5.3 PV Generator (DC) Connection

NOTICE!

Improperly connecting the charge controller to the PV generator may irreparably damage it.

- Never connect several charge controllers in parallel on the side of the PV generator.

The following limit values at the DC input of the charge controller must not be exceeded:

Maximum input voltage	Maximum input current
140 V (DC)	40 A (DC)

Connection Procedure



Disconnection terminal between the PV generator and the charge controller

The DIN VDE 0100-712 stipulates that an all-pole disconnection terminal must be installed between the PV generator and the charge controller. Observe this standard as well as all standards and guidelines that apply at the installation location for connecting the PV generator.

1.

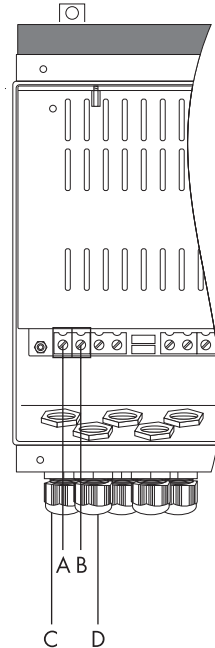


DANGER!

Danger to life due to high voltages in the charge controller.

- Disconnect the PV generator using a disconnection unit and secure it to prevent it from being reactivated.

2. Unscrew the metric-thread cable screw connection's lock nut (C) and slide it over the "PV+" cable of the PV generator.
3. Pull the "PV+" cable of the PV generator through the cable screw connection into the inside of the charge controller and connect it to the "PV+" connection terminal (A).
4. Tighten the lock nut of the cable screw connection.
5. Unscrew the metric-thread cable screw connection's lock nut (D) and pull it over the "PV-" cable of the the PV generator.
6. Pull the "PV-" cable of the PV generator through the cable screw connection into the inside of the charge controller and connect it to the "PV-" connection terminal (B).
7. Tighten the lock nut of the cable screw connection.



DANGER!

Danger to life due to high voltages in the charge controller.

- Only switch on the disconnection unit of the PV generator once all cables have been connected.

5.4 Battery Connection (DC)

Connection Requirements



Battery size

The battery size depends on the connected PV power.

Observe the following table.

Nominal battery voltage	Battery size per kWp PV
48 V	min. 100 Ah/kWp PV
24 V	min. 200 Ah/kWp PV
12 V	min. 400 Ah/kWp PV



Excessively long battery cables reduce system efficiency.

The cables leading from the battery to a DC distributor to which both the Sunny Island and the charge controller are connected may be max. 5 m long.

- Observe all standards and guidelines that apply at the installation location (e.g. DIN VDE 0510 "Rules for Accumulators and Battery Systems").
- Observe all specifications of the battery manufacturer.

Cable Requirements

NOTICE!

Irreparable damage of the cable leading from the charge controller to the battery.

- Do not lay the battery cables under plaster or in armored plastic pipes.

Cable Protection

In addition to the thermal fuses in the charge controller, install a separate fuse as close to the battery as possible. Install a suitable fuse according to the maximum specified DC currents. You can, for example, install a 63 A line circuit breaker.

NOTICE!

Irreparable damage of the cable leading from the charge controller to the battery.

- Lay the battery cables so they are protected against ground faults and short circuits if no line circuit breaker is present.
- Make sure that the cable cross-section is sufficient.

Connection Procedure

NOTICE!

Reversing the poles when connecting the battery may irreparably damage the charge controller.

- Make sure that the poles of the cables leading to the battery are correct.

1.

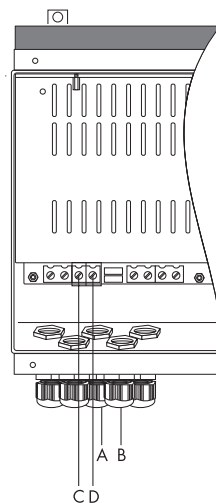


DANGER!

Danger to life due to high voltages in the charge controller.

- Switch off the line circuit breaker and secure it to prevent it from being reactivated.
- Test each unit to ensure that all voltages have been removed.

2. Unscrew the metric-thread cable screw connection's lock nut (A) and slide it over the "BAT-" cable of the battery.
3. Pull the "BAT-" cable of the battery through the cable screw connection into the inside of the charge controller and connect it to the "BAT-" connection terminal (C).
4. Tighten the lock nut of the cable screw connection.
5. Unscrew the metric-thread cable screw connection's lock nut (B) and slide it over the "BAT+" cable of the battery.
6. Pull the "BAT+" cable of the battery through the cable screw connection into the inside of the charge controller and connect it to the "BAT+" connection terminal (D).



7. Tighten the lock nut of the cable screw connection.



If the poles of the DC cables are reversed, replace the thermal fuses

If the DC cables are reversed when connecting, the thermal fuse will be irreparably damaged. Proceed as described in section 9.1 "Replacing the Thermal Fuses" (Page 36) to replace the thermal fuses.



Multicolored LED

Once the battery has been connected, the multicolored LED of the charge controller illuminates red. If the LED does not illuminate, the poles of the DC cables are reversed and the thermal fuses must be replaced. If this is not the case, the charge controller is defective and must be replaced. In this case, contact the SMA Service Line. See section 14 "Contact" (Page 47).



DANGER!

Danger to life due to high voltages in the charge controller.

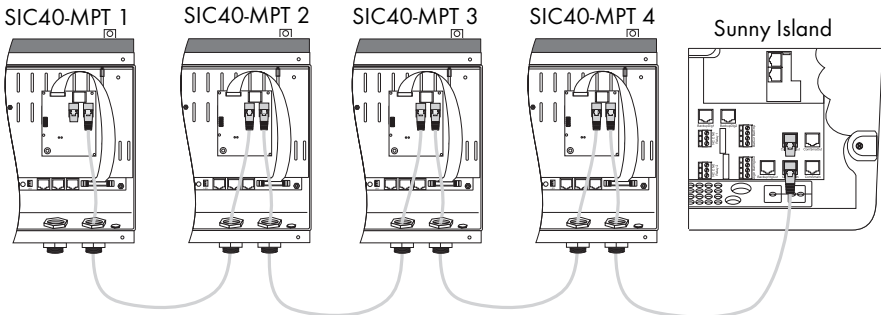
- Only switch on the line circuit breaker and connect the cables to the battery once all connections on the charge controller have been established.

5.5 Communication

The communication between the charge controller and the Sunny Island 5048/2012/2224 allows the charge controller to be controlled in a coordinated manner and ensures the precise calculation of the charge state in the Sunny Island without an additional battery current sensor resistor.

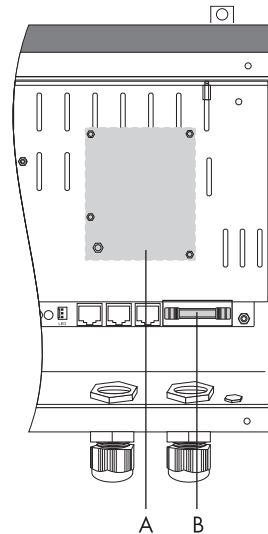
All important operating data of the charge controller can be read on the Sunny Island display. In addition, the most important values are saved on the Sunny Island SD card (if available).

Up to four charge controllers can be connected in parallel to one Sunny Island system.



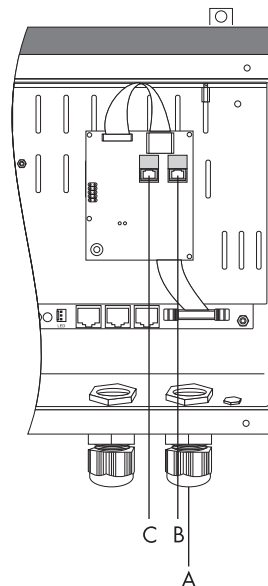
5.5.1 Installing the Communication Interface

1. Insert the communication interface in area A. Route the ribbon cable for the connection under the communication interface to the socket (B).
2. Secure the ribbon cable on the corresponding position of the shield plate.
3. Tighten the communication interface on the shield plate using the provided washers and nuts.
4. Securely insert the ribbon cable with the side marked in red on the right into the socket until it audibly clicks into place.



5.5.2 Connection of the Communication Interface

1. Remove the metric-thread cable screw connection's lock nut (A) and slide it over the communication interface cable (RJ45 cable provided).
2. Remove the seal insert from the cable screw connection and remove the dummy plug.
3. Route the communication interface cable through a cable opening in the seal insert.
4. Insert the seal insert along with communication interface cable into the cable screw connection.
5. Route the communication interface cable through the cable screw connection into the inside of the charger controller and insert it into a RJ45 socket (B) of the communication interface.
6. Insert a termination connector into the open RJ45 socket (C) of the communication interface.



If...	Then...
a charge controller is connected to the system...	<ol style="list-style-type: none"> 1. Route the communication interface cable of the charge controller to the Sunny Island and insert it into the "ComSyncln" socket/"Sync IN" socket in the Sunny Island. 2. Insert a termination connector in the "ComSyncOut" socket/"Sync OUT" socket in the Sunny Island.
several charge controllers are connected to the system...	<ol style="list-style-type: none"> 1. Route the communication interface cable of the first charge controller to the next charge controller (in this case, the second charge controller) and insert it into the RJ45 socket of the communication interface. Follow the same procedure for the first two charge controllers to connect additional charge controllers. 2. Route the communication interface cable of the last charge controller to the Sunny Island and insert it into the "ComSyncln" socket/"Sync IN" socket in the Sunny Island. 3. Insert a termination connector in the "ComSyncOut" socket/"Sync OUT" socket in the Sunny Island.

5.6 Additional Connections

5.6.1 Signalling Contact

You can connect a signalling contact to your charge controller that automatically closes in case of battery overvoltage (battery voltage > 65 V).

The signalling contact operates like a make contact and can be loaded with voltage up to 200 V (DC) and a contact load of 1 A/15 W.

NOTICE!

If a switch in the charge controller short circuits, the battery may be irreparably damaged.

If a short circuit occurs in the charge controller, the battery is no longer protected against overcharging.

- SMA Solar Technology AG recommends using the signalling contact to ensure that in case of a failure, the battery is disconnected from the charge controller by a relay or contactor.
- If several charge controllers are connected to the stand-alone grid system, a signalling contact must be connected between each charge controller and the battery.

Cable Requirements

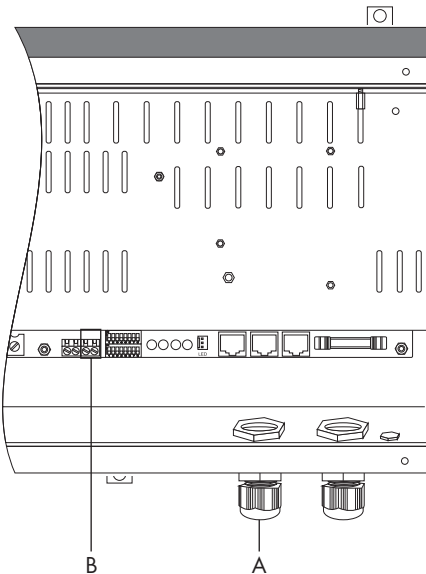


Signalling Contact Cable

To maintain the IP65 protection rating, use a cable with an outer diameter of 5 mm - 7 mm to connect the signalling contact.

Connection Procedure

1. Unscrew the M25 metric-thread cable screw connection's lock nut (A) and slide it over the signalling contact cables.
2. Remove the seal insert from the cable screw connection and remove the dummy plug.
3. Route the signalling contact cable through a cable opening into the seal insert.
4. Insert the seal insert along with signalling contact cables into the cable screw connection.
5. Pull the signalling contact cables through the cable screw connection into the inside of the charge controller and connect them to the connection terminal (B).
6. Tighten the lock nut of the cable screw connection.



5.6.2 Battery Temperature Sensor

To allow a temperature-independent charge control during stand-alone operation or during operation with a Sunny Island 3324/4248, you can connect an external battery temperature sensor (BAT-TEMP-SENSOR) to the charge controller.



SMA Operation

No external battery temperature sensor is required when operating in "SMA operation" mode.

NOTICE!

Damage to battery due to over or insufficient charging.

In the "Stand-alone operation" operating mode, a battery temperature sensor must be connected. Otherwise, the battery may be overcharged or insufficiently charged if temperatures outside of the temperature range +15 °C to 35 °C frequently occur.

- Connect an external battery temperature sensor if the charge controller is operated in stand-alone operation or with a Sunny Island 3324/4248.



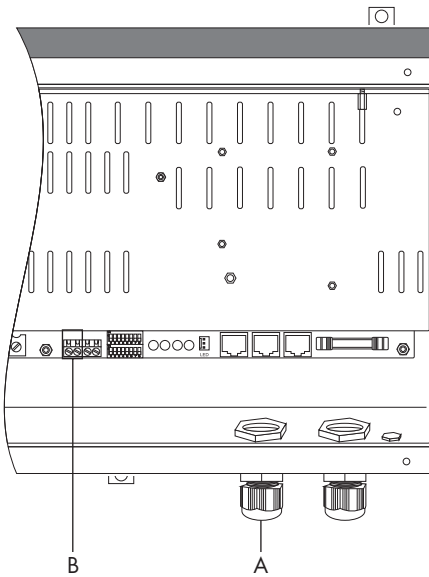
2.2 k Resistor

A 2.2 k resistor is connected as standard to the connection terminal for the battery temperature sensor.

If both the resistor and a battery temperature sensor are not connected during stand-alone operation or during operation with a Sunny Island 3324/4248, the charge controller cannot be commissioned.

Connection Procedure

1. Remove the resistor.
2. Unscrew the M25 metric-thread cable screw connection's lock nut (A) and slide it over the battery temperature sensor cable.
3. Remove the seal insert along with the cable gland from the cable screw connection.
4. Route the cables through the cable openings in the seal insert.
5. Connect the battery temperature sensor cables to the connection terminal (B).
6. Tighten the lock nut of the cable screw connection.



6 (First) Commissioning

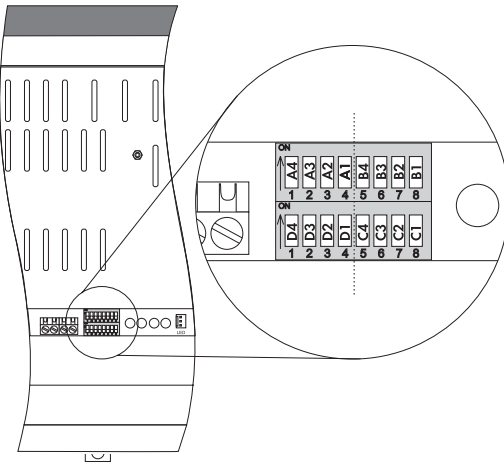
6.1 Configuration of the Charge Controller

Configure the charge controller before commissioning. You can carry out the basic configuration using the operating switch (DIL switch).

The operating mode, battery system, battery type, device address of the charge controller and a fault diagnosis can be configured by changing the switch position of the DIL switch.

Assignment of the DIL Switch

The DIL switches have the following assignment:



6.1.1 Operating Mode

The operating mode is set using the "D4" DIL switch.

i **Operation with Sunny Island 3324/4248**

If the charge controller is operated in the stand-alone grid system with a Sunny Island 3324/4248, the "Stand-alone" operating mode must be selected, since this Sunny Island does not support the communication type of the charge controller.

The following table displays the switch position for the required operating mode.

Switch	SMA operation (operation with Sunny Island)	Stand-alone operation
D4	ON	OFF

6.1.2 Battery System

The battery system is set using the C1, C2 and C3 DIL switches. The following table displays the switch position of the required battery system.

Switch	12 V battery system	24 V battery system	48 V battery system
C1	ON	OFF	OFF
C2	OFF	ON	OFF
C3	OFF	OFF	ON

6.1.3 Device Address

The sequential order of the devices is determined by configuring the device address. The device address is set using the D1, D2 and D3 DIL switches.



Stand-alone Operation

In the "Stand-alone operation" operating mode, the device address must be set to 0.



SMA Operation

In the "SMA operation" operating mode, up to 4 charge controllers can be connected to the Sunny Island. The device addresses intended for these four devices are one to four.

The following table displays the switch position of the device addresses.

Switch	Device address 0	Device address 1	Device address 2	Device address 3	Device address 4
D1	OFF	ON	OFF	ON	OFF
D2	OFF	OFF	ON	ON	OFF
D3	OFF	OFF	OFF	OFF	ON

6.1.4 Battery Type

In stand-alone operation, the battery type and the charging voltage must be set. The battery type and charging voltage are set using the B1, B2, B3 and B4 DIL switches. When performing these settings, observe all the specifications of the battery manufacturer.

The possible settings for the charging voltage/cells can be found in the following tables.

Battery type	Charging process			Switch			
	Boost	Continuous	Float	B1	B2	B3	B4
Typical locked battery	2.392 V	2.35 V	2.3 V	ON	OFF	OFF	OFF
Type 2 locked battery	2.392 V	2.35 V	2.267 V	OFF	OFF	ON	OFF
Type 3 locked battery	2.375 V	2.35 V	2.283 V	OFF	ON	OFF	OFF
Type 4 locked battery	2.358 V	2.33 V	2.25 V	OFF	ON	ON	OFF
Typical self-contained battery	2.4 V	2.375 V	2.33 V	ON	OFF	OFF	OFF
Type 2 self-contained battery	2.4 V	2.35 V	2.3 V	ON	OFF	ON	OFF
Type 3 self-contained battery	2.467 V	2.35 V	2.3 V	ON	ON	ON	OFF
Type 4 self-contained battery	2.583 V	2.35 V	2.3 V	OFF	OFF	OFF	ON

6.2 Commissioning

Check the following requirements before commissioning:

- properly designed fuses
- full connection of the DC cables (PV strings and batteries)
- connected battery temperature sensor
(only in stand-alone operation or during operation with a Sunny Island 3324/4248)
- configured DIL switch

Commissioning Procedure

1. Check the polarity of the battery and the PV generator.
2. Close the charge controller. Fasten the lid to the housing using four screws.
3. Connect the cables leading from the charge controller to the battery on the battery.
4. Switch on the line circuit breaker and the disconnection unit.
5. The LED changes its color from red to green. The green LED indicates that the device is operating. If this is the case, commissioning was completed successfully.
If the PV voltage drops and falls below the battery voltage, the LED changes from green to orange. If the PV voltage exceeds the battery voltage, the device starts back up and the LED changes from orange to green.

7 Opening and Closing

7.1 Opening the Charge Controller

1.



DANGER!

Danger to life due to high voltages in the charge controller.

- Switch off the line circuit breaker and secure it to prevent it from being reactivated.
- Switch off the supply voltage to the signalling contact and secure it to prevent it from being reactivated (if applicable).
- Test each unit to ensure that all voltages have been removed.

2. Unscrew the housing lid screws and set them aside.
3. Pull the lid slightly forward.
4. Disconnect the PE connection from the lid.
5. Carefully remove the multicolored LED from the "LED" socket in the charge controller.
6. Remove the lid and set it aside.

7.2 Closing the Charge Controller

1. Establish the PE connection to the lid.
2. Carefully insert the multicolored LED into the "LED" socket in the charge controller.
3. Close the charge controller. Fasten the lid to the housing using four screws.
4. Switch on the line circuit breaker and the disconnection unit.
5. Look at the LED display to check whether the charge controller is in a fault-free operating status.

8 Battery Management and Charge Control

8.1 SMA Operation

If the charge controller is operated in SMA operation and a communication connection has been established to the Sunny Island 5048/2012/2224, the Sunny Island controls the complete battery management including the charge control.

The charge controller receives the current and temperature-compensated nominal charging voltage from the Sunny Island and transmits the battery's present charging current back to the Sunny Island. This ensures that the battery is always optimally charged and that the Sunny Island calculates the correct charge state. Further details on the battery management are located in the Sunny Island documentation.

If the communication does not function in SMA operation, the battery is only securely charged with 13.5/27/54 V.

8.2 Stand-alone Operation

During stand-alone operation or during operation with the Sunny Islands 3324/4248, the charge controller automatically controls the charging voltage of the battery, depending on the battery type set and current charging phase, according to the "four-phase charging process" (MPP, boost, continuous, float). During the first phase, charging is carried out using the maximum power provided by the PV generator. During the second phase, the charging current is reduced and the battery voltage is regulated to the charging voltage set for the boost phase. This phase is only completed if the battery voltage ever drops below 2.08 V/cell during previous discharging. Otherwise, the charging process is immediately continued with the third phase, continuous. The continuous and the boost charging phases are identical, except that the continuous phase has a slightly lower charging voltage. Once the continuous charging is completed, the charge controller switches to float charging in which it remains until the next discharging.

If a battery temperature sensor is connected, the charging voltage is adjusted to the temperature using $-4 \text{ mV}/^{\circ}\text{C}$ and cell.

9 Maintenance and Cleaning

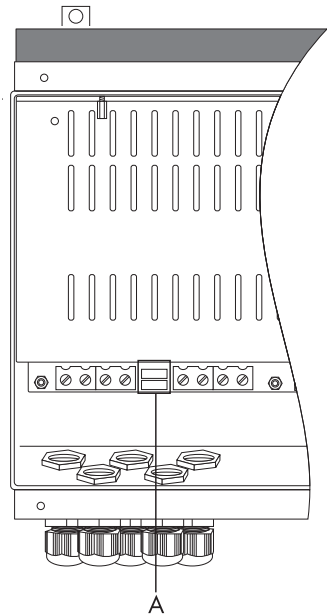
9.1 Replacing the Thermal Fuses

NOTICE!

Using incorrect thermal fuses may irreparably damage the charge controller.

- Only use the thermal fuses included in the packing list.

1. Open the charge controller as described in section 7.1 "Opening the Charge Controller" (Page 34).
2. Remove irreparably damaged thermal fuses from the slots (A).
3. Insert the new thermal fuses (included in the packing list).
4. Close the charge controller as described in section 7.2 "Closing the Charge Controller" (Page 34).



9.2 Cleaning the Cooling Fins

It is only necessary to clean the cooling fins if the charge controller's heat dissipation is restricted by dirt.

- Carefully remove dirt with a suitable soft brush.

10 Parameter Lists on the Sunny Island

If the charge controller is connected to the Sunny Island through the communication interface and thus integrated into the stand-alone grid system, the following values are shown on the Sunny Island display:

10.1 Display Values

Menu no.	Parameter no.	Parameter name	Range/ Unit	Description
141# SIC40 Total				
141	01	TotSicPvPwr	W	Total output of all charge controllers
141	02	TotSicBatCur	A	Battery current of all charge controllers
142# SIC40 1				
142	01	Sic1PvPwr	W	PV power of the first charge controller
142	02	Sic1PvVtg	V	PV voltage of the first charge controller
142	03	Sic1BatVtg	V	Battery voltage of the first charge controller
142	04	Sic1BatCur	A	Battery current of the first charge controller
142	07	Sic1HsTmp	°C	Heatsink temperature of the first charge controller
142	09	Sic1SWVers	-	Software version number of the communication interface

Menu no.	Parameter no.	Parameter name	Range/ Unit	Description
143# SIC40 2				
143	01	Sic2PvPwr	W	PV power of the second charge controller
143	02	Sic2PvVtg	V	PV voltage of the second charge controller
143	03	Sic2BatVtg	V	Battery voltage of the second charge controller
143	04	Sic2BatCur	A	Battery current of the second charge controller
143	07	Sic2HsTmp	°C	Heatsink temperature of the second charge controller
143	09	Sic2SWVers	-	Software version number of the communication interface
144# SIC40 3				
144	01	Sic3PvPwr	W	PV power of the third charge controller
144	02	Sic3PvVtg	V	PV voltage of the third charge controller
144	03	Sic3BatVtg	V	Battery voltage of the third charge controller
144	04	Sic3BatCur	A	Battery current of the third charge controller
144	07	Sic3HsTmp	°C	Heatsink temperature of the third charge controller
144	09	Sic3SWVers	-	Software version number of the communication interface
145# SIC40 4				
145	01	Sic4PvPwr	W	PV power of the fourth charge controller
145	02	Sic4PvVtg	V	PV voltage of the fourth charge controller
145	03	Sic4BatVtg	V	Battery voltage of the fourth charge controller
145	04	Sic4BatCur	A	Battery current of the fourth charge controller
145	07	Sic4HsTmp	°C	Heatsink temperature of the fourth charge controller
145	09	Sic4SWVers	-	Software version number of the communication interface

10.2 Events

Events describe state changes or transient states.

The meaning of events reported by the Sunny Island are explained in the following table:

Display no.	Display text	Description
E851	Sic1Detect	First charge controller was detected
E852	Sic2Detect	Second charge controller was detected
E853	Sic3Detect	Third charge controller was detected
E854	Sic4Detect	Fourth charge controller was detected

10.3 Error (Warnings)

Errors describe impermissible or only limited permissible states. This includes warnings, failures and errors. If an error or a failure is indicated by the illuminated red LED, contact your installer.

The meaning of warnings and errors reported by the Sunny Island are explained in the following table:

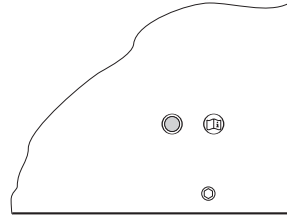
Display no.	Display text	Description
W851	Sic1BatShort	Pole of battery connection is reversed or short circuit on the first charge controller
W852	Sic1BatVtgHi	Battery overvoltage (>65 V) on the first charge controller
W853	Sic1PvVtgHi	Overvoltage of PV generator on the first charge controller
W854	Sic1PvVtgLo	No PV voltage or short circuit on the first charge controller
W855	Sic1TmpLo	Sensor error or undertemperature on the first charge controller
W856	Sic1TmpHi	Device overtemperature on the first charge controller
W857	Sic1ComLoss	Communications loss on the first charge controller for more than 24 h
W861	Sic2BatShort	Pole of battery connection is reversed or short circuit on the second charge controller
W862	Sic2BatVtgHi	Battery overvoltage (>65 V) on the second charge controller
W863	Sic2PvVtgHi	Overvoltage of PV generator on the second charge controller
W864	Sic2PvVtgLo	No PV voltage or short circuit on the second charge controller
W865	Sic2TmpLo	Sensor error or undertemperature on the second charge controller
W866	Sic2TmpHi	Device overtemperature on the second charge controller

Display no.	Display text	Description
W867	Sic2ComLoss	Communications loss on the second charge controller for more than 24 h
W871	Sic3BatShort	Pole of battery connection is reversed or short circuit on the third charge controller
W872	Sic3BatVtgHi	Battery overvoltage (>65 V) on the third charge controller
W873	Sic3PvVtgHi	Overvoltage of PV generator on the third charge controller
W874	Sic3PvVtgLo	No PV voltage or short circuit on the third charge controller
W875	Sic3TmpLo	Sensor error or undertemperature on the third charge controller
W876	Sic3TmpHi	Device overtemperature on the third charge controller
W877	Sic3ComLoss	Communications loss on the third charge controller for more than 24 h
W881	Sic4BatShort	Pole of battery connection is reversed or short circuit on the fourth charge controller
W882	Sic4BatVtgHi	Battery overvoltage (>65 V) on the fourth charge controller
W883	Sic4PvVtgHi	Overvoltage of PV generator on the fourth charge controller
W884	Sic4PvVtgLo	No PV voltage or short circuit on the fourth charge controller
W885	Sic4TmpLo	Sensor error or undertemperature on the fourth charge controller
W886	Sic4TmpHi	Device overtemperature on the fourth charge controller
W887	Sic4ComLoss	Communications loss on the fourth charge controller for more than 24 h

11 Explanation of the LEDs (With Codes)

11.1 Multicolored LED

LED	Meaning
Green	in operation (PV voltage > battery voltage)
Red	failure / error
Orange	low PV voltage (PV voltage < battery voltage)

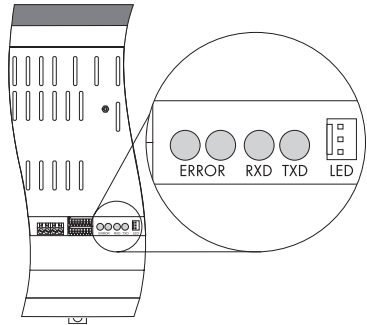


11.2 Internal LEDs



Internal LEDs

The internal LEDs are located inside the charge controller and are only visible to the installer.



Yellow (ERROR)	Yellow (ERROR)	Green (RXD)	Green (TXD)	Meaning
is illuminated	is illuminated	-	-	error / stop
-	-	-	-	charge controller is charging
-	-	flashes	-	charge controller is receiving data from Sunny Island
-	-	-	flashes	charge controller is transmitting data

12 Decommissioning

12.1 Disassembly



CAUTION!

Risk of injury due to the heavy weight of the charge controller.

- Take into account that the charge controller weighs 10 kg.

1.



DANGER!

Danger to life due to high voltages in the charge controller.

- Switch off all fuses and secure them to prevent them from being reactivated.

2. Wait until the LED on the charge controller has gone out.
3. Open the charge controller. Remove the lid screws and the lid.
4. Disconnect the PV generator from the charge controller.
5. Disconnect the battery from the charge controller.
6. Remove the communication cable from the charge controller.
7. Close the charge controller. Fasten the lid to the charge controller using four screws.
8. Remove the charge controller.

12.2 Packaging

If possible, always pack the charge controller in the original packaging. If this is no longer available, you can also use an equivalent box that fulfills the following requirements:

- suitable for loads of up to 10 kg
- can be closed fully

12.3 Storage

Store the charge controller in a dry place where the ambient temperature is always between $-25\text{ }^{\circ}\text{C}$ and $+60\text{ }^{\circ}\text{C}$.

12.4 Disposal

Dispose of the charge controller at the end of its service life in accordance with the disposal regulations for electronic waste which apply at the installation site at that time. Alternatively, send it back to SMA with shipping paid by sender, and labeled "ZUR ENTSORGUNG" ("for disposal").

13 Technical Data

	SIC40-MPT
Input (PV generator)	
Max. PV power (12 V / 24 V / 48 V)	630 W / 1250 W / 2100 W
Max. DC voltage	140 V _{DC}
Optimum MPPT voltage range (12 V / 24 V / 48 V)	25 V - 60 V / 40 V - 80 V / 70 V - 100 V
Number of MPP trackers	1
Max. PV current for 12 V / 24 V / 48 V system	40 A / 40 A / 30 A
PV current control unit	MPPT (coarse current control in minute cycles, fine current control every two seconds.)
Clamping position	screw terminals
Recommended cable cross-section	10 mm ²
Max. cable cross-section that can be connected	16 mm ²
Torque (bolt or screw terminals)	0.5 Nm - 0.6 Nm

	SIC40-MPT
Output (battery)	
Nominal DC input power up to 40 °C (12 V / 24 V / 48 V)	600 W / 1200 W / 2000 W
Output limitation (50 °C / 60 °C ambient temperature)	1500 W / 1000 W
Nominal battery voltage (adjustable)	12 V / 24 V / 48 V
Battery voltage range	8 V - 65 V
Battery type	locked and self-contained lead batteries
Max. charging current (12 V / 24 V / 48 V)	50 A / 50 A / 40 A
Permanent charging current (12 V / 24 V / 48 V)	50 A / 50 A / 40 A
Charge control	IUoU
Clamping position	screw terminals
Recommended cable cross-section	10 mm ²
Max. cable cross-section that can be connected	16 mm ²
Fuse type (max. contact unit)	thermal fuse (2 x 30 A)
Torque (bolt or screw terminals)	0.5 Nm - 0.6 Nm

Efficiency / Power consumption	
Max. efficiency	98 %
Euro ETA	97,3 %
Internal consumption during the day	< 5 W @ $U_{\text{Bat nom}} = 48 \text{ V}_{\text{DC}}$
Internal consumption at night	< 3 W @ $U_{\text{Bat nom}} = 48 \text{ V}_{\text{DC}}$

	SIC40-MPT
General information	
Dimensions (w x h x d) in mm	421 x 310 x 143
Protection class according to DIN EN 60529	IP65
Weight	10 kg
Device protection	short circuit / reverse polarity / overload / overvoltage and undervoltage / overtemperature and undertemperature
EC Declaration of Conformity	download area www.SMA.de
Display screen	1 x multicolored LED
Method of installation	suspended
Setting the parameters	Plug and Play in combination with Sunny Island (CAN Piggy-Back required) DIL switch by stand-alone applications and in SMA operation
Parallel operation	up to four devices through CAN bus
Battery temperature compensation	- 4 mV / °C
Interfaces	CAN Piggy-Back (optional)
External temperature sensor	type KTY (optional)

Ambient conditions	
Permissible ambient temperature during operation	-25 °C to +60 °C
Humidity	0 % - 100 %
Altitude (operational)	5,000 m above sea level
Transport height	16,000 m above sea level

	SIC40-MPT
Security	
Device overtemperature	derating / disconnection
Device undertemperature	disconnection at -30 °C
Overvoltage (PV)	disconnection >140 V
Undervoltage (PV)	disconnection at $U_{PV} < U_{Bat}$; reconnection $U_{PV} = U_{Bat} + 5 V$
Overvoltage (battery)	disconnection $U_{Bat} > 65 V$
Undervoltage (battery)	disconnection < 8 V; reconnection > 8.5 V
Short circuit PV	disconnection
Short circuit battery	disconnection
Reverse polarity PV	disconnection
Reverse polarity battery	fuse trips

Displays	
Operation display	multicolored LED
Transmission data display	internal LED (not visible from the outside)
Data reception display	internal LED (not visible from the outside)
Display on the Sunny Island	battery current, PV power, PV voltage, operating mode, error

14 Contact

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

- series number of the charge controller
- number of additional charge controllers
- type and number of modules connected
- type of the Sunny Island connected

SMA Solar Technology AG

Sonnenallee 1

34266 Niestetal, Germany

Tel. +49 561 9522 399

Fax +49 561 9522 4697

SunnyIsland.Service@SMA.de

www.SMA.de

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- Ignoring safety warnings and instructions contained in all documents relevant to the product
- Operating the product under incorrect safety or protection conditions
- Altering the product or supplied software without authority
- The product malfunctions due to operating attached or neighboring devices beyond statutory limit values
- In case of unforeseen calamity or force majeure

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SMA Solar Technology AG

Sonnenallee 1

34266 Niestetal

Germany

Tel. +49 561 9522-0

Fax +49 561 9522-100

www.SMA.de

E-Mail: info@SMA.de

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SMA Solar Technology AG

www.SMA.de

Sonnenallee 1

34266 Niestetal, Germany

Tel.: +49 561 9522 4000

Fax: +49 561 9522 4040

E-Mail: Vertrieb@SMA.de

Freecall: 0800 SUNNYBOY

Freecall: 0800 78669269

