Protection devices

3RB24 solid-state overload relay for IO-Link

Manual · 12/2011

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Protection devices
3RB24 solid-state overload relay for IO-Link

Manual

12/2011

GWA 4NEB 969 1656-02 DS 02

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

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE

indicates that an unintended result or situation can occur if the relevant information is not taken into account.

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

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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.

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Order number: 3ZX1012-0RB24-0AC0
℗ 12/2011 Technical data subject to change

Table of contents

Introduction

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Purpose of the manual

This manual describes the 3RB24 solid-state overload relay for IO-Link. The manual supplies the following information:

- Information for integrating the solid-state overload relay into the system environment.
- Information about the necessary hardware and software components.
- Information about the parameters that can be set on the overload relay or via the IO-Link.
- Information on installing, connecting and operating the overload relay.
- Technical information such as dimension drawings, device circuit diagrams and data sets in the appendix.

The information in this manual enables you to configure, commission and diagnose the 3RB24 solid-state overload relay.

Required basic knowledge

To understand these operating instructions you should have a general knowledge of automation engineering and low-voltage switchgear.

Scope of the manual

This manual is valid for the 3RB24 solid-state overload relay for IO-Link. It describes the components that are valid at the time of publication.

Further documentation

To install and connect the current measuring module, you require the operating instructions of the current measuring module used. For additional information on the Siemens IO-Link masters, please refer to the respective manuals for the electronic modules 4SI IO-Link and 4SI SIRIUS (IP20) and ET 200eco PN (IP65).

The Appendix "References (Page 129)" has a list of the operating instructions.

Recycling and disposal

The 3RB24 solid-state overload relays for IO-Link can be recycled, as they are low in pollutants. For environmentally-friendly recycling and disposal of your electronic waste, please contact a company certified for the disposal of electronic waste.

Up-to-the-minute information

You can obtain further assistance by calling the following numbers:

Technical Assistance:

Phone: +49 (0) 911-895-5900 (8 a.m. to 5 p.m. CET)

Fax: +49 (0) 911-895-5907

or on the Internet at:

E-mail: (mailto:technical-assistance@siemens.com)

Internet: (www.siemens.com/industrial-controls/technical-assistance)

Correction sheet

A correction sheet is included at the end of the manual. Please use it to record your suggestions for improvements, additions and corrections, and return the sheet to us. This will help us to improve the next edition of the manual.

Safety information

2

Working on the system

DANGER

Hazardous voltage!

Will cause death or serious injury.

Turn off and lock out power before working on this equipment.

Restricted touch protection

DANGER

Restricted touch protection!

Will cause death or serious injury.

The 3RB24 overload relay for IO-Link corresponds to degree of protection in accordance with IP20 (IEC 60529) and is safe to touch in accordance with DIN VDE 0106, Part 100. Touching the terminals can result in an electric shock.

Commissioning and maintenance must be carried out by qualified personnel only.
Cover the terminals of the current measuring module (size S6 and S10 / S12) with the appropriate terminal covers.

Intended use

⚠ WARNING

Intended use

Can Cause Death, Serious Injury, or Property Damage.

The devices may only be used for the applications described in the catalog and the technical description, and only in conjunction with equipment or components from other manufacturers which have been approved or recommended by Siemens.

This product can function correctly and reliably only if it is transported, stored, assembled, and installed correctly, and operated and maintained as recommended.

Before you run any sample programs or programs that you have written yourself, make sure that running the plant cannot cause injury to anyone else or damage to the machine itself.

EU note: Start-up/commissioning is absolutely prohibited until it has been ensured that the machine in which the component described here is to be installed fulfills the regulations/specifications of Machinery Directive 89/392/EEC.

Important note for maintaining the operational safety of your system

⚠ 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 certain actions when monitoring the product. 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. You should subscribe to the corresponding newsletter in order to obtain the latest information and to allow you to modify your plant accordingly. Please go to the Internet (http://www.automation.siemens.com/WW/newsletter/guiThemes2Select.aspx?subjectID=2&lang=en)

There, you can register for the following newsletter:

- IO-Link (in the Automation folder).

To receive this newsletter, select the "Updates" check box.

ESD guidelines

ESD components are destroyed by voltage and energy far below the limits of human perception. Voltages of this kind occur as soon as a device or an assembly is touched by a person who is not electrostatically discharged. ESD components which have been subject to such voltage are usually not recognized immediately as being defective, because the malfunction does not occur until after a longer period of operation.

CAUTION

Damage to the solid-state overload relay from electrostatic charging!

The solid-state overload relay contains components that are sensitive to electrostatic discharge. These components will be destroyed or damaged by incorrect handling.
Observe ESD guidelines when handling and installing the devices.
Connection is only permitted when the power adapters have been deactivated (PELV power adapter in accordance with IEC EN 50178).

- You must discharge your body electrostatically immediately before touching an electronic component. To do this, touch a conductive, grounded object, e.g., a bare metal part of a switch cabinet or the water pipe.
- Always hold the component by the plastic enclosure.
- Electronic modules should not be brought into contact with electrically insulating materials such as plastic film, plastic parts, insulating table supports or clothing made of synthetic fibers.
- Always place electrostatic sensitive devices on conductive bases.
- Always store and transport electronic modules or components in ESD-safe conductive packaging, e.g. metallized plastic or metal containers. Leave the component in its packaging until installation.

Product description

3

3.1 Properties

Solid-state overload relay for IO-Link

The solid-state overload relay, comprising the 3RB24 evaluation module and a 3RB29 current measuring module, protects electrical equipment (e.g. three-phase motors) with two different protection mechanisms: overload protection and thermistor protection. Ground fault detection can also be enabled via IO-Link.

In conjunction with the 3RT contactors, the solid-state overload relay for IO-Link can be used as a direct-on-line starter, reversing starter or, with the help of an additional circuit, as a star-delta (wye-delta) starter. It is possible to read out diagnostics data, such as the current, via IO-Link and to further process this data in the higher-level controller.

3.2 System structure

Device concept

The 3RB24 solid-state overload relay has a modular device concept. Each device consists of a motor-current-independent evaluation module, and a motor-current-dependent current measuring module. Both modules are connected electrically to each other by connecting cable via the interface.

Optionally, the 3RA6935-0A operator panel can be connected to the front of the evaluation module.

Requirements

You require the following tools for system setup:

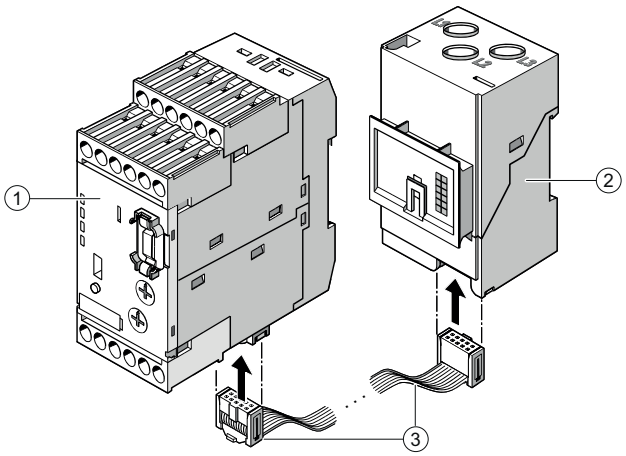
- 1 x evaluation module 3RB2483-4A .1
- 1 x current measuring module 3RB29.6-2...
- 1 x connecting cable 3RB2987-2.

Note

The connecting cable 3RB2987-2B for linking the evaluation module and the current measuring module is only to be used when the evaluation module is mounted direct on the current measuring module.

System structure

The following graphic illustrates the design principle of a system.



① Evaluation module 3RB2483-4A .1
② Current measuring module 3RB29.6-2...
③ Connecting cable 3RB2987-2.

Figure 3-1 System structure

You can find information on the evaluation module, current measuring module, and connecting cables in the Chapter "Accessories (Page 26)".

3.3 Functions

Overview of the basic functions

The 3RB24 solid-state overload relay for IO-Link offers the following basic functions:

Protective function:

- Current-dependent protection of loads against overload
- Current-dependent protection of loads against phase asymmetry
- Current-dependent protection of loads against phase failure
- Cold conductor (PTC) sensor circuit (thermistor protection)
- Protection of loads against incomplete ground faults

Motor starter function:

- Control of the relay contacts for operating the connected contactors via IO-Link

Diagnostics and monitoring:

- Output of an analog signal DC 4 mA to DC 20 mA as an image of the flowing motor current
- Diagnostics via IO-Link for further processing in the higher-level controller, e.g. device status with regard to protective functions, parameterization and transfer of the measured current value

Note

Fuses or circuit breakers must be used for short-circuit protection.

Overload protection/phase asymmetry/phase failure

The 3RB24 solid-state overload relays for IO-Link are modular in design and are supplied with power via the IO-Link master. The associated 3RB29 current measuring modules can be ordered in different sizes and cover a current range of 0.3 to 630 A. This means the right current measuring module can be selected for every application. A current setting up to 820 A is possible in conjunction with a series transformer. The solid-state overload relays have been designed to provide current-dependent protection for loads with normal starting and heavy starting against impermissibly high temperature rises due to overload, phase asymmetry or phase failure. The devices can be used as direct-on-line starters, reversing starters or, with the help of an additional circuit, as star-delta (wye-delta) starters.

Overload, phase asymmetry or phase failure results in an increase of the motor current beyond the set rated operational current of the motor. This increase in current is detected using a current measuring module, and electronically analyzed by a connected 3RB24 evaluation module. The evaluation electronics send a signal to the auxiliary contacts. The auxiliary contacts then disconnect the contactor and the load. The break time depends on the ratio of the tripping current to the rated operational current I_e and is stored in the form of a tripping characteristic with long-term stability (see Setting the current (rated operational current) and trip class (Page 79)).

The status "Tripped" is signaled by an "OVERLOAD" LED showing a permanently red light and a "DEVICE / IO-Link" LED showing a permanently red light. The "OVERLOAD" LED flickers to indicate an imminent relay trip following violation of a limit current resulting from overload, phase asymmetry or phase failure. This overload warning is reported as a general warning via the IO-Link to the higher-level controller.

If, after a tripping operation, the voltage supply of the overload relay is interrupted within the recovery time of 3 minutes, the time starts again when the supply is restored, and a period of 3 minutes must elapse before the device is ready for service again.

Thermistor protection

The 3RB24 solid-state overload relays for IO-Link offer the option of direct temperature monitoring of the motor windings. Full motor protection is implemented by connection of a cold conductor (PTC) sensor circuit monitored for short-circuit and wire break.

With this temperature-dependent protection, the loads can be protected against overtemperature resulting indirectly from restricted coolant flow, for example, and undetectable by current measurement. In the case of overtemperature, the devices shut down the contactor and thus the loads via the auxiliary contact.

The status "Tripped" is signaled by a "THERMISTOR" LED showing a permanently red light and a "DEVICE / IO-Link" LED showing a permanently red light.

NOTICE
To guarantee sure functioning of the short-circuit detection in the thermistor circuit, the line resistance must not exceed 10 Ω in the case of a short-circuited thermistor.

Ground fault protection

To also protect the loads against high-resistance short circuits due to damage to the insulation, humidity or condensation the solid-state overload relays for IO-Link offer the possibility of internal ground fault detection.

Note

Internal ground fault detection is not possible in conjunction with contactor assemblies for star-delta (wye-delta) start.

In the event of a ground fault, the relays trip instantaneously.

The "Tripped" status is signaled by means of a "GND FAULT" LED showing a permanently red light and a "DEVICE / IO-Link" LED showing a permanently red light, and it can also be signaled via IO-Link.

Ground fault detection can be enabled or parameterized in the solid-state overload relay when using with motors with 3-conductor connection (without N connection). Ground fault detection is disabled in the delivery state.

Self-monitoring

The 3RB24 solid-state overload relay for IO-Link has a self-monitoring feature. The overload relay constantly monitors its own basic functions and trips if an internal fault is detected.

Electrical interlock

The electrical interlock prevents simultaneous selection of direction of rotation 1 and direction of rotation 2. If direction of rotation 1 and direction of rotation 2 are selected simultaneously, the overload relay outputs a process image error.

The switchover time is the time provided for changing the direction of rotation. The switchover time is 0.5 s and cannot be parameterized. The electrical interlock is also active during the switchover time, in other words, selection of a direction of rotation only becomes effective 0.5 s after revoking a selection signal for the other direction of rotation.

Residual current detection

The 3RB24 solid-state overload relay for IO-Link has internal residual current detection and checks for a current-free state with regard to an active or non-active control command. If not, the device switches off and signals a fault.

A current flow is detected if the current is greater than 12% of the rated operational current. Detection takes place 1.5 s after switching the overload relay on or off.

The table below represents the different states.

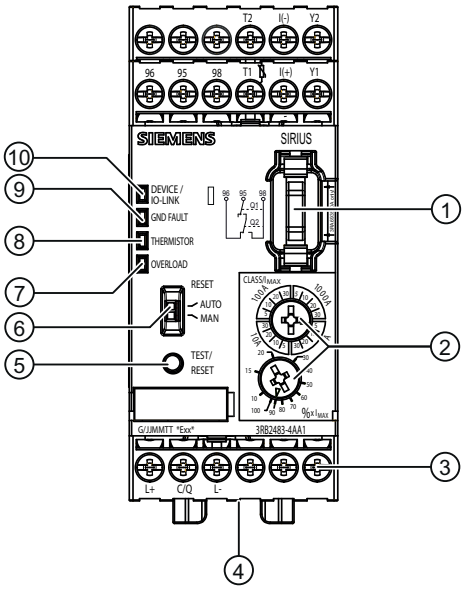
Table 3- 1 Residual current detection

Switch-on command …	Current flow …	Response/state	Message
pending	detected	Device ready for service	No fault message
pending	not detected	Residual current tripping	Fault message and shutdown of the auxiliary contacts
not pending	detected	Switching element defective	Fault message (no further response possible)
not pending	not detected	Device ready for service	No fault message

You can find further information on residual current detection in the Chapter "IO-Link diagnostics (Page 106)".

3.4 Operator controls and display elements

Equipment features of the evaluation module



① Interface for operator panel:
Enables connection of the 3RA6935-0A operator panel (optional accessory).

② Rotary switches for rated operational current and trip class:
With the two rotary switches, you set the overload relay to the rated operational current of the motor and the required trip class depending on the startup conditions.

③ Connecting terminals (removable joint block):
The generously dimensioned terminals permit connection of two conductors with different cross-sections for the auxiliary circuits, control circuits, and sensor circuits. Connection is possible using screw terminals or spring-loaded terminals.

④ Interface for current measuring module:
Enables the connection of a current measuring module (device required for system setup).

⑤ TEST/RESET button:
Enables self-testing of all important device components and device functions as well as resetting of the device after a trip when manual RESET is selected.

⑥ Slide switch for AUTO/MAN-RESET:
Enables selection between manual and automatic reset.
Automatic reset is only possible after overload tripping and thermistor tripping.

⑦ Red "OVERLOAD" LED:
A continuous red light signals an active overload trip; a flickering red light signals an imminent trip (overload warning).

⑧ Red "THERMISTOR" LED:
A continuous red light signals an active thermistor trip.

⑨ Red "GND FAULT" LED:
A continuous red light signals an active ground fault trip.

⑩ Green "DEVICE/IO-LINK" LED:
A continuous green light signals that the device is working correctly; an interrupted continuous light (interrupted for 200 ms every 3 s) indicates communication via IO-Link.
Continuous red light indicates a trip or a fault.
You can find more information in Chapter "Fault codes (only in the case of non-acknowledgeable faults) (Page 104)" and Chapter "IO-Link diagnostics (Page 106)".

Figure 3-2 Operator controls and display elements of the evaluation module

Note

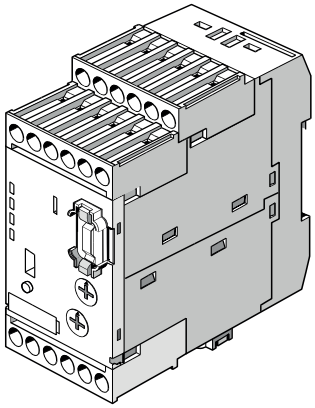
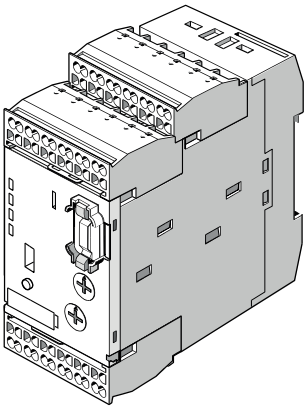
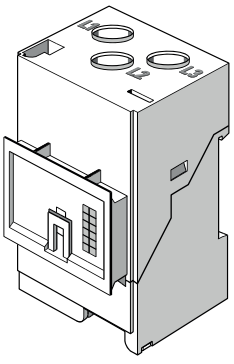
Connection of the solid-state overload relay for IO-Link is described in Chapter "Connecting (Page 69)".

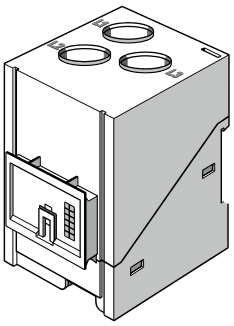
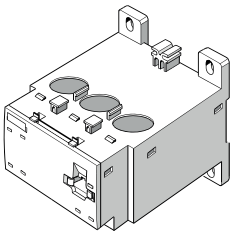
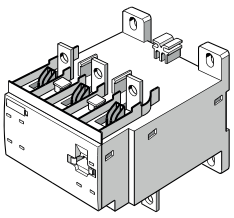
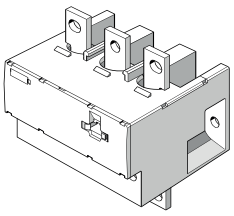
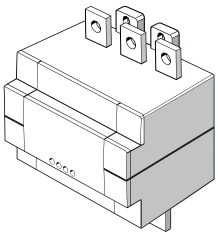
3.5 System components

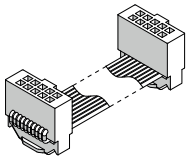
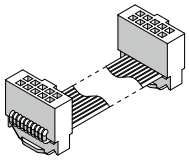
The necessary components for setting up a system are described in Chapter "System structure (Page 16)".

The components below can be ordered individually using the order numbers.

Table 3- 2 Scope of supply of the solid-state overload relay for IO-Link

Order number	Scope of supply	Image
3RB2483-4AA1	Solid-state overload relay for IO-Link: 1 x evaluation module with screw-type terminals	
3RB2483-4AC1	Solid-state overload relay for IO-Link: 1 x evaluation module with spring-loaded terminals	
3RB2906-2BG1	1 x current measuring module (0.3 to 3 A)	
3RB2906-2DG1	1 x current measuring module (2.4 to 25 A)	

Order number	Scope of supply	Image
3RB2906-2JG1	1 x current measuring module (10 to 100 A)	
3RB2956-2TG2	1 x current measuring module (20 to 200 A) for contactors of size S6 with box terminals	
3RB2956-2TH2	1 x current measuring module (20 to 200 A) for contactors of size S6 with busbar connection	
3RB2966-2WH2	1 x current measuring module (63 to 630 A)	
3UF1868-3GA00	1 x series transformer (820 A / 1 A)	

Order number	Scope of supply	Image
3RB2987-2B	1 x connecting cable for linking the evaluation module and the current measuring module (length 0.1 m); only for the following current measuring modules: 3RB2906-2BG1, 3RB2906-2DG1, 3RB2906-2JG1	
3RB2987-2D	1 x connecting cable for linking the evaluation module and the current measuring module (length 0.5 m);	

Note

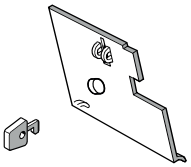
The connecting cable 3RB2987-2B for linking the evaluation module and the current measuring module is only to be used when the evaluation module is mounted direct on the current measuring module.

3.6 Accessories

Accessories for the evaluation modules

In addition, you can order the following components for the evaluation module:

Table 3- 3 Accessories for the evaluation module

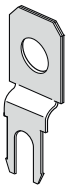
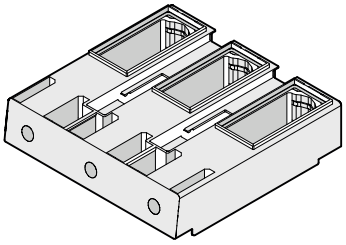
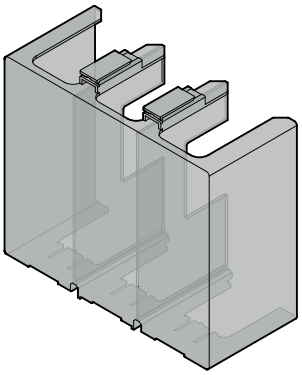
Order number	Components supplied	Image
3RP1903	Push-in lugs for screw mounting	
3RB2984-2	Sealable cover	

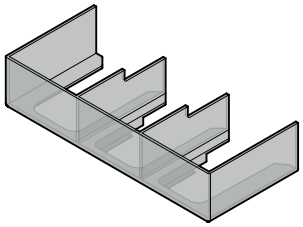
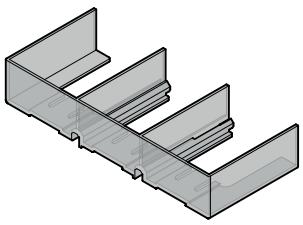
Accessories for the current measuring modules

In addition, you can order the following components for the current measuring modules:

- Box terminal blocks (for devices of size S6 and S10/S12).
- Terminal covers (for devices of size S6 and S10/S12).
- Push-in lugs for screw mounting (for devices of size S00 to S3).

Table 3- 4 Accessories for the current measuring module

Order number	Components supplied	Image
3RB1900-0B	Push-in lug for screw mounting (two per module required)	
Box terminal blocks		
3RT1956-4G	Box terminal blocks for ribbon cable conductors to 120 mm² (size S6)	
3RT1966-4G	Box terminal blocks for ribbon cable conductors to 240 mm² (size S10/S12)	
Terminal covers		
3RT1956-4EA1	Cover for cable lug and busbar connection, length 100 mm (size S6)	
3RT1966-4EA1	Cover for cable lug and busbar connection, length 120 mm (size S10/12)	

Order number	Components supplied	Image
3RT1956-4EA2	Cover for box terminals, length 25 mm (size S6)	
3RT1966-4EA2	Cover for box terminals, length 30 mm (size S10/12)	
3RT1956-4EA3	Cover for screw-type connection between contactor and overload relay, without box terminals (one required per combination) (size S6)	
3RT1966-4EA3	Cover for screw-type connection between contactor and overload relay, without box terminals (one required per combination) (size S10/12)	

Operator panel

The 3RB24 solid-state overload relay for IO-Link is controlled in manual mode with the operator panel. The device statuses are also scanned. The operator panel is connected to the front interface of the solid-state overload relay via the 10-core to 10-core connecting cable. If the voltage supply is present via IO-Link, an additional voltage supply is not required.

You can find more information on using the operator panel in Chapter "Operation using the operator panel (Page 94)".

Table 3- 5 Scope of supply of operator panel

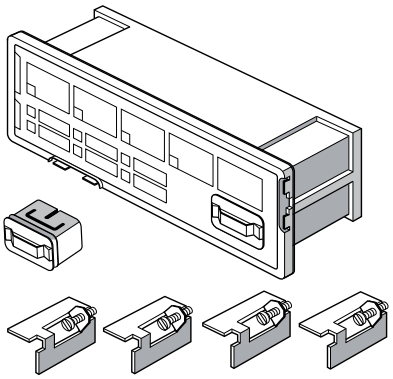
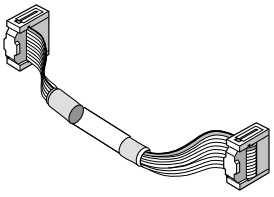
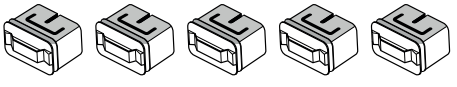
Order number	Scope of supply	Image
3RA6935-0A	1 x operator panel 1 x enabling module 1 x interface cover 4 x mounting bracket	

Table 3- 6 Accessories operator panel

Order number	Scope of supply	Image
3UF7933-0BA00-0	1 x connecting cable 10-core to 10-core, length 2.5 m (round) for operator panel	
3RA6936-0A	1 x enabling module	
3RA6936-0B	5 x interface cover	

3.7 Technical data

3.7.1 3RB24 evaluation unit

General technical data

Order number	3RB2483-4AA1	3RB2483-4AC1
Product brand name	SIRIUS	
Product designation	Solid-state overload relay for IO-Link	
IP degree of protection front	IP20	
Insulation voltage at pollution degree 3, rated value	300 V	
Installation altitude above sea level	Max. 2000 m	
Ambient temperature		
• During storage	-40 °C to +80 °C	
• During transport	-40 °C to +80 °C	
• During operation	-25 °C to +60 °C	
Relative humidity during operation		
• Minimum	10 %	
• Maximum	100 %	
Immunity to electromagnetic interference acc. to IEC 60947-1	Corresponds to degree of severity 3	
Conducted interference, BURST to IEC 61000-4-4	2 kV (relay contacts 95-96-98), 1 kV (IO-Link connections, thermistor, remote reset, analog output) corresponds to degree of severity 3	
Conducted interference, SURGE to IEC 61000-4-5		
• Line to ground	2 kV (line to ground) corresponds to degree of severity 3	
• Line to line	1 kV (line to line) corresponds to degree of severity 3	
Electrostatic discharge in accordance with IEC 61000-4-2	6 kV contact discharge/8 kV air discharge	
Field-related interference to IEC 61000-4-3	10 V/m	
Shock resistance	15 g / 11 ms	
Vibration resistance	2 g	
Impulse withstand voltage rated value	4000 V	
Total power loss, typical	0.5 W	

Order number	3RB2483-4AA1	3RB2483-4AC1
Equipment designation		
• In accordance with DIN 40719, expanded in accordance with IEC 204-2 and IEC 750	F	
• In accordance with DIN EN 61346-2	F	
Size of the overload relay	S00	
Size of the contactor, combinable company-specifically	S00 ... S12	
Protection against ignition	Increased safety EEX e	
Maximum cable length remote reset	On request	
Minimum pulse length remote reset (Y1-Y2)	150 ms	

Main circuit

Table 3- 7 Main circuit

Order number	3RB2483-4AA1	3RB2483-4AC1
Tripping class acc. to IEC 60947-4-1	CLASS 5, 10, 20 and 30 adjustable	
Number of poles for main circuit	3	
Adjustable current response value of the current-dependent overload release	0.3 A to 630 A	

Auxiliary circuit

Table 3- 8 Auxiliary circuit

Order number	3RB2483-4AA1	3RB2483-4AC1
Contact reliability of the auxiliary contacts	Suitability for PLC control (17 V, 5 mA)	
Number of NC contacts for auxiliary contacts	0	
Number of NO contacts for auxiliary contacts[1)]	1	
Number of changeover contacts for auxiliary contacts[1)]	1	
Operational current of the auxiliary contacts at DC-13		
• At 24 V	2 A	
• At 60 V	0.55 A	
• At 110 V	—	
• At 125 V	0.3 A	
• At 220 V	0.2 A	
Operational current of the auxiliary contacts at AC-15		
• At 24 V	6 A	
• At 110 V	—	
• At 120 V	—	
• At 125 V	6 A	
• At 230 V	3 A	
• At 400 V	—	

1) NO contacts and changeover contacts are switched in series.

Short-circuit protection

Table 3- 9 Short-circuit protection auxiliary circuit

Order number	3RB2483-4AA1	3RB2483-4AC1
Version of the fuse link required for short-circuit protection of the auxiliary switch	Fuse gL/gG: 6 A	

Mechanical design

Table 3- 10 Mechanical design

Order number	3RB2483-4AA1	3RB2483-4AC1
Mounting position	Any	
Installation altitude at maximum height above sea level	2000 m	
Type of mounting	• Snap-on mounting: - Standard mounting rail - Current measuring module (to size S3) • Screw-type mounting (accessories 3RP1903)	
Width	45 mm	
Height	111 mm	113 mm
Depth	95 mm	
Distance to be maintained with side-by-side mounting		
• At the top	0 mm	
• At the front	0 mm	
• At the side	0 mm	
• At the rear	0 mm	
• At the bottom	0 mm	
Distance to be maintained from grounded parts		
• At the top	0 mm	
• At the front	0 mm	
• At the side	6 mm	
• At the rear	0 mm	
• At the bottom	0 mm	
Distance to be maintained from live parts		
• At the top	0 mm	
• At the front	0 mm	
• At the side	6 mm	
• At the rear	0 mm	
• At the bottom	0 mm	

Connections

Table 3- 11 Connections

Order number	3RB2483-4AA1	3RB2483-4AC1
Connection electrical version	Screw-type connection	Spring-loaded connection
Product function removable terminal for auxiliary circuit and control circuit	Yes	Yes
Type of connectable conductor cross-sections		
Tool	∅ 5 ... 6 mm/PZ 2	3 mm flat-bladed screwdriver (3.0 x 0.5 mm)
Tightening torque	0.8 to 1.2 Nm (7 to 10.3 lb in)	—
Solid	1 x (0.5 … 4.0) mm^2 2 x (0.5 … 2.5) mm^2	2 x (0.25 … 1.5) mm^2
Finely stranded without end sleeve	—	2 x (0.25 … 1.5) mm^2
Finely stranded with end sleeve	1 x (0.5 to 2.5) mm^2 2 x (0.5 to 1.5) mm^2	2 x (0.25 … 1.5) mm^2
AWG cables	2 x (20 to 14)	2 x (24 to 16)

Approvals/certificates

Table 3- 12 Approvals/certificates

Order number	3RB2483-4AA1	3RB2483-4AC1
Certificate of suitability	IEC / CSA / UL / CCC	

Safety (3RB2483-4A.1 evaluation unit)

Table 3- 13 Safety

Standard	Designation	Value
IEC 61508	SIL	1
IEC 61508	PFD_{avg}	< 3.0 x 10^{-2}
DIN EN 60079-17, Section 4.4	Repeat test	—

IO-Link

Table 3- 14 IO-Link

Order number	3RB2483-4AA1	3RB2483-4AC1
IO-Link transfer rate	COM2 (38.4 kbit/s)	
IO-Link communication connection	Yes	
IO-Link protocol supported	Yes	
Status display for IO-Link communication	Dual LED green/red	
Status display for IO-Link device	Dual LED green/red	
Voltage supply from IO-Link master sufficient	Yes	
Point-to-point cycle time between the master and the IO-Link device	2.3 ms[1)]	
Data volume of the address area of the outputs with cyclic transfer	1 bytes	
Data volume of the address area of the inputs with cyclic transfer	2 bytes	

1) 4 cycles are required to exchange a complete message frame (PII and PIO) between the IO-Link master and 3RB24. This results in a frame transfer time of approx. 10 ms (depending on the corresponding cycle time on the master).

Example:

	3RB24	4SI IO-Link	4SI SIRIUS
Point-to-point cycle time between the master and the IO-Link device	approx. 2.3 ms	approx. 3 ms	approx. 5 ms

	3RB24 + 4SI IO-Link	3RB24 + 4SI SIRIUS
Frame transfer time	Approx. 4 x 3 ms	Approx. 4 x 5 ms

3.7.2 3RB29 current measuring module

Main circuit

Table 3- 15 Main circuit - current measuring module 3RB29..

Type – overload relay current measuring module	**3RB2906**	**3RB2906**	**3RB2956**	**3RB2966**
Size	**S00/S0**	**S2/S3**	**S6**	**S10/S12**
Width	**45 mm**	**55 mm**	**120 mm**	**145 mm**
Rated insulation voltage U_i (pollution degree 3)	1000 V			
Rated impulse withstand voltage U_{imp}	6 kV		8 kV	
Rated operational voltage U_e	1000 V			
Type of current				
• Direct current	No			
• Alternating current	Yes, 50/60 Hz ± 5%			
Current setting	0.3 ... 3 A; 2.4 ... 25 A	10 to 100 A	20 to 200 A	63 to 630 A
Power loss per device (max.)	0.5 W			
Short-circuit protection				
• With fuse without contactor	You can find more information in the "Reference Manual Protection Equipment - Overload Relays 3RU1, 3RB2" (http://support.automation.siemens.com/WW/view/en/35681830) .			
• With fuse and contactor	You can find more information in the "Configuration Manual SIRIUS Configuration" (http://support.automation.siemens.com/WW/view/en/40625241).			
Protective separation between main and auxiliary current paths acc. to IEC/EN 60947-1 (pollution degree 2)	690 V[1)]			

[1)] For grounded networks, otherwise 600 V.

Connection of the main circuit

Table 3- 16 Connecting the main circuit - current measuring module 3RB29..

Type – overload relay current measuring module	**3RB2906**	**3RB2906**	**3RB2956**	**3RB2966**
Size	**S00/S0**	**S2/S3**	**S6**	**S10/S12**
Width	**45 mm**	**55 mm**	**120 mm**	**145 mm**
Type of connection	**Screw with box terminal**			
• Connection screw (hexagon socket-head screw)	—		4 mm	5 mm
• Tightening torque	—		10 … 12 Nm	20 … 22 Nm
• Conductor cross-sections (min./max.), 1-wire or 2-wire				
- Solid	—		—	—
- Finely stranded without end sleeve	—		with box terminal 3RT1955-4G: 2 x (1 x max. 50, 1 x max. 70) mm^2, 1 x (10 ... 70) mm^2 with box terminal 3RT1956-4G: 2 x (1 x max. 95, 1 x max. 120) m^2, 1 x (10 ... 120) mm^2	2 x (50 to 185) mm^2 front clamping point only: 1 x (70 to 240) mm^2 rear clamping point only: 1 x (120 to 185) mm^2
- Finely stranded with end sleeve	—		With box terminal 3RT1955-4G: 2 x (1 x max. 50, 1 x max. 70) mm^2, 1 x (10 ... 70) mm^2 with box terminal 3RT1956-4G: 2 x (1 x max. 95, 1 x max. 120) m^2, 1 x (10 ... 120) mm^2	2 x (50 to 185) mm^2 front clamping point only: 1 x (70 to 240) mm^2 rear clamping point only: 1 x (120 to 185) mm^2
- Stranded	—		With box terminal 3RT1955-4G: 2 x (max. 70) mm^2, 1 x (16 ... 70) mm^2 with box terminal 3RT1956-4G: 2 x (max. 120) mm^2, 1 x (16 ... 120) mm^2	2 x (70 to 240) mm^2 front clamping point only: 1 x (95 to 300) mm^2 rear clamping point only: 1 x (120 to 240) mm^2

Type – overload relay current measuring module	**3RB2906**	**3RB2906**	**3RB2956**	**3RB2966**
Size	**S00/S0**	**S2/S3**	**S6**	**S10/S12**
Width	**45 mm**	**55 mm**	**120 mm**	**145 mm**
- AWG cables, solid or stranded	—		With box terminal 3RT1955-4G: AWG 2 x (max. 1/0), AWG 1 x (6 ... 2/0) with box terminal 3RT1956-4G: AWG 2 x (max. 3/0), AWG 1 x (6 ... 250 kcmil)	2 x (2/0 ... 500 kcmil), front clamping point only: 1 x (3/0 ... 600 kcmil), rear clamping point only: 1 x (250 kcmil ... 500 kcmil)
- Ribbon cable conductors (number x width x thickness)	—		With box terminal 3RT1955-4G: 2 x (6 x 15.5 x 0.8) mm, 1 x (3 x 9 x 0.8 ... 6 x 15.5 x 0.8) mm with box terminal 3RT1956-4G: 2 x (10 x 15.5 x 0.8) mm, 1 x (3 x 9 x 0.8 ... 10 x 15. 5 x 0.8) mm	2 x (20 x 24 x 0.5) mm, 1 x (6 x 9 x 0.8 ... 20 x 24 x 0.5) mm
Type of connection	**Busbar connection**			
• Connection screw	—		M8 x 25	M10 x 30
• Tightening torque	—		10 to 14 Nm	14 to 24 Nm
• Conductor cross-sections (min./max.)				
- Solid with cable lug	—		16 ... 95 mm^2 1)	50 ... 240 mm^2 2)
- Stranded with cable lug	—		25 ... 120 mm^2 1)	70 ... 240 mm^2 2)
- AWG cables, solid or stranded with cable lug	—		4 ... 250 kcmil	2/0 ... 500 kcmil
- With connecting bars (max. width)	—		15 mm	25 mm
Type of connection	**Straight-through transformers**			
Opening diameter	7.5	14	25 mm	—

1) When connecting cable lugs in accordance with DIN 46235 for conductor cross-sections from 95 mm^2, use the 3RT1956-4EA1 terminal cover to ensure phase spacing.

2) When connecting cable lugs in accordance with DIN 46234 for conductor cross-sections from 240 mm^2, as well as DIN 46235 for cable cross-sections from 185 mm^2, use the 3RT1956-4EA1 terminal cover to ensure phase spacing.

Use planning

4

4.1 Applications

Sectors

The 3RB24 solid-state overload relay for IO-Link is suitable for customers from all industries who want to ensure optimal current-dependent and temperature-dependent protection of their electrical loads (such as motors) under normal starting and heavy starting conditions (CLASS 5 to CLASS 30), and also minimize project runtimes, inventories and energy consumption, and optimize plant availability and maintenance management.

Application area

The 3RB24 solid-state overload relays for IO-Link have been designed to protect three-phase asynchronous motors and single-phase AC motors.

In addition to the protective function, these devices can be used in conjunction with contactors as direct starters or reversing starters (star-delta start also possible) controlled via IO-Link. This makes it possible to control drives direct via IO-Link from a higher-level controller, or on-site using the optional hand-held operator panel, and also, for example, to return current values direct via IO-Link.

If single-phase AC motors are to be protected with the 3RB24 solid-state overload relay for IO-Link, the main circuits of the current measuring modules must be switched in series.

You can find more information in Chapter "Connecting (Page 69)".

Ambient conditions

The 3RB24 solid-state overload relays for IO-Link are not sensitive to external influences such as shocks, corrosive ambient conditions, ageing, and temperature fluctuations. The 3RB24 solid-state overload relays compensate temperature in the temperature range from –25 °C to +60 °C according to IEC/EN 60947-4-1.

You can obtain configuring information for using the devices under -25 °C or over +60 °C on request on the Internet (www.siemens.com/industrial-controls/technical-assistance).

4.2 Special application cases

Overload relays in contactor assemblies for star-delta (wye-delta) start

When using the 3RB24 solid-state overload relay in conjunction with contactor assemblies for star-delta (wye-delta) start, you need to bear in mind that only 0.58 times the motor current flows through the line contactor. The solid-state overload relay mounted onto the line contactor must be set to this level of 0.58 times the motor current.

Note

When using the 3RB24 solid-state overload relay in conjunction with contactor assemblies for start-delta (wye-delta) start, internal ground fault detection must not be enabled on the overload relay.

Overload protection of motors in hazardous environments

The 3RB24 solid-state overload relay for IO-Link with monostable relays is suitable for overload protection of explosion-proof motors. The device must only be used outside the hazardous area for protecting explosion-proof electric motors in accordance with RL94/9/EG Group II of Category 2 and 3 (gas: Zone 1 and 2 or dust : Zone 21 and 22).

NOTICE
When using motors in hazardous environments, the information in the Safety and commissioning instructions (http://support.automation.siemens.com/WW/view/en/22712155) must be observed at all times.

Operation with frequency converter

The 3RB24 solid-state overload relay is suitable for frequencies of 50/60 Hz and their associated harmonics. This makes it possible to use the solid-state overload relay on the input side of the frequency converter. If motor protection is required in the outgoing circuit of the frequency converter, the 3RN thermistor motor protection devices or the 3RU thermal overload relays are recommended.

Operation with loads in excess of 630 A rated operational current

The 3RB24 solid-state overload relay for IO-Link can also be used for protecting loads up to 820 A by means of an external 3UF1868-3GA00 current transformer . The secondary cables of the current transformer are looped through the three feed-through openings of the current measuring module, and short-circuited. The secondary current of the external current transformer is the primary current of the 3RB29 current measuring module of the 3RB24 solid-state overload relay. You can find a connection example in the Chapter "Circuit diagrams (Page 116)".

Other current transformers can also be used for protecting loads with a rated operational current greater than 630 A. The current transformers used must have the following characteristics:

- Secondary current: 1 A
- Frequency: 50 Hz/60 Hz
- Recommended transformer rating: ≥ 2.5 VA (depending on the secondary current and cable length)
- Overcurrent factor: 5P10 or 10P10
- Accuracy class: 1

NOTICE
If the main circuit is using rated current, the secondary current of the current transformer must be within the setting range of the current measuring module used!

Example

- 3UF1868-3GA00 current transformer:
- Primary: 820 A with rated operational current
- Secondary current: 1 A
- 3RB24 solid-state overload relay with 3RB2906-2BG1 current measuring module with a setting current of 0.3 A to 3.0 A.

The secondary current of the current transformer is 1 A at rated load and is, therefore, within the 0.3 to 3.0 A setting range of the current measuring module used. The setting current I_e in the 3RB24 solid-state overload relay is 1 A.

If the analog value transfer function is used, the transformation ratio must be taken into account: The transferred value of 1 A corresponds to an actual current of 820 A when using the external 3UF1868-3GA00 current transformer with a transformation ratio of 820 at rated operational current.

Representation of the current values of the 3RB24 solid-state overload relay for IO-Link (the actual image may deviate from this example).

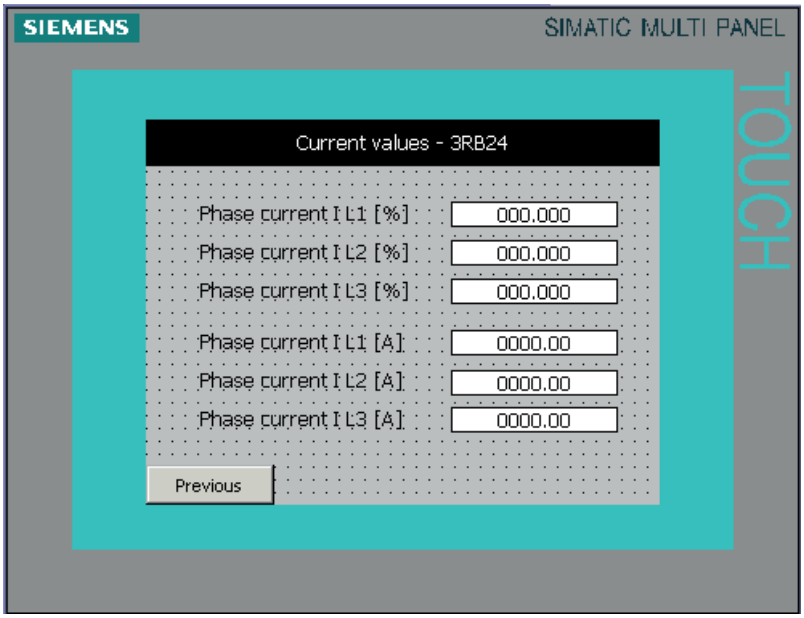


Figure 4-1 SIMATIC WINCC flexible 2008 for the 3RB24 solid-state overload relay for IO-Link

Configuring

5

5.1 Configuring in STEP 7

5.1.1 Requirements

Procedure when configuring IO-Link master and IO-Link device

Configuration takes place in two steps with STEP 7, V5.4 SP5 or higher:

1. In *HW Config*, configure the IO-Link master (with GSD if necessary), e.g. the 4SI SIRIUS electronics module or 4SI IO-Link (both require at least firmware version 1.0.1).
2. With the Port-Configurator-Tool *S7-PCT (V2.0 or higher)* you configure the connected solid-state overload relay for IO-Link (IO-Link Device).

Requirements

- STEP 7 V5.4 SP5 or higher
- The Port-Configurator-Tool *S7-PCT (V2.0 or higher)* is installed on the PG/PC.

  You can either install *S7-PCT* together with STEP 7 V5.4 SP5 or higher, or you can download it from the Internet (http://support.automation.siemens.com/WW/view/en/33102519/133100).
- The associated IO-Link IODD file (IO Device Description) is installed in *S7-PCT* . You can download the IODD files for the SIRIUS Devices from the Internet (http://support.automation.siemens.com/WW/view/en/29801139/133100).
- Optional: The GSD files are installed in HW Config. You can download the GSD files for the ET 200S from the Internet (http://www.siemens.com/comdec).
- Optional: Install the function block FB ""IOL_CALL" " for backing up/restoring IO-Link master parameters and IO-Link device parameters.
  You can obtain the function block on the Internet (http://support.automation.siemens.com/WW/view/en/33102519/133100).
  You can find further information on the function block in "Module replacement (Page 48)".

5.1.2 Configuration with STEP 7 and S7-PCT

Configuring the IO-Link master in *HW Config*

1. Start the SIMATIC Manager and configure the project as described in the *STEP 7* online help.
2. Select the IO-Link master in the hardware catalog of *HW Config* (in the ET 200S or ET 200eco PN distributed I/O system, for example).
3. Drag-and-drop the IO-Link master from the hardware catalog to the configuration table.
4. Parameterize the IO-Link master.

Configuring the IO-Link device with the Port Configurator Tool

1. In the configuration table, select the IO-Link master (e.g. the 4SI SIRIUS electronics module).
2. Right-click and select "**Launch IO-Link Configurator**" in the shortcut menu.
   Result: *S7-PCT* is started.
3. Select the SIRIUS 3RB24 overload relay IO-Link in the hardware catalog of the S7-PCT.
4. Load the configuration into the IO-Link master before parameterizing the overload relay.
5. Start by parameterizing the SIRIUS overload relay IO-Link (IO-Link device).
   Additional information is available in the *S7-PCT* online help.

5.1.3 Configuration with STEP 7 and S7-PCT (GSD version)

Configuring the IO-Link master in *HW Config* with GSD

1. Start the SIMATIC Manager and configure the project as described in the *STEP 7* online help.
2. Select the IO-Link master in the hardware catalog of *HW Config* (e.g. in the ET 200S or ET 200eco PN distributed I/O system).
3. Drag-and-drop the IO-Link master from the hardware catalog to the configuration table.
4. Parameterize the IO-Link master.

Configuring the IO-Link device with the Port Configurator Tool

1. In the configuration table, select the IO-Link master (e.g. the 4SI SIRIUS electronics module).
2. Right-click and select "**Start Device Tool**" in the shortcut menu. Click on "S7-PCT" in the submenu.

   Result: *S7-PCT* will be started.
3. Select the SIRIUS 3RB24 overload relay IO-Link in the hardware catalog of the S7-PCT.
4. Load the configuration into the IO-Link master before parameterizing the overload relay.
5. Start by parameterizing the SIRIUS overload relay IO-Link (IO-Link device).
   Additional information is available in the *S7-PCT* online help.

5.2 Configuring without STEP 7

5.2.1 Requirements

Basic procedure when configuring IO-Link master and IO-Link devices with S7-PCT stand-alone

1. You configure the connected solid-state overload relay (IO-Link device) with the Port Configurator tool *S7-PCT (V2.0 or higher)*.

Requirements

- The Port Configurator tool *S7-PCT (V2.0 or higher)* is installed on the PG/PC.

  You can either install *S7-PCT* together with STEP 7 V5.4 SP5 or higher, or you can download it from the Internet (http://support.automation.siemens.com/WW/view/en/33102519/133100).
- The associated IO-Link IODD file (IO-Link Device Description) is installed in *S7-PCT*. You can download the IODD files for the SIRIUS devices from the Internet (http://support.automation.siemens.com/WW/view/en/29801139/133100).

Note

Configuring with S7-PCT Stand-Alone is not possible for the CPU versions of the ET 200.

5.2.2 Configuring without STEP 7

Configuring the IO-Link device with the Port Configurator Tool

1. Start the S7-PCT Port Configurator Tool.
2. Create a new project or open an existing project as described in the online help.
3. Select an IO-Link master.
4. Select the SIRIUS overload relay IO-Link in the hardware catalog of the S7-PCT.
5. Load the configuration into the IO-Link master before parameterizing the overload relay.
6. Start by parameterizing the SIRIUS overload relay IO-Link (IO-Link device).
   Additional information is available in the *S7-PCT* online help.

Note

To be able to access the IO-Link master or an IO-Link device online, communication between the ET 200 and the higher-level controller must be active (BF-LED on ET 200 interface module is off).

5.3 Module replacement

5.3.1 Module replacement (replacement of an IO-Link device)

Parameter data and configuration data specially optimized for a specific application are stored in an IO-Link Device. This data deviates in many cases from the default values stored in the IO-Link Device.

In the event of replacement of an IO-Link Device (referred to below as "module"), the optimized data must be transferred to the new module.

Data can be transferred via two channels:

- Module replacement with PG/PC
- Module replacement without PG/PC

5.3.2 Module replacement with PG/PC

Procedure

In the event of a replacement, a PG/PC is available with the SIMATIC project of the plant.

With the data stored in the SIMATIC project, and the S7-PCT, you transfer the parameters belonging to the replaced Device to the new Device.

5.3.3 Module replacement without PG/PC

Procedure

On completion of commissioning, a PG/PC with the project is no longer available. For backing up and restoring the parameter data and configuration data from or to a module, the function block (FB) "IOL_Call" is available for the SIMATIC controllers of the S7-300 and S7-400 families.

With this function block, you back up all relevant data records of a module after commissioning, in a data block (DB), for example. In the event of a replacement, you write the relevant data from the data block to the replaced module with the IOL_Call.

Refer to the Appendix "Data sets (Page 120)" for data records to be backed up in the case of a module.

Note

An IO-Link Device is a module that communicates with the IO-Link master via its communication connection. With the special cases "SIRIUS 3RA64/65 compact starter " and "SIRIUS 3RA2711 function modules", where group formations of up to four starters are possible, the above information refers to the replacement of the first load feeder. Replacement of load feeders 2 to 4 of a group of four does not require any supplementary measures.

Requirements

- Install the demo project "IOL-CALL".
  You can download the "IOL-CALL" and the description from the Internet (http://support.automation.siemens.com/WW/view/en/33102519/133100).
- Copy the IO-Link Call function block FB1 (including data block DB10) to a STEP 7 project.
- Use the IO-Link Call function block FB1 as described in the demo project.

5.4 Integration into the SIMATIC environment (3RB24)

Integration into the SIMATIC environment

Faceplates embedded in a demo project are offered for download for human machine interfacing and diagnostics for Siemens IO-Link Devices in conjunction with a SIMATIC and WinCC flexible 2008.

The faceplates can be transferred from the demo project to your own WinCC flexible 2008 project.

Faceplates are available for the process data and the diagnostics data.

You can download the project from the Internet (http://support.automation.siemens.com/WW/view/en/38006560) free of charge.

Example

Process image for the solid-state overload relay for IO-Link 3RB24 (the actual image may deviate from this example).

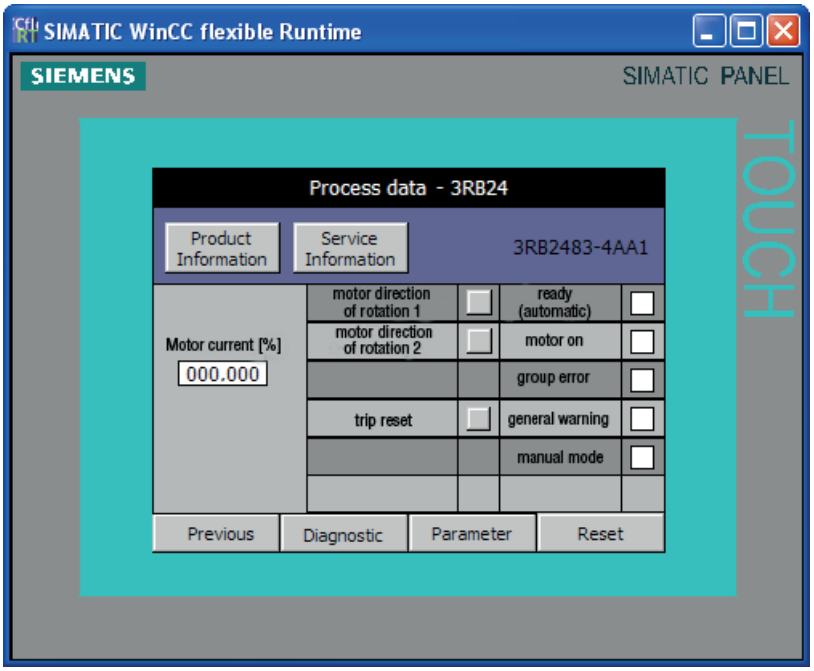


Figure 5-1 SIMATIC WINCC flexible for the solid-state overload relay for IO-Link 3RB24

Parameters

6

6.1 Parameters

Parameters

You can set the following parameters:

via IO-Link	on the device
• Cold start • Ground fault detection • Operator panel available • Operation at Preset <> Actual Configuration	• Rated operational current I_e • Trip class [CLASS] • Response to overload - thermal motor model • Response to overload - thermistor • Thermistor - monitoring

Notes on parameter assignment

Parameter assignment is carried out in two ways.
With the help of the local control elements, the following parameters can be set:

- Rated operational current I_e (rotary switch)
- Trip class [CLASS] (rotary switch)
- Response to overload - thermal motor model (slide switch for AUTO/MAN-RESET)
- Response to overload - thermistor (slide switch for AUTO/MAN-RESET)
- Thermistor - monitoring (TEST/RESET pushbutton)

The following parameters can be read out via IO-Link:

- Rated operational current I_e [A]
- Trip class [CLASS]
- Response to overload - thermal motor model
- Response to overload - thermistor
- Thermistor - monitoring
- Cold start
- Ground fault detection
- Operator panel available
- Operation at Preset <> Actual Configuration

This parameter can also be set without connected voltage and is described in detail in Chapter "Operation (Page 79)".
The parameters accessible via IO-Link are shown below.

6.2 "Cold start" parameter

"Cold start" parameter

The "Cold start" parameter enables startup without connected motor or without main power. If an ON command is received via the process image ("Motor direction of rotation 1" or "Motor direction of rotation 2"), the contactor is activated. If the "Cold start" parameter is set to "Enable", the contactor only remains activated if no current flow is measured.
If a current flow is detected during cold starting (no current flow on the activated contactor), a fault message appears and the device trips immediately.

The table below shows the values for the "Cold start" parameter.

Table 6- 1 "Cold start" parameter

Value	Description	Default setting
0	Cold start:Disable	Disable
1	Cold start: Enable	—

The "Cold start" parameter can only be modified via IO-Link. It cannot be adjusted at the device.

6.3 "Ground fault detection" parameter

"Ground fault detection" parameter

The "Ground fault detection" parameter enables detection of a "ground fault". If the "Ground fault detection" parameter is enabled, the relays trip instantaneously in the event of a ground fault.

The table below shows the values for the "Ground fault detection" parameter.

Table 6- 2 "Ground fault detection" parameter

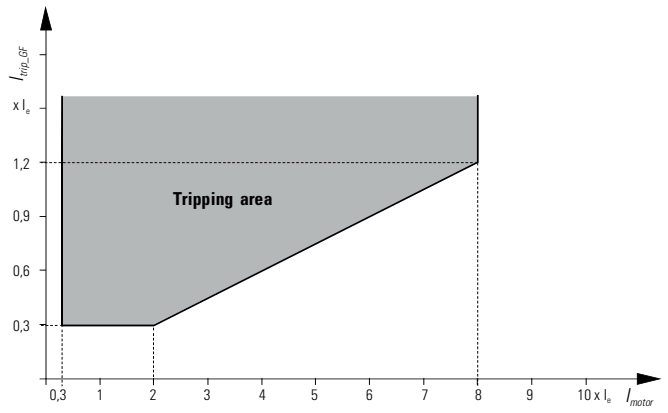
Value	Description	Default setting
0	Ground fault detection: Disable	Disable
1	Ground fault detection: Enable	—

The "Ground fault detection" parameter can only be modified via IO-Link if no ground fault has been detected. It cannot be adjusted at the device.

Tripping characteristic

The following information refers to sinusoidal fault currents of 50/60 Hz. With a motor current between 0.3 and 2 times the rated operational current I_e, the device trips at a ground fault current that is 30% of the rated operational current. With a motor current between 2 times and 8 times the rated operational current I_e, the device trips at a ground fault current that is 15% of the motor current.

The response delay is 0.5 to 1 s.



I_{GF} Ground fault current

I_{trip_GF} Tripping current at ground fault

Figure 6-1 Tripping Area (ground fault protection)

6.4 "Rated operational current" parameter

"Rated operational current I_e" parameter

The "Rated operational current I_e" parameter is set using two rotary switches on the device.

A detailed explanation of the control elements for setting the rated operational current can be found in Chapter "Setting the current (rated operational current) and trip class (Page 79)".

Note

The absolute value of the rated operational current can be read out via IO-Link for documentation purposes, for example. This value cannot be set or modified via IO-Link.

6.5 "Trip class [CLASS]" parameter

"Trip class [CLASS]" parameter

The "Trip class [CLASS]" parameter is set using a rotary switch on the device.

A detailed explanation of the control elements for setting the trip class can be found in Chapter "Setting the current (rated operational current) and trip class (Page 79)".

Note

The set trip class can be read out via IO-Link for documentation purposes, for example. This value cannot be set or modified via IO-Link.

6.6 "Response to overload - thermal motor model" parameter

"Response to overload - thermal motor model" parameter

The Response to overload - thermal motor model parameter can only be set using the slide switch for AUTO/MAN-RESET on the overload relay.

A detailed explanation of the functional principle of automatic and manual resetting can be found in Chapter "Performing a reset (Page 89)".

Note

The "Response to overload - thermal motor model" parameter can be read out via IO-Link for documentation purposes, for example. This parameter cannot be set or modified via IO-Link.

6.7 "Response to overload - thermistor" parameter

"Response to overload - thermistor" parameter

The Response to overload - thermistor parameter can only be set using the slide switch for AUTO/MAN-RESET on the overload relay.

A detailed explanation of the functional principle of automatic and manual resetting can be found in Chapter "Performing a reset (Page 89)".

Note

The "Response to overload - thermistor" parameter can be read out via IO-Link for documentation purposes, for example. This parameter cannot be set or modified via IO-Link.

6.8 "Thermistor - monitoring" parameter

"Thermistor - monitoring" parameter

The "Thermistor - monitoring" parameter indicates whether the thermistor protection function is activated or deactivated.
A detailed explanation of thermistor protection can be found in Chapter "Activating/deactivating thermistor protection (Page 84)".

Note

The "Thermistor - monitoring" parameter can be read out via IO-Link for documentation purposes, for example. This parameter cannot be set or modified via IO-Link.

6.9 Operation with operator panel

6.9.1 "Operator panel available" parameter

With the "Operator panel available" parameter, you determine whether or not an operator panel is available for operating the solid-state overload relay.
In conjunction with the "Operation at Preset <> Actual Configuration" parameter, operation of the solid-state overload relay with or without operator panel can be configured (see Chapter "Parameter "Operation at Preset <> Actual Operation" (Page 56)").

Use of the operator panel is above all useful if manual intervention in an application is an indispensable requirement for operating the plant, or to enable manual intervention in an emergency.

The table below shows the values for the "Operator panel available" parameter.

Table 6- 3 "Operator panel available" parameter

Value	Description	Default setting
0	Operator panel available: No	—
1	Operator panel available: Yes	Yes

The "Operator panel available" parameter can only be modified via IO-Link. It cannot be adjusted at the device.

6.9.2 Parameter "Operation at Preset <> Actual Operation"

The "Operation at Preset <> Actual Configuration" parameter sets the severity level of the test for the "Operator panel available" parameter.

The table below shows the values for the "Operation at Preset <> Actual Configuration" parameter.

Table 6- 4 "Operation at Preset <> Actual Configuration" parameter

Value	Description	Default setting
0	Operation at Preset <> Actual Configuration: Disable	—
1	Operation at Preset <> Actual Configuration: Enable	Enable

If the value of the "Operation at Preset <> Actual Configuration" parameter is set to "Enable", the solid-state overload relay can be operated via IO-Link regardless of whether an operator panel is connected or not.

If the value of the "Operation at Preset <> Actual Configuration" parameter is set to "Disable", the solid-state overload relay can only be operated if the setting of the "Operator panel available" parameter is precisely fulfilled. If the setting of the "Operator panel available" parameter is not fulfilled, the diagnostics message "Preset <> Actual Configuration" is output by the controller.

The following table shows the effects of the sample parameter values set:

Table 6- 5 Parameter setting - example of operation with operator panel

Set parameter values	Practical implementation		
	Operator panel available	Operator panel not available	Operator panel is disconnected during operation
"Operator panel available" = "yes" and "Operation at Preset <> Actual Configuration = "Disable"	Operation of the solid-state overload relay possible.	Operation of the solid-state overload relay not possible. → Fault message "Preset <> Actual Configuration"	The solid-state overload relay trips. Further operation of the device not possible. → Fault message "Preset <> Actual Configuration"
"Operator panel available" = "no" and "Operation at Preset <> Actual Configuration = "Disable"	The solid-state overload relay trips. Further operation of the device not possible. → Fault message "Preset <> Actual Configuration"	Operation of the solid-state overload relay possible.	The group error (SF) is reset automatically. Operation of the solid-state overload relay possible.
"Operator panel available" = "yes" and "Operation at Preset <> Actual Configuration = "Enable"	Operation of the solid-state overload relay possible.	Operation of the solid-state overload relay possible.	Operation of the solid-state overload relay possible.
"Operator panel available" = "no" and "Operation at Preset <> Actual Configuration = "Enable"	Operation of the solid-state overload relay possible.	Operation of the solid-state overload relay possible.	Operation of the solid-state overload relay possible.

The "Operation at Preset <> Actual Configuration" parameter can only be modified via IO-Link. It cannot be adjusted at the device.

Note

Parameter assignment for "Operation at Preset <> Actual Configuration" refers only to the connectable operator panel.
By contrast, the diagnostics message "Preset <> Actual Configuration" can have different causes:

- The condition of the "Operator panel available" parameter is not fulfilled.
- Communication with current measuring module faulty.
- An incorrect current measuring module is connected.

Process image of outputs (PIQ) and inputs (PII) 7

Process image of output (PIQ)

The process image of outputs contains the control commands for the solid-state overload relay for IO-Link.

Table 7- 1 PIQ - Control commands

DO (1 bytes)	PIQ	Explanation
DO0.0	1: Motor direction of rotation 1	The bit affects terminals 95 / 96[1)]
DO0.1	1: Motor direction of rotation 2	The bit affects terminals 95 / 98[1)]
DO0.2	Reserved	—
DO0.3	1: Trip Reset	Acknowledgment of resettable group error [2)]
DO0.4	Reserved	—
DO0.5	Reserved	—
DO0.6	Reserved	—
DO0.7	Reserved	—

[1)] See also Chapter "Carrying out self-test (Page 86)".

[2)] For additional information on acknowledging and resetting group errors, please refer to Chapter "Performing a reset (Page 89)".

Process image of inputs (PII)

The process image of outputs contains the most important status information of the solid-state overload relay for IO-Link.

Table 7- 2 PII - status information

DI (2 bytes)	PII	Explanation
DI0.0	1: Ready (automatic)	Bit is set: The solid-state overload relay can be controlled via IO-Link.
DI0.1	1: Motor ON	Bit is set if a current flow is measured.
DI0.2	1: Group error	Bit is set if an error results in disconnection of the device or if the device cannot be switched on due to an error.[1)]
DI0.3	1: General warning	Bit is set if the device is close to a trip (thermal motor model) (LED OVERLOAD flashing) or if the device is carrying out a self-test. [2)]
DI0.4	Reserved	—
DI0.5	Reserved	—
DI0.6	Reserved	—
DI0.7	Reserved	—
DI1.0	Motor current [%]	The returned 6-bit value DI1.0 - DI1.5 gives the motor current ratio of the actual current to the set current in steps of 3.125%: $I_{act}\ (max) = 1.97 \bullet I_{rated}$ [3) 4)]
DI1.1		
DI1.2		
DI1.3		
DI1.4		
DI1.5		
DI1.6	1: Manual mode	Bit is set: The solid-state overload relay can be controlled via a connected operator panel.
DI1.7	Reserved	—

[1)] You can find detailed information on the group error via diagnostics set 92 in Chapter "Diagnostics - data set (index) 92 (Page 123)"

[2)] You can find detailed information on the general warning via diagnostics set 92 in Chapter "Diagnostics - data set (index) 92 (Page 123)"

[3)] I_{act} = actually flowing current [A]; I_{rated} = rated operational current [A]

[4)] In the case of "non-acknowledgable" errors, the maximum current is displayed: 63 (= 111111B = 0x3F)

6-bit value

6-bit value = (I_{act} • 100) / (I_{rated} • 3.125)

Evaluation of the 6-bit value

I_{act} = (6-bit value • I_{rated} • 3.125) / 100 = (6-bit value • I_{rated}) / 32

Table 7- 3 Examples of evaluation of the 6-bit value

Irated	**200 A**	**200 A**	**200 A**	**200 A**
6-bit value	**0**	**32**	**44**	**64**
I_{act}	0 A	200 A	275 A	393.75 A
I_{act} / I_{rated}	0	1	1.38	1.97

Mounting/removal

8

8.1 Mounting options

Evaluation module

The following mounting options are available for the evaluation module:

- Snap-on mounting on 35 mm rail in accordance with EN 50022
- Snap-on mounting straight onto the current measuring module 3RB2906.. (only for the sizes S00 / S0 and S2 / S3)
- Screw mounting on a flat surface with push-in lugs as accessories (3RP1903)

Current measuring module

The following mounting options are available for the current measuring module:

- Snap-on mounting on 35 mm rail in accordance with EN 50022
- Screw mounting on a flat surface with push-in lugs as accessories (3RB1900-0B)

The current measuring modules in size S00 / S0 and S2 / S3 are designed for stand-alone installation. The current measuring modules in size S6 and S10 / S12 are suitable for stand-alone installation and mounting onto contactors.

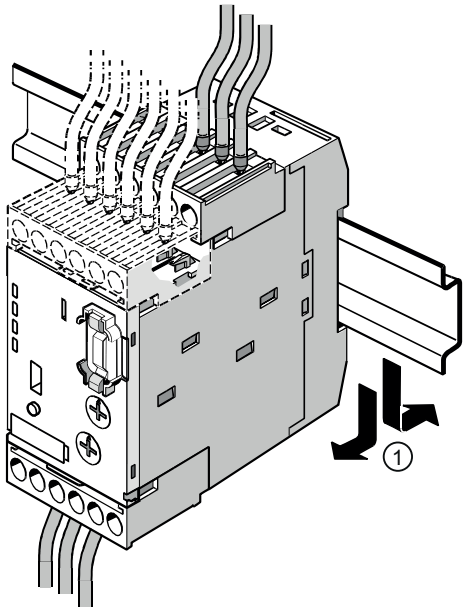
8.2 Mounting position

Mounting position

Arbitrary mounting position of the solid-state overload relay for IO-Link.

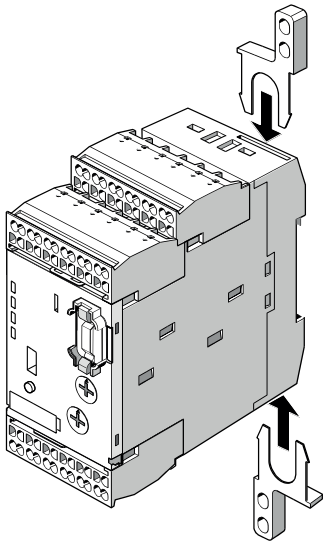
8.3 Snapping onto/off DIN rail (snap-on mounting)

The illustration below shows how to snap the devices onto/off a DIN rail:

Step	Instruction	Image
1	Place the evaluation module on the upper edge of the rail and press it down until it snaps onto the lower edge of the rail. To remove, push the evaluation module against the pressure of the securing spring and swing it out.	

8.4 Screw mounting

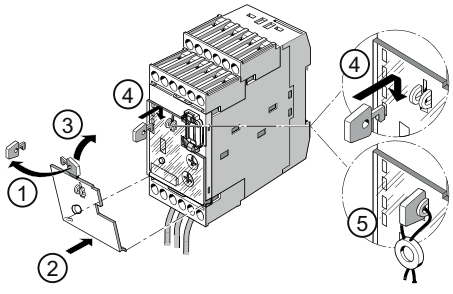
The illustrations below show how to mount the evaluation module on a level surface.

Step	Instruction	Image
1	Insert the push-in lugs for screw mounting 3RP1903 into the evaluation module at the top and bottom. Use a screwdriver to tighten the screws in the drill holes provided on the evaluation module.	

You can find information on the drill hole dimensions in Appendix "Dimension drawings (dimensions in mm) (Page 109)".

8.5 Mounting the sealing cover

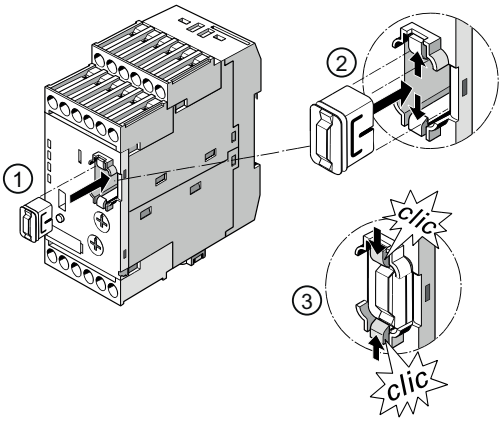
The illustration below shows how to mount the sealing cover.

Step	Instruction	Image
1	Break off the clip on the sealing cover.	
2	Insert the sealing cover into the openings on the evaluation module.	
3	Fold the sealing cover up.	
4	Insert the clip into the opening until it engages.	
5	Seal the clip to secure it against unauthorized removal.	

8.6 Inserting the interface cover

Use the interface covers to close unused interfaces. This prevents damage or contamination to the interfaces.

The illustration below shows how to assemble the interface cover.

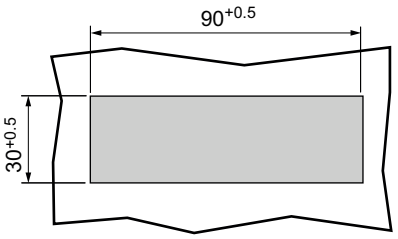
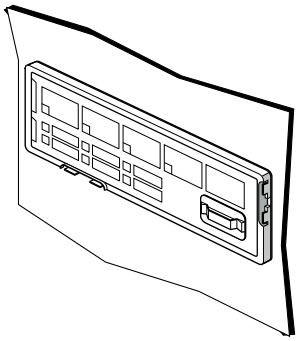
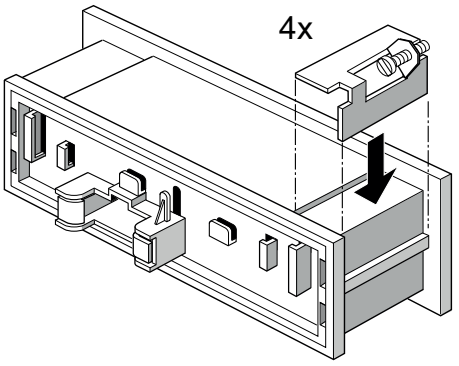
Step	Instruction	Image
1 / 2 / 3	Insert the interface cover into the slot from the front until it engages in the locking mechanism.	

8.7 Installing an operator panel

The operator panel is designed for use in the front panels of motor control centers, for example, or in control cabinet doors.

For information on connecting the operator panel, please refer to "Operation using the operator panel (Page 94)".

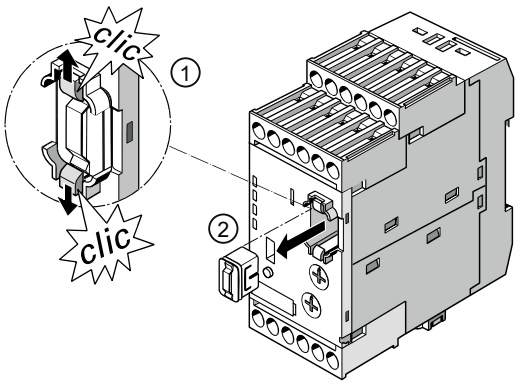
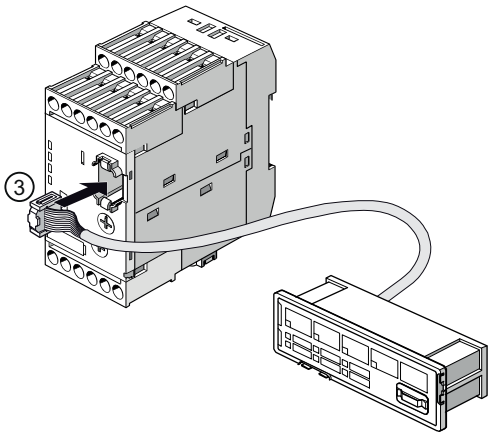
Installing

Step	Instruction	Image
1	Make a cutout in the front panel, for example, or in the control cabinet door.	
2	Insert the operator panel in the cutout.	
3	Snap the four securing brackets onto the operator panel. Screw the securing brackets with one screw each (maximum tightening torque 4 x 0.15 + 0.05 Nm).	
4	Lock the operator panel in position by tightening the four screws on the securing brackets.	

CAUTION
In order to guarantee the IP54 tightness and correct functionality of the operator panel, ensure that the tightening torque of the screws selected is not excessive when tightening the enclosed screws.

Mounting onto the solid-state overload relay for IO-Link

The illustration below shows how to mount the operator panel onto the solid-state overload relay for IO-Link.

Step	Instruction	Image
1 / 2	Disengage the locking mechanism and remove the interface cover on the front of the solid-state overload relay for IO-Link.	
3	Insert the 10-core connecting cable for the operator panel from the front into the interface of the solid-state overload relay for IO-Link.	

Note

Use the interface covers to close unused interfaces. This prevents damage or contamination to the interfaces.

Connecting

9

9.1 Connection via terminals

Connection types

The solid-state overload relays for IO-Link are connected via removable terminals with the following connection options:

- Free wiring on screw-type terminals
- Free wiring on spring-loaded terminals

Connection using screw-type terminals

DANGER

Hazardous voltage!

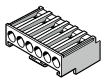
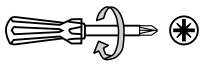
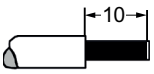
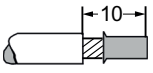
Will cause death or serious injury.

Turn off and lock out power before working on this equipment.

To tighten/release the screw-type terminals, you need a PZ 2 screwdriver. The tightening torque must be between 0.8 and 1.2 Nm.

Please refer to the table for the conductor cross-sections and stripping lengths.

Table 9- 1 Conductor cross-sections for screw-type terminals

Type of connection	Conductor cross-section
	 ∅ 5 ... 6 mm/PZ 2
	0.8 to 1.2 Nm (7 to 10.3 lb in)
	1 x (0.5 to 4) mm² 2 x (0.5 to 2.5) mm²
	1 x (0.5 to 2.5) mm² 2 x (0.5 to 1.5) mm²
AWG	2 x (20 to 14)

Connection via spring-loaded terminals

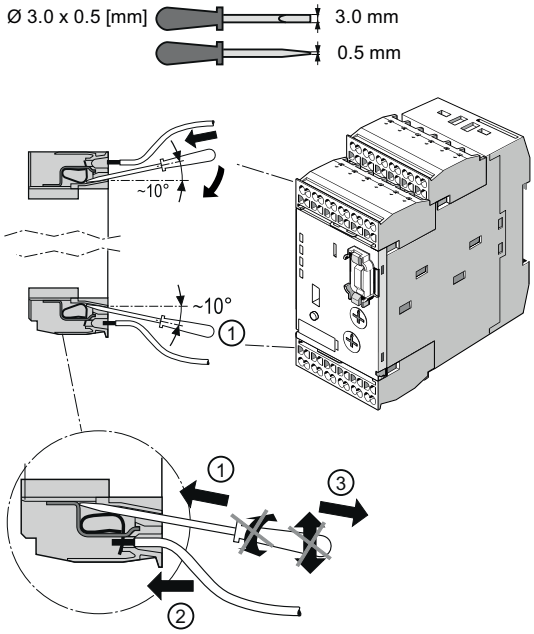
DANGER

Hazardous voltage!

Will cause death or serious injury.

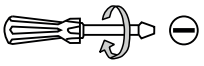
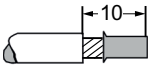
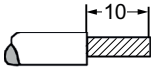
Turn off and lock out power before working on this equipment.

You need a 3-mm flat-bladed screwdriver (3.0 x 0.5 mm).

Step	Instruction	
1	To release the clamping springs, insert the screwdriver as far as it will go into the square opening of the spring-loaded terminal. Position the screwdriver at an angle of 10° with respect to the oval opening.	
2	Insert the cable as far as it will go into the oval opening and hold it in place.	
3	Remove the screwdriver. Pull on the cable to ensure it is completely secure.	

Please refer to the table for the conductor cross-sections and stripping lengths.

Table 9- 2 Conductor cross-sections for spring-loaded terminals

Type of connection	Conductor cross-section
	 (3.0 x 0.5) mm
	2 x (0.25 … 1.5) mm²
	2 x (0.25 … 1.5) mm²
	2 x (0.25 … 1.5) mm²
AWG	2 x (24 to 16)

Replacing the removable terminals

DANGER

Hazardous voltage!

Will cause death or serious injury.

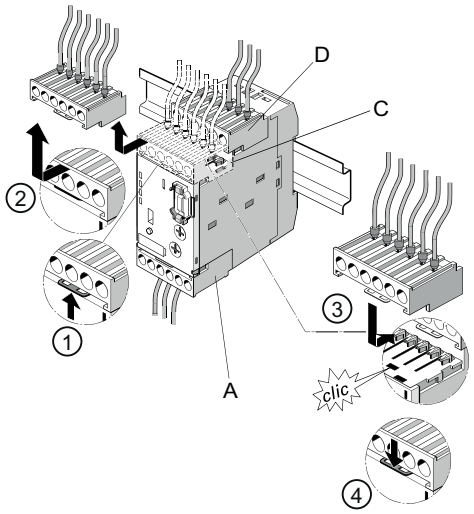
Turn off and lock out power before working on this equipment.

The removable terminals of the solid-state overload relay for IO-Link facilitate module replacement when necessary. The mechanical coding on the terminals prevents mix-ups.

Note

Terminals C and D can only be installed in the following order because of how they are arranged on the solid-state overload relay for IO-Link:

1. Rear terminal (D)
2. Front terminal (C)

Step	Instruction	Image
1	Press the interlock.	
2	Remove the terminal.	
3 / 4	Attach the new terminal and press the terminal into the device until the interlock audibly engages.	

Connection example for applications to 630 A

The motor current is calculated with the current measuring module 3RB29.6-2.... The evaluation module is connected to the current measuring module by a ribbon cable (3RB2987-2.).

Note

Connection of the main circuit is shown in the operating instructions of the current measuring module. You can find more information in Chapter "References (Page 129)"

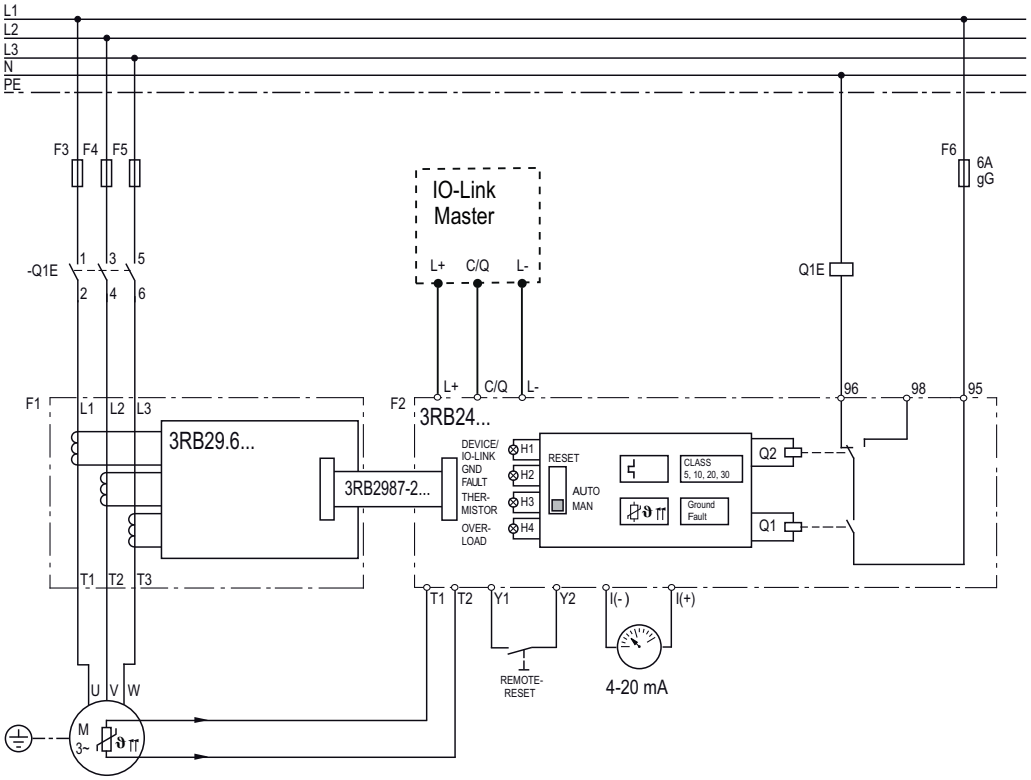


Figure 9-1 Connection example

Protection of single-phase motors

The graphic below shows the main current connection for single-phase operation.

Note

Protection of single-phase motors is not possible in conjunction with internal ground fault detection!

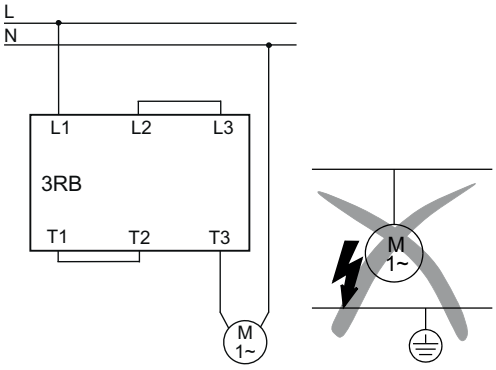


Figure 9-2 3RB2906-2.G1, 3RB2956-2TG2

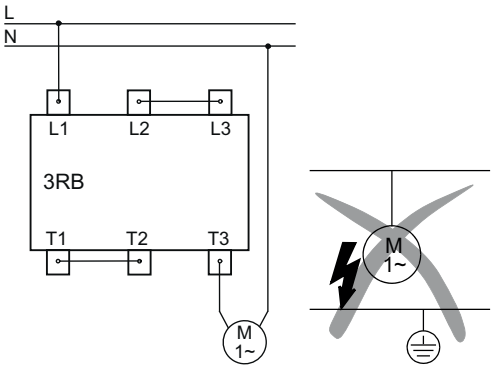


Figure 9-3 3RB2956-2TH2, 3RB2966-2WH2

9.2 Connecting the solid-state overload relay for IO-Link

The 3RB24 solid-state overload relay for IO-Link is connected to the IO-Link master via removable terminals and supplied with 24 V DC via this connection.

DANGER

Hazardous voltage!

If voltages are too high, the overload relay can be damaged and electric shock can result.

Use only power supplies that comply with the requirements of protective extra-low voltage (PELV in accordance with IEC EN 50178).

DANGER

Hazardous voltage!

Will cause death or serious injury.

Turn off and lock out power before working on this equipment.

There are 2 methods of supplying the overload relay with voltage via the control circuit.

Option 1: Connection to IO-Link master

Connect the overload relay with the master via the three cables L+, C / Q and L-. The overload relay (slave) is supplied with voltage via the three cables L+, C / Q and L-. The overload relay communicates with the master via the cable C / Q.

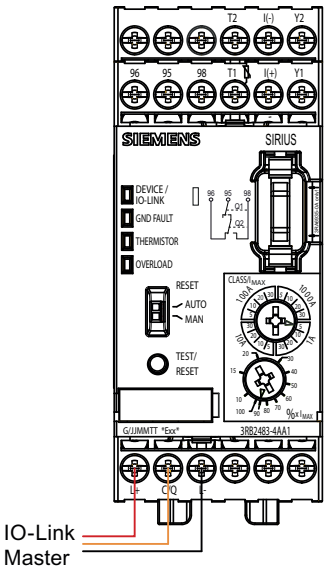


Figure 9-4 Connection to IO-Link master

Option 2: Direct voltage supply with 24 V DC

If no master is available, you can operate the overload relay with a 24 V DC voltage source in conjunction with the operator panel.

For this purpose, connect the overload relay with the voltage source via the two cables L+ and L-. Since the cable C / Q is not used in this case, communication via the IO-Link is not possible. You cannot adjust the parameters "Cold start", "Ground fault detection", "Operator panel available" and "Operation at Preset <> Actual Configuration".

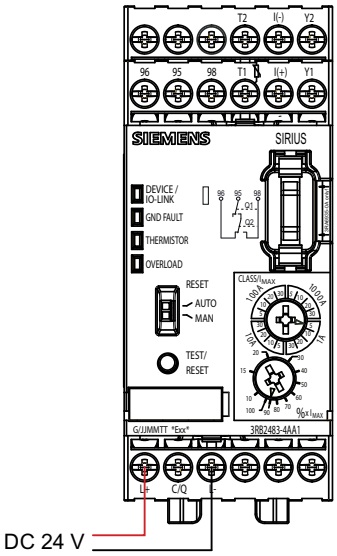
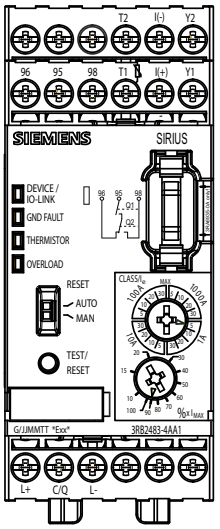
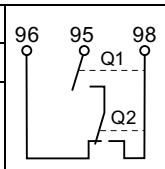


Figure 9-5 Direct voltage supply with 24 V DC

Pin assignment of the solid-state overload relay for IO-Link

The following pin assignments apply for the solid-state overload relay for IO-Link with screw-type terminals or spring-loaded terminals.

Table 9- 3 Pin assignment of the solid-state overload relay for IO-Link

Marking	Meaning		Image
L+	Supply voltage IO-Link/24 V DC	Connection for IO-Link master/PELV 24 V DC	
C/Q	Communication signal IO-Link		
L-	Chassis ground IO-Link/24 V DC		
T2	Thermistor input		
I(-)	Analog output		
Y2	Remote reset		
T1	Thermistor input		
I(+)	Analog output		
Y1	Remote reset		
96	Changeover contact Q2 - NC contact		
95	Switching contact Q1 - NO contact [1]		
98	Changeover contact Q2 - NO contact		

[1] Q1 is responsible for the ON and OFF function of the changeover unit. Q2 is responsible for the actual changeover function.

Note

Connection of the main circuit is shown in the operating instructions of the current measuring module. You can find more information in Chapter "References (Page 129)"

Operation

10

10.1 Setting the current (rated operational current) and trip class

The 3RB24 solid-state overload relay is set to the rated operational current I_e with two rotary switches.

Upper rotary switch

The upper rotary switch (CLASS / I_{MAX}) is divided into 4 ranges: 1 A, 10 A, 100 A and 1000 A. The relevant range must be selected depending on the rated operational current I_e of the motor and the current measuring module to be used with this. Within the selected range, the necessary trip class must be determined (CLASS 5, CLASS 10, CLASS 20 or CLASS 30).

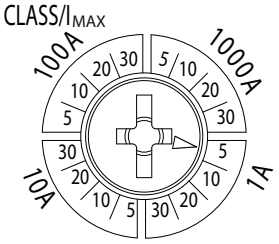


Figure 10-1 Set CLASS and I_{MAX} (e.g. CLASS 5 / 1 A)

Lower rotary switch

Using the lower rotary switch (% x I_{MAX}) with percentage scale from 10 to 100%, the rated operational voltage I_e of the motor is set as a percentage of the range selected via the upper rotary switch (CLASS / I_{MAX}).

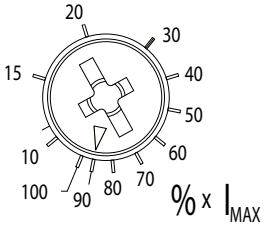


Figure 10-2 Setting the rated operational current I_e of the motor (e.g. 90%)

Example:
CLASS / I_{MAX} = 5/1 A
% x I_{MAX} = 90%
⇒ I_e = 0.9 A

Note

The motor, cables and contactor must be designed for the corresponding trip class (CLASS).

- Check the CLASS setting before initial commissioning.
- Select the relevant tripping characteristic with the rotary switch for the trip classes (CLASS / I_{MAX}).

Note

With the help of the sealable cover 3RB2984-2, you can secure the rotary switches against inadvertent operation. Assembly of the sealable cover is described in Chapter "Mounting the sealing cover (Page 65)"

Note

The set rated operational current can be read out via IO-Link for documentation purposes, for example.

Example

- Three-phase motor power = 45 kW (AC 50 Hz, 400 V)
- Rated operational current of the motor = 80 A
- Required trip class = CLASS 20
- Selected transformer: 10 to 100 A

Solution:

- Step 1: Select the area 100 A using the upper rotary switch (CLASS / I_{MAX})
- Step 2: Set the trip class CLASS 20 within the range 100 A
- Step 3: Set the lower rotary switch to 80% (= 0.8) in accordance with 100 A × 0.8 = 80 A.

Note

If the current set on the evaluation module does not match the current range of the connected current transformer, a diagnostics message results.

You can find more information on the errors in Chapter "Fault codes (only in the case of non-acknowledgeable faults) (Page 104)".

Trip classes

The 3RB24 solid-state overload relay for IO-Link is suitable for normal starting conditions and heavy starting conditions. Depending on the prevailing starting condition, the required trip class CLASS 5, CLASS 10, CLASS 20 or CLASS 30 can be set using a rotary switch.

Note

The set trip class can be read out via IO-Link for documentation purposes, for example.

Tripping characteristics

The tripping characteristics map the relationship between tripping time and tripping current as a multiple of the rated operational current I_e; they are specified for symmetrical 3-pole loading and 2-pole loading from cold.

Minimum tripping current

The lowest current at which tripping will occur is known as the minimum tripping current. According to IEC 60947-4-1, the minimum tripping current must be within defined limits. In the case of the 3RB24 solid-state overload relay, the limits for the minimum tripping current with symmetrical 3-pole loading are between 105 and 120% of the rated operational current.

Tripping times

The minimum tripping current determines the progression of the tripping characteristic up to higher tripping currents based on the characteristics of the trip classes. The trip classes describe time intervals within which the solid-state overload relays for IO-Link have to trip in the case of a symmetrical, 3-pole load from the cold state with 7.2 times the rated operational current I_e.

The tripping times according to IEC/EN 60947-4-1, tolerance band E, are shown in the table below.

Table 10- 1 Tripping times

Trip class	Tripping time
CLASS 5	3 ... 5 s
CLASS 10	5 ... 10 s
CLASS 20	10 ... 20 s
CLASS 30	20 ... 30 s

Tripping characteristics for 3-pole load

The tripping characteristic for a solid-state overload relay loaded at 3 poles from cold applies subject to the requirement that all three phases are loaded with the same current at the same time.

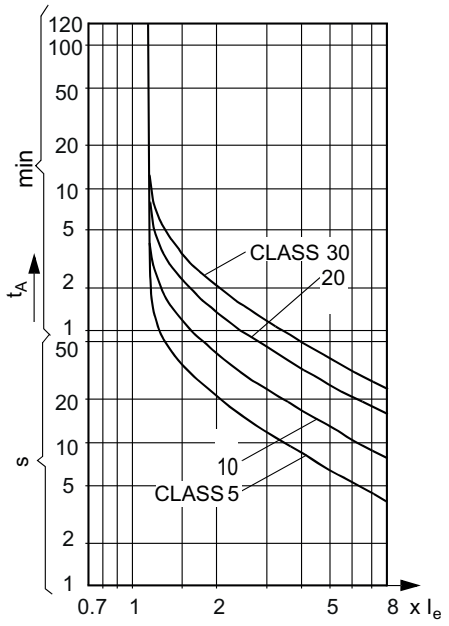


Figure 10-3 Tripping characteristic for 3-pole load

Phase failure detection

To minimize the temperature rise of the load in the case of a phase failure during single-phase operation, the 3RB24 solid-state overload relay for IO-Link has a phase failure detection feature.

Tripping characteristics for 2-pole load

In the case of a phase failure or current unbalance > 40 % (in accordance with NEMA), the 3RB24 solid-state overload relay disconnects the contactor faster to minimize the temperature rise of the load. This operation takes place in accordance with the tripping characteristic for two-pole load from cold.

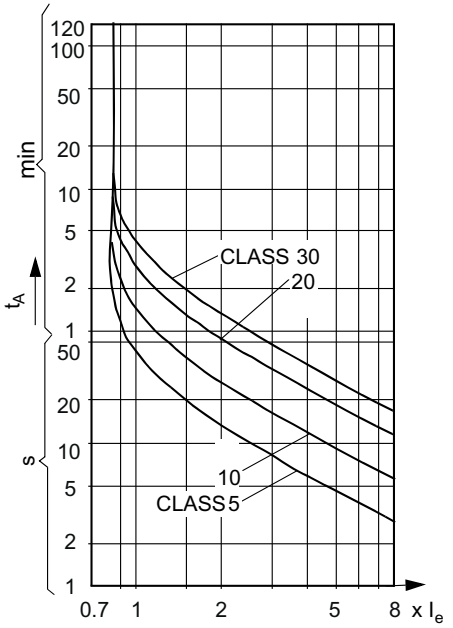


Figure 10-4 Tripping characteristic for 2-pole load

The characteristic curves apply for cold restart. In the case of a start with preloading, the tripping times t_A are lower.

Tripping time in the case of loads at operating temperature

Compared with a cold load, a load at operating temperature obviously has a lower temperature reserve. It is for this reason that the tripping time of the 3RB24 solid-state overload relay is reduced to approximately 30% following prolonged loading with the rated operational current I_e.

10.2 Activating/deactivating thermistor protection

Activation

The thermistor protection function is disabled in the delivery state. If the device detects a connected thermistor when switched on, the thermistor is automatically activated. If the thermistor is removed, the thermistor function must also be deactivated by the user, otherwise, a diagnostics message is generated. You can find more information on the faults in Chapter "Fault codes (only in the case of non-acknowledgeable faults) (Page 104)".

Deactivation

If you press and hold down the TEST/RESET button while switching on the control voltage (L+ / L-), the THERMISTOR LED lights up. If you now release the button within 3 s, the thermistor function is deactivated. This is indicated by flashing of the THERMISTOR LED at 7 s intervals.

NOTICE
Danger of false short-circuit detection! To guarantee sure functioning of the short-circuit detection in the thermistor circuit, the line resistance must not exceed 10 Ω in the case of a short-circuited thermistor.

Note

The "Thermistor - monitoring" parameter can be read out via IO-Link for documentation purposes, for example. This parameter cannot be set or modified via IO-Link.

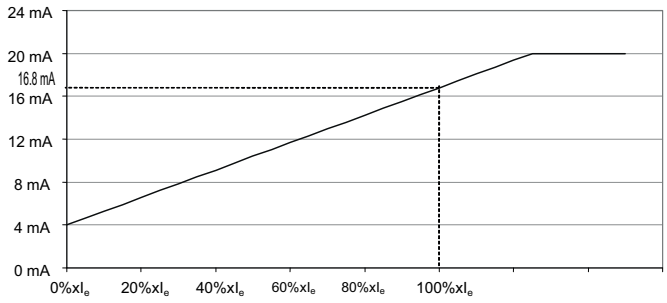
10.3 Outputting an analog signal

Outputting the motor current with the help of an analog signal

The motor current measured by the microprocessor can be output in the form of an analog signal DC 4 mA to 20 mA for activating three-phase permanent-magnet moving-coil instruments or supplying analog inputs of programmable controllers. The output value always indicates the maximum value of the three phases. Transfer of the current values via IO-Link is represented in Chapter "Process image of outputs (PIQ) and inputs (PII) (Page 59)". The analog values of the 3 phases can be read out in detail via data set "Measured value - data set (index) 94 (Page 125)".

Example of recording the analog value

Output current range: 4 ... 20 mA
Increment: 1 % x I_e = 0.128 mA



I/I_e [%] = (I_{out} - 4 mA) / 0.128 mA
I_{motor} [A] = (I_{out} - 4 mA) x I_e / 12.8 mA
I_{out} [mA] = I_{motor} x 12.8 mA / I_e + 4 mA

Figure 10-5 Recording the analog value

Example:
Output analog value I_{out} = 10.40 mA; set motor current I_e = 6.0 A
I_{motor} = ((10.40 mA - 4 mA) x 6 A) / 12.8 mA = 3 A

Table 10- 2 Example

Feature	Value
Maximum output current	20 mA
Terminals	I(+) and I(-)
Maximum load	100 Ω
Accuracy	+ / - 5 %
Short-circuit-proof and open circuit-proof	Yes

10.4 Carrying out self-test

TEST function

The proper function of the ready overload relay can be checked by pressing the TEST/RESET button.

The following functions are tested:

- LEDs
- Device hardware
- Device configuration (GND FAULT, THERMISTOR): The actively parameterized functions are tested.

Test phases

The test phase runs while the TEST/RESET button remains pressed for 6 seconds. During the test phase, direct current is output at the terminals of the analog output. After 24 seconds, the auxiliary contacts are closed and the feeder is thus disconnected. The self-test has been completed.

The self-test can be aborted at any time by releasing the TEST/RESET button.

Resetting the relay after test triggering

Following a successful self-test, the relays are in the OFF state. To be able to switch the relays again, you must acknowledge the end of the test. For this purpose, press the TEST/RESET button again for longer than 1 s.

The relays respond differently depending on whether the overload relay is controlled at this time via IO-Link or via the operator panel:

1. Control via IO-Link (automatic mode)
   After acknowledging the test, the switching signals DO 0.0 and DO 0.1 pending from the controller are valid. The relays therefore assume the states requested by the controller immediately after acknowledgment of the test. The reset mode of the device (automatic reset/manual reset) is irrelevant.
2. Control via operator panel (manual mode):
   After acknowledgment of the test, you must switch the relays on again manually. The reset mode of the device (automatic reset/manual reset), and the switching signals pending from the controller (DO 0.0 and D0 0.1) are irrelevant.

Carrying out self-test

The self-test is initiated by pressing the TEST/RESET button for t > 1 s. All protection functions remain active during the self-test. A trip/warning results in abort of the self-test. The self-test is also carried out if the TEST/RESET button is pressed for t > 1 s at the moment of switching on the overload relay.

Note

Regular tests of the device are described in EN 60079-17.
The self-test of the 3RB24 solid-state overload relay for IO-Link encompasses a full function test. All the test phases described in the table below must be executed. The individual test phases are the display test (1), the configuration test (2), the internal test with current measurement (3), the relay test (4) and the acknowledgment (5).
The measured current values and the correct opening and closing of the relay contacts (test phase 4) must be checked by the user!

Table 10- 3 Test phases

Test phase	Duration	Description	Comment
1	3 s	Indicator test	Check that all LEDs flash.
2	3 s	Configuration test	Active ground fault monitoring and/or thermistor monitoring is/are indicated by flickering of the relevant LED(s). Active automatic reset is signaled by a flickering DEVICE/IO-Link LED.
3	18 s	Internal tests	The system carries out internal tests. During the test, you can compare the highest motor current of the 3 phases with the current of the analog output.
4	—	Relay test [1]	System opens the outputs 95/96 and 05/06.
5	2 s	Acknowledgment [2]	Press the TEST/RESET button for 2 s.

[1] The flickering of the three red LEDs for 2 seconds initiates shutdown of the relays. The user test can be aborted without shutting down the relays at any time up to this point.

[2] In automatic mode (control via IO-Link), the relay control commands DO 0.0 / DO 0.1 are accepted again.

The graphic below represents the chronological sequence of the test phases:

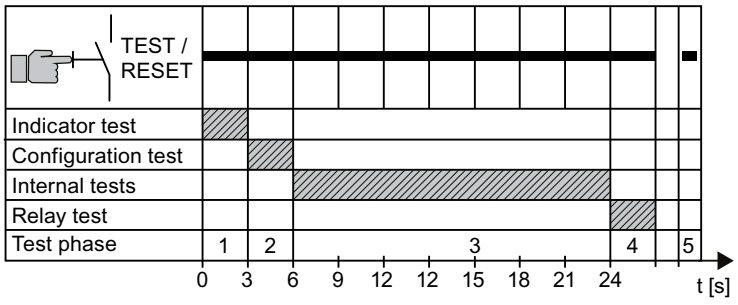


Figure 10-6 Chronological sequence of the test phases

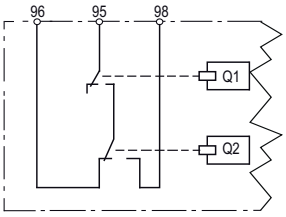
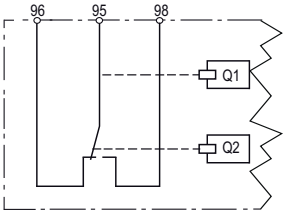
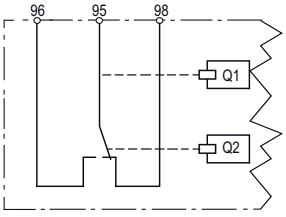
Response of the relay contacts

The device can be in one of the following three states at the time of the self-test:

1. Everything off (factory setting)
2. Clockwise rotation
3. Counter-clockwise rotation

During the first three test phases, the switching state of the relay contacts remains the same. A change in the contacts only takes effect when the relay test is concluded (test phase 4):

Table 10- 4 Response of the relay contacts in test phase 4 depending on the current switching state

Current switching state	Response of the relay contacts
Everything off 	Relay Q1 and Q2 remain in the drop-out state.
Clockwise rotation 	Relay Q1 is in the pick-up state.
Counter-clockwise rotation 	Relay Q1 and Q2 are in the pick-up state.

10.5 Performing a reset

Possible reset settings

When you confirm a fault, you confirm that you have taken account of the fault message. You acknowledge fault messages with the Reset function.

You determine the reset method with the slide switch for AUTO/MAN RESET. You can choose between manual and automatic reset. The position of the slide switch for AUTO/MAN RESET is continuously read in by the controller during operation.

- **Automatic reset:** Automatic reset only functions with thermistor tripping and overload tripping (thermal motor model overload). In the case of automatic reset, the fault acknowledges itself automatically as soon as the cause of the fault (e.g. overheating of the motor) is no longer active.
- **Manual reset:** With manual reset, you as the user must actively acknowledge the fault message via the TRIP/RESET button on the device, the SF/RESET button on the operator panel, a remote reset, or the IO-Link. All fault messages can be acknowledged manually.
  "Non-acknowledgeable faults" are the exception. "Non-acknowledgeable faults" can only be reset by removing the control supply voltage for at least 3 seconds. You can diagnose "non-acknowledgeable faults" direct on the device by means of a flashing code sequence of the three red LEDs. You can find the fault codes for "non-acknowledgeable faults" in Chapter "Fault codes (only in the case of non-acknowledgeable faults) (Page 104)".

Note

Resetting switching states

When you acknowledge a fault, you confirm that you have taken account of a fault message. The acknowledgment deletes the fault bits in the device but the switching states are not restored.

The switching states only become active again when the cause of the fault has been removed and the switching relays are activated again.

You can find information on how to remove the causes of faults in Chapter " IO-Link diagnostics (Page 106)".

The table below provides an overview of the possible reset methods depending on the pending fault message:

Error message	Manual reset	Automatic reset
Thermistor tripping	✓	✓
Overload tripping	✓	✓
Ground fault tripping	✓	—
Switching element defective (current flowing despite disconnection)	✓	—
Residual current tripping (switching relay switched on but no current flow can be measured)	✓	—
Current flow in operating mode "Cold start"	✓	—
Connection abort in manual mode of the operator panel [1)]	✓	✓
Process image error (both relay switching options are selected simultaneously via IO-Link) [2)]	✓	✓
Preset <> Actual Configuration	✓	✓
"Non-acknowledgeable faults"	— [3)]	— [3)]

1) In manual mode only (control via operator panel).

2) In automatic mode only (control via IO-Link).

3) Fault acknowledgment and resetting of the relay switching states only by opening and reclosing the 3RB24 overload relay.

10.5.1 Manual reset

Manual reset

If the slide switch on the device is set to "MAN", you can acknowledge faults in the following ways:

- Trip reset (process image of the outputs via IO-Link)
- TEST/RESET button on the 3RB24 overload relay
- SF/RESET button on the 3RA6935-0A operator panel
- Remote reset: Remote reset can be implemented electrically by jumpering terminals Y1 and Y2.

⚠ WARNING

Automatic restart!

Can result in death, serious injury, or property damage.

The motor switches on again when the following condition is met:

- the overload relay is in automatic mode, and following the reset, the pending control commands DO 0.0 / DO 0.1 of the higher-level controller are executed again.

Manual reset must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly.

Make sure that the machine danger zone is kept clear of people at the time of restarting.

10.5.2 Automatic reset

Automatic reset

If the slide switch on the device is set to "AUTO", a tripping operation (current-dependent or temperature-dependent protection) is acknowledged as soon as the recovery time has elapsed or the temperature measured by the thermistor has dropped below the reclosing value.

⚠ WARNING

Automatic restart!

Can result in death, serious injury, or property damage.

The motor switches on again when all the following conditions are met:

- Automatic reset is set
- The cause of the fault message is no longer active
- The overload relay is in automatic mode and an ON command is active

Automatic reset must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly.

Make sure that the machine danger zone is kept clear of people at the time of restarting.

Recovery time

The time between tripping and resetting is determined by the recovery time.

The recovery time depends on the tripping method:

1. Recovery time after **current-dependent tripping**:
   On the 3RB24 solid-state overload relay for IO-Link, the recovery time following current-dependent tripping is approximately three minutes regardless of the reset mode set. The recovery time gives the load a chance to cool down.
2. Recovery time following **temperature-dependent tripping**:
   If temperature-dependent tripping takes place through a connected PTC thermistor sensor circuit, the device can only be reset manually or automatically when the winding temperature at the installation location of the cold conductor has cooled down to 5 Kelvin below its response temperature.
3. Recovery time following **other faults**:
   With all other faults, the overload relay is capable of reclosing as soon as the fault has been removed.

If the solid-state overload relay for IO-Link has tripped for one of the following reasons, you reset the device by one of the actions listed in the table below after the appropriate time.

Table 10- 5 Resetting the solid-state overload relay for IO-Link

Reason for tripping	Reset action				
	Brief pressing of the TEST/RESET button	Remote reset (press button at Y1-Y2)	Automatic reset (switch[2)])	Reset via IO-Link Process image	Operator panel
Self-test	Immediately				
Overload[1)]	After 3 min.			After 3 min.[3)]	
Thermistor[1)]	When 5 K below response temperature reached.			When 5 K below response temperature reached.[3)]	
Ground fault	Immediately		Not functional	Immediately	

1) If the thermistor trip and the overload trip have responded simultaneously, the longer reset phase is valid.

2) In the "AUTO" switch position, the overload relay resets automatically.

3) The slide switch must be set to "MAN".

NOTICE

Continuous reclosing!

If you apply the reset selection continuously, e.g. by continuously pressing the TEST/RESET button, or by continuously sending a reset signal via the controller, the overload relay closes continuously and trips again immediately afterwards.

Remove the cause for the trip before carrying out a reset.

Apply the reset selection for no more than 2 s, e.g. by briefly pressing the TEST/RESET button, or by setting and then resetting the reset signal via the controller.

RESET function with trip-free mechanism

The RESET function with trip-free mechanism prevents reclosing of the solid-state overload relay while a fault is being diagnosed.

The protection functions are not hindered by the following actions:

- Holding the TEST/RESET button
- Short-circuit of the contacts (Y1, Y2) of the remote reset
- Continuous pressing of the SF/RESET button at the connected operator panel
- Continuously active trip reset command from the controller

Note

The cause of the fault must be removed before the RESET.

10.6 Operation using the operator panel

Operation using the operator panel

The solid-state overload relay for IO-Link is controlled in manual mode with the operator panel. The device statuses are also scanned.

Connecting

The operator panel is connected to the interface on the front of the solid-state overload relay for IO-Link using the 10-core connecting cable for the operator panel.

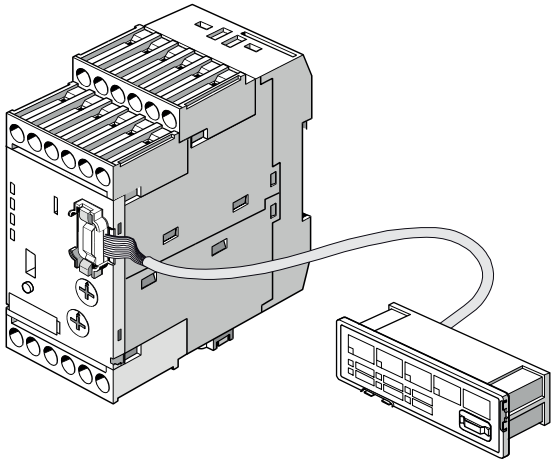


Figure 10-7 Connecting the operator panel to the solid-state overload relay for IO-Link

CAUTION
To avoid faults in the overload relay and a defect on the operator panel, connect or disconnect the operator panel only when the power to the evaluation unit is turned off.

Operator controls and display elements of the operator panel

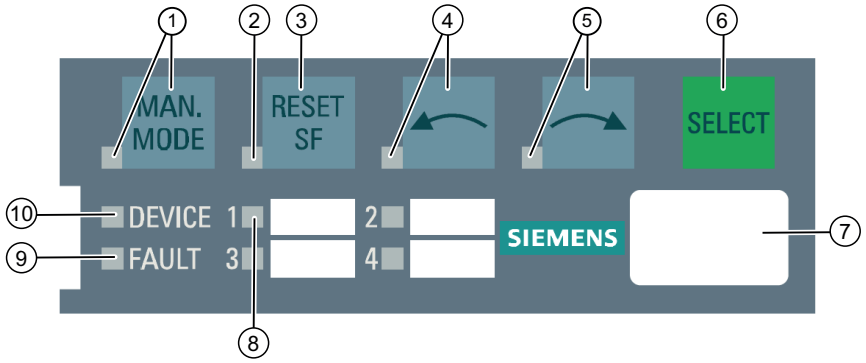
The representation below explains the operator controls and display elements of the operator panel.

Note

Enable signals from the enabling module

The operator controls of the operator panel only function if the enabling module is plugged in.

Table 10- 6 Operator controls and display elements of the operator panel



(1)	Manual Mode button and LED	You isolate the solid-state overload relay for manual mode using the MANUAL MODE button. Switching between manual mode and automatic mode is confirmed by lighting up of the "MANUAL MODE" LED. Please note the following warning information!
(2)	SF LED	The SF LED shows a RED light if there is a group error of the solid-state overload relay.
(3)	RESET SF button	You manually reset the overload relay using the RESET SF button.
(4)	↶ Button and LED	You use the ↶ button to activate the solid-state overload relay in direction of rotation 2 (counter-clockwise). The LED lights up to confirm this.
(5)	↷ Button and LED	You use the ↷ button to activate the solid-state overload relay in direction of rotation 1 (clockwise). The LED lights up to confirm this.
(6)	SELECT button	If you press the SELECT button for more than 5 seconds, you switch the solid-state overload relay between jog mode and continuous mode. The change to the operating mode is confirmed by flashing of the "MANUAL MODE" LED.
(7)	Slot for enabling module	Plug the enabling module into the slot to take control priority of the solid-state overload relay.
(8)	LED 1	LED 1 indicates whether the solid-state overload relay is selected: - Yellow: Connection to the solid-state overload relay.

(9)	FAULT LED	The FAULT LED indicates whether communication between the solid-state overload relay and the operator panel is functioning properly and whether a system fault is pending: - Red: No communication between the solid-state overload relay and the operator panel. - Flashing red: There is a non-acknowledgeable fault. - Off: Communication between the solid-state overload relay and the operator panel is functioning properly.
(10)	DEVICE LED	The DEVICE LED indicates whether the operator panel is ready to run: - Green: Operator panel is ready to run.

⚠ WARNING

Automatic restart!

Can result in death, serious injury, or property damage.

The motor switches on again when the following condition is met:

- the overload relay is switched from manual mode to automatic mode with the help of the operator panel, and the pending control commands DO 0.0 / DO 0.1 of the higher-level controller are executed again.

Manual switching from manual mode to automatic mode must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly.

Make sure that the machine danger zone is kept clear of people at the time of restarting.

Monitoring mode

The operator panel is always in monitoring mode as standard. The user can read the switching states of the solid-state overload relay for IO-Link and detect group errors.

Table 10- 7 Monitoring mode of the operator panel

Action	Procedure
Reading off the selection	1. Read off the selection: - ↷ LED shows yellow light: Direction of rotation 1 (clockwise) on. - ↶ LED shows yellow light: Direction of rotation 2 (counter-clockwise) on. - ↷ LED and ↶ LED are off: No selection.
Detecting group errors	1. Check whether a group error is present: - SF LED shows red light: Group error present. - SF LED is off: No group error.
Detecting non-acknowledgeable errors	1. Check whether a group error is present: - SF LED shows red light: Group error present. - SF LED is off: No group error. 2. Check whether a non-acknowledgeable error is present: - FAULT LED flashes: Non-acknowledgeable error present - FAULT LED is off: No system error

Manual mode

You can take control priority over the solid-state overload relay for IO-Link in manual mode. This enables the user to activate the device using the operator panel.

Note

Switching between automatic mode and manual mode

To switch between automatic and manual mode, you require an enabling module.

Please therefore ensure when changing from manual to automatic mode that you activate automatic mode first before removing the enabling module.

To use the operating panel and activate manual mode of the solid-state overload relay, you require an enabling module.

⚠ WARNING

Automatic restart!

Can result in death, serious injury, or property damage.

The motor switches on again when the following condition is met:

- the overload relay is in automatic mode, and following a manual or automatic reset, the pending control commands DO 0.0 / DO 0.1 of the higher-level controller are executed again

Manual or automatic reset must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly.

Make sure that the machine danger zone is kept clear of people at the time of restarting.

Note

After applying the control supply voltage, the operator panel is in jog mode. If the voltage fails and manual mode is active, the operator panel will be in jog mode following renewed application of the control supply voltage.

Table 10- 8 Manual mode of the operator panel

Action	Procedure
Activating manual mode	1. Insert the enabling module into the slot in the operator panel. 2. Press the MANUAL MODE button to activate manual mode. Successful activation is confirmed by lighting up of the "MANUAL MODE" LED.
Activating the solid-state overload relay in jog mode	1. Activate the starter by pressing - The ↷ button for direction of rotation 1 (clockwise) and - The ↶ button for direction of rotation 2 (counter-clockwise). 2. Hold the button pressed while activating. Activation stops as soon as you release the button.
Changing from jog mode [1] to continuous mode [2]	Change to continuous mode by pressing the SELECT button for longer than 5 seconds. The changeover is confirmed by flashing of the "MANUAL MODE" LED.
Activating the solid-state overload relay in continuous mode	1. Activate the solid-state overload relay by pressing - The ↷ button for direction of rotation 1 (clockwise) and - The ↶ button for direction of rotation 2 (counter-clockwise). 2. Press the ↷ or ↶ button again to stop activation.
Change from continuous mode [2] to jog mode [1]	Change to jog mode by pressing the SELECT button for longer than 5 seconds. The changeover is confirmed by flashing of the "MANUAL MODE" LED.
Resetting to automatic mode	1. Make sure that the solid-state overload relay is not activated. 2. Press the MANUAL MODE button to activate automatic mode. If activation is successful, the "MANUAL MODE" LED goes out. 3. Remove the enabling module from the operator panel.

[1] **Jog mode**: The solid-state overload relay is only activated while you press the ↷ or ↶ button. Activation stops as soon as you release the button.

[2] **Continuous operation:** If you press the ↷ or ↶ button, the solid-state overload relay is activated until you press the button again.

⚠ WARNING

Machine start-up!

Can Cause Death, Serious Injury or Property Damage

If you reset the operator panel to automatic mode while an ON command is simultaneously pending via the IO-Link, the solid-state overload relay switches back on immediately and the machine starts up. People may be injured if they stay in the danger area of the machine.

Make sure that the danger area of the machine is kept clear of people.

Diagnostics

11

11.1 Indication of the operating state

Indication of the operating state

The operating state of the solid-state overload relay is indicated via four LEDs.

Status	Status display	Auxiliary contacts
Device ready, no trip	DEVICE / IO-LINK: green continuous light[1)]	The set status of the relay remains in force.
Communication via IO-Link	DEVICE / IO-LINK: green interrupted continuous light (LED is interrupted for 200 ms every 3 s)	The set status of the relay remains in force.
Simultaneous flashing of the following LEDs: • GND FAULT • THERMISTOR • OVERLOAD (See Chapter "Fault codes (only in the case of non-acknowledgeable faults) (Page 104)") or device defective	DEVICE / IO-LINK: red continuous light	95/96 open 95/98 open
Ground fault tripping	GND FAULT: red continuous light DEVICE / IO-LINK: red continuous light	95/96 open 95/98 open
Thermistor trip	THERMISTOR: red continuous light DEVICE / IO-LINK: red continuous light	95/96 open 95/98 open
Thermistor deactivated	THERMISTOR: red flashing at 7 s intervals	The set status of the relay remains in force.
Overload tripping	OVERLOAD: red continuous light DEVICE / IO-LINK: red continuous light	95/96 open 95/98 open
Overload warning[2)]	OVERLOAD: red flickering light	The set status of the relay remains in force.
User test	See Chapter "Carrying out self-test (Page 86)"	

Status	Status display	Auxiliary contacts
Device not ready		
a) IO-Link voltage failure	DEVICE / IO-LINK: dark	95/96 open 95/98 open
b) Functional test negative	DEVICE / IO-LINK: red continuous light	95/96 open 95/98 open
c) Device fault	DEVICE / IO-LINK: red continuous light	95/96 open 95/98 open

1) With existing IO-LINK connection, green interrupted continuous light (LED is interrupted for 200 ms every 3 s)

2) The OVERLOAD LED flickers when the minimum tripping current is reached and indicates the imminent trip:

- In 3-pole operation with a maximum unbalance ≤ 40%: from 1.14 x I_e
- In 1-pole and 2-pole operation with a maximum unbalance > 40%: 0.85 x I_e

11.2 Auxiliary contacts

Auxiliary contacts

The auxiliary contacts of the 3RB24 solid-state overload relay are an NO contact and a changeover contact switched downstream of the NO contact.

Response of the auxiliary contacts

The 3RB24 solid-state overload relay for IO-Link has monostable auxiliary contacts. The auxiliary contacts return to the initial state if voltage is not supplied.

Response to IO-Link voltage failure

If the supply voltage fails, both internal relays drop out (95/96 open, 95/98 open). Depending on whether the overload relay is controlled at this time via IO-Link or via the operator panel, the relays assume different states when the supply voltage is restored:

1. Control via IO-Link (automatic mode)
   When the supply voltage is restored, the control commands pending from the controller (IO-Link master) are transferred direct and the relays are switched immediately.
2. Control via the operator panel (manual mode):
   Relays remain in the drop-out state and must be closed again manually. Press the relevant button (button or button) on the operator panel to activate the directions of rotation. After applying the control supply voltage again, the operator panel is in jog mode.

WARNING

Automatic restart

Can result in death, serious injury, or property damage.

Automatic mode must not be used in applications where there is a risk of serious injury to persons or substantial damage to property from an unexpected restart.

11.3 Fault codes (only in the case of non-acknowledgeable faults)

In the case of faults, the system outputs fault codes in the form of a flashing sequence of the three red LEDs "GND FAULT", "THERMISTOR" and "OVERLOAD".

The example shows a fault with code number 6.

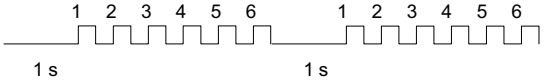


Figure 11-1 Fault codes - example

The table below describes the possible faults and the measures to be taken to remedy a fault.

Note

When remedying a fault, the following sequential order must always be followed:

1. Removing the control supply voltage at the 3RB24 solid-state overload relay.
2. Remove the cause of the fault.
3. Applying the control supply voltage at the 3RB24 solid-state overload relay.

Table 11- 1 Error codes

Code	Description	Remedy[1)]
1	Thermistor fault on starting. The thermistor is activated but not detectable or no longer detectable. There is possibly a wire break.	Check the thermistor. Deactivate the thermistor or connect the thermistor.
2	Thermistor fault: Short-circuit. The thermistor has short-circuited.	Remove the short-circuit.
3	Thermistor fault: Wire break. The connection is interrupted.	Remove the interruption and connect the thermistor.
4	—	—
5	There is a fault in communication with the current measuring module during starting.	Check that the current measuring module is connected.
6	The assignment of the rated operational current I_e to the current measuring module is incorrect: The set rated operational current I_e is outside the permissible current range of the current measuring module, or the rotary switch is outside 10 ... 100%. (See Chapter "Setting the current (rated operational current) and trip class (Page 79)")	Check the set rated operational current I_e on the solid-state overload relay. Correct the setting error with the help of the two rotary switches on the device.
7	An invalid current measuring module has been detected.	Connect the 3RB29.. current measuring module. You can find the suitable current measuring modules in Chapter "System components (Page 23)".
8	Undervoltage detected: The permissible lower limit for operating voltage has been violated.	Correct the operating voltage setting to a permissible value.
9	—	—
10	Internal fault: An internal fault has been detected.	Return the device to the manufacturer.

1) Reset possible by switching off the control voltage supply and disconnecting the IO-Link supply voltage.

11.4 IO-Link diagnostics

IO-Link diagnostics

The manufacturer-specific diagnostics listed in the table are reported via the diagnostic mechanism of IO-Link. The table below provides information on possible causes and remedial measures:

Table 11- 2 Possible causes and remedial measures

Diagnostics and messages	Possible causes	Possible remedial measures
Preset <> actual configuration	• Fault in communication with current measuring module. • Wrong current measuring module. • Operator panel available/not available.	• Check the connection to the current measuring module and replace the current measuring module if necessary. • Connect a suitable current measuring module. • Correct the parameter "Operator panel available". • Change the parameter "Operation at Preset <> Actual Operation" to "enable":
Switching element defective	• Contactor welded. • Defective relay contacts in the 3RB24 overload relay.	• Replace the contactor. • Replace the overload relay.
Process image error	Error in the process image of the directions of rotation: Direction of rotation 1 and direction of rotation 2 are active simultaneously.	• Delete the selection of the two directions of rotation in the process image. • Correct the selection via the process image.
Manual mode connection abort (operator panel)	Operator panel removed in "manual mode"	Remount operator panel and perform "reset to automatic mode". (see "Manual mode" in the Chapter "Operation using the operator panel (Page 94)")[1)]
The overload relay is in manual mode and cannot be controlled using the operator panel.	• There is a group error. • The enabling module has been removed from the operator panel.	• Remove the cause of the fault and reset the group error. • Insert the enabling module into the slot on the operator panel.
Thermistor overload	Overheating of the motor.	• Allow the motor to cool down.
Overload tripping	Overheating of the motor.	• Allow the motor to cool down.
Ground fault tripping	The overload relay has detected a ground fault.	Eliminate the ground fault.

Diagnostics and messages	Possible causes	Possible remedial measures
Residual current tripping (Switching relay is switched on but there is no current flow.)	• Defective contactor. • Defective fuse in the main circuit. • Defective relay in the overload relay.	• Replace the contactor. • Replace the fuse in the main circuit. • Replace the overload relay.
Thermistor wire break	• Connection to the thermistor disrupted. • Thermistor is defective.	• Renew the connection to the thermistor. • Renew the thermistor.
Thermistor short-circuit	• Connection to the thermistor is defective/flattened. • Thermistor is defective.	• Renew the connection to the thermistor. • Renew the thermistor.
Electronics supply voltage too low	Supply voltage too low or incorrect	• Ensure a supply voltage with 24 V DC.
Self-test error	Fault in internal test	Return the device to the manufacturer.
Impermissible I_e/CLASS setting	The set rated operational current I_e is outside the permissible current range of the current measuring device or the rotary switch.	• Correct the setting of the rated operational current I_e. • Select a current measuring module that is suited to the set rated operational current I_e .
Cold start tripping	A current flow has been detected in the main circuit during cold starting (current > 12%).	Switch off the main circuit.
Thermal motor model overload	Overheating of the motor.	Allow the motor to cool down.

1) Please note the following warning information:

CAUTION
To avoid faults in the overload relay and a defect on the operator panel, connect or disconnect the operator panel only when the power to the evaluation unit is turned off.

The table below indicates how the manufacturer-specific diagnostics are reported:

Table 11- 3 Diagnostics and messages

Diagnostics and messages	IO-Link for event code [1]	PII [2]		Data set 92	LED
		SF[3]	GW [4]		DEVICE/ IO-LINK
Switching element defective	0x8CA9	x	—	x	red
Thermistor wire break	0x8CA6	x	—	x	red
Thermistor short-circuit	0x8CA1	x	—	x	red
Overload tripping	0x8CB8	x	—	x	red
Residual current detected	0x8CB8	x	—	x	red
Ground fault tripping	0x8CB8	x	—	x	red
Manual mode connection abort (operator panel)	0x8CA9	x	—	x	red
Process image error	0x8CBA	x	—	x	red
Self-test error	0x8CA9	x	—	x	red
Preset <> actual configuration	0x8CB0	x	—	x	red
Cold start tripping	0x8CB8	x	—	x	red
Impermissible I_e/CLASS setting	0x8CB0	x	—	x	red
Operating voltage too low	0x8CA9	x	—	x	red

[1] The manufacturer-specific diagnostic events listed in the table are reported to the IO-Link master via the diagnostic mechanism of IO-Link.

[2] With the "process input image" (see "Process image of outputs (PIQ) and inputs (PII) (Page 59)"), you can determine via the group error (GE) bit or general warning (GW) bit in the user program whether detailed information on diagnostics or messages in diagnostic data set 92 are present. If bit (= 1) is set, you can obtain detailed information on what caused a "group error" or "general warning" by reading data set 92. The table above provides information on the possible cause and remedial measures.

[3] GE = Group error: You can obtain detailed information via diagnostics data set 92 (see "Diagnostics - data set (index) 92 (Page 123)").

[4] GE = Group error: You can obtain detailed information via diagnostics data set 92 (see "Diagnostics - data set (index) 92 (Page 123)").

x: Bit set

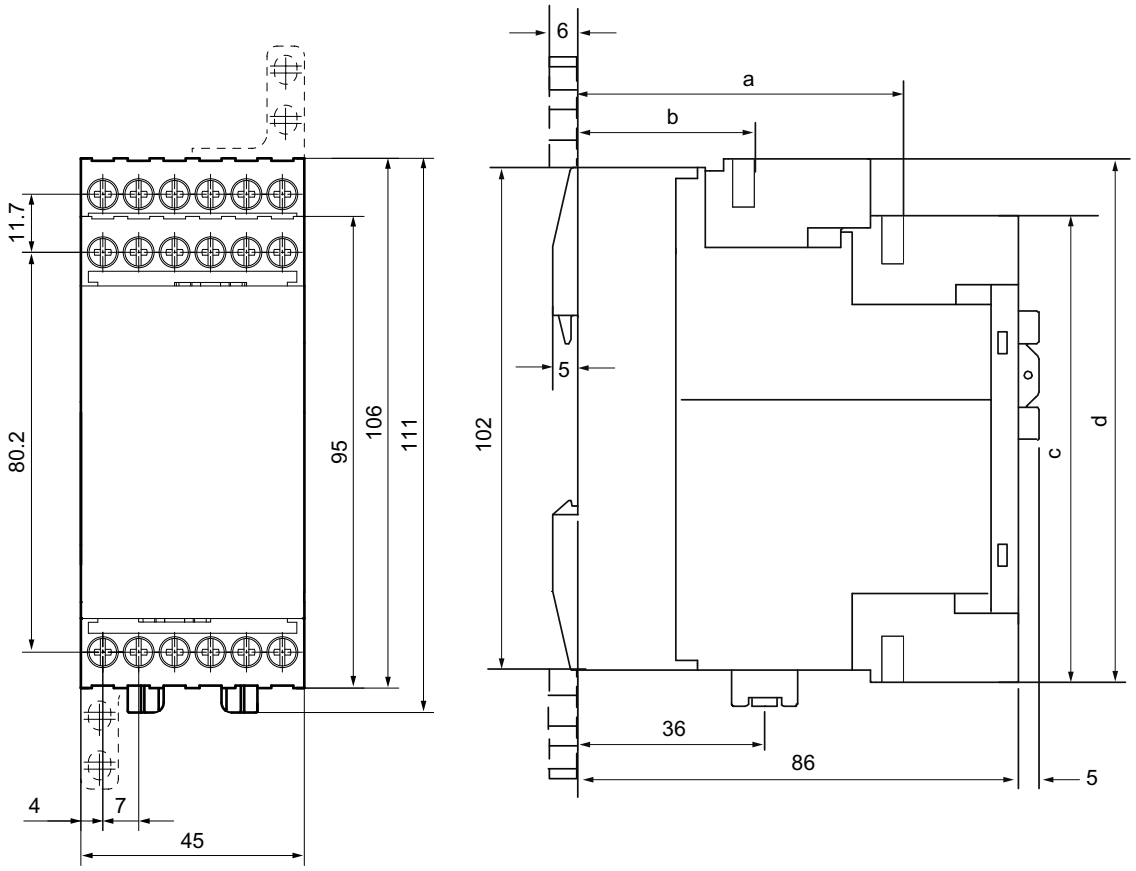
—: Bit not set

Appendix

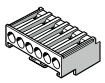
A

A.1 Dimension drawings (dimensions in mm)

The dimension drawings below show the evaluation module with the different connection methods: screw-type and spring-loaded.

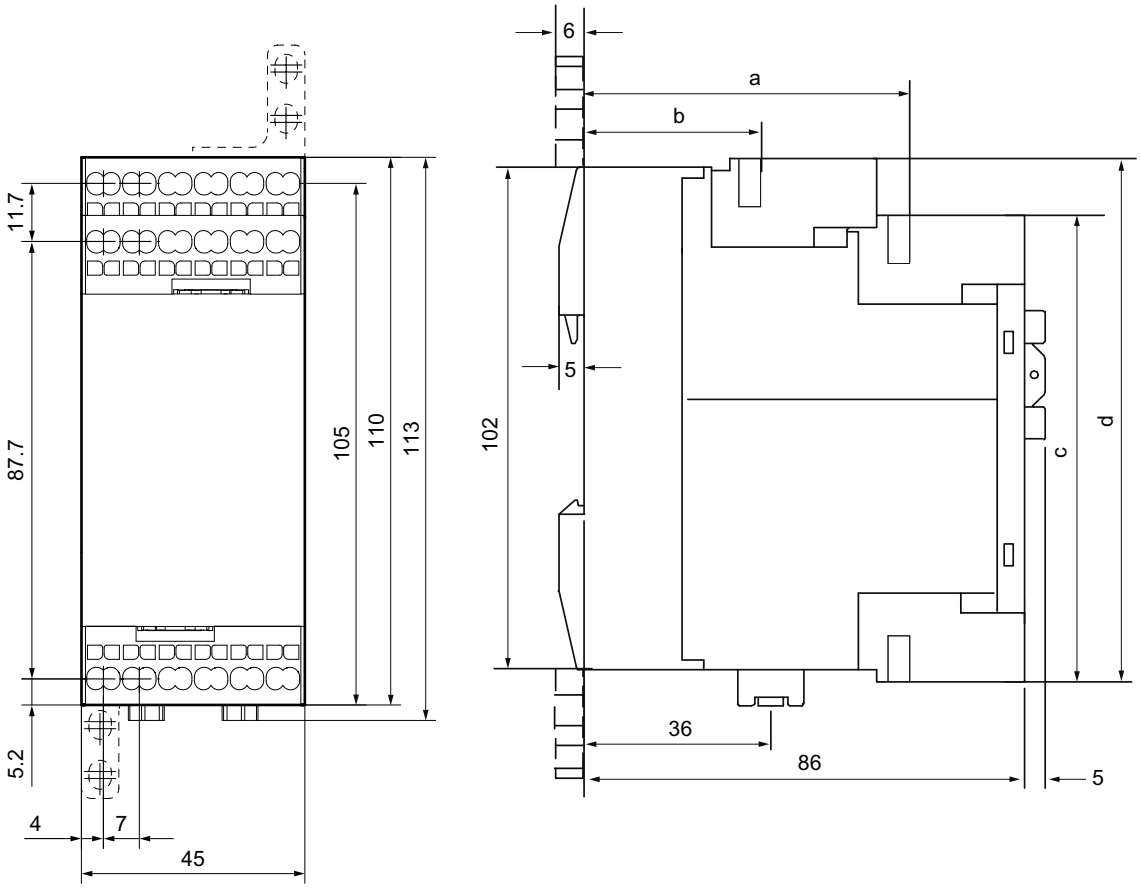


3RB2483-4AA1



a 65
b 36
c 95
d 106

Figure A-1 Evaluation module 3RB2483-4AA1 (screw-type connection)



3RB2483-4AC1

a —
b —
c 99
d 110

Figure A-2 Evaluation module 3RB2483-4AC1 (spring-loaded connection)

A.1.1 Current measuring module

A.1.1.1 Current measuring module 3RB2906-2BG1 and 3RB2906-2DG1

The following dimension drawings show the different versions of the current measuring modules.

Current measuring module 3RB2906-2BG1 and 3RB2906-2DG1

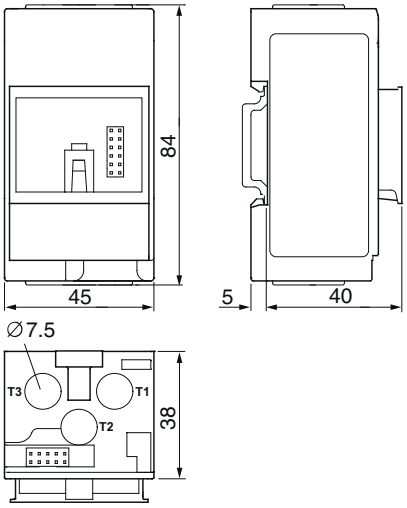


Figure A-3 Current measuring module 3RB2906-2BG1, 3RB2906-2DG1

A.1.1.2 Current measuring module 3RB2906-2JG1

Current measuring module 3RB2906-2JG1

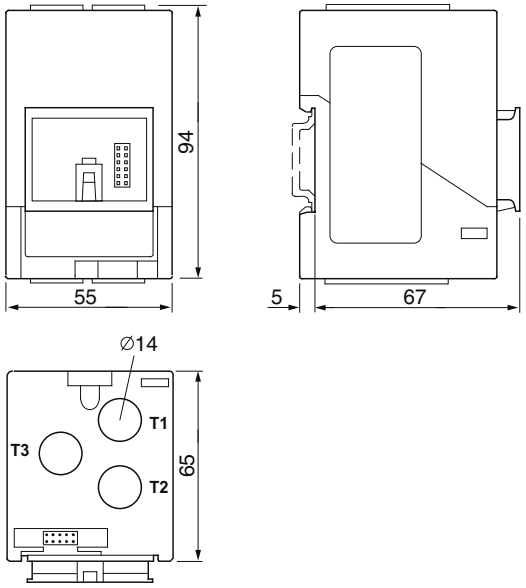


Figure A-4 Current measuring module 3RB2906-2JG1

A.1.1.3 Current measuring module 3RB2956-2TG2

Current measuring module 3RB2956-2TG2

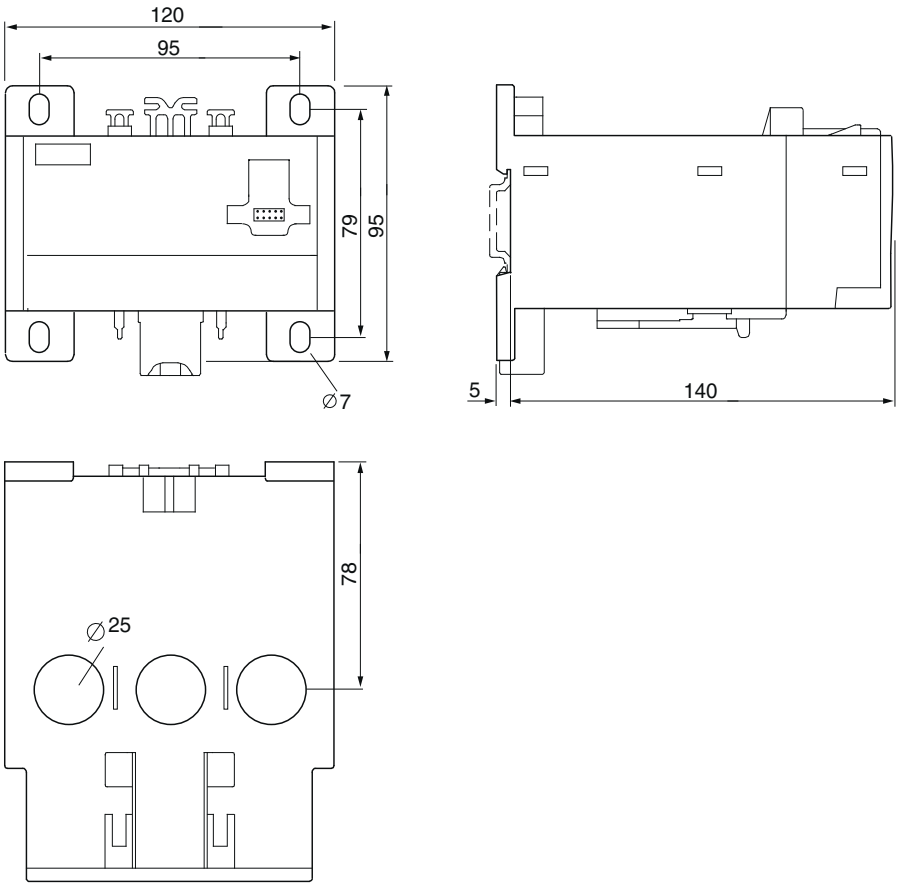


Figure A-5 Current measuring module 3RB2956-2TG2

A.1.1.4 Current measuring module 3RB2956-2TH2

Current measuring module 3RB2956-2TH2

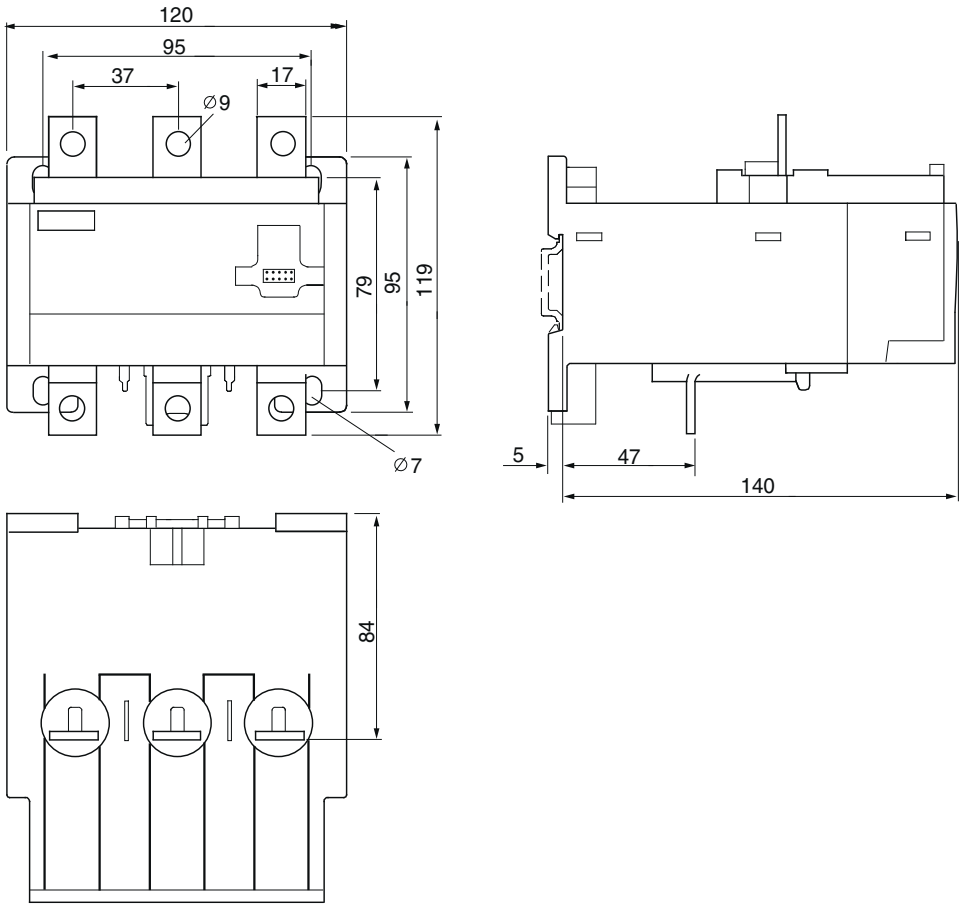


Figure A-6 Current measuring module 3RB2956-2TH2

A.1.1.5 Current measuring module 3RB2966-2WH2

Current measuring module 3RB2966-2WH2

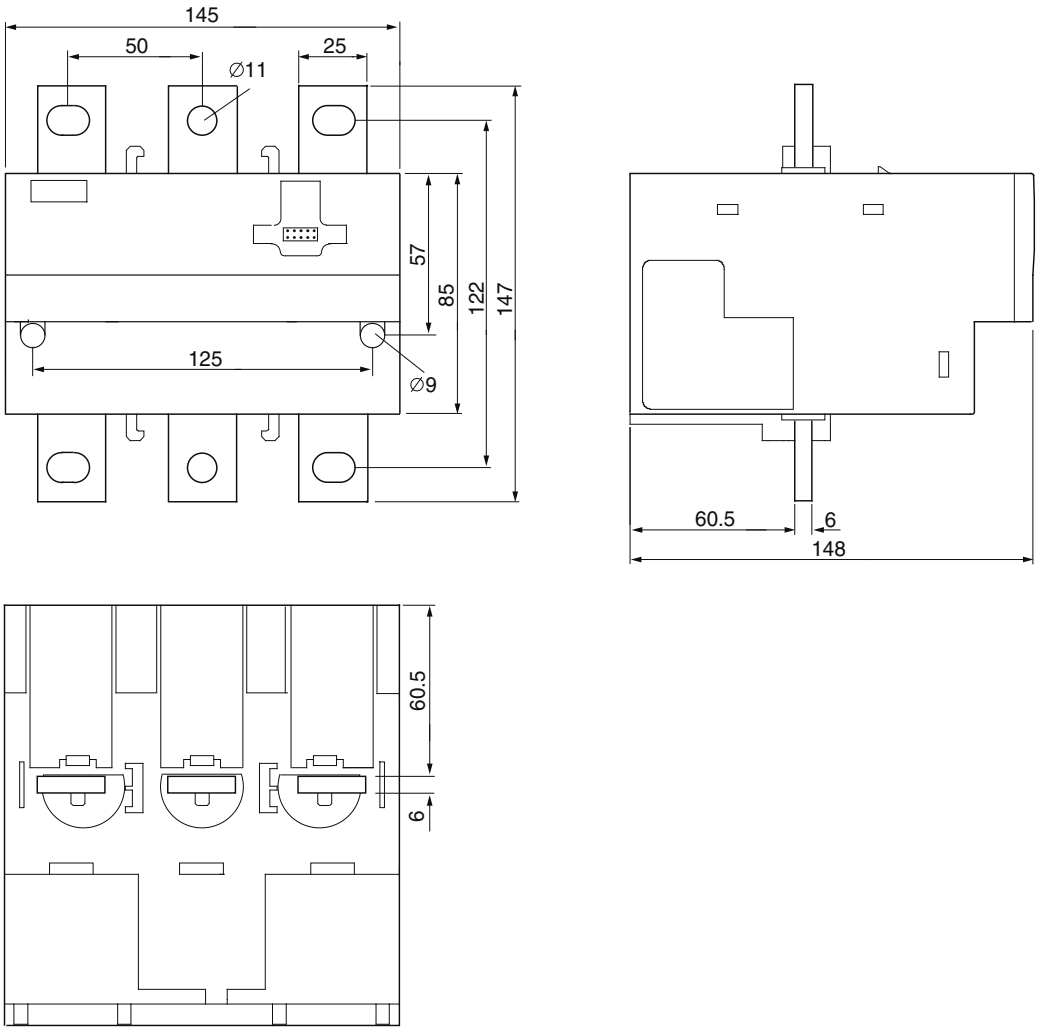


Figure A-7 Current measuring module 3RB2966-2WH2

A.2 Circuit diagrams

A.2.1 Internal circuit diagram

Internal circuit diagram for 3RB24 for IO-Link

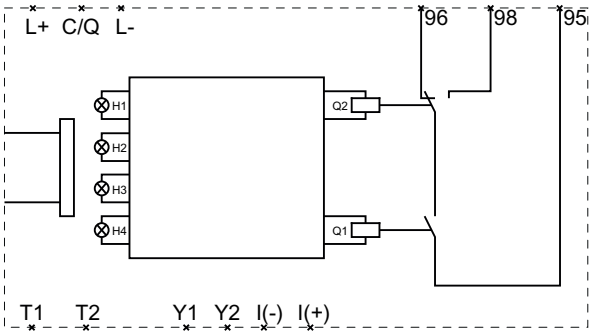


Figure A-8 Internal circuit diagram for 3RB24 for IO-Link

A.2.2 Sample circuit diagrams

The solid-state overload relay for IO-Link is connected to the current measuring module by a ribbon cable (3RB2987-.).

Direct-on-line start/star-delta (wye-delta) start

Note

Star-delta (wye-delta) starters must be activated by the solid-state overload relay for IO-Link as direct-on-line starters.

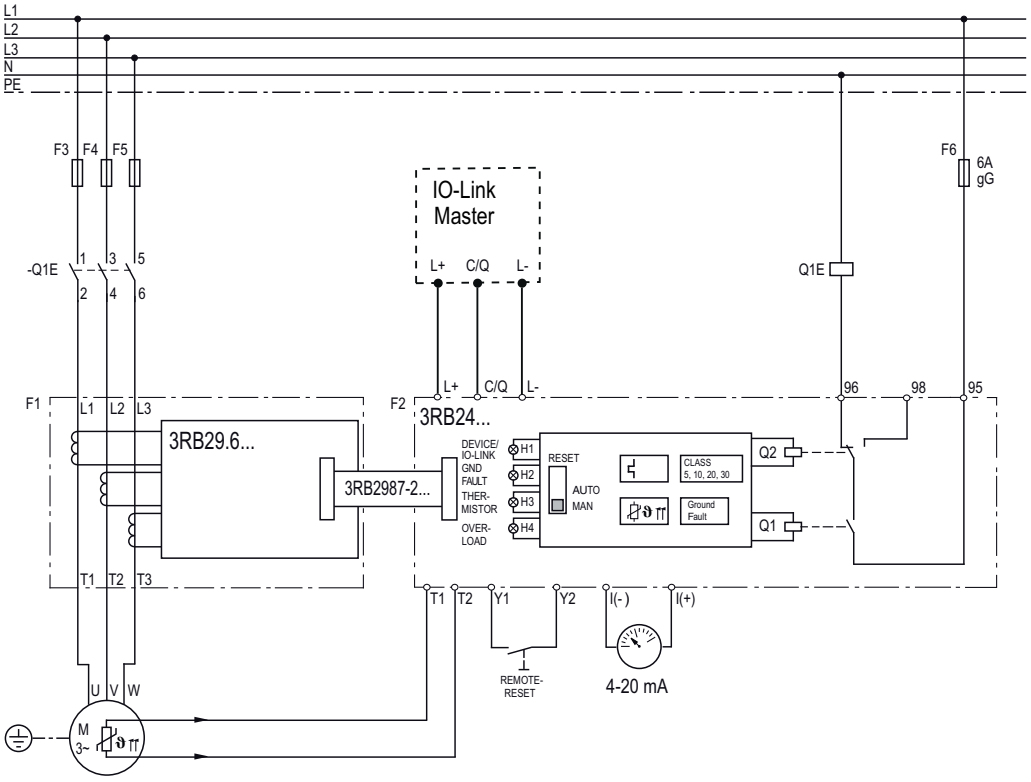


Figure A-9 Sample circuit diagram direct-on-line start/star-delta (wye-delta) start

Current measuring with an external current transformer

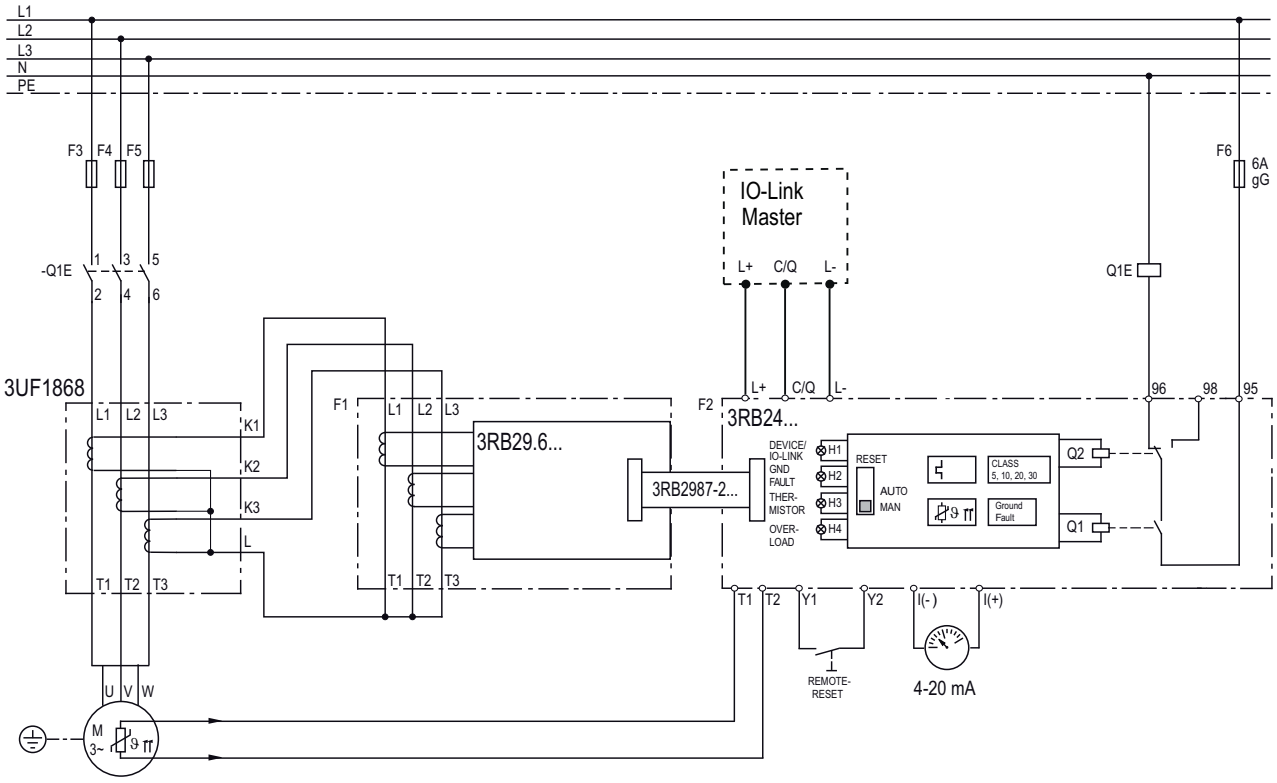


Figure A-10 Example circuit: current measuring with an external 3UF1868 current transformer

Reversing start

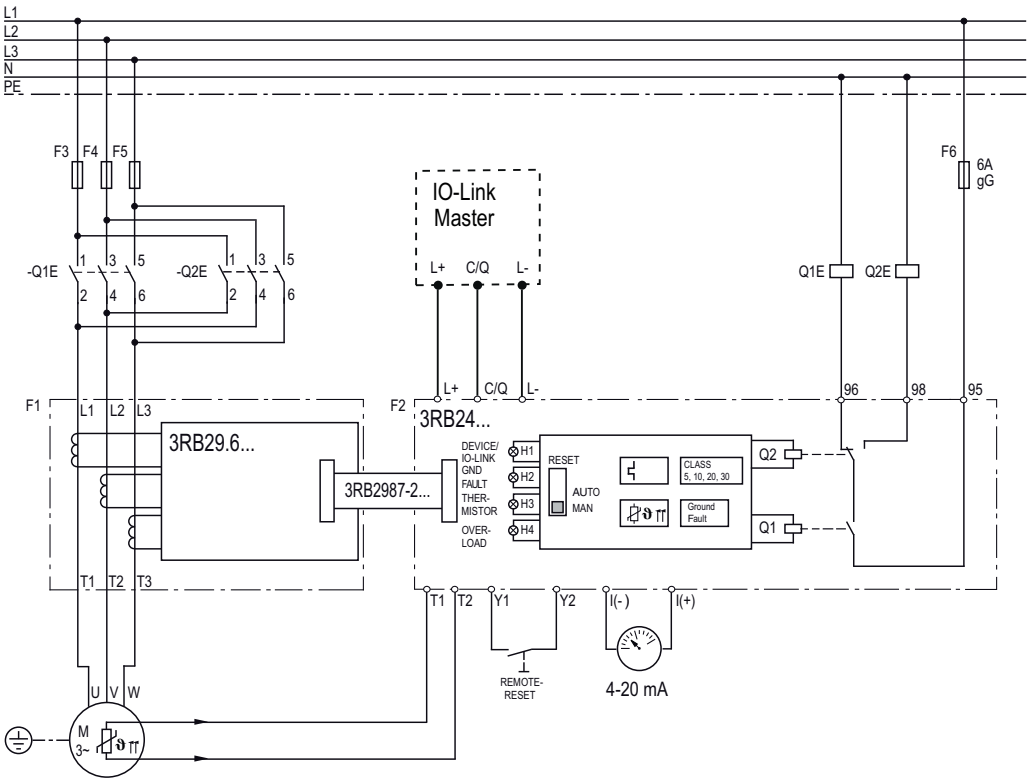


Figure A-11 Sample circuit diagram reversing start

A.3 Data sets

A.3.1 Structure of the data sets

Overview of the data sets

Table A- 1 Data sets - overview

Data set		Name	Access	Value	Length (bytes)
Address (dec)	Subindex supported				
0x00 (0)	Yes	**Parameter Page 0**	r	—	16
0x10 (16)	No	Manufacturer's name	r	Siemens AG	10
0x11 (17)	No	Manufacturer's text	r	Internet (http://support.automation.siemens.com/WW/view/en/37432258/133200)	64
0x12 (18)	No	Product name	r	SIRIUS Overload Relays IO-Link	30
0x13 (19)	No	Product ID	r	3RB2483-4A*1	12
0x14 (20)	No	Product text	r	—	2
0x15 (21)	No	Serial number	r	*Serial number* 1)	8
0x16 (22)	No	Hardware revision	r	*Hardware version* 1)	4
0x17 (23)	No	Firmware revision	r	*Firmware version* 1)	4
0x18 (24)	No	Application-specific name	r/w	—	64
0x28 (40)	No	Process Data Input	r	—	2
0x29 (41)	No	Process Data Output	r	—	1

1) Value varies for each overload relay.

A.3.2 IO-Link communication parameters

Parameter Page 0 - IO-Link communication parameters

Table A- 2 Parameter Page 0

Address (dec)	Parameter name	Access	Description
0x00 (0)	Master Command	r/w	—
0x01 (1)	Master Cycle Time	r/w	—
0x02 (2)	Min. Cycle Time	r	0x17
0x03 (3)	Frame Capability	r	0x03
0x04 (4)	IO-Link Revision ID	r	0x10
0x05 (5)	Process data IN	r	0x10
0x06 (6)	Process data OUT	r	0x08
0x07 (7)	Vendor ID 1	r	0x00
0x08 (8)	Vendor ID 2	r	0x2A
0x09 (9)	Device ID 1	r	0x09
0x0A (10)	Device ID 2	r	0x06
0x0B (11)	Device ID 3	r	0x01
0x0C (12)	Function ID 1	r	0x00
0x0D (13)	Function ID 2	—	0x00
0x0E (14)	Reserved	—	—
0x0F (15)	Reserved	—	—

A.3.3 Identification data

Identification data

Identification data refers to data stored in a module that supports users in the following areas:

- When checking the system configuration
- When locating modified system hardware
- When troubleshooting a system.

Modules can be uniquely identified with the identification data.

Identification data

DPP [1] Index (dec)	Data set Index (dec)	Access	Parameter	Length (bytes)	Default setting
0x07 (7)	—	r	Vendor ID	2	0x00
0x08 (8)	—	r			0x2A
0x09 (9)	—	r	Device ID	3	0x09
0x0A (10)	—	r			0x06
0x0B (11)	—	r			0x01
—	0x10 (16)	r	Manufacturer's name	10	Siemens AG
—	0x11 (17)	r	Manufacturer's text	64	Internet (http://support.automation.siemens.com/WW/view/en/37432258/133200)
—	0x12 (18)	r	Product name	30	SIRIUS Overload Relays IO-Link
—	0x13 (19)	r	Product ID	12	3RB2483-4A*1
—	0x14 (20)	r	Product text	2	—
—	0x15 (21)	r	Serial number	8	*Serial number* [2]
—	0x16 (22)	r	Hardware revision	4	*Hardware version* [2]
—	0x17 (23)	r	Firmware revision	4	*Firmware version* [2]
—	0x18 (24)	r/rw	Application-specific name	64	—
—	0x28 (40)	r	Process Data Input	2	—
—	0x29 (41)	r	Process Data Output	1	—

[1] Direct Parameter Page

[2] Value varies for each overload relay.

A.3.4 Diagnostics - data set (index) 92

Data set (index) 92 - diagnostics

Note

Bits that are not described in the tables below are reserved and should be ignored.

Note

Sub-indices are not supported.

Table A- 3 Data set (index) 92 (diagnostics) - solid-state overload relay for IO-Link

Byte.Bit	Description	SF[1)]	GW [2)]
Specific module diagnostics - solid-state overload relay for IO-Link			
0.0	Ready		
0.1	Motor direction of rotation 1 (clockwise)		
0.2	Motor direction of rotation 2 (counter-clockwise)		
0.0 ... 0.3	*Reserved*		
0.4	Switching element defective	x	
0.5	*Reserved*		
0.6	Group error		
0.7	General warning		
1	*Reserved*		
2.0	Thermistor overload	x	
2.1	Thermistor wire break	x	
2.2	Thermistor short-circuit	x	
2.3	Thermal motor model overload	x	
2.4	Overload tripping	x	
2.5 ... 2.7	*Reserved*		
3	*Reserved*		
4.0 ... 4.4	*Reserved*		
4.5	Residual current detected		
4.6	Residual current tripping	x	
4.7 ... 5.7	*Reserved*		
6.0	Ground fault detected		
6.1	Ground fault tripping	x	
6.2 ... 6.6	*Reserved*		
6.7	Electronics supply voltage too low	x	
7.0 ... 7.1	*Reserved*		
7.2 ... 7.3	Automatic mode		

Byte.Bit	Description	SF[1)]	GW [2)]
7.4 ... 7.5	Manual mode (operator panel)		
7.6	Manual mode connection abort (operator panel)	x	
7.7	Process image error	x	
8	*Reserved*		
9.0 ... 9.1	Self-test active		x
9.2	Self-test error	x	
9.3 ... 9.7	*Reserved*		
10 ... 11	*Reserved*		
12.0 ... 12.1	*Reserved*		
12.2	Impermissible I_e/CLASS setting	x	
12.3	Preset <> actual configuration	x	
12.4	Thermistor protection deactivated		
12.5 ... 12.7	*Reserved*		
13	*Reserved*		
14.0	Cold start active		
14.1	Cold start tripping	x	
14.2 ... 14.7	*Reserved*		
15 ... 23	*Reserved*		
24.0 ... 24.2	*Reserved*		
24.3	Prewarning limit: Motor heating exceeded		x
24.4 ... 24.7	*Reserved*		

1) GE = Group error

2) GW = General warning

For additional information, please refer to " Process image of outputs (PIQ) and inputs (PII) (Page 59) " chapter.

A.3.5 Measured value - data set (index) 94

Data set (index) 94 - measured values

Note

Bits that are not described in the tables below are reserved and should be ignored.

Note

Sub-indices are not supported.

Table A- 4 Data set (index) 94 (measured values) - solid-state overload relay for IO-Link

Byte.Bit	Description
0.0 ... 0.7	Phase current I (L1 $_{rms}$ in 3.125% steps)
1.0 ... 1.7	Phase current I (L2 $_{rms}$ in 3.125% steps)
2.0 ... 2.7	Phase current I (L3 $_{rms}$ in 3.125% steps)
3.0 ... 27.7	*Reserved*
28.0 ... 31.7	Phase current I (L1 $_{rms}$ in 0.01-A steps)
32.0 ... 35.7	Phase current I (L2 $_{rms}$ in 0.01-A steps)
36.0 ... 39.7	Phase current I (L3 $_{rms}$ in 0.01-A steps)

Example of relative value in [%] phase current I (L1 $_{rms}$), Byte 0:
0x1E = 30 dec. → 30 • 3.125 = 93.75%

Example of absolute value in [A] phase current I (L1 $_{rms}$), Byte 28 - 31:
00x00007A34 = 31284 dec. → 31284 • 0.01 A = 312.84 A

Note

In the case of non-acknowledgeable faults (see Chapter "Fault codes (only in the case of non-acknowledgeable faults) (Page 104)"), the current value registers in data set 94 always show maximum values:

- Phase current I (L1 $_{rms}$ in 3.125% steps) = 0xFF
- Phase current I (L2 $_{rms}$ in 3.125% steps) = 0xFF
- Phase current I (L3 $_{rms}$ in 3.125% steps) = 0xFF
- Phase current I (L1 $_{rms}$ in 0.01-A steps) = 0x7FFFFFFF
- Phase current I (L2 $_{rms}$ in 0.01-A steps) = 0x7FFFFFFF
- Phase current I (L3 $_{rms}$ in 0.01-A steps) = 0x7FFFFFFF

A.3.6 Preset configuration - data set (index) 130

Data set (index) 130 - preset configuration - operator panel

⚠ WARNING

Danger of uncontrolled motor start-up

Can Cause Death, Serious Injury, or Property Damage.

Make sure that the correct preset configuration is set in the new device after the solid-state overload relay for IO-Link has been replaced.

For additional information on the procedure, please refer to "Parameters (Page 51)".

Note

Bits that are not described in the tables below are reserved and should be ignored.

Note

Sub-indices are not supported.

Table A- 5 Data set (index) 130 (target configuration) - operator panel

Byte.Bit	Description
0 ... 17	*Reserved*
18.0 ... 18.5	*Reserved*
18.6	Operation at Preset <> Actual Configuration[1)]
18.7	Operator panel available[2)]
19 ... 21	*Reserved*

[1)] You can find more information on the "Operation at Preset <> Actual Configuration" parameter for operation with the operator panel in Chapter "Parameter "Operation at Preset <> Actual Operation" (Page 56)".

[2)] You can find more information on the "Operation at Preset <> Actual Configuration" parameter for operation with the operator panel in Chapter ""Operator panel available" parameter (Page 56)".

A.3.7 Technology functions - data set (index) 131

Data set (index) 131 - technology functions

Note

Bits that are not described in the tables below are reserved and should be ignored.

Note

Sub-indices are not supported.

Table A- 6 Data set (index) 131 (technology functions) - solid-state overload relay for IO-Link

Byte.Bit	Bit length	Access	Description
0 ... 7	*64*	—	*Reserved*
8.5	1	r/w	Ground fault detection[2)] 0 = Disable; 1 = Enable
9 ... 10	*16*	—	*Reserved*
11.3	1	r/w	Cold start[1)] 0 = Disable; 1 = Enable
12 ... 15	32	r	Rated operational current[3)] (in 0.01 A steps)
16 ... 17	*16*	—	*Reserved*
18.0 ... 18.1	2	r	Response to overload - thermal motor model[4)] 0 = Tripping without restart (MAN); 1 = Tripping with restart (AUTO)
18.2 ... 18.7	*6*	—	*Reserved*
19.0 ... 19.3	4	r	Trip class [CLASS] CLASS 5 = 0x03 CLASS 10 = 0x00 CLASS 20 = 0x01 CLASS 30 = 0x02

Byte.Bit	Bit length	Access	Description
19.4 ... 19.7	*4*	—	*Reserved*
20 ... 23	*32*	—	*Reserved*
24.0	2	r	Response to overload - thermistor[5)] 0 = Tripping without restart (MAN); 1 = Tripping with restart (AUTO)
24.2 ... 24.6	*5*	—	*Reserved*
24.7	1	r	Thermistor - monitoring 0 = No; 1 = Yes

[1)] You can find more information on the "Cold start" parameter in Chapter ""Cold start" parameter (Page 52)".

[2)] You can find more information on the "Ground fault detection" parameter in Chapter ""Ground fault detection" parameter (Page 53)".

[3)] You can find more information on the "Rated operational current" parameter in Chapter ""Rated operational current" parameter (Page 54)".

[4)] You can find more information on the "Response to overload - thermal motor model" parameter in Chapter ""Response to overload - thermal motor model" parameter (Page 55)".

[5)] You can find more information on the "Response to overload - thermistor" parameter in Chapter ""Response to overload - thermistor" parameter (Page 55)".

A.4 References

Further references

In addition to this manual, please refer to the operating instructions and manuals for any accessories. You can download the relevant documentation from the Internet (www.siemens.com/automation/csi/manual). Simply enter the order number of the relevant item into the search field.

Operating instructions

Title	Order number
Solid-state overload relay for IO-Link	
Solid-state overload relay for IO-Link (evaluation module)	3ZX1012-0RB24-1AA1
Current measuring module	3ZX1012-0RB00-1AA1
Contactors	
Contactor S00	3ZX1012-0RH21-1AA1
Contactor S0	3ZX1012-0RT22-1AA1
Contactor combinations	
Reversing combination S00	3ZX1012-0RA23-8AA1
Reversing combination S0	3ZX1012-0RA23-8BA1
Kit for reversing combination S00	3ZX1012-0RA20-4AA1
Kit for reversing combination S0	3ZX1012-0RA20-3AA1
Kit for star-delta contactor combination S00	3ZX1012-0RA20-4BA1
Kit for star-delta contactor combination S0	3ZX1012-0RA20-3BA1

A.5 Correction sheet

Correction sheet

Have you noticed any errors while reading this manual? If so, please use this form to tell us about them. We welcome comments and suggestions for improvement.

Fax response

	From (please complete):
To	Name
SIEMENS AG	
I IA CE MK&ST 3	Company/Department
92220 Amberg / Germany	Address

Fax: +49 (0)9621-80-3337

Manual title:

Table A- 7 Errors, comments, and suggestions for improvements

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