SIEMENS

AS-Interface

**I/O modules for use in the control cabinet
AS-Interface SlimLine Compact Modules**

Equipment Manual

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

> ⚠ **DANGER**
>
> indicates that death or severe personal injury **will** result if proper precautions are not taken.

> ⚠ **WARNING**
>
> indicates that death or severe personal injury **may** result if proper precautions are not taken.

> ⚠ **CAUTION**
>
> indicates that minor personal injury can result if proper precautions are not taken.

> **NOTICE**
>
> indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

> ⚠ **WARNING**
>
> Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Table of contents

Introduction

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1.1 Required basic knowledge

A general knowledge of the following areas is needed in order to understand this manual:

- Low-voltage switchgear and control gear
- Digital circuit logic
- Automation technology
- Safety technology

1.2   Siemens Industry Online Support

Information and service

At Siemens Industry Online Support you can obtain up-to-date information from our global support database:

- Product support
- Application examples
- Forum
- mySupport

Link: Siemens Industry Online Support (https://support.industry.siemens.com/cs/de/en)

Product support

You can find information and comprehensive know-how covering all aspects of your product here:

- **FAQs**
  Answers to frequently asked questions

- **Manuals/operating instructions**
  Read online or download, available as PDF or individually configurable.

- **Certificates**
  Clearly sorted according to approving authority, type and country.

- **Characteristics**
  For support in planning and configuring your system.

- **Product announcements**
  The latest information and news concerning our products.

- **Downloads**
  Here you will find updates, service packs, HSPs and much more for your product.

- **Application examples**
  Function blocks, background and system descriptions, performance statements, demonstration systems, and application examples, clearly explained and represented.

- **Technical data**
  Technical product data for support in planning and implementing your project

Link: Product support (https://support.industry.siemens.com/cs/ww/en/ps)

mySupport

The following functions are available in your personal work area "mySupport":

- **Support Request**
  Search for request number, product or subject

- **My filters**
  With filters, you limit the content of the online support to different focal points.

- **My favorites**
  With favorites you bookmark articles and products that you need frequently.

- **My notifications**
  Your personal mailbox for exchanging information and managing your contacts. You can compile your own individual newsletter in the "Notifications" section.

- **My products**
  With product lists you can virtually map your control cabinet, your system or your entire automation project.

- **My documentation**
  Configure your individual documentation from different manuals.

- **CAx data**
  Easy access to CAx data, e.g. 3D models, 2D dimension drawings, EPLAN macros, device circuit diagrams

- **My IBase registrations**
  Register your Siemens products, systems and software.

1.3 Siemens Industry Online Support app

Siemens Industry Online Support app

The Siemens Industry Online Support app provides you access to all the device-specific information available on the Siemens Industry Online Support portal for a particular article number, such as operating instructions, manuals, data sheets, FAQs etc.

The Siemens Industry Online Support app is available for Android and iOS:

Android

iOS

1.4   Support Request

After you have registered, you can use the Support Request form in the online support to send your question directly to Technical Support:

Support Request:	Internet (https://support.industry.siemens.com/My/ww/en/requests)

1.5 History

Release number	New features
10/2015	First edition
06/2016	Second edition with analog modules
07/2018	Change of output "DQ2" to "DQ1" in Chapter 7.2 Module properties, table "Assignment of the data bits", section "4 digital inputs / 2 digital outputs", column "D1".
08/2021	Revision und corrections

Safety notes

2

2.1   General safety notes

Note

Recycling and disposal

Dispose of existing packing material in accordance with applicable regulations or recycle it.

The products described in the following documentation can be recycled thanks to their low-pollutant manufacturing process. For environmentally compatible recycling and disposal of your old device, contact a company certified for the disposal of electronic waste.

⚠ **WARNING**

Risk of electrically conductive contamination!

The devices must be protected against conductive contamination while taking account of the ambient conditions. One way you can do this is to install the devices in a control cabinet with the appropriate degree of protection.

You will find more detailed information in IEC 60529, for example.

⚠ **WARNING**

Protection against electrostatic charge

When handling and installing the described components, ensure that the components are protected against electrostatic charge. Changes to the system configuration and wiring are permissible only when the supply voltage is switched off.

The connection of devices is permitted only when the supply voltage is switched off.

⚠ **DANGER**

Hazardous voltage. Can cause death or serious injury

To ensure touch protection and IP20 degree of protection, tighten all screws which are not used for conductor clamping and close the terminal covers.

2.2   Intended use

⚠️ WARNING
Hazardous Voltage **Can Cause Death, Serious Injury, or Property Damage.** **Intended Use of Hardware Products** This equipment is only allowed to be used for the applications described in the catalog and in the technical description, and only in conjunction with non-Siemens equipment and components recommended by Siemens. Correct transport, storage, installation and assembly, as well as careful operation and maintenance, are required to ensure that the product operates safely and without faults.

2.3 Current information about operational safety

Important note for maintaining operational safety of your system

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⚠ **WARNING**

Hazardous voltage

Can Cause Death, Serious Injury, or Property Damage.

Please take note of our latest information

Systems with safety-related characteristics are subject to special operational safety requirements on the part of the operator. The supplier is also obliged to comply with special product monitoring measures. For this reason, we publish a special newsletter containing information on product developments and features that are (or could be) relevant to operation of safety-related systems. By subscribing to the appropriate newsletter, you will ensure that you are always up-to-date and able to make changes to your system, when necessary:

SIEMENS Newsletter (www.siemens.com/safety-integrated) Subscribe to the following newsletter under "Products & Solutions":

- Industrial Controls - SIRIUS News

2.4 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit
https://www.siemens.com/industrialsecurity.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under
https://www.siemens.com/industrialsecurity.

2.5 Declaration of conformity

The manufacturer declares that the AS-i modules of the 3RK series in the designs marketed by us comply with the applicable basic health and safety requirements of the EU Directives* stated (including amendments) and that the stated standards were applied in their design and construction.

You can download all EU Declarations of Conformity from the internet in PDF form from the following links:

1. Declaration of Conformity, EC/EU certificate of conformity, certificate number 2262 (https://support.industry.siemens.com/cs/ww/en/view/5355895)

2. Declaration of Conformity, EC/EU certificate of conformity, certificate number 2188 (https://support.industry.siemens.com/cs/ww/en/view/5356294)

Description

<div style="text-align: right; font-size: 3em;">3</div>

3.1 Module description

Module description

The SlimLine Compact module series comprises both digital and analog I/O modules as well as ASIsafe modules with safety inputs. Digital outputs are available as solid-state or relay outputs.

The SlimLine Compact AS-Interface module series with degree of protection IP20 for use in control cabinets free up space in control cabinets and in distributed on-site control boxes. At a width of just 17.5 mm or 22.5 mm, the modules maximize space savings in the control cabinet.

Sensors and actuators as well as the AS-Interface bus cable are connected by means of removable screw terminals or push-in spring-loaded terminals. Device connectors available as accessories offer the possibility of looping through the AS-Interface bus cable and the 24 V DC power supply U_{aux} from one module to additional modules. This significantly simplifies the wiring because the AS-Interface bus cable and U_{aux} only have to be connected to one device.

All devices for the connection of 3-wire sensors offer the possibility of supplying the sensors either from the AS-Interface bus cable or alternatively from the 24 V DC voltage supply U_{aux} depending on the requirements of the particular application. A slide switch is used to make the selection. If the supply via U_{aux} is selected, the wiring of the sensor terminals remains unchanged. This means that an external supply of the sensors is not required.

All modules have LEDs on the front that provide diagnostic information and indicate the status of the module inputs and outputs. An addressing socket integrated on the front enables addressing even in installed condition. Integrated adapters allow mounting on a standard mounting rail – either directly for the module or for the device connector. The modules can also be screwed on with an additional accessory (push-in lugs).

In the versions with analog inputs, connections are available for four analog sensors. If not all four analog inputs are required, the unused inputs can be deactivated using DIP switches. This optimizes the transmission time of the analog values. Likewise, the analog inputs and outputs can be switched from voltage to current using DIP switches. This means that only one device is required in both cases.

3.2 Overview of the new AS-i modules

Mounting variants
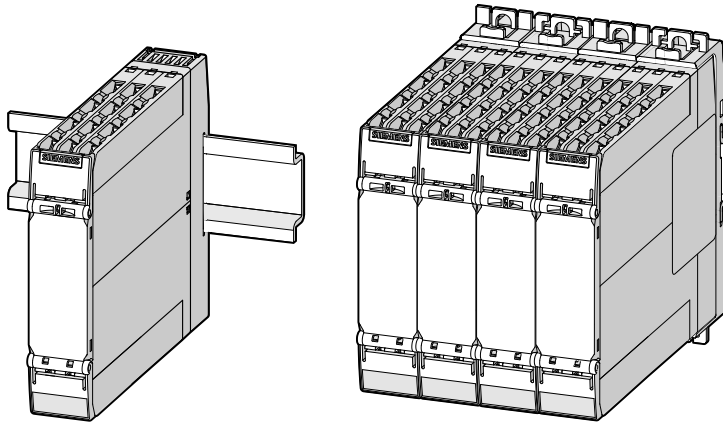
Properties

AS-i SlimLine Compact offers more functions at half the width.

- Simple connection of multiple modules using the device connector
- Can select between AS-i/U_{aux} sensor supply
- Extensive portfolio of digital, analog and ASIsafe modules and solid-state and relay outputs
- Slim widths in new enclosure with 17.5 mm (4DI/2F-DI) and 22.5 mm (4DI/4DQ).

Customer benefits

The following table provides an overview of the features and functions of AS-i SlimLine Compact modules and the benefits they offer customers.

Feature / function	Benefit
Integration in the new enclosure: • 4DI/4DQ only 22.5 mm wide • 4DI and 2F-DI only 17.5 mm wide	• Cost saving through lower space requirement in the control cabinet
Selectable sensor supply (AS-i/U_{aux})	• Flexible use depending on requirements • Greater energy efficiency by switching off the outputs and sensor supply
Device connector enables easy wiring of multiple modules	• Easy wiring saves time and reduces errors
Plain text parameter assignment of the analog modules through TIA integration	• Simple engineering in Step 7 (classic + TIA Portal)

Product data comparison

The following table shows you at a glance the most important differences between the previous module series and AS-i SlimLine Compact:

	Previous series	AS-i SlimLine Compact
Width	• 4DI/4DQ in 45 mm • 4DI in 22.5 mm • 2F-DI in 22.5 mm	• 4DI/4DQ in 22.5 mm • 4DI in 17.5 mm • 2F-DI in 17.5 mm
Device connector	The AS-i and U_{aux} power supplies must be connected to each device individually.	Distribution of the AS÷i and U_{aux} power supply using device connectors.
Analog modules	• Not in IP20	• 4AI voltage / current switchable • 4AI Pt100 / Ni100 / 0 to 600 Ω • 4AQ voltage / current switchable
Sensor supply	Only two devices available with sensor supply via U_{aux}.	Supply via AS÷i or U_{aux} can be selected for all devices.

Product overview

Digital SlimLine Compact modules

| Inputs/outputs	Slave type	Width	Special feature
4DI 2-wire sensors	A/B slave	17.5 mm	For 2-wire sensors or mechanical contacts
4DI 3-wire sensors	A/B slave	22.5 mm	Can select between AS-i/U_{aux} sensor supply
4DI/2RQ relays	A/B slave	22.5 mm	Can select between AS-i/U_{aux} sensor supply. relays (CO contacts)
4DQ	A/B slave	22.5 mm	Output transistor (PNP) 2 A
4DI/4DQ	Standard slave	22.5 mm	Can select between AS÷i/U_{aux} sensor supply, output transistor (PNP) 2 A
4DI/4DQ	A/B slave	22.5 mm	Can select between AS÷i/U_{aux} sensor supply, output transistor (PNP) 2 A
4DI/4RQ relays	A/B slave	22.5 mm	Can select between AS-i/U_{aux} sensor supply, output relays (NO contacts)

Analog SlimLine Compact modules

Inputs/outputs	Slave type	Width	Special feature
4AI voltage / current	Analog	22.5 mm	Analog inputs that can be switched between voltage or current measurement
4AI Pt100	Analog	22.5 mm	Thermal resistance
2AQ voltage current	Analog	22.5 mm	Analog outputs that can be switched between voltage or current output

ASIsafe SlimLine Compact modules

Inputs/outputs	Slave type	Width	Special feature
2F-DI	ASIsafe	17.5 mm	Input for mechanical contacts
2F-DI/2DQ	ASIsafe	17.5 mm	Input for mechanical contacts, can select between AS÷i/U_{aux} for supply of standard outputs; output transistor (PNP)

3.3 Function overview of AS-i SlimLine Compact modules
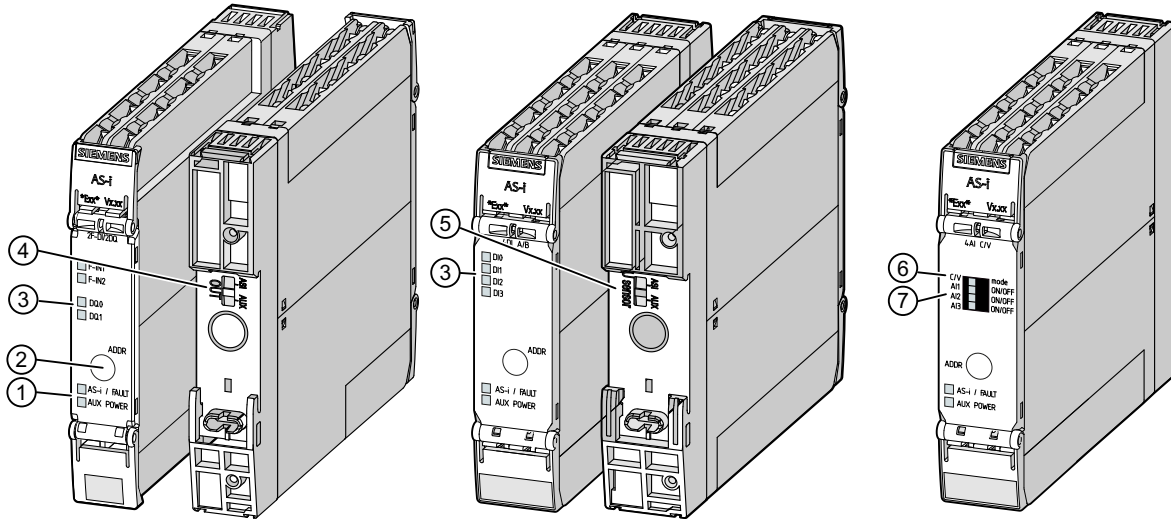
①	LED display for AS-i / Fault and AUX power
②	Socket for addressing device connector
③	LED display for inputs/outputs
④	Change-over switch for output supply (on ASIsafe modules)
⑤	Change-over switch for sensor supply (on digital modules)
⑥	Change-over switch for current / voltage
⑦	Channel selector switch

Status LEDs

The LEDs indicate the operating state of the module.

You can find the signal states here:

- Digital modules (Page 61)
- ASIsafe modules (Page 73)
- Analog modules (Page 81)

Inputs, outputs

The digital modules have 4 digital inputs and/or up to 4 digital outputs. The digital outputs are available as solid-state outputs or relay outputs. Relay outputs are available with NO or CO contacts.

ASIsafe modules have two fail-safe inputs for contacting sensors (e.g. Emergency Stop). Some versions also have 2 standard outputs.

The analog modules have 4 analog inputs and 2 analog outputs. Versions are available for current, voltage or resistance measurement. There are analog outputs for voltage and current output.

AS-i Power24V

When operating with AS-i Power24V, a separate AS-i power supply is not required. All SlimLine Compact modules are suitable for AS-i Power24V.

3.4 Device connectors for AS-i SlimLine Compact modules
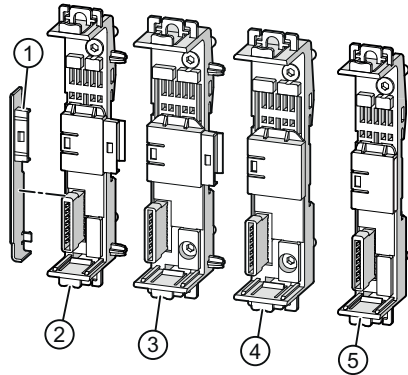
①	Cover
②	Device connector for AS÷i SlimLine Compact modules 3RK, 17.5 mm width
③	Device connector for AS÷i SlimLine Compact modules 3RK, 22.5 mm width
④	Device termination connector for AS÷i SlimLine Compact modules 3RK, 22.5 mm width
⑤	Device termination connector for AS÷i SlimLine Compact modules 3RK, 17.5 mm width

General information

When multiple AS-i SlimLine modules are used, the wiring can be simplified through the use of device connectors. The AS-i bus cable and the 24 V DC auxiliary voltage U_{aux} are distributed among the device connectors. The AS-i bus cable and the 24 V DC auxiliary voltage U_{aux} only have to be connected to one SlimLine Compact module.

A maximum of 2 A for the AS-i bus cable or 6 A for the 24 V DC auxiliary voltage can be transmitted via the device connectors.

The device connectors are available in two different widths (17.5 mm and 22.5 mm). A device termination connector is required for the last SlimLine Compact module on the right side.
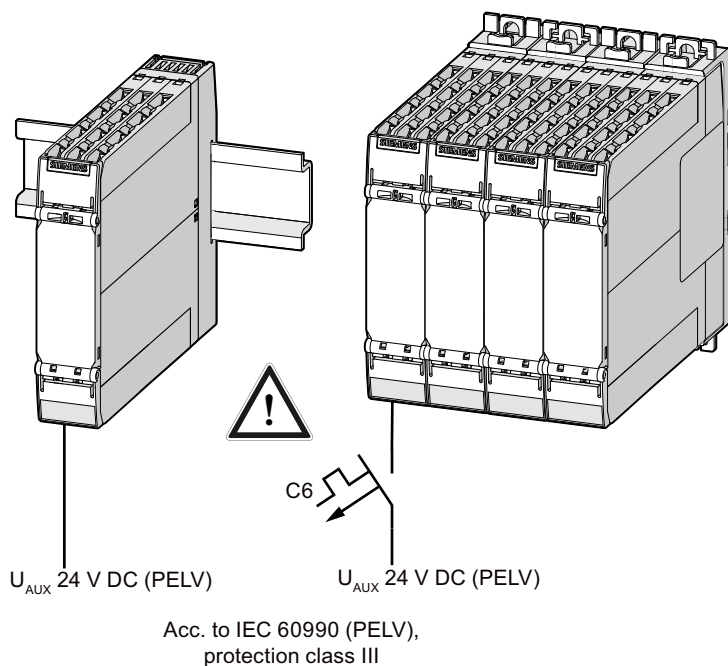

Note

To avoid exceeding the maximum current load of the device connectors, you must protect the infeed of the 24 V DC U_{aux} supply with a miniature circuit breaker 6 A Type C.

Only AS÷i SlimLine Compact modules are permitted to be used on the 3RK19 device connectors!

U$_{AUX}$ 24 V DC (PELV)   U$_{AUX}$ 24 V DC (PELV)

Acc. to IEC 60990 (PELV),
protection class III

Article number

Article number	Type of device connector
3RK1901-1YA00	Device connector for enclosure, width 17.5 mm
3RK1901-1YA10	Device connector for enclosure, width 22.5 mm
3RK1901-1YA01	Device termination connector for enclosure, width 17.5 mm
3RK1901-1YA11	Device termination connector for enclosure, width 22.5 mm

Use of device connectors

The following device connectors are required for the various enclosure widths of the devices:

Devices	Device connector for enclosure, width 17.5 mm 3RK1901-1YA00	Device connector for enclosure, width 22.5 mm 3RK1901-1YA10	Device termination connector for enclosure, width 17.5 mm 3RK1901-1YA01	Device termination connector for enclosure, width 22.5 mm 3RK1901-1YA11
Digital modules				
3RK2200-0C.00-2AA2	✔	-	✔	-
3RK2200-2C.00-2AA2	-	✔	-	✔
3RK2402-2M.00-2AA2	-	✔	-	✔
3RK2100-1C.00-2AA2	-	✔	-	✔
3RK2400-2C.00-2AA2	-	✔	-	✔
3RK1400-2C.00-2AA2	-	✔	-	✔
3RK2402-2C.00-2AA2	-	✔	-	✔

Devices	Device connector for enclosure, width 17.5 mm 3RK1901-1YA00	Device connector for enclosure, width 22.5 mm 3RK1901-1YA10	Device termination connector for enclosure, width 17.5 mm 3RK1901-1YA01	Device termination connector for enclosure, width 22.5 mm 3RK1901-1YA11
ASIsafe modules				
3RK1205-0B.00-2AA2	✓	-	✓	-
3RK1405-2B.00-2AA2	✓	-	✓	-
Analog modules				
3RK1207-0C.00-2AA2	-	✓	-	✓
3RK1207-3C.00-2AA2	-	✓	-	✓
3RK1107-0B.00-2AA2	-	✓	-	✓

3.5 Article No. scheme

Note

The Article No. scheme is presented here merely for information purposes and for better understanding of the logic behind the article numbers.

For your orders, please use the article numbers quoted in the catalog in the Selection and ordering data.

Digit of the Article No.	1 ... 3	4	5	6	7		8	9	10	11, 12		13 ... 16			
AS-i SlimLine Compact module	**3 R K**	□	□	□	□	-	□	□	□	□□	-	**2 A A 2**			
Generation		□												1	Standard
														2	A/B
Device type			□											1	Output module
														2	Input module
														4	Input/output module
Communication interface				□										0	AS-Interface
Type of input / output					□									0	Binary input/output
														2	Binary solid-state input/output
														5	Safety input/output
														7	Analog input/output
Auxiliary voltage							□							0	None (supply via BUS)
														1	24 V DC
														2	Can select between AS-i / U_{aux}
														3	230 V AC / 115 V
Number of inputs / outputs								□						B	2 In / 2 Out (2DI/2DQ)
														C	4 In / 4 Out (4DI/4DQ)
														M	4 In / 2 Out (4DI/2DQ)
Degree of protection and connection technology									□					E	IP20 - screw terminal
														G	IP20 - spring-loaded terminal
Product design										□ □				00	(Constant)
Example	**3 R K**	**2**	**1**	**0**	**0**	**-**	**1**	**C**	**E**	**0 0**	**-**	**2 A A 2**			Digital output module, A/B slave, 24 V DC supply, 4DQ, IP20 as well as screw terminal connection

Installing

<div style="text-align: right">

4

</div>

4.1 Warning notices

Warning notices before installation, wiring, and commissioning

> ⚠️ **WARNING**
>
> **Hazardous voltage!**
>
> **Causes electric shock and burns when touched.**
>
> Turn off and lock out all power supplying this device before working on this device.

Note

This product is designed for Environment A. It may produce radio interference in the domestic environment, in which case the user shall be responsible for taking appropriate precautions.

Note

The following figures are for illustrative purposes only!

The figures below show a 22.5-mm enclosure. The width, depth, terminals (type and number of terminals) and accessories and mounted components are similar and may differ from the actual product.

4.2 Terminal position / terminal coding

To prevent mistakes when replacing terminals, they are each numbered on the front.

This numbering can also be found on the inside of the upper and lower spring flaps.
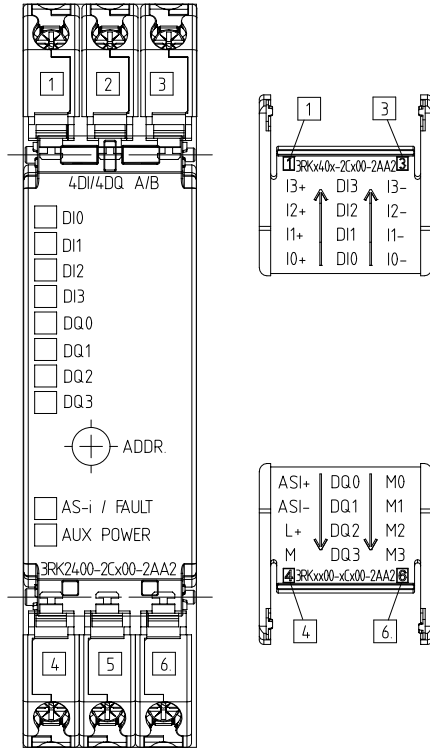
You can also provide the terminals with coding pins (3ZY1440-1AA00). These also help you to prevent mistakes when replacing the terminals.
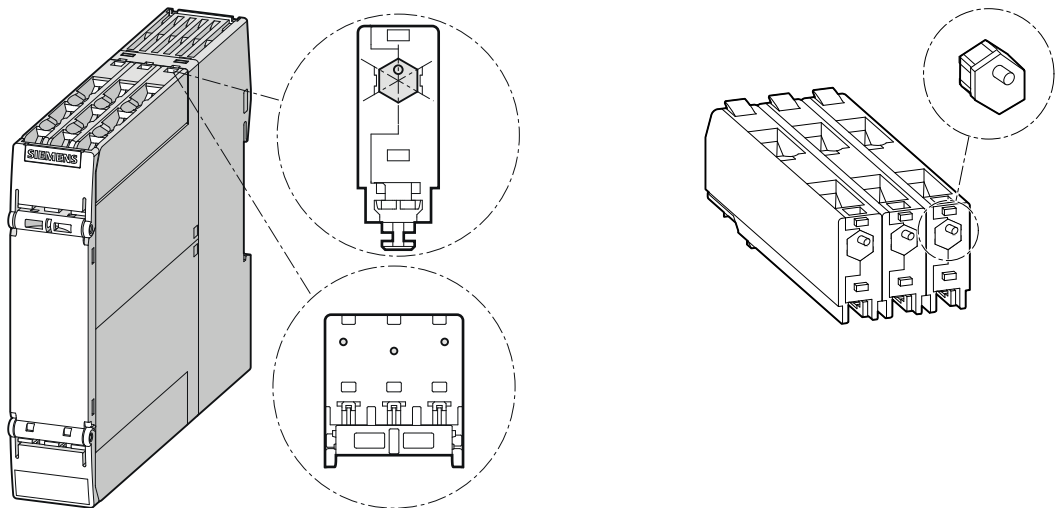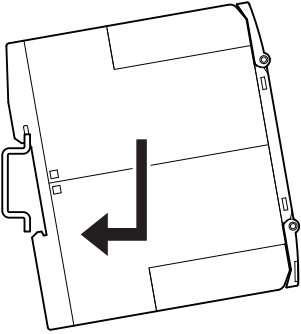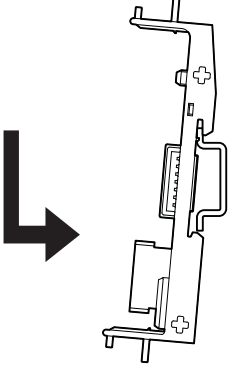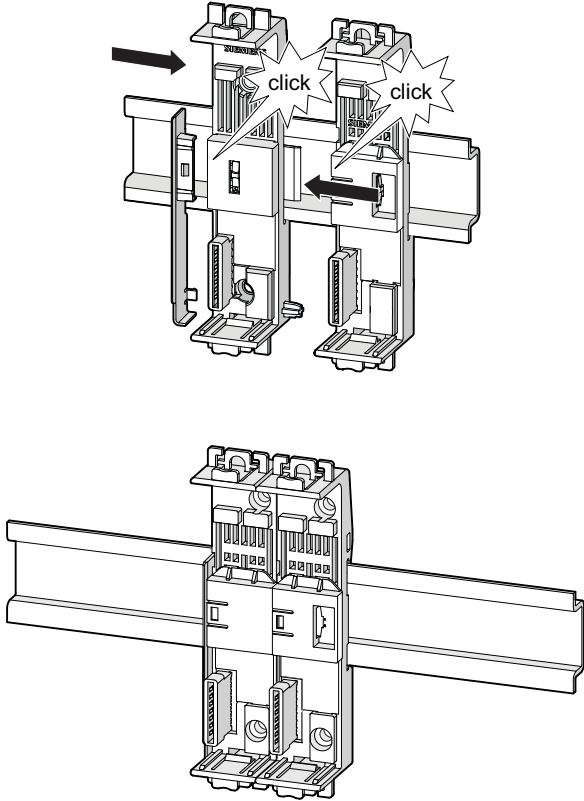
4.3 Mounting the devices on a standard mounting rail

Requirements

- A horizontal 35-mm wide mounting rail in accordance with DIN EN 60715 has been properly secured at the installation location.

Procedure

Step	Instructions	Figure
1	Place the back of the device onto the upper edge of the standard mounting rail.	
2	Press the lower half of the device against the DIN rail until the device engages.	

See also

Dimension drawings 3RK devices (Page 111)

4.4 Disassembling devices from a standard mounting rail
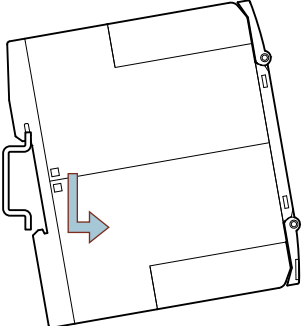
⚠ WARNING
Hazardous Voltage **Can Cause Death, Serious Injury, or Property Damage.**
Before starting work, therefore, disconnect the system and devices from the power supply.

Requirements

- The terminals have been removed or disconnected.

Procedure

Step	Instructions	Figure
1	Press the device downwards.	
2	Pull the lower half of the device away from the standard mounting rail.	
3	Lift the device from the upper edge of the mounting rail.	

4.5 Mounting the devices with device connector on a standard mounting rail

Requirements

- A horizontal 35-mm wide mounting rail in accordance with DIN EN 60715 has been properly secured at the installation location.
- Device connector: Refer to the accessories list in section "Accessories for 3RK (Page 117)" for the relevant article number.
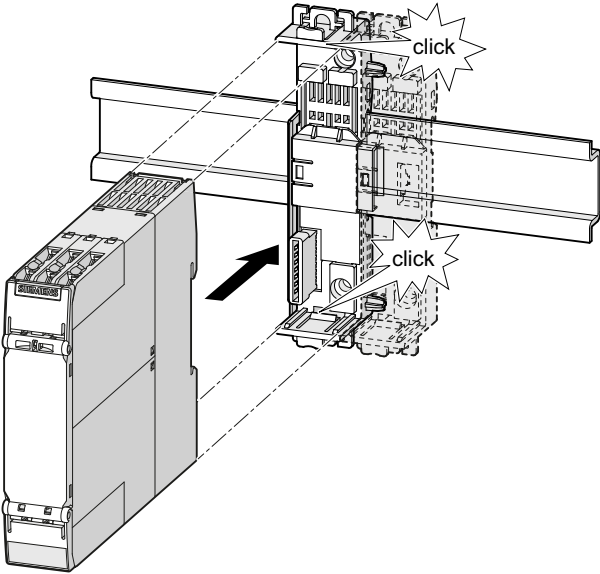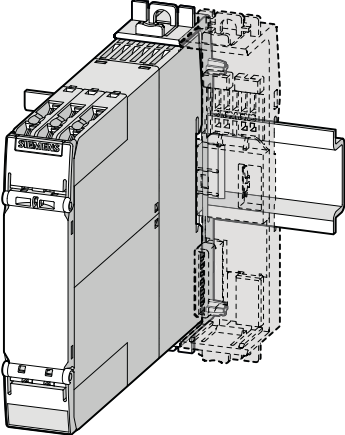
Procedure

Step	Instructions	Figure
1	Place the back of the device connector on the upper edge of the standard mounting rail.	
2	Press the lower half of the device connector against the standard mounting rail until the connector engages.	
3	Repeat the procedure with all the required device connectors.	

Step	Instructions	Figure
4	Push the device connectors together until they engage.	
5	Mount the cover on the left of the first device connector. The cover is included in the scope of supply of the device terminator.	

Step	Instructions	Figure
6	Mount the device on the device connector.	
7	Mount all the devices required for the system configuration on the device connectors in accordance with the respective installation guidelines.	

See also

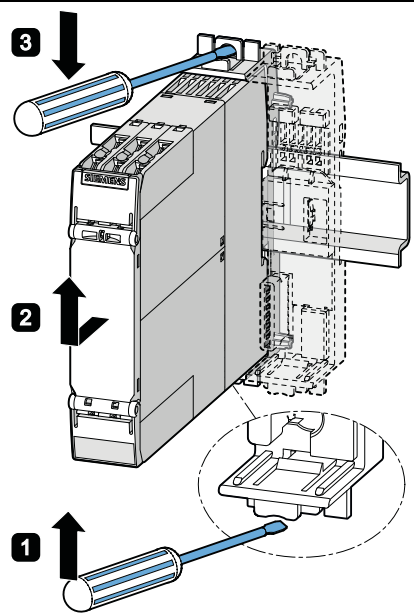Dimension drawings 3RK device connectors (Page 114)

4.6 Removing the devices with device connector from a standard mounting rail

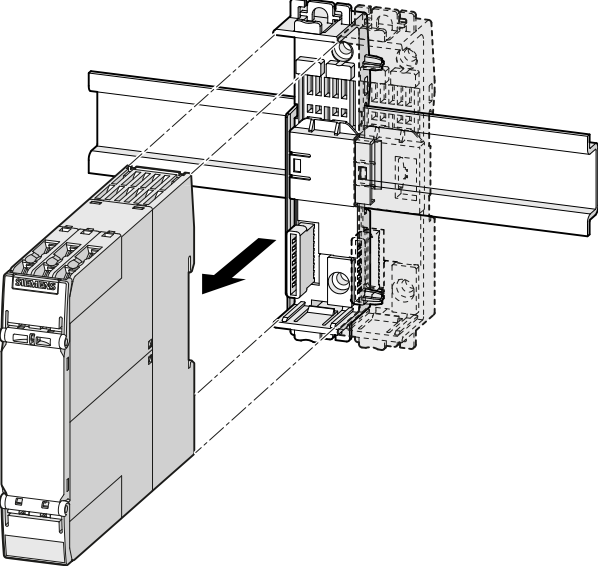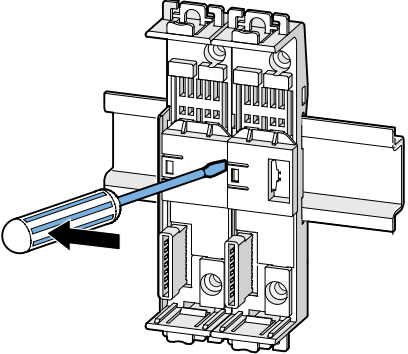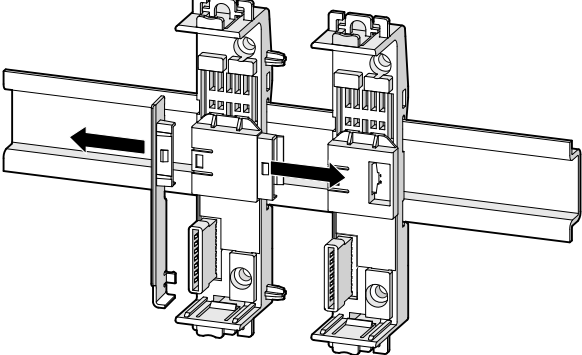| ⚠ WARNING |
| --- |
| **Hazardous Voltage**
Can Cause Death, Serious Injury, or Property Damage. |
| Before starting work, therefore, disconnect the system and devices from the power supply. |

Requirements
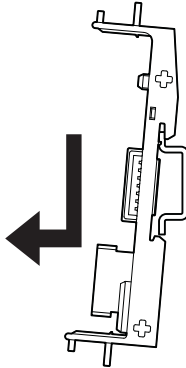
- The terminals have been removed or disconnected.

Procedure

Step	Instructions	Figure
1	Unlock the device using a screwdriver.	
2	Pull the lower half of the device away from the device connector.	
3	Unlock the device using a screwdriver.	

Step	Instructions	Figure
4	Pull the device away from the device connector.	
5	Separate the device connectors using a screwdriver.	
6	Remove the cover.	

Step	Instructions	Figure
7	Press the device connector down.	
8	Pull the lower half of the device connector away from the standard mounting rail.	
9	Lift the device connector from the upper edge of the standard mounting rail.	

AS-Interface SlimLine Compact Modules
Equipment Manual, 08/2021, A5E33414181002A/RS-AE/005

4.7 Mounting the devices on a wall

Requirements

Please note the following requirements for mounting on a level surface:

- A vertical mounting surface is recommended for the enclosure.

- Two properly executed drill holes with thread or plug on the level surface. For details of the distances between the drilled holes, refer to the relevant dimension drawings in section "Dimension drawings 3RK devices (Page 111)".

- Two cap screws M4 x 12 in accordance with DIN 784 that match the holes.

- Two fixing lugs in accordance with the article number in the accessories list in section "Spare parts/accessories (Page 117)".

Procedure

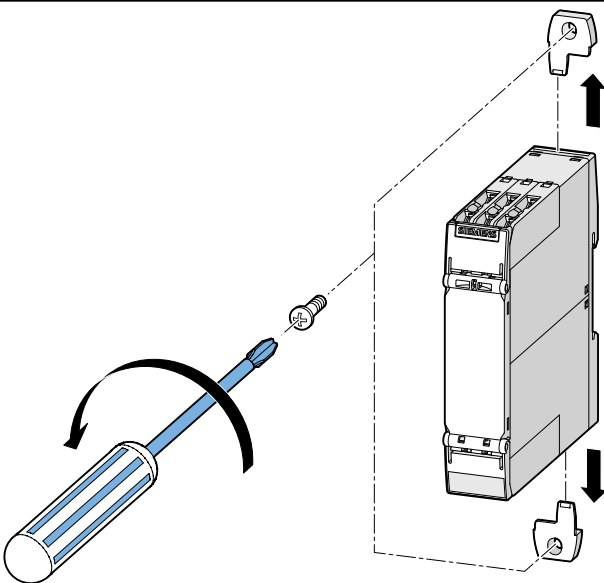| Step	Instructions	Figure
1	Insert the securing brackets into the openings provided on the device until they engage.	
2	Hold the device up to the level surface prepared for screw fastening.	
3	Insert the head screws through the corresponding elongated holes in the fixing lugs.	
4	Screw the device securely onto the level surface. Tightening torque: 1 Nm	

4.8 Removing the devices from the wall

⚠ WARNING
Hazardous Voltage
Can Cause Death, Serious Injury, or Property Damage.
Before starting work, therefore, disconnect the system and devices from the power supply.

Requirements

- The terminals have been removed or disconnected.

Procedure

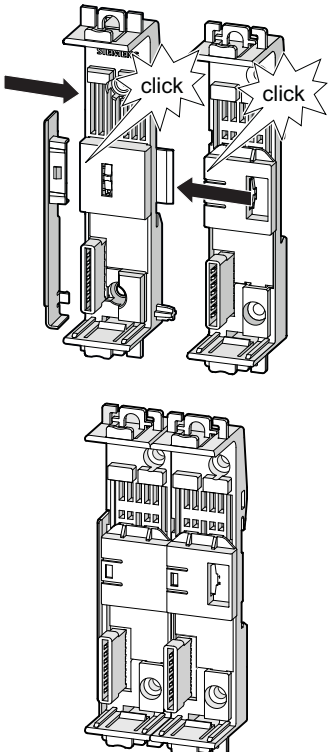| Step	Instructions	Figure
1	Hold the device firmly.	
2	Unscrew the cap screws.	
3	Lift the device from the level surface.	
4	Remove the securing brackets from the device.	

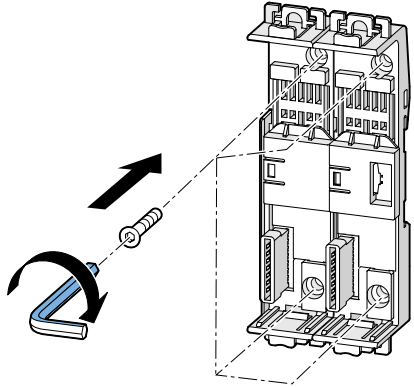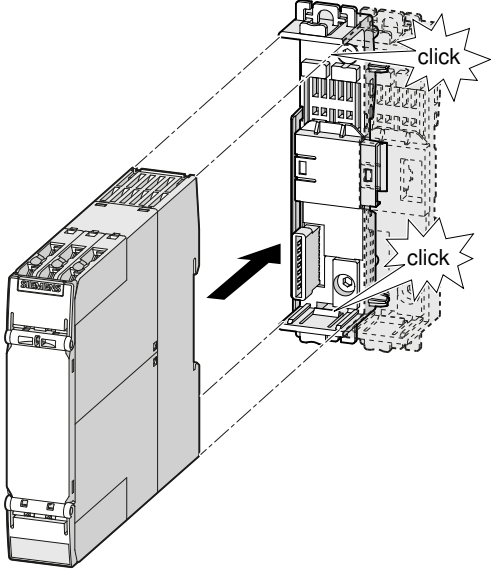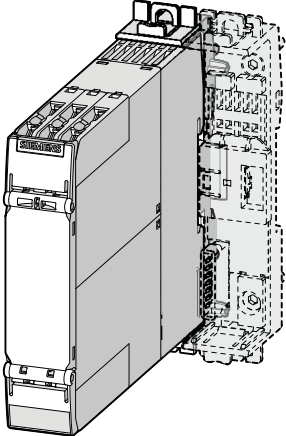# 4.9 Mounting the devices with device connector on a wall

Requirements

Please note the following requirements for mounting on a level surface:

- Two properly executed drill holes (per device connector) with thread or plug on the level surface.
  For details of the distances between the drilled holes, refer to the relevant dimension drawings in section "Dimension drawings 3RK device connectors (Page 114)".

- Two cap screws (per device connector) M4 x12 in accordance with IEC 784 that match the holes.

- Device connector. Refer to the accessories list in section "Accessories for 3RK (Page 117)" for the relevant article number.

Procedure for mounting on a level surface

Step	Instructions	Figure
1	Push the device connectors together until they engage.	
2	Mount the cover on the left of the first device connector. The cover is included in the scope of supply of the device terminator.	

Step	Instructions	Figure
3	Hold the device connector against the level surface prepared for screw fastening.	
4	Insert the screws through the holes in the device connectors.	
5	Screw the device connector securely onto the level surface. Tightening torques: • Top: < 0.1 Nm • Bottom: 1 Nm	
6	Mount the device on the device connector.	
7	Mount all the devices required for the system configuration on the device connectors in accordance with the respective installation guidelines.	

4.10 Removing the devices with device connector from the wall

> **⚠ WARNING**
>
> **Hazardous Voltage**
> **Can Cause Death, Serious Injury, or Property Damage.**
>
> Before starting work, therefore, disconnect the system and devices from the power supply.
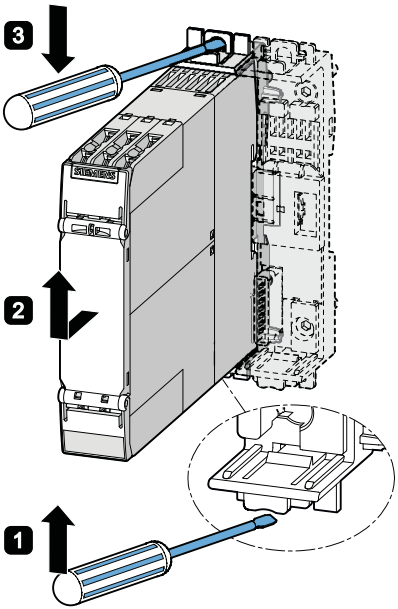
Requirements
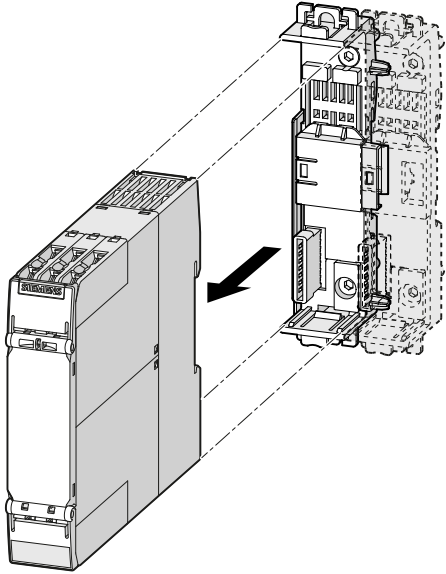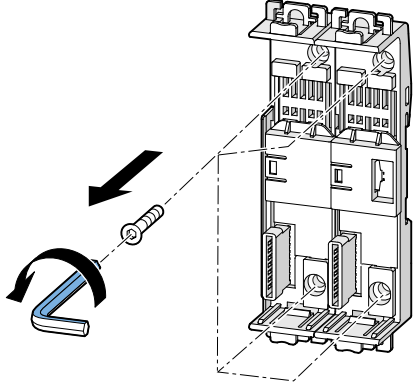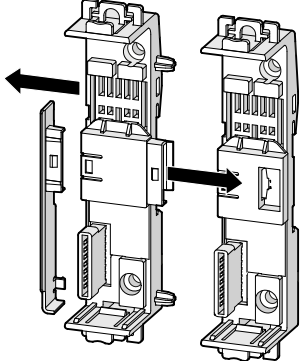
- The terminals have been removed or disconnected.

Procedure

The figures show 22.5 mm devices. The 17.5 mm devices are removed in the same manner.

Step	Instructions	Figure
1	Unlock the device (below) using a screwdriver.	
2	Pull the lower half of the device away from the device connector.	
3	Unlock the device (above) using a screwdriver.	

Step	Instructions	Figure
4	Pull the device away from the device connector.	
5	Release the screws.	
6	Separate the device connectors using a screwdriver.	--
7	Remove the cover.	

Connection 5

5.1 Terminal assignment

Location of the connections

The front sides of the terminals are numbered. The terminal covers are also numbered and additionally labeled with the assignment of the particular terminal and the device article number. The position of the label corresponds to the position of the respective terminal.
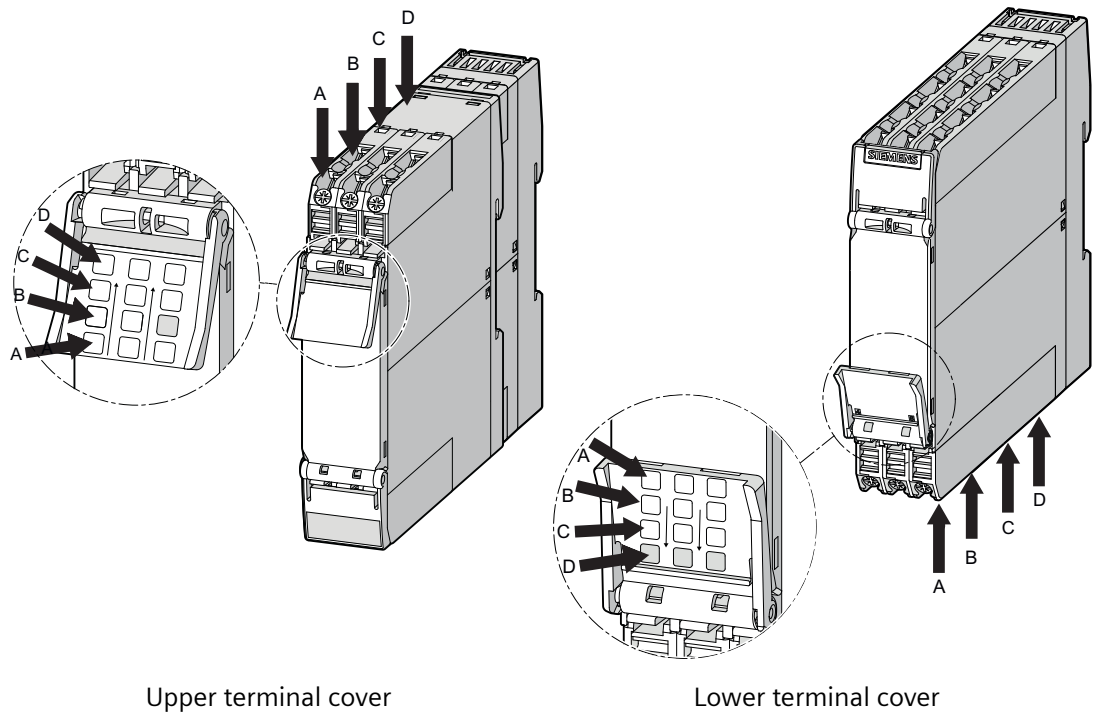
NOTICE
Risk of property damage
When using the terminal blocks, you must observe the correct position of the blocks (see inside of cover).

Upper terminal cover   Lower terminal cover

The connecting terminals are numbered on the front to enable identification of the correct position again after removal of the terminals for device replacement. Once the flaps are opened, the corresponding numbers (1 to 4 for 17.5 mm devices; 1 to 6 for 22.5 devices) are seen inside a square frame on both the top and bottom flaps.
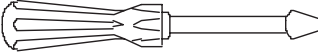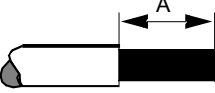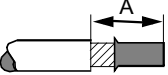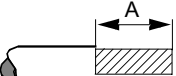
Assignment

Depending on the version of the AS-i module, the following assignments are written on the covers:

Module version		Inscription of the terminal cover	
		Assignment, top	Assignment, bottom
Analog module	• 4x input (voltage / current switchable) • Sensor supply from AS-i or U_aux • Width 22.5 mm • **3RK1207-0C.00-2AA2**		
	• 4x input (resistance / thermal resistance) • Width 22.5 mm • **3RK1207-3C.00-2AA2**		
	• 2x output (voltage / current switchable) • Width 22.5 mm • **3RK1107-0B.00-2AA2**		
ASIsafe module	• 2x safety input for sensor (mechan.) • Width 17.5 mm • **3RK1205-0B.00-2AA2**		
	• 2x safety input for sensor (mechan.) • 2x output (supply from AS-i or U_aux) • Width 17.5 mm • **3RK1405-2B.00-2AA2**		

Module version		Inscription of the terminal cover
Digital modules	• 4x input for sensor (mechan., 2-wire) • Sensor supply from AS÷i • Width 17.5 mm • **3RK2200-0C.00-2AA2**	
	• 4x input for sensor (mechan., 3-wire) • Sensor supply from AS-i or U_{aux} • Width 22.5 mm • **3RK2200-2C.00-2AA2**	
	• 4x input for sensor (mechan., 3-wire) • Sensor supply from AS-i or U_{aux} • 2x output (relays, changeover contacts) • Width 22.5 mm • **3RK2402-2M.00-2AA2**	
	• 4x output, solid state • Width 22.5 mm • **3RK2100-1C.00-2AA2**	
	• 4x input for sensor (mechan., 3-wire) • 4x output, solid state • Sensor supply from AS-i or U_{aux} • Width 22.5 mm • **3RK.400-2C.00-2AA2**	
	• 4x input for sensor (mechan., 3-wire) • Supply from AS-i or U_{aux} • 4x output (relays, NO contacts) • Width 22.5 mm • **3RK2402-2C.00-2AA2**	

5.2 Connection data for terminals

	Specification and value for removable terminals with screw terminals	Specification and value for removable terminals with spring-type terminals (push-in terminals)
Screwdriver 	Cross-tip screwdriver Size: PZ 1 x 80 (Ø 4.5 mm) Torque: 0.6 ... 0.8 Nm (5.2 ... 7.0 lb/inch)	Flat-bladed screwdriver (3RA2908-1A) Size: 3 mm for operating the springs DIN 5264-A; 0.5 x 3
Rigid cable 	A = 10 mm 1 x 0.5 ... 2.5 mm² 2 x 0.5 ... 1.5 mm²	A = 10 mm 1 x 0.5 ... 1.5 mm² 2 x 0.5 ... 1.5 mm²
Flexible cable with end sleeve 	A = 10 mm 1 x 0.25 ... 2.5 mm² 2 x 0.25 ... 1.0 mm² [1]	A = 10 mm 1 x 0.25 ... 1.0 mm² 2 x 0.25 ... 1.0 mm²
Flexible cable 	Not permissible	A = 10 mm 1 x 0.5 ... 1.5 mm² 2 x 0.5 ... 1.5 mm²
AWG	1 x 24 ... 14 2 x 24 ... 16	1 x 20 ... 16 2 x 20 ... 16

[1] When 2 x 1.0 mm² end sleeves with a plastic sleeve are used, space problems may arise with the sleeves; as an alternative, you are advised to use end sleeves without plastic sleeves

5.3 Protection

Reverse polarity protection

Reverse polarity protection is integrated for the connection to the AS-i bus cable and the 24 V DC auxiliary voltage U_{aux} to prevent damage to the module. However, proper functioning of the devices is only guaranteed when the connection is made correctly.

NOTICE
Short-circuit/overload protection When multiple AS-i SlimLine Compact modules are connected using device connectors, external protection of the U_{aux} infeed from short-circuit and overload by a 6 A miniature circuit breaker Type C is required.

5.4 Connecting the screw-type terminals

> ⚠️ **WARNING**
>
> **Hazardous Voltage**
> **Can Cause Death, Serious Injury, or Property Damage.**
>
> Before starting work, therefore, disconnect the system and devices from the power supply.

Tools and materials

- Cross-tip screwdriver size PZ 1 x 80.
- For suitable connection cross-sections of the cables, see the chapter "Connection data for terminals (Page 48)".

Procedure

1. Insert the relevant cable into square on the screw-type terminal until it engages.
2. Hold the cable in the screw-type terminal.

3. Tighten the screw with a torque of 0.6 ... 0.8 Nm.
4. Pull on the cable to ensure it is screwed tight.

5.5 Disconnecting the screw-type terminals

⚠ **WARNING**

Hazardous Voltage
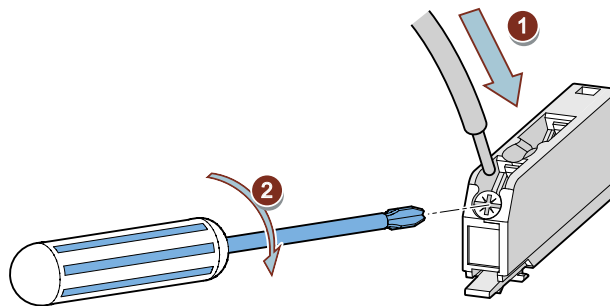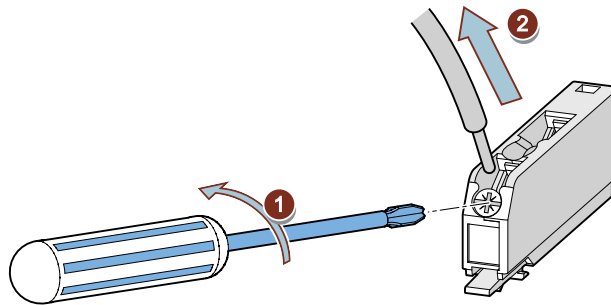**Can Cause Death, Serious Injury, or Property Damage.**

Before starting work, therefore, disconnect the system and devices from the power supply.

Tools

- Cross-tip screwdriver size PZ 1 x 80

Procedure

1. Unscrew the screw of the screw-type terminal.

2. Remove the cable from the unscrewed screw terminal.

5.6 Wiring rules for spring-loaded terminals (with push-in technology)

Wiring rules for ...		Control current terminals
Connectable cross-sections for solid cables		2 x 0.5 ... 2 x 1.5 mm²
		(AWG[1]: 24 ... 16)
Connectable cross-sections for flexible cables	Without end sleeve	2 x 0.5 ... 2 x 1.5 mm²
		(AWG[1]: 20 ... 16)
	With end sleeve (with and without plastic sleeve)	2 x 0.25 ... 2 x 1.0 mm² [2]

	With TWIN end sleeve	---

Cable stripping length		10 ... 11 mm
End sleeves according to DIN 46228-4 with plastic sleeve		10 mm

[1]	AWG: American Wire Gauge (AWG does not define use of end sleeves)

[2]	When 2 x 1.0 mm² end sleeves with a plastic sleeve are used, space problems may arise with the sleeves; as an alternative, you are advised to use end sleeves without plastic sleeves

Notes on handling spring-loaded terminals with push-in technology

The terminal area of the spring-loaded terminals is rectangular, and the maximum overall dimensions of the conductor to be wired must not exceed 1.5 x 2.4 mm (control current terminals).

Attention must be paid to the orientation of the terminal area, which may call for vertical fitting of rectangularly crimped cables.
To make optimum use of available terminal area, you are advised to choose a form of crimping that creates a corresponding rectangular contour. Trapezoidal crimping is generally very highly suitable in this case.

When use is made of a cable that utilizes the full overall height, the terminal's spring is deflected to the maximum. Therefore, removal of this cable may become a problem because it requires further deflection of the spring.

Control current terminals
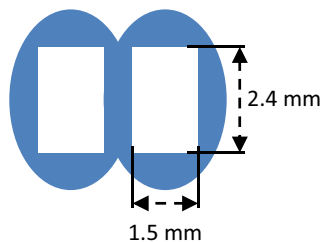
Terminal area of control current terminals

5.7   Connecting spring-loaded (push-in) terminals

> ⚠ **WARNING**
>
> **Hazardous Voltage**
> **Can Cause Death, Serious Injury, or Property Damage.**
>
> Before starting work, therefore, disconnect the system and devices from the power supply.

The spring-loaded (push-in) system allows wiring without tools for rigid conductors or conductors equipped with end sleeves.

A screwdriver is required for wiring finely-stranded or stranded conductors without end sleeves on spring-loaded (push-in) terminals.

Tools and materials

- 0.5 x 3 mm screwdriver DIN 5264 (for finely-stranded conductors only).

- For suitable connection cross-sections of the cables, see the chapter "Connection data for terminals (Page 48)".

Procedure

Rigid cables or cables equipped with end sleeves
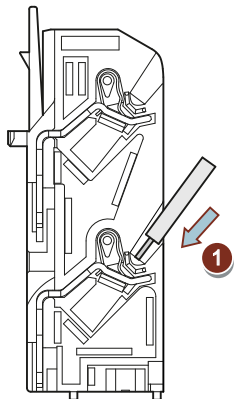
1. Insert the cable into the oval opening as far as it will go.

2. Pull on the cable to ensure it is tight.

Finely-stranded cables

1. Insert the screwdriver in the rectangular opening to open the terminal (oval opening).

2. Insert the cable as far as it will go into the oval opening and remove the screwdriver.

3. Pull on the cable to ensure it is tight.

5.8 Disconnect the spring-loaded (push-in) terminal

> ⚠ **WARNING**
>
> **Hazardous Voltage**
> **Can Cause Death, Serious Injury, or Property Damage.**
>
> Before starting work, therefore, disconnect the system and devices from the power supply.

Tools

- Screwdriver DIN 5264 of the size 0.5 x 3 mm

Procedure

1. Insert the screwdriver into the rectangular opening of the spring-loaded (push-in) terminal until it engages.

2. Remove the cable from the oval opening.

3. Remove the screwdriver.

5.9 Attaching the terminals

⚠ WARNING
Hazardous voltage
Can Cause Death, Serious Injury, or Property Damage.
Before starting work, therefore, disconnect the system and devices from the power supply.

Requirements

You must have removed the terminals, for the purpose of replacing a device, for example.

Procedure when plugging in the terminals

1. Insert the detachable terminals into the guide rail of the device.
2. Slide the detachable terminals back until they audibly engage.
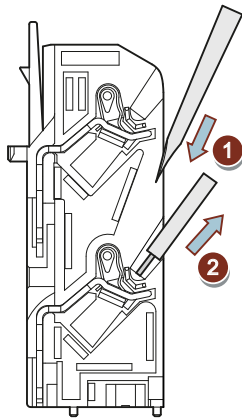
5.10   Disconnecting

> ⚠ **WARNING**
>
> **Hazardous voltage**
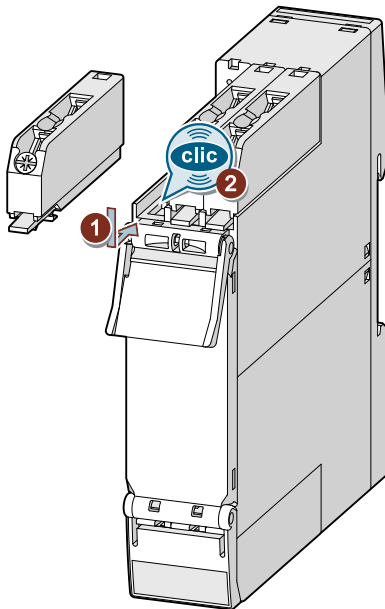>
> Can Cause Death, Serious Injury, or Property Damage.
>
> Before starting work, therefore, disconnect the system and devices from the power supply.

Removing terminals from the device
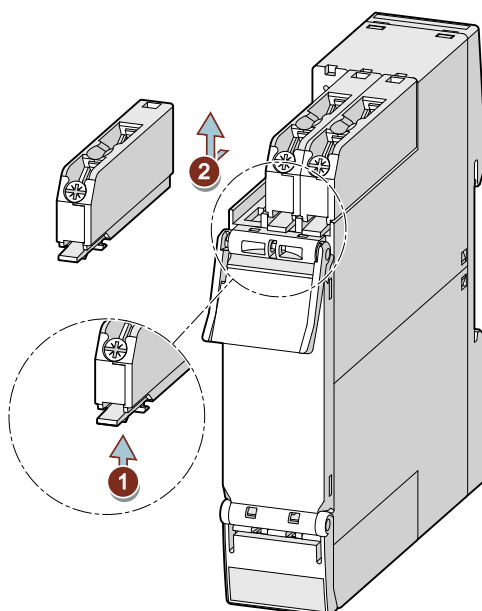
1. Press the clip of the terminals upwards.
2. Pull the terminals out to the front.
3. Lift the terminals out of the guide rail of the device.

Screw terminals: Disconnecting the conductor
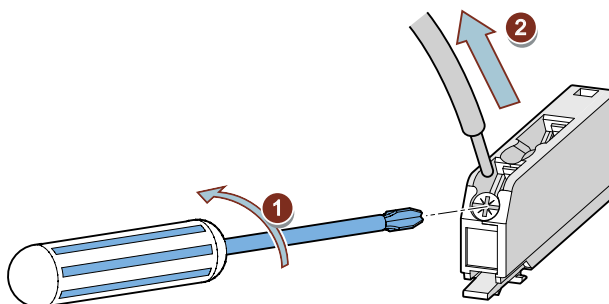
1. Unscrew the screw of the screw-type terminal.

2. Remove the cable from the unscrewed screw-type terminal.

Push-in terminals Disconnecting the conductor
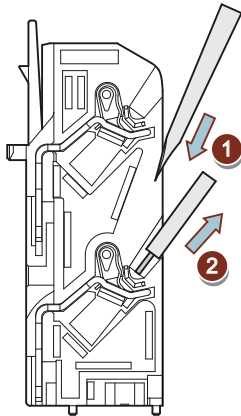
1. Insert the screwdriver into the rectangular opening of the push-in terminal until it engages. Please observe a 10° horizontal angular deviation of the screwdriver to the oval opening.

2. Remove the cable from the oval opening.

3. Remove the screwdriver.

Addressing

6

6.1 Addressing AS-i SlimLine Compact modules

Each module must be assigned **one** individual address on the AS-Interface. Each address may be used only once per AS-i master. The address is stored in the slave. The address of a slave is programmed with the addressing device.

The following addresses can be set for the modules:

- Modules with the article numbers 3RK1 are not A/B slaves and occupy a full address. Further A/B modules at the same address are not permissible. Valid addresses are 1 to 31.

- Modules with the article number 3RK2 are A/B modules. This means a maximum of 62 modules are possible on any one AS-i master. Valid addresses are 1A to 31B. If the A or B address only is used, transmission is faster.

Addressing the modules

The address can be assigned through the "ADDR" socket with the help of the AS-i addressing device.

When the addressing device is connected, the module is disconnected from the AS-i bus.

For addressing the modules, the following is needed:

- An addressing device

- A connecting cable for connecting the addressing device and AS-i module

The addressing socket is located on the front of the SlimLine Compact module.

The following figure shows the location of the addressing device with the connecting cable and the addressing device.

For the addressing operation itself, refer to the corresponding instructions (for the addressing device).

Digital modules

7

7.1 Module overview

Overview / terminal assignment

①	②	③	④
I3+ DI3	I3+ DI3 I3-	I3+ DI3 I3-	
I2+ DI2	I2+ DI2 I2-	I2+ DI2 I2-	
I1+ DI1	I1+ DI1 I1-	I1+ DI1 I1-	
I0+ DI0	I0+ DI0 I0-	I0+ DI0 I0-	
ASI+	ASI+	ASI+ 14.0 11.0	ASI+ DQ0 M0
ASI-	ASI-	ASI- 12.0	ASI- DQ1 M1
	L+	L+ 14.1 11.1	L+ DQ2 M2
	M	M 12.1	M DQ3 M3
3RK2200-0C.00-2AA2	3RK2200-2C.00-2AA2	3RK2402-2M.00-2AA2	3RK2100-1C.00-2AA2

⑤			⑥				
I3+	DI3	I3-	I3+	DI3	I3-		
I2+	DI2	I2-	I2+	DI2	I2-		
I1+	DI1	I1-	I1+	DI1	I1-		
I0+	DI0	I0-	I0+	DI0	I0-		
		◯			◯		
ASI+	DQ0	M0	ASI+	13.0	14.0		
ASI-	DQ1	M1	ASI-	13.1	14.1		
L+	DQ2	M2	L+	13.2	14.2		
M	DQ3	M3	M	13.3	14.3		
3RK2400-2C.00-2AA2 3RK1400-2C.00-2AA2			3RK2402-2C.00-2AA2				

Overview of article numbers

	Article number	Type of connection	Inputs	Outputs	Sensor type	Sensor supply	Slave profile	Slave type	Width in mm
①	3RK2200-0CE00-2AA2	Screw terminal	4 digital	---	2-wire sensors Mechanical contacts	AS-i	0.A.0	A/B slave	17.5
	3RK2200-0CG00-2AA2	Spring-loaded terminal							
②	3RK2200-2CE00-2AA2	Screw terminal	4 digital	---	2-wire sensors 3-wire sensors Mechanical contacts	AS-i or U_{aux} can be selected	0.A.0	A/B slave	22.5
	3RK2200-2CG00-2AA2	Spring-loaded terminal							
③	3RK2402-2ME00-2AA2	Screw terminal	4 digital	2 relays	2-wire sensors 3-wire sensors Mechanical contacts	AS-i or U_{aux} can be selected	7.A.0	A/B slave	22.5
	3RK2402-2MG00-2AA2	Spring-loaded terminal							
④	3RK2100-1CE00-2AA2	Screw terminal	---	4 semiconductor	Not available	---	7.A.7	A/B slave Spec. 3.0	22.5
	3RK2100-1CG00-2AA2	Spring-loaded terminal							

	Article number	Type of connection	Inputs	Outputs	Sensor type	Sensor supply	Slave profile	Slave type	Width in mm
⑤	3RK2400-2CE00-2AA2	Screw terminal	4 digital	4 semi-conductor	2-wire sensors 3-wire sensors Mechanical contacts	AS-i or U_{aux} can be selected	7.A.7	A/B slave Spec. 3.0	22.5
	3RK2400-2CG00-2AA2	Spring-loaded terminal							
	3RK1400-2CE00-2AA2	Screw terminal	4 digital	4 semi-conductor	2-wire sensors 3-wire sensors Mechanical contacts	AS-i or U_{aux} can be selected	7.0.F	Standard	22.5
	3RK1400-2CG00-2AA2	Spring-loaded terminal							
⑥	3RK2402-2CE00-2AA2	Screw terminal	4 digital	4 relays	2-wire sensors 3-wire sensors Mechanical contacts	AS-i or U_{aux} can be selected	7.A.7	A/B slave Spec. 3.0	22.5
	3RK2402-2CG00-2AA2	Spring-loaded terminal							

7.2 Module properties

Assignment of the data bits

4 digital inputs:

Data bit	D0	D1	D2	D3
Input	DI0	DI1	DI2	DI3
Output				

4 digital outputs:

Data bit	D0	D1	D2	D3
Input				
Output	DQ0	DQ1	DQ2	DQ3

4 digital inputs / 2 digital outputs:

Data bit	D0	D1	D2	D3
Input	DI0	DI1	DI2	DI3
Output	DQ0	DQ1		

4 digital inputs / 4 digital outputs

Data bit	D0	D1	D2	D3
Input	DI0	DI1	DI2	DI3
Output	DQ0	DQ1	DQ2	DQ3

Parameters

No parameters are used for digital modules.

7.3 Sensor supply

Digital inputs

A switch allows you to select between sensor supply from the AS-i voltage and from AUX power. When supplied, the switch is in position U_{sens} = AS-i.

The switch for selecting the sensor supply is located on the back the device and may only be actuated in the de-energized state.

The sensor supply is protected against short circuit and overload. At an overload or short-circuit of the sensor supply, the module is not damaged.

Rated current of the sensor supply at 40 °C ambient temperature:

- Supply via AS-i voltage: 200 mA for all inputs of a module

- Supply via AUX Power voltage: 500 mA for all inputs of a module

The sensor supply voltage is > U_{AS-i} – 8.5 V in the case of supply from AS-i

The sensor supply voltage is > U_{aux} – 1.0 V in the case of supply from AUX power

The sensors are supplied via terminals I+ and I- irrespective of the selected sensor supply. This means that the sensors are connected to the module in exactly the same manner when supplied from AUX Power as when supplied from AS-i.

7.4 Inputs

Digital inputs

Digital inputs are designed for PNP Type 2 sensors according to EN 61131-2:2007

Level:
- Low I_{IN}:   ≤ 1.5 mA
- High V_{IN}:   ≥ 10 V

                I_{IN}:   ≥ 6 mA

7.5 Outputs

Digital outputs

After communication errors (e.g. master error), the outputs are reset after approx. 40 to 100 ms (cycle-time monitoring).

Supply of the outputs

The outputs are supplied by the 24 V DC auxiliary voltage U_{aux}.

The auxiliary voltage must conform to IEC 60990 (PELV) protection class III.

7.6 Diagnostics

Status display

The status of a module is indicated by LEDs with continuous or flashing light. This enables diagnostics at a glance:

- for AS÷i communication via a dual green/red LED
- for the auxiliary voltage U_{aux} with a green LED
- for the switching state of the inputs with a yellow LED
- for the switching state of the outputs with a dual yellow/red LED

The following sections provide an overview of the LED status displays for the input/output modules.

LED position

For the position of the LEDs, see the diagram below:

① Status display for inputs
② Status display for outputs
③ Communication AS÷i / FAULT
④ AUX POWER operating state
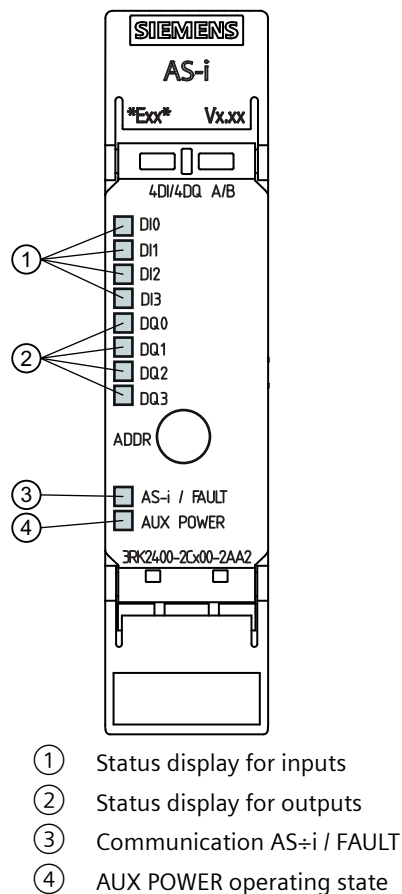
Status display for inputs/outputs

Each input has a yellow LED with the designation "DIx".

Each semiconductor output has a dual red/yellow LED with the designation "DQx".

Each relay output has a yellow LED with the designation "RQx".

For the functions, see the table below:

Table 7-1   Diagnostics of the inputs via LED

DI x	Meaning
Yellow	Signal activated
OFF	Signal deactivated

Table 7-2   Diagnostics of the semiconductor outputs via LEDs

DQ x	Meaning
Yellow	Output activated
Red	Overload of the output
OFF	Output deactivated

The output LED (for transistor outputs) indicates an overload for each channel by changing its color to red.

Table 7-3   Diagnostics of the relay outputs via LEDs

RQ x	Meaning
Yellow	Output activated
OFF	Output deactivated

Status display AS-i / FAULT

All modules have a dual LED (green/red) for the "AS-i / FAULT" status display. For the functions and remedies, see the table below:

Table 7-4   Diagnostics of the AS÷i status via LEDs

AS-i / FAULT (green/yellow/red)	Possible cause	Possible remedial measures
Green	Normal operation, AS÷i communication OK	—
Red	No AS÷i communication: • Master is switched off or offline • Slave is not configured in the master • Incorrect slave type is connected • Slave has the wrong address	Ensure AS÷i communication: • Switch on the master or switch it to online mode • Reconfigure the master • Connect the correct module • Check/correct the slave address

AS-i / FAULT (green/yellow/ red)	Possible cause	Possible remedial measures
Flashing red	Communication is interrupted by: • Overload of the sensor supply	• Disconnect sensor cables from input sockets • Use sensors with a lower overall current consumption • Check sensors and cables
Flashing yellow/red	Module has slave address "0" (delivery condition)	Assign an address other than "0"
Flashing green/red	Overload of the outputs	Disconnect actuator cables from output sockets Check actuators and cables
OFF	No AS÷i voltage	Switch on AS÷i voltage
	AS-i voltage has been connected with reverse polarity	Connect it correctly
	AS÷i voltage too low	Measure the AS-i voltage (approx. 30 V DC)

AUX POWER operating state

All modules have a green LED for the "AUX POWER" operating state. For the functions and remedies, see the table below:

Table 7-5   Diagnostics of the operating state via LED

AUX POWER	Possible cause	Possible remedial measures
Green	Normal operation, 24 V DC auxiliary voltage OK	—
OFF	• No auxiliary voltage • Auxiliary voltage connected with incorrect polarity • Auxiliary voltage too low	• Switch on auxiliary voltage 24 V DC • Connect it properly • Measure the auxiliary voltage (approx. 24 V DC)

Sensor supply display

There is not an additional LED for indicating the selected sensor supply source. The current source is selected using a switch on the back of the device and is indicated by the switch.

I/O fault bit

In the event of an overload of the outputs, the I/O fault bit is transmitted to the AS-i master in addition to the local LED diagnostics. All modules designed as an A/B slave support this function (3RK24* and 3RK21*).

For modules designed as a standard slave (3RK14*), an I/O fault bit is not transmitted.

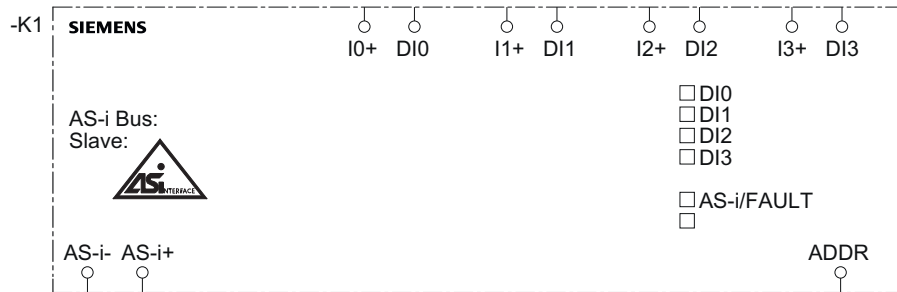## 7.7 Wiring

Examples

3RK2200-0Cx00-2AA2

Figure 7-1   Inputs: Connection of mechanical contacts or 2-wire sensors

3RK2200-2Cx00-2AA2
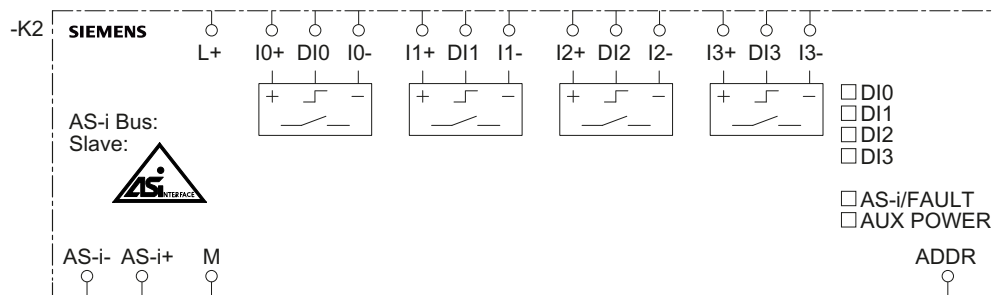
Figure 7-2   Inputs: Connection of mechanical contacts or two-wire or three-wire sensors

3RK2402-2Mx00-2AA2
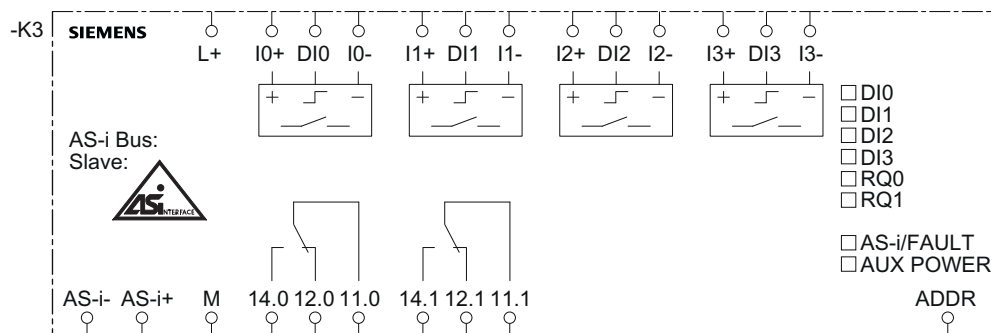
Figure 7-3   Inputs: Connection of mechanical contacts, 2-wire or 3-wire sensors; outputs: Relay CO contacts

3RK2100-1Cx00-2AA2

Figure 7-4   Outputs: Solid-state

3RKx400-2Cx00-2AA2

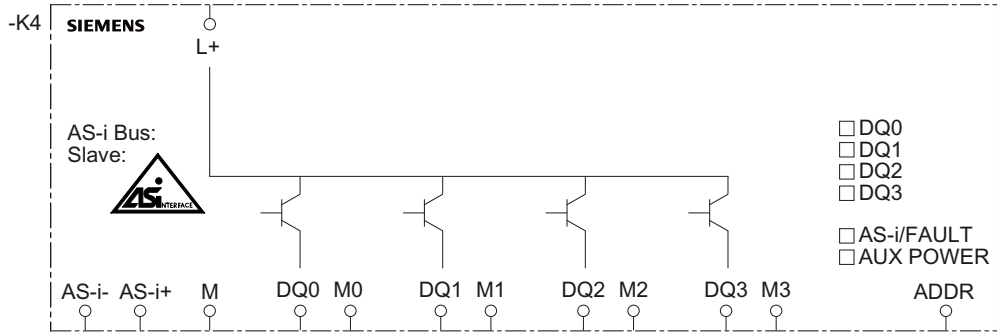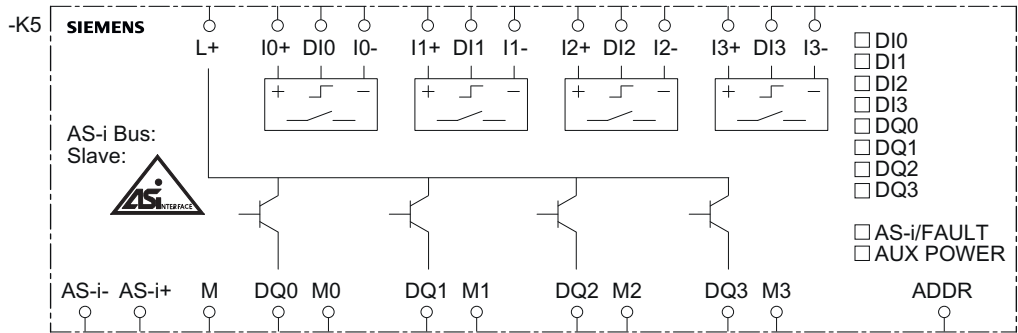Figure 7-5   Inputs: Connection of mechanical contacts, 2-wire or 3-wire sensors; outputs: Solid-state

3RK2402-2Cx00-2AA2
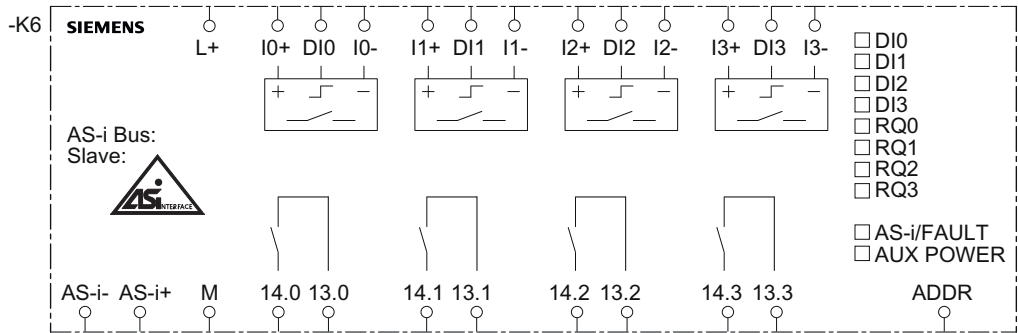
Figure 7-6   Inputs: Connection of mechanical contacts, 2-wire or 3-wire sensors; outputs: Relay NO contacts

ASIsafe modules

8.1 Module overview

Overview / terminal assignment

①	②		
F-IN 1.2 / F-IN 2.2 F-IN 1.1 / F-IN 2.1 ASI+ / ASI-	DQ0 / DQ1 M0 / M1 F-IN 1.2 / F-IN 2.2 F-IN 1.1 / F-IN 2.1 ASI+ / L+ ASI- / M		
3RK1205-0B.00-2AA2	3RK1405-2B.00-2AA2		

Table of article numbers

	Article number	Type of connection	Inputs	Outputs	Sensor type	Sensor supply	Slave profile	Slave type	Width in mm
①	3RK1205-0BE00-2AA2	Screw terminal	2 fail-safe	---	Mechanical contacts	AS-i	0.B.F	Standard	17.5
	3RK1205-0BG00-2AA2	Spring-loaded terminal							
②	3RK1405-2BE00-2AA2	Screw terminal	2 fail-safe	2 standard outputs	Mechanical contacts	AS-i	7.B.F	Standard	17.5
	3RK1405-2BG00-2AA2	Spring-loaded terminal							

8.2 Module properties

Assignment of the data bits

2 fail-safe inputs:

Data bit	D0	D1	D2	D3
Input	F-IN1	F-IN1	F-IN2	F-IN2
Output				

2 fail-safe inputs / 2 standard outputs:

Data bit	D0	D1	D2	D3
Input	F-IN1	F-IN1	F-IN2	F-IN2
Output	DQ0	DQ1		

Parameters

No parameters are used for ASIsafe modules.

Safety-related specifications

PL	up to PL e
Cat	up to Category 4
SIL	up to SIL 3
PFH_D	$< 4.5 \times 10^{-9}$ [1/h]
PFD_{avg}	$< 5.0 \times 10^{-6}$
SFF	> 99 %
DC_{avg}	> 99 %

8.3 Fail-safe inputs

ASIsafe inputs

ASIsafe inputs are designed for mechanical switching contacts.

8.4 Standard outputs

Digital standard outputs

After communication errors (e.g. master error), the standard outputs are reset after approx. 40 to 100 ms (cycle-time monitoring).

Supply of the standard outputs

The standard outputs can be supplied selectively using the AS-i bus cable or the 24 V DC auxiliary voltage U_{aux}. The supply is selected using a switch on the back of the device and the selection is indicated by the switch. The switch may only be actuated in the de-energized state.

When power demand is low, it is advantageous to select the supply via AS-i. The module then does not have to be connected to U_{aux}. For higher power demand, the outputs are supplied from U_{aux}.

Current carrying capacity of the standard outputs:

- DC-12 / DC-13: 0.5 A per output when supplied from U_{aux}.

- DC-12 / DC-13: 0.15 A per output, max. 0.2 A per module when supplied from AS-i

The following output voltages result depending on the supply of the outputs:

- Output voltage $> U_{AS\div i}$ – 8.5 V in the case of supply from AS-i

- Output voltage $> U_{aux}$ – 1.0 V in the case of supply from U_{aux}
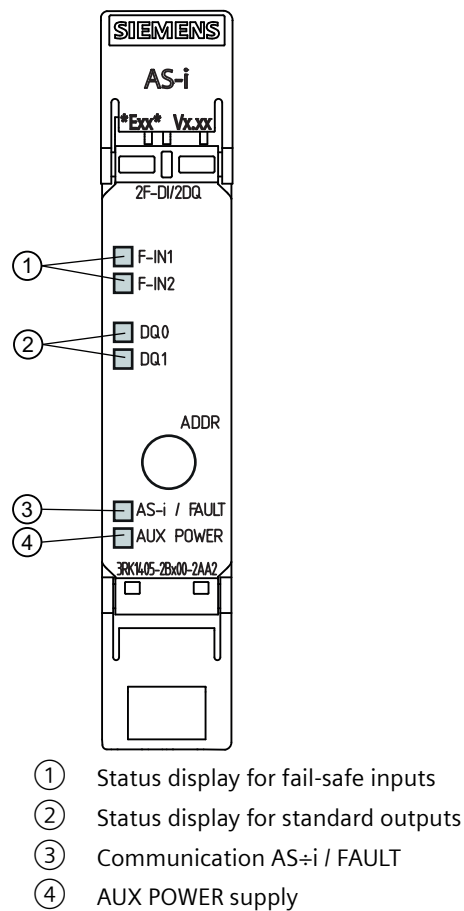
8.5 Diagnostics

Status display

The status of a module is indicated by LEDs with continuous or flashing light. This enables diagnostics at a glance:

- for AS-i communication via a dual LED
- for the auxiliary voltage U_{aux} with a green LED
- for the switching state of the inputs and outputs with yellow LEDs
- for the switching state of the outputs with a dual yellow/red LEDs

The following sections provide an overview of the LED status displays for the input/output modules.

LED position

For the position of the LEDs, see the diagram below:

① Status display for fail-safe inputs
② Status display for standard outputs
③ Communication AS÷i / FAULT
④ AUX POWER supply

Inputs/outputs

Each input has a yellow LED with designation "F-INx". Each semiconductor output has a dual red/yellow LED with the designation "DQx". For the functions, see the table below:

Table 8-1   Diagnostics of the inputs via LED

F-IN x	Meaning
Yellow	Signal activated
OFF	Signal deactivated

Table 8-2   Diagnostics of the outputs via LEDs

DQ x	Meaning
Yellow	Output activated
Red	Overload of the output
OFF	Output deactivated

Note

The output LED indicates the overload for each channel by changing its color to red. This diagnostic function is only available when the outputs are supplied from U_{aux}. When the outputs are supplied via AS-i, the module switches off communication at an overload of the outputs.

Status display AS-i / FAULT

All modules have a dual LED (green/red) for the "AS-i / FAULT" status display. For the functions and remedies, see the table below:

Table 8-3   Diagnostics of the AS÷i status via LEDs

AS-i / FAULT (green/yellow/red)	Possible cause	Possible remedial measures
Green	Normal operation, AS÷i communication OK	—
Red	No AS÷i communication: • Master is switched off or offline • Slave is not configured in the master • Incorrect slave type is connected • Slave has the wrong address	Ensure AS÷i communication: • Switch on the master or switch it to online mode • Reconfigure the master • Connect the correct module • Check/correct the slave address
Flashing yellow/red	Module has slave address "0" (delivery condition)	Assign an address other than "0"
Flashing green/red	Overload of the outputs	Disconnect actuator cables from output sockets Check actuators and cables

AS-i / FAULT (green/yellow/ red)	Possible cause	Possible remedial measures
OFF	No AS÷i voltage	Switch on AS÷i voltage
	AS-i voltage has been connected with reverse polarity	Connect it correctly
	AS÷i voltage too low	Measure the AS-i voltage (approx. 30 V DC)

Note

The overload of the outputs is indicated by green/red flashing of the AS-i / Fault LED only if the outputs are being supplied from U_{aux}. When the outputs are supplied via AS-i, the communication is switched off at an overload of the outputs. The Fault LED then lights up red.

AUX POWER operating state

All modules have a green LED for the "AUX POWER" operating state. For the functions and remedies, see the table below:

Table 8-4   Diagnostics of the operating state via LED

AUX POWER	Possible cause	Possible remedial measures
Green	Normal operation, 24 V DC auxiliary voltage OK	—
OFF	• No auxiliary voltage • Auxiliary voltage connected with incorrect polarity • Auxiliary voltage too low	• Switch on auxiliary voltage 24 V DC • Connect it properly • Measure the auxiliary voltage (approx. 24 V DC)

Display for supply of the outputs

The standard outputs can be supplied selectively using the AS-i bus cable or the 24 V DC auxiliary voltage U_{aux}. The supply is selected using a switch on the back of the device and the selection is indicated by the switch. The switch may only be actuated in the de-energized state.
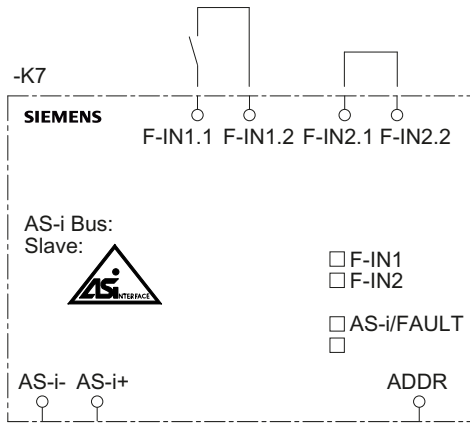
I/O fault bit

The I/O fault bit function is not supported by the ASIsafe modules.
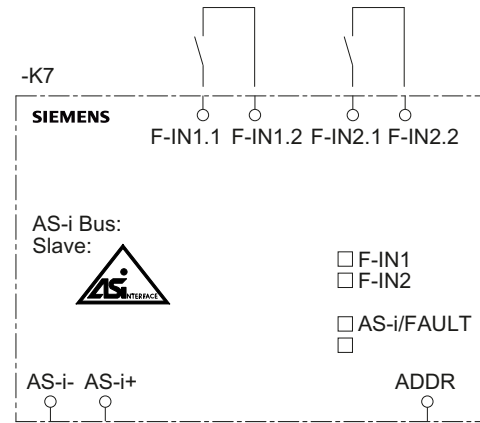
8.6 Wiring

Examples

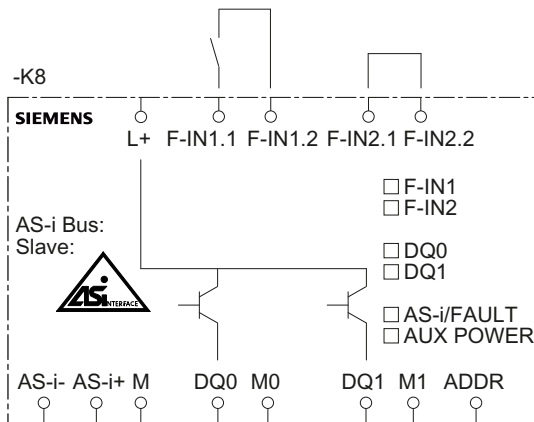### 3RK1205-0Bx00-2AA2

Wiring up to SIL1, PLc, Category 2
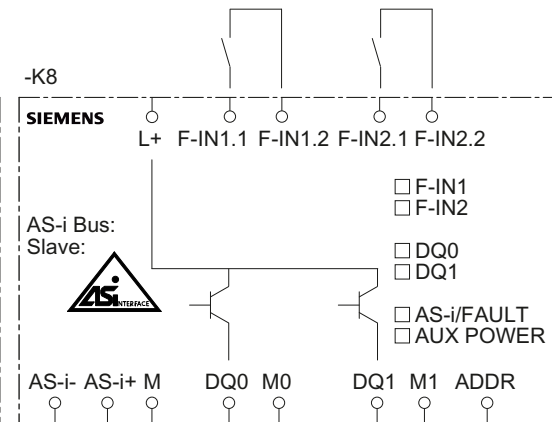
Wiring up to SIL3, PLe, Category 4

Safety inputs Connection of mechanical contacts

3RK1405-0Bx00-2AA2

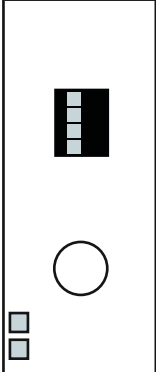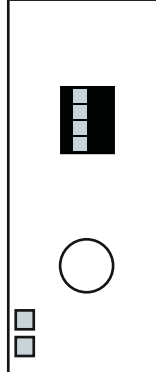Wiring up to SIL1, PLc, Category 2
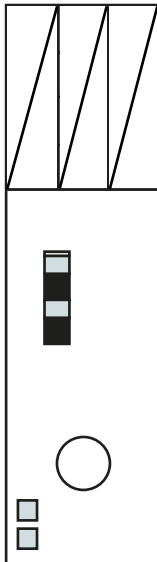
Wiring up to SIL3, PLe, Category 4

Safety inputs Connection of mechanical contacts; standard outputs: Solid-state

Analog modules

9

9.1 Module overview

Overview / terminal assignment

| 3RK1207-0C.00-2AA2 | 3RK1207-3C.00-2AA2 | 3RK1107-0B.00-2AA2 |

Table of article numbers

Article number	Type of connection	Inputs	Outputs	Sensor supply	Slave profile	Slave type	Width in mm
3RK1207-0CE00-2AA2	Screw terminal	4 analog	---	AS-i	7.3.E	Standard	22.5
3RK1207-0CG00-2AA2	Spring-loaded terminal	Current / voltage		AUX POWER			
3RK1207-3CE00-2AA2	Screw terminal	4 analog	---	AS-i	7.3.E	Standard	22.5
3RK1207-3CG00-2AA2	Spring-loaded terminal	PT 100					

Article number	Type of con-nection	Inputs	Outputs	Sensor supply	Slave profile	Slave type	Width in mm
3RK1107-0BE00-2AA2	Screw terminal	---	2 analog Current / volt-age	---	7.3.5	Standard	22.5
3RK1107-0BG00-2AA2	Spring-loaded terminal						

9.2 Connection of the modules
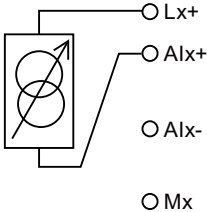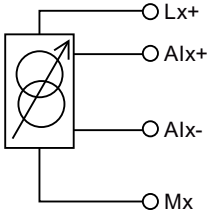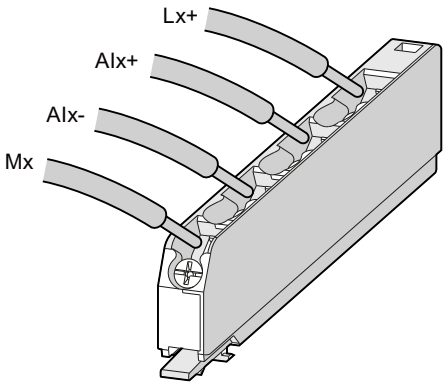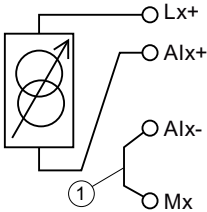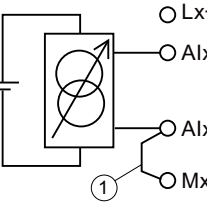
The figures below show the connection of the individual module variants:

Note
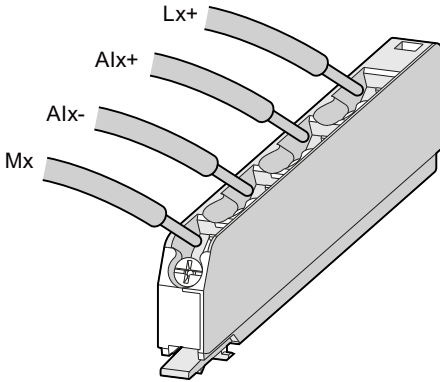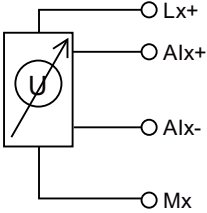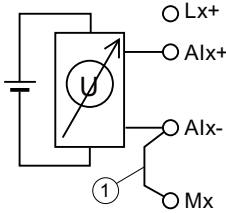
The assignment of the removable terminals Lx+ (e.g. L1+) is NOT the same as the module supply L+!

The numerical designation is only the designation of the corresponding sensor in each case.
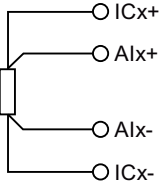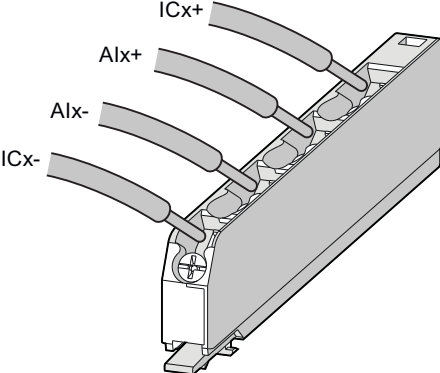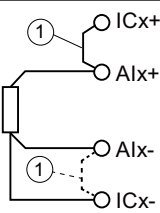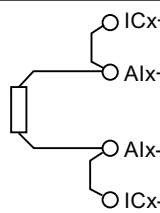
Input module for current measurement

2-wire sensor	4-wire sensor	Assignment of removable terminal
For parameter setting for 2-wire connection	Supply from the analog module	

2-wire sensor	4-wire sensor
For parameter setting for 4-wire connection	External supply
① - Jumper is required	

Input module for voltage measurement

4-wire sensor	4-wire sensor	Assignment of removable terminal
Supply from the analog module	External supply	

① - Jumper is required to prevent the differential input amplifier from being overdriven. This can be achieved by means of a 50 Hz ripple voltage caused by the external sensor supply. The ripple voltage would otherwise trigger a measurement error.

Input module for resistance / thermal resistance measurement

	4-wire sensor	Assignment of removable terminal
Pt100, Ni 100, 600 Ω To minimize measurement errors for 2- and 3-wire sensors, use a short connecting cable.		

3-wire sensor	2-wire sensor

① - The jumper can also be between AIx- and ICx-.

Output module for current and voltage

	Assignment of removable terminal
Current —○ AQx-I / —○ Mx-I Voltage —○ AQx-U / —○ Mx-U	M1-U M0-U M1-I M0-I AQ1-U AQ0-U AQ1-I AQ0-I
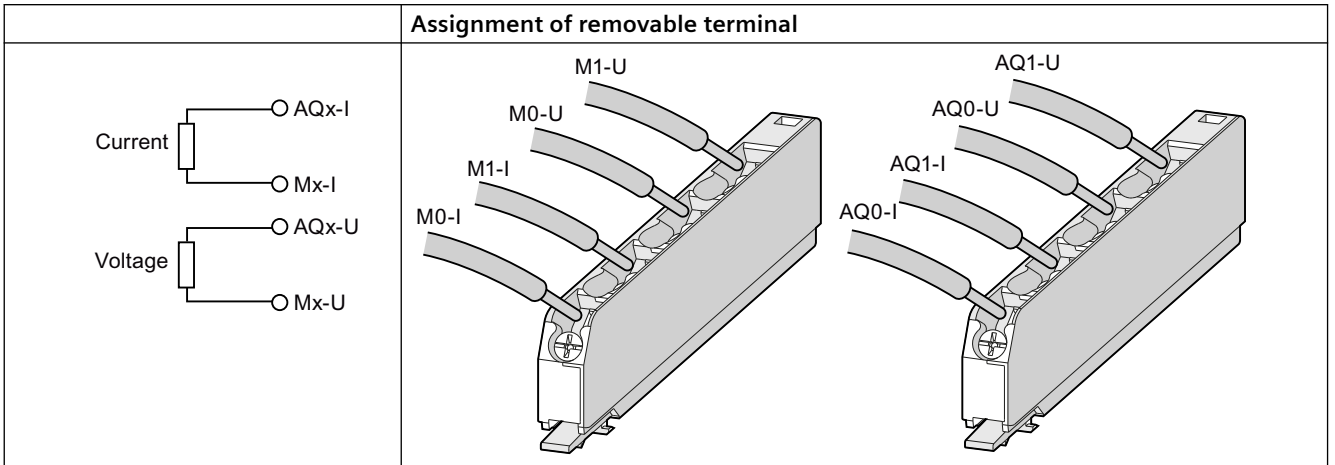
9.3 Sensor supply

Analog inputs

Supply voltage 24 V DC U_{aux}

In the case of analog modules, the sensor is supplied automatically via U_{aux} if available. If U_{aux} is not available, supply is ensured via AS-i. If a total current of more than 46 mA is required for the sensor supply of the analog input modules for current and voltage, the auxiliary energy line must be additionally connected to the analog module. When the auxiliary power is connected, the sensor supply is short-circuit-proof (max. 500 mA).

The **green AUX Power LED** indicates that auxiliary power is active.

No auxiliary power is required for output modules and the resistance / thermal resistance modules.

9.4 Input modules

9.4.1 Module properties

Connection of the analog input modules

Four analog inputs are available. If not all four analog inputs are required, the unused inputs (AI1, AI2, AI3) can be deactivated using DIP switches on the front of the device. This optimizes the transmission time of the analog values in the AS-i system. The analog input AI0 is always active.

The unused connection terminals simply remain unassigned.
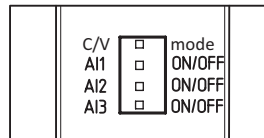
Note

Changing the number of channels is only permissible in the de-energized state.

Selection of measuring mode

In the case of the SlimLine Compact modules, the analog inputs and outputs can continue to be switched from voltage (V) to current (C) using a DIP switch. Only **one** device is thus required for both application cases. The selection of current or voltage measurement applies for all channels (see the figure below for the representation).

Note

Switchover of the measuring method is only permissible in the de-energized state.

Watchdog and I/O fault

If the module does not receive a data telegram from the AS-i master for longer than 50 ms, this is indicated by continuous lighting of the red FAULT LED on the slave module, and the I/O fault bit is set.

Interference frequency suppression

Interference frequency suppression for the analog input modules must be parameterized for a line frequency of 50 or 60 Hz.

Open-circuit detection

In the ranges 4 … 20 mA and 1 … 5 V, the value for overflow / underflow in the case of open circuit is read in (32 767 / -32 768$_{dec}$, see also the table "Current range 4 … 20 mA" in the chapter "Current measurement (Page 91)" and the table "Voltage measuring range 1 … 5 V") in the chapter "Voltage measurement (Page 93)".

Common mode voltage

The common mode voltage between the connection points AIx- and Mx must not exceed ± 2V.

Equipotential bonding

If several analog modules are operated on the same AS-i network, potential equalization between the individual machines and sensors must be ensured.

The voltage between the sensor and the AS-i network must not exceed ± 50 V. The voltage is calculated according to the following formula:

$$| \, U_{S1} - U_1 \, | \leq | \, 50 \text{ V} \, |$$

The following figure shows the basic structure:

①   Machine 1
②   Sensor 1
③   Machine 2
④   Sensor 2
⑤   Equipotential bonding
⑥   Analog input module
⑦   AS-i network
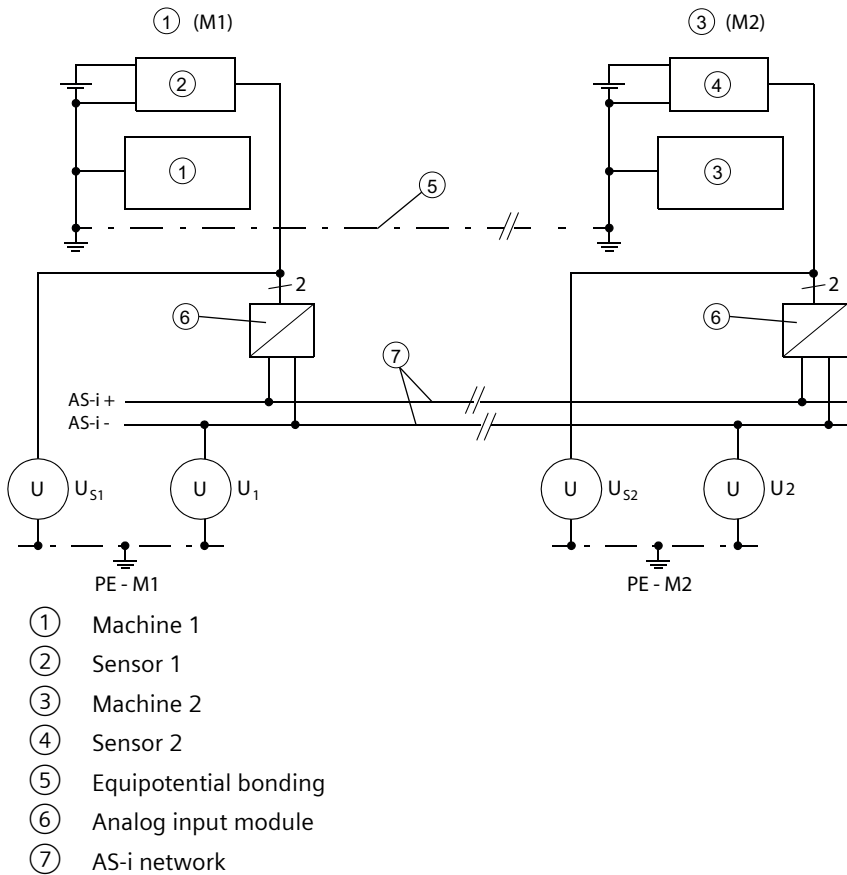
Updating of the measured values

The measured values of the analog modules are read out cyclically.

Resolution

The resolution of the A / D converter is 15 bits + sign.

Smoothing of measured values

The individual measured values are smoothed using digital filtering.

This is a digital 1st order low-pass filter.

Smoothing can be switched on and off via a parameter.

- Parameter bit P3 = 1: without smoothing, k = 1 module read-in cycle
- Parameter bit P3 = 0: with smoothing, k = 8 module read-in cycles

The time response can be calculated according to the following formula for any jump of the measured value *x* and the smoothing factor used *k* :

$y_n = x_n + (k-1)y_{n-1} \, / \, k$

y_n = Transfer value to the system in the current cycle n

The figure below shows the step response at a smoothing factor of *k* = 8 depending on the number of module read-in cycles.

① Step response

② Module read-in cycles
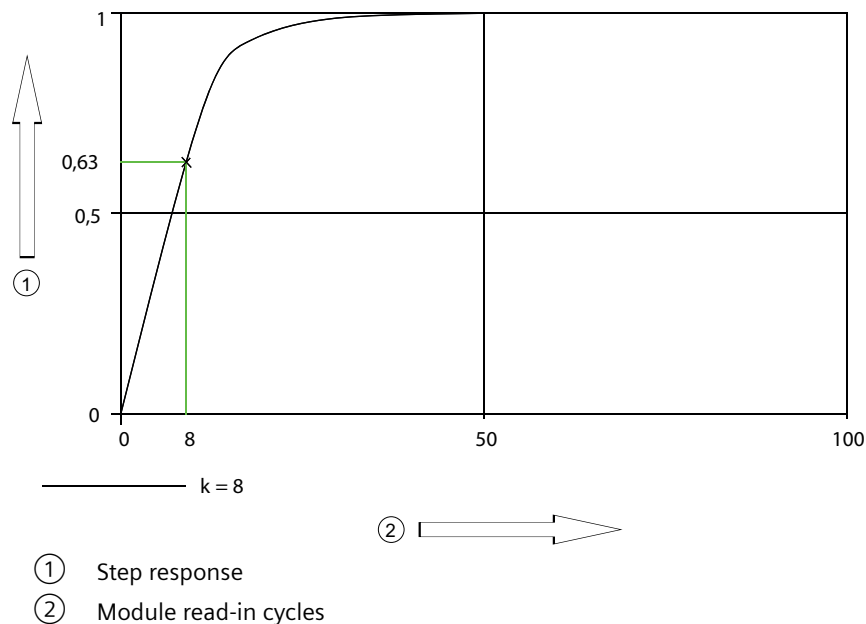
A module read-in cycle is approximately 130 ms for 2 inputs and 50 Hz interference frequency suppression (see also the preceding figure).

Analog / digital converter

The analog / digital converter used in the modules works according to the sigma-delta principle.

- t_c = Number of active channels * 20 ms (50 Hz)

- t_c = Number of active channels * 16.6 ms (60 Hz)

Transmission time analog value

The transmission time $t_{transmission}$ for a new analog value from the analog module to the AS-i master is dependent on the number of active channels.

The transmission time can be calculated as follows:

$t_{transmission} \leq$ (7 * number of active channels + 7) * t_{AS-i} + t_{PLC}

Where:

- t_{AS-i} = max. 5 ms

- t_{PLC} = Transmission time between PLC and master.

The 4 inputs are transmitted with multiplexing (alternately).

Total execution time

The total execution time t_{total} for full transmission comprises:

- Conversion time t_c

- Transmission time $t_{transmission}$

The following maximum total transmission time is thus calculated:

- $t_{Total} = t_c + t_{transmission}$

Adjustable parameters

The parameters are set together for the inputs, and they are sent automatically from the AS-i master to the analog module following power failure.

It is possible to change the parameters.

The parameters printed in **bold** are assigned by the AS-i master if the configured slave parameters in the AS-i master have not been changed (delivery state of the AS-i master).

Note

If an impermissible parameter assignment is sent to the module, the parameter assignment shown in **bold** is set.

9.4.2 Measurement types

The modules are available for the following measurement types:

- Current measurement
- Voltage measurement
- Resistance / thermal resistance measurement

Current and voltage measurement are each contained in one device.

These measuring modes are described in the following chapters.

9.4.3 Current measurement

Parameter settings

The following parameters can be set:

Adjustable parameters		Parameter bit P3 ... P0	Setting options	
Filter		**1** X X X	**50** Hz	
		0 X X X	60 Hz	
Smoothing		X **1** X X	**Without** smoothing	
		X 0 X X	With smoothing	
Measuring ranges	4-wire	X X 0 1	±20 mA	(±23.52 mA max.)
	4-wire	X X **1 1**	**4 ... 20 mA** [2]	(+22.81 mA max.)
	2-wire [1]	X X 1 0	4 ... 20 mA [2]	(+22.81 mA max.)

1) Sensor is supplied from analog module. For this reason, the measuring range does not rise until 4 mA in the case of two-wire connection.

2) With open-circuit detection

Note

If an invalid parameter set is sent to the module, XX11 is set as the parameter. This corresponds to a measuring range of 4 to 20 mA. The set values for filter and smoothing are adopted.

Important technical data

Data of the current measurement	Value
Input resistance	50 Ω
max. input current (destruction limit)	50 mA [1]
Common mode voltage U_{GL} (AIx- to Mx) from input to input	max. ±2 V
Sensor supply (total current for all inputs) without U_{aux}	46 mA (short-circuit-proof)
Sensor supply (total current for all inputs) with U_{aux}	500 mA (short-circuit-proof)

1)

NOTICE
Destruction limit
If the input current exceeds the destruction limit of 50 mA, the input will be damaged.
This may result in no values or incorrect values being displayed.

Current measurement range ±20 mA

(Parameter setting XX01)

Measured value		Units		Range
±20 mA	in %	dec	hex	
> 23.52 mA	>117.589	32767	7FFF	Overflow
23.52 mA	117.589	32511	7EFF	Overrange
		27649	6C01	
20 mA	100	27648	6C00	Rated range
723.4 nA	0.003617	1	0001	
0 mA	0	0	0000	
-723.4 nA	-0.003617	-1	FFFF	
-20 mA	-100	-27648	9400	
		-27649	93FF	Underrange
-23.51 mA	-117.593	-32512	8100	
< -23.51 mA	<-117.593	-32768	8000	Underflow
		(+32767)	(7FFF)	(for certain AS-i masters)

Current measuring range 4 ... 20 mA

(Parameter setting XX11 for 4-wire connection)

(Parameter setting XX10 for 2-wire connection)

Measured value		Units		Range
4 ... 20 mA	in %	dec	hex	
> 22.81 mA	>117.589	32767	7FFF	Overflow
22.81 mA	117.589	32511	7EFF	Overrange
		27649	6C01	
20 mA	100	27648	6C00	Rated range
4 mA + 578.7 nA	0.003617	1	0001	
4 mA	0	0	0000	
		-1	FFFF	Underrange
1.185 mA	-17.593	-4864	ED00	
< 1.185 mA	<-17.593	32767	7FFF	Open circuit

9.4.4 Voltage measurement

Parameter settings

The following parameters can be set:

Adjustable parameters		Parameter bit P3 ... P0	Setting options	
Filter		**1** X X X	**50** Hz	
		0 X X X	60 Hz	
Smoothing		X **1** X X	**Without** smoothing	
		X 0 X X	With smoothing	
Measuring ranges	4-wire	X X **1 1**	**±10 V**	(± 11.759 V max.)
		X X **1** 0	1 - 5 V [1]	(+ 5.704 V max.)

[1] With open-circuit detection

Note

If an invalid parameter set is sent to the module, XX11 is set as the parameter. This corresponds to a measuring range of ±10 V. The set values for filter and smoothing are adopted.

Important technical data

Data of the voltage measurement	Value
Input resistance	100 kΩ
Max. input voltage to GND (destruction limit)	±25 V
Max. input voltage differential (destruction limit)	±50 V
Common mode voltage U_{GL} (AIx- to Mx) from input to input	max. ±2 V
Sensor supply (total current for all inputs) without U_{aux}	46 mA (short-circuit-proof)
Sensor supply (total current for all inputs) with U_{aux}	500 mA (short-circuit-proof)

Voltage measurement range ±10 V

(Parameter setting XX11)

Range		Units		Range
±10 V	**in %**	**dec**	**hex**	
> 11.759 V	>117.589	32767	7FFF	Overflow
11.759 V	117.589	32511	7EFF	Overrange
		27649	6C01	

Range		Units		Range
±10 V	in %	dec	hex	
10 V	100	27648	6C00	Rated range
361.7 µV	0.003617	1	0001	
0 V	0	0	0000	
-361.7 µV	-0.003617	-1	FFFF	
-10 V	-100	-27648	9400	
		-27649	93FF	Underrange
-11.759 V	-117.593	-32512	8100	
< -11.759 V	<-117.593	-32768	8000	Underflow
		(+32767)	(7FFF)	(for certain AS-i masters)

Voltage measurement range 1 ... 5 V

(Parameter setting XX10)

Range		Units		Range
1 ... 5 V	in %	dec	hex	
> 5.704 V	>117.589	32767	7FFF	Overflow
5.704 V	117.589	32511	7EFF	Overrange
		27649	6C01	
5 V	100	27648	6C00	Rated range
1 V + 144.7 µV	0.003617	1	0001	
1 V	0	0	0000	
		-1	FFFF	Underrange
0.296 V	-17.593	-4864	ED00	
< 0.296 V	<-17.593	32767	7FFF	Open circuit

9.4.5 Resistance/thermal resistance measurement

Parameter settings

The following parameters can be set:

Adjustable parameters		Parameter bit P3 ... P0	Setting options
Filter		**1** X X X	**50** Hz
		0 X X X	60 Hz
Smoothing		X **1** X X	**Without** smoothing
		X **0** X X	With smoothing
Measuring ranges			
• Pt100 thermal resistance 4-wire [1]	linear standard	X X **1 1**	**-200 ... +850** °C
	linear climatic	X X **0 1**	-120 ... +130 °C
• Thermal resistance Ni 100 4-wire [1]	linear standard	X X **0 0**	-60 ... +250 °C
• Resistance measurement 4-wire [1]		X X **1 0**	0 ... 600 Ω

[1] 2- and 3-wire simulated by 4-wire

Important technical data

Data of the (thermal) resistance measurement	Value
Input resistance	2 MΩ
Max. input voltage to GND (destruction limit)	±10 V
Max. input voltage differential (destruction limit)	±20 V
Measured current	1.667 mA
Type of connection	floating

Pt100 thermal resistance

Standard range linear -200 ... +850 °C

(Parameter setting XX11)

Range	Units		Range
-200 ... +850 °C	dec	hex	
> 1000 °C	32767	7FFF	Overflow
1000 °C [1]			Overrange
	8501	2135	

Range	Units		Range
-200 ... +850 °C	**dec**	**hex**	
850 °C	8500	2134	Rated range
...			
0.1 °C	1	0001	
0 °C	0	0000	
-0.1 °C	-1	FFFF	
...			
-200 °C	-2000	F830	
-243 °C [1]	-2001	F82F	Underrange
< -243 °C	-32768	8000	Underflow
	(+32767)	(7FFF)	(for certain AS-i masters)

[1]   In the overrange/underrange, the gradient of the characteristic is maintained when the linearized nominal range is exited.

Climate range linear -120 ... +130 °C

(Parameter setting XX01)

Range	Units		Range
-120 ... +130 °C	**dec**	**hex**	
> 155 °C	32767	7FFF	Overflow
155 °C [1]			Overrange
	13001	32C9	
130 °C	13000	32C8	Rated range
...			
0.01 °C	1	0001	
0 °C	0	0000	
-0.01 °C	-1	FFFF	
...			
-120 °C	-12000	D120	
	-12001	D11F	Underrange
-145 °C [1]			
< -145 °C	-32768	8000	Underflow
	(+32767)	(7FFF)	(for certain AS-i masters)

[1]   In the overrange/underrange, the gradient of the characteristic is maintained when the linearized nominal range is exited.

Thermal resistance Ni 100

Standard range linear -60 ... +250 °C

(Parameter setting XX00)

Range	Units		Range
-60 ... +250 °C	dec	hex	
> 295 °C	32767	7FFF	Overflow
295 °C [1]			Overrange
	2501	9C5	
250 °C	2500	9C4	Rated range
...			
0.1 °C	1	0001	
0 °C	0	0000	
-0.1 °C	-1	FFFF	
...			
-60 °C	-600	FDA8	
-105 °C [1]	-601	FDA7	Underrange
< -105 °C	-32768	8000	Underflow
	(+32767)	(7FFF)	(for certain AS-i masters)

[1] In the overrange/underrange, the gradient of the characteristic is maintained when the linearized nominal range is exited.

Resistance measurement

Range 0 ... 600 Ω

(Parameter setting XX10)

Table 9-1   Resistance measurement

Range		Units		Range
0 ... 600 Ω	in %	dec	hex	
> 705.53 Ω	>117.589	32767	7FFF	Overflow
705.53 Ω	117.589	32511	7EFF	Overrange
		27649	6C01	
600 Ω	100	27648	6C00	Rated range
...				
21.7 MΩ	0.003617	1	0001	
0 Ω	0	0	0000	
	<0	-32768	8000	Underflow
		(+32767)	(7FFF)	(for certain AS-i masters)

9.5 Output modules

9.5.1 Module properties

Switchover of the voltage / current output

In the case of the SlimLine Compact modules, the analog inputs and outputs can be switched from voltage (V mode) to current (C mode) using a DIP switch.
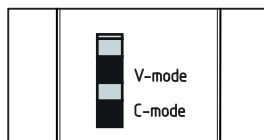
Note

Switchover of the output mode is only permissible in the de-energized state.

Transmission time analog value

The transmission time for an analog value from the analog module to the AS-i master is 21 AS-i cycles for 2 outputs in the worst case.

The transmission time for the two outputs can be calculated as follows:

$t_{transmission} = 21 * t_{AS-i} + t_{PLC}$

Where:

- t_{AS-i} = max. 5 ms

- t_{PLC} = Transmission time between PLC and master
  With a locally connected CP 343-2, the following example applies: typ. 250 μs, max. 650 μs

The two outputs are transmitted with multiplexing (alternately).

This gives the following maximum transmission time: $t_{transmission} = 105$ ms + t_{PLC} [ms]

Time response output jump (settling time t_t)

The settling time t_t for the analog output module is dependent on the connected load. This is:

- 0.6 ms with resistive load

- 6 ms with inductive / capacitive load.

After expiry of the settling time, the analog output signal is active and stable.

Watchdog and I/O fault

If no data exchange according to the slave profile 7.3 takes place for longer than 5 s, or if there is no data telegram call with the analog module within 50 ms, the outputs are switched permanently to 0 V or 0 mA.

This means that if the analog module is connected to an AS-i master that includes the analog module in the cyclic data exchange but does not supply the analog module with analog output values according to the slave profile 7.3, the watchdog will respond and an I/O fault will result.

The response of the watchdog is indicated by the analog module through continuous lighting of the red FAULT LED.

The watchdog signal is automatically deleted again as soon as the output module is supplied again with analog output values.

The I/O fault bit is not used on the output modules.

Total execution time

The total execution time t_{total} for full transmission of 2 outputs comprises:

- PLC transfer time t_{PLC}

- AS-i transmission time $t_{transmission}$

- Settling time t_t

The following maximum total transmission time is thus calculated for 2 outputs (with locally connected CP 343-2): $t_{Total} \leq t_{PLC} + 105 \text{ ms } (t_{transmission}) + 6 \text{ ms } (t_t) \sim 111 \text{ ms}$

Adjustable parameters

The parameters are set together for both outputs, and they are sent automatically from the AS-i master to the analog module following power failure.

It is possible to change the parameters.

The parameters printed in **bold** are assigned by the AS-i master if the configured slave parameters in the AS-i master have not been changed (delivery state of the AS-i master).

Note

If an impermissible parameter assignment is sent to the module, the parameter assignment shown in **bold** is set.

9.5.2 Current output

Parameter settings

The following parameters can be set:

Table 9-2   Adjustable parameters for current measurement

Adjustable parameters		Parameter bit P3 … P0	Setting options
Output ranges:	2-wire	1 1 1 0 1 1 **1 1** 1 1 0 1	±20 mA **4 … 20 mA** 0 … 20 mA

Important technical data

Data of the current output	Value
Load impedance	max. 500 Ω
Load impedance with inductive load	max. 0.1 mH
No-load proof (open output)	Yes
No-load voltage	approx. 15 V
Max. output current	24 mA per channel
Open-circuit detection	No

> **Note**
>
> **When connecting the actuators, it should be ensured that they have a galvanic isolation between the input signal and the supply voltage.**

Current output range ±20 mA

(Parameter setting 1110)

Measured value		Units		Range
±20 mA	in %	dec	hex	
0 mA	118.5149	32767	7FFF	Overflow
	117.593	32512	7F00	
23.52 mA	117.589	32511	7EFF	Overrange
		27649	6C01	
20 mA	100	27648	6C00	Rated range
723.4 nA	0.003617	1	0001	
0 mA	0	0	0000	
-723.4 nA	-0.003617	-1	FFFF	
-20 mA	-100	-27648	9400	

Measured value		Units		Range
±20 mA	in %	dec	hex	
		-27649	93FF	Underrange
-23.52 mA	-117.593	-32512	8100	
0 mA	-117.596	-32513	80FF	Underflow
	-118.519	-32768	8000	

Current output range 0 ... 20 mA

(Parameter setting 1101)

Measured value		Units		Range
0 ... 20 mA	in %	dec	hex	
0 mA	118.5149	32767	7FFF	Overflow
	117.593	32512	7F00	
23.52 mA	117.589	32511	7EFF	Overrange
		27649	6C01	
20 mA	100	27648	6C00	Rated range
723.4 nA	0.003617	1	0001	
0 mA	0	0	0000	
		-1	FFFF	Impermissible range
0 mA	-117.593	-32512	8100	
0 mA	-117.596	-32513	80FF	Underflow
	-118.519	-32768	8000	

Current output range 4 ... 20 mA

(Parameter setting 1111)

Measured value		Units		Range
4 ... 20 mA	in %	dec	hex	
0 mA	118.5149	32767	7FFF	Overflow
	117.593	32512	7F00	
22.81 mA	117.589	32511	7EFF	Overrange
		27649	6C01	
20 mA	100	27648	6C00	Rated range
4 mA	0.003617	1	0001	
+ 578.7 nA	0	0	0000	
4 mA				
4 mA ... 578.7 nA		-1	FFFF	Underrange
0 mA	-25	-6912	E500	
		-6913	E4FF	Impermissible range
0 mA	-117.593	-32512	8100	
0 mA	-117.596	-32513	80FF	Underflow
	-118.519	-32768	8000	

> **Note**
>
> The lowest possible resolution for the D / A converter is 11.57 µA.
>
> The current resulting from the units received therefore only changes within 11.57 mV.

9.5.3 Voltage output

Parameter settings

The following parameters can be set:

Table 9-3   Adjustable parameters for voltage output

Adjustable parameters		Parameter bit P3 ... P0	Setting options
Output ranges:	2-wire	1 1 **1 1**	**±10 V**
		1 1 0 0	1 ... 5 V
		1 1 1 0	0 ... 10 V

Important technical data

Data of the current measurement	Value
Load impedance	min. 1 kΩ
Load impedance with capacitive load	max. 0.1 µF
Short-circuit-proof	Yes
Short-circuit current	60 mA
Max. output voltage	approx. 15 V
Open-circuit detection	No

Voltage output range ±10 V

(Parameter setting 1111)

Range		Units		Range
±10 V	in %	dec	hex	
0 V	118.5149	32767	7FFF	Overflow
	117.593	32512	7F00	
11.76 V	117.589	32511	7EFF	Overrange
		27649	6C01	

Range		Units		Range
±10 V	in %	dec	hex	
10 V	100	27648	6C00	Rated range
361.7 µV	0.003617	1	0001	
0 V	0	0	0000	
-361.7 µV	-0.003617	-1	FFFF	
-10 V	-100	-27648	9400	
		-27649	93FF	Underrange
-11.76 V	-117.593	-32512	8100	
0 V	-117.596	-32513	80FF	Underflow
	-118.519	-32768	8000	

Voltage output range 0 ... 10 V

(Parameter setting 1110)

Range		Units		Range
0 ... 10 V	in %	dec	hex	
0 V	118.5149	32767	7FFF	Overflow
	117.593	32512	7F00	
11.76 V	117.589	32511	7EFF	Overrange
		27649	6C01	
10 V	100	27648	6C00	Rated range
361.7 µV	0.003617	1	0001	
0 V	0	0	0000	
		-1	FFFF	Impermissible range
0 V	-117.593	-32512	8100	
0 V	-117.596	-32513	80FF	Underflow
	-118.519	-32768	8000	

Voltage output range 1 ... 5 V

(Parameter setting 1100)

Range		Units		Range
1 ... 5 V	in %	dec	hex	
0 V	118.5149	32767	7FFF	Overflow
	117.593	32512	7F00	
5.7 V	117.589	32511	7EFF	Overrange
		27649	6C01	
5 V	100	27648	6C00	Rated range
1 V	0.003617	1	0001	
+144.7 µV				
1 V	0	0	0000	

Range		Units		Range
1 ... 5 V	**in %**	**dec**	**hex**	
1 V		-1	FFFF	Underrange
-144.7 μV				
0 V	-25	-6912	E500	
		-6913	E4FF	Impermissible range
0 V	-117.593	-32512	8100	
	-117.596	-32513	80FF	Underflow
0 V	-118.519	-32768	8000	

Note

The lowest possible resolution for the D / A converter is 5.787 mV.

The voltage resulting from the units received therefore only changes within 5.787 mV.

9.6 Diagnostics

Status display

The status of a module is indicated by LEDs with continuous or flashing light. This enables diagnostics at a glance:

- for AS÷i communication via a dual green / red LED
- for the auxiliary voltage U_{AUX} with a green LED

The following sections provide an overview of the LED status displays for the input/output modules.

LED position

For the position of the LEDs, see the diagram below:

① Communication AS÷i / FAULT
② AUX POWER operating state
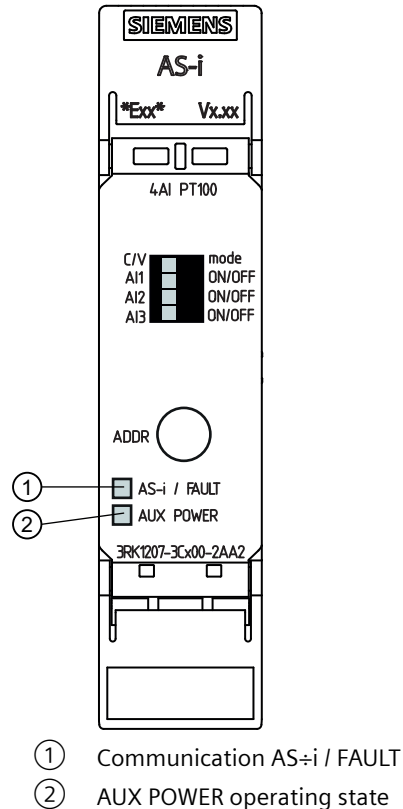
Indication of channels (inputs / outputs)

There are no additional LEDs for indicating the selected channels. In the case of input modules, the number of active channels is indicated by the position of the DIP switch.

Status display AS-i / FAULT

All modules have a dual LED (green / red) for the "AS-i / FAULT" status display. For the functions and remedies, see the table below:

Table 9-4   Diagnostics of the AS÷i status via LEDs

AS-i / FAULT (green/ yellow/red)	Possible cause	Possible remedial measures
Green	Normal operation, AS÷i communication OK	—
Red	No AS÷i communication:	Ensure AS÷i communication:
	• Master is switched off or offline	• Switch on the master or switch it to online mode
	• Slave is not configured in the master	• Reconfigure the master
	• Incorrect slave type is connected	• Connect the correct module
	• Slave has the wrong address	• Check/correct the slave address
Flashing yellow/red	Module has slave address "0" (delivery condition)	Assign an address other than "0"
Flashing green/red	No analog data exchange (triple exchange) on AS-i	AS-i master according to AS-i Spec. 2.1 or more
OFF	No AS÷i voltage	Switch on AS÷i voltage
	AS-i voltage has been connected with reverse polarity	Connect it correctly
	AS÷i voltage too low	Measure the AS-i voltage (approx. 30 V DC)

AUX POWER operating state

All modules have a green LED for the "AUX POWER" operating state. For the functions and remedies, see the table below:

Table 9-5   Diagnostics of the operating state via LED

AUX POWER	Possible cause	Possible remedial measures
Green	Normal operation, 24 V DC auxiliary voltage OK	—
OFF	• No auxiliary voltage	• Switch on auxiliary voltage 24 V DC
	• Auxiliary voltage connected with incorrect polarity	• Connect it correctly
	• Auxiliary voltage too low	• Measure the auxiliary voltage (approx. 24 V DC)

Sensor supply display

There is not an additional LED for indicating the selected sensor supply source. The sensor is supplied automatically via U_{aux} if available. If U_{aux} is not available, supply is ensured via AS-i.

The **green AUX Power LED** indicates that auxiliary power is active.

No auxiliary power is required for output modules and the resistance / thermal resistance modules.

Accuracies and error limits

Accuracies and error limits	Value
Operational limit over entire temperature range [1] [2]	±1 %
Basic error limit at 25 °C (inputs) [1]	±0.7 %
Basic error limit at 25 °C (outputs) [2]	±0.8 %
Temperature error [1] [2]	±0.01 % / K
Linearity error (inputs) [1]	±0.05 %
Linearity error (outputs) [2]	±0.08 %
Repeat accuracy, settled, at 25 °C [1] [2]	±0.1 %

[1]   Related to the full scale of the input range

[2]   Related to the full scale of the output range

Technical data

<div style="text-align: right; font-size: 2em;">**10**</div>

10.1 Technical data in Siemens Industry Online Support

Technical data sheet

You can also find the technical data of the product at Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/en/ps/15765).

1. Enter the full article number of the desired device in the "Product" field, and confirm with the Enter key.

2. Click the "Technical data" link.

Dimension drawings

11

11.1   Dimension drawings 3RK devices

Enclosure 17.5 mm for AS-i modules
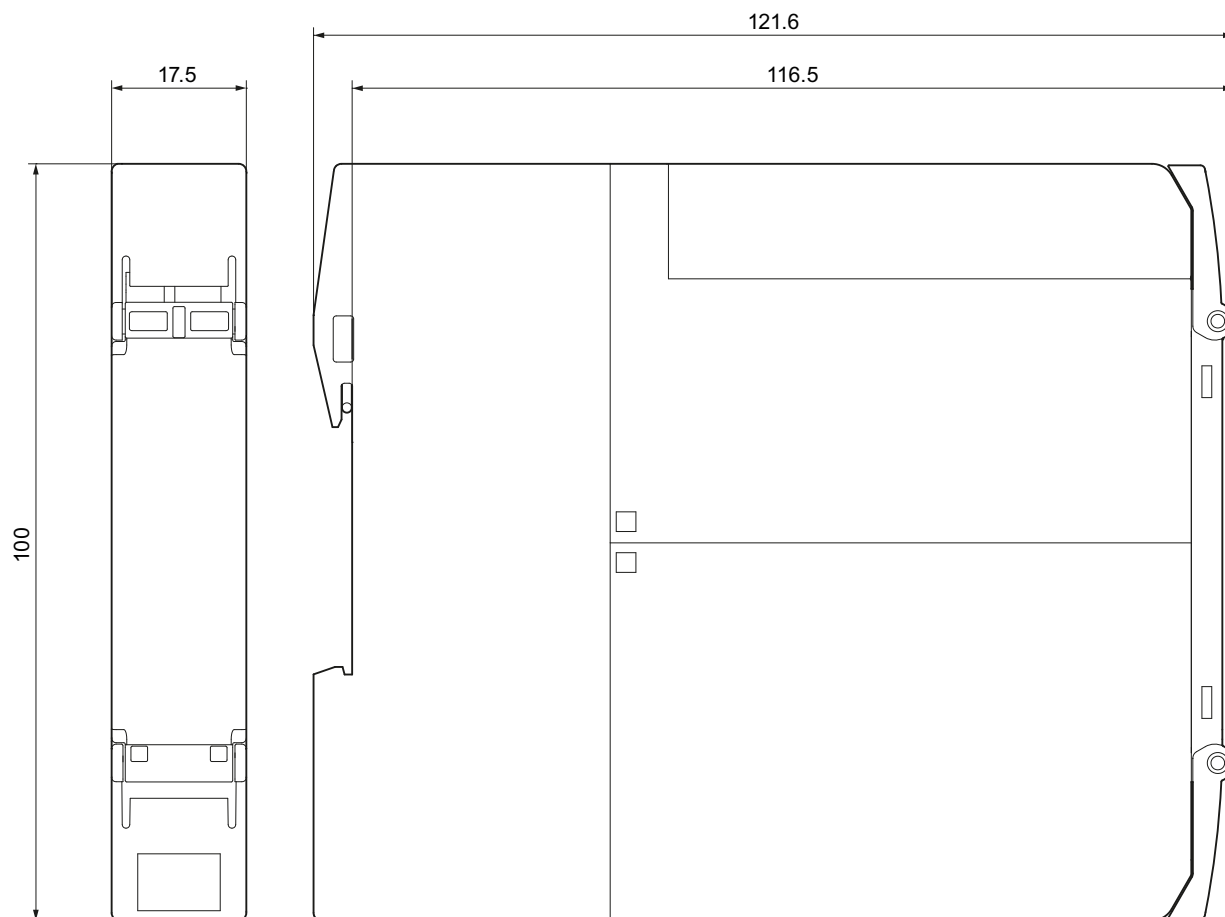
- 3RK2200-0C.00-2AA2
- 3RK1205-0B.00-2AA2
- 3RK1405-2B.00-2AA2

Enclosure 22.5 mm for AS-i modules
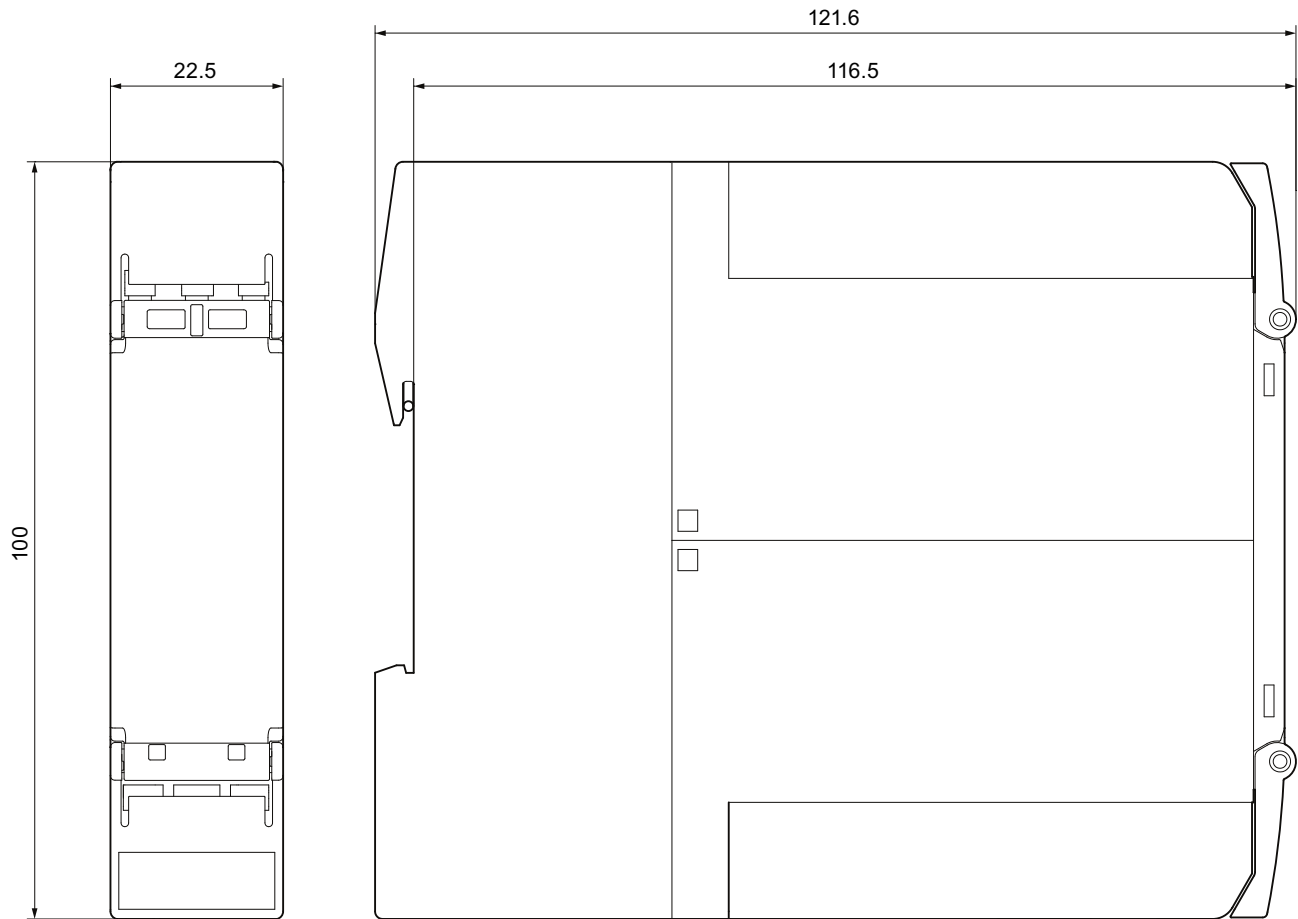
- 3RK2200-2C.00-2AA2
- 3RK2402-2C.00-2AA2
- 3RK2402-2M.00-2AA2
- 3RK2100-1C.00-2AA2
- 3RK1400-2C.00-2AA2
- 3RK2400-2C.00-2AA2
- 3RK1207-0C.00-2AA2
- 3RK1207-3C.00-2AA2
- 3RK1107-0B.00-2AA2

Drilling diagram, enclosure 17.5 mm
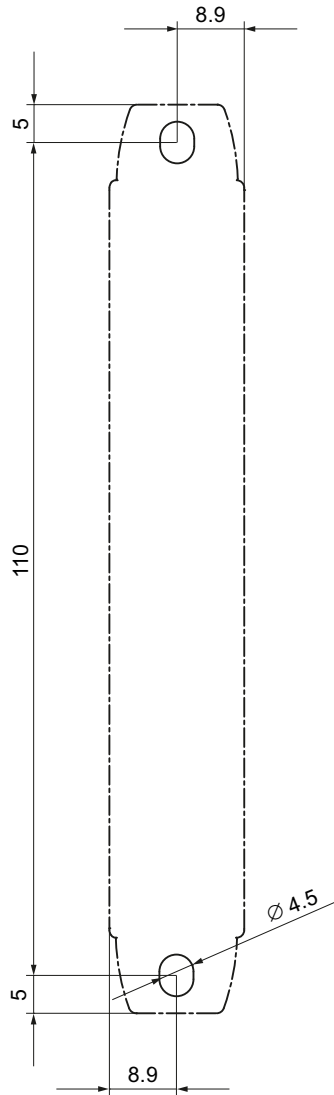
Drilling diagram, enclosure 22.5 mm
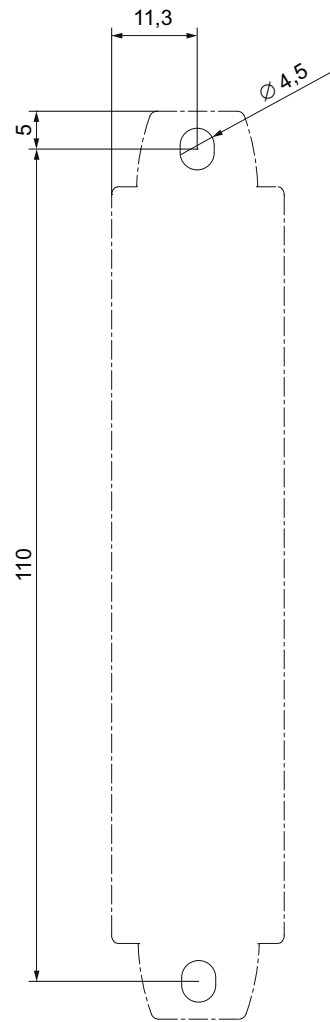
See also

Mounting the devices on a wall (Page 39)

11.2 Dimension drawings 3RK device connectors

Dimension drawing of device connectors for 3RK AS-i modules

Device connector for 17.5 mm devices
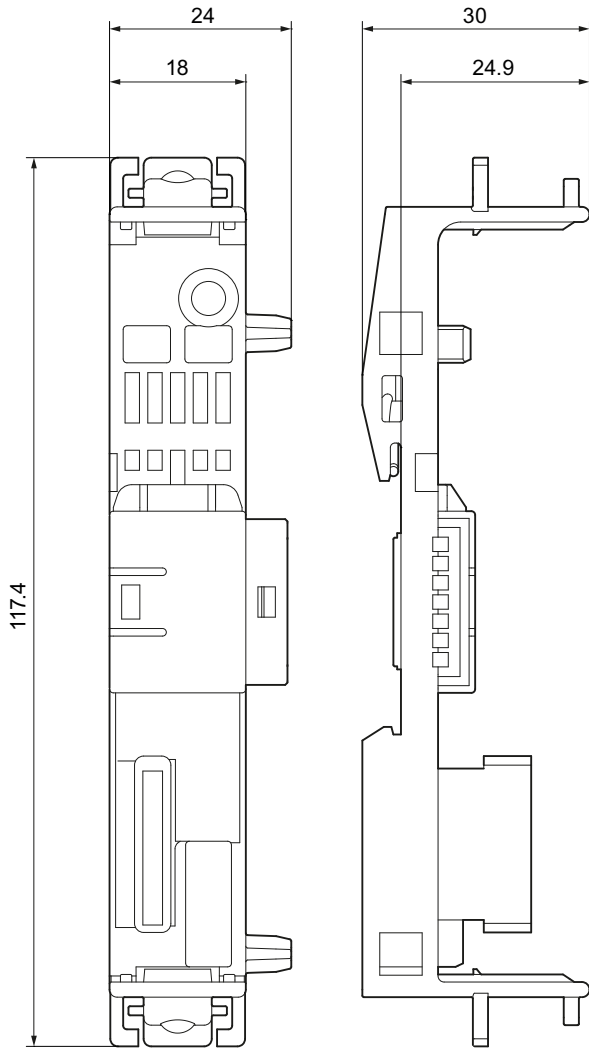
Device connector for 22.5 mm devices
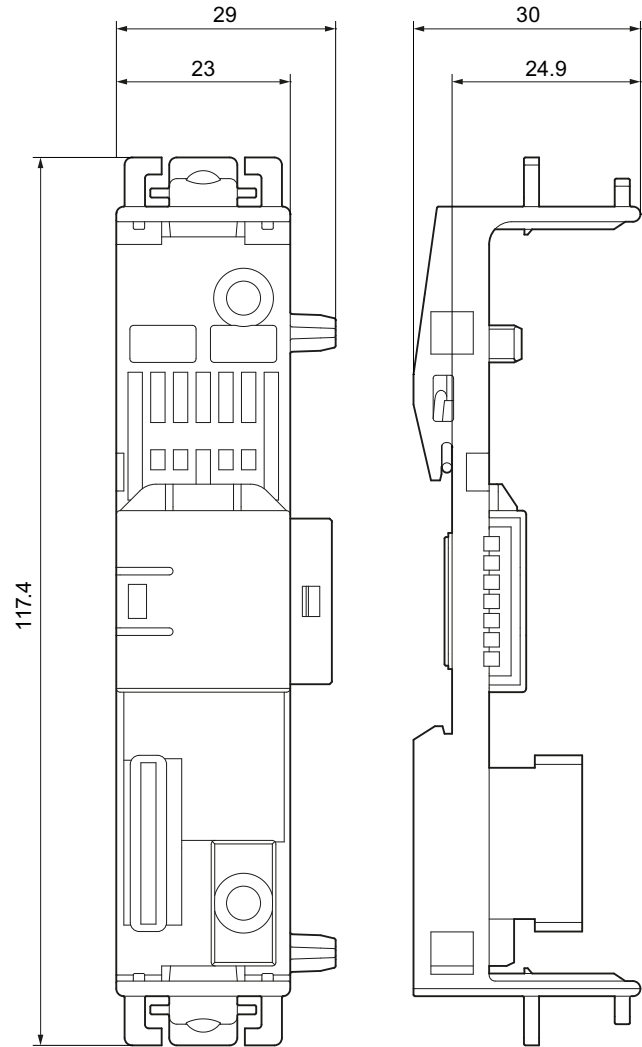
Dimension drawing for device termination connectors for 3RK AS-i modules

Device termination connector for 17.5 mm devices
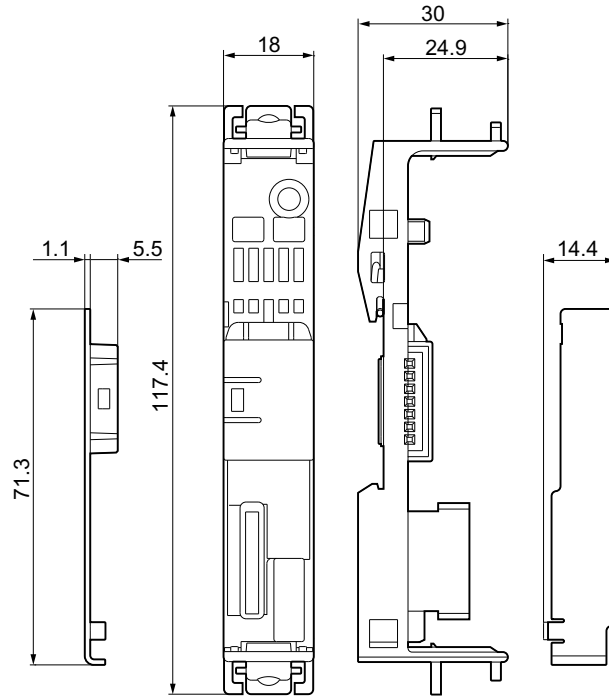
Device termination connector for 22.5 mm devices
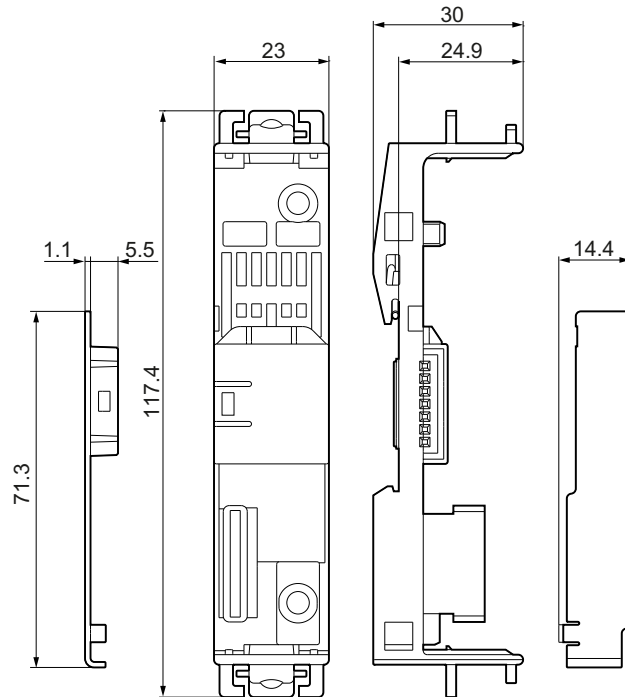
Drilling diagram for device connectors with 18 mm and 23 mm widths
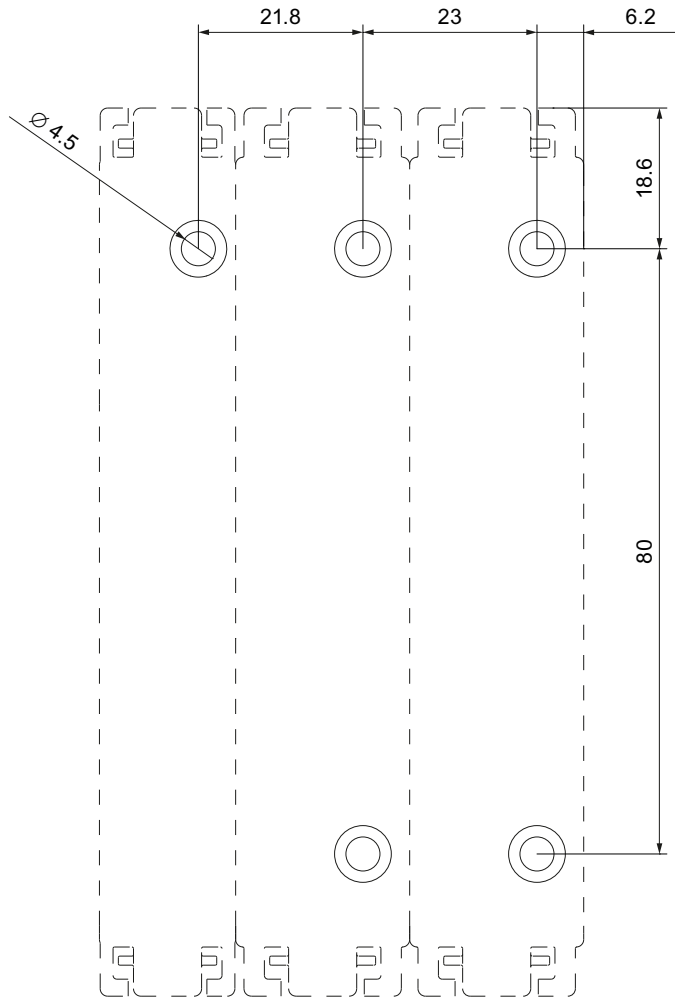
See also

Mounting the devices with device connector on a wall (Page 41)

Mounting the devices with device connector on a standard mounting rail (Page 33)

Spare parts/accessories

<div style="text-align: right">

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12.1 Accessories for 3RK

The following accessories are available for the 3RK control cabinet modules.

Designation	Article number
SIRIUS terminal, 2-pole, screw-type, 1 x 2.5 mm² / 2 x 1.5 mm²	3ZY1121-1BA00
SIRIUS terminal, 4-pole, screw-type, 1 x 2.5 mm² / 2 x 1.5 mm²	3ZY1141-1BA00
SIRIUS terminal, 2-pole, push-in, 2 x 1.5 mm²	3ZY1121-2BA00
SIRIUS terminal, 4-pole, push-in, 2 x 1.5 mm²	3ZY1141-2BA00
SIRIUS device connector for enclosure, 17.5 mm wide	3RK1901-1YA00
SIRIUS device connector for enclosure, 22.5 mm wide	3RK1901-1YA10
SIRIUS device termination connector for devices, 17.5 mm wide	3RK1901-1YA01
SIRIUS device termination connector for devices, 22.5 mm wide	3RK1901-1YA11
SIRIUS push-in lugs for wall mounting (Contents: 12 units)	3ZY1311-0AA00
SIRIUS device identification label 17 sheets with 48 labels each; size 10 x 7 mm	3RT2900-1SB10
SIRIUS device identification label 17 sheets with 20 labels each; size 20 x 7 mm	3RT2900-1SB20
Screwdriver 3.0 x 0.5 mm; l = 200 mm; titanium gray/black; partially insulated	3RA2908-1A

See also

Mounting the devices with device connector on a standard mounting rail (Page 33)

Mounting the devices with device connector on a wall (Page 41)

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