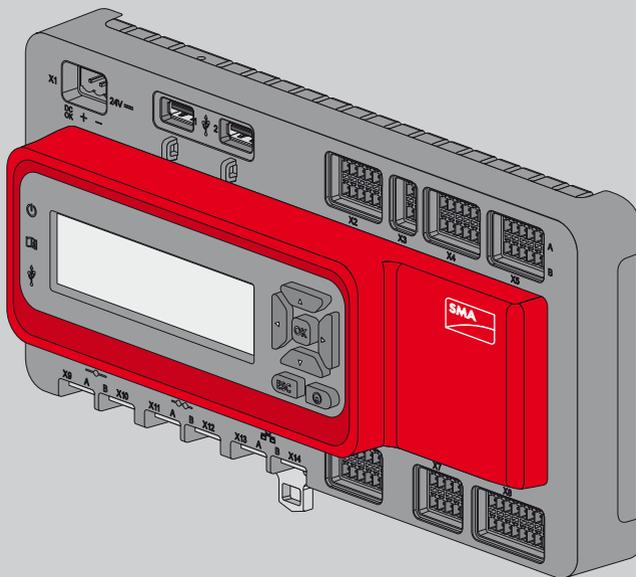


# Installation Manual

## SMA CLUSTER CONTROLLER



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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](http://www.SMA.de)  
E-Mail: [info@SMA.de](mailto:info@SMA.de)

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# 1 Information on this Document

## Validity

This document is applicable for the device type "CLCON-10.GR1" (SMA Cluster Controller) from hardware version A1 and from firmware version 1.0.

## Target Group

This document is for skilled persons. Only persons with the appropriate skills are allowed to perform the tasks described in this manual (see Section 2.2 "Qualifications of Skilled Persons", page 8).

## Symbols

Icon	Explanation
 <b>DANGER</b>	Indicates a hazardous situation which, if not avoided, will result in death or serious injury
 <b>WARNING</b>	Indicates a hazardous situation which, if not avoided, could result in death or serious injury
 <b>CAUTION</b>	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury
<b>NOTICE</b>	Indicates a situation which, if not avoided, could result in property damage
	Information that is important for a specific topic or goal, but is not safety-relevant
<input type="checkbox"/>	Indicates an essential requirement for achieving a specific goal
<input checked="" type="checkbox"/>	Desired result
<b>x</b>	A problem that might occur

## Typography

Typography	Usage	Example
<b>bold</b>	<ul style="list-style-type: none"> <li>Display messages</li> <li>Elements of a user interface</li> <li>Terminals</li> <li>Elements to be selected</li> <li>Elements to be entered</li> </ul>	<ul style="list-style-type: none"> <li>The value can be read from the <b>Energy</b> field.</li> <li>Select <b>Settings</b>.</li> <li>Enter the value <b>10</b> in the <b>Minutes</b> field.</li> </ul>
<b>&gt;</b>	<ul style="list-style-type: none"> <li>Connects several elements to be selected</li> </ul>	<ul style="list-style-type: none"> <li>Select <b>Settings &gt; Date</b>.</li> </ul>
<b>[Button/Key]</b>	<ul style="list-style-type: none"> <li>Button or key to be selected or pressed</li> </ul>	<ul style="list-style-type: none"> <li>Select <b>[Next]</b>.</li> </ul>

## Nomenclature

Full Designation	Designation in this Document
Large-scale PV plant	System
PV inverters	Inverter
SMA Cluster Controller	Cluster Controller

## Abbreviations

Abbreviation	Designation	Explanation
CO	Change Over	Relay change-over contact
DHCP	Dynamic Host Configuration Protocol	Protocol for the dynamic assignment of IP configurations
FTP	File Transfer Protocol	Network protocol for data transmission
LED	Light-Emitting Diode	-
MSL	Mean Sea Level	-
NC	Normally Closed	Rest contact of the relay
NO	Normally Open	Operating contact of the relay
PV	Photovoltaics	-
TCP	Transmission Control Protocol	Transport protocol for packet-switching in connection-oriented networks
USB	Universal Serial Bus	Serial bus system

## 2 Safety

### 2.1 Appropriate Usage

The Cluster Controller is a device for monitoring and controlling up to 75 SMA inverters with Speedwire/Webconnect interface in decentralised large-scale PV plants. For this purpose, the Cluster Controller performs the following tasks:

- Set-up of the Speedwire network
- Reading out, provision and administration of plant data
- Configuring device parameters
- Sending e-mail alerts in the event of critical plant statuses
- Implementation and feedback of network operator setpoints for active power limitation and reactive power under grid management
- Sending the plant data to an FTP server and/or the Sunny Portal Internet portal
- Performing updates for the Cluster Controller and the Inverters

The Cluster Controller is an ITE Class A device according to EN 55022 and is designed for industrial use.

The Cluster Controller is suitable for indoor use only.

The Cluster Controller must only be used with supported devices.

For safety reasons, it is not permitted to modify the product or install components that are not explicitly recommended or distributed by SMA Solar Technology AG for this product.

Only use the Cluster Controller in accordance with the information provided in the enclosed documentation. Any other use may result in personal injury or property damage.

The enclosed documentation is an integral part of this product:

- Read and observe the documentation.
- Keep the documentation in a convenient place for future reference.

### 2.2 Qualifications of Skilled Persons

The work described in this document must be performed by skilled persons only. Skilled persons must have the following qualifications:

- Training in the installation and commissioning of electrical devices
- Training in how to deal with the dangers and risks involved in installing and operating electrical devices and plants
- Training in the installation and configuration of IT systems
- Knowledge of how an inverter works and is operated
- Knowledge of all applicable standards and directives
- Knowledge of and adherence to this document and all safety precautions

## 2.3 Safety Precautions

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

### **⚠ DANGER**

#### **Danger to life due to electric shock**

If overvoltage occurs (e. g. through a flash of lightning) or if the enclosure of the Cluster Controller is not earthed, there is a danger of electric shock.

- Ensure that the Cluster Controller is integrated in the existing overvoltage protection.
- Earth the enclosure of the Cluster Controller (for information on connecting the protective conductor, see Section 6.14).

### **NOTICE**

#### **Damage to the Devices and Cables**

The Cluster Controller is not splash water-protected (degree of protection: IP20). Consequently, it is possible that moisture may penetrate the device.

- Only use the Cluster Controller in a dry, indoor environment.

## 2.4 Supported Products

### **SMA Products**

The Cluster Controller can establish a connection to and display data on the following SMA products that are equipped with Speedwire communication:

#### **Inverters:**

- All inverters with integrated or retrofitted Speedwire/Webconnect interface.

Information on whether an inverter has an integrated Speedwire/Webconnect interface or can be retrofitted with a Speedwire/Webconnect interface can be found on the product page of the respective inverter at [www.SMA-Solar.com](http://www.SMA-Solar.com).

#### **Additional products:**

- Sunny Portal
- SMA Grid Gate of device type "GRIDGATE-20" from firmware version 1.0\*

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\* Not available in all countries (for information on whether the product is available in your country, see the website of the SMA subsidiary in your country at [www.SMA-Solar.com](http://www.SMA-Solar.com) or contact your specialist dealer).

## Products from Other Manufacturers

### Sensors:

- Irradiation sensors that can output a current signal in the range from 0 mA to 20 mA
- Temperature sensors with a PT100 measuring shunt or a PT1000 measuring shunt
- Additional sensors that can output a current signal in the range from 0 mA to 20 mA or a voltage signal in the range from -10 V to +10 V

### Digital and analogue signal sources:

- Signal sources with digital relay contacts
- Signal sources that provide digital output signals
- Signal sources that can output current signals in the range from 0 mA to 20 mA
- Signal sources that can process current signals in the range from 0 mA to 20 mA
- Signal sources that can output voltage signals in the range from -10 V to +10 V

### Routers and network switches:

- Router and switches for Fast Ethernet with a data transfer rate of at least 100 Mbit/s

### Top-hat rail power supply units:

Along with the top-hat rail power supply units offered as an accessory (see Section 10), the Cluster Controller supports top-hat rail power supply units with the following properties:

- Maximum output current including short circuit: 8 A
- Maximum apparent output power: 100 VA
- DC output voltage: 24 V
- Nominal current: minimum 1.8 A

## 2.5 System Requirements

### Supported Internet browsers:

- Microsoft Internet Explorer from version 8
- Mozilla Firefox from version 3.6

### Recommended Screen Resolution:

- Minimum 1,024 pixels x 768 pixels

### 3 Scope of Delivery

Check the scope of delivery for completeness and any externally visible damage. Contact your specialist dealer if the delivery is incomplete or damaged.

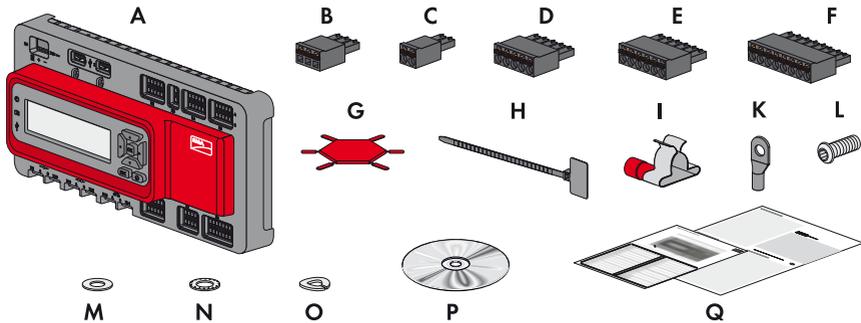


Figure 1: Parts included in the scope of delivery

Position	Number	Description
A	1	Cluster Controller
B	1	Three-pole plug
C	1	Two-pole plug*
D	2	Five-pole plug
E	8	Six-pole plug* *
F	2	Eight-pole plug
G	2	Coding element
H	20	Cable ties with caption field
I	8	Shield clamp with ring terminal lug
K	1	Ring terminal lug
L	1	Fastening screw
M	2	Washer
N	1	Tooth lock washer
O	1	Split lock washer
P	1	CD with installation manual and user manuals
Q	1	Quick reference guide for commissioning and supplementary sheet for noting connected devices

\* Reserved for future applications. Keep the plug in a safe place.

\*\* Two of the eight plugs are reserved for future applications. Keep the two plugs in a safe place.

## 4 Product Description

### 4.1 Cluster Controller

The Cluster Controller is a device for monitoring and controlling up to 75 SMA inverters with Speedwire/Webconnect interface in decentralised large-scale PV plants. For this purpose, the Cluster Controller performs the following tasks:

- Set-up of the Speedwire network
- Reading out, provision and administration of plant data
- Configuring device parameters
- Implementation and feedback of network operator setpoints for active power limitation and reactive power operation under grid management
- Sending e-mail alerts in the event of critical plant statuses
- Sending the plant data to an FTP server and/or the Sunny Portal Internet portal
- Performing Updates for the Cluster Controller and the Inverters

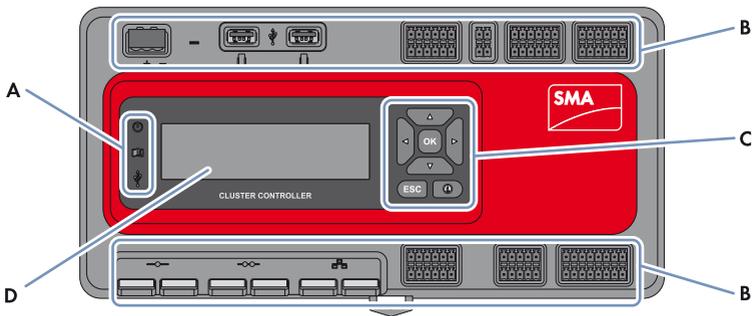


Figure 2: Design of the Cluster Controller

Position	Description
A	LEDs
B	Connection areas
C	Button field
D	Display

## Reading out, Provision and Administration of Plant Data

The Cluster Controller is the central communication unit for the plant and continuously reads out the data of the devices in the plant (e.g. inverters, sensors). The Cluster Controller then makes this plant data available via the display, user interface and Modbus®\* data interface. In addition, the plant data can be displayed, evaluated and managed using Sunny Portal (see the Cluster Controller user manual and the user manual of the Cluster Controller in Sunny Portal).

## Configuring Device Parameters

You can configure specific parameters of individual devices or entire device classes via the user interface of the Cluster Controller. For this purpose, you must be logged into the **Installer** user group on the Cluster Controller. The device parameters that can be configured, if any, depend on the device and the rights of the user group. You may only change grid-sensitive device parameters (SMA Grid Guard parameters) with the approval of the network operator and using your personal SMA Grid Guard code (see the Cluster Controller user manual).

## Sending E-Mail Alerts in the Event of Critical Plant Statuses

You have the option of receiving prompt information on critical plant statuses via e-mail (see the Cluster Controller user manual). The Cluster Controller automatically sends a notification if alert-related events occur in the plant.

## Implementation and Feedback of Network Operator Setpoints for Active Power Limitation and Reactive Power Operation under Grid Management

With the Cluster Controller, you can implement different network operator setpoints for the active power limitation and the reactive power operation of your plant under grid management. Your network operator transmits the setpoints directly to the Cluster Controller, either in the form of digital or analogue signals (e.g. to a ripple control receiver that is connected to the Cluster Controller) or via the Modbus client. In agreement with your network operator, you can use the user interface of the Cluster Controller to configure which setpoints of the Cluster Controller are to be transmitted to the connected inverters depending on the respective signal. In addition, you have the option of using a digital response contact or an analogue current output signal to inform the network operator of the setpoints (if any) for the active power limitation and the reactive power operation that are currently being transmitted to the plant.

## Sending the Plant Data to an FTP Server and/or the Sunny Portal Internet Portal

The Cluster Controller can automatically send the plant data that has been read out to an arbitrary FTP server and/or the Sunny Portal Internet portal via the Internet. The Cluster Controller establishes the connection to the FTP server and/or the Sunny Portal e.g. via a router.

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\* Modbus® is a registered trademark of Schneider Electric and is licensed by the Modbus Organization, Inc.

### Performing Updates for the Cluster Controller and the Inverters

You have the option of performing updates for the Cluster Controller and the inverters in the plant (see the Cluster Controller user manual). You can perform the updates automatically or manually. The update source can be the SMA update portal or a USB data carrier with update files downloaded from the Internet. Alternatively, you can also upload the update files directly from the computer via the user interface of the Cluster Controller.

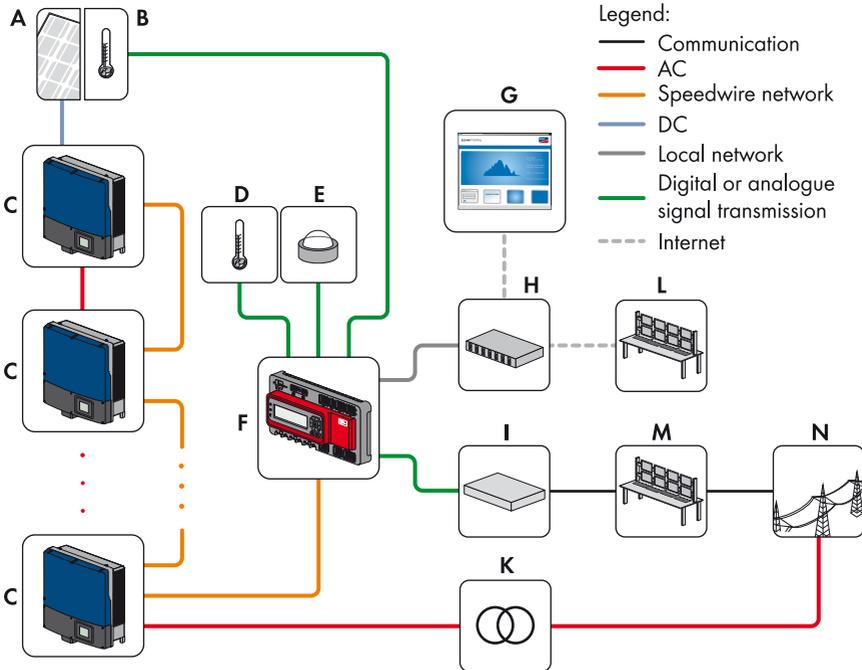


Figure 3: Decentralised large-scale PV plant with Cluster Controller (example)

Position	Description
A	PV modules
B	Module temperature sensor
C	Inverters
D	Outside temperature sensor
E	Irradiation sensor
F	Cluster Controller
G	Sunny Portal
H	Router
I	Ripple control receiver or remote terminal unit

Position	Description
K	Grid station
L	Control room
M	Grid control room
N	Electricity grid

## 4.2 Type Label

The type label clearly identifies the product. The type label can be found on the back of the enclosure. You will find the following information on the type label:

- Device type (Type)
- Serial number (Serial No.)
- Hardware version (Version)
- Device-specific characteristics

You will require the information on the type label to use the product safely and for customer support from the SMA Service Line. The type label must be permanently attached to the product.

### Symbols on the Type Label

Icon	Description	Explanation
 N23114	C-Tick	The product complies with the requirements of the applicable Australian EMC standards.
<b>CAN ICES-3 (A)/NMB-3(A)</b>	IC labelling	The product complies with the requirements of the applicable Canadian EMC standards.
	Indoor	The product is only suitable for indoor installation.
	FCC marking	The product complies with the requirements of the applicable FCC standards.
	CE marking	The product complies with the requirements of the applicable EU directives.
	WEEE designation	Do not dispose of the product with household waste, but only in accordance with the locally applicable disposal regulations for electronic waste.
	Data matrix code	2D code for device-specific characteristics

## 4.3 LEDs

### Operation LEDs

LED	Description	Explanation
	Power LED	Displays whether the Cluster Controller is starting or is in operation (for a description of the LED statuses, see Section 7.1.1)
	Status LED	Displays the status of the Cluster Controller and the connected devices as well as the communication status of the plant and the status of the grid management (for a description of the LED statuses, see Section 7.1.1)
	Data carrier status LED	Displays the status of the connected USB data carrier (for a description of the LED statuses, see Section 7.1.1)

### LEDs of the Network Connections

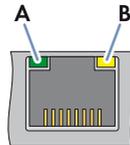


Figure 4: LEDs of the network connections

Position	Description	Colour	Explanation
A	Link/activity LED	Green	Displays the status and the activity of the network connection (for a description of the LED statuses, see Section 7.1.2)
B	Speed LED	Yellow	Displays the speed of the network connection (for a description of the LED statuses, see Section 7.1.2)

## 4.4 Display

The display shows information on the Cluster Controller and the connected devices as well as the plant status and the plant configuration. The display contrast can be configured (see the Cluster Controller user manual). The display languages are German and English. The display language is changed via the user interface of the Cluster Controller (see the Cluster Controller user manual).



Figure 5: Display of the Cluster Controller (example)

Position	Description	Explanation
A	Title line	Displays the title of the display view The plant time is always displayed.
B	Data lines	Displays text and numeric values The numeric values for measurement or yield data are displayed with units.

### Overview of the Display Views

Display view	Explanation
Start view	Displays when the Cluster Controller starts up and includes the current firmware version of the Cluster Controller
Plant overview	Displays the plant status, the current daily yield, the plant power and the current setpoints for active power and reactive power If no button on the button field is pressed within five minutes, the Cluster Controller switches to the <b>Plant overview</b> display view.
Yield Data	Displays the yield data of the plant
Plant status	Displays the current plant status The number of inverters detected by the Cluster Controller and the status of the inverters is displayed here

Display view	Explanation
Cluster Controller	Displays the status and device information of the Cluster Controller  When a USB data carrier is inserted into USB terminal <b>1</b> , information on the current memory usage of the USB data carrier is displayed.
Sunny Portal settings	Displays the configured upload frequency and the date of the last successful data upload to Sunny Portal
Analogue inputs	Displays the analogue inputs with the current level value and unit
Digital inputs	Displays the digital inputs in binary form  The digital inputs are summarised in two groups here.
Meteorology	Displays the measured values of the connected irradiation sensor and the connected temperature sensors
Effective power control	Displays the current setpoint for active power limitation with the data of the last change to the configuration
Reactive power setpoint	Displays the current reactive power setpoint and the date of the last change to the configuration
Grid management	Displays the selected setpoint type and the signal sources for the grid management via the user interface of the Cluster Controller
External communication	Displays the settings for the local area network (LAN)
Speedwire	Displays the settings in the Speedwire network
Modbus settings	Displays the Modbus settings with the activated network protocols and the corresponding network ports
Settings	Enables the display contrast to be changed and the Cluster Controller to be partially or fully reset (see Section 7.3)

## 4.5 Button Field

Description	Explanation
Any button	Activates the display illumination
Arrow buttons (◀, ▶, ▲, ▼)	Changes the display views and selects specific display lines
[OK]	Confirms the selected action
[ESC]	Cancels the selected action
ⓘ	Opens the <b>Plant status</b> display view

## 5 Installation

### 5.1 Selecting the Mounting Location

#### Requirements for the mounting location:

#### NOTICE

##### Radio interference in living areas possible due to the Cluster Controller

The Cluster Controller is a device of ITE class A (EN 55022) and can cause radio interference in living areas.

- Take suitable measures for shielding radio waves when used in the vicinity of living areas.

- The mounting location must be indoors.
- The ambient conditions at the mounting location must be suitable for the operation of the Cluster Controller (see Section 9 "Technical Data", page 79).
- The mounting location must be protected against dust, moisture and corrosive substances.

#### Observe the maximum cable length:

- Observe the respective maximum cable length of 100 m between two nodes in the Speedwire network and in the local area network (LAN).
- When connecting a digital or analogue signal source (e.g. remote terminal unit, ripple control receiver), observe the maximum cable length of 30 m from the Cluster Controller to the signal source.
- When connecting a temperature sensor in a four-conductor connection, observe the maximum cable length of 20 m from the Cluster Controller to the temperature sensor.
- When connecting a temperature sensor in a two-conductor connection, observe the maximum cable length of 2.5 m from the Cluster Controller to the temperature sensor.

**Observe minimum clearances:**

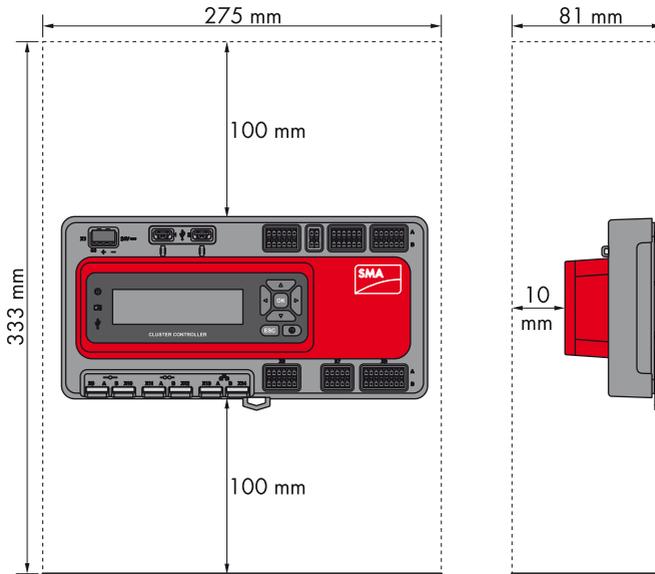


Figure 6: Minimum clearances

- Observe the minimum clearance to walls and other devices or objects.

**Observe Permitted Mounting Position:**

- Mount the Cluster Controller in such a way, that the ventilation slots face the top and the bottom. This ensures adequate ventilation and avoids overheating of the Cluster Controller.

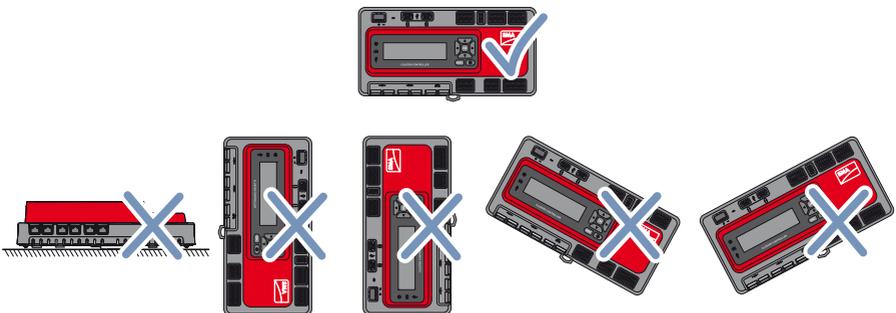


Figure 7: Permitted and prohibited mounting positions

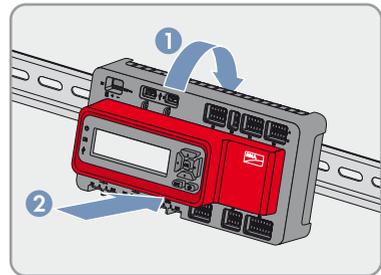
## 5.2 Mounting the Cluster Controller

### Requirements:

- A top-hat rail must be available.
- The top-hat rail must be 35 mm wide.
- To mount the Cluster Controller, the top-hat rail must be at least 26 cm long.
- To mount the top-hat rail power supply unit, the top-hat rail must be correspondingly longer.
- The top-hat rail must be securely mounted on the wall or in the switch cabinet.

### Procedure:

- Use the rear-side upper retainers to hook the Cluster Controller into upper edge of the top-hat rail and press down in the direction of the top-hat rail. This will hook the spring-mounted top-hat rail locking mechanism of the Cluster Controller onto the lower edge of the top-hat rail.
  - The top-hat rail locking mechanism audibly snaps into place.



## 6 Connection and Commissioning

### 6.1 Overview of the Connection Area

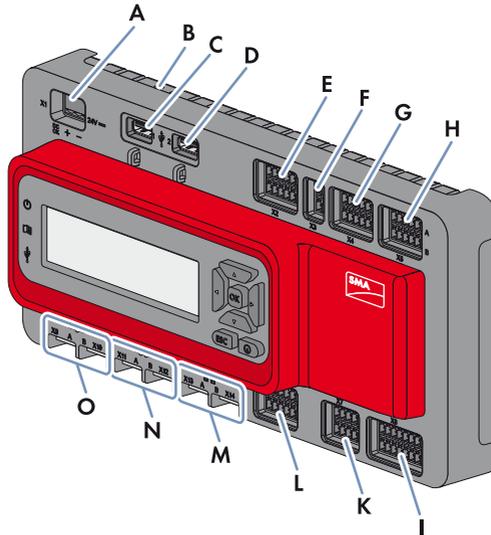


Figure 8: Overview of the connection area

Position	Number	Description	Explanation
A	1	X1	Terminal for the voltage supply
B	1	-	Terminal for earthing
C	1	1	USB terminal for exporting plant data
D	1	2	USB terminal for updates
E	1	X2	Digital outputs
F	1	X3	Reserved for future applications
G	1	X4	Digital inputs
H	1	X5	Digital inputs
I	1	X8	Analogue inputs
K	1	X7	Connections for temperature sensors
L	1	X6	Analogue outputs
M	2	X13, X14	Network terminals for local area network (LAN)
N	2	X11, X12	Reserved for future applications
O	2	X9, X10	Network terminal of the inverter (Speedwire)

## 6.2 Functions of the Terminals and Terminal Blocks

The digital and analogue terminals of the Cluster Controller are divided into terminal blocks. A terminal block is a group of pins. Each respective pin group forms one of the digital or analogue inputs or outputs. On the enclosure, the upper row of pins is marked with **A** and the lower row of pins is marked with **B**. The pins are counted from left to right.

The distribution of the terminals into terminal blocks and the functions of the terminal blocks are described in the following table.

Connection	Terminal block	Pin	Function
X1	–	1 to 3	Voltage Supply
X2	Digital output 1 (DO1)* Relay A	A1 to A3	Fault indication relay for the status <b>Fault</b>
	Digital output 2 (DO2) Relay B	A4 to A6	Fault indication relay for the status <b>Warning or Fault</b>
	Digital output 3 (DO3) Relay C	B1 to B3	Response contact for the current active power limitation under grid management
X3	–	–	Reserved for future applications
X4	Digital input 1 (DI1)**	A1 to A3	Signal 1 of 4 for the active power limitation under grid management
	Digital input 2 (DI2)	A4 to A6	Signal 2 of 4 for the active power limitation under grid management
	Digital input 3 (DI3)	B1 to B3	Signal 3 of 4 for the active power limitation under grid management
	Digital input 4 (DI4)	B4 to B6	Signal 4 of 4 for the active power limitation under grid management
X5	Digital input 5 (DI5)	A1 to A3	Signal 1 of 4 for the reactive power setpoint under grid management
	Digital input 6 (DI6)	A4 to A6	Signal 2 of 4 for the reactive power setpoint under grid management
	Digital input 7 (DI7)	B1 to B3	Signal 3 of 4 for the reactive power setpoint under grid management
	Digital input 8 (DI8)	B4 to B6	Signal 4 of 4 for the reactive power setpoint under grid management

Connection	Terminal block	Pin	Function
X6	Analogue current output 1 (AO1)***	A1 ... A3	Analogue current output for the feedback of the current active power limitation under grid management
	Analogue current output 2 (AO2)	A4 to A6	Analogue current output for the feedback of the current reactive power setpoint under grid management
X7	Temperature input 1	A1 to A5	Analogue input for the connection of an external temperature sensor
	Temperature input 2	B1 to B5	Analogue input for the connection of a module temperature sensor
X8	Analogue current input 1 (AI1)****	A1 to A4	Analogue current input for the connection of an irradiation sensor or a different sensor
	Analogue current input 2 (AI2)	A5 to A8	Analogue current input for the active power setpoint under grid management or for the connection of a sensor
	Analogue current input 3 (AI3)	B1 to B4	Analogue current input for the reactive power setpoint under grid management or for the connection of a sensor
	Analogue voltage input 4 (AI4)	B5 to B8	Analogue voltage input for the connection of a sensor
X9, X10	–	1 to 8	Network terminal of the inverter (Speedwire)
X11, X12	–	–	Reserved for future applications
X13, X14	–	1 to 8	Network terminals for local area network (LAN)

\* DO = Digital output

\*\* DI = Digital input

\*\*\* AO = Analogue output

\*\*\*\* AI = Analogue input

## 6.3 Cable Requirements

### UV resistance of the connection cable

Connection cables to be laid outdoors must be UV-resistant or routed in a UV-resistant cable channel.

Connection	Cable Requirements
Earthing	<input type="checkbox"/> Conductor cross-section: 2.5 mm <sup>2</sup> <input type="checkbox"/> Maximum cable length: 30 cm
Voltage supply	<input type="checkbox"/> Number of insulated wires: at least two <input type="checkbox"/> Conductor cross-section: 0.2 mm <sup>2</sup> to 2.5 mm <sup>2</sup> <input type="checkbox"/> Maximum cable length: 3 m
Digital inputs	<input type="checkbox"/> Number of insulated wires: at least two <input type="checkbox"/> Conductor cross-section: 0.2 mm <sup>2</sup> to 1.5 mm <sup>2</sup> <input type="checkbox"/> Maximum cable length: 30 m
Digital outputs	<input type="checkbox"/> Number of insulated wires: at least two <input type="checkbox"/> Conductor cross-section: 0.2 mm <sup>2</sup> to 1.5 mm <sup>2</sup> <input type="checkbox"/> Maximum cable length: 30 m
Analogue inputs, analogue outputs and temperature inputs (single core)	<input type="checkbox"/> Conductor cross-section: 1.5 mm <sup>2</sup> <input type="checkbox"/> Length of cable: 32 cm
Analogue inputs (connection cable)	<input type="checkbox"/> Number of insulated wires: at least two <input type="checkbox"/> Shielding: yes <input type="checkbox"/> Conductor cross-section: 0.2 mm <sup>2</sup> to 1.5 mm <sup>2</sup> <input type="checkbox"/> Maximum cable length: 30 m
Analogue outputs (connection cable)	<input type="checkbox"/> Number of insulated wires: at least two <input type="checkbox"/> Shielding: yes <input type="checkbox"/> Conductor cross-section: 0.2 mm <sup>2</sup> to 1.5 mm <sup>2</sup> <input type="checkbox"/> Maximum cable length: 3,000 m
Temperature inputs (connection cable)	<input type="checkbox"/> Number of insulated wires for tolerance $\pm 2^{\circ}\text{C}$ : at least two <input type="checkbox"/> Number of insulated wires for tolerance $\pm 0.5^{\circ}\text{C}$ : at least four <input type="checkbox"/> Conductor cross-section: at least 4 x 0.25 mm <sup>2</sup> or at least 4 x AWG 24 <input type="checkbox"/> External cable diameter: 4.5 mm to 7 mm <input type="checkbox"/> Maximum cable length for four-conductor connection: 20 m <input type="checkbox"/> Maximum cable length for two-conductor connection: 2.5 m

Connection	Cable Requirements
Inverter (Speedwire)	<ul style="list-style-type: none"> <li><input type="checkbox"/> Number of insulated wire pairs and insulated wire cross-section: at least <math>2 \times 2 \times 0.22 \text{ mm}^2</math> or at least <math>2 \times 2</math> AWG 24</li> <li><input type="checkbox"/> External diameter: the maximum external diameter depends on the size of the cable gland</li> <li><input type="checkbox"/> Cable category: Cat5, Cat5e, Cat6, Cat6a, Cat7</li> <li><input type="checkbox"/> Cable shield: SF/UTP, S/UTP, SF/FTP, S/FTP</li> <li><input type="checkbox"/> Plug type: RJ45 for Cat5, Cat5e, Cat6, Cat6a</li> <li><input type="checkbox"/> Cable length between two nodes: max 50 m with patch cable, max 100 m with installation cable</li> </ul>
Local area network (LAN)	<ul style="list-style-type: none"> <li><input type="checkbox"/> Number of insulated wire pairs and insulated wire cross-section: at least <math>2 \times 2 \times 0.22 \text{ mm}^2</math> or at least <math>2 \times 2</math> AWG 24</li> <li><input type="checkbox"/> Cable category: Cat5, Cat5e, Cat6, Cat6a, Cat7</li> <li><input type="checkbox"/> Cable shield: SF/UTP, S/UTP, SF/FTP, S/FTP</li> <li><input type="checkbox"/> Plug type: RJ45 for Cat5, Cat5e, Cat6, Cat6a</li> <li><input type="checkbox"/> Cable length between two nodes: max 50 m with patch cable, max 100 m with installation cable</li> </ul>

## 6.4 Performing Pin Coding

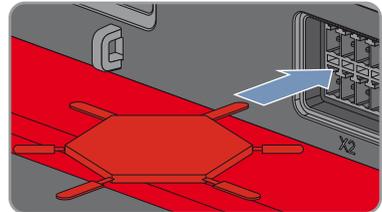
Pin coding prevents confusion when using multipole terminals, e.g. in the event of removal and later re-insertion of the multipole plug. The correct terminal can always be assigned to the multipole plug via the coded pins. Tip: perform pin coding for all multipole terminals now, even if you do not wish to use all multipole terminals at this point. This means that you do not subsequently have to perform pin coding for the multipole terminals that are not currently in use.

### Code the pins correctly

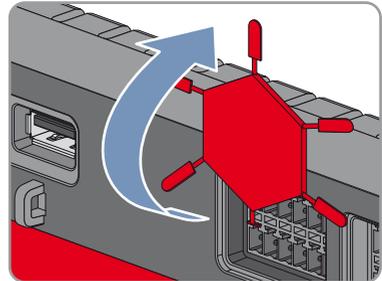
When selecting the pins to be coded, ensure that different pins are coded for each terminal and for each pin row.

Code every multipole terminal according to the following procedure.

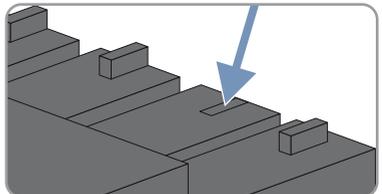
1. Insert the coding tab of the coding element into the pin that is to be coded parallel to the conductor axis.



2. Remove the coding tab from the coding element by snapping it off.



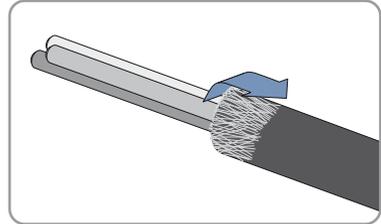
3. Remove the key at the rear of the cable entry in the multipole plug into which the code pin is to be inserted during connection to the Cluster Controller.



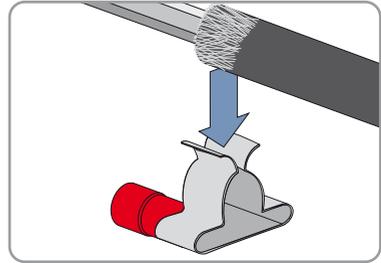
## 6.5 Preparing Connection Cables for Connection to a Multipole Plug

Always proceed as follows to prepare connection cables for connection to multipole plugs.

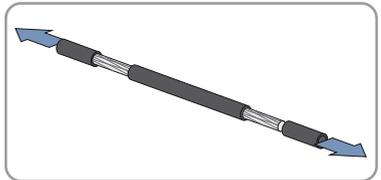
1. Strip 4 cm of cable sheath off the connection cable to which the multipole plug is to be attached.
2. Perform the following additional steps for the connection cables for the analogue inputs, the analogue outputs and the temperature inputs:
  - Trim the cable shield of the connection cable to 15 mm.
  - Fold the surplus cable shield back onto the cable sleeve.



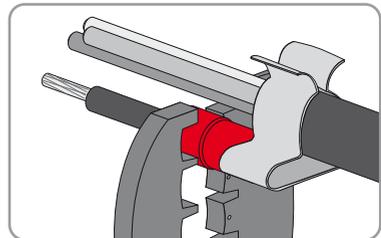
- Press the shield clamp onto the cable shield. For this purpose, the cable shield must be clamped as fully as possible under the shield connection terminal.



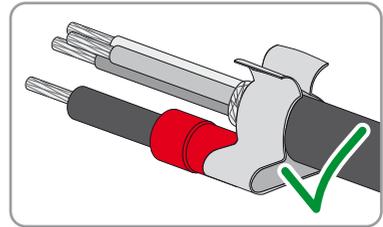
- Depending on the number of connection cables, split the single core required for the shielding into pieces of a length of 4 cm.
- At both ends of the single core, remove 6 mm of cable sheath and strip 6 mm insulation off the wire.



- Insert the insulated wire at one end of the single core into the ring terminal lug of the shield connection terminal and crimp with a crimping tool.



3. Trim unused insulated wires flush with the cable sheath.
4. Strip the insulated wire insulation by 6 mm.
  - ☑ The connection cable is prepared for connection to the multipole plug.



## 6.6 Connecting the Cluster Controller to the Voltage Supply

### **⚠ DANGER**

#### **Danger to life due to electric shock if earthing is omitted**

If the enclosure of the Cluster Controller is not earthed, there is a danger of electric shock.

- Earth the enclosure of the Cluster Controller.

### **NOTICE**

#### **Damage to the Cluster Controller due to condensation water**

If the Cluster Controller is moved from a cold environment to a warm environment, condensation water may form in the Cluster Controller.

- In the event of large temperature differences, only supply voltage to the Cluster Controller once the Cluster Controller has reached room temperature.

#### **Procedure:**

To connect the Cluster Controller to the voltage supply, perform the following actions in the specified order. The exact procedure is described in the subsequent sections.

- Connect the protective conductor to the Cluster Controller.
- Connect the top-hat rail power supply unit.

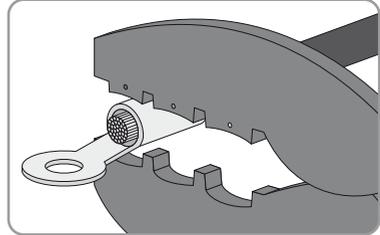
## Connecting the Protective Conductor to the Cluster Controller.

### Additionally required material (not included in scope of delivery):

- 1 protective conductor (for cable requirements, see Section 6.3)

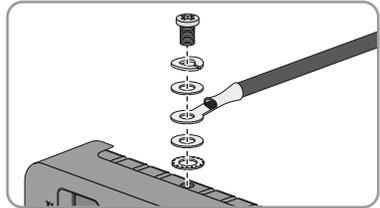
### Procedure:

1. Remove 1 cm of the cable sheath from the protective conductor.
2. Insert the insulated wires into the ring terminal lug and crimp with a crimping tool.



3. Attach the protective conductor at the terminal for the earthing (for the position of the terminal, see Section 6.1). For this purpose, observe the following sequence and hand-tighten the fastening screws (torque: 0.8 Nm):

- Fastening screw
- Split lock washer
- Washer
- Ring terminal lug with protective conductor
- Washer
- Tooth lock washer



## Connecting the Top-Hat Rail Power Supply Unit

### Additionally required material (not included in scope of delivery):

- 1 top-hat rail power supply unit (see Section 10 "Accessories", page 83)
- 1 AC connection cable
- 1 connection cable for the connection of the top-hat rail power supply unit to the Cluster Controller (for cable requirements, see Section 6.3)

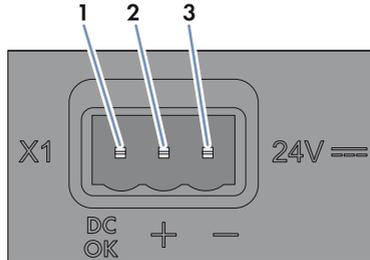
If you are not using the top-hat rail power supply unit supplied as an accessory for the Cluster Controller, the top-hat rail power supply unit you are using must meet the requirements detailed below.

### Top-hat rail power supply requirements:

- Maximum output current including short circuit: 8 A
- Maximum apparent output power: 100 VA
- DC output voltage: 24 V
- Nominal current: minimum 1.8 A

**Requirement:**

- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5)

Figure 9: Pin assignment at terminal **X1**

Pin	Signal	Explanation
1	Not assigned	Reserved for future applications
2	24 V	Input voltage 24 V DC
3	GND	Earth

**Procedure:**

1. Mount the top-hat rail power supply unit on the top-hat rail (see the manufacturer manual).
2. Connect the connection cable to the top-hat rail power supply unit (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable sheath and note the wire colours.
3. Connect the connection cable to the three-pole plug as follows. For this purpose, release conductor entries 2 and 3 with a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
4. Connect the three-pole plug to terminal **X1** of the Cluster Controller.
5. Connect the AC connection cable to the top-hat rail power supply unit (see the manufacturer manual).

6. **DANGER**

**Danger to life due to electric shock**

Lethal voltages are present at the connection point of the electricity grid.

- Disconnect the connection point from voltage sources and ensure that the connection point is voltage-free.
7. Connect the other end of the AC connection cable to the power supply.

## 8. Connect the connection point to the electricity grid.

- ☑ The power LED (  ) of the Cluster Controller glows red for two seconds, then it permanently glows green. The status LED (  ) glows corresponding to the current device status (see Section 7.1 "LED States", page 68). The Cluster Controller is ready for operation after a maximum of one minute.
- ✘ Is the power LED (  ) glowing permanently red, the status LED (  ) glowing yellow or red and the Cluster Controller not starting?

Possible fault cause: the voltage supply is too low.

- Ensure that the voltage supply is sufficient (see Section 9 "Technical Data", page 79).
- If the problem persists, contact the SMA Service Line (see Section 11).

## 6.7 Checking and Setting the Plant Time of the Cluster Controller

Before connecting the Cluster Controller to the Speedwire network and before commissioning the inverters, you must use the display of the Cluster Controller to check if the correct plant time is displayed on the Cluster Controller. If the correct plant time is not displayed, you must set the correct plant time using the user interface of the Cluster Controller. This way, you can avoid inconsistencies in the time settings of the inverters.

### Available display languages

The display languages of the Cluster Controller are German and English. The default language is English. You can only change the display language via the user interface of the Cluster Controller

If you select **German** as the user interface language and then log in, the display language is changed to German. If you choose a user interface language other than **German** and then log in, English remains set as the display language.

### Requirements:

- ☐ The Cluster Controller must be connected to the voltage supply and be in operation (see Section 6.6).

### Procedure:

1. Connect the computer directly with the Cluster Controller using one network cable. Also connect the network cable to terminal **X13** or **X14** of the Cluster Controller.
2. Select the **External communication** display view and read and take note of the IP address of the Cluster Controller from the line **IP Address**. Tip: if you wish to integrate the Cluster Controller in a static local area network (LAN), you also require the IP address for the network configuration (see Section 6.15).
3. Call up the IP address of the Cluster Controller via the Internet browser.
  - ☑ The login page opens.



✘ Does the login page fail to open?

Possible fault cause: you have not written down the IP address correctly or you have not entered it correctly.

- Enter the correct IP address and confirm the entry with the enter key.
- If the problem persists, read the troubleshooting (see Section 7.2 "Faults in the Cluster Controller or the Connected Devices", page 72).

4. Select the desired language in the upper area of the login page.

5. Log in either as **User** or as **Installer** with the respective default plant password of the user group. This implements the language change on the user interface and on the display:

User group	Default plant password
User	0000
Installer	1111

**i** **Changing default plant passwords**

Change the default plant passwords of all user groups promptly to prevent unauthorised access to the user interface of the Cluster Controller and the inverters in your plant (see the Cluster Controller user manual).

- The user interface opens.
- ✘ The user interface does not open?

Fault cause: you have not entered the default plant password of the selected user group correctly.

- On the login page, enter the correct default plant password for the selected user group and confirm the entry with the enter key.

6. Select the Cluster Controller in the plant tree and select the **Settings** menu in the device menu.
7. Select the **Device > Time settings** parameter group.
8. Select [**Edit**].
9. If required, use the **Standard/Daylight Saving Time conversion on** drop-down list to set automatic conversion between standard and daylight saving time.
10. In the **Set plant time** field, set the current date and time of the plant.
11. In the **Time zone** drop-down list, select the time zone in which the plant is located.
12. Select [**Save**].
  - The plant time is updated.
13. Select [**Logout**] in the icon bar.
14. Connect the Cluster Controller to the Speedwire network (see Section 6.8) and make any additional required connections.

## 6.8 Connecting the Cluster Controller to a Speedwire Network

### **Disturbance of data transmission due to unshielded power cables**

If unshielded power cables are used, they generate an electromagnetic field which may induce interference in network cables during data transmission.

- When laying network cables, observe the following minimum clearances to unshielded power cables:
  - For installation without separating strip: at least 200 mm
  - For installation with aluminium separating strip: at least 100 mm
  - For installation with steel separating strip: at least 50 mm

### **Do not connect the Speedwire network and the local network (LAN)**

The Speedwire network is a separate network managed by the Cluster Controller. If the Speedwire network and the local network (LAN) are connected, a disturbance of both networks is likely to occur.

- In order to ensure correct communication, do not connect the Speedwire network and the local network (LAN) (the Speedwire bus and the Ethernet bus of the local network (LAN) must not be connected to the same switch, for example).

### **Observe the configuration of the router and the switch**

For the Speedwire connection, the Cluster Controller uses IP addresses from the Unicast area and also IP addresses from the Multicast area 239/8 (239.0.0.0 to 239.255.255.255).

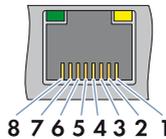
- When using a router or switch, ensure that the router and switch forward the Multicast telegrams required for the Speedwire connection to all nodes of the Speedwire network (for information on configuration of the router or switch, see the manufacturer manual).

**Requirements:**

- The nodes in the Speedwire network (e. g. inverters) must be cabled according to one of the possible network topologies (see the node installation manual).
- In the router and in the switch, network port 9522 must be approved.

**Additionally required material (not included in scope of delivery):**

- Depending on the network topology: network cable (for cable requirements, see Section 6.3)

Figure 10: Pin assignment at the network terminals **X9**, **X10**, **X13** and **X14**

Pin	Description	Explanation
1	TX+	Data Out +
2	TX –	Data Out –
3	RX+	Data In +
4	Not assigned	Not assigned
5	Not assigned	Not assigned
6	RX –	Data In –
7	Not assigned	Not assigned
8	Not assigned	Not assigned

**Procedure:**1. **⚠ DANGER****Danger to life due to electric shock when the inverter is opened**

Lethal voltages are present in the conductive parts of the inverter.

If a network cable has not yet been connected to the retrofitted Speedwire/Webconnect interface in the inverter, perform the following steps:

- Disconnect the inverter from voltage sources on the AC and DC sides (see the inverter installation manual). Observe the waiting time to allow the capacitors to discharge.
  - Open the inverter (see inverter installation manual).
  - Connect the network cable to the retrofitted Speedwire/Webconnect interface (see the Speedwire/Webconnect interface installation manual).
  - Close the inverter (see inverter installation manual).
2. If no network cable has yet been connected to the inverter with integrated Speedwire/Webconnect interface, connect the network cable to the network socket in the inverter (see installation manual of the inverter).

3. If no network cable has yet been connected to the SMA Grid Gate, connect the network cable to the SMA Grid Gate (see installation manual of the SMA Grid Gate).
4. Connect the Cluster Controller to the Speedwire network. For this purpose, observe the desired network topology:
  - When using a pre-configured patch cable, connect the patch cable to terminal **X9** or **X10**.
  - When using a patch cable that is to be configured by the user, mount the RJ45 plug connector on the patch cable (see the manufacturer manual) and connect the patch cable to terminal **X9** or **X10** of the Cluster Controller.
5. Observe the terminal assignment on the supplementary sheet supplied.
6. Deactivate the Webconnect function of the inverters after completion of the commissioning of the Cluster Controllers (see user manual of the Cluster Controller).

## 6.9 Connecting the Cluster Controller to a Local Area Network (LAN)

### NOTICE

#### High costs possible through inappropriate Internet rates

Depending on use, the data volume of the Cluster Controller transferred via the Internet can be more than 1 GB per month. The data volume depends, among other things, on the number of inverters, the frequency of device updates, the frequency of data transfer to the Sunny Portal and the use of FTP push.

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



#### Different IP address ranges required for Speedwire network and local network (LAN)

In order for a clear assignment of the IP addresses in the Speedwire network and in the local network (LAN) from the perspective of the Cluster Controller to be possible, the IP address ranges of both networks must be different. At the factory, the Cluster Controller uses address range 172/16 for the Speedwire network.

- Ensure that different IP address ranges are used for the Speedwire network and the local network (LAN).



#### Observe the configuration of the router and the switch

For the Speedwire connection, the Cluster Controller uses IP addresses from the Unicast area and also IP addresses from the Multicast area 239/8 (239.0.0.0 to 239.255.255.255).

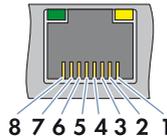
- When using a router or switch, ensure that the router and switch forward the Multicast telegrams required for the Speedwire connection to all nodes of the Speedwire network (for information on configuration of the router or switch, see the manufacturer manual).

#### Requirements:

- In the router and in the switch, network port 9522 must be approved.

**Additionally required material (not included in scope of delivery):**

- 1 patch cable (for cable requirements, see Section 6.3)

Figure 11: Pin assignment at the network terminals **X9**, **X10**, **X13** and **X14**

Pin	Description	Explanation
1	TX+	Data Out +
2	TX –	Data Out –
3	RX+	Data In +
4	Not assigned	Not assigned
5	Not assigned	Not assigned
6	RX –	Data In –
7	Not assigned	Not assigned
8	Not assigned	Not assigned

**Procedure:**

1. Connect the patch cable to the Cluster Controller:
  - When using a pre-configured patch cable, connect the patch cable to terminal **X13** or **X14**.
  - When using a patch cable that is to be configured by the user, mount the two RJ45 plug connectors at both ends of the patch cable (see the manufacturer manual) and connect the patch cable to terminal **X13** or **X14** of the Cluster Controller.
2. Connect the other end of the patch cable to the desired node in the local area network (LAN).
3. Observe the terminal assignment on the supplementary sheet supplied.

**6.10 Connecting USB Data Carriers to the Cluster Controller**

In order to save plant data or perform an update, you can connect up to two USB data carriers to the Cluster Controller (for information on updates, see the Cluster Controller user manual).

**i Not possible to use USB Ethernet hubs**

The Cluster Controller does not support any USB Ethernet hubs. You must connect the USB data carrier directly to the desired USB terminal on the Cluster Controller.

**Additional required accessories (not included in scope of delivery):**

- Up to two USB data carriers, e.g. two USB sticks (see Section 10 "Accessories", page 83)

If you use a USB data carrier other than that provided by SMA Solar Technology AG as an accessory, the USB data carrier must correspond to the requirements stated below.

#### Requirements for USB data carriers:

- Maximum memory capacity: 2 TB
- Supported file systems: FAT 16 or FAT 32

#### **i** Use of USB hard disks with external power supply is recommended

In the case of USB hard disks with power supply via the USB interface, malfunction can occur if the connected USB hard disk temporarily has a greater electricity demand than that intended for USB 2.0 standard.

- To avoid malfunction as a result of excessive electricity demand when using USB hard disks, use only USB hard disks with external power supply.

#### Period of Archiving

Depending on the available storage capacity of the USB data carrier and your plant's configuration, the following approximate periods of archiving for the plant data are possible:

Number of connected inverters	Approximate period of archiving	
	4 GB memory capacity	8 GB memory capacity
5	10 years	20 years
10	5 years	10 years
25	2 years	4 years
50	1 years	2 years
75	9 months	18 months

#### Procedure:

1. To protect the USB data carrier against loss, attach the USB data carrier to the eyelets located on the underside of the USB plug e.g. using a loop attached to the USB data carrier.
2. Connect the USB data carrier to the desired USB terminal:
  - To export plant data, connect the USB data carrier to the USB terminal **1**.
  - To transmit update files to the Cluster Controller, connect the USB data carrier to USB terminal **2**.
3. If the USB data carrier is permanently inserted into the Cluster Controller, observe the terminal assignment on the supplementary sheet supplied.
4. If the USB data carrier is to be removed from the Cluster Controller, wait until the data carrier status LED (  ) is not flashing anymore.

## 6.11 Connecting Sensors to the Cluster Controller

### 6.11.1 Connecting the Irradiation Sensor

You can connect one irradiation sensor or pyranometer to the Cluster Controller. The measured value of the irradiation sensor or the pyranometer is shown on the display and the user interface of the Cluster Controller and transmitted to Sunny Portal. In Sunny Portal, the measured values are taken into account in the calculation of the performance ratio.

#### Additional required accessories (not included in scope of delivery):

- 1 irradiation sensor
- 1 connection cable (for cable requirements, see Section 6.3).

#### Requirements:

- The sensor must be technically suitable for connection to the analogue inputs (see Section 9 "Technical Data", page 79).
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

Analogue current input 1 (AI1)

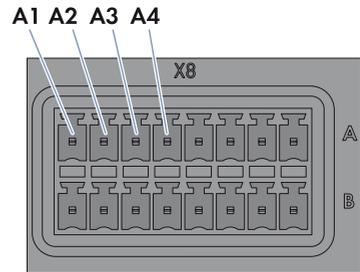
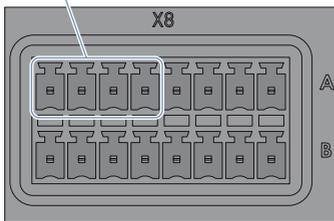


Figure 12: Pin assignment at the terminal block **Analogue current input 1 (AI1)**

Pin	Signal	Explanation
A1	Not assigned	Reserved for future applications
A2	I+	Current input
A3	I-	Current feedback
A4	GND	Shield ground

**Procedure:**

1. Connect the connection cable to the irradiation sensor (see the manufacturer manual).  
For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. Connect the connection cable to the eight-pole plug as follows:
  - Release conductor entry 4 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
  - Release conductor entries 2 and 3 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
3. Insert the eight-pole plug at terminal **X8** into pin row **A**.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. Observe the terminal assignment on the supplementary sheet supplied.
6. Adjust the characteristic curve of the irradiation sensor or pyranometer via the user interface of the Cluster Controller (see the Cluster Controller user manual). The measured irradiation values can therefore be shown on the display and the user interface of the Cluster Controller.

### 6.1.1.2 Connecting the Temperature Sensor

You can connect one outside temperature sensor and one module temperature sensor to the Cluster Controller. The measured values of the temperature sensors are shown on the display and the user interface of the Cluster Controller and transmitted to Sunny Portal. In Sunny Portal, the measured values of the module temperature sensor flow into the calculation of the performance ratio.

#### Connecting the Outside Temperature Sensor

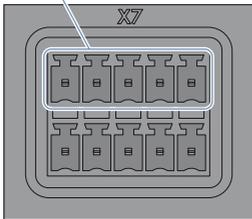
##### Additional required accessories (not included in scope of delivery):

- 1 outside temperature sensor
- 1 connection cable (for cable requirements, see Section 6.3)

##### Requirements:

- The sensor must be technically suitable for connection to the temperature inputs (see Section 9 "Technical Data", page 79).
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

Temperature input 1



A1 A2 A3 A4 A5

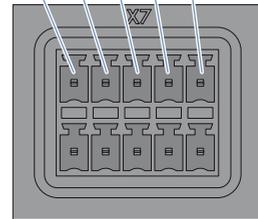


Figure 13: Pin assignment at the terminal block **Temperature input 1**

Pin	Signal	Explanation
A1	GND	Shield ground
A2	I+	Current input
A3	V+	Voltage input
A4	V-	Voltage feedback
A5	I-	Current feedback

**Procedure:**

1. Connect the connection cable to the outside temperature sensor (see the manufacturer manual).  
For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. For connecting to the Cluster Controller in two-conductor connection, perform the following steps:
  - On the five-pole plug, release conductor entry 1 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
  - On the five-pole plug, release conductor entries 3 and 4 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
  - At terminal **X7** in contact pin row **A**, form a bridge between contact pin 2 and contact pin 3 and between contact pin 4 and contact pin 5.
3. For connecting to the Cluster Controller in four-conductor connection, perform the following steps:
  - On the five-pole plug, release conductor entry 1 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
  - On the five-pole plug, release conductor entries 2, 3, 4 and 5 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
4. Insert the five-pole plug at terminal **X7** into pin row **A**.
5. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
6. Observe the terminal assignment on the supplementary sheet supplied.

## Connecting the Module Temperature Sensor

### Additional required accessories (not included in scope of delivery):

- 1 module temperature sensor
- 1 connection cable (for cable requirements, see Section 6.3)

### Requirements:

- The sensor must be technically suitable for connection to the temperature inputs (see Section 9 "Technical Data", page 79).
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

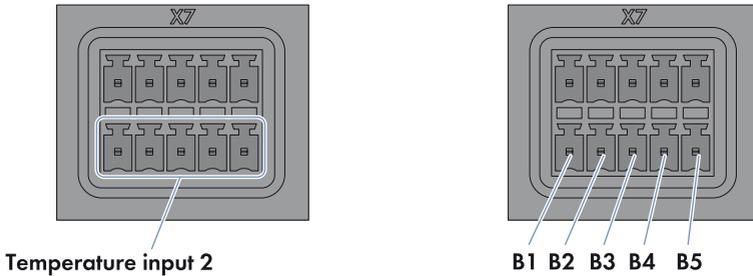


Figure 14: Pin assignment at the terminal block **Temperature input 2**

Pin	Signal	Explanation
B1	GND	Shield ground
B2	I+	Current input
B3	V+	Voltage input
B4	V –	Voltage feedback
B5	I –	Current feedback

### Procedure:

1. Connect the connection cable to the module temperature sensor (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. For connecting to the Cluster Controller in two-conductor connection, perform the following steps:
  - On the five-pole plug, release conductor entry 1 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
  - On the five-pole plug, release conductor entries 3 and 4 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
  - At terminal **X7** in contact pin row **B**, form a bridge between contact pin 2 and contact pin 3 and between contact pin 4 and contact pin 5.

3. For connecting to the Cluster Controller in four-conductor connection, perform the following steps:
  - On the five-pole plug, release conductor entry 1 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
  - On the five-pole plug, release conductor entries 2, 3, 4 and 5 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
4. Insert the five-pole plug at terminal **X7** into pin row **B**.
5. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
6. Observe the terminal assignment on the supplementary sheet supplied.

### 6.1.1.3 Connecting Additional Sensors

Depending on whether you are using an irradiation sensor (see Section 6.1.1.1), you can connect a maximum of three sensors to the analogue current outputs and one sensor to the analogue voltage input **X8** of the Cluster Controller.



#### Display of measured values at terminal block analogue voltage input 4 (AI4)

If no sensor is connected to the terminal block **Analogue voltage input 4 (AI4)**, a measured value for this terminal block of up to 2.2 V will nevertheless be shown on the display and the user interface of the Cluster Controller.

- In order for a measured value of 0 V to be displayed for the terminal block **Analogue voltage input 4 (AI4)** when it is not connected, place a jumper wire at terminal **X8** between contact pin **B5** and contact pin **B7**.

### Connecting Sensors to the Analogue Current Inputs

#### Additional required accessories (not included in scope of delivery):

- Up to three sensors
- Up to three connection cables (for cable requirements, see Section 6.3)

#### Requirements:

- The sensor must be technically suitable for connection to the analogue inputs (see Section 9 "Technical Data", page 79).
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

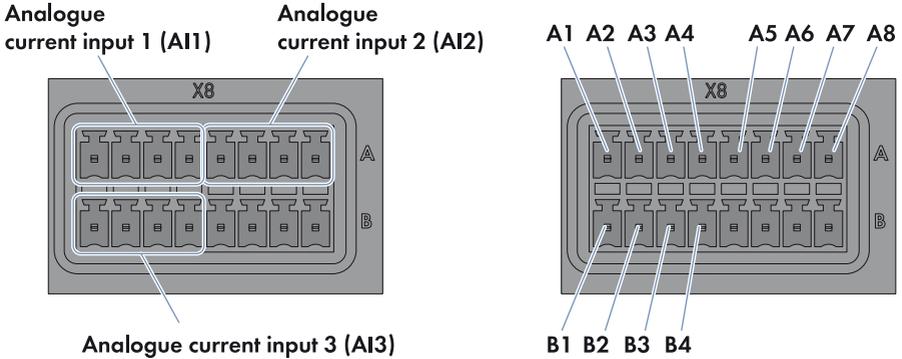


Figure 15: Pin assignment at the terminal blocks **Analogue current input 1 (AI1)**, **Analogue current input 2 (AI2)** and **Analogue current input 3 (AI3)**

Terminal block	Pin	Signal	Explanation
Analogue current input 1 (AI1)	A1	Not assigned	Reserved for future applications
	A2	I+	Current input
	A3	I-	Current feedback
	A4	GND	Shield ground
Analogue current input 2 (AI2)	A5	Not assigned	Reserved for future applications
	A6	I+	Current input
	A7	I-	Current feedback
	A8	GND	Shield ground
Analogue current input 3 (AI3)	B1	Not assigned	Reserved for future applications
	B2	I+	Current input
	B3	I-	Current feedback
	B4	GND	Shield ground

**Procedure:**

1. Connect the connection cable to the sensor (see the manufacturer manual). For this purpose, trim the insulated wires that are not required up to the cable shield and note the wire colours.
2. For connecting to the terminal block **Analogue current input 1 (AI1)**, perform the following steps:
  - Release conductor entry 4 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
  - Release conductor entries 2 and 3 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
  - Insert the eight-pole plug at terminal **X8** into pin row **A**.
3. For connecting to the terminal block **Analogue current input 2 (AI2)**, perform the following steps:
  - Release conductor entry 8 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
  - Release conductor entries 6 and 7 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
  - Insert the eight-pole plug at terminal **X8** into pin row **A**.
4. For connecting to the terminal block **Analogue current input 3 (AI3)**, perform the following steps:
  - Release conductor entry 4 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
  - Release conductor entries 2 and 3 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
  - Insert the eight-pole plug at terminal **X8** into pin row **B**.
5. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
6. Observe the terminal assignment on the supplementary sheet supplied.

## Connecting the Sensor to the Analogue Voltage Input

### Additional required accessories (not included in scope of delivery):

- 1 sensor
- 1 connection cable (for cable requirements, see Section 6.3)

### Requirements:

- The sensor must be technically suitable for connection to the analogue inputs (see Section 9 "Technical Data", page 79).
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5)

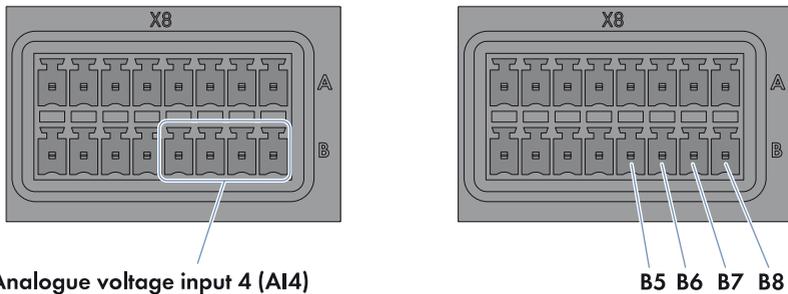


Figure 16: Pin assignment at the terminal block **Analogue voltage input 4**

Pin	Signal	Explanation
B5	V+	Voltage input
B6	Not assigned	Reserved for future applications
B7	V –	Voltage feedback
B8	GND	Shield ground

### Procedure:

1. Connect the connection cable to the sensor (see the manufacturer manual). For this purpose, trim the insulated wires that are not required up to the cable shield and note the wire colours.
2. Connect the connection cable to the eight-pole plug as follows:
  - Release conductor entry 8 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
  - Release conductor entries 5 and 7 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
3. Insert the eight-pole plug at terminal **X8** into pin row **B**.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. Observe the terminal assignment on the supplementary sheet supplied.

## 6.12 Connections for Grid Management

### 6.12.1 Options for Implementing the Network Operator Setpoints

The Cluster Controller can receive the network operator setpoints for grid management via three types of signal. For this purpose, the type of signal can be combined, meaning for example that setpoints for active power limitation can be received as digital signals and the setpoints for the reactive power setpoint can be received as analogue signals. Within one plant, you can also use multiple Cluster Controllers to implement the network operator setpoints for grid management and to provide feedback.

Configure the grid management via the user interface of the Cluster Controller (see the Cluster Controller user manual).

Type of signal	Explanation
Digital signals	The network operator setpoints are sent to the Cluster Controller as digital signals in the form of binary values. For this purpose, up to four relay contacts can be used for the active power limitation and the reactive power setpoint.
Analogue signals	The network operator setpoints are sent to the Cluster Controller as analogue current signals. For this purpose, current signals from 0 mA to 20 mA can be sent for the active power limitation and the reactive power setpoint, respectively.
Signal via Modbus client	The network operator setpoints are sent to network terminal <b>X13</b> or <b>X14</b> of the Cluster Controller via a Modbus client (for information on Modbus configuration, see the Cluster Controller user manual).

## 6.12.2 Digital Signal Setpoint

### 6.12.2.1 Possible Connections for Digital Terminal Block

For each digital terminal block, you have two connection options:

- Connection of a signal source with zero-potential relay contact
- or
- Connection of a 24 V signal source with digital output signals

#### Connection of a Signal Source with Zero-Potential Relay Contact

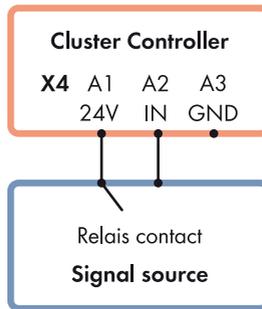


Figure 17: Connection of a signal source with zero-potential relay contact (example)

#### Connection of a 24 V Signal Source with Digital Output Signals

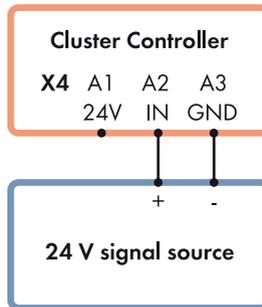


Figure 18: Connection of a 24 V signal source with digital output signals (example)

### 6.12.2.2 Connecting the Signal Source to the Digital Input for the Active Power Limitation

The digital signals for the active power limitation can be sent to up to four terminal blocks at terminal **X4** of the Cluster Controller. A ripple control receiver or a remote terminal unit can be used as a digital signal source, for example.

#### Additional required accessories (not included in scope of delivery):

- Up to four digital signal sources
- Connection cable (for cable requirements, see Section 6.3)

#### Requirements:

- The signal source must be technically suitable for connection to the digital inputs (see Section 9 "Technical Data", page 79).
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

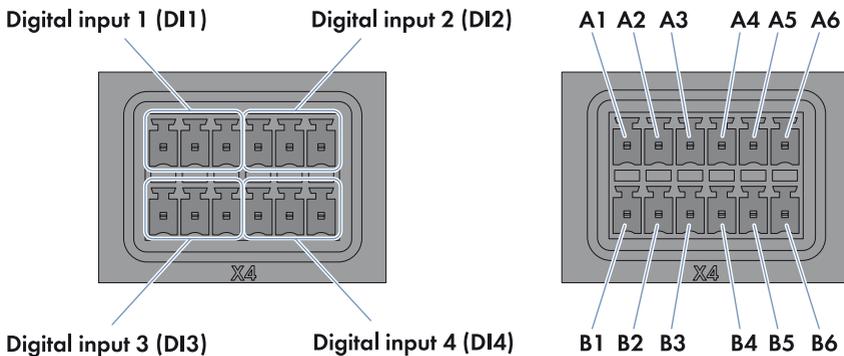


Figure 19: Terminal blocks and pin assignment at terminal **X4**

Terminal block	Pin	Pin assignment	Explanation
Digital input 1 (DI1)	A1	24 V	Voltage supply output
Signal 1 of 4 for the active power limitation	A2	IN	Input
	A3	GND	Reference potential
Digital input 2 (DI2)	A4	24 V	Voltage supply output
Signal 2 of 4 for the active power limitation	A5	IN	Input
	A6	GND	Reference potential

Terminal block	Pin	Pin assignment	Explanation
Digital input 3 (DI3)	B1	24 V	Voltage supply output
Signal 3 of 4 for the active power limitation	B2	IN	Input
	B3	GND	Reference potential
Digital input 4 (DI4)	B4	24 V	Voltage supply output
Signal 4 of 4 for the active power limitation	B5	IN	Input
	B6	GND	Reference potential

### Procedure:

1. Connect the connection cable to the digital signal source (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.

### DANGER

#### **Danger to life due to electric shock from faulty connection of the connection cable to the ripple control receiver**

In the event of faulty connection of the connection cable to the ripple control receiver, mains voltage may be present in the Cluster Controller enclosure.

- Do not connect insulated wires of the connection cable to phase conductors of the ripple control receiver.
  - When connecting, ensure that no bridge is being used in the ripple control receiver.
2. Connect the connection cable to the six-pole plug as follows:
    - Depending on the digital signal source and the pin assignment at terminal **X4**, identify the conductor entries that will be required for connecting the connection cable. The voltage supply (24 V) and the reference potential (GND) must only be connected once for each signal source.
    - Release the required conductor entries using a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
  3. Connect the six-pole plug to terminal **X4**. For this purpose, observe the pin coding.
  4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
  5. Observe the terminal assignment on the supplementary sheet supplied.

### 6.12.2.3 Connecting the Signal Source to the Digital Input for the Reactive Power Setpoint

The digital signals for the reactive power setpoint can be sent to up to four terminal blocks at terminal **X5** of the Cluster Controller. A ripple control receiver or a remote terminal unit can be used as a digital signal source, for example.

**Additional required accessories (not included in scope of delivery):**

- Up to four digital signal sources
- Connection cable (for cable requirements, see Section 6.3)

**Requirements:**

- The signal source must be technically suitable for connection to the digital inputs (see Section 9 "Technical Data", page 79).
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

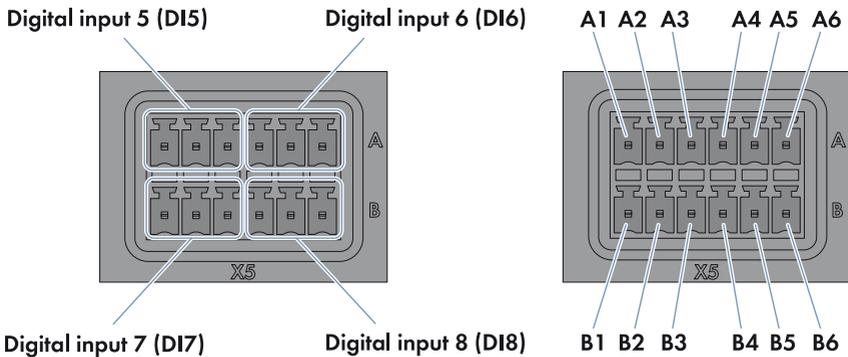


Figure 20: Terminal blocks and pin assignment at terminal **X5**

Terminal block	Pin	Pin assignment	Explanation
Digital input 5 (DI5)	A1	24 V	Voltage supply output
Signal 1 of 4 for the reactive power setpoint	A2	IN	Input
	A3	GND	Reference potential
	A4	24 V	Voltage supply output
Digital input 6 (DI6)	A4	24 V	Voltage supply output
Signal 2 of 4 for the reactive power setpoint	A5	IN	Input
	A6	GND	Reference potential

Terminal block	Pin	Pin assignment	Explanation
Digital input 7 (DI7)	B1	24 V	Voltage supply output
Signal 3 of 4 for the reactive power setpoint	B2	IN	Input
	B3	GND	Reference potential
Digital input 8 (DI8)	B4	24 V	Voltage supply output
Signal 4 of 4 for the reactive power setpoint	B5	IN	Input
	B6	GND	Reference potential

### Procedure:

1. Connect the connection cable to the digital signal source (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.

### DANGER

#### **Danger to life due to electric shock from faulty connection of the connection cable to the ripple control receiver**

In the event of faulty connection of the connection cable to the ripple control receiver, mains voltage may be present in the Cluster Controller enclosure.

- Do not connect insulated wires of the connection cable to phase conductors of the ripple control receiver.
  - When connecting, ensure that no bridge is being used in the ripple control receiver.
2. Connect the connection cable to the six-pole plug as follows:
    - Depending on the digital signal source and the pin assignment at terminal **X5**, identify the conductor entries that will be required for connecting the connection cable. The voltage supply (24 V) and the reference potential (GND) must only be connected once for each signal source.
    - Release the required conductor entries using a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
  3. Connect the six-pole plug to terminal **X5**. For this purpose, observe the pin coding.
  4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
  5. Observe the terminal assignment on the supplementary sheet supplied.

### 6.12.2.4 Digital Signal Setpoint When Using Multiple Cluster Controllers

To implement digital setpoint specifications from the network operator, you can connect any number of Cluster Controllers in parallel to one digital signal source.

**Additional required accessories (not included in scope of delivery):**

- Power supply unit (number dependent on the number of Cluster Controllers to be connected)

**Requirements of power supply unit:**

- DC output voltage: 24 V
- The power supply unit must deliver at least 10 mA for each input signal for the Cluster Controller.

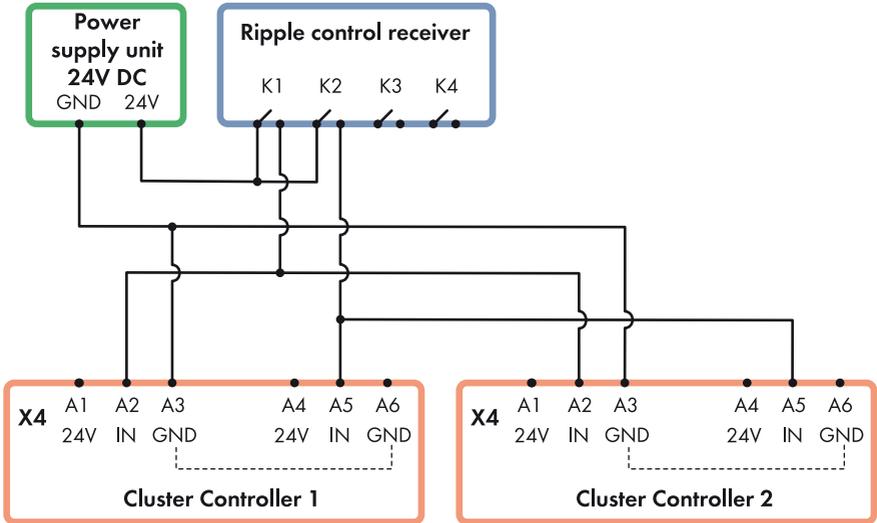


Figure 21: Transmission of digital signals for active power limitation to two Cluster Controllers via relays K1 and K2 of a ripple control receiver (example); in this case, the power supply unit must be capable of supplying at least  $4 \times 10 \text{ mA} = 40 \text{ mA}$ .

## 6.12.3 Analogue Signal Setpoint

### 6.12.3.1 Connecting the Signal Source to the Analogue Input for the Active Power Limitation

The analogue signals for the active power limitation are sent to the terminal block **Analogue current input 2 (AI2)** at terminal **X8** of the Cluster Controller. A remote terminal unit can be used as an analogue signal source, for example.

#### Additional required accessories (not included in scope of delivery):

- 1 analogue signal source
- Connection cable (for cable requirements, see Section 6.3)

#### Requirements:

- The signal source must be technically suitable for connection to the analogue inputs (see Section 9 "Technical Data", page 79).
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

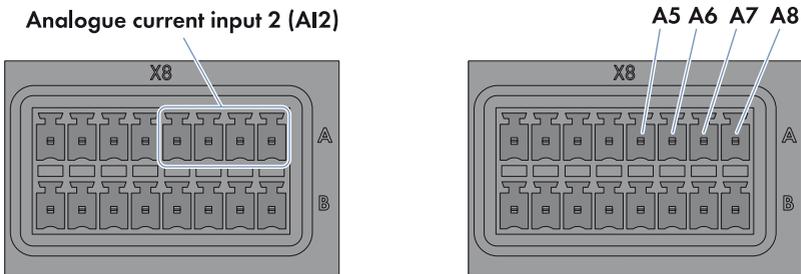


Figure 22: Pin assignment at the terminal block **Analogue current input 2 (AI2)**

Pin	Signal	Explanation
A5	Not assigned	Reserved for future applications
A6	I+	Current input
A7	I-	Current feedback
A8	GND	Shield ground

**Procedure:**

1. Connect the connection cable to the analogue signal source (see the manufacturer manual).  
For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. Connect the connection cable to the eight-pole plug as follows:
  - Release conductor entry 8 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
  - Release conductor entries 6 and 7 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
3. Insert the eight-pole plug at terminal **X8** into pin row **A**.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. Observe the terminal assignment on the supplementary sheet supplied.

### 6.12.3.2 Connecting the Signal Source to the Analogue Input for the Reactive Power Setpoint

The analogue signals for the reactive power setpoint are sent to the terminal block **Analogue current input 3 (AI3)** at terminal **X8** of the Cluster Controller. A remote terminal unit can be used as an analogue signal source, for example.

**Additional required accessories (not included in scope of delivery):**

- 1 analogue signal source
- Connection cable (for cable requirements, see Section 6.3)

**Requirements:**

- The signal source must be technically suitable for connection to the analogue inputs (see Section 9 "Technical Data", page 79).
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

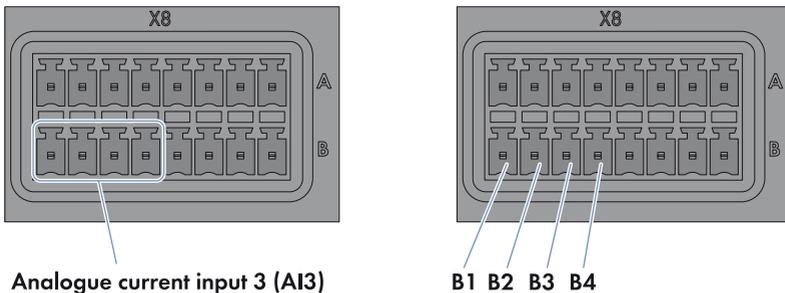


Figure 23: Pin assignment at the terminal block **Analogue current input 3 (AI3)**

Pin	Signal	Explanation
B1	Not assigned	Reserved for future applications
B2	I+	Current input
B3	I –	Current feedback
B4	GND	Shield ground

**Procedure:**

1. Connect the connection cable to the analogue signal source (see the manufacturer manual).  
For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. Connect the connection cable to the eight-pole plug as follows:
  - Release conductor entry 4 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
  - Release conductor entries 2 and 3 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
3. Insert the eight-pole plug at terminal **X8** into pin row **B**.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. Observe the terminal assignment on the supplementary sheet supplied.

### 6.12.3.3 Analogue Signal Setpoint When Using Multiple Cluster Controllers

To implement analogue setpoint specifications from the network operator when using multiple Cluster Controllers, you can use isolation amplifiers to duplicate the analogue current signals. By switching the isolation amplifiers in series, the analogue current signals can be transferred to any number of Cluster Controllers.

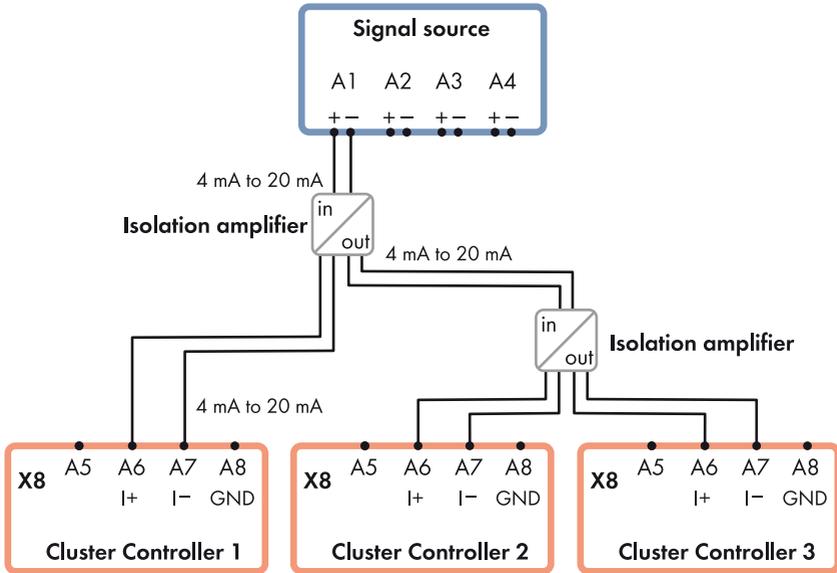


Figure 24: Transmission of analogue current signals for active power limitation to three Cluster Controllers via isolation amplifiers (example)

### 6.12.4 Setpoint via Modbus Client

#### Requirements:

- The Cluster Controller and the Modbus client must be located on the same local area network (LAN) (see Section 6.16).
- The commissioning of the Cluster Controller must be completed.

In order to receive the network operator setpoints via a Modbus client, you must perform the Modbus configuration via the user interface of the Cluster Controller after completing the commissioning (see the Cluster Controller user manual).

### 6.12.5 Feedback on Network Operator Setpoints

If the Cluster Controller sends the network operator setpoints for grid management to the inverters in the plant, you have the option of providing related feedback to the network operator. For this purpose, the Cluster Controller prepares one digital output and two analogue current outputs as response contacts to which you can connect corresponding remote terminals, e.g. a remote terminal unit.

### 6.12.5.1 Feedback via Digital Signal

Via the terminal block **Digital output 3 (DO3)**, you can provide feedback on whether the Cluster Controller has sent a network operator setpoint for the active power limitation to the inverters in the plant.

**i** **Observe the maximum load capacity of the relay contacts**

The relay contacts may be loaded with a maximum switching capacity of 30 watts and a maximum voltage of 48 V DC (see Section 9 "Technical Data", page 79).

**Requirements:**

- The remote terminal must be technically suitable for connection to the digital output (see Section 9 "Technical Data", page 79).
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

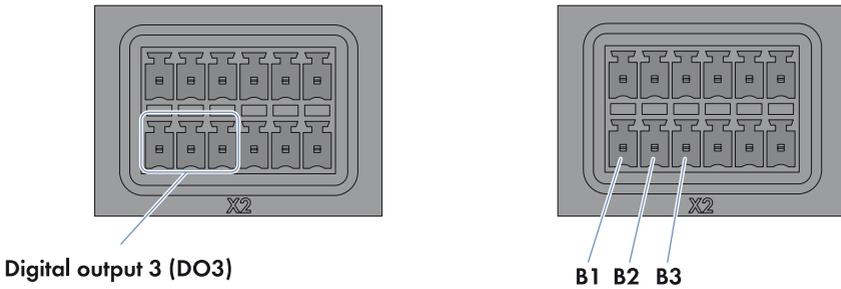


Figure 25: Pin assignment at the terminal block **Temperature output 3 (DO3)**

Terminal block	Relay	Pin	Signal	Explanation
Digital output 3 (DO3)	C	B1	NC	Back contact
Response contact for the current active power limitation		B2	CO	Change-over contact
		B3	NO	Front contact

**Procedure:**

1. Connect the connection cable to the remote terminal (see the manufacturer manual).  
For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. Connect the connection cable to the six-pole plug as follows:
  - Depending on the remote terminal and the pin assignment at terminal block **Digital output 3 (DO3)**, identify the conductor entries that will be required for connecting the connection cable.
  - Release the required conductor entries using a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
3. Insert the six-pole plug at terminal **X2** into pin row **B**.

4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. Observe the terminal assignment on the supplementary sheet supplied.

### 6.12.5.2 Feedback via Analogue Signal

Via the two analogue current outputs **Analogue current output 1 (AO1)** and **Analogue current output 2 (AO2)**, you can provide feedback on the value (if any) for the active power limitation or the reactive power setpoint of the Cluster Controller that is currently being sent to the inverters in the plant.

#### Requirements:

- The remote terminal must be technically suitable for connection to the analogue outputs (see Section 9 "Technical Data", page 79).
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

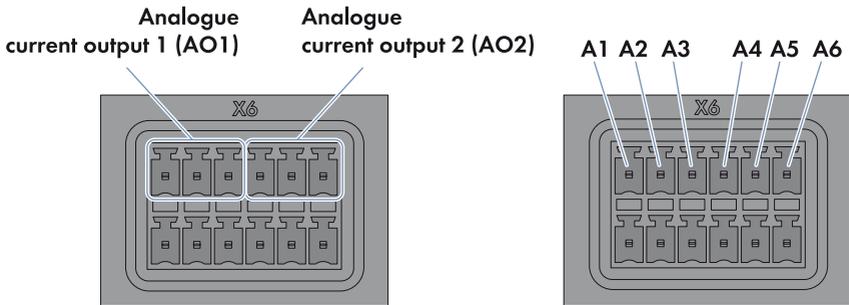
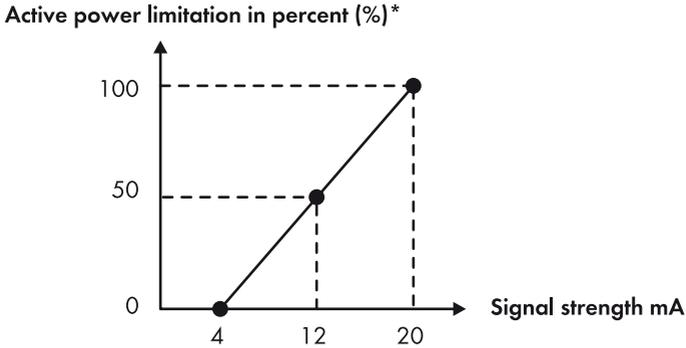


Figure 26: Pin assignment at the terminal blocks **Analogue current output 1 (AO1)** and **Analogue current output 2 (AO2)**

Terminal block	Pin	Signal	Explanation
Analogue current output 1 (AO1)	A1	I+	Current output
Feedback of the current active power limitation	A2	I-	Current feedback
	A3	GND	Shield ground
Analogue current output 2 (AO2)	A4	I+	Current output
Feedback of the current reactive power setpoint	A5	I-	Current feedback
	A6	GND	Shield ground

### Interpretation of the Signal Strength as a Percentage Value of the Active Power Limitation

The strength of the feedback signal corresponds to the percentage value to which the active power of the inverters in the plant is currently limited.

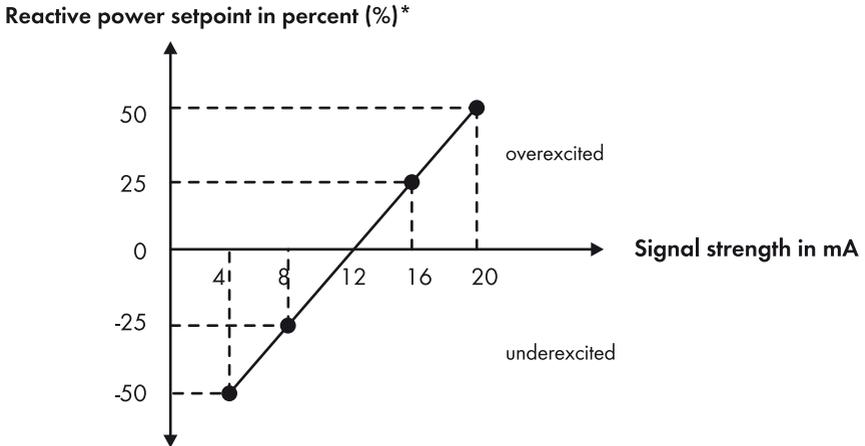


\* regarding inverter parameter currently set active power limit or **Pmax**

Figure 27: Interpretation of the signal strength as a percentage value of the active power limitation in relation to the inverter parameter **Set active power limit** or **Pmax**

### Interpretation of the Signal Strength as a Value of the Reactive Power Setpoint

Depending on the size of the reactive power setpoint that was selected via the user interface (see the Cluster Controller user manual), the strength of the feedback signal corresponds either to the percentage value for the reactive power setpoint or to the latest displacement power factor  $\cos \varphi$  sent to the inverters in the plant.



\* regarding inverter parameter currently set active power limit or **Pmax**

Figure 28: Interpretation of the signal strength as a percentage value of the reactive power setpoint in relation to the inverter parameter **Set active power limit** or **Pmax**

### Reactive power setpoint as displacement power factor $\cos \varphi$

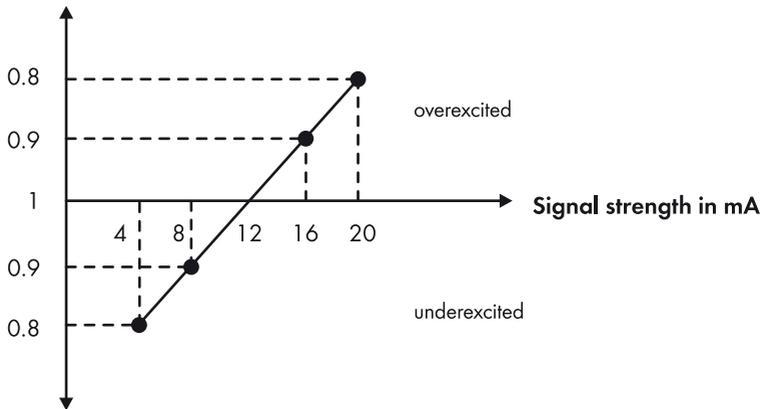


Figure 29: Interpretation of the signal strength as displacement power factor  $\cos \varphi$

#### Procedure:

- Connect the connection cable to the remote terminal (see the manufacturer manual).  
For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
- When using the terminal block **Analogue current output 1 (AO1)**, perform the following steps to connect the connection cable to the six-pole plug:
  - Release conductor entry 3 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
  - Depending on the remote terminal and the pin assignment at the terminal block **Analogue current output 1 (AO1)**, identify the conductor entries that are required for the connection of the connection cable.
  - Release the required conductor entries using a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
- When using the terminal block **Analogue current output 2 (AO2)**, perform the following steps to connect the connection cable to the six-pole plug:
  - Release conductor entry 6 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
  - Depending on the remote terminal and the pin assignment at the terminal block **Analogue current output 2 (AO2)**, identify the conductor entries that are required for the connection of the connection cable.
  - Release the required conductor entries using a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
- Insert the six-pole plug at terminal **X6** into pin row **A**.
- On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
- Observe the terminal assignment on the supplementary sheet supplied.

### 6.12.5.3 Feedback When Using Multiple Cluster Controllers

#### Feedback via Digital Signal

When using multiple Cluster Controllers, you have two options for feedback of operator setpoints via digital signal:

- Connect one remote terminal to the digital output of each Cluster Controller (see Section 6.12.5.1 "Feedback via Digital Signal", page 59)

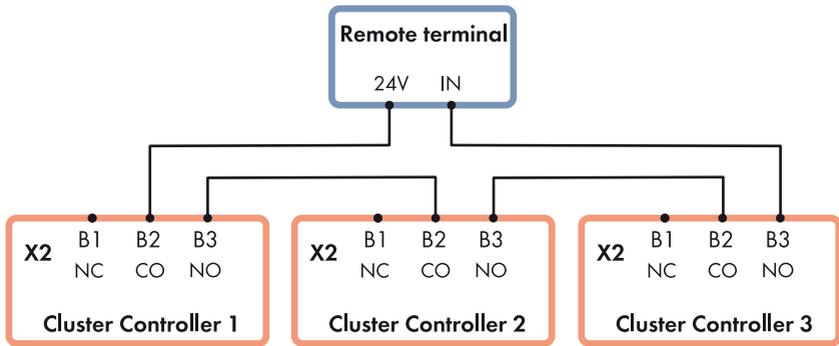
**or**

- Switch the digital outputs of several Cluster Controllers in series.

#### Switching Digital Outputs of Several Cluster Controllers in Series

If you switch the digital outputs of several Cluster Controllers in series,

Feedback on active power limitation only occurs if all Cluster Controllers in the series confirm the active power limitation.



NC = Normally Closed (back contact), CO = Change Over (change-over contact), NO = Normally Open (front contact)

Figure 30: Series connection of the digital outputs of three Cluster Controllers for feedback of network operator setpoints on active power limitation (example)

#### Feedback via Analogue Signal

When using multiple Cluster Controllers, you must connect one remote terminal to the analogue current outputs of each Cluster Controller (see Section 6.12.5.2 "Feedback via Analogue Signal", page 60).

### 6.13 Using Fault Indication Relays

You can connect up to three remote terminals (e.g. optical or acoustic signal generators) to the three potential-free relay contacts of the Cluster Controller. The relay contacts are implemented as two fault indication relays and one response contact. Via the fault indication relay **Digital output 1 (DO1)**, you can signal the plant status **Fault**. Via the fault indication relay **Digital output 2 (DO2)**, you can signal the plant status **Fault** or **Warning**.

**i** **Observe the maximum load capacity of the relay contacts**

The relay contacts may be loaded with a maximum switching capacity of 30 watts and a maximum voltage of 48 V DC (see Section 9 "Technical Data", page 79).

**Requirements:**

- The remote terminal must be technically suitable for connection to the digital outputs (see Section 9 "Technical Data", page 79).
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

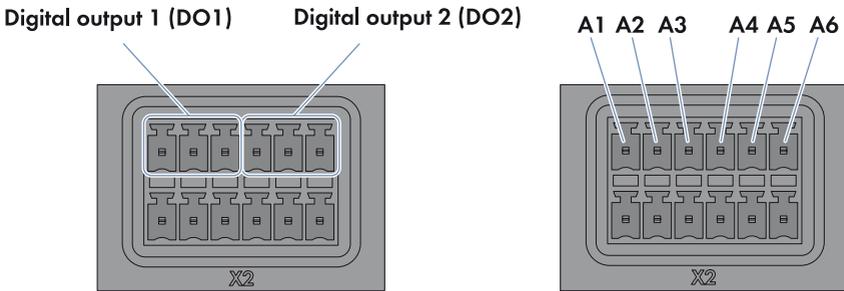


Figure 31: Pin assignment at the terminal blocks **Digital output 1 (DO1)** and **Digital output 2 (DO2)**

Terminal block	Relay	Pin	Signal	Explanation
Digital output 1 (DO1)	A	A1	NC	Back contact
Fault indication relay for the plant status <b>Fault</b>		A2	CO	Change-over contact
		A3	NO	Front contact
Digital output 2 (DO2)	B	A4	NC	Back contact
Fault indication relay for the plant status <b>Fault</b> or <b>Warning</b>		A5	CO	Change-over contact
		A6	NO	Front contact

**Procedure:**

1. Connect the connection cable to the remote terminal (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. Connect the connection cable to the six-pole plug as follows:
  - Depending on the remote terminal and the pin assignment at the terminal blocks **Digital output 1 (DO1)** and **Digital output 2 (DO2)**, identify the conductor entries that are required for the connection of the connection cable.
  - Release the required conductor entries using a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
3. Insert the six-pole plug at terminal **X2** into pin row **A**.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. Observe the terminal assignment on the supplementary sheet supplied.

## 6.14 Checking the Connections via the Display

You can use the display of the Cluster Controller to check whether the connections have been made correctly and whether all inverters, sensors and remote terminals have been detected by the Cluster Controller. The content of the display views takes one or two seconds to update. For technical reasons, representation on the display depends on the ambient temperature and may be correspondingly delayed in the event of low ambient temperature.

**Procedure:**

1. Select the **Plant status** display view.
2. Check whether the correct total number of connected inverters is displayed in the **Number of devices** line.

Plant Status	10:01
Number of devices	42
Device status: ok	40
Device status: warning	1
Device status: error	1

If the correct total number of connected inverters is not displayed, it is likely that one or more inverters are not connected correctly (see Section 7.2 "Faults in the Cluster Controller or the Connected Devices", page 72).

3. When using the digital inputs, select the **Digital Inputs** display view.
4. Check whether the expected binary values are displayed in the lines **Dig. input group 1** and **Dig. input group 2**.

Digital inputs	10:03
Dig. input group 1	0 0 0 1
Dig. input group 1	0 0 0 0

If the expected binary values are not displayed, it is likely that the digital signal source is not correctly connected (see Section 7.2 "Faults in the Cluster Controller or the Connected Devices", page 72).

5. When using the analogue inputs, select the **Analogue inputs** display view.

6. If an analogue signal source or a sensor is connected, check whether a current signal is displayed in the lines **Analogue current input 1 (AI1)**, **Analogue current input 2 (AI2)** or **Analogue current input 3 (AI3)**, respectively.

Analogue inputs		10:02
Ana. current input 1		8.35 mA
Ana. current input 2		0.00 mA
Ana. current input 3		14.00 mA
Ana. voltage input 4		8.50 V

If no current signal is displayed, it is likely that the analogue signal source or the sensor is not correctly connected (see Section 7.2 "Faults in the Cluster Controller or the Connected Devices", page 72).

7. If a sensor is connected to the terminal block **Analogue voltage input 4 (AI4)**, check whether a measured value is displayed in the line **Analogue voltage input 4**.

Analogue inputs		10:02
Ana. current input 1		8.35 mA
Ana. current input 2		0.00 mA
Ana. current input 3		14.00 mA
Ana. voltage input 4		8.50 V

If no measured value is displayed, the sensor is not correctly connected.

- Ensure that the sensor is correctly connected (see Section 6.11.3).

8. When connecting an irradiation sensor or a temperature sensor, select the **Meteorology** display view.

9. Check whether measured values are displayed for each connected sensor.

Meteorology		10:33
Ambient temperature		25.5 °C
Module temperature		40.0 °C
Insolation		852 W/m <sup>2</sup>

If no measured values are displayed for the connected temperature sensor, the temperature sensor is not correctly connected.

- Ensure that the temperature sensor is correctly connected (see Section 6.11.2).

If no measured values are displayed for the connected irradiation sensor, either the characteristic curve of the irradiation sensor is not configured or the irradiation sensor is not correctly connected.

- Ensure that the characteristic curve of the irradiation sensor is configured (see the Cluster Controller user manual).
- Ensure that the irradiation sensor is correctly connected (see Section 6.11.1).

## 6.15 Performing Configuration for a Static Local Network (LAN)

You have the option of configuring the Cluster Controller and the inverters in the plant for a static local area network (LAN) (see the Cluster Controller user manual). The Cluster Controller and the inverters are configured for automatic address allocation via DHCP by default.

## 6.16 Setting Up a Modbus Data Connection

**Additional required accessories (not included in scope of delivery):**

- Up to two Modbus clients

**Requirements:**

- The Cluster Controller and the Modbus client must be located on the same local area network (LAN) (for information on connecting the Cluster Controller to the local area network (LAN), see Section 6.9).
- The commissioning of the Cluster Controller must be completed.

Perform the setup of the Modbus data connection via the user interface of the Cluster Controller (see the Cluster Controller user manual) and the Modbus client (see the manufacturer manual). You can find further information on possible Modbus settings on the Cluster Controller in the technical description "SMA CLUSTER CONTROLLER Modbus<sup>®</sup> Interface".

## 7 Troubleshooting

### 7.1 LED States

#### 7.1.1 Operation LEDs

##### Configuration of the Status LED ( )

The status LED can display the following statuses:

- Status of the Cluster Controller
- Status of the connected inverters
- Status of the plant communication
- Status of the grid management

In this document, the only states described below are those that the status LED can adopt upon initial start-up (for a complete description of the states, see the Cluster Controller user manual).

##### Procedure:

- If the status LED is not glowing green after commissioning, refer also to the event log of the Cluster Controller to determine the precise cause of the fault. The details of the respective fault are logged in the event log (see the Cluster Controller user manual).

LED	Status	Cause and Corrective Measures
All	Off	<p>The Cluster Controller is not connected to the voltage supply.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Connect the Cluster Controller to the voltage supply (see Section 6.14).</li> </ul> <hr/> <p>The voltage supply is reverse-connected or the top-hat rail power supply unit is defective.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the voltage supply is correctly connected (see Section 6.14).</li> <li>• If the voltage supply is correctly connected, replace the top-hat rail power supply unit.</li> </ul>
Power (  ) and status (  )	Power glowing red, status glowing yellow or red	<p>The voltage supply is too low.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the connected voltage supply is sufficient (see Section 6.14).</li> <li>• If the problem persists, contact the SMA Service Line (see Section 11).</li> </ul>

LED	Status	Cause and Corrective Measures
Power (  )	Glowing green	The start procedure is complete. The Cluster Controller is ready for operation.
Status (  )	Glowing green	Normal operation
	Glowing yellow	At least one device has the status <b>Warning</b> .  <b>Corrective Measures:</b> <ul style="list-style-type: none"> <li>• Observe the event log of the Cluster Controller (see the Cluster Controller user manual).</li> <li>• Observe the device documentation.</li> </ul>
	Glowing red	At least one device has the status <b>Fault</b> .  <b>Corrective Measures:</b> <ul style="list-style-type: none"> <li>• Observe the event log of the Cluster Controller (see the Cluster Controller user manual).</li> <li>• Observe the device documentation.</li> </ul> <p>The SD card in the Cluster Controller may be defective.</p> <b>Corrective Measures:</b> <ul style="list-style-type: none"> <li>• Check the event report of the Cluster Controller (see the Cluster Controller user manual).</li> <li>• If the SD card is defective, contact the SMA Service Line (see Section 11).</li> </ul>
	Flashing red	The Cluster Controller could not start correctly. A system fault has occurred.  <b>Corrective Measures:</b> <ul style="list-style-type: none"> <li>• Contact the SMA Service Line (see Section 11).</li> </ul>

LED	Status	Cause and Corrective Measures
Data carrier status (  )	Off	<p>The Cluster Controller is starting and no information is yet available for data export or for USB data carriers.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>Wait until the Cluster Controller has completed the start process and is ready for operation. Once the start process is complete, the power LED (  ) glows green.</li> </ul>
		<p>No USB data carrier was detected. It is possible that no USB data carrier is connected or the USB data carrier is not compatible.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>Ensure that a compatible USB data carrier is connected (see Section 9 "Technical Data", page 79).</li> </ul>
	Glowing green	The USB data carrier is compatible. The free memory capacity is above 10%.
	Glowing yellow	<p>The USB data carrier at the USB terminal <b>1</b> is compatible but the free memory capacity is 10% at maximum.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>Delete files that are no longer required from the USB data carrier.</li> </ul> <p><b>or</b></p> <ul style="list-style-type: none"> <li>Replace the USB data carrier with a USB data carrier that has sufficient free memory capacity.</li> </ul>
	Glowing red	<p>The USB data carrier at USB terminal <b>1</b> is full or write-protected.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>If the USB data carrier is full, replace the USB data carrier.</li> <li>If the USB data carrier is write-protected, remove the write protection or use a USB data carrier without write protection.</li> </ul>
	Flashing green or yellow or red	<p>Write or read accesses are currently being performed on the USB data carrier.</p> <ul style="list-style-type: none"> <li>Only remove the USB data carrier once the data carrier status LED is no longer flashing.</li> </ul>

## 7.1.2 LEDs of the Network Connections

LED	Status	Cause and Corrective Measures
Link/activity (green)	Off	<p>No network connection has been established.</p> <p>The Cluster Controller is not connected to the voltage supply.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>Connect the Cluster Controller to the voltage supply (see Section 6.14).</li> </ul>
		<p>No network connection has been established.</p> <p>The patch cable at the Cluster Controller, at the router or at the network switch is not correctly connected.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>Ensure that the patch cable is correctly connected (see Section 6.9).</li> </ul>
		<p>No network connection has been established.</p> <p>One or more network components, patch cables or plug connectors are defective or damaged.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>Replace the defective or damaged network components, patch cables or plug connectors.</li> </ul>
	Flashing	<p>Network connection established.</p> <p>Data is being transmitted or received.</p>
Speed (yellow)	Off	<p>Network connection established.</p> <p>The data transfer rate is up to 10 Mbit/s.</p>
	On	<p>Network connection established.</p> <p>The data transfer rate is up to 100 Mbit/s.</p>

## 7.2 Faults in the Cluster Controller or the Connected Devices

Problem	Cause and Corrective Measures
<p>The Cluster Controller does not start. The LEDs and the display are off.</p>	<p>The Cluster Controller is not connected to the voltage supply.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the three-pole plug for the voltage supply is connected to terminal <b>X1</b> of the Cluster Controller.</li> </ul> <hr/> <p>The voltage supply is reverse-connected or the top-hat rail power supply unit is defective.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the voltage supply is correctly connected (see Section 6.14).</li> <li>• If the voltage supply is correctly connected, replace the top-hat rail power supply unit.</li> </ul>
<p>The login page does not open and the status LED (  ) flashes red.</p>	<p>The Cluster Controller could not start correctly. A system fault has occurred.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Disconnect the Cluster Controller from the voltage supply and reconnect to the voltage supply. Note that this can lead to loss of plant data.</li> <li>• If the problem persists, contact the SMA Service Line (see Section 11).</li> </ul>
<p>The login page does not open</p>	<p>The Cluster Controller is not connected to the voltage supply.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the three-pole plug for the voltage supply is connected to terminal <b>X1</b> of the Cluster Controller.</li> </ul>

Problem	Cause and Corrective Measures
The login page does not open.	<p>The voltage supply is reverse-connected or the top-hat rail power supply unit is defective.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the voltage supply is correctly connected (see Section 6.14).</li> <li>• If the voltage supply is correctly connected, replace the top-hat rail power supply unit.</li> </ul>
	<p>A firewall is blocking the connection.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Adjust the firewall settings in order to allow the required connection.</li> </ul>
	<p>If the Cluster Controller is connected to the local area network (LAN) via DHCP and the voltage supply of the Cluster Controller was interrupted, it is possible that the DHCP server in the local area network (LAN) has assigned a new IP address to the Cluster Controller.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Select the <b>External communication</b> display view and read out the current IP address of the Cluster Controller.</li> <li>• Call up the IP address via the Internet browser.</li> </ul>
	<p>There is a problem in the local area network (LAN).</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the patch cable is correctly connected to the Cluster Controller (see Section 6.9).</li> <li>• Check whether the network components, patch cables or plug connectors are defective or damaged. Replace defective or damaged network components, patch cables or plug connectors.</li> <li>• Check whether the network settings of the individual network components are correct. Adapt the network settings if required.</li> <li>• Restart the Cluster Controller. For this purpose, disconnect the Cluster Controller from the voltage supply and reconnect to the voltage supply. Note that this can lead to loss of plant data.</li> <li>• If the problem persists, contact the network administrator.</li> </ul>

Problem	Cause and Corrective Measures
Login to the user interface has failed.	<p>The plant password has been entered incorrectly four times. Access to the Cluster Controller is suspended for 15 minutes.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Wait for 15 minutes, then log in with the correct plant password.</li> </ul>
The user interface is not displayed properly.	<p>JavaScript is disabled in the Internet browser.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Enable JavaScript in the Internet browser.</li> </ul>
The correct number of all connected inverters is not shown on the display.	<p>The communication with at least one inverter is interrupted. Either the Cluster Controller has not yet registered with one or more inverters or the connection to one or more inverters has been interrupted.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Wait for six minutes and re-check whether the correct number of all connected inverters is displayed.</li> </ul> <p>If the correct number of all connected inverters is still not displayed:</p> <ul style="list-style-type: none"> <li>• Ensure that the inverters are in operation.</li> <li>• Ensure that the network cables that connect the inverters to one another are correctly connected (depending on the inverter equipment; see the inverter installation manual or the Speedwire/ Webconnect interface installation manual).</li> <li>• Ensure that the inverter patch cable that is directly connected to the Cluster Controller is connected to network terminal <b>X9</b> or <b>X10</b> of the Cluster Controller.</li> <li>• Ensure that no network components, patch cables or plug connectors are defective.</li> </ul>
The expected binary values for the digital signal source are not shown on the display.	<p>The digital signal source is not correctly connected.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the digital signal source is correctly connected (see Section 6.12.2).</li> </ul>

Problem	Cause and Corrective Measures
<p>No current signal for the analogue signal source or the sensor is shown on the display.</p>	<p>It is likely that the analogue signal source or the sensor is not correctly connected.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the analogue signal source is correctly connected (see Section 6.12.3).</li> <li>• Ensure that the sensor is correctly connected (see Section 6.11.3).</li> </ul>
<p>No measured values for the connected temperature sensor are shown on the display.</p>	<p>The temperature sensor is not correctly connected.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the temperature sensor is correctly connected (see Section 6.11.2).</li> </ul>
<p>No measured values for the connected irradiation sensor are shown on the display.</p>	<p>If no measured values are displayed for the irradiation sensor, either the characteristic curve of the irradiation sensor is not configured or the irradiation sensor is not correctly connected.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the characteristic curve of the irradiation sensor is configured (see the Cluster Controller user manual).</li> <li>• Ensure that the irradiation sensor is correctly connected (see Section 6.11.1).</li> </ul>
<p>Despite not being switched on, a measured value of up to 2.2 V for <b>Analogue voltage input 4 (AI4)</b> is still shown on the display and the user interface.</p>	<p>If no sensor is connected to the terminal block <b>Analogue voltage input 4 (AI4)</b>, a measured value of up to 2.2 V will nevertheless be shown in the display and on the user interface of the Cluster Controller.</p> <p><b>Corrective Measures:</b></p> <ul style="list-style-type: none"> <li>• In order for a measured value of 0 V to be displayed for the terminal block <b>Analogue voltage input 4</b> when it is not connected, place a jumper wire at terminal <b>X8</b> between contact pin B5 and contact pin B7.</li> </ul>

## 7.3 Resetting the Cluster Controller

You can reset the Cluster Controller via the button field.

### Procedure:

1. Call up the **Settings** display view. For this purpose, simultaneously press and hold the **[OK]** and **[ESC]** buttons on the button field for two seconds.

The **Settings** display view opens.

2. Select the settings that are to be reset:

Settings to be reset	Explanation
Reset password	The user password and the installer password are reset.
Reset Network Settings	The network settings of the Cluster Controller are reset.
Restoring Factory Settings	The Cluster Controller is reset to default settings. Stored plant data is deleted.

3. To exit the display view again, press **[ESC]**.
4. To confirm the settings that are to be reset, perform the following steps:
  - Press **[OK]**.
  - The **Confirm the Resetting** display view appears.
  - Select **OK** and confirm with **[OK]**.
  - The selected settings are reset.
  - If the network settings were reset or the Cluster Controller was reset to default settings, the Cluster Controller restarts.

## 8 Decommissioning

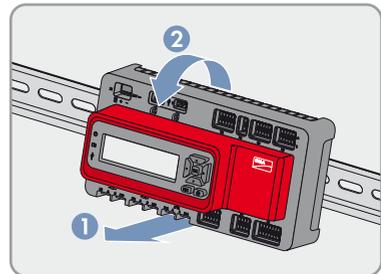
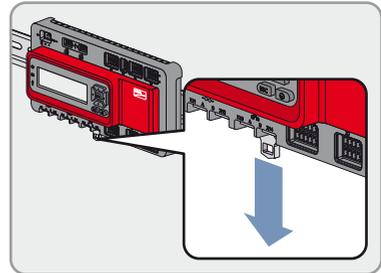
### 8.1 Disassembling the Cluster Controller

1. **DANGER**

**Danger to life due to electric shock.**

Lethal voltages are present at the connection point of the electricity grid.

- Disconnect the connection point from the electricity grid using the separator (e.g. miniature circuit-breaker).
  - Remove the three-pole plug of the top-hat rail power supply unit from terminal **X1** of the Cluster Controller.
2. Remove the patch cable of the Speedwire network (e.g. of the inverter) from the Cluster Controller.
  3. Remove the patch cable of the local area network (LAN) (e.g. of the router) from the Cluster Controller.
  4. Remove the multipole plugs of the connected devices and sensors from the Cluster Controller.
  5. Remove the Cluster Controller from the top-hat rail:
    - Pull or press the visible flap of the top-hat rail locking mechanism located underneath the Cluster Controller downwards using a screwdriver.



- Tilt the lower edge of the Cluster Controller forwards and remove from the top-hat rail.

## 8.2 Packing the Cluster Controller for Shipping

- Pack the Cluster Controller for shipping. Use either the original packaging or other packaging suitable for the weight and size of the Cluster Controller (see Section 9 "Technical Data", page 79).

## 8.3 Disposing of the Cluster Controller

- Dispose of the Cluster Controller in accordance with the locally applicable disposal regulations for electronic waste.

## 9 Technical Data

<b>General Data</b>	
Status display	LEDs, display
Operation	Button field, integrated Web server
Type of mounting	Top-hat Rail Mounting
Mounting location	Indoors
<b>Mechanical Data</b>	
Width x height x depth	275 mm x 133 mm x 71 mm
Weight	1.2 kg
<b>Display</b>	
Display	LCD display
Resolution	240 px × 64 px
Display languages	German, English
Operation	Button field
<b>Memory</b>	
Internal ring buffer	1.7 GB
External memory*	USB data carrier
* Optional	
<b>Voltage Supply</b>	
Voltage supply	Top-hat rail power supply unit
Input voltage	18 V DC to 30 V DC
Typical power consumption	24 W
Maximum power consumption	30 W

### Ambient Conditions

Ambient temperature in operation*	- 25 °C to +60 °C
Ambient temperature during storage and transport	- 40 °C to +70 °C
Relative humidity in operation**	4 to 95%
Relative humidity during storage and transport**	10% to 95%
Degree of protection according to IEC 60529	IP20
Electromagnetic compatibility according to EN 55022	Class A
Maximum height above MSL	3,000 m

\* If the flow rate of the ambient air is constantly  $\geq 0.5$  m/s, the ambient temperature range in operation will be extended to - 25 °C to +70 °C.

\*\* non-condensing

### Communication

Inverter	Speedwire
Local area network (LAN)	Ethernet
Data interfaces	HTTP, FTP, Modbus TCP/UDP, SMTP, Sunny Portal

### Maximum Radio Range

Speedwire*	100 m
Ethernet*	100 m

\* between two nodes when using installation cables

### Maximum Number of Devices

SMA inverter	75
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### Network Terminals

Number (Speedwire)	2
Number (local area network (LAN))	2
Auto-MDIX (auto-crossing)	yes
Data transfer standard	10BASE-T or 100BASE-TX
Data transfer rate*	up to 10 Mbit/s or up to 100 Mbit/s

\* negotiated via autonegotiation

**Digital Inputs**

Number	8
Input voltage	24 V DC
Maximum cable length	30 m

**Digital Outputs**

Number	3
Model	Potential-free relay contacts
Maximum switching power	30 W
Maximum voltage load	48 V DC
Maximum cable length	30 m

**Analogue Inputs**

Number of analogue inputs for current signals	3
Number of analogue inputs for voltage signals	1
Internal resistance	450 $\Omega$
Measurement range for current signals	0 mA to 20 mA
Measuring range for voltage signals	0 V to +10 V
Typical tolerance	$\pm 0.3\%$
Maximum tolerance	$\pm 2\%$
Maximum cable length	30 m

**Analogue Outputs**

Number of analogue outputs for current signals	2
Measurement range for current signals	4 mA to 20 mA
Maximum tolerance	$\pm 0.5\%$
Maximum cable length	3,000 m

**Temperature Inputs**

Number	2
Measuring shunt	Printed circuit board sensor PT100, printed circuit board sensor PT1000
Type of measurement	Two-conductor connection, four-conductor connection
Measuring range	- 40°C to +85°C
Maximum tolerance*	± 0.5°C
Maximum cable length*	20 m

\* for measuring with four-conductor connection

**USB Terminals**

Number	2
Specification	USB 2.0 Hi-Speed
Maximum current	500 mA
Maximum cable length	3 m

## 10 Accessories

You will find the corresponding accessories and spare parts for your product in the following overview. If required, you can order them from SMA Solar Technology AG or from your specialist dealer.

<b>Description</b>	<b>Brief description</b>	<b>SMA order number</b>
Top-hat rail power supply unit	Top-hat rail power supply for the SMA Cluster Controller	CLCON-PWRSUPPLY
USB stick 4 GB	USB memory stick with storage capacity of 4 GB	USB-FLASHDRV4GB
USB stick 8 GB	USB memory stick with storage capacity of 8 GB	USB-FLASHDRV8GB

# 11 Contact

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

- Cluster Controller:
  - Serial number
  - Firmware version
- Inverters:
  - Type
  - Serial number
  - Firmware version
- When using a retrofitted Speedwire/Webconnect interface:
  - Serial number and firmware version of the Speedwire/Webconnect interface

You can read out the necessary information via the user interface of the Cluster Controller (see the Cluster Controller user manual). Alternatively, you can also read out the serial number and the device type on the type label of the respective product (see the respective product manual).

You can read out the serial number and the firmware version of the Cluster Controller on the **Cluster Controller** display view.

Australia	SMA Australia Pty Ltd. Sydney	Toll free for Australia: International:	1800 SMA AUS (1800 762 287) +61 2 9491 4200
Belgien/ Belgique/ België	SMA Benelux bvba/sprl Mechelen	+32 15 28 67 30	
Brasil	Vide España (Espanha)		
Česko	SMA Central & Eastern Europe s.r.o. Praha	+420 235 010 417	
Chile	Ver España		
Danmark	Se Deutschland (Tyskland)		
Deutschland	SMA Solar Technology AG Niestetal	Medium Power Solutions Wechselrichter: Kommunikation: SMS mit „Rückruf“:	+49 561 9522-1499 +49 561 9522-2499 +49 176 888 222 44
		Hybrid Energy Solutions Sunny Island:	+49 561 9522-399
		Power Plant Solutions Sunny Central:	+49 561 9522-299

España	SMA Ibérica Tecnología Solar, S.L.U. Barcelona	Exento de tasas en España: Internacional:	900 14 22 22  +34 900 14 22 22
France	SMA France S.A.S. Lyon	Medium Power Solutions Onduleurs : Communication : Hybrid Energy Solutions Sunny Island : Power Plant Solutions Sunny Central :	  +33 (0)4 72 09 04 40 +33 (0)4 72 09 04 41  +33 (0)4 72 09 04 42  +33 (0)4 72 09 04 43
India	SMA Solar India Pvt. Ltd. Mumbai	+91 22 61713888	
Italia	SMA Italia S.r.l. Milano	+39 02 8934-7299	
Κύπρος/ Kıbrıs	Βλέπε Ελλάδα/ Bkz. Ελλάδα (Yunanistan)		
Luxemburg/ Luxembourg	Siehe Belgien Voir Belgique (Belgique)		
Magyarország	lásd Česko (Csehország)		
Nederland	zie Belgien (België)		
Österreich	Siehe Deutschland		
Perú	Ver España		
Polska	Patrz Česko (Czechy)		
Portugal	SMA Solar Technology Portugal, Unipessoal Lda Lisboa	Isento de taxas em Portugal: Internacional:	800 20 89 87  +351 2 12 37 78 60
România	Vezi Česko (Cehia)		
Schweiz	Siehe Deutschland		
Slovensko	pozri Česko (Česká republika)		
South Africa	SMA Solar Technology South Africa Pty Ltd. Centurion (Pretoria)	08600 SUNNY (08600 78669) International:	  +27 (12) 643 1785
United Kingdom	SMA Solar UK Ltd. Milton Keynes	+44 1908 304899	

Ελλάδα	SMA Hellas AE Αθήνα	801 222 9 222 International: +30 212 222 9 222
България	Вижте Ελλάδα (Гърция)	
ไทย	SMA Solar (Thailand) Co., Ltd. ปทุมธานี	+66 2 670 6999
대한민국	SMA Technology Korea Co., Ltd. 서울	+82 2 508-8599
中国	SMA Beijing Commercial Company Ltd. 北京	+86 10 5670 1350
日本	SMA Japan K.K. 東京	+81 3 3451 9530
+971 2 698-5080	SMA Middle East LLC أبو ظبي	الإمارات العربية المتحدة
Other countries	International SMA Service Line Niestetal	Toll free worldwide: 00800 SMA SERVICE (+800 762 7378423)

**SMA Solar Technology**

**[www.SMA-Solar.com](http://www.SMA-Solar.com)**

