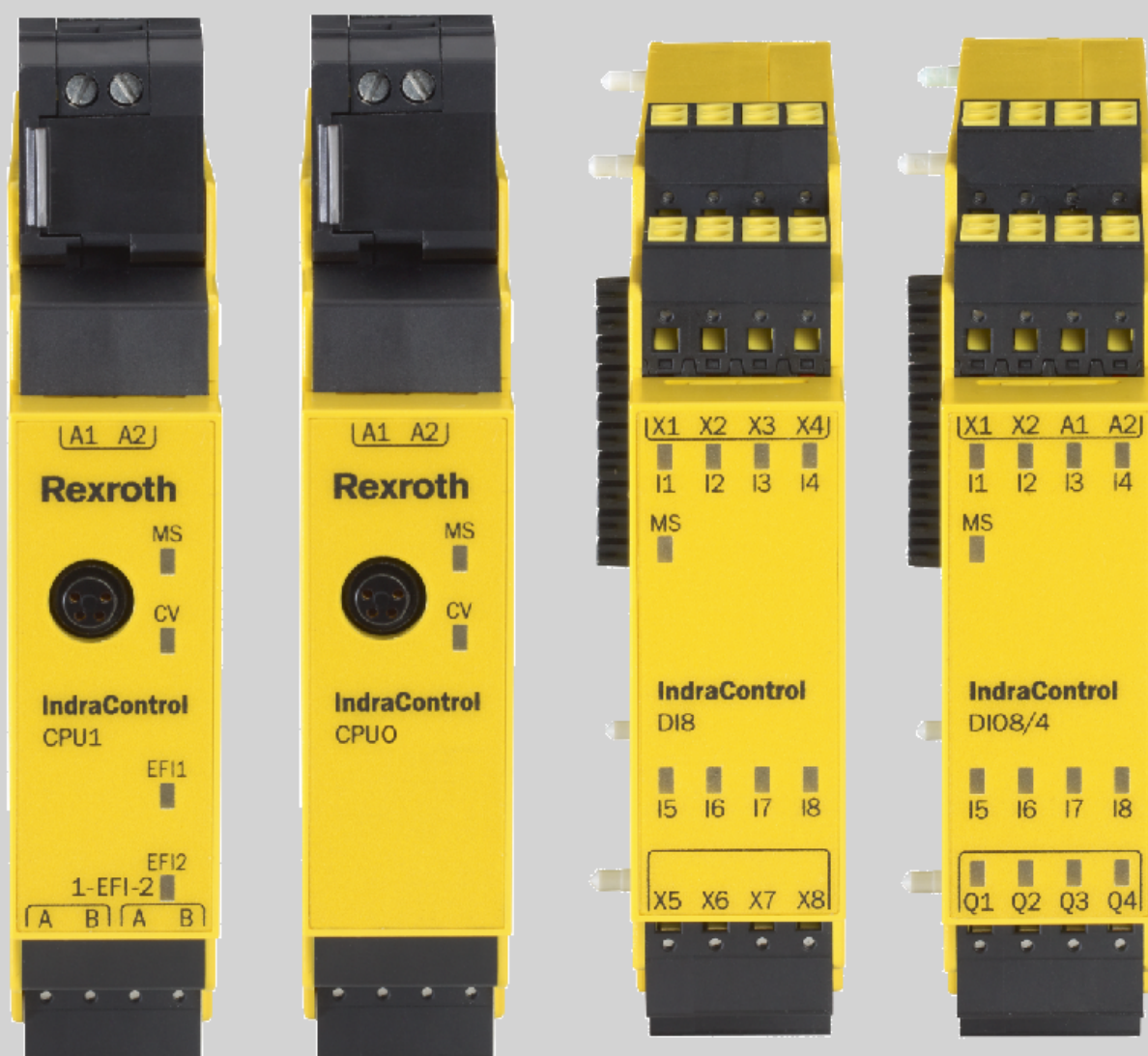


IndraControl SafeLogic compact

Hardware

Operating Instructions
R911332746

Edition 07



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1 About this document

Please read [chapter 1 "About this document" on page 5](#) and [chapter 2 "For safety" on page 11](#) carefully before working with this documentation and the modular safety control SafeLogic compact.

Editions of this documentation

Edition	Release Date	Note
Edition 01	2011-08	First edition
Edition 02	2011-11	Supplements, corrections
Edition 03	2012-03	Supplements, corrections
Edition 04	2013-04	Supplements, corrections
Edition 05	2014-04	Supplements
Edition 06	2016-04	Supplements
Edition 07	2018-06	Update for Designer V1.8.0

Tab. 1-1: Change Record

1.1 Overview on target groups and product phases

In the following illustration, the framed activities, product phases and target groups refer to the present documentation.

Example: In the product phase "Mounting (assembly/installation)", the "mechanic/electrician" can execute the activity "mount and install" using this documentation.

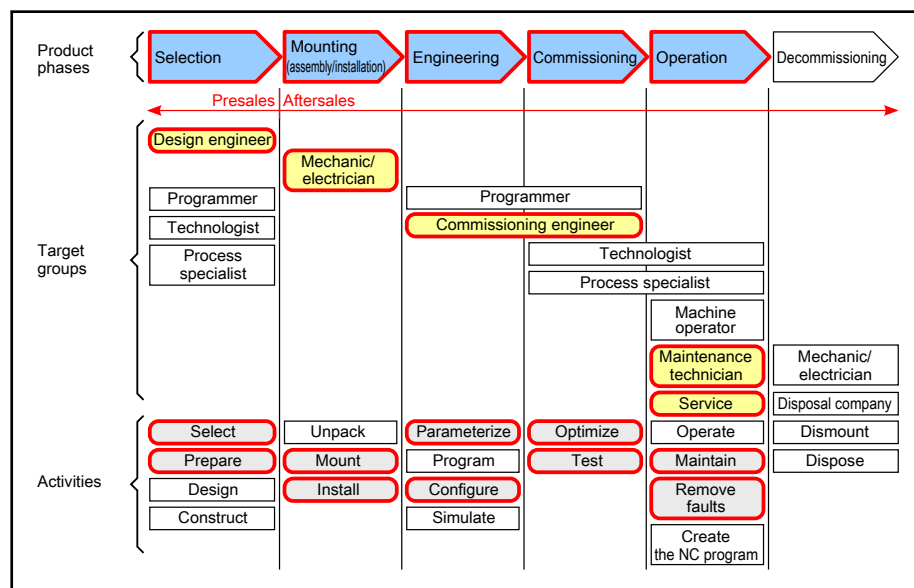


Fig. 1-1: Assigning this documentation to the target groups, product phases and target group activities

1.2 Purpose

These operating instructions can only be used together with other SafeLogic compact operating instructions (see [chapter 1.4 "SafeLogic compact operating instructions and assembly instructions" on page 6](#)). These

About this document

operating instructions include information on the integration of the safety control SafeLogic compact in a machine, on commissioning, error diagnostics, debugging and maintenance.

These operating instructions do not provide instructions for operating the machine in which the modular safety control is integrated. For information on the operation, refer to the operating instructions of the respective machine.

1.3 Scope

This operating instructions is an original operating instructions.

This operating instructions apply to all modules of the safety control SafeLogic compact safety except for the SafeLogic compact Diagnostic Gateway and the Sercos Gateway.

The configuration software "SafeLogic Designer" V1.7.0 or higher is required to configure and diagnose all modules. To check the software version, select **Tools ► Info** from the menu of the "SafeLogic Designer".

1.4 SafeLogic compact operating instructions and assembly instructions

The following manuals are available for the SafeLogic compact system:

Document	Part number, document type	Description
IndraControl SafeLogic compact Designer Software	R911332749 Operating Instructions	This operating instructions provides information on the software configuration as well as on the operation and diagnostics of a SafeLogic compact system with the SafeLogic Designer software for the technical staff of the machine manufacturer
IndraControl SafeLogic compact Diagnostic Gateways	R911332752 Operating Instructions	Describes the SafeLogic compact Diagnostic Gateways and their functions in detail
IndraControl SafeLogic compact Sercos Gateway	R911338436 Project Planning Manual	This operating instructions instructs the technical staff of the machine manufacturer and the machine operator regarding the safe assembly, configuration, electrical installation, commissioning as well as operation and maintenance of the SafeLogic compact Sercos Gateway
Safety controls, network solutions SafeLogic compact	R911332754 Safety instructions	The safety instructions provide information on the initial commissioning and operating of the machine/system to the planners, developers and operators as well as to persons installing protective devices in a machine/ system

Document	Part number, document type	Description
Rexroth IndraControl SafeLogic compact Mounting Instructions		
Sercos Gateway SLC-3-GS3S00300	R911339570	These mounting instructions describe the mounting of modules into a SafeLogic compact safety control
Ethernet Gateway Profinet IO SLC-0-GPNT00300	R911334404	
Profibus Gateway SLC-0-GPRO00300	R911334403	
Motion control modules SLC-3-MOC000300	R911343758	
Main Modules SLC-3-CPU0/ SLC-3-CPU1/SLC-3-CPU3	R911334402	
Extension Modules SLC-3-XTDI/SLC-3-XTIO/SLC-3-XTDS/SLC-0-STIO	R911334401	
Relay Modules SLC-A-UE410-2RO4/ SLC-A-UE410-4RO4	R911334400	
Encoder Connection Boxes SLC-A-MOC-MFSB-RX/SLC-A-MOC-DECB-RX	R911343761	

Tab. 1-2: Required and supplementing documentation

1.5 Further information on the SafeLogic compact system

The planning and use of protective devices also requires specific technical skills which are not detailed in this documentation.

When operating the safety control SafeLogic compact, the national, local and statutory rules and regulations must be observed.

Also use the Bosch Rexroth homepage and the installation CD:

<http://www.boschrexroth.com>

SafeLogic Designer installation CD (part number: R911334897)

The following information can be found on the CD or the Bosch Rexroth website:

- Operating instructions in different languages for displaying and printing
- The configuration software SafeLogic Designer
- Add-on to enable other gateways of SICK (EtherCat, Ethernet/IP, Modbus, CANopen)
- Application examples
- E-CAD data
- GSD, GSDML and SDDML files

1.6 Documentation structure

This operating instructions include information on the following topics of the modular safety control SafeLogic compact:

- Information on safety and intended use

About this document

- Product description
- Connecting safety sensors and actuators
- Special functions (EFI, muting)
- Mounting and demounting
- Electrical installation
- Configuration
- Hardware commissioning
- Error diagnostics and troubleshooting
- Maintenance
- Technical data
- Ordering data
- Conformity and approval

1.7 Information representation

1.7.1 Safety instructions

Safety instructions in the documentation contain certain signal words ("Danger", "Warning", "Caution", "Notice") and sometimes a safety alert symbol (according to ANSI Z535.6-2006).

The signal word draws attention to the safety instruction and indicates the risk potential.

The safety alert symbol (triangular safety reflector with exclamation marks), preceding the signal words "Danger", "Warning", "Caution" indicates hazards for persons.

The safety instructions are represented as follows in this documentation:

** DANGER**

In case of non-compliance with this safety instruction, death or serious injury **will** occur.

** WARNING**

In case of non-compliance with this safety instruction, death or serious injury **can** occur.

** CAUTION**

In case of non-compliance with this safety instruction, minor or moderate injury can occur.

NOTICE

In case of non-compliance with this safety instruction, material damage can occur.

1.7.2 Symbols used

Note Notes are shown as follows:



This is a note for the user.

Tip Tips are shown as follows:



This is a tip for the user.

LED symbols

LED symbols

LED symbols describe the state of a diagnostic LED:



The LED is off



The LED is flashing



The LED is permanently on

1.7.3 Terms and abbreviations

Term	Explanation
ACR	Automatic configuration recovery = Function to automatically restore or multiply the configuration of connected EFI-compatible safety sensors such as laser sensors and light curtains
ESPE	Electro-sensitive protective device (e.g. light array)
CDS	SICK Configuration and Diagnostic Software
EDM	External device monitoring (EDM)
EFI	Enhanced Function Interface (safe SafeLogic compact device communication)
NC	Normally closed
NO	Normally open
OSSD	Output signal switching device = Signal output controlling the safety circuit
PFHd	Probability of dangerous failure per hour
SIL	Safety Integrity Level (safety class)
SILCL	Safety Integrity Level Claim Limit
PLC	Programmable Logic Controller

Tab. 1-3: Abbreviations used

1.8 Customer feedback

Customer requests, comments or suggestions for improvement are of great importance to us. Please email your feedback on the documentations to Feedback.Documentation@boschrexroth.de. Directly insert comments in the electronic PDF document and send the PDF file to Bosch Rexroth.

2 For safety

This chapter deals with your own safety and the safety of the equipment operators.

Please read this chapter carefully before working with the modular SafeLogic compact safety control or with the machine protected by a SafeLogic compact system.

2.1 Qualified personnel

The modular SafeLogic compact safety control may only be installed, commissioned and serviced by qualified personnel.

Qualified is who...

- has undergone the appropriate technical training
- and
- has been instructed by the responsible machine operator in the operation of the machine and the current valid safety guidelines
- and
- who is familiar with the relevant technical measures for occupational safety and health, the accident prevention regulations, guidelines and generally approved technology standards and regulations (e.g. DIN standards, VDE regulations, technical rules issued by other European Union member states) to such an extent that he or she can assess whether mechanical equipment is safe
- and
- who has access to the operating instructions of the SafeLogic compact and has read and familiarized with the instructions
- and
- who has access to the operating instructions for the protective devices (e.g. light arrays) connected to the safety control and has read and familiarized with the instructions.

2.2 Use cases of the device

The safety control SafeLogic compact is a scalable control for safety applications. The SafeLogic compact control can be used...

- acc. to IEC 61 508 to SIL3
- acc. to EN 62 061 to SILCL3
- acc. to EN ISO 13 8491 to performance level e

The actual degree of safety depends on the external wiring, the wiring design, the parameterization, the selection of the command devices and their locations at the machine.

Optoelectronic and tactile safety sensors (e.g. light curtains, laser scanners, safety switches, sensors, E-STOP buttons, encoders) are connected to the modular safety control and are linked logically. The corresponding actuators of the machines or systems can be switched off safely via the switching outputs of the safety control.

For safety

2.3 Intended use



The SafeLogic compact system fulfils the requirements of class A (industrial applications) acc. to the "interference emission" generic standard.

The SafeLogic compact system is therefore only suitable for use in an industrial environment and not for private use.

The modular SafeLogic compact safety control may only be used within specified operating limits (voltage, temperature etc., see the technical data in [chapter 12 "Technical data" on page 109](#)) as per [chapter 2.2 "Use cases of the device" on page 11](#) and [chapter 7.1 "Electrical installation requirements" on page 91](#). The SafeLogic compact control may only be used by specialist personnel and only at the machine at which the control was mounted and initially commissioned by qualified personnel in accordance with these operating instructions.

Any warranty claim against the Bosch Rexroth AG shall be waived in case of unintended use if the device is modified or changed in any way - even within the framework of mounting or installation.

- Comply with the safety instructions and safety measures specified in the "IndraControl SafeLogic compact Hardware" and "IndraControl SafeLogic compact Designer Software" operating instructions!
- When implementing a safety-related control logic, ensure that the requirements of national and international regulations and standards are met, in particular the control strategies and the measures for risk minimization that are stipulated for your application
- The external power supply of the devices has to bridge a short power failure of 20 ms according to EN 60 204. Compatible PELV- and SELV-compatible power supply units are available as accessories from Bosch Rexroth

UL/CSA applications:

- If the product is used acc. to the UL 508 or CSA 22.2 no. 142, the following additional conditions have to be met:
 - To secure the 24V voltage supply of the device, use a fuse with max. 4 A and min DC 30V acc. to UL 248.
 - For wiring, only use copper conductors with a minimum temperature resistance of 60 °C/75 °C, conductor cross-section AWG 30–12 with screw terminals or AWG 24–16 with spring terminals.
 - The terminal tightening torque must be 5–7 lbs/in or 0.6-0.8 Nm.
 - Use the devices only in a pollution degree 2 environment only.
- The gateway SLC-0-GPNT is intended for use with class 2. Therefore, the main module must be supplied in this case with a Class 2 power source or Class 2 transformer in accordance with UL 1310 or UL 1585



The safety functions are not evaluated by UL. The approval is accomplished according to UL 508, general use applications.

2.4 General safety instructions and protective measures

Observe the safety instructions and protective measures!

For safety

Please observe the following items in order to ensure proper use of the SafeLogic safety control.

- When mounting, installing and using the SafeLogic compact safety control, observe the standards and directives applicable in your country
- The national/international rules and regulations apply to the installation, use and periodic technical inspection of the SafeLogic compact safety control, in particular
 - Machine directive 2006/42/EC
 - EMC directive 2014/30/EU
 - Provision and use of work equipment directive 2009/104/EC
 - Low-voltage directive 2014/35/EC¹⁾
 - The accident prevention regulations/safety rules
- Manufacturers and owners of the machine on which a SafeLogic compact safety control is used are responsible for obtaining and observing all applicable safety regulations and rules
- The notices, in particular the test instructions (see chapter [chapter 9 "Commissioning" on page 97](#)) of these operating instructions (e.g. on use, assembly, installation or integration into the existing machine control) must be complied with
- The tests must be carried out by specialized personnel or specially qualified and authorized personnel and must be recorded and documented to ensure that the tests can be reconstructed and retraced at any time by third parties

2.5 Environmentally-friendly behavior

The SafeLogic compact modular safety control has been designed to minimize environmental impact. The SafeLogic compact control uses only a minimum of power and natural resources.

- At work, always act in an environmentally responsible manner

2.5.1 Disposal

Defective or irreparable devices always should be disposed of according to the statutory national waste disposal regulations (e.g. European waste entry 16 02 14).

We would be pleased to be of assistance to you on the disposal of these devices. Contact us.

2.5.2 Separation of materials

Only appropriately trained personnel are allowed to separate materials!

Caution is required when dismantling devices. Danger of injury is present.

Before you can turn over the devices for environmental-friendly recycling, you must separate the different materials of the SafeLogic compact from one another.

- Separate the housing from the rest of the parts (in particular the circuit board)
- Dispose of the separated components in the corresponding recycling centers (see the following table)

¹⁾ Only applies to SLC-A-UE410-xRO

For safety

Components	Disposal
Product	
Housing	Plastic recycling
PCBs, cables, plugs and electrical connection pieces	Electronic recycling
Packaging	
Cardboard, paper	Paper and cardboard recycling

Tab. 2-1: Overview on disposal according to materials

3 Product description

This chapter provides information on the features and properties of the SafeLogic compact system and describes the structure and operating principle.

3.1 System properties

The SafeLogic compact modular safety control is connected to sensors and switching elements (e.g. light curtains, laser scanners, safety switches, sensors, encoders, E-STOP buttons) and logically connected. The corresponding actuators of the machines or systems can be switched off safely via the switching outputs of the safety controller.

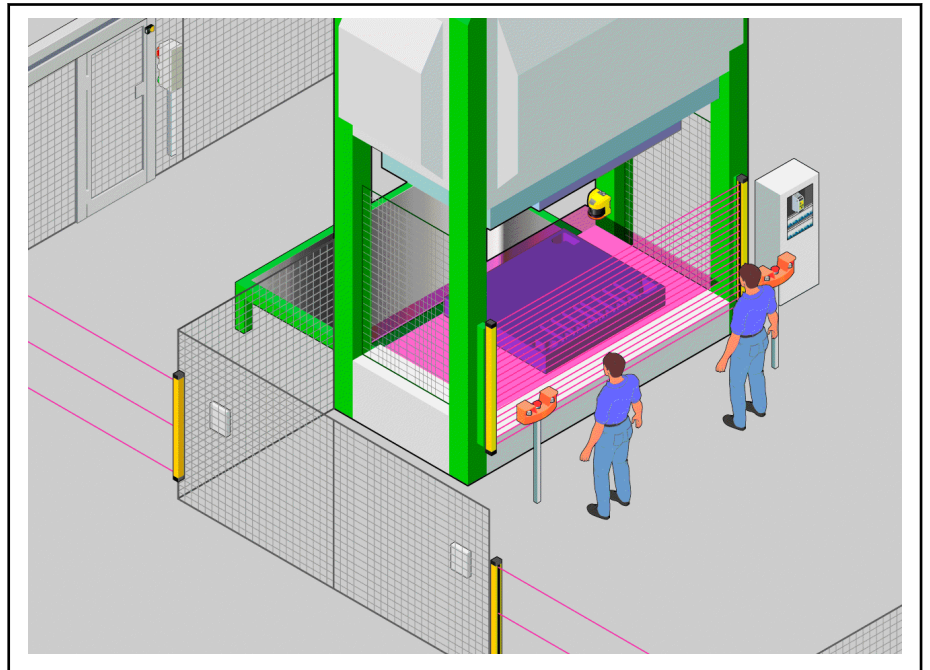


Fig. 3-1: Modular SafeLogic compact safety control

The SafeLogic compact system is characterized by the following system properties:

- Modular design: 1 main module, up to 2 different gateways and up to 12 input/output extension modules¹⁾
- Up to 96 safe digital inputs
- Up to 48 safe digital outputs or up to 96 non-safe digital outputs
- Configurable
- Use of up to 255 standard-specific and application-specific function blocks
- Standard function blocks, such as
 - AND
 - OR
 - NOT

¹⁾ The number of extension modules is limited by the capacity of the FLEXBUS+ backplane bus. A drive monitor (SLC-3-MOCx) requires twice the bus capacity of other extension modules. For this reason, the maximum possible number of usable extension modules is reduced by two for each used SLC-3-MOCx.

Product description

- XNOR
 - XOR
- Application-specific standard function blocks, such as
 - Emergency Stop
 - Two hand
 - Muting
 - Presses
 - Ramp down detection
 - Operation mode selection switch
 - Reset
 - Restart
- Can be integrated in different networks with gateways
 - Profinet I/O Gateway for diagnostics
 - Profibus DP Gateway for diagnostics
 - Sercos gateway to connect the safety functions in the drive/ IndraDrive via CIP Safety on Sercos. Therefore, there is no discrete drive wiring
- 2 EFI interfaces at the SLC-3-CPU1 SLC-3-CPU3 main modules, see [chapter 3.6 "Main module SLC-3-CPU1" on page 25](#)

The SafeLogic Designer configuration software is available for configuring the control tasks.

Also use the Bosch Rexroth homepage and the installation CD:

- Operating instructions "IndraControl SafeLogic compact Designer Software" (part number [R911332748](#))
- SafeLogic Designer installation CD (part number: R911334897)

3.2 System setup

A SafeLogic compact system consists of the following modules:

- One memory plug
- One main module
- Up to two gateways
- Up to 12 additional extension modules²⁾
- In addition up to 8 SLC-A-UE410-2RO relay output modules and/or 4 SLC-A-UE410-4RO relay output modules (i.e. up to 16 safe relay outputs)

²⁾ The number of extension modules is limited by the capacity of the FLEXBUS+ backplane bus. A drive monitor (SLC-3-MOCx) requires twice the bus capacity of other extension modules. For this reason, the maximum possible number of usable extension modules is reduced by two for each used SLC-3-MOCx.

Product description

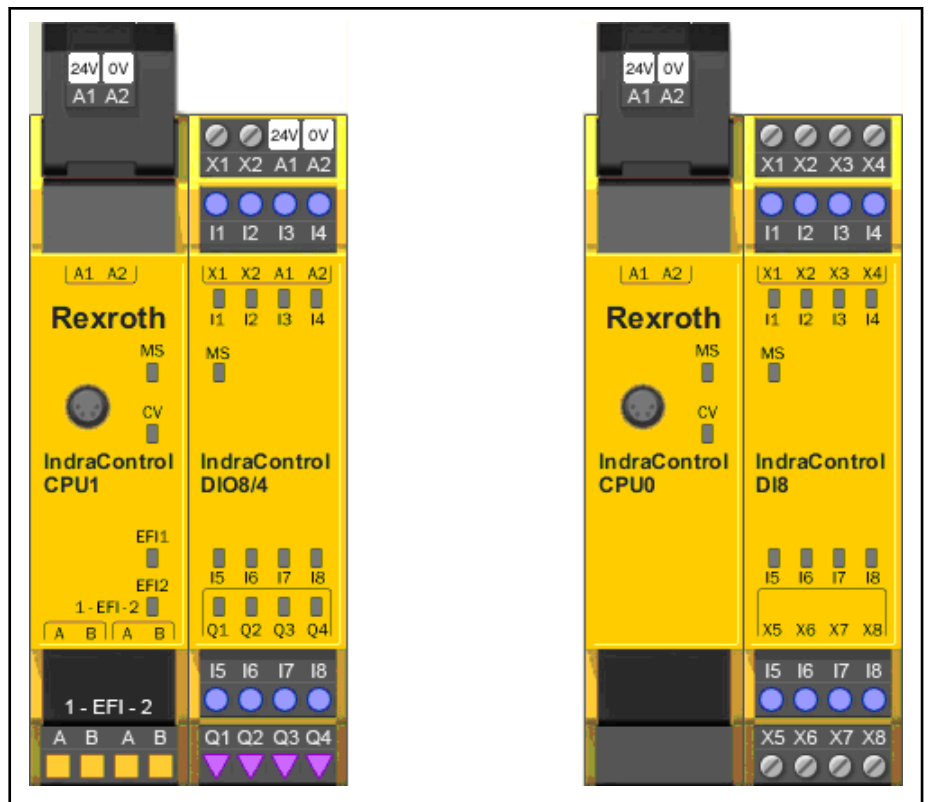


Fig. 3-2: Examples of the minimum design of a SafeLogic compact system with SLC-3-CPU0 and SLC-3-XTDI or SLC-3-CPU1 and SLC-3-XTIO

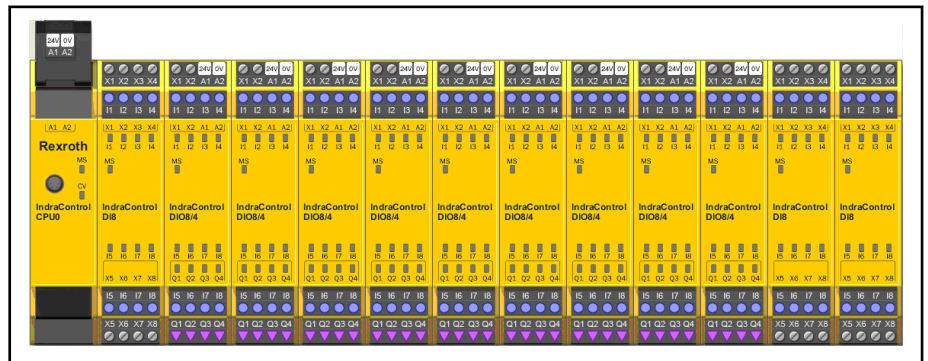


Fig. 3-3: Maximum setup of a SafeLogic compact system (without relay output extensions and gateways)

Product description

Type	Type	Inputs	Outputs	Functions blocks	Max. occurrence
Main modules					
SLC-3-CPU0	Main module	–	–	255	1×
SLC-3-CPU1	Main module with EFI	4 ¹⁾	–		
SLC-3-CPU3	Main module with EFI, ACR and Flexi Line	8 ²⁾			
Gateways					
SLC-0-GPNT	Profinet I/O gateway	2 ³⁾	–	–	2×
SLC-0-GPRO	Profibus DP gateway	1 ⁴⁾	–	–	
SLC-3-GS3S	Sercos gateway	2 ³⁾	–	–	
Extension modules					
SCL-3-XTIO	Input/output extension	8	4	–	12×
SLC-3-XTDI	Input extension	8	–	–	
SLC-3-XTDS	Input/output extension	8	4 - 6 ⁵⁾	–	
SLC-0-STIO	Input/output extension	6 - 8 ⁶⁾	6 - 8 ⁶⁾	–	
SLC-3-MOC0	Drive monitor	–	–	10	6x ⁷⁾
Relay modules					
SLC-A-UE410-2RO	Relay output extension	–	2	–	8x ⁸⁾
SLC-A-UE410-4RO	Relay output extension	–	4	–	4x ⁸⁾

1) EFI connections

2) EFI connections and Flexi Line connections

3) RJ45 sockets

4) RS485 socket

5) Non-safe outputs. Additionally, the outputs XY1 and XY2 can be used as further non-safe outputs

6) SLC-0-STIO is provided with six non-safe inputs and outputs each. Additionally, the connections IY7 and IY8 can be used as non-safe input and as non-safe output

7) Each connected SLC-3-MOC0 module reduces the possible number of other extension modules by two

8) Max. of 16 safe relay outputs

Tab. 3-1: Overview on the modules

3.3 Version, compatibility and features

For the SafeLogic compact product family, there are multiple firmware versions and function packages that allow different functions. This section provides an overview on which firmware version, which function package and/or which version of the SafeLogic Designer software is required to use a certain function or device.

Product description

Feature	Minimum required version		
	SLC-3-CPUx	SLC-3-XTIO SLC-3-XTDI SLC-3-XTDS SLC-0-STIO	Available from SafeLogic Designer
Logic offline simulation	– ³⁾	–	V1.3.0
Import and export of part applications	–	–	V1.3.0
Two S3000 on one EFI interface	V2.00.0	–	V1.3.0
Automatic wiring diagrams	–	–	V1.3.0
Central tag name editor	–	–	V1.3.0
Easy Applications for SLC-3-MOC0	V3.00.0 (Step 3.xx)	–	V1.8.0
EFI Link (only with SLC-3-CPU1 and SLC-3-CPU3)	V2.00.0 (Step 2.xx)	–	V1.3.0
Flexi Loop (not with SLC-0-STIO)	V3.00.0 (Step 3.xx)	V3.00.0 (Step 3.xx)	V1.7.0
Flexi Line (only with SLC-3-CPU3)	V3.00.0 (Step 3.xx)	–	V1.7.0
Automatic configuration of connected EFI-compatible safety sensors (Automatic configuration recovery, ACR) with CPU3	V3.00.0 (Step 3.xx)	–	V1.7.0
Function block documentation in the SafeLogic Designer	–	–	V1.3.0
Input/output relations	–	–	V1.3.0
Invertible inputs for the AND, OR, RS Flip-Flop and Routing N:N function blocks	V2.00.0 (Step 2.xx)	–	V1.3.0
Ramp down detection function block	V2.00.0 (Step 2.xx)	–	V1.3.0
“Adjustable on-delay timer” and “Adjustable off-delay timer” function blocks	V2.00.0 (Step 2.xx)	–	V1.3.0
“Fast shut off with bypass” function block (with SLC-3-XTIO only)	V2.00.0 (Step 2.xx)	V2.00.0 (Step 2.xx)	V1.3.0
Disabling the test pulses at Q1 ... Q4 at the SLC-3-XTIO possible	–	V2.00.0 (Step 2.xx)	V1.3.0
Verification possible without identical hardware	V2.00.0 (Step 2.xx)	–	V1.3.0

3) "–" means "any" or "not applicable"

Product description

Feature	Minimum required version		
	SLC-3-CPUx	SLC-3-XTIO SLC-3-XTDI SLC-3-XTDS SLC-0-STIO	Available from SafeLogic Designer
Status of input data and output data in the logic	V2.00.0 (Step 2.xx)	V2.00.0 (Step 2.xx)	V1.3.0
Multiple safety mats at SLC-3-XTIO/ SLC-3-XTDI	–	V1.13 (Step 1.xx)	V1.3.0
Data recorder	V2.00.0 (Step 2.xx)	–	V1.7.0
Extended cross fault detection time for switching increased capacitive loads	–	V3.00.0 (Step 3.xx)	V1.7.0
Adjustable filter time for on-off filters and off-on filters at the inputs I1 to I8 at SLC-3-XTIO/SLC-3-XTDI	–	V3.00.0 (Step 3.xx)	V1.7.0
Optimization of logic execution time	V4.00.0 (Step 4.xx)	–	V1.8.0
Device	SLC-3-CPUx	SLC-3-XTIO SLC-3-XTDI SLC-3-XTDS SLC-0-STIO	Available from SafeLogic Designer
Gateway for Profinet (SLC-0-GPNT)	V2.00.0 (Step 2.xx)	–	V1.3.0
Gateway for Profibus (SLC-0-GPRO)	V2.00.0 (Step 2.xx)	–	V1.3.0
Gateway for Sercos (SLC-3-GS3S)	V2.00.0 (Step 2.xx)	–	V1.4.0
SLC-3-MOC0	V3.00.0 (Step 3.xx)	–	V1.7.0
SLC-3-XTDS	–	–	V1.7.0
SLC-0-STIO	–	–	V1.7.0
SLC-3-XTDI	–	–	V1.3.0
SLC-3-XTIO	–	–	V1.3.0
RoHS conformity SLC-3-XTIO	–	V1.13 ⁴⁾	–

Tab. 3-2: Required firmware versions and software versions

4) All other modules from product launch onwards



- Newer modules are backward compatible. Thus, any module can be replaced by a module with a higher firmware version.
- With a Designer version $\geq$ V1.4.0, device with later firmware versions can be configured even if the Designer does not yet know the new firmware. However, only function packages (Step 1.xx, Step 2.xx, ...) supported by the present Designer version are available.
- To use the complete functional scope of modules with a newer firmware version, a new SafeLogic Designer version is required. E.g. for CPU0/1 with the firmware $\geq$ V2.00.0 and for XTIO/XTDI with the firmware $\geq$ V2.00.0, a Designer $\geq$ V1.3.0 is required.
- The configuration software is not upward compatible. This means, projects created with a newer version cannot be opened with an older Designer software version.
- The function package (Step 1.xx, Step 2.xx or Step 3.xx) must be selected in the hardware configuration of the configuration software. The availability of a required function package in Designer is specified in the table.
- To use the function package Step n.xx, the respective module has to have at least the firmware version VN.00.0. Otherwise, an error message is output when trying to apply a configuration to a module with a lower firmware version.
- For the firmware version, go to the "Software version" field on the type label of the SafeLogic compact module
- For the hardware version of the SafeLogic compact modules, refer to the hardware configuration of the SafeLogic Designer in "online" state or to the report if the system was online before
- For the version of the SafeLogic Designer, refer to the "Tools" menu under "Info"
- For the date of manufacture of a device, refer to the "FD" field on the type label in the format yy[W]ww (yy = Year, ww = Calendar week)

3.4 Memory plugs SLC-3-MPL0 and SLC-3-MPL1

The system configuration of the entire SafeLogic compact system is only stored to the memory plug. The advantage when replacing extension modules is replaced that the SafeLogic compact system does not have to be reconfigured.

3.4.1 Memory plug variants

There are two variants of the system plug. Each of them can only be used together with specific main modules.

Product description

System plug	Connecti on terminal color	Compatible main modules	Functions
SLC-3-MPL0	Black	• SLC-3-CPU0 • SLC-3-CPU1	• Electronic supply of the SafeLogic compact system • Saving the system configuration (without EFI-capable devices)
SLC-3-MPL1	Yellow	• SLC-3-CPU3	• Electric supply for the Flexi Soft system • Saving the system configuration (including EFI-capable devices) • Automatic configuration of connected EFI-compatible safety sensors (Automatic configuration recovery, ACR)

Tab. 3-3: Memory plug variants



- The main module, the internal logic of all modules and the inputs (I1 ... I8) and test outputs (X1 ... X8) of the extension modules are supplied with electricity exclusively via the memory plug. In contrast, the outputs are supplied separately (Q1 ... Q4, Y1 ... Y6 as well as IY7 and IY8)
- Data stored in the system plug is retained when the voltage supply is interrupted
- If modules are replaced, ensure that the memory plug is plugged into the correct main module. Uniquely mark all the connecting cables and plug-in connectors at the SafeLogic compact system to avoid confusion
- When using a system plug SLC-3-MPL0, reconfigure the connected EFI-capable devices after replacement

3.4.2 Automatic Configuration Recovery (ACR)

When using a memory plug SLC-3-MPL1, EFI-capable devices of the same type can be detected after a replacement and automatically configured again (ACR = Automatic Configuration Recovery).

Benefits:

- Configuration backup of EFI sensors in the SafeLogic compact SLC-3-CPU3
- Fast sensor replacement without reconfiguration with the SafeLogic Designer or CDS
- Fast and simple system duplication in the serial machine engineering

Also note the respective operating instructions of the EFI-compatible devices used. For more information on the ACR use, refer to the operating instructions "IndraControl SafeLogic compact Designer Software".

3.5 Main module SLC-3-CPU0

3.5.1 Description

The main module SLC-3-CPU0 is the central process unit of the entire system, in which all signals are monitored and processed logically as per the configuration stored in the memory plug. The outputs of the system are switched as a result of the processing. The internal bus FLEXBUS+ is used as data interface.



The main module SLC-3-CPU0 can only be operated together with the system plug SLC-3-MPL0.

3.5.2 Display elements, error codes and terminal description

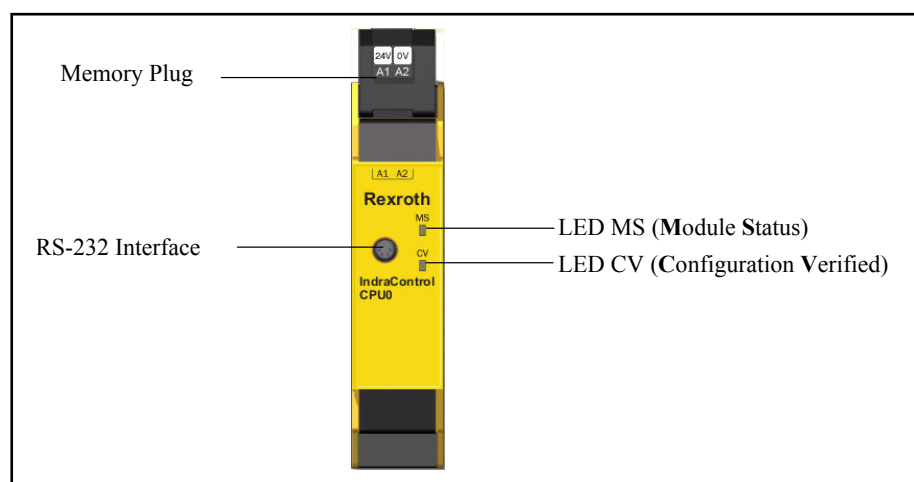


Fig. 3-4: Display elements SLC-3-CPU0

MS LED	Meaning	Notes
○	Supply voltage outside the range	Switch on the supply voltage and check it at the terminals A1 and A2
 Red/green (1 Hz)	A self test is performed or the system is initialized	Please wait ...
 Green (1 Hz)	System is in "Stop" state	Press Start to start the application in the SafeLogic Designer
 Green (2 Hz)	Identify (e.g. for EFI Link)	-
 Green	System is in "Run" state	-

Product description

MS LED	Meaning	Notes
 Red (1 Hz)	Invalid configuration	Check the module type and version of the main module and of extension modules whose "MS" LED flashes red/green If necessary, adapt the configuration using the SafeLogic Designer For detailed diagnostic information, please refer to the SafeLogic compact Designer
 Red (2 Hz)	Critical error in the system, probably in this module. Application was stopped. All outputs are disabled	Switch off and on the supply voltage If the error is not eliminated after multiple repetition, replace this module For a more detailed diagnostic information, refer to the operation instructions "IndraControl SafeLogic compact Designer Software", chapter "Diagnostic view"
 Red	Critical error in the system, probably in another module. Application was stopped. All outputs are disabled	Switch off and on the supply voltage If the error is not eliminated after multiple repetition, replace the module which flashes  red (2 Hz). If this is not the case, use the diagnostic function in the SafeLogic Designer to narrow down the respective module

Tab. 3-4: Displays of the "MS" LED

CV LED	Meaning	Note
○	Configuration in progress	
 Yellow (2 Hz)	Saving configuration data in the non-volatile memory	The voltage supply may not be interrupted until the storage has been completed
 Yellow (1 Hz)	Unverified configuration	Verify configuration with SafeLogic Designer software
 Yellow	Verified configuration	

Tab. 3-5: Displays of the "CV" LED

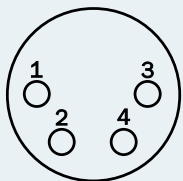
RS232 interface

Pin	Assignment
A1	24 V voltage supply for all the modules, except for the supply of the outputs (Q1 ... Q4)
A2	GND of the voltage supply

Tab. 3-6: Pin assignment of the memory plug

The main module is also provided with an RS232 interface with the following functions:

- Loading the configuration from SafeLogic Designer to the memory plug
- Loading the configuration from the memory plug to the SafeLogic Designer
- Diagnostics of the SafeLogic compact system with the SafeLogic Designer
- Continuous diagnostics of the SafeLogic compact system via a connected PLC. The RS232 interface is thus an alternative to a gateway

Plug/socket	Pin	Signal	Color	Assignment on PC RS232 Sub-D (9-pin)
	1	Reserved	Brown	–
	2	RxD	White	Pin 3
	3	GND (internally electrically connected with A2 of the main module)	Blue	Pin 5
	4	TxD	Black	Pin 2

Tab. 3-7: Pin assignment of the RS232 interface



- If the RS232 interface of the main module is connected permanently for usage as an alternative to a gateway, the maximum permissible cable length is 3 m
- The GND of the RS-232 interface is connected internally to the GND of the supply voltage of the main module (A2). Avoid ground loops between the GND of the RS232 interface and the connection A2 of the main module, e.g. by using optocouplers

3.6 Main module SLC-3-CPU1

3.6.1 Description

The main module SLC-3-CPU1 has the same functions as the SLC-3-CPU0. Please observe the notes in [chapter 3.5 "Main module SLC-3-CPU0" on page 23](#).



The main module SLC-3-CPU1 can only be operated together with the system plug SLC-3-MPL0.

In addition, this module is provided with two EFI interfaces. If EFI-compatible devices are connected, the following additional functions are available:

Product description

- Loading the configuration from the SafeLogic Designer to the memory plug and to the connected EFI-compatible devices
- Loading the configuration from the memory plug and the connected EFI-compatible devices to the SafeLogic Designer
- Diagnostics of the SafeLogic compact system and the connected EFI-compatible devices with the SafeLogic Designer
- Process data exchange between the main module and EFI-compatible devices
- Connection of up to four SLC-3-CPU1 main modules to one EFI Link system (see [chapter 4.7 "EFI Link" on page 75](#))

For further information on the EFI interfaces, refer to [chapter 5.1 "Enhanced Function Interface – EFI" on page 85](#).

3.6.2 Display elements, error codes and terminal description

The displays of the "MS" and "CV" LEDs as well as the terminal assignment of the RS232 interface are identical with those at the main module SLC-3-CPU0, see [chapter 3.5.2 "Display elements, error codes and terminal description" on page 23](#).

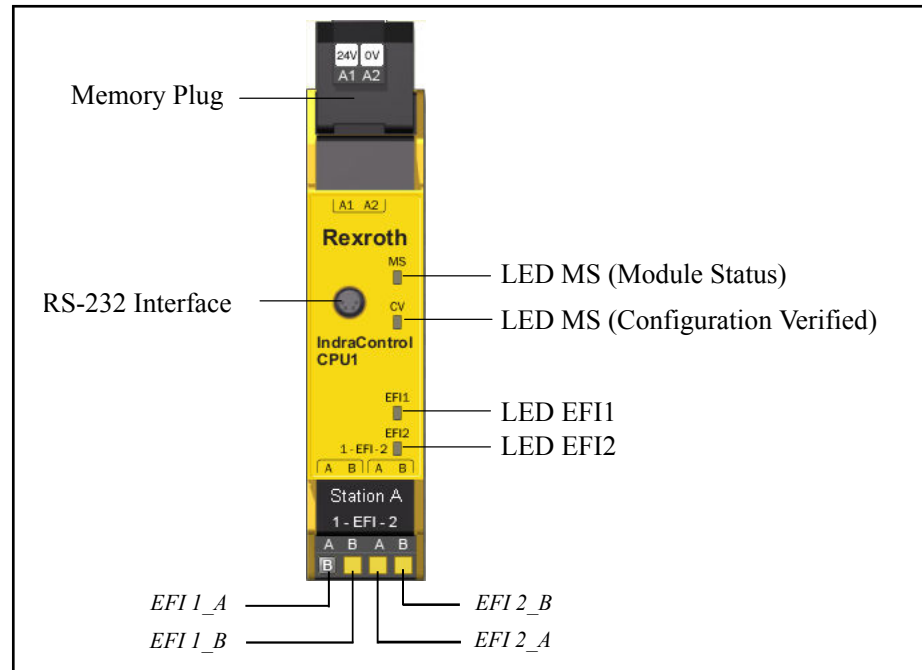


Fig. 3-5: Display elements SLC-3-CPU1

EFI LED (EFI1 or EFI2)	Meaning	Note
○	OK	–
●	Waiting for integration of any EFI-compatible devices or an EFI Link station after power up	–
Red		

EFI LED (EFI1 or EFI2)	Meaning	Note
 Red (1 Hz)	Error, e.g.: - Expected EFI-compatible device or EFI Link station was not found within three minutes - Integration check failed - Communication interruption - EFI device address conflict - EFI Link ID conflict	Check the wiring Later integration is still possible
 Red (2 Hz, alternating)	Identify (e.g. for EFI Link)	–

Tab. 3-8: Displays of the "EFI" LEDs

3.7 Main module SLC-3-CPU3

3.7.1 Description

The main module SLC-3-CPU3 has the same functions as the SLC-3CPU1. Also observe the notes in [chapter 3.6 "Main module SLC-3-CPU1" on page 25](#).

Additionally, the SLC-3-CPU3 is provided with a function to automatically configure connected EFI-capable safety sensors (ACR). For detailed information, refer to [chapter 3.4 "Memory plugs SLC-3-MPL0 and SLC-3-MPL1" on page 21](#).

Additionally, this module is provided with a Flexi Line interface allowing a safe networking of up to 32 Safe Logic compact stations.



The main module SLC-3-CPU3 can only be operated together with the system plug SLC-3-MPL1.



For more detailed information on the main module SLC-3-CPU3, refer to the operating instructions "IndraControl SafeLogic compact Designer Software".

3.7.2 Display elements, error codes and terminal description

The displays of the "MS" and "CV" LEDs as well as the terminal assignment of the RS232 interface are identical with those at the main module SLC-3-CPU0, see [chapter 3.5 "Main module SLC-3-CPU0" on page 23](#).

The displays of the LEDs "EFI1" und "EFI2" are identical with those at the main module SLC-3-CPU1, see [chapter 3.6 "Main module SLC-3-CPU1" on page 25](#).

Product description

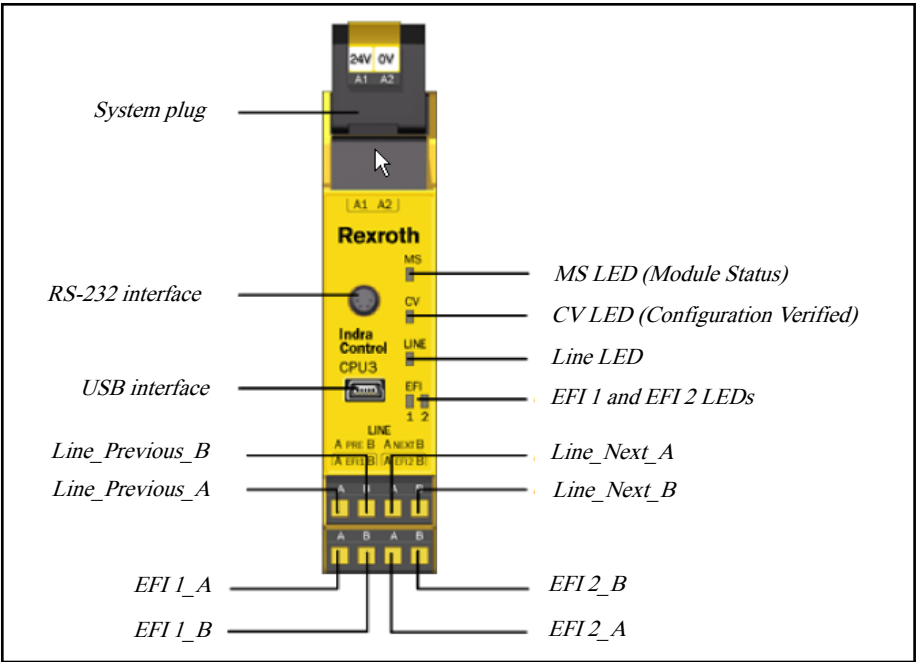


Fig. 3-6: Display elements SLC-3-CPU3

EFI LED (EFI1 or EFI2)	Meaning	Note
○	OK	–
● Red	- Waiting for integration of EFI-compatible devices or Flexi Link station after power up - ACR execution Waiting for integration of any EFI-compatible devices or an EFI Link station after power up	–

Product description

EFI LED (EFI1 or EFI2)	Meaning	Note
 Red (1 Hz)	Error, e.g.: - Expected EFI-compatible device or EFI Link station was not found within three minutes - Integration check failed - Communication interruption - EFI device address conflict - EFI Link ID conflict - Error executing ACR (ACR integration test failed, ACR transfer error)	Check the wiring Later integration is still possible
 Red (2 Hz, alternating)	Identify (e.g. for EFI Link)	–

Tab. 3-9: Displays of the "EFI" LEDs

LED Line	Meaning
	Flexi Line is not configured and not operating
 Green	Flexi Line in operation
 Green (1 Hz)	Flexi Line started, waiting for neighboring stations
 Green (2 Hz)	Teach required
 Red/green (2 Hz)	Flexi Line configuration required
 Red (1 Hz)	Error at the Flexi Line bus, e.g. interrupted communication
 Red	Critical fault, Flexi Line stopped

Tab. 3-10: Displays of the "Line" LED

USB interface

The CPU3 main module has an USB interface (USB version 2.0, Mini-B connection type) with the following functions:

- Transfer of the configuration from the configuration software to the memory plug.
- Loading of the configuration from the memory plug to the configuration software
- Diagnostics of Flexi Soft safety control in connection with the configuration software

Product description

3.8 Input/output extension module SLC-3-XTIO

3.8.1 Description

The module SLC-3-XTIO is the input/output extension with eight safe inputs and four safe outputs. The module has two test signal generators: One for test output X1 and one for test output X2.

The SLC-3-XTIO module provides the following functions:

- Monitoring of the connected safety devices, also refer to [chapter 4 "Connecting devices" on page 59](#)
- Transmitting the input information to the main module
- Receiving the control signals from the main module and corresponding switching of the outputs
- Fast Shut Off: Direct switch-off of the actuators connected to the module possible from the firmware version V2.00.0 of the main module SLC-3-CPU0 or SLC-3-CPU1 and the version V1.3.0 of the SafeLogic Designer or from the firmware version V3.00.0 of the main module with SLC-3-CPU3 and the version V1.7.0 of the SafeLogic Designer.

This leads to a considerable reduction of the response time of the complete system. To switch-off outputs, only 8 ms have to be added to the response times of the devices connected to the inputs and outputs. The response time on the internal bus FLEXBUS+ as well as the "Logic Execution Time" are irrelevant in this case, also see [chapter 12.1 "Response times of the SafeLogic compact system" on page 109](#)

- Enabling or disabling test pulses at the outputs Q1 ... Q4 from the firmware version V2.00.0 or and the SafeLogic Designer version V1.3.0



- The SLC-3-XTIO module cannot be used alone and always requires the main module SLC-3-CPU0/1/3, refer to the SafeLogic Designer configuration software
 - The simultaneous use of several SLC-3-XTIO modules is possible, see [chapter 3.2 "System setup" on page 16](#)
 - Voltage of the internal logic and the test outputs is supplied via the memory plug and the internal bus FLEXBUS+
 - The voltage for the SLC-3-XTIO outputs Q1 ... Q4 has to be supplied directly via A1/A2 at the respective module
-



- Short circuits between arbitrary test signal generators of the SafeLogic compact extension modules are detected, also between test signal generators of different modules provided that the test gaps are ≤ 4 ms and the test cycles ≥ 200 ms for the relevant test outputs
 - Short circuits after 24 V DC (after "High") at inputs connected to test outputs are detected independently of the test gap time
-

3.8.2 Display elements, error codes and terminal description

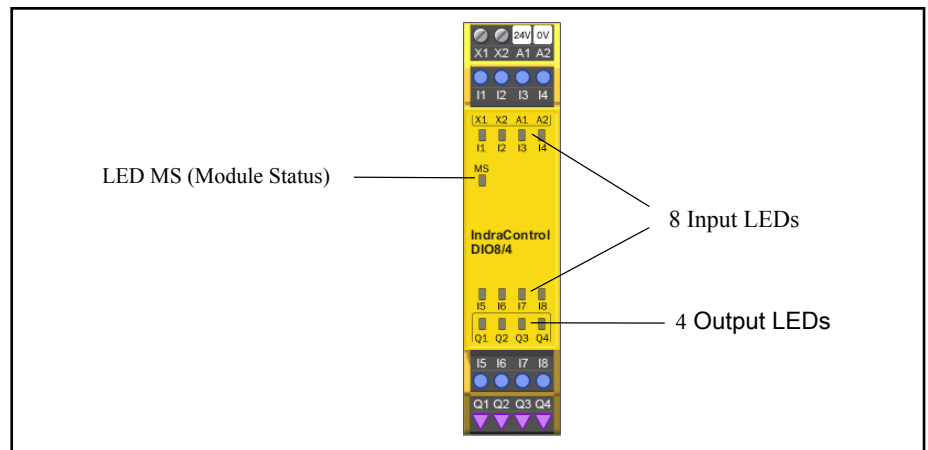


Fig. 3-7: Display elements SLC-3-XTIO

Terminal	Assignment
X1, X2	Test output 1, test output 2
I1 ... I4	Safe inputs 1 to 4
A1	24 V
A2	GND
I5 ... I8	Safe inputs 5 to 8
Q1 ... Q4	Outputs 1 to 4

Tab. 3-11: Terminal assignment SLC-3-XTIO

MS LED	Meaning	Notes
○	Supply voltage outside the range	Switch on the supply voltage and check it at the terminals A1 and A2
 Red/green (1 Hz)	With the firmware V1.xx.0: Invalid configuration With the firmware ≥ V2.00.0: Recoverable external error	- Check the wiring of the flashing inputs and outputs If all output LEDs flash, check the supply voltage at the terminals A1 and A2 of this module
 Green (1 Hz)	System is in "Stop" state	Start the application in the SafeLogic Designer
● Green	System is in "Run" state	-

Product description

MS LED	Meaning	Notes
 Red (1 Hz)	With the firmware V1.xx.0: Recoverable external error With a firmware $\geq$ V2.00.0: Invalid configuration	Check the wiring of the flashing inputs and outputs If all output LEDs flash, check the supply voltage at the terminals A1 and A2 of this module -
 Red (2 Hz)	Critical error in the system, probably in this module. Application was stopped. All outputs are disabled	Switch off and on the supply voltage If the error is not eliminated after multiple repetition, replace this module For a more detailed diagnostic information, refer to the operation instructions "IndraControl SafeLogic compact Designer Software", chapter "Diagnostic view"
 Red	Critical error in the system, probably in another module. Application was stopped. All outputs are disabled	Switch off and on the supply voltage If the error is not eliminated after multiple repetition, replace the module which flashes  red (2 Hz). If this is not the case, use the diagnostic function in the SafeLogicDesigner to narrow down the affected module

Tab. 3-12: Displays of the "MS" LED

Input LEDs (I1 ... I8) Output LEDs (Q1 ... Q4)	Meaning
	Input/output is inactive
 Green	Input/output is active
 Green (1 Hz) synchronous with the red "MS" LED	Input/output is inactive and there is a recoverable error
 Green (1 Hz) alternating with the red "MS" LED	Input/output is active and there is a recoverable error

Tab. 3-13: Displays of the input LEDs and output LEDs



The LEDs of the inputs and outputs display the state with a refresh rate of approx. 64 ms.

3.8.3 Internal circuits

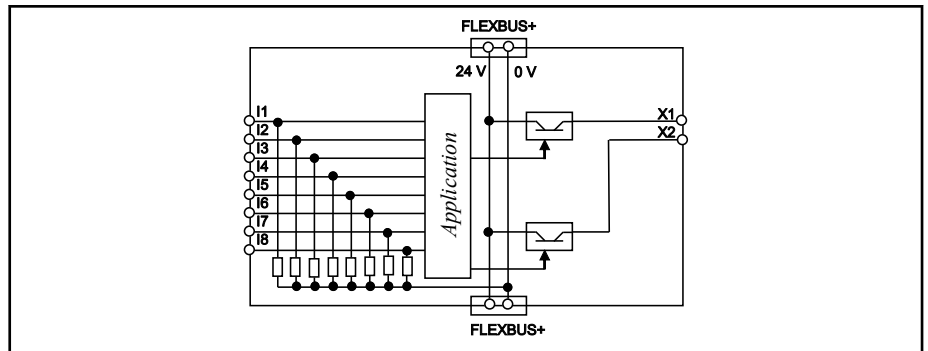


Fig. 3-8: Internal circuits of the SLC-3-XTIO – Safety inputs and test outputs

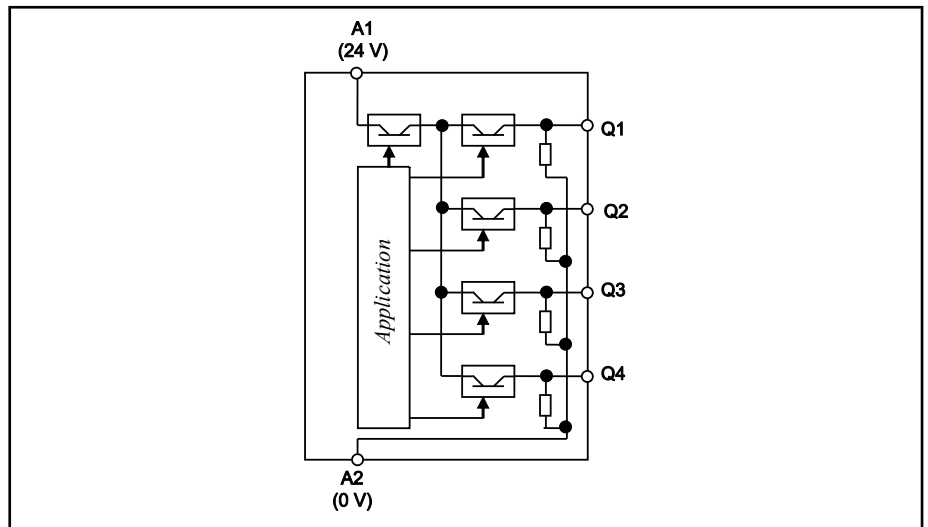


Fig. 3-9: Internal circuits of the SLC-3-XTIO – Safety outputs

3.8.4 Disabling the test pulses at the outputs Q1 ... Q4 of the SLC-3-XTIO

From the firmware version V2.00.0, it is possible to disable the test pulses at one or multiple outputs of SLC-3-XTIO modules.

⚠ CAUTION

Disabling the test pulses of any output reduces the safety parameters of all outputs!

Disabling the test pulses at one or multiple safety outputs of an SLC-3-XTIO module, reduces the safety parameters for all safety outputs Q1 ... Q4 of this module. Observe this to ensure that your application complies with an appropriate risk analysis and avoidance strategy!

For detailed information on the safety parameters, refer to [chapter 12 "Technical data"](#) on page 109.

⚠ CAUTION

Use protected or separate cabling!

When disabling the test pulses of one or more safety outputs Q1 ... Q4, use protected or separate wiring for the safety outputs with disabled test pulses, as a short circuit after 24 V cannot be detected if the output is "High". This could inhibit the switch-off capability for the other outputs in case of a detected internal hardware error due to reverse current.

Product description

⚠ CAUTION

Perform cyclic tests if the test pulses of any safety output are disabled!

When disabling the test pulses of one or more safety outputs Q1 ... Q4, either all safety outputs without test pulses have to be switched off at the same time and for at least one second and at least annually by the logic program of the main module. Alternatively, restart the SafeLogic compact system by switching off the voltage supply.

How to disable the test pulses at an SLC-3-XTIO output:

- Connect an output element to the SLC-3-XTIO module
- Left double-click on the output element
- Deselect the option "Enable test pulses of this output". The test pulses of this output are disabled. A note is displayed in the hardware configuration area under the respective SLC-3-XTIO module

3.8.5 Extended error detection time for cross faults at the outputs Q1 ... Q4 of the SLC-3-XTIO to switch increased capacitive loads

From the firmware version V3.00.0, it is possible to configure a longer error detection time for cross faults for the outputs Q1 ... Q4 of SLC-3-XTIO modules.

This can be required when switching loads resulting in a cross fault error immediately after switch-off (from "High" to "Low") after a normal error detection time, as the voltage at the load does not reduce to the "Low" level as fast as expected. Examples for such cases:

- Loads with a higher capacity are permitted for the output as default, e.g. the supply voltage of PLC output cards to be switched safely
For this application, the test pulse has to be disabled additionally for the output
- Inductive loads causing an overshoot in the positive voltage range after the reduction of the induction voltage

SLC-3-XTIO firmware version	Option "Switching increased capacitive loads"	Maximum permitted time up to "Low" level (≤ 3.5 V) after disabling the output (Q1 ... Q4)
$\leq$ V2.11.0	Not possible	3 ms
$\geq$ V3.00.0	Disabled	3 ms
	Enabled	43 ms

Tab. 3-14: Maximum extended error detection times for cross faults at the SLC-3-XTIO

The capacity exceeding the value permitted by default to the "Low" level, has to be discharged by the customer after switching off the output. If this condition is not met within the maximum permitted time, a cross fault error is caused at the output irrespective of whether the test pulses are enabled or disabled at this output.

⚠ CAUTION

Note that the PLC output card has to be suitable for the safety-related switch-off of the outputs by switching the supply voltage!

The safety-related switch-off capability can be affected or lost due to the following faults:

- Unknown cross fault at an output if the PLC output card, which can cause a backfeeding to the supply of the PLC output card. Under certain circumstances, this error can be eliminated by a wiring in a sufficiently protected area
- Unknown error in the PLC output card, which can cause an external feeding to the supply of the PLC output card from another live signal
- Extending the response time by a buffer capacitor in the PLC output card supply

Note that the outputs of the SLC-3-XTIO modules are not able to discharge this buffer capacitor, as the buffer capacitor is normally located behind a reverse protection diode

Activate the option "Switching increased capacitive loads" at one output Q1 ... Q4 of the SLC-3-XTIO

- Connect an output element to the SLC-3-XTIO module
- Left double-click on the output element
- Enable the option **Enable switching increased capacitive loads using this output**

⚠ CAUTION

Observe the extended error detection time!

Selecting the option "Switching increased capacitive loads" causes an extended error detection time. This applied especially to single-channel outputs. Please see [chapter 3.8 "Input/output extension module SLC-3-XTIO" on page 30](#)

3.8.6 Single-channel use of outputs at the SLC-3-XTIO

⚠ CAUTION

Consider a possible brief switching to "high" for single-channel safety outputs!

In case of an internal hardware error, the outputs Q1 ... Q4, which were normally "Low", switch off with delay or switch to "High" for a short time until the error was detected and the error response was executed. The error detection time plus the error response time depends on the selected configuration for the output.

SLC-3-XTIO firmware version	Option "Switching increased capacitive loads"	Error detection time + error response time
≤ V2.11.0	Not possible	≤ 10 ms
≥ V3.00.0	Disabled	≤ 10 ms
	Enabled	≤ 50 ms

Tab. 3-15: Error detection time + error response time when switching increased capacitive loads

Product description

Observe this for your risk analysis and reduction strategy, especially for single-channel outputs. Otherwise, the operator of the machine is in danger.

3.9 Input extension module SLC-3-XTDI

3.9.1 Description

The SLC-3-XTDI module is an input extension with eight safe inputs. 2 test pulse generators are available: one for test outputs X1, X3, X5 and X7 and one for test outputs X2, X4, X6 and X8. The module offers the following functions:

- Monitoring of the connected sensors, also refer to [chapter 4 "Connecting devices" on page 59](#)
- Transmitting the input information to the main module



- The SLC-3-XTDI module cannot be used alone and always requires the main module SLC-3-CPU0/1/3, refer to the "SafeLogic Designer" configuration software
- The simultaneous use of several SLC-3-XTDI modules is possible, see [chapter 3.2 "System setup" on page 16](#)
- Voltage of the internal logic and the test outputs is supplied via the memory plug and the internal bus FLEXBUS+

CAUTION

Limited short-circuit detection!

An SLC-3-XTDI has two test signal generators. One test signal generator is responsible for the odd-numbered test outputs X1, X3, X5 and X7, the other for the even-numbered test outputs X2, X4, X6 and X8.

Short circuits between arbitrary test signal generators of the SafeLogic compact extension modules are detected, also between test signal generators of different modules provided that the test gaps are ≤ 4 ms and the test cycles ≥ 200 ms. Short circuits after 24 V DC (after "High") at inputs connected to test outputs are detected independently of the test gap time.

Note that the odd-numbered test outputs X1, X3, X5 and X7 at the SLC-3-XTDI are connected to one common test signal generator and that the even-numbered test outputs X2, X4, X6 and X8 are connected to another common test signal generator. Therefore, short circuits between the odd-number test outputs X1, X3, X5 and X7 cannot be detected. The same applies respectively for even-numbered test outputs X2, X4, X6 and X8.

Consider that while wiring (e.g. separate routing, protected cables)!

3.9.2 Display elements, error codes and terminal description

The displays of the "MS" LED as well as the input LEDs I1 ... I8 are identical with those at the SLC-3-XTIO, see [chapter 3.8.2 "Display elements, error codes and terminal description" on page 31](#).

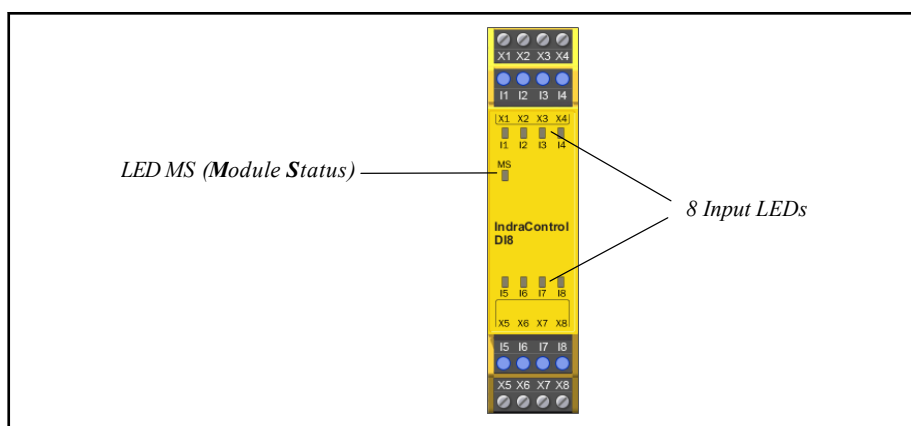


Fig. 3-10: Display elements of the SLC-3-XTDI

Terminal	Assignment
X1, X3	Test output 1 (test signal generator 1)
X2, X4	Test output 2 (test signal generator 2)
I1 ... I4	Safe inputs 1 to 4
I5 ... I8	Safe inputs 5 to 8
X5, X7	Test output 1 (test signal generator 1)
X6, X8	Test output 2 (test signal generator 2)

3.9.3 Internal circuits

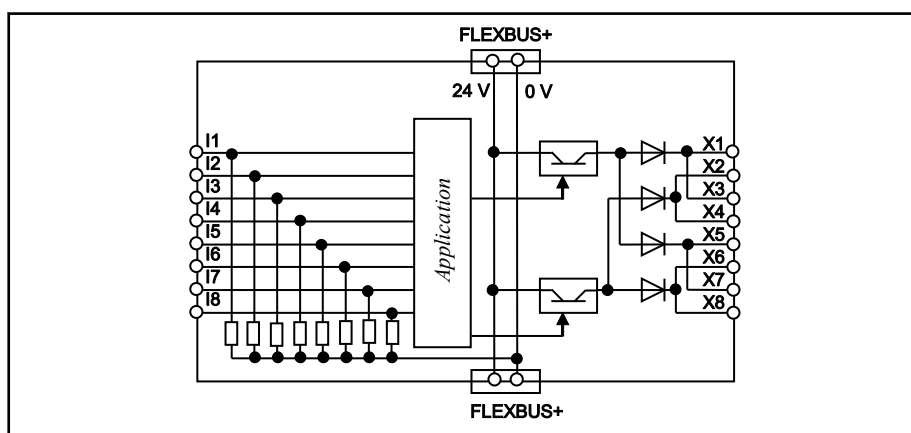


Fig. 3-11: Internal circuits of the SLC-3-XTDI – Safety inputs and test outputs

3.10 Input/output extension module SLC-3-XTDS

3.10.1 Description

The module SLC-3-XTDS is the input/output extension with eight safe inputs and four non-safe outputs. The module has two optional test signal generators: One for test output XY1 and one for test output XY2.

The SLC-3-XTDS module provides the following functions:

- Monitoring of the connected safety devices
- Transmitting the input information to the main module
- Receiving the control signals from the main module and corresponding switching of the outputs

Product description

- The outputs XY1 and XY2 can be used as test outputs and as non-safe outputs

⚠ CAUTION

Do not use non-safe outputs for safety functions!

The non-safe outputs XY1, XY2 and Y3–Y6 of the SLC-3-XTDS may not be used for safety-relevant functions. Otherwise, the operator of the machine is in danger.



- The SLC-3-XTDS module cannot be used alone. It always requires the main module SLC-3-CPUx
- The simultaneous use of several SLC-3-XTDS modules is possible
- Voltage of the internal logic and the test outputs is supplied via the memory plug and the internal bus FLEXBUS+
- The voltage for the SLC-3-XTDS outputs Y3–Y6 have to be supplied directly via A1/A2 at the respective module



- Short circuits between arbitrary test signal generators of the SafeLogic compact extension modules are detected, also between test signal generators of different modules provided that the test gaps are < 4 ms
- Short circuits after 24 V DC (after “High”) at inputs connected to test outputs are detected independently of the test gap time
- Even though both the outputs XY1 and XY2 are already used as non-safe outputs, a tested element can still be connected to one of the inputs from I1 to I8. However, a warning is displayed, i.e. this element is displayed in red in the hardware configuration.

3.10.2 Using the outputs XY1 and XY2 of the SLC-3-XTDS

The outputs XY1 and XY2 of an SLC-3-XTDS module can be used as test outputs and as non-safe outputs.

As non-safe output

- In the hardware configuration of the SafeLogic Designer, drag any output element to one of the two outputs XY1 and XY2. The respective output now responds like a non-safe output

As test output

- In the hardware configuration of the SafeLogic Designer, drag any tested input element to one of the inputs I1 and I8. One of the free outputs XY1 or XY2 is automatically configured as test output for the tested element



Even though both the outputs XY1 and XY2 are already used as non-safe outputs, a tested element can still be connected to one of the inputs from I1 to I8. However, a warning is displayed, i.e. this element is displayed in red in the hardware configuration.

3.10.3 Display elements, error codes and terminal description

The displays of the "MS" LED as well as the input LEDs I1 ... I8 are identical with those at the SLC-3-XTIO, see [chapter 3.8.2 "Display elements, error codes and terminal description"](#) on page 31.

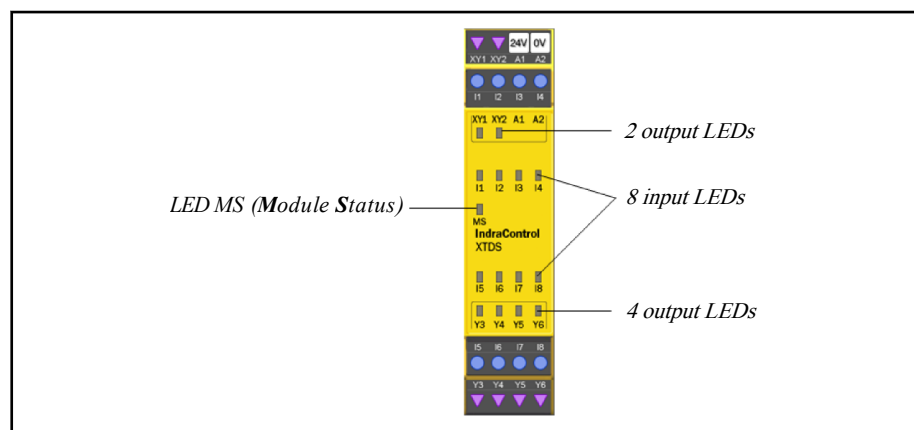


Fig. 3-12: Display elements of the SLC-3-XTDS

Terminal	Assignment
XY1,XY2	Test output 1, test output 2 or non-safe output 1, non-safe output 2
A1	24 V
A2	GND
I1 ... I4	Safe inputs 1 to 4
I5 ... I8	Safe inputs 5 to 8
Y3 ... Y6	Non-safe outputs 3 to 6

Tab. 3-16: Terminal assignment of the SLC-3-XTDS

MS LED	Meaning	Notes
○	Supply voltage outside the range	Switch on the supply voltage and check it at the terminals A1 and A2
⊙ Red/green (1 Hz)	Recoverable external error	Check the wiring of the flashing inputs and outputs If all output LEDs flash, check the supply voltage at the terminals A1 and A2 of this module
⊙ Green (1 Hz)	System is in "Stop" state	Start the application in the SafeLogic Designer
● Green	System is in "Run" state	-
⊙ Red (1 Hz)	Invalid configuration	-

Product description

MS LED	Meaning	Notes
 Red (2 Hz)	Critical error in the system, probably in this module. Application was stopped. All outputs are disabled	Switch off and on the supply voltage If the error is not eliminated after multiple repetition, replace this module For a more detailed diagnostic information, refer to the operation instructions "IndraControl SafeLogic compact Designer Software", chapter "Diagnostic view"
 Red	Critical error in the system, probably in another module. Application was stopped. All outputs are disabled	Switch off and on the supply voltage If the error is not eliminated after multiple repetition, replace the module which flashes  red (2 Hz). If this is not the case, use the diagnostic function in the SafeLogicDesigner to narrow down the affected module

Tab. 3-17: *Displays of the "MS" LED*

Input LEDs (I1 ... I8) Output LEDs (XY1, XY2 and Y3 ... Y6)	Meaning
	Input/output is inactive
 Green	Input/output is active
 Green (1 Hz) synchronous with the red "MS" LED	Input/output is inactive and there is a recoverable error
 Green (1 Hz) alternating with the red "MS" LED	Input/output is active and there is a recoverable error

Tab. 3-18: *Displays of the input LEDs and output LEDs of the SLC-3-XTDS*

 The LEDs of the inputs and outputs display the state with a refresh rate of approx. 64 ms.

3.10.4 Internal circuits

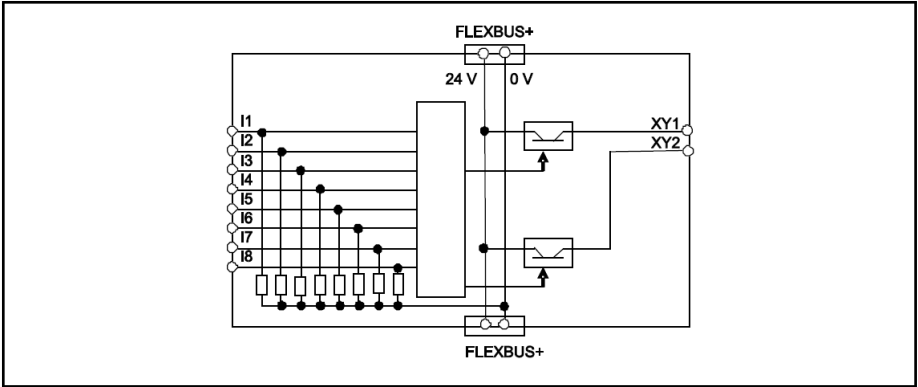


Fig. 3-13: *Internal circuits of the SLC-3-XTDS – Safe inputs and test outputs*

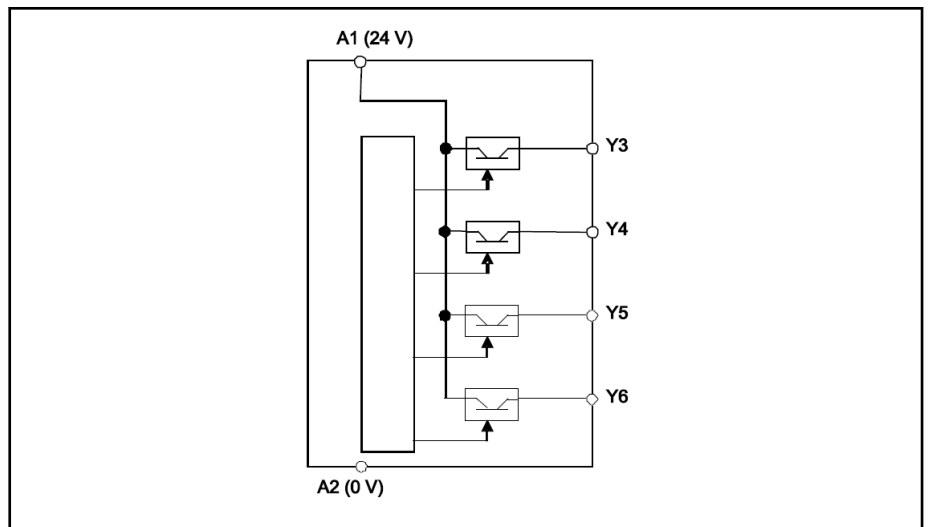


Fig. 3-14: Internal circuits of the SLC-3-XTDS – Non-safe outputs

3.11 Input/output extension module SLC-0-STIO

3.11.1 Description

The module SLC-0-STIO is an input/output extension with six non-safe inputs, six non-safe outputs and two connections which can be arbitrarily used as non-safe inputs or outputs.

The SLC-0-STIO module provides the following functions:

- Transmitting the input information to the main module
- Receiving the control signals from the main module and corresponding switching of the outputs

⚠ CAUTION

Do not use the SLC-0-STIO for safety functions!

SLC-0-STIO may not be used for safety-relevant functions. Otherwise, the operator of the machine is in danger.



- The SLC-0-STIO module cannot be operated alone. It always requires the main module SLC-3-CPUx
- The simultaneous use of several SLC-0-STIO modules is possible
- Voltage for the internal logic is supplied via the memory plug and the FLEXBUS+ internal bus
- The voltage for the outputs Y1–Y6 as well as the connections IY7 and IY8 of the SLC-0-STIO have to be supplied directly via A1/A2 at the respective module

3.11.2 Using the connections IY7 and IY8 of the SLC-0-STIO

The connections IY7 and IY8 of an SLC-0-STIO module can be used as non-safe input and as non-safe output.

- In the hardware configuration of the SafeLogic Designer, drag any input element or output element to one of the two connections IY7 and IY8. The respective connection now responds either like a non-safe input or

Product description

a non-safe output. This response depends on the type of the connected element

3.11.3 Display elements, error codes and terminal description

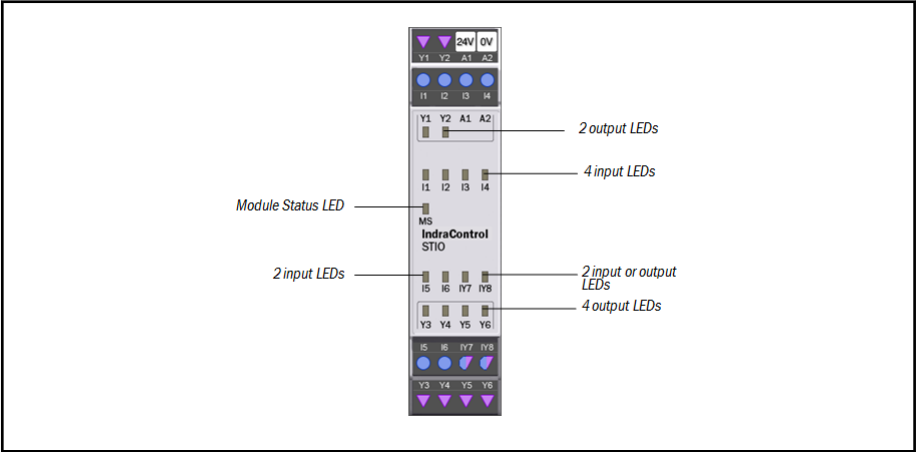


Fig. 3-15: Display elements of the SLC-0-STIO

Terminal	Assignment
Y1/Y2	Non-safe outputs 1 and 2
A1	24 V
A2	GND
I1 ... I4	Non-safe inputs 1 to 4
I5, I6	Non-safe inputs 5 to 6
IY7, IY8	Non-safe inputs 7 and 8 or non-safe outputs 7 and 8 (configurable)
Y3 ... Y6	Non-safe outputs 3 to 6

Tab. 3-19: Terminal assignment of the SLC-0-STIO

MS LED	Meaning	Notes
○	Supply voltage outside the range	Switch on the supply voltage and check it at the terminals A1 and A2
⊙ Red/green (1 Hz)	Recoverable external error	Check the wiring of the flashing inputs and outputs If all output LEDs flash, check the supply voltage at the terminals A1 and A2 of this module
⊙ Green (1 Hz)	System is in "Stop" state	Start the application in the SafeLogic Designer
● Green	System is in "Run" state	-
⊙ Red (1 Hz)	Invalid configuration	-

Product description

MS LED	Meaning	Notes
 Red (2 Hz)	Critical error in the system, probably in this module. Application was stopped. All outputs are disabled	Switch off and on the supply voltage If the error is not eliminated after multiple repetition, replace this module For a more detailed diagnostic information, refer to the operation instructions "IndraControl SafeLogic compact Designer Software", chapter "Diagnostic view"
 Red	Critical error in the system, probably in another module. Application was stopped. All outputs are disabled	Switch off and on the supply voltage If the error is not eliminated after multiple repetition, replace the module which flashes  red (2 Hz). If this is not the case, use the diagnostic function in the SafeLogicDesigner to narrow down the affected module

Tab. 3-20: Displays of the "MS" LED of the SLC-0-STIO

Input LEDs (I1 ... I6) Output LEDs (Y1 ... Y6) Input/output LEDs (IY7, IY8)	Meaning
	Input/output is inactive
 Green	Input/output is active
 Green (1 Hz) synchronous with the red "MS" LED	Input/output is inactive and there is a recoverable error
 Green (1 Hz) alternating with the red "MS" LED	Input/output is active and there is a recoverable error

Tab. 3-21: Displays of the input LEDs and output LEDs of the SLC-0-STIO

 The LEDs of the inputs and outputs display the state with a refresh rate of approx. 64 ms.

Product description

3.11.4 Internal circuits

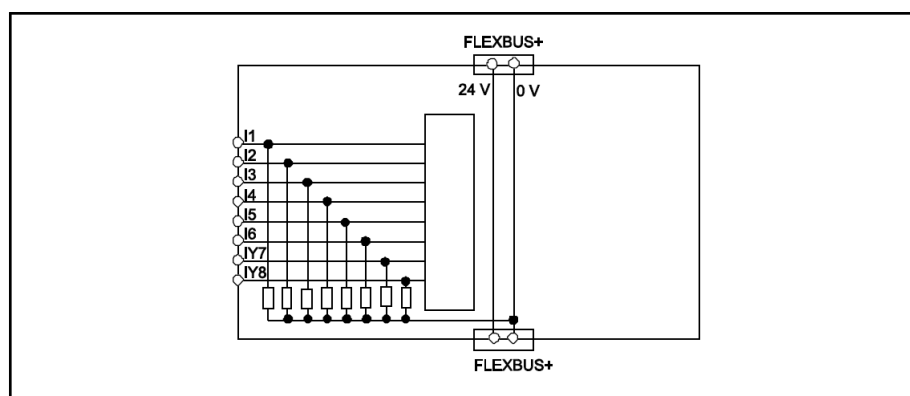


Fig. 3-16: Internal circuits of the SLC-0-STIO – inputs

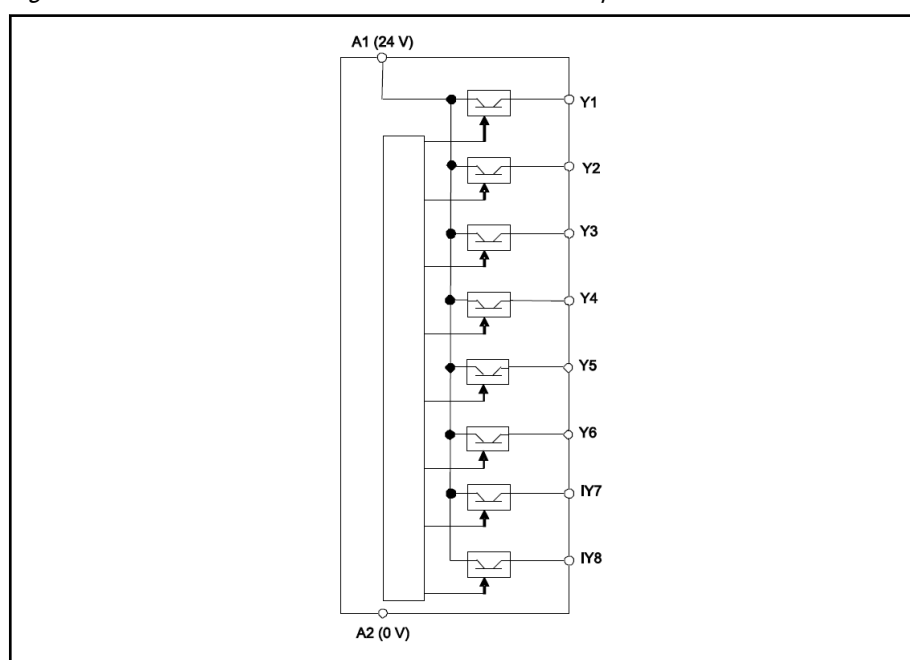


Fig. 3-17: Internal circuits of the SLC-0-STIO – outputs

3.12 Drive monitor SLC-3-MOC0

3.12.1 Description

The module SLC-3-MOC0 is an extension module for the safe motion monitoring of drive systems. Motion means velocity level, velocity ramp and position. The module is provided with an interface to connect two encoders (e.g. rotary encoder, linear encoder, motor feedback systems or linear measuring systems).

Product description

Module name	Functional scope
SCL-3-MOC0	• Connection of two encoders for one or two axes – Incremental encoder HTL 24 V, HTL 12 V, TTL, max. 300 kHz – Incremental encoder RS-422, max. 1 MHz⁵⁾ – Sin/cos encoder 1 V_{SS}, max. 120 kHz – SSI encoder, RS-422, max. 1 MBaud • Standstill monitoring • Velocity monitoring • Direction monitoring • Processing information of the encoders and the control signals from the main menu in the internal logic of the SCL-3-MOC0. An own logic editor is available with a number of function blocks • Forwarding the results of the internal logic of the SCL-3-MOC0 to the main module

Tab. 3-22: Functional scope of the SCL-3-MOC0



Depending on the encoders and their electric and mechanic properties used, different SIL or PL can be obtained!

⁵⁾ Possible for encoder 1 only (ENC1).

Product description

3.12.2 Use of encoders

Use of encoders	Possible axes per MOC0 module	Available functions to detect encoder errors	Attainable SIL (IEC 61508), SILCL (EN 62061) or PL (EN ISO 13849-1) ⁶⁾
Two encoders with relative position, optional	1	- Monitoring the ID code of the connection box for encoders to detect a tear off of the MOCx connecting cable⁷⁾ - Function block velocity comparison⁸⁾	SIL3, SILCL3, PL e
- A/B - Sine-cosine - SSI identical or different types			
One sine-cosine safety encoder (e.g. SICK DFS60S Pro)	2	- Monitoring the ID code of the connection box for encoders to detect a tear off of the MOCx connecting cable⁹⁾ - Sin/cos analog voltage monitoring¹⁰⁾	SIL2, SILCL2, PL d

Tab. 3-23: Achievable SIL and PL



To achieve the desired safety level, selecting the correct encoder is decisive. Especially systematic errors and common cause errors (CCF) have to be mastered.

Recommendation for the use of encoders:

- Using one encoder for one axis:**
 For a default encoder, loosening the coding disk/solid measure cannot be excluded. Thus, it is strongly recommended to use a certified safety encoder for the functional safety engineering
- Using two encoders for one axis:**
 To master the systematic errors and common cause errors, the use of diverse encoders is required
 Evaluate the diversity using:
 - Different interfaces (e.g. A/B, incrementally, SSI)
 - Different physics/measuring technique (e.g. optical/magnetic)
 - Different resolution

⁶⁾ For specific values, refer to [chapter "Data sheet SLC-3-MOC0" on page 130](#)

⁷⁾ Can be used by any supported encoder type in the SafeLogic Designer hardware configuration. Can be configured in the configuration dialog for the encoder on the "Encoder connection type" tab

⁸⁾ Can be used in the MOC logic. For details, refer to the operating instructions "IndraControl SafeLogic compact Designer Software"

⁹⁾ Can be used by any supported encoder type in the SafeLogic Designer hardware configuration. Can be configured in the configuration dialog for the encoder on the "Encoder connection type" tab

¹⁰⁾ Can be used for sin/cos encoders in the SafeLogic Designer hardware configuration. Can be configured in the configuration dialog for the sin/cos encoder on the "Sin/cos analog voltage monitoring" tab

⚠ CAUTION

Take suitable actions against common cause errors for the encoders!

This applies especially if both encoders are used for a redundant monitoring of an axis. Consider the following options as well:

- The common GND supply by the common connecting cable at the SLC-3-MOC0 for both encoders can be interrupted as common reference potential for both encoders
- The encoder supply might be too small or interrupted completely
- The common supply for both encoders can be too high. This could damage both encoders. When using PELV/SELV voltage supplies without additional protection measures, a voltage increase to 60 V is normally assumed
- The complete encoder connection to the SLC-3-MOC0 can be interrupted

There are the following monitoring options:

- Use at least one encoder connection box. For a description of this function, refer to the operating instructions "IndraControl SafeLogic compact Designer Software", chapter "Encoder connection type and ID code monitoring"
- Use a sin/cos encoder with enabled sin/cos analog voltage monitoring¹¹⁾. For a description of this function, refer to the operating instructions "IndraControl SafeLogic compact Designer Software", chapter "Sin/cos analog voltage monitoring"
- Use an SSI encoder with the evaluation of error bits. This requires one bit in the SSI data. This bit goes into an inverted state if the error to be observed occurs, e.g. due to an encoder supply that is too small or if one or multiple lines are disconnected between the encoder and the SLC-3-MOC0. For a description of this function, refer to the operating instructions "IndraControl SafeLogic compact Designer Software", chapter "Sin/cos encoder"
- When using A/B incremental encoders, the errors cannot be detected directly using encoder signals¹²⁾
- There is also the option to use another signal from the process together with the logic of the main module to check the motion signal of the encoder for plausibility, e.g. using a signal "Drive moves/does not move"

To master the voltage increase within the limits of a SELV/PELV supply, there are the following options if the error assumed is not mastered by one of the selected monitorings:

- Use separated voltage supplies for both encoders
- Use encoders designed for the assumed increased supply voltage
- Use the voltage supply for the encoders of the SLC-3-MOC0 module (ENC1_24V or ENC2_24V) either directly or via the encoder connection box. If the voltage supply for the SafeLogic compact system exceeds 35 V at the memory plug of the main module, the system goes into a safe

¹¹⁾ Can be used for sin/cos encoders in the SafeLogic Designer hardware configuration. Can be configured in the configuration dialog for the sin/cos encoder on the "Encoder connection type" tab

¹²⁾ This also applies for A/B incremental encoders with 2 output pairs. Error recognition based on the inverted output signals would enable line monitoring, however, not all potential errors could be recognized in one A/B incremental encoder, e.g. static state of the output stage.

Product description

state, i.e. all safe outputs are switched off. This ensures a safe switch-off in the application when voltage increases. However, in this case, it is possible that the encoders are damaged



- The SLC-3-MOC0 module cannot be operated alone. It always requires the main module SLC-3-CPUx with the firmware V3.00.0 and later
- The simultaneous use of up to six SLC-3-MOC0 is possible. Each connected SLC-3-MOC0 module reduces the possible number of other extension modules by two
- Voltage for the internal logic is supplied via the memory plug and the FLEXBUS+ internal bus

3.12.3 Display elements and error codes

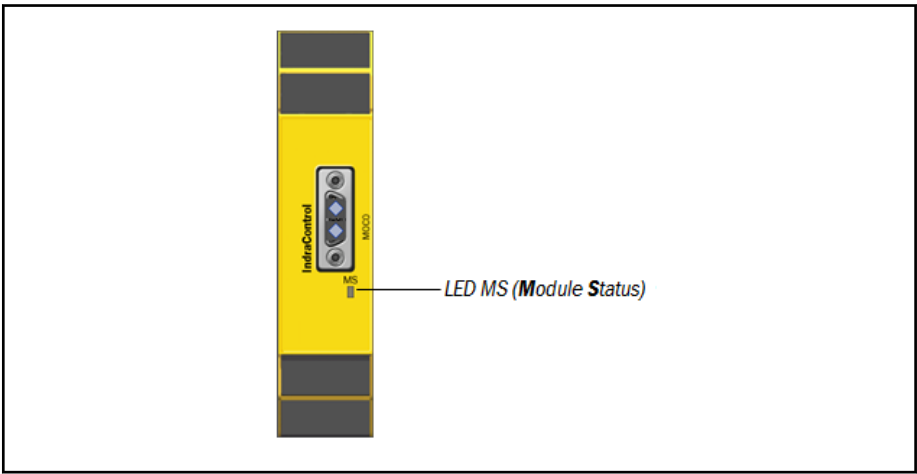


Fig. 3-18: Display elements of the SLC-3-MOC0

MS LED	Meaning	Notes
○	Supply voltage outside the range	Switch on the supply voltage and check it at the terminals A1 and A2
Red/green (1 Hz)	Recoverable external error	Check encoder signals For more diagnostic information, refer to the SafeLogic Designer, "Diagnostics" view
Green (1 Hz)	System is in "Stop" state	Start the application in the SafeLogic Designer
Green	System is in "Run" state	-
Red (1 Hz)	Invalid configuration	-

MS LED	Meaning	Notes
 Red (2 Hz)	Critical error in the system, probably in this module. Application was stopped. All outputs are disabled	Switch off and on the supply voltage If the error is not eliminated after multiple repetition, replace this module For a more detailed diagnostic information, refer to the operation instructions "IndraControl SafeLogic compact Designer Software", chapter "Diagnostic view"
 Red	Critical error in the system, probably in another module. Application was stopped. All outputs are disabled	Switch off and on the supply voltage If the error is not eliminated after multiple repetition, replace the module which flashes  red (2 Hz). If this is not the case, use the diagnostic function in the SafeLogicDesigner to narrow down the affected module

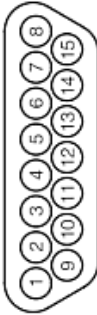
Tab. 3-24: Displays of the "MS" LED of the SLC-3-MOC0

3.12.4 Encoder connection

There is a 15-pin Micro-D-Sub socket to connect up to two encoders at the front panel of the SLC-3-MOC0.

- 
- For an easier installation, it is recommended to use the connecting cables and the connection boxes available as accessories (see [chapter 13 "Ordering data of modules and accessories" on page 147](#))
 - The signal assignment depends on the encoder type used (see [chapter 4 "Connecting devices" on page 59](#))

Product description

Plug	Pin	Signal	Encoder	Wiring ¹³⁾					
				Sine-cosine encoder		A/B incremental encoder, 2 output pairs (HTL 24 V, HTL 12 V, TTL)	A/B incremental encoder, 2 outputs (HTL 24 V, HTL 12 V, TTL)	A/B incremental encoder, 2 output pairs (RS-422)	SSI encoder
	1	ENC1_A+	1	Cos+	Cos	A+	A	A+	Data+
	9	ENC1_A–		Cos–	Cos_Ref	A–	GND	A–	Data–
	2	ENC1_B+		Sin+	Sin	B+	B	–	–
	10	ENC1_B–		Sin–	Sin_Ref	B–	GND	–	–
	3	ENC1_C+		–	–	–	–	B+	Clock+
	11	ENC1_C–		–	–	–	–	B–	Clock–
	4	ENC1_24V		24 V voltage supply for encoder 1					
	8	ENC2_A+	2	Cos+	Cos	A+	A	–	Data+
	15	ENC2_A–		Cos–	Cos_Ref	A–	GND	–	Data–
	7	ENC2_B+		Sin+	Sin	B+	B	–	–
	14	ENC2_B–		Sin–	Sin_Ref	B–	GND	–	–
	6	ENC2_C+		–	–	–	–	–	Clock+
	13	ENC2_C–		–	–	–	–	–	Clock–
	5	ENC2_24V		24 V voltage supply for encoder 2					
	12	ENC_0V	1&2	GND connection for the encoders 1 and 2					

Tab. 3-25: SLC-3-MOC0 – Pin assignment of the Micro-D plug

3.12.5 Connection boxes for encoders

The connection boxes available as accessories facilitate the connection of encoders to the encoder interface of the SLC-3-MOC0 modules, especially for encoders that can be used for an SLC-3-MOC0 and as motor feedback of a drive system.

There are two types of connection boxes:

1. **Motor feedback splitter box SLC-A-MOC-MFSB-RX:**

Connection options for an encoder. Normally, it is used together with a motor feedback encoder. Additional terminals are available to forward signals, which are not required for the SLC-3-MOC0 module, but can be carried along in the encoder channel, e.g. brake control, temperature sensor etc.

2. **Dual encoder connection box SLC-A-MOC-DECB-RX:**

Connection options for both encoders. For the recommended connection types, refer to [chapter 4.10 "Connecting encoders" on page 81](#)

¹³⁾ Combination of different encoder types is possible.

Product description

The connection boxes are equipped with on-board voltage supply for encoder and an insulation hood for pluggable spring clamp terminals C1 and C2 for protection against EMC influences. The on-board voltage supply is provided by SLC-3-MOCx and enables nominal switching between 5 V, 7 V, 12 V and 24 V.

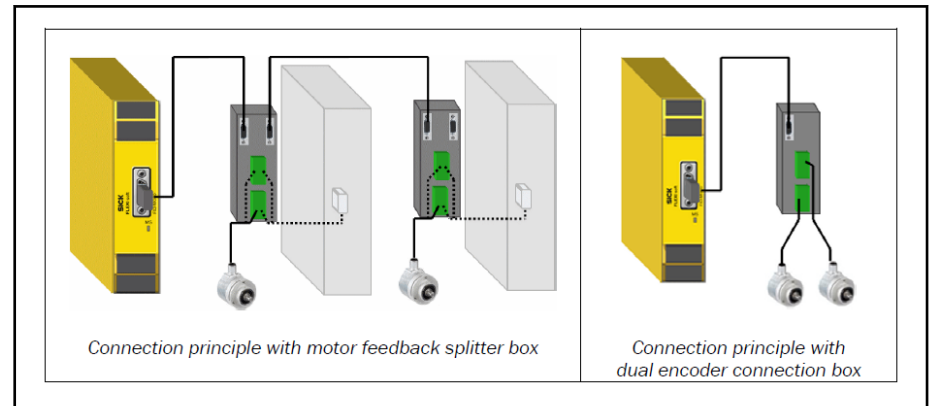


Fig. 3-19: Connection principle of connection boxes for encoders

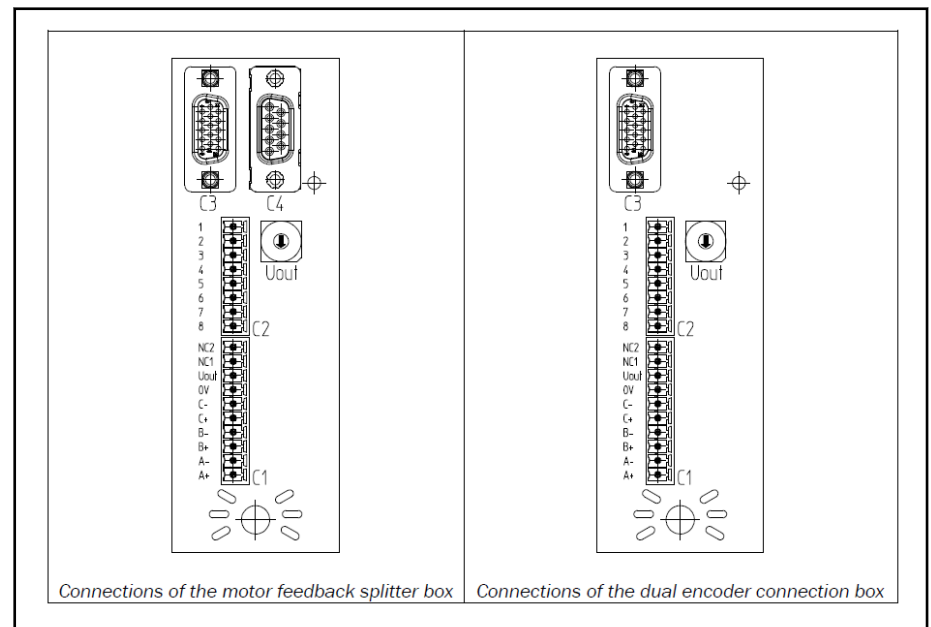


Fig. 3-20: Connections of the connection boxes for encoders (front view)

Description

Connections and switches	Motor feedback splitter box	Dual encoder connection box
C1	- Tension spring plug-in terminals to connect encoder signals of an encoder 2 free connection terminals for transfer of other signals	
C2	Tension spring plug-in terminals with eight terminals to forward other signals	Tension spring plug-in terminals to connect encoder signals of another encoder
C3	15-pin HD-D-Sub socket with M3 screws to connect the connecting cable to the SLC-3-MOC0	

Product description

Connections and switches	Motor feedback splitter box	Dual encoder connection box
C4	9-pin D-Sub socket with M3 screws to connect a second motor feedback splitter box (forwarding the ENC2_x signals from a 15-pin HD-D-Sub plug)	–
U _{Out}	Selector switch of on-board voltage supply for encoder, supplied by SLC-3-MOC0, nominally switchable between 5 V, 7 V, 12 V and 24 V	
	Shielding terminals for both encoder cables (from the encoder and to the motor control) for a low-resistance connection of both cable shieldings	

ID code combined with the supply voltage for evaluation by the SLC-3-MOC0

Tab. 3-26: Describing the connections of connection boxes for encoders



The connection boxes for encoders have to be mounted in an environment corresponding to the degree of protection IP 54 (EN 60529), e.g. in a control cabinet with the degree of protection IP 54.

Onboard voltage supply U_{Out}

Onboard voltage supply that can be optionally used for the encoders, fed by SLC-3-MOC0 (C3.ENC1_24V and C3.ENC2_24V). The output voltage U_{Out} can be switched nominally using a rotary switch between 5 V, 7 V, 12 V and 24 V.

Switch position	Supply voltage U _{Out}	Notes
0	5 V	Tolerance U _{Out} : 5 %
1	7 V	
2	12 V	
3	24 V nominal	Dependent on the voltage level of the SafeLogic compact voltage supply at the memory plug.

Tab. 3-27: Setting of the supply voltage for encoders at the motor feedback splitter box and dual encoder connection box



Press the rotary switch for the supply voltage only if the supply voltage is switched off!

Press the rotary switch for the supply voltage at the connection box only if the supply voltage is switched off. Otherwise, the connected encoder can be damaged by voltage peaks occurring during switching.

Tension spring plug-in terminals C1

Terminal strip	Terminal	Signal	Wiring					SSI encoder
			Sine-cosine encoder	A/B incremental encoder, 2 output pairs (HTL 24 V, HTL 12 V, TTL)	A/B incremental encoder, 2 outputs (HTL 24 V, HTL 12 V, TTL)	A/B incremental encoder, 2 output pairs (RS-422) ¹⁾		
1 2 3 4 5 6 7 8 9 10	1	NC2	Not connected and only used to forward a signal, e.g. for an external voltage supply (instead of using ENC_U _{OUT})					
	2	NC1						
	3	U _{Out}	Encoder voltage supply from the on-board voltage supply, nominally switchable between 5 V, 7 V, 12 V and 24 V					
	4	ENCx_0V ³⁾	GND connection for encoders					
	5	ENCx_C ⁻³⁾	–	–	–	–	B–	Clock–
	6	ENCx_C ⁺³⁾	–	–	–	–	B+	Clock+
	7	ENCx_B ⁻³⁾	Sin–	Sin_Ref	B–	GND	–	–
	8	ENCx_B ⁺³⁾	Sin+	Sin	B+	B	–	–
	9	ENCx_A ⁻³⁾	Cos–	Cos_Ref	A–	GND	A–	Data–
	10	ENCx_A ⁺³⁾	Cos+	Cos	A+	A	A+	Data+

Tab. 3-28: Pin assignment of the encoder connection C1

¹⁾ For encoder 1 only; i.e. if it is the first encoder/motor feedback connection box.

³⁾ x = 1; if it is the first encoder/motor feedback connection box, i.e. if connector C3 is directly connected to the SLC-3-MOCx;

x = 2; if it is the second encoder/motor feedback connection box, i.e. if connector C3 is connected to a different encoder/motor feedback connection box.

Tension spring plug-in terminals C2 at the motor feedback splitter box

Terminal strip	Terminal	Signal	Description
	1	NC	Not connected to the splitter box. It is only used to forward signals
	2	NC	
	3	NC	
	4	NC	
	5	NC	
	6	NC	
	7	NC	
	8	NC	

Tab. 3-29: Pin assignment of the connecting terminal C2 at the motor-feedback splitter box

Product description

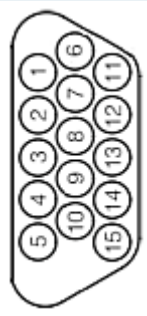
Tension spring plug-in terminals C2 at the dual encoder connection box

Terminal strip	Terminal	Signal	Wiring					
			Sine-cosine encoder	A/B incremental encoder, 2 output pairs (HTL 24 V, HTL 12 V, TTL)	A/B incremental encoder, 2 outputs (HTL 24 V, HTL 12 V, TTL)	A/B incremental encoder, 2 output pairs (RS-422)	SSI encoder	
1 2 3 4 5 6 7 8	1	U _{Out}	Encoder voltage supply from the on-board voltage supply of this connection box, nominally switchable between 5 V, 7 V, 12 V and 24 V					
	2	ENC_0V	GND connection for encoders					
	3	ENC2_C–	–	–	–	–	–	Clock–
	4	ENC2_C+	–	–	–	–	–	Clock+
	5	ENC2_B–	Sin–	Sin_Ref	B–	GND	–	–
	6	ENC2_B+	Sin+	Sin	B+	B	–	–
	7	ENC2_A–	Cos–	Cos_Ref	A–	GND	–	Data–
	8	ENC2_A+	Cos+	Cos	A+	A	–	Data+

Tab. 3-30: Pin assignment of the connecting terminal C2 at the dual encoder connection box

Plug-in connector C3

Both connection boxes for encoders are provided with a 15-pin HD-D-Sub socket (for the assignment, refer to the following table) to connect to the SLC-3-MOC0:

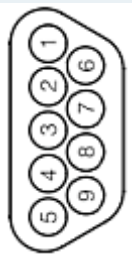
Socket	Terminal	Signal
	1	ENC1_A+
	2	ENC1_A-
	3	ENC1_24V
	4	ENC2_A+
	5	ENC2_A-
	6	ENC1_B+
	7	ENC1_B-
	8	ENC_0V
	9	ENC2_B+
	10	ENC2_B-
	11	ENC1_C+
	12	ENC1_C-
	13	ENC2_24V
	14	ENC2_C+
	15	ENC2_C-

Tab. 3-31: Pin assignment HDDSub-15 socket C3 at the connection boxes for the encoder

The motor feedback splitter box is provided with a 9-pin D-Sub socket (for the assignment, refer to the following table) to connect a second motor feedback splitter box.

- The connection of a dual encoder connection box is not permitted
- Up to two motor feedback splitter boxes are permitted per SLC-3-MOCx module

Plug-in connector C4 at the motor feedback splitter box

Socket	Terminal	Signal
	1	ENC_A+
	2	ENC_B+
	3	ENC_C+
	4	Reserved (ID code in combination with voltage supply)
	5	ENC_24V
	6	ENC_A-
	7	ENC_B-
	8	ENC_C-
	9	ENC_0V

Tab. 3-32: Pin assignment DSub9 socket C4 at the motor-feedback splitter box

Product description

3.13 Relay output modules SLC-A-UE410-2RO/SLC-A-UE410-4RO

3.13.1 Description

The SLC-A-UE410-2RO/SLC-A-UE410-4RO relay output modules provide dual-channel contact-based outputs with "positively guided relay contacts".

The SLC-A-UE410-2RO/SLC-A-UE410-4RO relay output modules cannot be used independently, but need to be switched via an SLC-3-XTIO module. For this purpose, a control output of the SLC-3-XTIO module (Q1 ... Q4) has to be bridged to a control input of the relay output module (B1, B2), see the following figure.

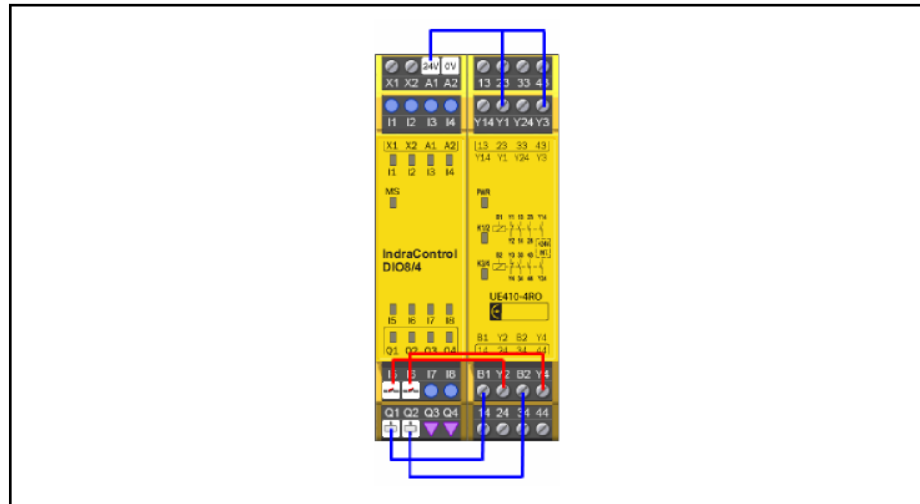


Fig. 3-21: Example of the inclusion of a relay module in the SafeLogic compact system

⚠ CAUTION

Monitor the feedback contacts using an "EDM" function block!

It is not sufficient to connect the control outputs B1 or B1/B2. Additionally, the feedback contacts Y1/Y2 on the SLC-A-UE410-2RO or the feedback contacts Y1/Y2 and Y3/Y4 at the SLC-A-UE410-4RO relay module have to be monitored using an "EDM" function block in the logic editor of the SafeLogic Designer.



The relay output modules are not participating in the communication via the internal FLEXBUS+. Thus, the relay output modules cannot receive any control signals from the main module.

Up to four SLC-A-UE410-4RO relay output modules or eight LC-A-UE410-2RO modules can be connected to one SafeLogic compact system, i.e. up to 16 safe relay outputs are available.

Other modules of the SLC-A-UE410 series cannot be integrated into the SafeLogic compact system.

3.13.2 SLC-A-UE410-2RO

The SLC-A-UE410-2RO has one control input (B1). This input controls two internal relays and provides a redundant switch-off path consisting of:

- Two safe enabling current paths (13/14, 23/24), dual-channel and potential-free
- a signaling circuit (Y14), dual-channel and internally connected to 24 V DC
- a feedback EDM (Y1/Y2), dual-channel and potential-free

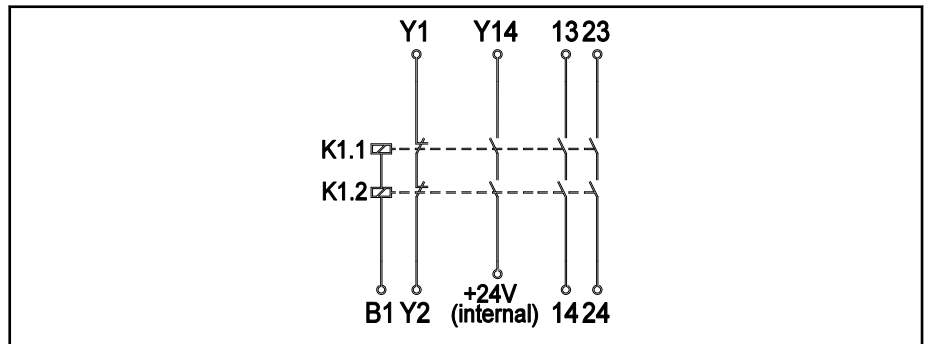


Fig. 3-22: Internal design SLC-A-UE410-2RO

3.13.3 SLC-A-UE410-4RO

The SLC-A-UE410-4RO is provided with two control inputs (B1, B2). These inputs control two internal relays providing two independently redundant switch-off paths two times.

Control input (B1) controls two internal relays and provides a redundant switch-off path consisting of:

- Two safe enabling current paths (13/14, 23/24), dual-channel and potential-free
- a signaling circuit (Y14), dual-channel and internally connected to 24 V DC
- a feedback EDM (Y1/Y2), dual-channel and potential-free

Control input (B2) controls two internal relays and provides a redundant switch-off path consisting of:

- Two safe enabling circuits (33/34, 43/44), dual-channel and potential-free
- a signaling circuit (Y24), dual-channel and internally connected to 24 V DC
- a feedback EDM (Y3/Y4), dual-channel and potential-free

The SLC-A-UE410-4RO module thus has twice the functionality of a SLC-A-UE410-2RO.

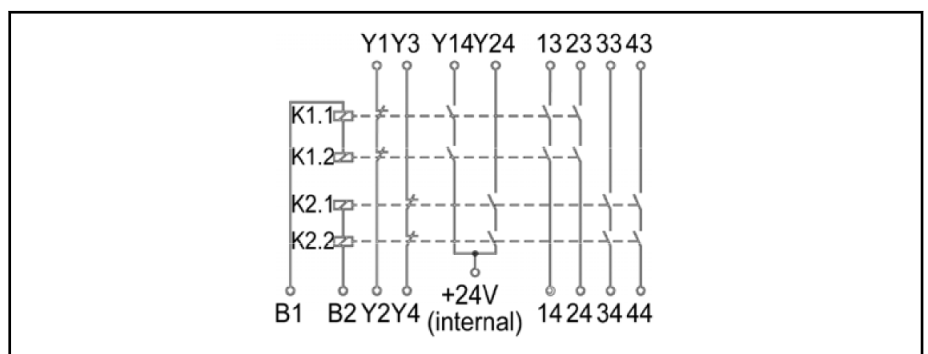


Fig. 3-23: Internal design SLC-A-UE410-4RO

Product description

3.13.4 Display elements and terminal description

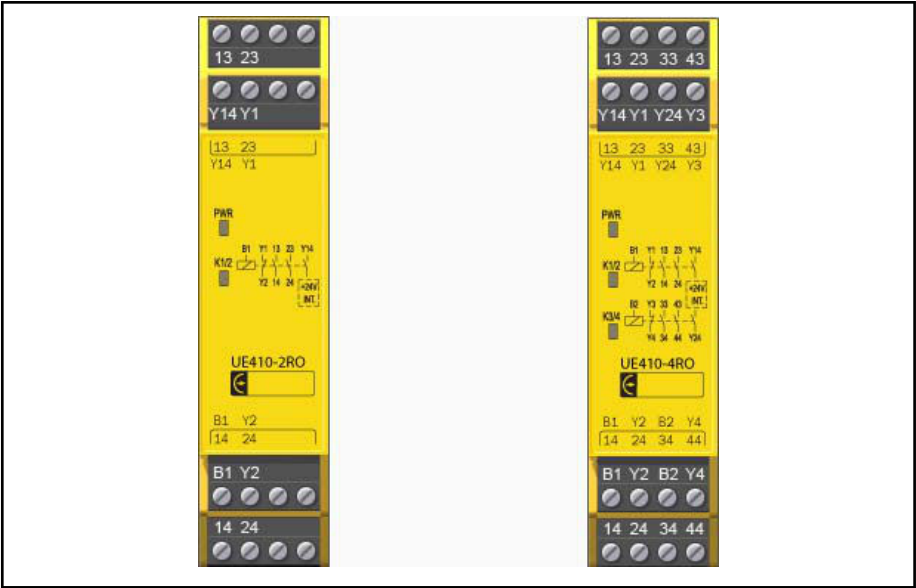


Fig. 3-24: Display elements SLC-A-UE410-2RO and SLC-A-UE410-4RO

Display	Meaning
PWR (green)	Supply voltage is applied via safety bus
K1/2 (green)	Relay K1/K2 — safety contacts closed
K3/4 (green)	Relay K3/K4 — safety contacts closed

Tab. 3-33: Displays SLC-A-UE410-2RO and SLC-A-UE410-4RO

Assignment	Description
B1	Connecting relay K1/K2
13/14 and 23/24	Safety contacts for switch-off circuit K1/K2
Y1/Y2	Feedback circuit EDM, N/C contact
Y14	N/O safety contact K1/K2, current-limited (see chapter 12 "Technical data" on page 109)

Tab. 3-34: Terminals SLC-A-UE410-2RO

Assignment	Description
B1	Connecting relay K1/K2
B2	Connecting relay K3/K4
13/14 and 23/24	Safety contacts for switch-off circuit, outputs K1/K2
33/34 and 43/44	Safety contacts for switch-off circuit, outputs K3/K4
Y1/Y2	Feedback circuit EDM K1/K2, N/C contact
Y3/Y4	Feedback circuit EDM K3/K4, N/C contact
Y14	N/O safety contact K1/K2, current-limited (see chapter 12 "Technical data" on page 109)
Y24	N/O safety contact K3/K4, current-limited (see chapter 12 "Technical data" on page 109)

Tab. 3-35: Terminals SLC-A-UE410-4RO

4 Connecting devices

This section describes the connection of safety sensors and actuators to the SafeLogic compact system and provides installation notes for specific functions.

The SafeLogic compact system supports applications up to the Performance Level (PL) e (acc. to EN ISO 13 849-1) and up to Safety Integrity Level SILCL3 (acc. to EN 62 061).

The degree of safety actually attained depends on the external circuitry, the wiring, the parameter configuration, the safety sensors and their arrangement at the machine. Observe and evaluate all required boundary conditions using e.g. a failure analysis (FMEA).

For further notes to be observed during the electrical installation, refer to [chapter 7 "Electrical installation " on page 91](#).

CAUTION

Loss of the safety function due to an incorrect configuration!

Plan and carry out configuration carefully!

The safety application has to be configured with greatest accuracy and thus has to match the conditions of the machine or system to be monitored.

- Check whether the configured safety application monitors the machine or system as planned and whether the safety of a configured application is ensured at all times. This has to be ensured in each operation mode and partial application. Document the result of this check!
- In each case, observe the instructions for commissioning and daily checking in the operating instructions of the protective devices integrated into the safety application!
- Note the warnings and functional descriptions of the protective devices connected to the safety control! Contact the respective manufacturer of the protective device if in doubt!
- Note that the minimum switch-off time of the connected sensors has to be greater than the execution time of the logic (see the chapter about the logic editor in the operating instructions "IndraControl SafeLogic compact Designer Software" and the logic editor in the SafeLogic Designer) to ensure that the SafeLogic compact system can detect the sensor switching. The minimum switch-off time of sensors is usually specified in the technical data of the sensors



Some extension modules are provided with two or more test outputs:

- If an odd-numbered test output is used, odd-numbered inputs have to be used. If an even-numbered test output is used, even-numbered inputs have to be used
- Use the test outputs of the module connected to the device to be tested

Connecting devices

⚠ CAUTION**Protect single-channel inputs against short circuits and cross faults!**

If a short circuit after "high" at the single-channel input with test pulses that was previously Low, the logic may look like a pulse for this signal. The short circuit after "High" the signal to become "High" and then after the error detection time "Low" again. Due to the error detection, a pulse may be generated. Therefore, single-channel signals with test pulses need special attention:

- If the short circuit after "High" occurs at a single-channel input with test pulses that was previously "High", the logic looks like a delayed falling edge (High to Low transition)
- If a single channel input is used and an unexpected pulse or a delayed falling edge (High to Low) at this input can lead to a dangerous situation, take the following measures:
 - Protected cabling of the respective signal (to exclude cross faults to other signals)
 - No cross fault detection, i.e. no connection to a test output (see section "Parameterization of connected elements" in the operating instructions "IndraControl SafeLogic compact Designer Software")

This needs to be considered especially for the following inputs:

- Reset input at the "Reset" function block
- "Restart" input at the "Restart" function block
- "Restart" input at the function blocks for press applications (eccentric press contact monitor, universal press contact monitor, N-break, press setup, single stroke monitoring, automatic press)
- "Override" input at a "Muting" function block
- "Reset" input at a "Valve monitoring" function block
- Reset input to zero and set an initial value at the counter function block

After the configuration, there are the following documentations in the SafeLogic Designer under "Report":

- Logic report
- Parts list
- Wiring diagrams

Connecting devices



Module	Type code	Step	Address
CPU1	SLC-3-CPU130302	V 2.xx	0
XTIO	SLC-3-XTIO84302	V 2.xx	1
XTDI	SLC-3-XTDI80302	V 2.xx	2

CPU

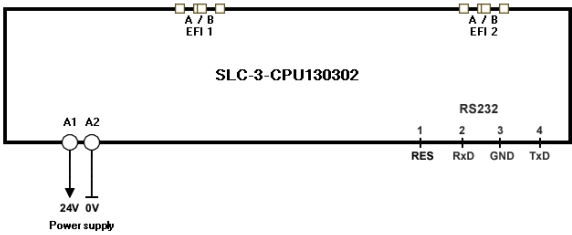
CPU1 - General information

Type code	Product-ID	SW version	Hardware version	Version Step	Memory usage (UI Logic)	Address
SLC-3-CPU130302	0000 0000	V 2.00.0	0.00	1.3.0.117 V 2.xx	2.30% / 1.28%	0
SLC-3-MPL000301	0801 0000	-	-	1.3.0.117	-	-

CPU1 - IO

Tag name	System integrity test based on type key	System integrity test based on Product-ID	System integrity test based on configuration date
24V A1 CPU1[0] Power supply	-	-	-
0V A2	-	-	-

Wiring diagram



I/O module

XTIO[1]

General information

Type code	Product-ID	SW version	Hardware version	Version/Step	Address
SLC-3-XTIO84302	0401 0000	V 2.00.0	0.00	1.3.0.117 V 2.xx	1

Inputs

	Mode	Title/tag name	OH- OFF	OFF- OH	Dis. [ms]
4 X1	I1 NC	Safety switch (Dual channel)	-	-	3000
X2	I2 NC				
5 X1	I3 NC	Safety switch (Dual channel)	-	-	3000
X2	I4 NC				

Outputs

	Mode	Title/tag name
2	Q1	Motor contactor (Single channel)
3	Q2	Lamp (Single channel)
6	Q3Q4	Motor (Dual channel)

Power supply

	Title/tag name
1 24V 0V	XTIO[1] Power supply

Wiring diagram

4 Safety switch

5 Safety switch

Fig. 4-1: Excerpt from a sample report in the SafeLogic Designer

Connecting devices

4.1 Safety command devices and electromagnetic safety switches

4.1.1 E-Stop button

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO

Single-channel, connected to 24 V	24 V		1	NC	Contact between 24 V and I1
Single-channel, connected to test output	X2		2	NC	Contact between X2 and I2
Dual-channel, connected to 24 V	24 V 24 V		3 4	NC	Channel 1: Contact between 24 V and I3 Channel 2: Contact between 24 V and I4
Dual-channel, connected to test output	X1 X2		5 6	NC	Channel 1: Contact between X1 and I5 Channel 2: Contact between X2 and I6

Tab. 4-1: E-Stop connection

The dual-channel E-Stop buttons preconfigured in the SafeLogic Designer have equivalent switching contacts. Corresponding elements for implementing dual-channel antivalent switch contacts are available in the element window under the group "Potential-free contacts and restart".

Function	Notes
Testing	Possible
Series connection/cascading	If E-Stop buttons are connected in series, the max. cable resistance may not exceed 100 Ω (see chapter chapter 12 "Technical data" on page 109)
Discrepancy time	Refer to the "SafeLogic Designer" software

Tab. 4-2: Functions with ES21



For further information, refer to the operating instructions of the E-STOP button of the respective manufacturer.

4.1.2 Electromechanic safety switches with and without guard locking



The contact symbols in this chapter show the switching state if the door is closed. Please note that the representation in the data sheet of the safety switch can deviate.

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO

Single-channel, connected to 24 V	24 V		1	NC	Contact between 24 V and I1
Single-channel, connected to test output	X2		2	NC	Contact between X2 and I2

Connecting devices

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO

Dual-channel, connected to 24 V	24 V 24 V		I3 I4 I5 I6	NC NC	Channel 1: Contact between 24 V and I3 Channel 2: Contact between 24 V and I4
Dual-channel, connected to test output	X1 X2		I5 I6	NC NC	Channel 1: Contact between X1 and I5 Channel 2: Contact between X2 and I6

Tab. 4-3: Connection of electro-mechanical safety switches

Electrical connection: Example taken from SafeLogic Designer with SCL-3-XTIO

Single-channel, connected to 24 V	24 V		I1 Q1	NC	Contact between 24 V and I1 Coil at Q1
Single-channel, connected to test output	X1		I1 Q1	NC	Contact between X1 and I1 Coil at Q1
Dual-channel, connected to 24 V	24 V 24 V		I3 I4 I5 I6	NC NC	Channel 1: Contact between 24 V and I3 Channel 2: Contact between 24 V and I4 Coil at Q1
Dual-channel, connected to test output	X1 X2		I1 I2 Q1	NC NC	Channel 1: Contact between X1 and I1 Channel 2: Contact between X2 and I2 Coil at Q1

Tab. 4-4: Connecting interlocks

Function	Notes
Testing	Possible
Series connection, cascading	If safety switches are connected in series, the max. cable resistance may not exceed 100 Ω (see chapter 12 "Technical data" on page 109)
Discrepancy time	Refer to the "SafeLogic Designer" software

Tab. 4-5: Functions with electro-mechanical safety switches and tumblers



For further information, refer to the operating instructions of the electro-mechanical safety switches of the respective manufacturer.

Connecting devices

4.1.3
Enabling switch

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO					
2 positions, connected to 24 V	24 V 24 V		NO 1 2	 	Channel 1: Contact between 24 V and I1 Channel 2: Contact between 24 V and I2
2 positions, connected to test output	X1 X2		NO 3 4	 	Channel 1: Contact between X1 and I3 Channel 2: Contact between X2 and I4
3 positions, connected to 24 V	24 V 24 V 24 V 24 V	 	NO 5 6 NO 7 8	   	Channel 1: Contact between 24 V and I5 Channel 2: Contact between 24 V and I6 Channel 3: Contact between 24 V and I7 Channel 4: Contact between 24 V and I8
3 positions, connected to test output	24 V 24 V X1 X2	 	NO 1 2 NO 3 4	   	Channel 1: Contact between 24 V and I1 Channel 2: Contact between 24 V and I2 Channel 3: Contact between X1 and I3 Channel 4: Contact between X2 and I4

Tab. 4-6:
Connection to an enabling switch

Function	Notes
Testing	Possible
Series connection	Not possible
Discrepancy time	Refer to the "SafeLogic Designer" software

Tab. 4-7:
Functions with enabling switch

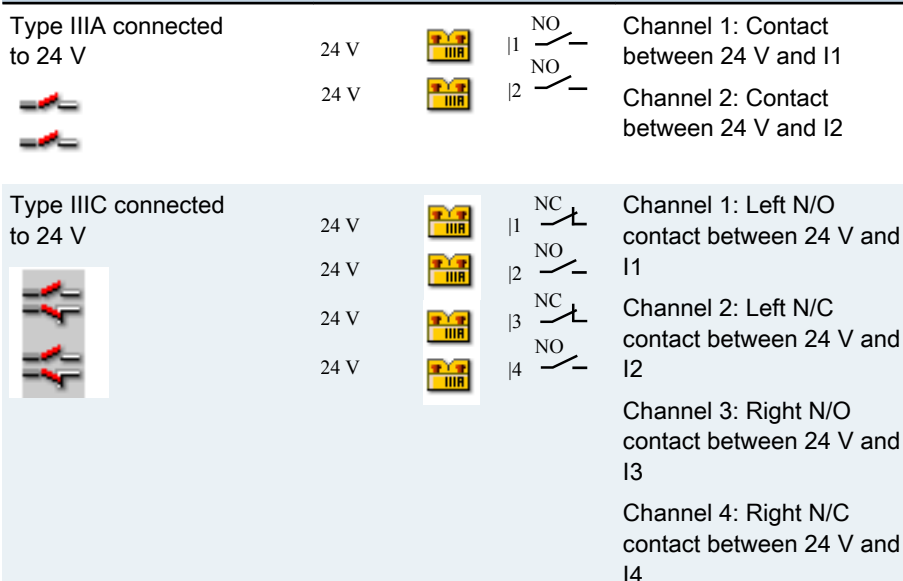
4.1.4
Two-hand control



The contact symbols in this chapter show the switching state of both two-hand pushbuttons in the non-actuated state.

Connecting devices

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO



Tab. 4-8: Connection of two-hand control

Type IIIA

At Type IIIA, two equivalent inputs (N/O contacts of the two two-hand buttons) are monitored.

A valid input signal is only generated if the ON state (High level) exists at both inputs within 0.5 s (synchronous change, both two-hand buttons pressed) and if both were in the OFF state (Low level) before.

Function	Notes
Testing	Possible
Series connection/ cascading	Not possible
Discrepancy time	Fixed value: 500 ms. Refer to the function block "Two-hand" type IIIA in the logic of the main module used to evaluate these inputs

Tab. 4-9: Functions with two-hand control type IIIA

Type IIIC

For Type IIIC, two pairs of antivalent inputs (NO/NC contact pairs of the two two-hand buttons) are monitored.

A valid input signal is only generated if the ON state (H/L level) exists at both inputs within 0.5 s (synchronous change, both two-hand buttons pressed) and if both were in the OFF state (L/H level) before.

Function	Notes
Testing	Possible
Series connection/ cascading	Not possible

Connecting devices

Function	Notes
Discrepancy time	Option: 0–500 ms. Refer to the function block “Two-hand” type IIIC in of the logic of the main module used to evaluate these inputs
Synchronization time	Fixed value: 500 ms. Refer to the function block “Two-hand” type IIIC in the logic of the main module used to evaluate these inputs

Tab. 4-10: Functions with two-hand control type IIIC



For further information, refer to the operating instructions of the two-hand control of the respective manufacturer.

4.1.5 Safety mats and bumpers



The contact symbols in this chapter show the switching state of the safety mat or the bumper in the non-actuated state.

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO

Short-circuiting safety mats in 4-wire technology, connected to test output	X1 X2		1 2		Channel 1: Contact between X1 and I1 Channel 2: Contact between X2 and I2
---	----------	---	--------	---	--

Tab. 4-11: Connection of safety mats

Function	Notes
Parallel connection	Possible
Number of safety mats or bumpers per XTIO, XTDS or XTDI module	Max. 1 without diode module Max. 4 with diode module

Tab. 4-12: Function “Safety mats”

⚠ CAUTION

Ensure that the switch off condition is sufficient!

The period of the switch-off condition of safety mats and bumpers as least as long as the greatest value for the "test period" of both test outputs used to ensure that the switch-off condition is detected and that no sequence error occurs.



For further information, refer to the operating instructions of the safety mats of the respective manufacturer.

4.1.6 Diode module

A diode module can be used as a connecting adapter when several short circuit forming safety mats are connected to one SafeLogic compact XTDI, XTDS or XTIO module. The diode module decouples and thus multiplies the test outputs X1 and X2.



A diode module is not a safety component as per the machinery directive 2006/42/EC. Therefore, the diode module must not be considered when determining the safety integrity level (SIL acc. to IEC 61 508 and SILCL acc. to EN 62 061) as well as the Performance Level (PL acc. to EN ISO 13 849-1).

Bosch Rexroth recommends using the SICK diode module DM8-A4K.

Electrical connection

Electrical connection: Example taken from SafeLogic Designer with SLC-3-XTIO or SLC-3-XTDI							
Short circuit forming safety mats in 4-wire technology, at test output and with the upstreamed DM8-A4K diode module	X1		1		Channel 1: Contact from X1 to I1 via diode		
	X2		2				
	X1		3		Channel 2: Contact from X2 to I2 via diode		
	X2		4				
	X1		5		Channels 3 to 8 corresponding		
	X2		6				
	X1		7		Refer to the connection diagram in fig. 4-2 "Connection diagram of multiple safety mats with the upstreamed SICK diode module DM8-A4K at the SLC-3-XTIO" on page 67		
	X2		8				

Tab. 4-13: Connecting multiple safety mats with the SICK diode module DM8-A4K connected in series

Connection diagrams

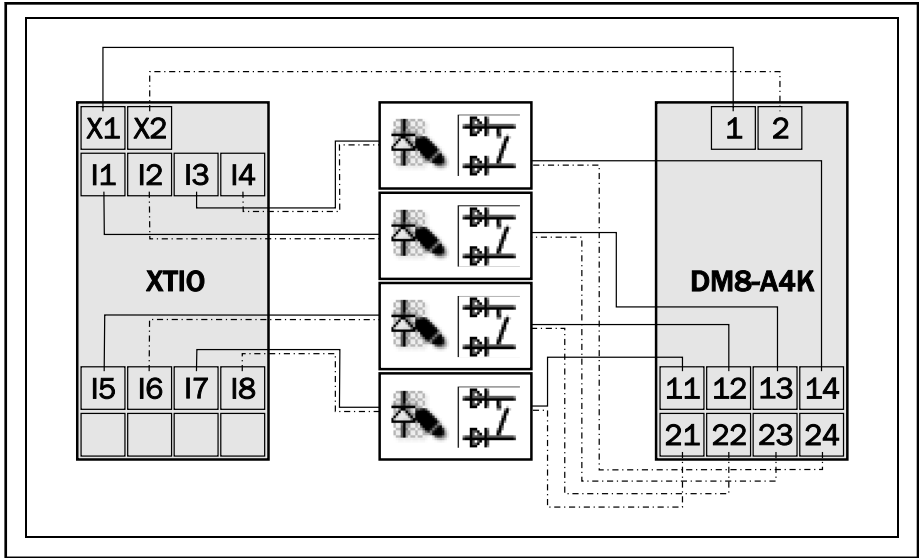


Fig. 4-2: Connection diagram of multiple safety mats with the upstreamed SICK diode module DM8-A4K at the SLC-3-XTIO

Connecting devices

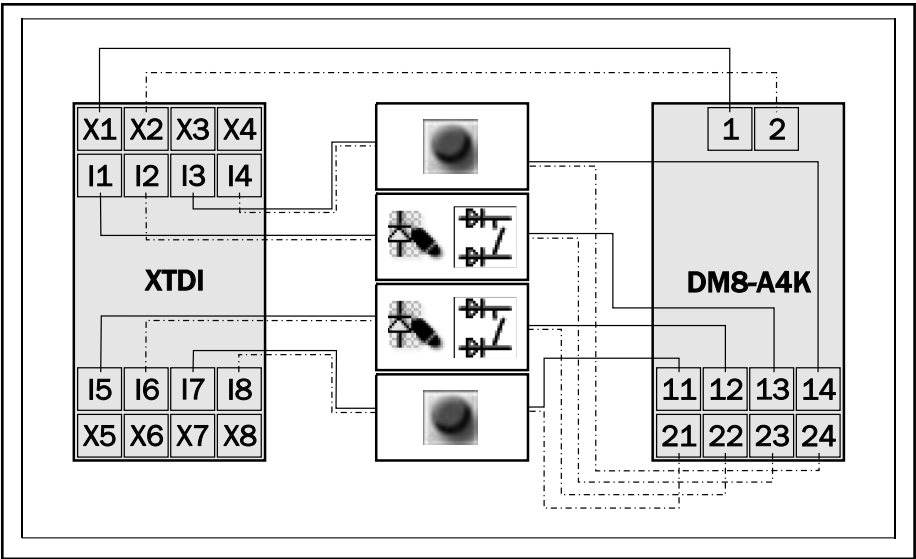


Fig. 4-3: Connection diagram of multiple safety mats with the upstreamed SICK diode module DM8-A4K at the SLC-3-XTDI



As shown in fig. 4-3 "Connection diagram of multiple safety mats with the upstreamed SICK diode module DM8-A4K at the SLC-3-XTDI" on page 68, it is possible to connect e.g. a safety switch or an E-Stop button instead of a safety mat.

Circuit diagram of the SICK diode module DM8-A4K

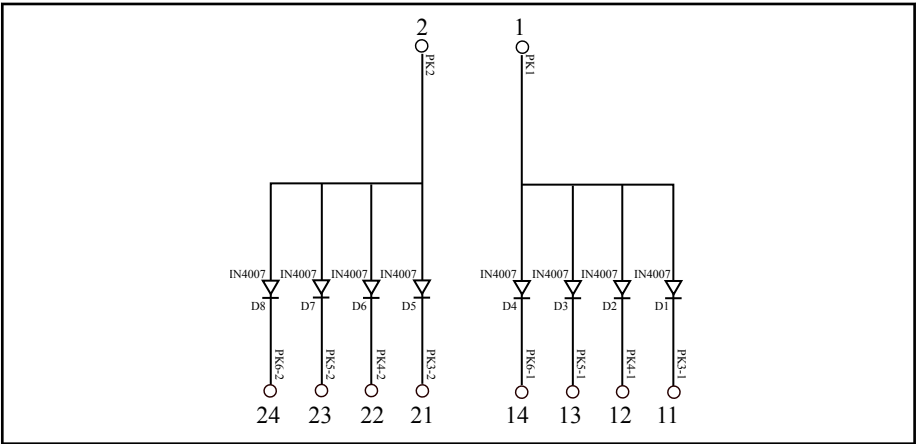


Fig. 4-4: Circuit diagram of the SICK diode module DM8-A4K

4.1.7 Operation mode selection switches

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO					
Operation mode switch (1 of 2), to 24 V	24 V		1 NO	Channel 1: Contact between 24 V and I1	
	24 V		2 NO	Channel 2: Contact between 24 V and I2	
Operation mode switch (1 of 2), at test output	X1		1 NO	Channel 1: Contact between X1 and I1	
	X1		3 NO	Channel 2: Contact between X1 and I3	

Tab. 4-14: Connecting the operation mode selection switch

Connecting devices

Function	Notes
Testing	Possible
<i>Tab. 4-15: Function of operation mode selection switch</i>	
	- Operating mode selector switches without test pulses allow 2 to 8 operating modes; operating mode selector switches with test pulses allow 2 to 4 operating modes. - When wiring the tested operating mode selector switches it should be noted that odd-numbered inputs (I1, I3, I5, I7) have to be used if an odd-numbered test output (X1, X3, X5, X7) is used, and even-numbered inputs (I2, I4, I6, I8) have to be used if an even-numbered test output (X2, X4, X6, X8) is used. - Further information is available in the operating instructions of the operating mode selector switches of the respective manufacturer.

4.1.8 Potential-free contacts

The SafeLogic Designer software provides a series of potential-free contacts for the "free" design of contact elements. This allows different N/ and N/O contact combinations with and without testing to be implemented. In addition, elements are available for the start and stop button, reset button and external device monitoring (EDM).

Function	Notes
Testing	Possible
Series connection	Possible
Discrepancy time	Refer to the "SafeLogic Designer" software

Tab. 4-16: Function of potential-free contacts

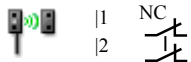
4.2 Electro-sensitive safety sensors

4.2.1 Magnetic safety switches

Magnetic safety switches with equivalent inputs

	The contact symbols in this chapter show the switching state when actuating the switch (e.g. if the door is closed). Please note that the representation in the data sheet of the safety switch can deviate.
---	--

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO

Connected to test output	X1 X2		Channel 1: Contact between X1 and I1 Channel 2: Contact between X2 and I2
--------------------------	----------	---	--

Tab. 4-17: Connection of magnetic safety switches with equivalent inputs

Connecting devices

Magnetic safety switches with antivalent inputs

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO

Connected to test output	X1 X2		I3 I4	NC/NO 	Normally closed contact between X1 and I3 Normally open contact between X2 and I4
--------------------------	----------	---	----------	--	--

Tab. 4-18: Connection of magnetic safety switches with antivalent inputs

Function	Notes
Testing	Possible
Series connection/cascading	Observe the max. cable resistance of 100 Ω and the correct setting of the test pulse time
Discrepancy time	Default setting: 1.5 s. Refer to the "SafeLogic Designer" software

Tab. 4-19: Functions with magnetic safety switches



For further information, refer to the operating instructions of the magnetic safety switches of the respective manufacturer.

4.2.2 Inductive safety switches

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO

Inductive safety switches	X1		I1	NC 	X1 at test input Output at I1
Inductive safety switch (with OSSD)			I3 I4	NC 	OSSD1 at I3 OSSD2 at I4

Tab. 4-20: Connection of inductive safety switches



For further information, refer to the operating instructions of the inductive safety switches of the respective manufacturer.

4.2.3 Transponder

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO

Transponders (to 24 V)	24 V 24 V		I1 I2	NC 	Channel 1: Contact between 24 V and I1 Channel 2: Contact between 24 V and I2
Transponders (to test output)	X1 X2		I3 I4	NC 	Channel 1: Contact between X1 and I3 Channel 2: Contact between X2 and I4
Transponders (with OSSD)	24V 24V		I5 I6	NC 	OSSD1 at I5 OSSD2 at I6

Tab. 4-21: Connection of transponders



For further information, refer to the operating instructions of the transponders of the respective manufacturer.

4.3 Testable single-beam safety light barriers

4.3.1 Testable type 2 single-beam safety light barriers

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO

Type 2 single-beam safety light barriers	X1		I1	NC	X1 at test input (sender) Output (receiver) at I1
Type 2 single-beam safety light barriers	X2		I2	NC	X2 at test input (sender) Output (receiver) at I2

Tab. 4-22: Connection of testable type 2 single-beam safety light barriers



Use protected or separate cabling from the test output of the module (X1...X8) to the test input of the transmitter and from the output of the receiver to the safe input of the module (I1...I8). Otherwise, a cross fault between these signals can inhibit the error detection by this test.

For further information, refer to the operating instructions of the testable type 2 single-beam safety light barriers of the respective manufacturer.

4.3.2 Testable type 4 single-beam safety light barriers

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO

Type 4 single-beam safety light barriers	X1		I1	NC	X1 at test input (sender) Output (receiver) at I1
--	----	--	----	----	--

Tab. 4-23: Connection of testable type 4 single-beam safety light barriers



Use protected or separate cabling for the connections from the test output of the module (X1...X8) to the test input of the transmitter and from the output of the receiver to the safe input of the module (I1...I8). Otherwise, a cross fault between these signals can inhibit the error detection by this test.

For further information, refer to the operating instructions of the testable type 4 single-beam safety light barriers of the respective manufacturer.

4.3.3 Customized testable single-beam safety light barriers

For information on creating customized elements, refer to the operating instructions "SafeLogic Designer Software" (refer to [tab. 1-2 "Required and supplementing documentation" on page 6](#)).

Connecting devices



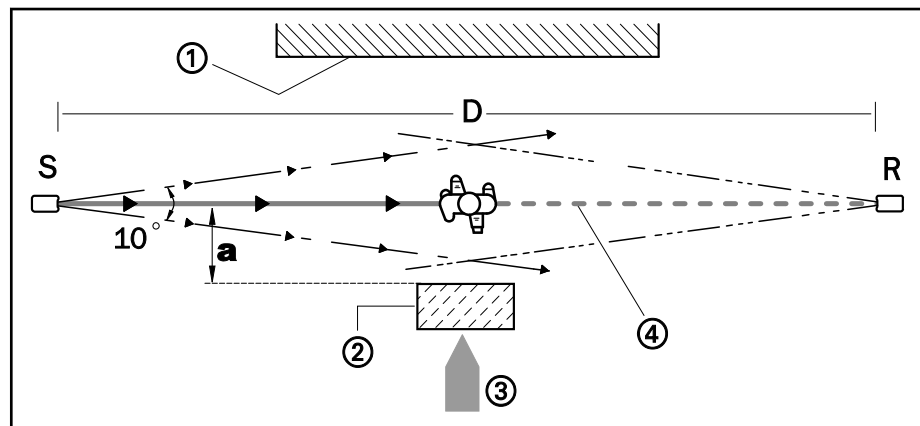
- In the “Settings” dialog for the customized element, select the minimum value for the desired test gap
- Irrespective of the test gap, the overall off-on-delay of the cascade has to be smaller than the max. off-on delay of the respective test output (as shown in the SafeLogic Designer report) –2 ms. Otherwise, the test gap causes a switch-off. For XTIO or XTDI modules, this value is = 12 ms – 2 ms = 10 ms
- Use protected or separate cabling for the connections from the test output of the module (X1...X8) to the test input of the transmitter and from the output of the receiver to the safe input of the module (I1...I8). Otherwise, a cross fault between these signals can inhibit the error detection by this test

4.3.4 Information on mounting testable single-beam safety light barriers



Observe the mounting notes in the operating instructions of the respective sensors and in particular the following:

- Single-beam safety light barriers may only be used for access protection acc. to EN ISO 13 855. Usage as finger and hand protection is not permissible
- Ensure the minimum distance to reflective surfaces
- It is imperative that the safety distance between the light beam and hazardous point is complied with upon access protection



S	Sender
R	Receiver
D	Distance between sender and receiver
a	Minimum distance from reflective surfaces
1	Limit to hazardous area
2	Reflective surface
3	Access direction to the hazardous area
4	Optical axis

Fig. 4-5: Minimum distance "a" to reflective surfaces, correct mounting and orientation

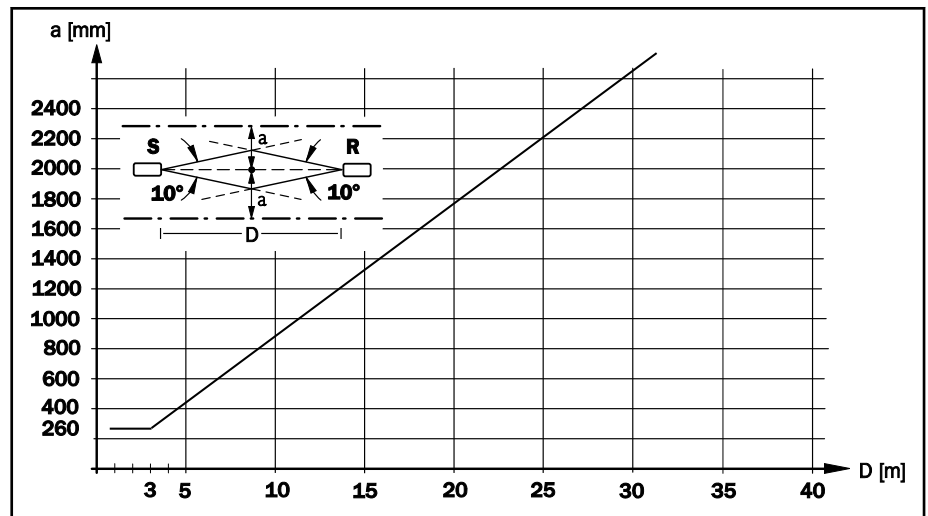


Fig. 4-6: Minimum distance "a" as a factor of the distance "D" for testable single-beam safety light barriers with a field view of 10°



For diagrams, refer to the operating instructions of the respective manufacturer.

Avoiding mutual influence at single-beam safety light barriers and between cascades

- If several single-beam safety light barrier pairs are used, the field of view of the sensors has to be observed to prevent mutual influence
- If the senders are only mounted on one side, the light beams may not overlap on the receiver side so that the light beam of one sender does not reach two receivers
- If the senders and receivers are mounted alternatively, ensure that the light beam of the sender S1 cannot be received by the receiver R3 and that the light beam of the sender S3 cannot be received by the receiver R1

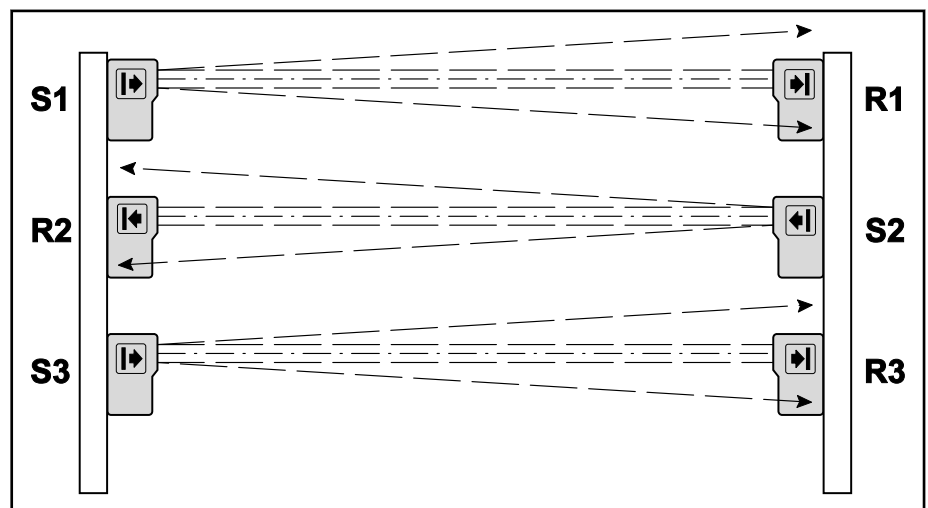
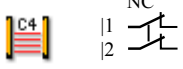


Fig. 4-7: Mounting to avoid mutual optical influence

Connecting devices

4.4 Electro-sensitive protective equipment (ESPE)

Electrical connection: Example from the SafeLogic Designer with SLC-3-XTIO

ESPE		OSSD1 (receiver) at I1 OSSD2 (receiver) at I2
------	---	--

Tab. 4-24: Connecting electro-sensitive protective equipment (ESPE)



For further information, refer to the operating instructions of the ESPE of the respective manufacturer.

4.5 Safe outputs Q1...Q4

⚠ CAUTION

Safety-oriented devices must be suitable for safety-related signals!

A functional interruption of the outputs Q1...Q4 results in a loss of the safety functions so that there is a risk of serious injury.

- Do not connect any loads that exceed the rated values of the outputs Q1...Q4
- Connect the GND connections of the actuators to the outputs Q1 to Q4 star-shaped to the GND connection of the voltage supply. Otherwise, an actuator (relay) can be activated accidentally if the common GND line is interrupted if at least one output is "High" and at least one output of the actuators is set to "Low".

4.6 EFI devices

If your SafeLogic compact system contains a CPU1 or CPU3, intelligent SICK EFI-compatible devices and sensors can be connected to your main module.

4.6.1 Connecting EFI devices

If shielding is required, for example due to EMC reasons, when connecting the EFI devices, use an earth terminal that is placed in the control cabinet near the SafeLogic compact main module for this purpose. Connect the grounding terminal to the shielding.



- No external termination resistor is required for EFI connections at the main module
- The main module and all connected EFI-compatible devices have to be connected to the same 0 V DC of the voltage supply
- The maximum permitted voltage at the EFI inputs is ± 30 V (to the terminal A2 = 0 V DC)
- For information on how to connect EFI-compatible devices incl. pin assignments, refer to the operating instructions for the corresponding devices

Cable

Bosch Rexroth provides a cable to connect EFI devices (see [chapter 13 "Ordering data of modules and accessories" on page 147](#)).

EMC measures

To increase the EMC resistance of the EFI communication, it is recommended to connect the EFI cable shielding on one or both sides to the functional earth.

Connect this shielding to the same DIN rail to which the functional earth (FE) of the SafeLogic compact system is connected to minimize interferences on the EFI cable. The shielding should be grounded closed to the cable inlet of the control cabinet.



- The FE terminal of the SafeLogic compact system is located at the bottom of the housing and connects automatically to the DIN rail when the module is mounted.
- To avoid further interferences, the functional earth of the sensors must be connected to the EFI shield as well.
- If other cables are present within the same cable duct where the EFI cable is routed and these cables emit a high degree of EMC interference (for drives or motors), this can lead to availability problems in the application. In this case, it is recommended to install the EFI cable in a separate duct.

4.7 EFI Link

4.7.1 EFI Link overview

With the EFI link, it is possible to combine up to four SafeLogic compact stations via EFI for a safe data exchange. Only SLC-3-CPU1 and SLC-3-CPU3 main modules can be used in an EFI Link system. The connection of SLC-3-CPU0 modules is not possible.

The process data of all stations (inputs and outputs, logic results, etc.) can be provided to all other stations in the EFI link system. The “Teach” function allows to temporarily deactivate single stations without impairing the function of the overall system.

Characteristics

- Safe connection of up to four SafeLogic compact stations via EFI
- Connection via EFI1 or EFI1 and EFI2
- Transfer/receive up to 52 bits of information per station (26 bits per EFI channel).
- A globally valid tag name can be assigned to each bit
- Teaching simulates the presence of temporarily suspended (switched off) stations
- Any station can be used as access point to address and configure the entire system with the SafeLogic Designer
- The configuration of the entire SafeLogic compact system is stored in a single project file

The SafeLogic compact system can be connected either only via EFI1 or via EFI1 and EFI2. The total number of process data bits per station that can be provided to the other stations in the SafeLogic compact system depends on the connection method.

Connecting devices

Connection method	Available process data bits per station
EFI1	26
EFI1/EFI2	52

Tab. 4-25: Available process data bits depend on the connection method



The EFI Link and the EFI communication cannot be used at the same time, i.e. it is not possible to connect other EFI-compatible devices to EFI2 while EFI1 is used for the EFI Link.

4.7.2 System requirements and limitations for EFI Link

For EFI link, the following system requirements have to be met:

System component	Minimum version
Hardware	SLC-3-CPU1 with the firmware version from V2.00.0 or SLC-3-CPU3
Software	SafeLogic Designer from version 1.3.0

Tab. 4-26: System requirements for EFI Link

The EFI Link system can be connected either only via EFI1 or via EFI1 and EFI2. The total number of status bits per station that can be provided to the other stations in the EFI Link system depends on the connection method.

Connection method	Available status bits per station
EFI1	26
EFI1/2	52

Tab. 4-27: Available status bits depending on the connection method



- The EFI Link and the EFI communication cannot be used at the same time, i.e. it is not possible to connect other EFI-compatible devices to EFI2 while EFI1 is used for the EFI Link.
- The process data sent by any station is received almost simultaneously by all other stations. The processing (logic) of the individual station, however, does not necessarily take place simultaneously, as the stations are not synchronized.
- Data within EFI1 and EFI2 is consistent. However, the data of EFI1 and EFI2 can temporarily be inconsistent as the data is transmitted separately.

4.7.3 Connecting an EFI Link system

⚠ CAUTION

Do not use buffering elements in an EFI Link system!

It is not allowed to use buffering elements, such as CAN bridges, CAN repeaters or CAN optical light barriers in an EFI Link system. As a general rule, no components other than EFI Link stations are allowed. Otherwise, the operator of the machine will be in danger.

There are two options for wiring an EFI Link system:

Connecting devices

- Connection via EFI1 (26 bits)
- Connection via EFI1 and EFI2 (52 bits)

Either way, always connect the identically named terminals e.g. EFI1 A at station A with EFI1 A at station B etc.).

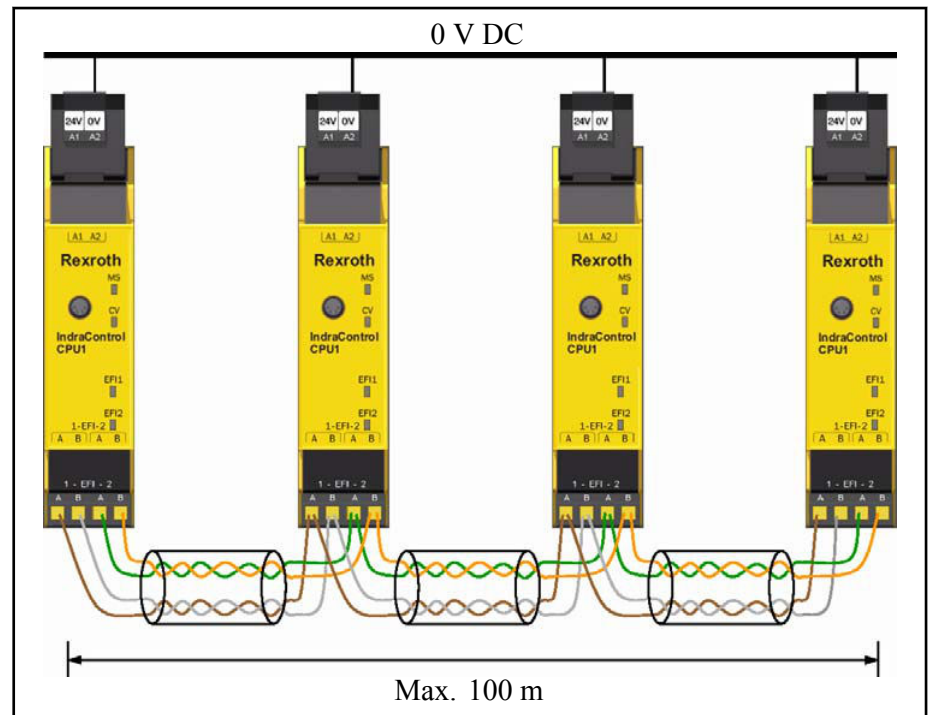


Fig. 4-8: Connecting EFI link stations via EFI1 and EFI2

NOTICE

Loss of the safe EFI communication due to incorrect wiring

- No external termination resistor is required for EFI connections at the CPU
- Stub lines or star-shaped wiring are not permitted
- The max. permitted total cable length (all stations) for EFI1 and EFI2 is 100 m each
- Unused conductors have to be connected to FE on both ends
- All connected EFI Link stations have to have the same 0 V DC connection to the voltage supply (terminal A2 at the memory plug)
- The maximum permitted voltage at the EFI inputs is ± 30 V (to the terminal A2 = 0 V DC)

EFI Link cable

The EFI Link stations can be connected using CAN cables (shielded, twisted pair).

Cable length	Type
Up to 40 m	$2 \times 2 \times 0.25 \text{ mm}^2$ (AWG 23)
Up to 100 m	$2 \times 2 \times 0.34 \text{ mm}^2$ (AWG 22)

Tab. 4-28: Possible cable lengths and types for EFI Link connections

Connecting devices

Bosch Rexroth provides a suitable cable for connection lengths up to 40 m (part no. R911170145, ordered per meter), also see [chapter 13 "Ordering data of modules and accessories" on page 147](#).

EMC measures

Please observe the notes in [chapter 4 "Connecting devices" on page 59](#).

Potential equalization

Always connect the cable shielding on both sides to earth potential. Note that the earth potential may differ on the earth connections. If this is the case, install an additional potential equalization. Follow the relevant standards and regulations.

4.8 Flexi Line

4.8.1 Flexi Line overview

Using Flexi Line, up to 32 SafeLogic compact stations can be safely networked. Only SLC-3-CPU3 modules can be used in a SafeLogic compact system. Connecting other main modules (SLC-3-CPU0 or SLC-3-CPU1) is not possible. A uniform process image is defined for the entire Flexi Line system. Each byte in this process image is either applicable globally, i.e. throughout the entire system, or locally, i.e. only for the relevant station and its neighboring stations. Each Flexi Line station communicates with the respective neighboring stations via this process image. The topology allows communication without addressing.

Characteristics

- Safe connection of up to 32 SafeLogic compact stations via the Flexi Line interface
- Topology without addressing: When changing the station sequence, just confirm the new order with a teach button
- The EFI interface remains available without restrictions:
 - An EFI-compatible sensors can be connected
 - An EFI link system can be connected
- A global process image is defined for all stations
- Globally or locally applicable bytes can be defined within the process image
- The process image can comprise up to 12 bytes or 96 bits
- The maximum cable length between two stations is 1.000 meters. The total possible length of a system with 32 stations is therefore 31 kilometers
- The complete system has a fixed update rate. The update rate depends on the maximum cable length between two stations and on the size of the process image



- You can use EFI Link or EFI communication at the same time as Flexi Line, i.e. it is possible to connect either EFI-compatible devices or EFI Link stations.
- The process image is transferred from station to station with a fixed update rate. However, processing (logic) of the individual stations is not necessarily synchronous as the stations are not synchronized with one another.
- The update rate of the Flexi Line system depends on the maximum cable length between two stations and on the size of the process image.

Max. cable length	32 bits	64 bits	96 bits
125 m	2 ms	2 ms	4 ms
250 m	2 ms	4 ms	8 ms
500 m	4 ms	8 ms	12 ms
1000 m	8 ms	12 ms	20 ms

Tab. 4-29: Update rate of a Flexi Line system depending on the maximum cable length and the size of the process image

4.8.2 Connecting a Flexi Line system

⚠ CAUTION

Do not use buffering elements in a Flexi Line system!

It is not allowed to use buffering elements such as CAN bridges, CAN repeaters or CAN optical light barriers in an Flexi Line system. As a general rule, no components other than Flexi Line stations are allowed. Otherwise, the operator of the machine will be in danger.

The Flexi Line system stations are connected as follows:

- Connect the "NEXT" connection of each station to the "PRE" connection of the next station
- Connect the identically named terminals, i.e. connect A to A and B to B

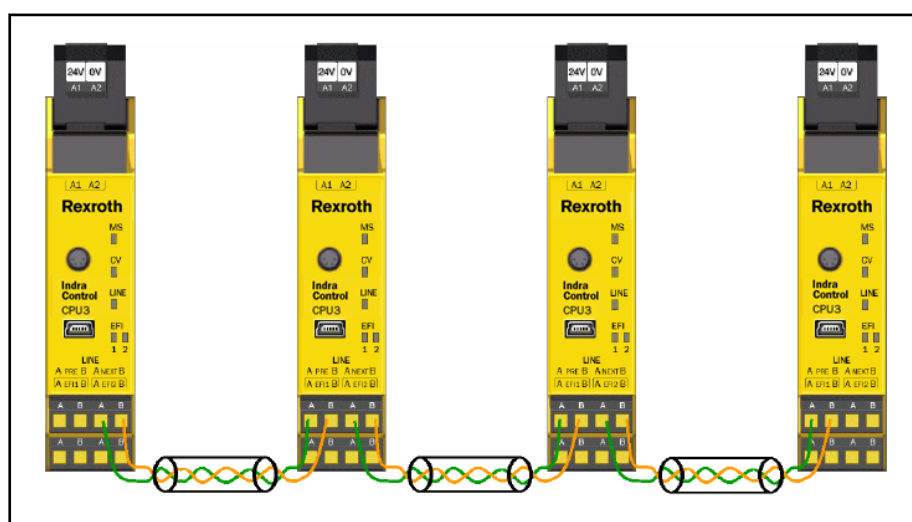


Fig. 4-9: Connecting a Flexi Line system

Connecting devices



- No external termination resistor is required for the Flexi Line connections at the main module
- Stub lines or star-shaped wiring are not permitted
- Unused conductors have to be connected to FE on both ends
- The maximum permitted voltage at Flexi Line inputs is ± 30 V (to the terminal A2 = 0 V DC)

Flexi Line cable

The Flexi Line stations can be connected using CAN cables (shielded, twisted pair).

Cable length	Type
Up to 40 m	2 × 0.22 mm ² (AWG 23)
Up to 125 m	2 × 0.34 mm ² (AWG 22)
Up to 1000 m	2 × 0.75 mm ² (AWG 18)

Tab. 4-30: Possible cable lengths and types for Flexi Line connections

EMC measures

Please observe the notes in [chapter 4.9 "EMC measures for EFI Link and Flexi Line"](#) on page 80.

Potential equalization

- Always connect the cable shielding on both sides to earth potential. If this is not possible, ground the side connected to the PRE terminals.
- Note that the earth potential may differ on the earth connections. If this is the case, install an additional potential equalization. Follow the relevant standards and regulations.

4.9 EMC measures for EFI Link and Flexi Line

Flexi Line or EFI Link cables are used to transfer communication signals. Electromagnetic influences may disturb the signal transfer and interrupt the EFI Link communication. To minimize electromagnetic interference, the following actions are required:

1. Ensure that there is enough potential equalization of the connection points for the shielding. Follow the relevant standards and regulations.
2. Connect all inactive metallic parts (control cabinet doors and housing, mounting rails etc.) to the same reference potential.
3. Connect the reference potential to the protective earth conductor.
4. Connect the protective earth conductor to the external earth potential.
5. Connect the shielding of the shielded cables to the reference potential directly at the entrance to the system (control cabinet, frame, mounting rail) using suitable cable clamps. The cable clamps must completely enclose the cable shield.
6. Connect the cable shielding again to the reference potential as close as possible to the main module (e.g. on the mounting rail) using suitable cable clamps. The cable clamps must completely enclose the cable shield.

Connecting devices

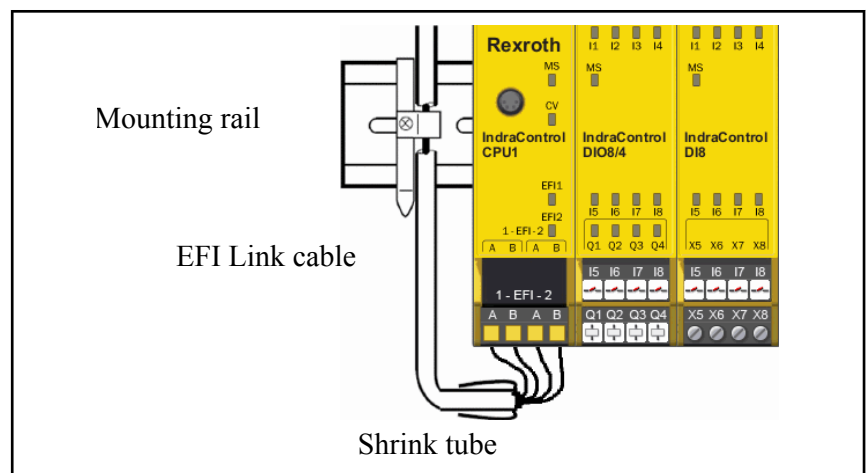


Fig. 4-10: Connection of the EFI Link cable shielding with the mounting rail

7. Keep the stripped cable ends as short as possible
8. Insulate the shielding end, e.g. with a suitable shrinking tube

NOTICE

Loss of the safe EFI communication due to incorrect wiring

- All connections have to be electrically well conducting with low impedance
- Stub lines or star-shaped EFI wiring are not permitted
- Load cables (e.g. for frequency changers, electronic velocity control, contactors, brakes etc.) and small-signal cables (e.g. measuring lines, analog sensors, field bus lines etc.) have to be routed separately and with a low inductive coupling

4.10 Connecting encoders

An SLC-3-MOC0 can be connected to the following encoder types:

- A/B incremental encoder HTL 24 V, HTL 12 V, TTL, max. 300 kHz
- A/B incremental encoder RS-422, max. 1 MHz
- Sine-cosine encoder 1 VSS, max. 120 kHz
- SSI encoder, RS-422, max. 1 Mbaud

CAUTION

Depending on the encoders and their electric and mechanic properties used, different SIL or PL can be obtained!

For further information on the different SIL or PL, refer to [chapter 3.12 "Drive monitor SLC-3-MOC0" on page 44](#).

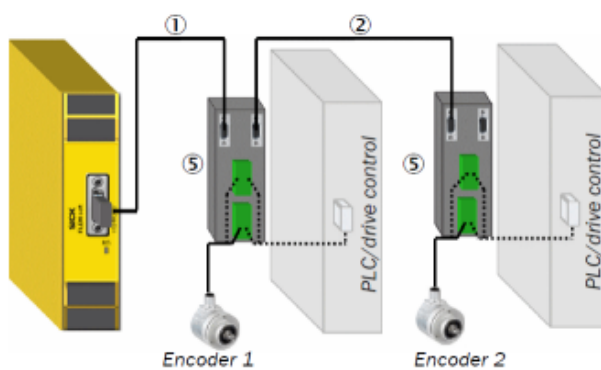


The wiring plan is in the SafeLogic Designer report for the encoder configuration selected in the SafeLogic Designer.

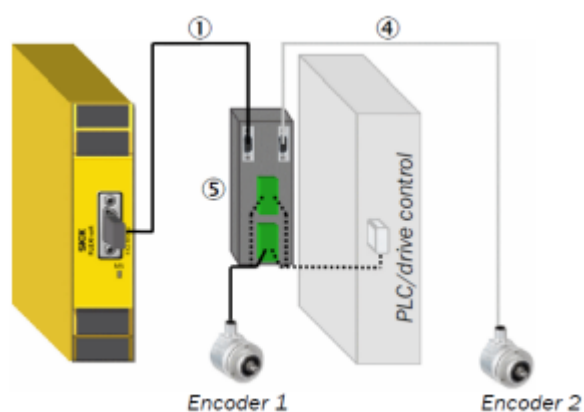
Please also note the options on the tab encoder connection type in the configuration dialog of the encoder elements.

Connecting devices

Connection with two
motor feedback splitter
boxes

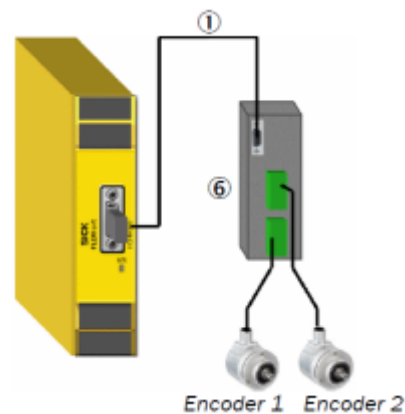


Connection with one
motor feedback splitter
box and an encoder
cable provided by the
customer

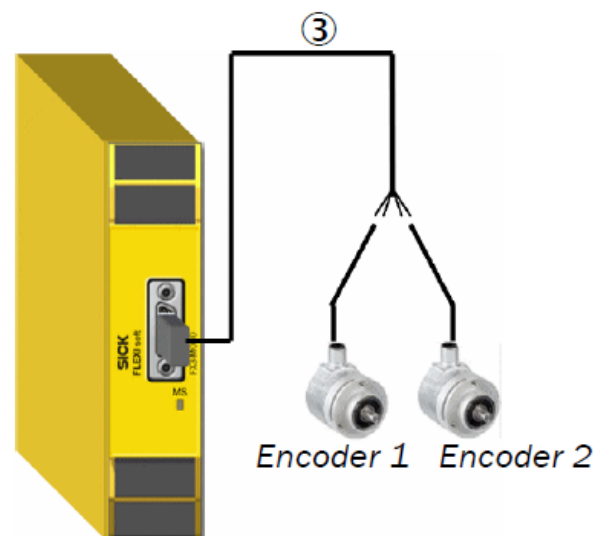


Connecting devices

Connection with one
 dual encoder
 connection box



Connection with
 connection cable for
 direct encoder
 connection



Tab. 4-31: Connection options for encoder

No.	Name	Variant	Part number
①	Primary connecting cable:	2 m	R911173413
	Connection line between SLC-3-MOC0 and connection box/splitter box	10 m	R911173414
②	Extension cable:	2 m	R911173415
	Connection line between two splitter boxes	10 m	R911173416
③	Connecting cable for direct encoder connection	2 m	R911173412
④	Encoder cable from the customer	–	–
⑤	Motor feedback splitter box	–	R911173410
⑥	Dual encoder connection box	–	R911173411

Tab. 4-32: Encoder accessories



It is recommended to use the connection cables and the connection boxes available as accessories (see [chapter 13](#) "Ordering data of modules and accessories" on page 147).

Connecting devices

The following graphics displays the differences when connecting incremental encoders with two output pairs and incremental encoders with two outputs.

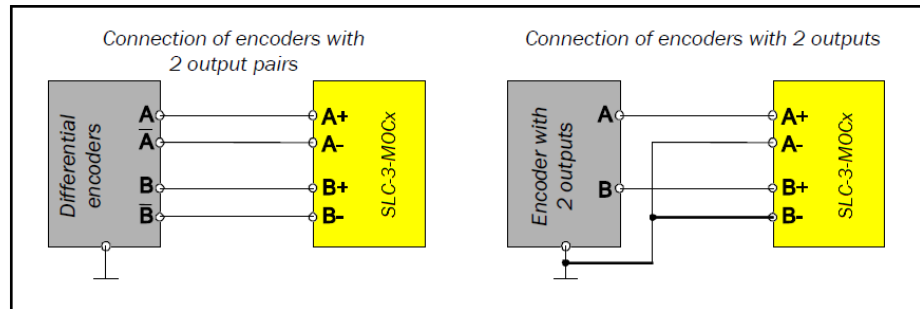


Fig. 4-11: Differences when connecting incremental encoders with two output pairs and incremental encoders with two outputs



For encoders with two outputs, the inputs A- and B- of SLC-3-MOC0 cannot remain open, but have to be connected to 0 V. The connection should thus be as close as possible to the 0 connection of the encoder.

For the encoder voltage supply, 24 V are available at the encoder connection of the SLC-3-MOC0 module. A selectable supply voltage is available at the connection boxes. For more details, see:

- [chapter 3.12 "Drive monitor SLC-3-MOC0" on page 44](#)
- [chapter "Data sheet SLC-3-MOC0" on page 130](#)
- [chapter "Data sheet of the encoder connection boxes" on page 136](#)

5 Special functions

5.1 Enhanced Function Interface – EFI

The main modules SLC-3-CPU1 and SLC-3-CPU3 are provided with two EFI interfaces. This chapter describes the properties, functions and benefits of these interfaces.

5.1.1 Definition

An EFI interface is a safe communication interface between EFI-compatible devices. Information can be retrieved from the sensors and commands transferred to the sensors.

5.1.2 Properties

- Up to four devices are possible per EFI line, in the EFI-compatible devices support this number
- Connection of the devices using a 2-wire cable
- Various device combinations
 - Sensor with sensor within the same product family
 - Sensor with safety controls and gateways
 - Connection of up to four SafeLogic compact SLC-3-CPU1 or SLC-3-CPU3 main modules to one EFI Link system (see section [chapter 4.7 "EFI Link" on page 75](#))
- Transmission of status information (process data) between devices using an EFI interface
- Transmission of the configuration from the SafeLogic Designer to the EFI-compatible devices
- Upload of the configuration from the EFI-compatible devices to the SafeLogic Designer
- Activation/use of sensor functions

5.1.3 Functions

In addition to the product-specific functions of the respective EFI-compatible devices, the following functions are available:

General functions

- **Status information (process data)** of the EFI-compatible devices is available in the control and at the sensor
- **Diagnostic information** of all EFI-compatible devices is available in the control
- Transfer of configuration information

Special functions

- Simultaneous protective field evaluation
- Protective field switching
- Function changeover
- Operating mode selection
- Signal routing
- Decentralized diagnostic information via Ethernet
- Information on the location of the protective field interruption at host-guest applications

Special functions

- Evaluation of signals and forwarding of the results

5.1.4 Benefits

- **Reduction in installation work** (only 2 wires) if signals from several sensors are used
- **Reduction in material expenses** due to the possibility of saving function blocks and I/Os
- **Higher availability** by providing the diagnostic information with high information content for fast and correct handling options

5.2 Muting

Muting is the automatic temporary bypassing of safety-oriented functions of the control system or of the safety device. Muting is used when certain objects, such as pallets with material, may be moved into the hazardous area. During this transportation through electro-sensitive protective equipment (ESPE), such as a safety light curtain, the muting function inhibits monitoring by the ESPE.

For further information on how to proceed, refer to the operating instructions "IndraControl SafeLogic compact Designer Software".

6 Mounting and demounting

This chapter describes the mounting of the modules of the SafeLogic compact safety control.

6.1 Steps to mount the modules



The SafeLogic compact system has to be mounted into an environment corresponding to the degree of protection IP 54 (EN 60529), e.g. into a control cabinet with the degree of protection IP 54.

While supply voltage is applied, modules must not be plugged to nor be removed from the SafeLogic compact system.

- The main module SLC-3-CPUx is positioned at the far left in a SafeLogic compact system
- The two optional gateways are immediately on the right of the main module
- Install any additional SafeLogic compact extension modules (e.g. SLC-3-XTIO or SLC-3-XTDI) to the right of the gateways or to the right of the main module if no gateways are used
- Mount additional relay modules (SLC-A-UE410-2RO or SLC-A-UE410-4RO) to the far right of the SafeLogic compact system
- The modules are located in a 22.5 mm wide modular system for 35 mm DIN rails acc. to EN 60 715
- The modules are connected to each other via the FLEXBUS+ plug connection integrated in the housing. Note that, when replacing a module, the SafeLogic compact modules have to be pushed apart for approx. 10 mm before the corresponding module can be removed from the DIN rail
- Install the modules acc. to EN 50 274
- Ensure suitable ESD protective measures while mounting. Otherwise, the FLEXBUS+ bus could be damaged
- Take suitable measures to prevent any foreign objects from entering the openings of the connector, in particular those of the memory plug
- Modules with ventilation slots have to be installed vertically in such a way that vertical air circulation is possible, i.e. the ventilation slots have to be positioned at the top and at the bottom

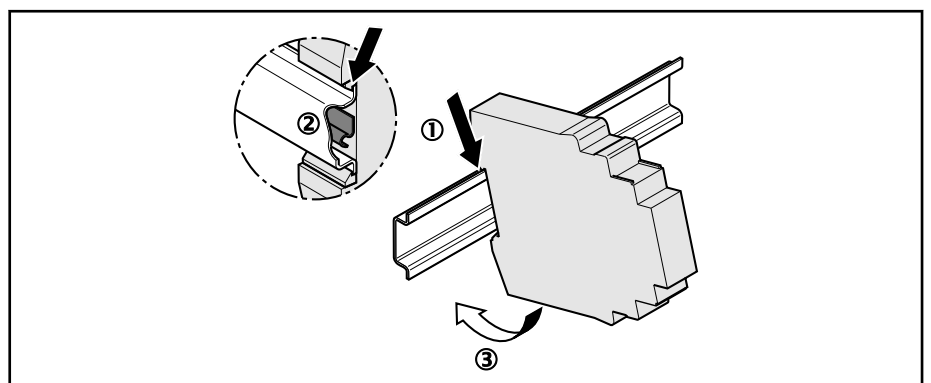


Fig. 6-1: Hanging the module on the standard rail

Mounting and demounting

- Ensure that the operating voltage of the SafeLogic compact system is switched off
- Hang the device onto the DIN rail (①)
- Verify correct position of the grounding spring ②. The grounding spring contact of the module has to be in contact with the DIN rail. This contact has to be secure and has to allow electrical conductivity
- Engage the module onto the DIN rail by pressing it slightly in the direction of the arrow (③)

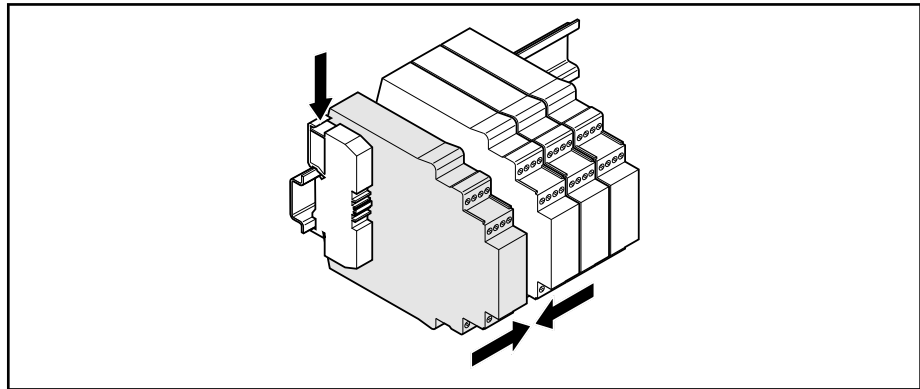


Fig. 6-2: Installing end brackets

- If there are several modules, push the modules individually together in the direction of the arrow until the lateral plug-in connection is engaged
- Install end brackets on the left and on the right

After the mounting, proceed with the following steps:

- Establishing electrical connections ([chapter 7 "Electrical installation" on page 91](#))
- Configuration (refer to the operating instructions "IndraControl SafeLogic compact Designer Software")
- Checking the installation ([chapter 9.2 "Tests before the initial commissioning" on page 98](#))

6.2 Steps to demount the module

1. Remove the plug-in terminal blocks with the wiring and the end clips.

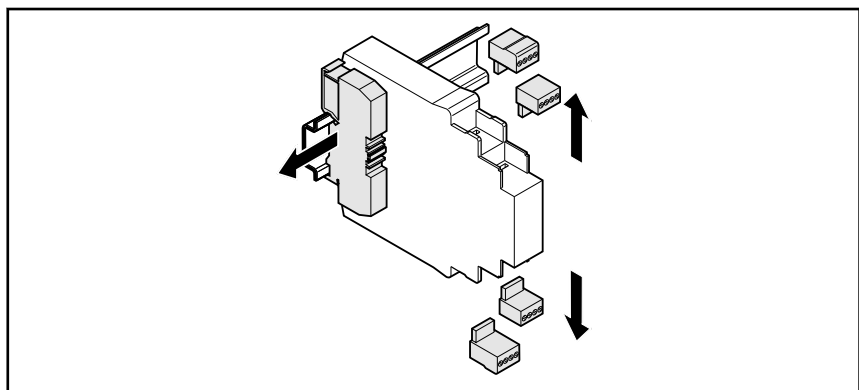


Fig. 6-3: Removing plug-in terminal blocks

2. If there are several modules, slide the modules away from each other individually in the direction of the arrow until the side plug connection is separated.

Mounting and demounting

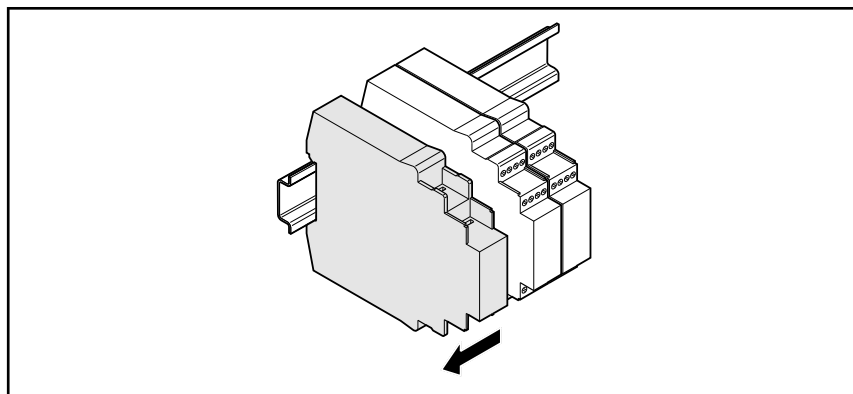


Fig. 6-4: *Disconnecting the plug-in connection*

3. Press the module downwards at the rear (①) and remove the module from the rail in the direction of the arrow while keeping it pressed down (②).

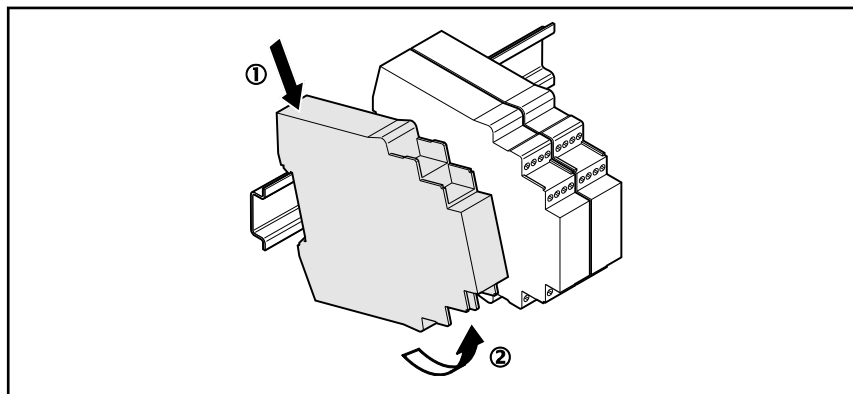


Fig. 6-5: *Removing the module from the standard rail*

7 Electrical installation

7.1 Electrical installation requirements

This chapter deals with the electrical installation of the SafeLogic compact system in the control cabinet. For further information on the electrical connection of other devices to the SafeLogic compact system, refer to the section on the respective device in [chapter 4 "Connecting devices" on page 59](#).

DANGER

Disconnect the entire machine/system!

While connecting the devices, the system could start accidentally.

Note the respective safety standards!

All safety related parts of the installation (cabling, connected sensors and actuators, configuration settings, EDM) have to correspond to the relevant safety standards (e.g. EN 62 or EN ISO 13 849-1). This can mean that safety-related signals need to be redundant or that single-channel signals need protected wiring or short circuit detection by using test outputs and/or periodical function tests.

- Take into account that short circuits between test outputs and the corresponding input cannot be detected
- Decide whether protected or separate cabling is required for these signals

Electrical installation



- The SafeLogic compact safety control fulfils the EMC requirements acc. to the basic specification EN 61 000-6-2 for industrial use
- Bosch Rexroth industrial safety devices are only designed for local DC supply applications. If the device is used in power supply networks, e.g. according to IEC 61 326-3-1, additional protective measures have to be taken
- Machines, at which safety devices are used, must be installed and designed with regard to the Lightning Protection Zone (LPZ) according to EN 62 305-1. Required immunity levels can be achieved by using external protective devices. The installed surge protective devices (SPD) have to meet the requirements acc. to EN 61 643-11
- The system has to prevent "common mode" disturbances according to IEC 61 000-4-1 in the frequency range from 0 Hz to 150 kHz
- To ensure full electromagnetic compatibility (EMC), the mounting rail has to be connected to functional earth (FE)
- The SafeLogic compact system has to be mounted in an environment corresponding to the degree of protection IP 54 (EN 60529), e.g. in a control cabinet with the degree of protection IP 54
- Install electrically acc. to EN 60 204-1
- The external voltage supply of the device has to be capable of bridging short mains voltage failures of 20 ms acc. to EN 60 204-1
- The voltage supply as well as all connected signals have to fulfill the regulations for extra-low voltages with safe separation (SELV, PELV) acc. to EN 60 664 and EN 50 178 (equipment of electrical power installation with electronic devices)
- Connect all modules of the SafeLogic compact system, the connected protective devices (e.g. the EFI-compatible devices) as well as the voltage supply/supplies with the same 0 V DC connection (GND). The GND of the RS232 interface is connected internally to the GND of the supply voltage of the main module (A2)
- Connect the GND connections of the actuators to the outputs Q1 to Q4 star-shaped to the GND connection of the voltage supply. Otherwise, an actuator (relay) can be activated accidentally if the common GND line is interrupted if at least one output is "High" and at least one output of the actuators is set to "Low".
- If the RS232 interface at the main module is used as an alternative to a gateway, the maximum permissible cable length is 3 m
- Avoid ground loops between the GND of the RS232 interface and the connection A2 of the main module, e.g. by using optocouplers
- Depending on the external loads, especially for inductive loads, additional external protective measures, e.g. varistors or RC elements can be required to protect the outputs. See [chapter 12 "Technical data" on page 109](#) for operating

limits. Take into account that the response times may increase depending on the type of protective element

- If a module is replaced, the correct terminal assignment has to be guaranteed, for example by labeling or suitable cable routing
- When being behind the protective devices (e.g. safety light curtain) is possible, mount the reset button so that it cannot be actuated by a person in the hazardous area. When operating the reset button, the operator must have full visual command of the hazardous area

⚠ WARNING

Limited short-circuit detection!

An SLC-3-XTDI has two test signal generators. One test signal generator is responsible for the odd-numbered test outputs X1, X3, X5 and X7, the other for the even-numbered test outputs X2, X4, X6 and X8.

Short circuits between arbitrary test signal generators of the SafeLogic compact extension modules are detected, also between test signal generators of different modules provided that the test gaps are ≤ 4 ms and the test cycles ≥ 200 ms for the relevant test outputs. Short circuits after 24 V DC (after "High") at inputs connected to test outputs are detected independently of the test gap time.

Note that the odd-numbered test outputs X1, X3, X5 and X7 at the SLC-3-XTDI are connected to one common test signal generator and that the even-numbered test outputs X2, X4, X6 and X8 are connected to another common test signal generator. Therefore, short circuits between the odd-number test outputs X1, X3, X5 and X7 cannot be detected. The same applies to the test outputs X2, X4, X6 and X8.

Consider that while wiring (e.g. separate routing, protected cables)!

Reverse current at inputs SLC-3-XTIO, SLC-3-XTDI or SLC-3-XTDS in case of ground interruption!

In case of an internal or external ground interruption, there can be a reverse current from the voltage supply of the main module (memory plug terminal A2) to the safety inputs I1...I8 of the modules SLC-3-XTIO, SLC-3-XTDI or SLC-3-XTDS. Observe this if other inputs are connected to these inputs in parallel, so that this reverse current does not lead to an unintended "High" at the parallel connected inputs (also see [chapter 12.2.2 "Input/output extension module SLC-3-XTIO" on page 118](#) and [chapter 12.2.3 "Input extension module SLC-3-XTDI" on page 122](#)).

Electrical installation

7.2 Internal circuitry of the voltage supply

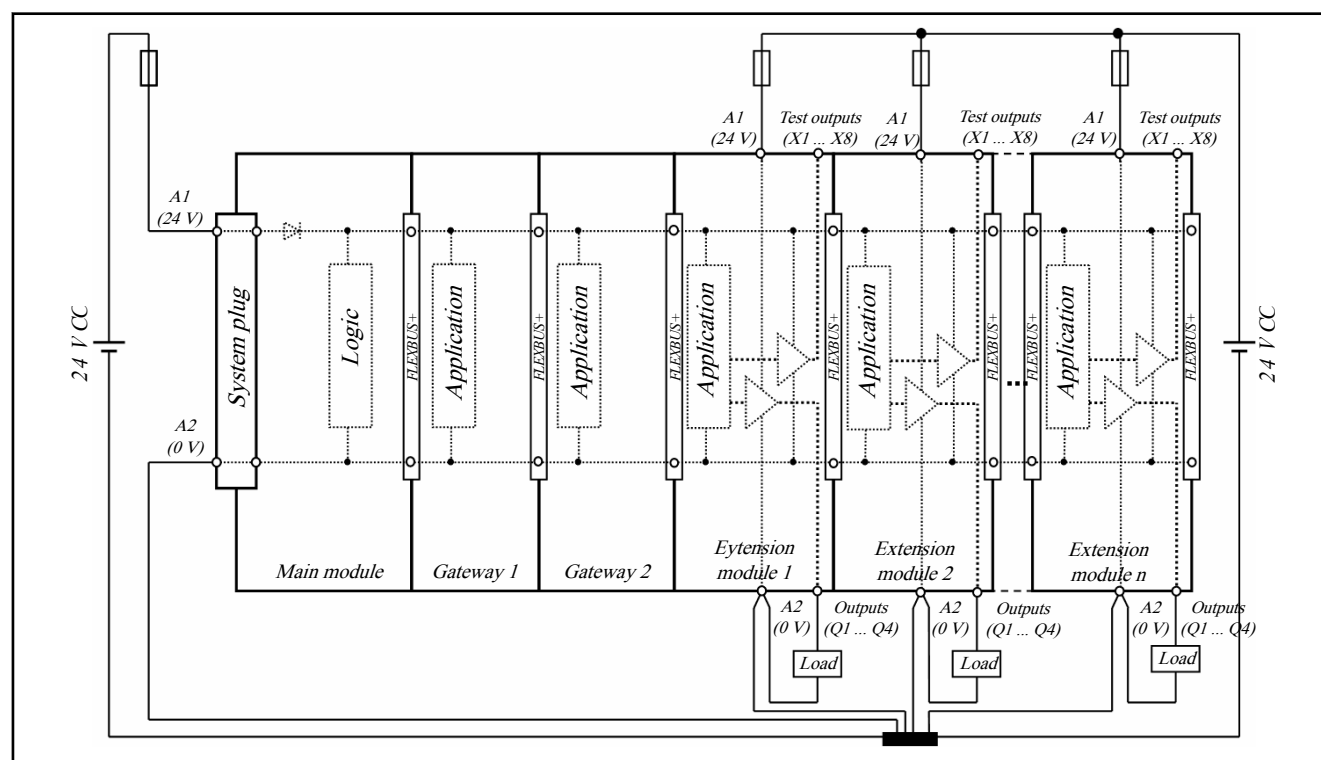


Fig. 7-1: Internal circuitry of the SafeLogic compact voltage supply

8 Configuration

CAUTION

Check the safety function before commissioning and after every change!

If you change the configuration, you must check the effectiveness of the safety function. Please observe the test notes in the operating instructions of the connected protective devices.



For the configuration of the SafeLogic compact system you require the "SafeLogic Designer" software and the memory plug SLC-3-MPL0 or SLC-3-MPL1.

Configuration and verification of devices that are connected to the safety controller is generally not carried out via the SafeLogic Designer software. These devices have their own mechanisms for configuration and verification. For information on the operation, refer to the operating instruction of the respective machine.

One exception are EFI-compatible devices connected to the SafeLogic main module SLC-3-CPU1 or SLC-3-CPU3 (the EFI compatible devices can be found under "EFI elements" in the elements window). These devices can be configured directly in the SafeLogic Designer by double-clicking the icon, or alternatively configured and verified locally at the device via its RS232 interface. The SICK configuration and diagnostic software "CDS" is required for the configuration of the EFI-compatible devices.

- The system configuration of the complete SafeLogic compact system (with exception of the EFI-compatible devices) is stored in the memory plug. This offers the advantage when extension modules or gateways are replaced that the system does not have to be reconfigured
- The data stored in the memory plug is retained when the voltage supply is interrupted
- It is possible to transfer **configuration information** via the EFI interface



If two computers establish TCP/IP connections in parallel with a CPU main module via port 9000 of an Ethernet gateway, the CPU main module communicates only via the connection established last. This causes the other computer to establish an additional connection without closing the connection established before. At some point, there are too many open connections to the computers via the gateways where only messages on maintaining of these open connections (keep alive messages) are exchanged. This causes the SafeLogic compact station to switch to lock-out status.

9 Commissioning

CAUTION

No commissioning without approval by a qualified person!

Before the initial commissioning of a system using a SafeLogic compact safety controller, it must be checked and released by qualified personnel.

- Check the hazardous area!
- Ensure that no one is located in the hazardous area before commissioning
- Check the hazardous area and secure it against being entered by people (e.g. set up warning signs, attach blocking ropes or similar). Observe the relevant laws and local regulations

9.1 Full approval of the application

System commission may only be carried out if full approval was successful. Full approval may only be performed by professionals trained accordingly.

The full approval includes the following items to be checked:

- Check whether all safety related parts of the installation (cabling, connected sensors and actuators, configuration settings) are according to the relevant safety standards (e.g. EN 62 061 or EN ISO 13 849-1)
- Check the devices connected to the safety controller in accordance with the test notes in the accompanying operating instructions



More information on this can be found in the operating instructions of the ESPE of the respective manufacturer.

- Label all connections (connection cables and plugs) at the safety controller clearly and without ambiguity to avoid confusion. Since the SafeLogic compact system has several connections of the same design, ensure that disconnected cables or plugs cannot be connected back unintentionally to the wrong connection
- Check the signal paths and the correct inclusion in higher-level controllers
- Check the correct data transfer from and to the SafeLogic compact safety controller
- Check the logic program of the safety controller
- Perform a complete validation of the safety functions of the system in each operating mode and an error simulation. In particular, test the response time of the individual applications
- Completely document the configuration of the system, the individual devices and the results of the safety check
- In order to prevent unintentional overwriting of the configuration, activate the write protection of the configuration parameters of the SafeLogic compact system. Modifications are only possible if the write protection has been deactivated

Commissioning

9.2 Tests before the initial commissioning

The purpose of the initial commissioning tests is to confirm the safety requirements specified in the national/international rules and regulations, especially in the Machine and Work Equipment Directive (EC Conformity).

- Check the effectiveness of the protective device at the machine, using all the selectable operating modes and functions
- Ensure that the operating personnel of the machine fitted with the safety controller become instructed by the qualified personnel of the machine owner before beginning work. Arranging the instruction is the responsibility of the machine operator

10 Diagnostics

10.1 In the event of errors

CAUTION

No operation in case of unclear malfunction!

Switch off the machine if you cannot identify the error or if you cannot troubleshoot it safely.

CAUTION

Test after troubleshooting!

Execute an effect analysis and check all affected safety functions after the troubleshooting.

10.2 Error states

In case of certain malfunctions or a faulty configuration, the SafeLogic compact safety control enters the safe state. The LEDs of the individual modules of the safety control indicate the corresponding error level.

Depending on the error, there are different error levels:

Configuration error

- The system is in state "Configuration required" (LED "MS"  Red (1 Hz))
- The applications in all modules are in the operating state "Stop"
- All safety outputs in the system are switched off
- All safe process data is set to zero. Typically, non-safety-related process data is also set to zero

Recoverable error

- Applications in all modules remain in the operating state "RUN" (LED "MS" of the affected modules =  red/green alternating (1 Hz), LED "MS" of the non-affected modules =  green)
- If safe system outputs are affected, these are switched off at least
- If safe inputs are effected, at least the process data of these safe inputs is set to zero

Critical fault

- The system is in the state "Critical error" (LED "MS" of the module that detected the critical error =  Red (2 Hz). LED "MS" of the module, at which the error cause is unknown =  red)
- The applications in all modules are in the operating state "Stop"
- All safe system outputs are switched off
- All safe process data is set to zero. Typically, non-safety-related process data is also set to zero

How to commission the device again:

- Eliminate the error cause as per the displays of the "MS" and "CV" LEDs
- In case of critical errors, switch off the voltage supply of the SafeLogic compact system at least 3 seconds. The switch it on again

Diagnostics

10.3 Error displays of the status LEDs, error messages and troubleshooting measures

This section lists and describes the most important error codes, possible causes and potential measures for troubleshooting. These error messages can be displayed in the "Diagnostics" view of the SafeLogic Designer if connected to the SafeLogic compact system.

- For information on how to perform diagnostics, refer to the operating instructions "IndraControl SafeLogic compact Designer Software", chapter "Diagnostic view"
- For the error displays and troubleshooting for the individual modules, refer to the chapter of the affected modules, see [chapter 3.5 "Main module SLC-3-CPU0" on page 23](#) to [chapter 3.13 "Relay output modules SLC-A-UE410-2RO/SLC-A-UE410-4RO" on page 56](#)

LED display at the module				
Main module (CPUx)	Extension module (XTIO,XTDI, XTDS, STIO, MOC0)	Possible Error codes	Possible reasons	Possible actions
MS =  Red (1 Hz)	All extension modules: MS =  Red (1 Hz) (Firmware ≥ V2.00.0) or MS =  Red/green (1 Hz) (Firmware V1.xx.0)	Main module: 0x000E4006, 0x00160005, 0x000F0013	The configuration in the memory plug is incompatible, as the configuration is intended for a different main module type: • The memory plug has been used before in a system with a different main module type (e.g. CPU0 instead of CPU1 or vice versa) • A wrong main module was used in the hardware installation	• Download a configuration of the same main module type as in the hardware installation • Replace the main module in the hardware installation by a main module of the same module type as in the project file
		Main module: 0x00170005, 0x000F0013	The configuration in the memory plug is incompatible, as the configuration is intended for a newer firmware version of the main module: • The memory plug has been configured for an incompatible higher main module firmware version (e.g. V2.00.0 instead of V1.13.0) • An older main module firmware version is used in the hardware installation	• Download a configuration with the same or a smaller CPU firmware version (e.g. V1.xx.0 instead of V2.xx.0) • Replace the main module in the hardware installation by a module with an identical or higher firmware version as in the project file
		Main module: 0x000E4013, 0x00274006	The configuration in the memory plug is incompatible with at least one extension module: • One extension module is missing in the hardware installation	• Download a configuration with a matching number of extension modules • Add the missing extension module in the hardware installation
		Main module: 0x000E0006, 0x0005000D XTIO/XTDI: 0x4901, 0x4904	The configuration in the memory plug is invalid: • The last procedure has not been completed successfully, e.g. as the voltage supply was switched off before the writing to the memory plug has been completed • Hardware error in the memory plug • The memory plug is empty (as upon delivery)	• Download the configuration again and ensure that the voltage supply at the main module is on until the download has been completed • Replace the memory plug and download the configuration again

Diagnostics

LED display at the module				
Main module (CPUx)	Extension module (XTIO,XTDI, XTDS, STIO, MOC0)	Possible Error codes	Possible reasons	Possible actions
MS =  Red (1 Hz) EFI =  Red (1 Hz)	One or more extension modules : MS =  Red (1 Hz) (Firmware ≥ V2.00.0) or MS =  Red/ green (1 Hz) (Firmware V1.xx.0)	Main module: 0x0014000A	If CPU1: EFI device address conflict: There are at least two main modules with the same EFI address connected	Change the EFI device address of the main module or the connected device using the SafeLogic Designer
		Main module: 0x0015000A	If CPU1 and EFI Link: Wrong EFI Link ID: - EFI1 and EFI2 were interchanged during the wiring - There is at least one main module with a different EFI Link ID connected	- Check the wiring between the EFI Link stations: EFI1 has to be connected to EFI1, and if applicable EFI2 with EFI2 - Connect the EFI Link stations with matching EFI Link IDs - Download the configuration to all EFI Link stations with same EFI Link IDs
		Main module: 0x001F0006, 0x00230006, 0x00234006, 0x001F4006	The configuration in the memory plug is incompatible with at least one extension module: - Wrong type or version of the module (whose MS LED is flashing red or red/green) - Too many extension modules are connected (LED MS at module flashes red or red/green) - Extension modules are missing (MS LEDs of other modules flash red or red/green)	- Download a configuration with the same module type and the same or a smaller firmware version for all extension modules - Replace the affected extension module in the hardware installation with a module of the same module type and the same or smaller firmware version as in the project file
MS =  Green (1 Hz) CV =  Yellow (1 Hz)	MS =  Green (1 Hz)	–	System is in Stop state (ready to run)	Start the application in the SafeLogic Designer For an automatic start after power up a, it is required to verify the project with the SafeLogic Designer
MS =  Green (1 Hz) CV =  Yellow	MS =  Green (1 Hz)	–	System is in Stop state (ready to run)	Start the application in the SafeLogic Designer
MS =  Green	MS =  Green	–	System is operating. No error detected	–
MS =  Green	One or more extension modules : MS =  Red/green (1 Hz) (Firmware ≥ V2.00.0) or MS =  Red (1 Hz) (Firmware V1.xx.0) and Q1+Q2+Q3+Q4 =  Green (1 Hz)	XTIO: 0x4804, 0x4806, 0x4807	The voltage supply of an XTIO module is too low or missing	Check the supply voltage at the terminals A1 (24 V) and A2 (0 V) at the XTIO module, also under worst case load conditions The error is reset automatically after approx. 8 seconds if the error cause is no longer present

Diagnostics

LED display at the module				
Main module (CPUx)	Extension module (XTIO,XTDI, XTDS, STIO, MOC0)	Possible Error codes	Possible reasons	Possible actions
MS = ● Green	One or more extension modules : MS = ● Red/ green (1 Hz) (Firmware ≥ V2.00.0) or MS = ● Red (1 Hz) (Firmware V1.xx.0) and Q1 or Q2 or Q3 or Q4 = ● Green (1 Hz)	XTIO: 0x4701, 0x4702, 0x4704, 0x4705 Main module: 0x0029C006	Short circuit to 24 V or cross fault in the wiring of the safe output Q1 ... Q4 (whose LED is flashing) - Capacitive load exceeds the allowed maximum value (e.g. by capacitor for spark quenching) - Internal hardware error of the XTIO module - Inductive load exceeds the permissible maximum value - Short circuit after 0 V in the wiring of the safe output Q1 ... Q4 (whose LED is flashing) - Current supply of the XTIO module is temporarily interrupted	- Check the wiring of the affected output - Check the capacitive load - Check the inductive load - Replace XTIO module To reset the error, the logic of the main module has to disable all outputs of the affected module have by disabling the related input signals, e.g. E-Stop. Error reset can take up to 8 seconds. Optionally, execute a voltage reset at the main module
MS = ● Green	One or more extension modules : MS = ● Red/green (1 Hz) (Firmware ≥ V2.00.0) or MS = ● red (1 Hz) (Firmware V1.xx.0) and I1 or I2 or I3 or I4 or I5 or I6 or I7 or I8 = ● Green (1 Hz)	XTIO/XTDI: 0x4601	For inputs connected to a test output: - Short circuit after 24 V or cross fault in the wiring of tested sensors: - Short circuit after 24 V or cross fault in the wiring of X1, X2, ... or X8 to a tactile switch or to a test input of a testable input - Short circuit after 24 V or cross fault in the wiring of a tactile switch or to an output of a testable sensor to I1, I2, ...or I8 - Defective testable sensor - Cable break in the wiring of a safety mat: - Cable break in the wiring from X1, X2, ... or X8 to safety mat - Cable break in the wiring from a safety mat to I1, I2, ... or I8 - Defective safety mat	- Check the wiring of affected input - Replace testable sensor To reset the error, disable the respective input (input state Low/Low for equivalent dual-channel inputs, Low/High for antivalent dual-channel inputs) or reset the voltage at the main module

Diagnostics

LED display at the module				
Main module (CPUx)	Extension module (XTIO,XTDI, XTDS, STIO, MOC0)	Possible Error codes	Possible reasons	Possible actions
MS =  Green	One or more extension modules : MS =  Red/green (1 Hz) (Firmware ≥ V2.00.0) or MS =  Red (1 Hz) (Firmware V1.xx.0) and I1+I2 or I3+I4 or I5+I6 or I7+I8 =  Green (1 Hz)	XTIO/XTDI: 0x4429 or 0x442A	Discrepancy error or sequence error at dual-channel inputs (whose LEDs are flashing green): - Cable interruption or short circuit to 0 V at one of both input signals of the input pair - Hardware error of the sensor, e.g. one of the two contacts/ outputs is permanently closed (High) or opened (Low) - Defect sensor (one of the two signals does not change to the state corresponding to the other input within the configured discrepancy time) - Opening or closing of the safety door was too slow, so that the two contact switches (e.g. reed contacts) did not switch within the configured discrepancy time - Only one of the two inputs has caused the switch-off condition and has returned to the on-state while the error of the other input did not change at all (sequence error)	- Check the wiring of the affected input and check the switching capability of both contacts/ outputs of the connected sensor - Check the mechanical dependency of both switches - Replace switch/sensor in hardware installation To reset the error, the respective input pair has to be Low/Low for equivalent dual-channel inputs and Low/High for antivalent dual-channel inputs
MS =  Red	MS =  Red	Main module: 0XXXXCXXXX Extension modules: 0xCXXX (X= any value)	- Current supply 0 V at XTIO module missing (firmware V1.xx.0 only) - Internal error in the extension module - Internal error in main module	- Check the connection from the terminal A2 of XTIO modules to 0 V of the current supply - Check the system for EMC influence (earthing of DIN rail, ...) - To reset the error, execute a voltage reset at the main module - If the error remains, replace the modules
MS =  Red	MS =  Red (2 Hz) (with firmware ≥ V2.00.0)	Main module: 0XXXXCXXXX Extension modules: 0xCXXX (X= any value)	Internal error in the extension module (whose LED "MS" is flashing)	- Check the system for EMC influence (earthing of DIN rail, ...) - To reset the error, execute a voltage reset at the main module - If the error remains, replace the module whose LED "MS" is flashing
MS =  Red (2 Hz) (with firmware ≥ V2.00.0)	MS =  Red	Main module: 0XXXXCXXXX Extension modules: 0xCXXX (X= any value)	Internal error in the main module or in the system	- Check the system for EMC influence (earthing of DIN rail, ...) - To reset the error, execute a voltage reset at the main module - If the error remains, replace the main module and the extension modules in a subsequent order

Diagnostics

LED display at the module				
Main module (CPUx)	Extension module (XTIO,XTDI, XTDS, STIO, MOC0)	Possible Error codes	Possible reasons	Possible actions
MS = ● Red or  Red (2 Hz)	MS = ● Red or  Red (2 Hz)	Main module: 0x0006C002, 0x0007C002, 0x0001C005, 0x0003C006, 0x0005C006, 0x0029C006, 0x0003C013	- Sequential error of another critical error - Disturbances of the internal signals of the main module due to heavy EMC disturbances - Hardware error in the main module or an extension module	- Check the other diagnostic messages for critical faults with almost the same time stamp - To reset the error, execute a voltage reset at the main module - If the error remains, replace the main module and the extension modules in a subsequent order
		Main module: 0x0001C013, 0x0004C013, 0x0005C013, 0x000CC013	- FLEXBUS+ communication (backplane bus communication to I/O modules and to gateways) disturbed due to EMC disturbance - FLEXBUS+ communication (backplane bus communication to I/O modules and to gateways) disturbed due to critical fault in I/O modules. In this case, it is a sequential error and there are also other critical faults with almost the same time stamp (+/- 1 s) in the diagnostic history	- To reset the error, execute a voltage reset at the main module - Check the installation for EMC aspects (FE connection of DIN rail and control cabinet, star wiring of 24 V current supply, local separation of load and control elements, ...) - Check the other diagnostic messages with almost the same time stamp
		Main module: 0x002AC006	Unequal input data from extension module: - A dual-channel input at an XTIO module or an XTDI module has two signal drops (High to Low) with a temporal interval of 2 ms (e.g. test gaps of an OSSD output or bouncing relay contacts) - A signal input at an XTIO module or at an XTDI module changes its state in intervals of 4 ms for a duration of 40 ms or more (e.g. proximity switch at a toothed wheel)	- To reset the error, execute a voltage reset at the main module - Change the configuration by enabling the on-off filter and enabling the off-on filter for inputs of the respective XTIO/XTDI module. Note that this increases the response time for this signal by at least 8 ms
		XTIO/XTDI: 0xC306 Main module: 0x0029C006	- Internal hardware error of XTIO or XTDI module - Sequential error in main module: 0x0029C006	- To reset the error, execute a voltage reset at the main module - Replace XTDI/XTIO module in the hardware installation
		XTIO/XTDI: 0xC307 Main module: 0x0029C006	- Current supply at the terminal A2 (GND) of the XTIO module interrupted - Internal hardware error of XTIO or XTDI module - Sequential error in main module: 0x0029C006	- Check the supply voltage at the terminals A1 (24 V) and A2 (0 V) at the XTIO module, also under worst case load conditions - To reset the error, execute a voltage reset at the main module - If the error remains, replace the XTDI/XTIO module in the hardware installation
		XTIO/XTDI: 0xC30A Main module: 0x0029C006	- Short circuit after 24 V or cross fault in the wiring of the safe output Q1 ... Q4 (whose LED is flashing) - Capacitive load exceeds the allowed maximum value (e.g. by capacitor for spark quenching) - Inductive load exceeds the permissible maximum value - Internal hardware error in XTIO or XTDI module - Sequential error in main module: 0x0029C006	- Check the wiring of the affected output - Check the capacitive load - Check the inductive load - To reset the error, execute a voltage reset at the main module - If the error remains, replace the XTDI/XTIO module in the hardware installation

Diagnostics

LED display at the module				
Main module (CPUx)	Extension module (XTIO,XTDI, XTDS, STIO, MOC0)	Possible Error codes	Possible reasons	Possible actions
MS = ● Green	All extension modules: MS = ● Green	Main module: 0x000A0011	Function block error in case of dual-channel input evaluation (e.g. E-Stop, magnetic switch): Discrepancy error at pair 1 of the function block: - Cable interruption or short circuit to 0 V at one of both input signals of the input pair - Hardware error of the sensor, e.g. one of the two contacts/ outputs is permanently closed (High) or opened (Low) - Defect sensor (one of the two signals does not change to the state corresponding to the other input within the configured discrepancy time) - Opening or closing of the safety door was too slow, so that the two contact switches (e.g. reed contacts) did not switch within the configured discrepancy time	- Check the wiring of the affected input and check the switching capability of both contacts/ outputs of the connected sensor - Check the mechanical dependency of both switches - Replace switch/sensor in hardware installation To reset the error, the respective input pair has to change within the configured discrepancy time from Low/Low to High/High for equivalent dual-channel inputs, from Low/High to High/Low for antivalent dual-channel inputs
		Main module 0x00100011	- Function block error (EDM or valve monitoring): Feedback signal did not follow the control signal within the max. feedback delay time - Hardware error of the connected relay/valve or error in the wiring - The relay/valve used has greater switching delay at the monitoring contact	- Increase the max. feedback delay time of the function block if acceptable for the application - Replace the relay/valve in the hardware installation
All LEDs temporarily off, subsequently, LED test sequence	All LEDs temporarily off, subsequently, LED test sequence	Main module: 0x002D4006	- The current supply of the main module had short voltage drop (to almost 0 V) - The voltage of the current supply of the module dropped (approx. to 6V ... 16V) and increased back to operating range	- Ensure that power supply unit is capable of buffering a current supply interruption of up to 20 ms - Ensure that the power supply unit is capable of driving the load in a way that switching loads does not cause a voltage drop - Check the power supply wiring to the main module. Use separate cables to other heavy loads to avoid a voltage drop on the supply cable by other load currents
		Main module: 0x003E4006	The system has performed a restart, as interferences have been detected on the FLEXBUS+: - FLEXBUS+ communication (backplane bus communication to I/O modules and to gateways) disturbed due to EMC disturbance - FLEXBUS+ communication (backplane bus communication to I/O modules and to gateways) disturbed due to critical fault in any extension module (I/O modules or gateway). In this case, it is a sequential error and there are also other critical faults with almost the same time stamp (+/- 1 s) in the diagnostic history	- Check installation for EMC aspects (FE connection of DIN rail and control cabinet, star wiring of the current supply (24 V and 0 V), local separation of load and control elements, ...) - Check the other diagnostic messages with almost the same time stamp

Tab. 10-1:

Error codes and error messages of the SafeLogic compact system and possible troubleshooting actions

Diagnostics

10.4 Additional error displays of EFI-compatible devices

EFI-compatible devices (see [chapter 5.1 "Enhanced Function Interface – EFI" on page 85](#)) are provided with extended functions if used together with either the main module CPU1 or CPU3.

Error displays and troubleshooting are described in the operating instructions of the corresponding devices.

10.5 Bosch Rexroth support

If you cannot eliminate a malfunction using the information in this chapter, please contact your local Bosch Rexroth representative.

When sending in an SLC-3-MPL0 memory plug for repair or analysis, it is returned in the state of delivery, i.e. without a configuration. Thus, save your configuration(s) to project files using the "SafeLogic Designer" software.

10.6 Advanced diagnostics and error history

The SafeLogic Designer contains extended diagnostic options. If the error cannot be identified or if there are availability problems, use the SafeLogic Designer to narrow down the problem.

The diagnostic function of the designer allows to retrieve the error history from the SafeLogic compact system and to subsequently store it as PDF or to print it out.



For more detailed information, refer to the operating instructions "IndraControl SafeLogic compact Designer Software".

11 Maintenance

The following section informs about regular tests and the exchange of SafeLogic compact modules.

Do not try to dismantle, repair or modify the SafeLogic compact modules. This can lead to a loss of the safety function(s). In addition, Bosch Rexroth AG accepts no claims for liability.

11.1 Regular inspection of the protective device by qualified personnel

- Check the system at the inspection intervals specified in the national rules and regulations. This procedure ensures that any changes on the machine or manipulations of the protective device are detected before use/re-use
- Each safety application must be checked at an interval specified by you. The effectiveness of the protective device must be checked by authorized commissioned persons
- If any modifications have been made to the machine or the protective device, or if the safety controller has been changed or repaired, the system must be checked again as specified in the checklist in the annex
- Carry out regular or daily inspections in order to keep the SafeLogic compact modules in an optimal operating mode
- Check whether the implementation of the SafeLogic compact modules fulfill all the technical data of the device
- Check the mounting conditions and whether the wiring of the SafeLogic compact modules is still correct
- Regularly verify that the safety functions fulfil the requirements of the application as well as all relevant regulations and standards (e.g. regular checking) in order to ensure the reliability of the safety functions

11.2 Device Replacement

A critical fault in a SafeLogic compact module impairs the complete network. Devices that have critical faults must therefore be repaired or replaced rapidly. We recommend keeping spare devices of the SafeLogic compact modules at hand so that network operation can be re-established as fast as possible.

Maintenance

⚠ CAUTION**Safety measures for replacing devices!**

Observe the following safety measures when replacing SafeLogic compact modules:

- Do not try to dismantle or repair the SafeLogic compact modules. Not only does Bosch Rexroth accept no claims for liability, but it is also dangerous as it makes verifying the original safety functions impossible
- Reset the device into a state in which safety is ensured
- Replace only when the voltage supply is switched off in order to avoid an electric shock or unexpected device behavior
- To continue using the system configuration check:
 - Is the new module of the same type (same material number) and is there no error at the new module after the replacement?
 - Is the new module plugged in at the same position as the replaced module?
 - Have all connectors been re-connected to the correct terminals?
- Otherwise the system has to be completely reconfigured and commissioned including all necessary tests (see [chapter 9 "Commissioning" on page 97](#))

⚠ CAUTION**Safety measures after replacing devices!**

- After the replacement ensure that no errors arise with the new SafeLogic compact modules
- Always carry out a function test before commissioning a replacement module
- EFI-compatible devices do not have to be reconfigured after the replacement of a SafeLogic compact module
- If you send in SafeLogic compact modules for repair, generate a report on your project and carry out diagnostics with the SafeLogic Designer, enclose a detailed description of the problem with the device and send the SafeLogic compact modules with all available information to Bosch Rexroth

12 Technical data

12.1 Response times of the SafeLogic compact system

To calculate the response times of a SafeLogic compact system, consider all paths.

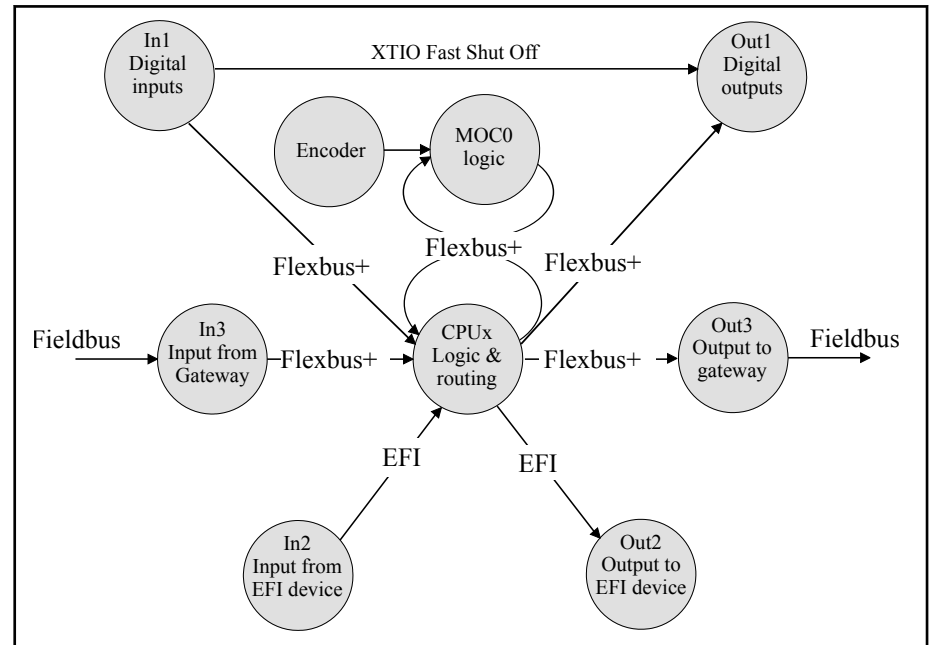


Fig. 12-1: Response times in a SafeLogic compact system

12.1.1 Fast Shut Off

The "Fast Shut Off" function can be executed at one of the SLC-3-XTIO input/output extension module each. A response time of 8 ms can thus be reached.



The "Fast Shut Off" function only affects the inputs and outputs of the same SLC-3-XTIO input/output extension module.

12.1.2 EFI Link

The response time in a SafeLogic compact system is increased for a remote input compared to a local input by $4.5 \text{ ms} + 2 \times \text{logic execution time of the remote SafeLogic compact station}$.

To calculate the response times of a SafeLogic compact system, consider all paths.

12.1.3 Flexi Line

The response time in a Flexi Line system increases for an input at a remote station by

- the input time of the remote station (E1 to E4 from [tab. 12-1 "Calculating the response times of the SafeLogic compact system in ms" on page 110](#))
- the trigger time of the logic of the station processing this input (point 2.a from [tab. 12-1 "Calculating the response times of the SafeLogic compact system in ms" on page 110](#))

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and

- $N \times (10 \text{ ms} + 2 \times \text{transmission cycle time})$

N = Number of connecting lines between the stations

Using the Flexi Line function within a station extends the response time by one logic execution time of this station.

12.1.4 Optimization of logic execution time

SafeLogic compact main modules with firmware $\geq$ V4.00.0 offer firmware optimization with potential effect on the logic execution time. To enable compatibility with older models, these optimizations can be enabled/disabled by the user.

By enabling the option for optimization of logic execution time in SafeLogic Designer and disabling unused functions (Flexi Line, Flexi Loop, EFI including EFI-Link), the increased efficiency of this firmware can be used.

If optimization is enabled, the logic program in the main module is executed quicker. This way, the logic execution time can be reduced. Particularly for complex applications, this enables shorter processing times and response times.



The minimum logic execution time of a SafeLogic compact system is always 4 ms and cannot be further reduced by optimization.

Changes to the logic execution time may require configuration adjustments at function blocks based on the logic execution time. To make use of the optimization of logic execution time, a SLC-3-CPUx main module with firmware $\geq$ V4.00.0 (step 4.xx) and SafeLogic Designer version $\geq$ V1.8.0 are required.

For further information on optimization of the logic execution time, refer to the operating instructions "IndraControl SafeLogic compact Designer Software".

12.1.5 Calculating the response times

The following table can be used to calculate the response times of corresponding paths within the SafeLogic compact system.

Evaluation		
1. Inputs	Response time of the considered input in the signal path	E1 or E2 or E3 or E4 (from the following table)
2. Logic	a) Response time of the logic of the main module (CPUx logic)	2 × logic execution time ¹⁾ Delay due to logic application ²⁾ (e.g. on- or off-delay of the function block)
	b) Response time of the routing (applies only to the output to the gateway)	No delay 0 ms
	c) Response time of the Fast-Shut-Off logic (only applies to SLX 3 XTIO modules)	No delay 0 ms
3. Outputs	Response time of the considered output in the signal path	A1 or A2 or A3 or A4 (from the table below)
Total response time		
Occurrence		
General	E1: Digital inputs	A1: Digital outputs
	Response time of the sensor ³⁾ Input processing time 6.5 ms	Response time of the actuator ³⁾ Output processing time a) From logic (via FLEXBUS+): + 4.5 ms b) From Fast Shut Off: + 1.5 ms
If on/off filter enabled	+ Min. filter time ⁴⁾	

Technical data

Evaluation		
If I1...I8 is connected to the test output X1...X8	+ Max. off-on delay ¹⁾ of the test output used	
a) Safety mats and switching rails	+ Test period ¹⁾ of the test output. Use a higher value of the two test outputs	
b) Testable sensors type 4	+ Test period ¹⁾ of the test output	
c) All other sensors	+ Test gaps ¹⁾ of the test output (if test gap ¹⁾ > 1 ms)	
If single-channel outputs		Potential switch-off delay in case of an internal error, depending on the option "Switching capacitive loads": +10 ms or +50 ms ⁶⁾
	Total E1	Total A1

Occurrence	E2: Input from EFI device	A2: Output to EFI device
If EFI functions are used via EFI-compatible devices	Response time of the EFI data source (generally, a sensor) for external OSSDs via EFI ³⁾ or remote EFI Link station	Response time of the message receiver (e.g. scanner with protective field switching via EFI) ³⁾
Constant:		EFI cycle time of the EFI receiver ³⁾
a) Scanner	+ 3.5 ms	+ 24 ms
b) Light curtain	+ 1.5 ms	+ 4 ms
c) EFI Link	+ 0.5 ms	+ 4 ms
	Total E2	Total A2

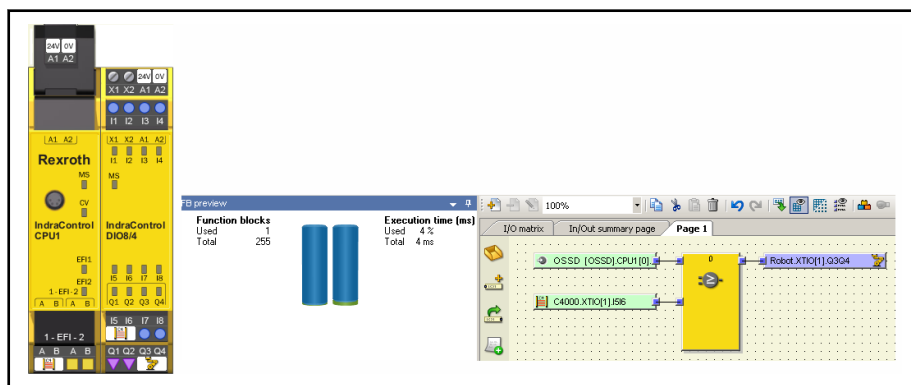
Occurrence	E3: Gateway — Data from the network	A3: Gateway — Data to the network
General information	Response time of the field bus for data to the gateway (e.g. from PLC) ³⁾	Response time of the field bus for data from the gateway (e.g. to PLC) ³⁾
General information	2 × internal update interval for data from the gateway to the main module ⁵⁾	2 × internal update interval for data from the main module to the gateway ⁵⁾
a) If 1 gateway	+ 5 ms	+ 8 ms
b) If two gateways	- 4 ms	- 4 ms
	Total E3	Total A3

Occurrence	E4: Input from SLC-3-MOCx	A4: Output to SLC-3-MOCx
General information	SLC-3-MOCx logic to SLC-3-CPUx logic	SLC-3-MOCx logic to SLC-3-CPUx logic
Encoder to SLC-3-MOCx logic	0 ms	Max. 4 ms
a) A/B incremental encoder, sine-cosine encoder (speed value and direction state) ⁷⁾	8 ms	
b) A/B incremental encoder, sine-cosine encoder (position value)	6 ms	
c) SSI master (speed value and direction status)	Max. 4 ms + 1.5 × Max. data reception interval ^{7) 8)}	
d) SSI master (position value)	Max. 4 ms + Max. data reception interval ⁸⁾	
e) SSI listener (speed value and direction status)	Max. 9 ms + 1.5 × Max. data reception interval ^{7) 8)}	
f) SSI listener (position value)	Max. 9 ms + Max. data reception interval ⁸⁾	
Error detection times		
a) Sine-cosine analog voltage monitoring, monitoring the vector length	22 ms	
a) Sine-cosine analog voltage monitoring, monitoring the signal deviation	6 ms + 1 sine-cosine period, however, min. 10 ms	

Technical data

Evaluation		
c) Error detection time of the ID code monitoring with encoder connection box ⁹⁾	10 ms	
	Total E4	Total A4
1)	For the values, refer to the SafeLogic Designer report	
2)	Time values have a tolerance of 10 ms plus the logic execution time. For each selected value, add 10 ms to calculate the response time. For example, 32 ms have to be applied for calculation with a switch-off delay of 10 ms and a logic execution time of 12 ms.	
3)	For the values, refer to the corresponding operating instructions	
4)	The switch-off is delayed until the signal was "Low" for at least the selected filter time. For the SLC-3-XTIO and SLC-3-XTDI firmware version < V3.00.0, the filter time is set to 8 ms	
5)	The update interval between the CPU and a SafeLogic compact Diagnostics Gateway depends on the data to be transferred and the number of gateways used in the system. For the values, refer to the report in the SafeLogic Designer. The update interval is a multiple of 4 ms for 10 bytes to be transferred to or from the gateway if the system contains one gateway. If two gateways are used, the update interval is a multiple of 8 ms	
6)	Refer to chapter 3.8.5 "Extended error detection time for cross faults at the outputs Q1 ... Q4 of the SLC-3-XTIO to switch increased capacitive loads" on page 34 and chapter 3.8.6 "Single-channel use of outputs at the SLC-3-XTIO" on page 35	
7)	As the speed is determined from the position difference between two recorded position values, the speed value is a mean value of the real speed in the time interval for position recognition. In case of a presumed linear speed change, the response time for the speed value is ½ the time interval for position value higher than the response time for the position value. The time interval for position recognition of A/B incremental encoders and sine/cosine encoders is 4 ms. For SSI encoders, the selected maximum data reception interval applies in the least favorable condition.	
8)	This is the value selected in the dialog of the SSI encoder. Take the value from the report in the Designer value.	
9)	Refer to the operating instructions "SafeLogic compact Designer Software", "Encoder connection type and monitoring of the ID code"	
Tab. 12-1:	Calculating the response times of the SafeLogic compact system in ms	

Example 1: Calculating the response time for a SafeLogic compact System from an SLC-3-CPU1 and an SLC-3-XTIO



Digital inputs: XTIO[1].I516.C4000: SICK C4000 safety light curtain
Digital outputs: XTIO[1].Q3Q4.Robot: Robot, dual-channel
Input from EFI device: [EFI 1.1] OSSD [OSSD]: A SICK C4000 receiver (standalone) (safety light curtain with high resolution for hazardous point, hazardous area and access protection at machines)

Fig. 12-2: Example of a SafeLogic compact system

Two paths have to be considered and calculated separately:

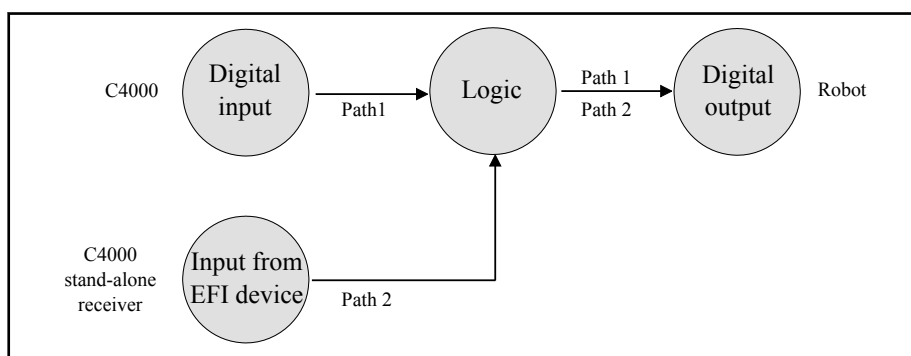


Fig. 12-3: Response times in a SafeLogic compact system

Occurrence	E1: Digital inputs		A1: Digital outputs	
General	C4000 response time	14.0 ms	Robot response time	40.0 ms
General	Input processing time	6.5 ms	Output processing time	4.5 ms
If on/off filter	8.0 ms	–		
If I1 ... I8 is connected at the test output X1 ... X8		–		
a) Safety mats and switching rails	–			
b) Testable sensors type 4	–			
c) All other sensors	–			
	Total E1	20.5 ms	Total A1	44.5 ms
Evaluation				
1. Inputs	Response time of the considered input in path 1	E1		20.5 ms
2. Logic	Response time of the logic	2 × logic execution time		8.0 ms
		Delay due to logic application		–

Technical data

Occurrence	E1: Digital inputs	A1: Digital outputs
3. Outputs	Response time of the considered output in path 1	44.5 ms
Total response time		73.0 ms

Tab. 12-2: Example of the calculation of the response time of path 1

Occurrence	E2: Input from EFI device	A2: Digital outputs
If EFI functions are used via EFI-compatible devices	Response time of the EFI data source [C4000 receiver (standalone)]	General Robot response time 40.0 ms
	Constant (C4000) 1.5 ms	General Output processing time 4.5 ms
	Total E2 13.5 ms	Total A2 44.5 ms

Evaluation			
1. Inputs	Response time of the considered input in path 2	E2	13.5 ms
2. Logic	Response time of the logic	Delay due to logic application	–
		2 × logic execution time	8.0 ms
3. Outputs	Response time of the considered output in Path 2	A2	44.5 ms
Total response time			66.0 ms

Tab. 12-3: Example of the calculation of the response time of path 2

Example 2: Calculation of the response time for a SafeLogic compact system

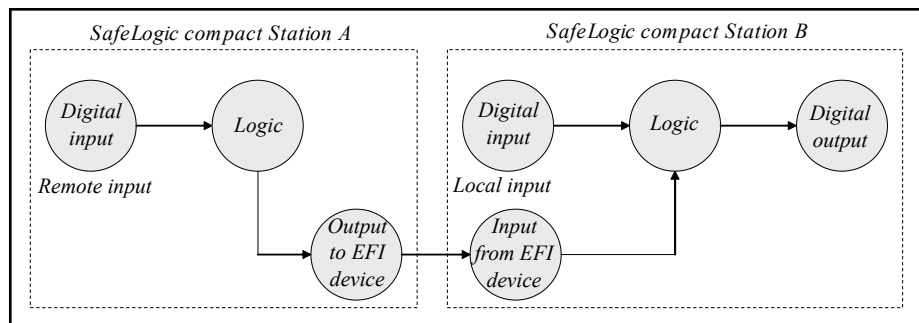


Fig. 12-4: Response times in a SafeLogic compact system

EFI Link station A: Logic execution time = 4 ms

EFI Link station B: Logic execution time = 8 ms

Occurrence	E1: Digital inputs		Occurrence	A1: Output to EFI device	
General information	Tactile sensor	0 ms	If EFI functions are used via EFI-compatible devices	Response time of the message receiver (see following table for an EFI Link station B)	
General information	Input processing time	6.5 ms			
When on/off filter	8.0 ms	–		Constant EFI Link	4 ms
If I1 ... I8 is connected at the test output X1 ... X8 ...		–			
	Total E1	6.5 ms		Total A1	4 ms
Evaluation					
1. Inputs	1) Response time of the considered input in the signal path		E1	6.5 ms	

Technical data

Occurrence	E1: Digital inputs	Occurrence	A1: Output to EFI device
2. Logic	2) Response time of the logic	2 × logic execution time	8.0 ms
		Delay due to logic application	–
3. Outputs	3) Response time of the considered output in the signal path	A1	4.0 ms
Total response time (from remote input to EFI)			18.5 ms

Tab. 12-4: Example of the calculation of the response time of path 1

Occurrence	E2: Input from EFI device		Occurrence	A2: Digital outputs	
If EFI functions are used via EFI-compatible devices	Response time of the EFI data source (see preceding table for EFI Link station A)	18.5 ms	General	Response time of the actuator (robot response time)	40.0 ms
	Constant (EFI Link)	0.5 ms	General	Output processing time	4.5 ms
	Total E2	19.0 ms		Total A2	44.5 ms

Evaluation			
1. Inputs	Response time of the considered input in the signal path	E2	19.0 ms
2. Logic	Response time of the logic	2 × logic execution time	16.0 ms
		Delay due to logic application	–
3. Outputs	Response time of the considered output in Path 2	A2	44.5 ms
Total response time (remote input to local output)			79.5 ms

Tab. 12-5: Calculation example of the response time of a remote input in an EFI Link system

12.1.6 Minimum switch-off time

The minimum switch-off time (e.g. of connected sensors) is the minimum time for which a switch-off condition has to be present to be detected so that error-free switching is possible. The min. switch-off time has to be ...

- greater than the logic execution time + 1 ms and
- greater than the test gap + max. off-on delay (for the values, refer to the report in the SafeLogic Designer) if the input is connected to test output X1 ... X8 and the test gap is > 1 ms and
- greater than the test period (e.g. the higher values of the two test outputs used) + max. switch off/on delay (for the values, refer to the report in the SafeLogic Designer) if safety mats or safety edges are used

12.2 Data sheets

12.2.1 Main modules SLC-3-CPU0, SLC-3-CPU1 and SLC-3-CPU3

	SLC-3-CPU0	SLC-3-CPU1 / SLC-3-CPU3
These specifications refer to an ambient temperature of +40 °C. This is the generally assumed value for the statistic calculation		
Safety integrity level ¹⁾	SIL3 (IEC 61 508)	
Safety integrity claim limit (SIL) ¹⁾	SILCL3 (EN 62 061)	
Category	Category 4 (EN ISO 13 849-1)	

Technical data

	SLC-3-CPU0	SLC-3-CPU1 / SLC-3-CPU3
Performance Level ¹⁾	PL e (EN ISO 13 849-1)	
PFHd	1.07 × 10 ⁻⁹ 1/h	1.69 × 10 ⁻⁹ 1/h
PFHd for Flexi Line station ²⁾	–	0.40 × 10 ⁻⁹ 1/h
T _M (service life)	20 years (EN ISO 13 849) The date of manufacturing is printed on the type plate: FD: Year/calendar week	
General data		
Conformity/approvals	CE, cULus, CCC	
Protection class	III (EN 61 140)	
Degree of protection	IP 20 (EN 60 529)	
Ambient temperature in operation	-25 °C ... +55 °C	
Storage temperature	-25 °C ... +70 °C	
Air humidity	10 % ... 95 %, non-condensing	
Operating height	Max. 2.000 m above msl (80 kPa)	
Vibration resistance	5 Hz – 150 Hz/1 g (EN 60 06826) 10 Hz – 500 Hz/3 g RMS (EN 60 068264)	
Shock resistance		
Continuous shock	10 g, 16 ms (EN 60 068-2-27)	
Single shock	30 g, 11 ms (EN 60 068-2-27)	
Noise immunity	EN 61000-6-2	
Emitted interference	EN 61000-6-4	
Number of EFI interfaces	0	2
Number of Flexi Line interfaces	0	SLC-3-CPU1: 0 SLC-3-CPU3: 1
Data interface	Internal bus (FLEXBUS+)	
Configuration interface	RS232	SLC-3-CPU1: RS-232 SLC-3-CPU3: RS-232, USB
Connection method RS-232	M8, 4-pin	
Connection method USB	–	SLC-3-CPU1: – SLC-3-CPU3: USB Mini-B, 5-pin
EFI connection method and Flexi Line	–	Dual level spring clamp terminals

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	SLC-3-CPU0	SLC-3-CPU1 / SLC-3-CPU3
Conductor cross-section EFI and Flexi Line	–	Single-core or finely stranded: 0.2 ... 1.5 mm ² Finely stranded with ferrule: a) with plastic sleeve max. 0.75 mm ² b) without plastic sleeve max. 1.5 mm ² AWG acc. to UL/CUL: 24 ... 16
Dimensions (W × H × D)	22.5 mm × 96.5 mm × 120.6 mm	
Weight	111 g (± 5 %)	SLC-3-CPU1: 119 g (± 5 %) SLC-3-CPU3: 133 g (± 5 %)

- 1) For detailed information on the safety design of your machine/ system, please contact your local Bosch Rexroth branch
 2) Valid for CPU3 main module which is only used for transfer of information via Flexi Line.

Tab. 12-6: Safety-related characteristics

Supply voltage	24 V DC (16.8 ... 24 ... 30 V DC)
Supply voltage UL/CSA applications	24 V DC
Type of supply voltage	PELV or SELV The current of the power supply unit for the main module has to be limited externally to 4 A – either by the power supply unit itself or by a fuse
Short-circuit protection	4 A gG (with trigger characteristics B or C)
Overvoltage category	II (EN 61 1312)
Power consumption	Max. 2.5 W
Switch-on time	Max. 18 s
Connection method	Screw terminals
Conductor cross-section	Single-core or finely stranded: 0.14 ... 2.5 mm ² AWG acc. to UL/CUL: 26 ... 14

Tab. 12-7: Power supply unit (A1, A2) for SLC-3-CPUx via memory plug SLC-3-MPL0 or SLC-3-MPL1

Technical data

12.2.2 Input/output extension module SLC-3-XTIO

Data sheet SLC-3-XTIO

These specifications refer to an ambient temperature of +40 °C. This is the generally assumed value for the statistic calculation

Safety integrity level ¹⁾	SIL3 (IEC 61 508)
Safety integrity claim limit (SIL) ¹⁾	SILCL3 (EN 62 061)
Category: ²⁾	
For single-channel outputs with enabled test pulses at all safe outputs (Q1...Q4)	Category 4 (EN ISO 13 849-1) ³⁾
For single-channel outputs with disabled test pulses at this output or any other safe output (Q1...Q4)	Category 3 (EN ISO 13 849-1) ^{3) 4)}
For dual-channel outputs with or without disabled test pulses at this output or any other safe output (Q1...Q4)	Category 4 (EN ISO 13 849-1) ^{4) 5)}
Performance Level ¹⁾	PL e (EN ISO 13 8491)
PFHd ²⁾	
For single-channel outputs	4.8×10^{-9} 1/h
For dual-channel outputs	0.9×10^{-9} 1/h
T _M (service life)	20 years (EN ISO 13 849) ⁴⁾ The date of manufacturing is printed on the type plate: FD: Year/calendar week

General data

Conformity/approvals	CE, cULus, CCC
Protection class	III (EN 61 140)
Degree of protection	IP 20 (EN 60 529)
Ambient temperature in operation	-25 °C ... +55 °C
Storage temperature	-25 °C ... +70 °C
Air humidity	10 % ... 95 %, non-condensing
Operating height	Max. 2,000 m above sea level (80 kPa)
Vibration resistance	5 Hz – 150 Hz/1 g (EN 60 068-2-6) 10 Hz – 500 Hz/3 g RMS (EN 60 068264)
Shock resistance:	
Continuous shock	10 g, 16 ms (EN 60 068-2-27)
Single shock	30 g, 11 ms (EN 60 068-2-27)
Noise immunity	EN 61000-6-2

Technical data

Emitted interference	EN 61000-6-4
Connection method	Dual level spring clamp terminals
Power consumption via FLEXBUS+ without currents at X1, X2	Max. 2.2 W
Conductor cross-section	Single-core or finely stranded: 0.2 ... 1.5 mm ² Finely stranded with ferrule: a) with plastic sleeve max. 0.75 mm ² b) without plastic sleeve max. 1.5 mm ² AWG acc. to UL/CUL: 24 ... 16
Data interface	Internal bus (FLEXBUS+)
Dimensions (W × H × D)	22.5 mm × 96.5 mm × 120.6 mm
Weight	164 g (± 5 %)

- 1) For detailed information on the safety design of your machine/system, please contact your local Bosch Rexroth representative
- 2) Valid for single-channel outputs and dual-channel outputs
- 3) If single-channel outputs are used: Use protected or separate cabling for the safe outputs with as a short circuit after 24 V can be recognized while no other option for deactivation is available.
- 4) If safe outputs are used without test pulses, either all safe outputs without test pulses have to be switched off at the same time at least annually and for at least one second or the SafeLogic compact system has to be restarted by a switch-off
- 5) If safe outputs are used without test pulses: Use protected or separate cabling for the safe outputs with disabled test pulses, as a short circuit after 24 V cannot be detected if the safe output is "High". This could inhibit the switch-off capability for the other safe outputs in case of a detected internal hardware error due to reverse current.

Tab. 12-8: Safety-related characteristics

Power supply unit (A1, A2)

Supply voltage	24 V DC (16.8 ... 24 ... 30 V DC)
Supply voltage UL/CSA applications	24 V DC
Type of supply voltage	PELV or SELV The current of the power supply unit supplying the main module has to be limited externally to a maximum of 4 A — either by the power supply unit itself or by a fuse
Power consumption	Max. 120 W (30 V × 4 A), determined by the load at the outputs Q1 ... Q4, plus a maximum of 1 W power consumption by the internal electric circuit
Switch-on time	Max. 18 s
Short-circuit protection	4 A gG (with trigger characteristics B or C)

Tab. 12-9: Power supply unit (A1, A2)

Technical data

Safe inputs (I1 ... I8)

Number of inputs	8
Input voltage HIGH	13 ... 30 V DC
Input voltage LOW	-5 V ... +5 V DC
Input current HIGH	2.4 ... 3.8 mA
Input current LOW	-2.5 ... 2.1 mA
Input reverse current in case of ground interruption ¹⁾ :	
• Hardware version < V1.10.0	Max. 20 mA 1.5 kΩ effective reverse resistance to current supply
• Hardware version ≥ V1.10.0 (Available together with firmware version ≥ 2.00)	Max. 2 mA
Switching current (when connecting mechanical contacts)	14.4 mA at 5 V 3 mA at 24 V
Input pulse filter (pulses within these limits do not have any effect):	
• Pulse width	Max. 0.9 ms
• Pulse period	Min. 4 ms
Input capacity	Max. 10 nF + 10 %
Discrepancy time	4 ms ... 30 s, configurable

¹⁾ Do not switch other safe inputs in parallel if the reverse current could lead to a "High" state at the other input

Tab. 12-10: Safe inputs (I1 ... I8)

Test outputs (X1, X2)

Number of outputs	2 (with two test pulse generators)
Type of output	PNP semiconductor, short circuit-protected, short circuit-monitored (configurable)
Output voltage "High"	15 ... 30 V DC (max. 1.8 V drop to terminal A1 of main module)
Output resistance "Low"	33 Ω ± 10 %, current limited to approx. 10 mA
Output current	Max. 120 mA at each test output (X1 or X2). Thus, up to eight testable sensor cascades are possible per module with max. 30 mA. The total current of the SafeLogic compact system is limited to 1.28 A. This corresponds for example to a maximum of 32 testable sensor cascades each with 30 mA plus 64 tactile sensors at the inputs of the extension modules with 5 mA each
Test pulse rate (test period)	40 ... 1000 ms, configurable

Technical data

Test pulse duration (test gap)	1 ... 100 ms, configurable
Load capacity	1 μ F for test gap $\geq$ 4 ms 0.5 μ F for test gap 1 ms
Cable resistance	< 100 Ω

Tab. 12-11: Test outputs (X1, X2)

Safe outputs (Q1 ... Q4)

Number of outputs	4
Type of output	PNP semiconductor, short circuit-protected, short circuit-monitored (configurable)
Output voltage "High"	15.6 ... 30 V DC (max. 0.8 V drop to terminal A1 of this module)
Leakage current "Low":	
• Normal mode	Max. 0.1 mA
• Error case: ¹⁾	
- Hardware version < V1.10.0	Max. 1.6 mA
- Hardware version $\geq$ V1.10.0	Max. 2.0 mA
(Available together with firmware version $\geq$ 2.00)	
Output current	Max. 2.0 A
Total current I_{sum}	
$T_U \leq 45^\circ\text{C}$	Max. 4.0 A
$T_U \leq 55^\circ\text{C}$	Max. 3.2 A
UL/CSA applications	Max. 3.2 A
Test pulse width (test gap) ²⁾	< 650 μ s or disabled ^{3) 4)}
Test pulse rate (test period)	Min. 200 ms
Load capacity	$\leq$ 0.5 μ F
Cable resistance ⁵⁾	Max. 5 Ω (e.g. 100 m $\times$ 1.5 mm ² = 1.2 Ω)
Max. permitted coil energy without external protection elements ⁶⁾	Hardware version V1.00: 0.22 J Hardware version $\geq$ V1.01: 0.37 J
Response time	Depending on the logic configuration, for details see chapter 12.1.5 "Calculating the response times" on page 110
Synchronization of outputs Qx in a SafeLogic compact station (time offset) ⁷⁾	Max. 1 ms

Technical data

Possible "High" switching in case of an internal hardware error	10 ms/50 ms. For details, refer to chapter 3.8.6 "Single-channel use of outputs at the SLC-3-XTIO" on page 35
Data interface	Internal bus (FLEXBUS+)
1)	If an error occurs (interruption of the 0 V line) at a load resistance of at least 2.5 k Ω , maximally the leakage current flows at the safe output. In case of lower load resistances, the leakage current can be stronger. In this case, however, the output voltage is < 5 V. A downstream device, such as a relay or an FPLC (fail-proof programmable logic controller) has to detect this state as "Low"
2)	If active, the outputs are tested cyclically (brief switching to "Low"). When selecting the downstream control elements, ensure that the test pulses do not result in deactivation when using the preceding parameters or disable the test pulses on the outputs
3)	If safe outputs are used without test pulses, either all safe outputs without test pulses have to be switched off at the same time at least annually and for at least one second or the SafeLogic compact system has to be restarted by a switch-off
4)	If safe outputs are used without test pulses: Use protected or separate cabling for the safe outputs with disabled test pulses, as a short circuit after 24 V cannot be detected if the safe output is "High". This could inhibit the switch-off capability for the other safe outputs in case of a detected internal hardware error due to reverse current
5)	Ensure to limit the individual line resistance to the downstream control element to this value to ensure that a short circuit between the outputs is safely detected (also note EN 60 204 Electrical Machine Equipment, Part 1: General requirements)
6)	Examples of the resulting max. coil inductivity: HW V1.00: 1760 mH @ 0.5 A, 440 mH @ 1 A, 110 mH @ 2 A; HW V1.01: 2960 mH @ 0.5 A, 740 mH @ 1 A, 185 mH @ 2 A. For inductive loads (e.g. contacts, relays and valves), no external protective elements are required if this maximum coil energy is not exceeded. RC elements should not be used parallelly to the inductive load, as the RC elements form an oscillating circuit, which can cause an overshoot in the positive voltage range and thus trigger a cross fault after the reduction of the induction voltage. The tolerated time for the overshoot (> 3.5 V) has to be observed: Firmware version $\leq$ V2.10: < 1 ms & firmware version $\geq$ V3.00 < 3 ms or < 43 ms if the option Switching increased capacitive loads is enabled. If required, the overshoot can be reduced using an external parallel resistance
7)	This includes shut-off in case of error: At a two-channel output, both channels are disabled within this time in case of error.

Tab. 12-12:

12.2.3 Input extension module SLC-3-XTDI

Data sheet SLC-3-XTDI

These specifications refer to an ambient temperature of +40 °C. This is the generally assumed value for the statistic calculation

Safety integrity level ¹⁾	SIL3 (IEC 61 508)
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Technical data

Safety integrity claim limit (SIL) ¹⁾	SILCL3 (EN 62 061)
Category	Category 4 (EN ISO 13 849-1)
Performance Level ¹⁾	PL e (EN ISO 13 849-1)
PFHd	0.4×10^{-9} 1/h
T _M (service life)	20 years (EN ISO 13 849) The date of manufacturing is printed on the type plate: FD: Year/calendar week
General data	
Conformity/approvals	CE, cULus, CCC
Protection class	III (EN 61 140)
Degree of protection	IP 20 (EN 60 529)
Ambient temperature in operation	-25 °C ... +55 °C
Storage temperature	-25 °C ... +70 °C
Air humidity	10 % ... 95 %, non-condensing
Operating height	Max. 2,000 m above sea level (80 kPa)
Vibration resistance	5 Hz – 150 Hz/1 g (EN 60 06826) 10 Hz – 500 Hz/3 g RMS (EN 60 068264)
Shock resistance	
Continuous shock	10 g, 16 ms (EN 60 068-2-27)
Single shock	30 g, 11 ms (EN 60 068-2-27)
Noise immunity	EN 61000-6-2
Emitted interference	EN 61000-6-4
Connection method	Dual level spring clamp terminals
Data interface	Internal bus (FLEXBUS+)
Power consumption via FLEXBUS+ without currents at X1 ... X8	Max. 2 W
Conductor cross-section	Single-core or finely stranded: 0.2 ... 1.5 mm ² Finely stranded with ferrule: a) with plastic sleeve max. 0.75 mm ² b) without plastic sleeve max. 1.5 mm ² AWG acc. to UL/CUL: 24 ... 16
Dimensions (W × H × D)	22.5 mm × 96.5 mm × 120.6 mm
Weight	139 g (± 5 %)

¹⁾ For detailed information on the safety design of your machine/system, please contact your local Bosch Rexroth representative

Tab. 12-13: Safety-related characteristics

Technical data

Safe inputs (I1 ... I8)

Number of inputs	8
Input voltage HIGH	13 ... 30 V DC
Input voltage LOW	-5 V ... +5 V DC
Input current HIGH	2.4 ... 3.8 mA
Input current LOW	-2.5 ... 2.1 mA
Input reverse current in case of ground interruption ¹⁾	
Hardware version < V1.10.0	Max. 20 mA 1.5 kΩ effective reverse resistance to current supply
Hardware version ≥ V1.10.0 (Available together with firmware version ≥ 2.00)	Max. 2 mA
Switching current (when connecting mechanical contacts)	14.4 mA at 5 V 3 mA at 24 V
Input capacity	Max. 10 nF + 10 %
Discrepancy time	4 ms ... 30 s, configurable

¹⁾ Do not switch other safe inputs in parallel if the reverse current could lead to a "High" state at the other input

Tab. 12-14: *Safety-related characteristics*

Test outputs (X1 ... X8)

Number of outputs	8 (with two test pulse generators)
Type of output	PNP semiconductor, short circuit-protected, cross fault-monitored
Output voltage HIGH	15 ... 30 V DC
Output voltage LOW	33 Ω + 10 %, current limited to approx. 10 mA
Output current	Max. 120 mA at each test signal generator (X1 or X2). Thus, up to eight testable sensor cascades are possible per module with max. 30 mA. For all outputs (X1 ... X8 and XY1 ... XY2), the total current of the SafeLogic compact system is limited to 1.28 A. This corresponds for example to a maximum of 32 testable sensor cascades each with 30 mA plus 64 tactile sensors at the inputs of the extension modules with 5 mA each
Test pulse rate (test period)	40 ... 1000 ms, configurable
Test pulse duration (test gap)	1 ... 100 ms, configurable

Technical data

Load capacity	1 μ F for test gap $\geq$ 4 ms 0.5 μ F for test gap 1 ms
Cable resistance	< 100 Ω

Tab. 12-15: Test outputs (X1 ... X8)

12.2.4 Input/output extension module SLC-3-XTDS

Data sheet SLC-3-XTDS

These specifications refer to an ambient temperature of +40 °C. This is the generally assumed value for the statistic calculation	
Safety integrity level ²⁾	SIL3 (IEC 61 508)
Safety integrity claim limit (SIL) ¹⁾	SILCL3 (EN 62 061)
Category	Category 4 (EN ISO 13 849-1)
Performance Level ¹⁾	PL e (EN ISO 13 849-1)
PFHd	0.4×10^{-9} 1/h
T _M (service life)	20 years (EN ISO 13 849) The date of manufacturing is printed on the type plate: FD: Year/calendar week
General data	
Conformity/approvals	CE, cULus, CCC
Protection class	III (EN 61 140)
Degree of protection	IP 20 (EN 60 529)
Ambient temperature in operation	-25 °C ... +55 °C
Storage temperature	-25 °C ... +70 °C
Air humidity	10 % ... 95 %, non-condensing
Operating height	Max. 2,000 m above sea level (80 kPa)
Vibration resistance	5 Hz – 150 Hz/1 g (EN 60 06826) 10 Hz – 500 Hz/3 g RMS (EN 60 068264)
Shock resistance	
Continuous shock	10 g, 16 ms (EN 60 068-2-27)
Single shock	30 g, 11 ms (EN 60 068-2-27)
Noise immunity	EN 61000-6-2
Emitted interference	EN 61000-6-4
Connection method	Dual level spring clamp terminals
Data interface	Internal bus (FLEXBUS+)
Power consumption via FLEXBUS+ without currents at XY1 and XY2	Max. 1.5 W

Technical data

Conductor cross-section	Conductor cross-section, single-core or finely stranded: 0.2 ... 1.5 mm ² Finely stranded with ferrule: a) with plastic sleeve max. 0.75 mm ² b) without plastic sleeve max. 1.5 mm ² AWG acc. to UL/CUL: 24 ... 16
Dimensions (W × H × D)	22.5 mm × 96.5 mm × 120.6 mm
Weight	139 g (± 5 %)

- 1) The safety-related characteristics do not apply to the outputs XY1, XY2 and Y3–Y6
- 2) For detailed information on the safety design of your machine/system, please contact your local Bosch Rexroth representative

Tab. 12-16: Safety-related characteristics

Power supply unit (A1, A2)

Supply voltage	24 V DC (16.8 ... 24 ... 30 V DC)
Supply voltage UL/CSA applications	24 V DC
Type of supply voltage	PELV or SELV The current of the power supply unit supplying the main module has to be limited externally to a maximum of 4 A — either by the power supply unit itself or by a fuse
Power consumption	Max. 60 W (30 V × 2 A), determined by the load at the outputs Y3 to Y6
Switch-on time	Max. 18 s
Short-circuit protection	4 A gG (with trigger characteristics B or C)

Tab. 12-17: Power supply unit (A1, A2)

Safe inputs (I1 ... I8)

Number of inputs	8
Input voltage HIGH	13 ... 30 V DC
Input voltage LOW	-5 V ... +5 V DC
Input current HIGH	2.4 ... 3.8 mA
Input current LOW	-2.5 ... +2.1 mA
Input reverse current in case of ground interruption ¹⁾	Max. 2 mA
Switching current (when connecting mechanical contacts)	14.4 mA at 5 V 3 mA at 24 V
Input capacity	Max. 10 nF + 10 %
Discrepancy time	4 ms ... 30 s, configurable

- 1) Do not switch other safe inputs in parallel if the reverse current could lead to a "High" state at the other input

Tab. 12-18: Safe inputs (I1 ... I8)

Technical data

Test outputs, non-safe outputs (XY1 ... XY2)

Number of outputs	2 (with two test pulse generators)
Type of output	PNP semiconductor, short-circuit-protected
Output voltage HIGH	DC 15 ... 30 V (max. 1.8 V drop to terminal A1 of main module)
Output voltage LOW	33 Ω + 10 %, current limited to approx. 10 mA
Output current	Max. 120 mA at each of the two test signal generators (XY1 or XY2). Thus, up to eight testable sensor cascades are possible per module with max. 30 mA. For all outputs (X1 ... X8 and XY1 ... XY2), the total current of the SafeLogic compact system is limited to 1.28 A. This corresponds for example to a maximum of 32 testable sensor cascades each with 30 mA plus 64 tactile sensors at the inputs of the extension modules with 5 mA each
Test pulse rate (test period)	40 ... 1000 ms, configurable
Test pulse duration (test gap)	1 ... 100 ms, configurable
Load capacity	1 μF for test gap $\geq$ 4 ms 0.5 μF for test gap 1 ms
Cable resistance	< 100 Ω

Tab. 12-19: Test outputs, non-safe outputs (XY1 ... XY2)

Non-safe outputs (XY1, XY2 and Y3 ... Y6)

Number of non-safe outputs	4(6)
Type of output	PNP semiconductor, short-circuit-protected
Output voltage HIGH	DC 15 ... 30 V (max. 0.8 V drop to terminal A1 of main module)
Leakage current "LOW":	
Normal mode	Max. 0.1 mA
Error case ¹⁾	Max. 1.0 mA
Output current:	
XY1, XY2	Max. 120 mA
Y3 to Y6	0.5 A max.
Max. permitted coil energy without external protection elements ²⁾	0.37 J

Technical data

Response time	Depending on the logic configuration, refer to tab. 12-1 "Calculating the response times of the SafeLogic compact system in ms" on page 110
Data interface	Internal bus (FLEXBUS+)

- 1) If an error occurs (interruption of the 0-V line) at a load resistance of at least 2.5 k Ω , maximally the leakage current flows at the output. In case of lower load resistances, the leakage current can be stronger. In this case, however, the output voltage is < 5 V. A downstream device, such as a relay or an FPLC (fail-proof programmable logic controller) has to detect this state as "Low"
- 2) Example of the resulting max. coil inductivity: 2960 mH @ 0.5 A

Tab. 12-20: Non-safe outputs (XY1, XY2 and Y3 ... Y6)

12.2.5 Input/output extension module SLC-0-STIO

Data sheet SLC-0-STIO

Conformity/approvals	CE, cULus, CCC
Protection class	III (EN 61 140)
Degree of protection	IP 20 (EN 60 529)
Ambient temperature in operation	-25 °C ... +55 °C
Storage temperature	-25 °C ... +70 °C
Air humidity	10 % ... 95 %, non-condensing
Operating height	Max. 2,000 m above sea level (80 kPa)
Vibration resistance	5 Hz – 150 Hz/1 g (EN 60 06826) 10 Hz – 500 Hz/3 g RMS (EN 60 068264)
Shock resistance	
Continuous shock	10 g, 16 ms (EN 60 068-2-27)
Single shock	30 g, 11 ms (EN 60 068-2-27)
Noise immunity	EN 61000-6-2
Emitted interference	EN 61000-6-4
Connection method	Dual level spring clamp terminals
Power consumption via FLEXBUS+ without currents at XY1 and XY2	Max. 1.5 W
Conductor cross-section	Single-core or finely stranded: 0.2 ... 1.5 mm ² Finely stranded with ferrule: a) with plastic sleeve max. 0.75 mm ² b) without plastic sleeve max. 1.5 mm ² AWG acc. to UL/CUL: 24 ... 16
Dimensions (W × H × D)	22.5 mm × 96.5 mm × 120.6 mm
Weight	139 g (± 5 %)

Tab. 12-21: General data

Technical data

Power supply unit (A1, A2)

Supply voltage	24 V DC (16.8 ... 24 ... 30 V DC)
Supply voltage UL/CSA applications	24 V DC
Type of supply voltage	PELV or SELV
	The current of the power supply unit supplying the main module has to be limited externally to a maximum of 4 A — either by the power supply unit itself or by a fuse
Power consumption	Max. 60 W (30 V × 2 A), determined by the load at the outputs Y3 to Y6
Switch-on time	Max. 18 s
Short-circuit protection	4 A gG (with trigger characteristics B or C)

Tab. 12-22: Power supply unit (A1, A2)

Input circuit (I1 ... IY8)

Input voltage HIGH	13 ... 30 V DC
Input voltage LOW	-5 V ... +5 V DC
Input current HIGH	2.4 ... 3.8 mA
Input current LOW	-2.5 ... +2.1 mA
Switching current (when connecting mechanical contacts)	14.4 mA at 5 V 3 mA at 24 V
Input capacity	Max. 15 nF + 10 %
Discrepancy time	4 ms ... 30 s, configurable
Number of non-safe inputs	6 (8)

Tab. 12-23: Input circuit (I1 ... IY8)

Non-safe outputs (Y1 ... Y6 as well as IY7 and IY8)

Number of outputs	6 (8)
Type of output	PNP semiconductor, short-circuit-protected
Output voltage HIGH	DC 15 ... 30 V (max. 0.8 V drop to terminal A1 of main module)
Output voltage LOW	33 Ω + 10 %, current limited to approx. 10 mA
Leakage current "Low":	
Normal mode	Max. 0.1 mA
Error case ¹⁾	Max. 1.0 mA
Output current	0.5 A max.
Max. permitted coil energy without external protection elements ²⁾	0.37 J

Technical data

Response time	Depending on the logic configuration, refer to tab. 12-1 "Calculating the response times of the SafeLogic compact system in ms" on page 110
Data interface	Internal bus (FLEXBUS+)

- 1) If an error occurs (interruption of the 0-V line) at a load resistance of at least 2.5 k Ω , maximally the leakage current flows at the output. In case of lower load resistances, the leakage current can be stronger. In this case, however, the output voltage is < 5 V. A downstream device, such as a relay or an FPLC (fail-proof programmable logic controller) has to detect this state as "Low"
- 2) Example of the resulting max. coil inductivity: 2960 mH @ 0.5 A

Tab. 12-24: Non-safe outputs (Y1 ... Y6 as well as IY7 and IY8)

12.2.6 Drive monitor SLC-3-MOC0

Data sheet SLC-3-MOC0

These specifications refer to an ambient temperature of +40 °C. This is the generally assumed value for the statistic calculation

For axes with two encoders (any combination of sin/cos, TTL, HTL 24 V, HTL 12 V, RS-422, SSI, same or different types):

Safety integrity level ¹⁾	SIL3 (IEC 61 508)
Safety integrity claim limit (SIL) ¹⁾	SILCL3 (EN 62 061)
Category	Category 4 (EN ISO 13 849-1)
Performance Level ¹⁾	PL e (EN ISO 13 849-1)
PFHd	5×10^{-9} 1/h
Minimum motion for error detection ²⁾	$\geq$ Selected tolerance limit of the function block used for the cross comparison, at least 1 $\times$ within 24 h

Enabled for axes with a sin/cos encoder and sin/cos analog voltage monitoring

Safety integrity level ¹⁾	SIL2 (IEC 61 508)
Safety integrity claim limit (SIL) ¹⁾	SILCL2 (EN 62 061)
Category	Category 3 (EN ISO 13 8491)
Performance Level ¹⁾	PL d (EN ISO 13 8491)
PFHd	6×10^{-9}
Minimum motion for error detection	$\geq$ 1 sin/cos period of at least 1 $\times$ within 24 h

Additional troubleshooting measures

For encoders with Sin/Sin_Ref and Cos/Cos_Ref ³⁾	Required, see section on "Limits of sine-cosine analog voltage monitoring" in the "SafeLogic compact Designer Software" operating instructions ⁴⁾
For encoders with Sin+/Sin- and Cos+/Cos- ⁵⁾	Not required

General data

Technical data

T _M (service life)	20 years (EN ISO 13 849) The date of manufacturing is printed on the type plate: FD: Year/calendar week
Conformity/approvals	CE, cULus, CCC
Protection class	III (EN 61 140)
Degree of protection	IP 20 (EN 60 529)
Ambient temperature in operation	-25 °C ... +55 °C
Storage temperature	-25 °C ... +70 °C
Air humidity	10 % ... 95 %, non-condensing
Operating height	Max. 2,000 m above sea level (80 kPa)
Operating height	Max. 2,000 m above sea level (80 kPa)
Vibration resistance	5 Hz – 150 Hz/1 g (EN 60 06826) 10 Hz – 500 Hz/3 g RMS (EN 60 068264)
Shock resistance	
Continuous shock	10 g, 16 ms (EN 60 068-2-27)
Single shock	30 g, 11 ms (EN 60 068-2-27)
Noise immunity	EN 61000-6-2
Emitted interference	EN 61000-6-4
Connection method	Micro-D-Sub connector, 15-pin
Power consumption via FLEXBUS+ without the voltage supply of the encoder (ENC1_24V, ENC2_24V, ENC_0V)	Max. 2.5 W
Data interface	Internal bus (FLEXBUS+)
Dimensions (W × H × D)	22.5 mm × 96.5 mm × 126.2 mm
Weight	120 g

- 1) For detailed information on the safety design of your machine/ system, please contact your local Bosch Rexroth representative
- 2) Typically, generally recognized testing regulations from testing authorities require the application to ensure that the unit to be monitored moves at least once within 24 hours. This motion has to generate a signal change at the encoder system used to detect the errors to be observed
- 3) Sin_Ref and Cos_Ref are DC voltages, typically DC 2.5 V.
- 4) E.g., shared use of encoder signals for electronic commutation of the drive system.
- 5) Sin– and Cos– are an inverted voltage of Sin+ and Cos+

Tab. 12-25: Safety-related characteristics

Technical data

Encoder connection at the SLC-3-MOC0

	Minimum	Typical	Maximum
General information			
(ENCx_A+, ENCx_B+, ENCx_C+, ENCx_A-, ENCx_B-, ENCx_C-, ENC_0V)			
Input resistance in case of configuration for SSI encoder or A/B incremental encoder ¹⁾	35 kΩ	–	–
Input resistance in case of configuration for sin/cos encoder ²⁾	0.9 kΩ	1 kΩ	1.1 kΩ
Differential resistance in case of configuration for SSI encoder or A/B incremental encoder RS-422 ³⁾	100 Ω	120 Ω	150 Ω
Voltage supply encoder (ENC1_24V, ENC2_24V, ENC_0V)			
Voltage drop of the output voltage ⁴⁾	–	–	1.8 V
Output current ENC1_24V	–	–	0.2 A total current
Output current ENC2_24V	–	–	
Current limitation ENC1_24V	–	0.7 A	< 1 s: 1.2 A
Current limitation ENC2_24V	–	–	≥ 1 s: 1.0 A
TTL, 2 outputs (ENCx_A+, ENCx_A-, ENCx_B+, ENCx_B-)			
Differential input voltage HIGH ⁵⁾	2 V	5 V	5.3 V
Differential input voltage LOW ⁵⁾	-0.3 V	0 V	0.8 V
Input voltage ⁶⁾	-5 V	–	10 V
TTL, 2 output pairs (ENCx_A+, ENCx_A-, ENCx_B+, ENCx_B-, ENC_0V)			
Differential input voltage HIGH ⁵⁾	1.2 V	5 V	5.6 V
Differential input voltage LOW ⁵⁾	-5.6 V	-5 V	-1.2 V
Input voltage ⁶⁾	-5 V	–	10 V
1)	Resistance between ENCx_y+/- and ENC_0V		
2)	Resistance between ENCx_y+/- and ENC_0V. An input voltage of 30 V between ENCx_y+/- and ENC_0V does not damage the module, e.g. in case of voltage limitation if the voltage exceeds 5 V		
3)	Resistance between ENCx_y+ and ENCx_y- with series capacitor to block the DC load. An input voltage of 30 V does not damage the module		
4)	Voltage between A1 of the main module and ENCx_24V at a total load current of 0.2 A		
5)	Voltage between ENCx_y+ and ENCx_y-		
6)	Voltage between ENCx_y+ and ENC_0V as well as between ENCx_y- and ENC_0V		

Tab. 12-26: Encoder connection at SLC-3-MOC0

Technical data

	Minimum	Typical	Maximum
HTL 24 V, 2 outputs (ENCx_A+, ENCx_A-, ENCx_B+, ENCx_B-)			
Differential input voltage HIGH ⁵⁾	13 V	24 V	30 V
Differential input voltage LOW ⁵⁾	-3 V	0 V	5 V
Input voltage ⁶⁾	-10 V	–	40 V
HTL 24 V, 2 output pairs (ENCx_A+, ENCx_A-, ENCx_B+, ENCx_B-, ENC_0V)			
Differential input voltage HIGH ⁵⁾	8 V	24 V	30 V
Differential input voltage LOW ⁵⁾	-30 V	-24 V	-8 V
Input voltage ⁶⁾	-10 V	–	40 V
HTL 12 V, 2 outputs (ENCx_A+, ENCx_A-, ENCx_B+, ENCx_B-)			
Differential input voltage HIGH ⁵⁾	6.5 V	12 V	15 V
Differential input voltage LOW ⁵⁾	-1 V	0 V	2.5 V
Input voltage ⁶⁾	-5 V	–	20 V
HTL 12 V, 2 output pairs (ENCx_A+, ENCx_A-, ENCx_B+, ENCx_B-, ENC_0V)			
Differential input voltage HIGH ⁵⁾	4 V	12 V	15 V
Differential input voltage LOW ⁵⁾	-15 V	-12 V	-4 V
Input voltage ⁶⁾	-5 V	–	20 V
SSI encoder (ENCx_A+, ENCx_A-, ENCx_C+, ENCx_C-, ENC_0V)			
Input voltage difference HIGH for clock if SSI listener and data ⁵⁾	0.2 V	–	5 V
Input voltage difference LOW for clock if SSI listener and data ⁵⁾	-5 V	–	-0.2 V
Input voltage ⁶⁾	-7 V	–	7 V
Output voltage difference HIGH for clock if SSI master ⁷⁾	2 V	–	–
Output voltage difference LOW for clock if SSI master ⁷⁾	–	–	-2 V

⁵⁾ Voltage between ENCx_y+ and ENCx_y-

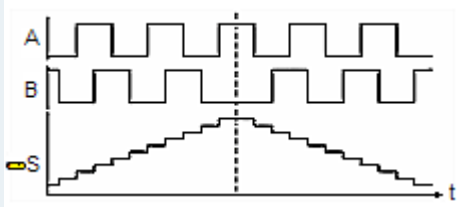
⁶⁾ Voltage between ENCx_y+ and ENC_0V as well as between ENCx_y- and ENC_0V

⁷⁾ Voltage between ENCx_y+ and ENCx_y- with a terminating resistor of $\geq 60 \Omega$

Tab. 12-27: Encoder connection at SLC-3-MOC0

	Minimum	Typical	Maximum
A/B incremental encoder with HTL 24 V, HTL 12 V, TTL (ENCx_A+, ENCx_A-, ENCx_B+, ENCx_B-, ENC_0V)			
Input frequency	–	–	300 kHz
Pulse duration HIGH	1.5 μ s	–	–
Pulse duration LOW	1.5 μ s	–	–

Technical data

	Minimum	Typical	Maximum
Edge detection A/B (phase offset)	70°	90°	110°
Accuracy error of the speed detection ⁸⁾	Max. 5 % incl. the internal resolution of the velocity information		
Accuracy error of the position detection ⁹⁾	Max. 1 increment of the internal resolution of the position information		
Counting direction	 S = Position information		

A/B incremental encoder with RS-422 (ENC1_A+, ENC1_A-, ENC1_C+, ENC1_C-, ENC_0V)

Differential input voltage HIGH ⁵⁾	0.2 V	–	5 V
Differential input voltage LOW ⁵⁾	-5 V	–	-0.2 V
Input voltage ⁶⁾	-7 V	–	7 V
Differential output voltage HIGH ⁷⁾	2 V	–	–
Differential output voltage LOW ⁷⁾	–	–	-2 V
Input frequency	–	–	1 Mhz
Pulse duration HIGH	0.4 µs	–	–
Pulse duration LOW	0.4 µs	–	–
Edge detection A/B (phase offset)	70°	90°	110°
Accuracy error of the speed detection ⁸⁾	Max. 5 % incl. the internal resolution of the velocity information		
Accuracy error of the position detection ⁹⁾	Max. 1 increment of the internal resolution of the position information		

SSI encoder (ENCx_A+, ENCx_A-, ENCx_C+, ENCx_C-, ENC_0V)

Baud rate ^{15) 16)}	100 kHz	–	1 MHz
Cycle gap between the data packages (monoflop time) ¹⁷⁾	100 µs	–	–
SSI clock synchronization for SSI master between encoder 1 and encoder 2	-1 ms	–	1 ms
Tolerance parameter "Max. data reception interval" ¹⁶⁾	-0.5 ms	–	0.5 ms
Number of position data bits ¹⁶⁾ ^{18) 19)}	8	–	32

Technical data

	Minimum	Typical	Maximum
Number of bits in the entire SSI protocol frame ^{16) 18) 20)}	8	–	62
Change of position information (speed) per max. data reception interval ¹⁶⁾			
≤ 16 position data bits ¹⁶⁾	Max. ½ value range of position data bits – 1 increment		
≥ 17 position data bits ¹⁶⁾	Max. 65,535 increments		
Accuracy error of the speed detection ²¹⁾	Max. 5 % incl. the internal resolution of the velocity information		
Accuracy error of the position detection ²²⁾	Max. 1 increment of the internal resolution of the position information		

- 5) Voltage between ENCx_y+ and ENCx_y–
6) Voltage between ENCx_y+ and ENC_0V as well as between ENCx_y– and ENC_0V
7) Voltage between ENCx_y+ and ENCx_y– with a terminating resistor of ≥ 60 Ω
8) Additionally, resolution of the velocity information caused by the resolution of the encoder system; a) rotary motion in rpm = 15.000 / (4 × number A/B periods per rev.), b) linear motion in mm/s = 250 / (4 × number A/B periods per rev.)
9) Additionally, resolution of information due to the resolution of the encoder system: 1 U / (4 × Number of A/B periods/rev)
15) Master mode and Listener mode
16) These are the parameters of the SSI encoder that can be set in the SafeLogic compact Designer
17) Time span between the falling edges of the cycle
18) Without starting bit. If a repetitive transmission is used (cycle without cycle gap to transfer the same data again), the complete stream is considered to be a frame
19) Firmware version ≥ V1.10.0. With previous firmware versions 16 ... 32 bits.
20) Firmware version ≥ V1.10.0. With previous firmware versions 16 ... 62 bits.
21) Additionally, resolution of the velocity information caused by the resolution of the encoder system; a) rotary motion in rpm = 15.000 / (increments/rev.), b) linear motion in mm/s = 250 / (increments/rev.)
22) Additionally, resolution of information due to the resolution of the encoder system: 1 rev / (increments/rev)

Tab. 12-28: Encoder connection at SLC-3-MOC0

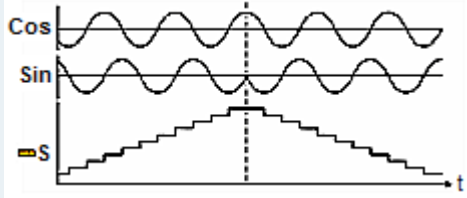
⚠ CAUTION

Note the maximum velocity!

If the maximum allowed change of data bits is not observed, it is possible that an inverted direction of rotation is output and a low speed can be caused, as undetected overflows of the position data bits might not be detected.

	Minimum	Typical	Maximum
Sin/cos encoder (ENCx_A+, ENCx_A–, ENCx_B+, ENCx_B–, ENC_0V)			
Differential input voltage ¹⁰⁾	0.8 Vss	1 Vss	1.2 Vss

Technical data

	Minimum	Typical	Maximum
Input voltage ¹¹⁾	0 V	–	5 V
Input frequency	0 Hz	–	120 kHz
Phase offset	80°	90°	100°
Sin/cos analog voltage monitoring ¹²⁾ , lower limit for vector length monitoring ¹⁰⁾	0.5 Vss	0.55 Vss	–
Sin/cos analog voltage monitoring ¹²⁾ , upper limit for vector length monitoring ¹⁰⁾	–	1.26 Vss	1.5 Vss
Accuracy error of the velocity detection ¹³⁾	Max. 5 % incl. the internal resolution of the velocity information		
Accuracy error of the position detection ¹⁴⁾	Max. 1 increment of the internal resolution of the position information		
Counting direction	 S = Position information		

- 10)

Peak-peak-voltage between ENCx_y+ and ENCx_y–
- 11)

Voltage between ENCx_y+ and ENC_0V as well as between ENCx_y– and ENC_0V
- 12)

For a description of this function, refer to the operating instructions "IndraControl SafeLogic compact Designer Software", chapter "Sin/cos analog voltage monitoring"
- 13)

In addition to the resolution of the velocity information caused by the resolution of the encoder system; a) rotary motion in rpm = 15.000 / (4 × number sin/cos periods per rev.), b) linear motion in mm/s = 250 / (4 × number sin/cos periods per rev.)
- 14)

In addition to the resolution of the position information due to the resolution of the encoder system: 1 U / (4 × Number of sin/cos periods/rev)

Tab. 12-29: Encoder connection at SLC-3-MOC0

12.2.7 Encoder connection boxes for SLC-3-MOC0

Data sheet of the encoder connection boxes

	Minimum	Typical	Maximum
Onboard voltage supply U _{Out} (from SLC-3-MOC0)			
Supply voltage	24 V DC (16.8 ... 24 ... 30 V DC)		
Supply voltage UL/CSA applications	24 V DC		

Technical data

	Minimum	Typical	Maximum
Type of supply voltage	PELV or SELV The supply current for the connection box has to be limited to 1 A – either by the connection to the supply at the encoder connection of the SLC-3-MOC0 or by the power supply unit itself or by a fuse		
Output voltage at U_{Out}			
Rotary switch SW = 0	4.75 V	5 V	5.25 V
Rotary switch SW = 1	6.65 V	7 V	7.35 V
Rotary switch SW = 2	11.4 V	12 V	12.6 V
Rotary switch SW = 3	–	24 V ¹⁾	–
Permitted output current at U_{Out}			
Rotary switch SW = 0		650 mA ²⁾	430 mA ^{3) 4)}
Rotary switch SW = 1	–	470 mA ²⁾	310 mA ^{3) 4)}
Rotary switch SW = 2	–	270 mA ²⁾	180 mA ^{3) 4)}
Rotary switch SW = 3	–	180 mA ²⁾	180 mA ^{3) 4)}
Current limitation U_{Out}	–	1.4 A	$< 1 \text{ s: } 2.4 \text{ A}^{5)}$ $\geq 1 \text{ s: } 2.0 \text{ A}^{5)}$
General data			
Protection class	III (EN 61140)		
Degree of protection	IP20 (EN 60529)		
Ambient operating temperature (UL/CSA: surrounding air temperature)	–25 ... +55 °C		
Storage temperature	–25 ... +70 °C		
Air humidity	10 ... 95 %, non-condensing		
Operating height	Max. 2,000 m above sea level (80 kPa)		
Vibration resistance	5–150 Hz/1 G (EN 60068-2-6) 10–500 Hz/3 Grms (EN 60068-2-64)		
Shock resistance			
Continuous shock	15 g, 11 ms (EN 60068-2-27)		
Single shock	30 g, 11 ms (EN 60068-2-27)		
Noise immunity	EN 61000-6-2		
Emitted interference	EN 61000-6-4		
Conductor cross-section	Single-core or finely stranded: 0.2 ... 1.5 mm ² Finely stranded with ferrule: a) with plastic sleeve max. 0.75 mm ² b) without plastic sleeve max. 1.5 mm ² AWG acc. to UL/CUL: 24 ... 16		

Technical data

	Minimum	Typical	Maximum
Dimensions (W × H × D)	45 mm × 120 mm × 90 mm		
Weight			
Motor feedback splitter box	170 g		
Dual encoder connection box	163 g		

- 1) Up to 2.8 V, the voltage supply for the encoder can be below the voltage supply at the system plug (connection terminal A1).
- 2) At 24 V at SafeLogic compact MPLx memory plug.
- 3) At 16.8 V at SafeLogic compact MPLx memory plug.
- 4) Total current for all encoders supplied by this connection box, i.e. including the encoders connected via D4, e.g. via an additional connection box.
- 5) Total current of ENC1_24V and ENC2_24V and double the value.

Tab. 12-30: Data sheet of the encoder connection boxes

12.2.8 Output modules SLC-A-UE410-2RO/SLC-A-UE410-4RO

Supply circuit (via SLC-3-CPUx)

	Minimum	Typical	Maximum
Power consumption			
SLC-A-UE410-4RO	–	–	3.2 W
SLC-A-UE410-2RO	–	–	1.6 W

Tab. 12-31: Supply circuit (via SLC-3-CPUx)

Input circuit B1, B2

	Minimum	Typical	Maximum
Input voltage ON	18 V DC	–	30 V DC

Tab. 12-32: Input circuit B1, B2

Output circuit (13-14, 23-24, 33-34, 43-44)

	Minimum	Typical	Maximum
Number of N/O contacts			
SLC-A-UE410-2RO	–	2	–
SLC-A-UE410-4RO	–	4	–
Number of N/C contacts			
SLC-A-UE410-2RO	–	1	–
SLC-A-UE410-4RO	–	2	–
Switching voltage	5 V AC	230 V ¹⁾ AC	253 V AC
	5 V DC	230 V ¹⁾ DC	253 V DC
Switching current	10 mA	–	6 A
Mechanical service life	Min. 10 × 10 ⁶		
Electrical service life	Refer to fig. 12-5 "DC switching voltage, relay modules SLC-A-UE410-2RO/SLC-A-UE410-4RO" on page 139		

Technical data

	Minimum	Typical	Maximum
Minimum contact load at $U_n = \text{DC } 24 \text{ V}$	50 mW	–	–
Total current	–	–	8 A
Response time ²⁾	–	–	30 ms
Type of output	Potential-free N/O contacts, positively guided		
Contact material	AgSnO ₂		
Output circuit fuse	6 A (gG), per current path		
Utilization category	AC-15: U_e 250 V, I_e 3 A		
	DC-13: U_e 24 V, I_e 3 A		

- 1) See figures below
2) Time from LOW at B1/B2 up to relay drop

Tab. 12-33:

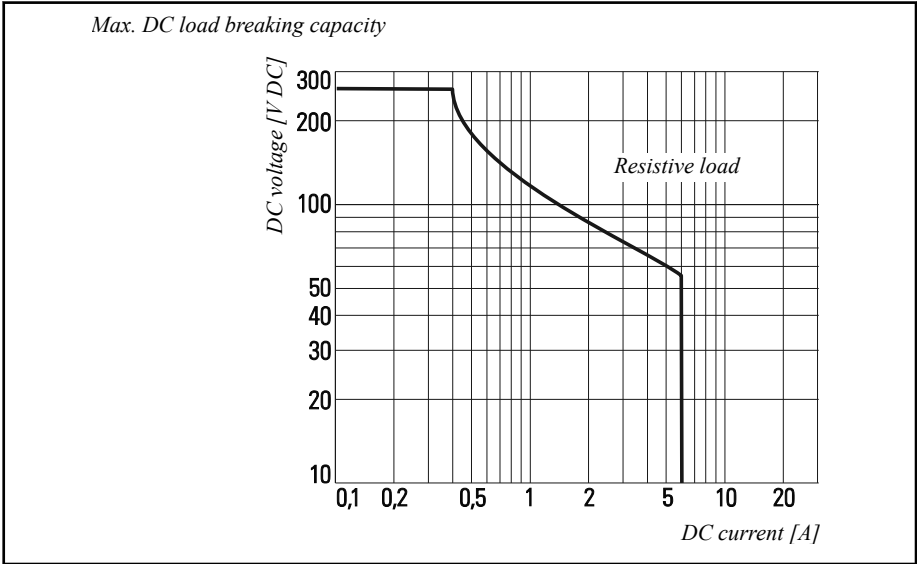


Fig. 12-5: DC switching voltage, relay modules SLC-A-UE410-2RO/SLC-A-UE410-4RO

Technical data

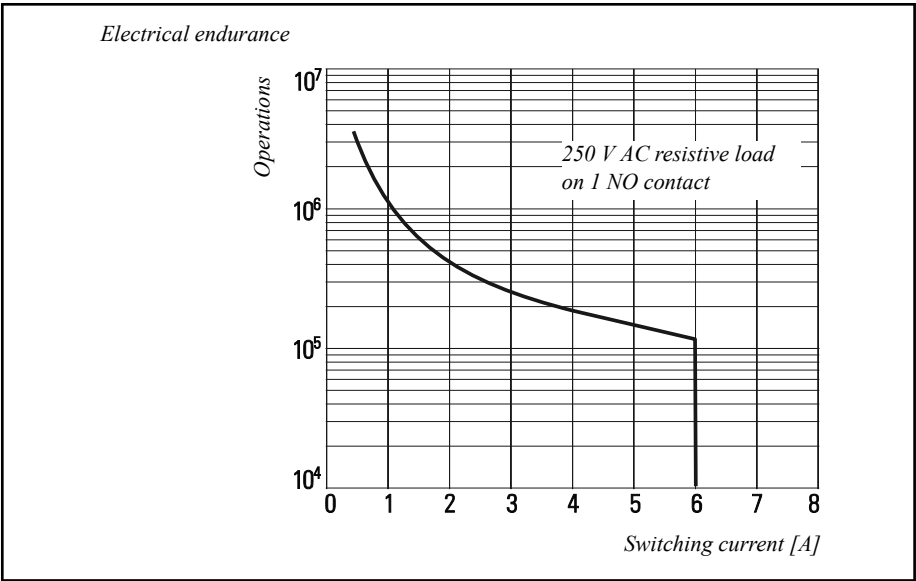


Fig. 12-6: Electrical service life of the output modules SLC-A-UE410-2RO/SLC-A-UE410-4RO

Output circuit (Y14, Y24)

	Minimum	Typical	Maximum
Type of output	NO contact, to internal DC 24, positively guided, current-limited		
Number of N/O contacts Y14/24			
SLC-A-UE410-2RO	–	1	–
SLC-A-UE410-4RO	–	2	–
Output voltage	16 V DC	24 V DC	30 V DC
Output current ¹⁾	–	–	75 mA
Load capacity	–	–	200 nF

1) The total output current is limited. Maximum total current for all relay modules is I < 80 mA at Y14 and Y24

Tab. 12-34: Output circuit (Y14, Y24)

General data

	Minimum	Typical	Maximum
Conformity, approvals	CE, cULus, CCC		
Degree of protection	IP20 (EN 60529)		
Ambient operating temperature (UL/CSA: surrounding air temperature)	–25 °C ... +55 °C		
Storage temperature	–25 °C ... +70 °C		
Air humidity	10 ... 95 %, non-condensing		
Operating height	Max. 2,000 m above sea level (80 kPa)		
Vibration resistance	5–150 Hz/1 G (EN 60068-2-6) 10–500 Hz/3 Grms (EN 60068-2-64)		

Technical data

	Minimum	Typical	Maximum
Shock resistance			
Continuous shock	15 g, 11 ms (EN 60068-2-27) 30 g,		
Single shock	11 ms (EN 60068-2-27)		
Noise immunity	EN 61000-6-2		
Emitted interference	EN 61000-6-4		
Impulse voltage withstand level (U _{imp})	4 kV		
Overvoltage category	II (EN 61131-2)		
Contamination level	2 inside, 3 outside		
Rated voltage	300 V AC		
Electrical isolation:			
- Supply circuit–input circuit	No		
- Supply circuit–output circuit	Yes		
- Input circuit–output circuit	Yes		
Dimensions (W × H × D)	22.5 × 96.5 × 120.8 mm		
Weight (without packaging)			
SLC-A-UE410-2RO	160 g (± 5 %)		
SLC-A-UE410-4RO	186 g (± 5 %)		

Tab. 12-35: Data for SLC-A-UE410-2RO and SLC-A-UE410-4RO

Terminal and connection data

	Minimum	Typical	Maximum
Conductor cross-section	Single-core or finely stranded: 0.2 ... 1.5 mm ² Finely stranded with ferrule: a) with plastic sleeve max. 0.75 mm ² b) without plastic sleeve max. 1.5 mm ² AWG acc. to UL/CUL: 24 ... 16		
Stripping length	–	–	8 mm
Maximum tightening torque	–	–	0.6 Nm
For UL-508 and CSA applications	Connection cross-section AWG 30–12 (use 60/75 °C copper wires only) Tightening torque 5–7 lb-in		

Tab. 12-36: Terminal and connection data for SLC-A-UE410-2RO and SLC-A-UE410-4RO

Safety-related characteristics

These specifications refer to an ambient temperature of +40 °C. This is the generally assumed value for the statistical calculation.

Safety integrity level ¹⁾	SIL3 (IEC 61 508)
Safety integrity claim limit (SIL) ¹⁾	SILCL3 (EN 62 061)
Category	Category 4 (EN ISO 13 849-1)

Technical data

Performance Level ¹⁾	PL e (EN ISO 13 849-1)
PFHd at I = 0.75 A, switching frequency = h ⁻¹ (see also tab. 12-38 "PFHd values SLC-A-UE410-2RO/SLC-A- UE410-4RO" on page 142)	1.2 × 10 ⁻⁹ 1/h
B10d value, switching frequency = h ⁻¹	0.75 A (AC 15)/4,150,000 (see also tab. 12-38 "PFHd values SLC-A-UE410-2RO/SLC-A- UE410-4RO" on page 142)
SFF	99.6 %
DC	99 %
T _M (service life)	Depending on PFHd value, ambient temperature, load drop and switching operations (see tab. 12-38 "PFHd values SLC-A-UE410-2RO/SLC-A- UE410-4RO" on page 142)
No. of mechanical switching cycles	Min. 200,000

1) For detailed information on the safety design of your machine/
system, please contact your local Bosch Rexroth representa-
tive

Tab. 12-37:

Load type	I[A]	Switching frequency	Switching cycles per year	B10d	PFHd
AC15	0,1	1/h	8760	10.000.000	5.00 × 10 ⁻¹⁰
	0.75	1/h	8760	4.150.000	1.20 × 10⁻⁰⁹
	3	1/h	8760	400.000	1.20 × 10 ⁻⁰⁸
	5	1/h	8760	70.000	7.20 × 10 ⁻⁰⁸
DC13	1	1/h	8760	2.000.000	2.50 × 10 ⁻⁰⁹
	3	1/h	8760	450.000	1.10 × 10 ⁻⁰⁸
AC1	2	1/h	8760	1.000.000	5.00 × 10 ⁻⁰⁹
	4	1/h	8760	600.000	8.40 × 10 ⁻⁰⁹

Tab. 12-38: PFHd values SLC-A-UE410-2RO/SLC-A-UE410-4RO

 **WARNING**

To achieve SILCL3 according to EN 62 061,
perform the following test at least annually:

Check the correct switching function for each safety-relevant output circuit of the SLC-A-UE410xRO modules, e.g. by switching off and on the machine or system monitored by the EDM function.

The contacts have to be switched at least annually. It is sufficient to switch off/on the coils B1/B2 if the correct function is checked using an EDM feedback contact (contactor monitoring).

12.3 Dimensioned drawings



For the E-CAD data of the SafeLogic compact modules, refer to the installation storage medium of the SafeLogic Designer (part no. R911334897).

12.3.1 Main module SLC-3-CPUx with memory plug

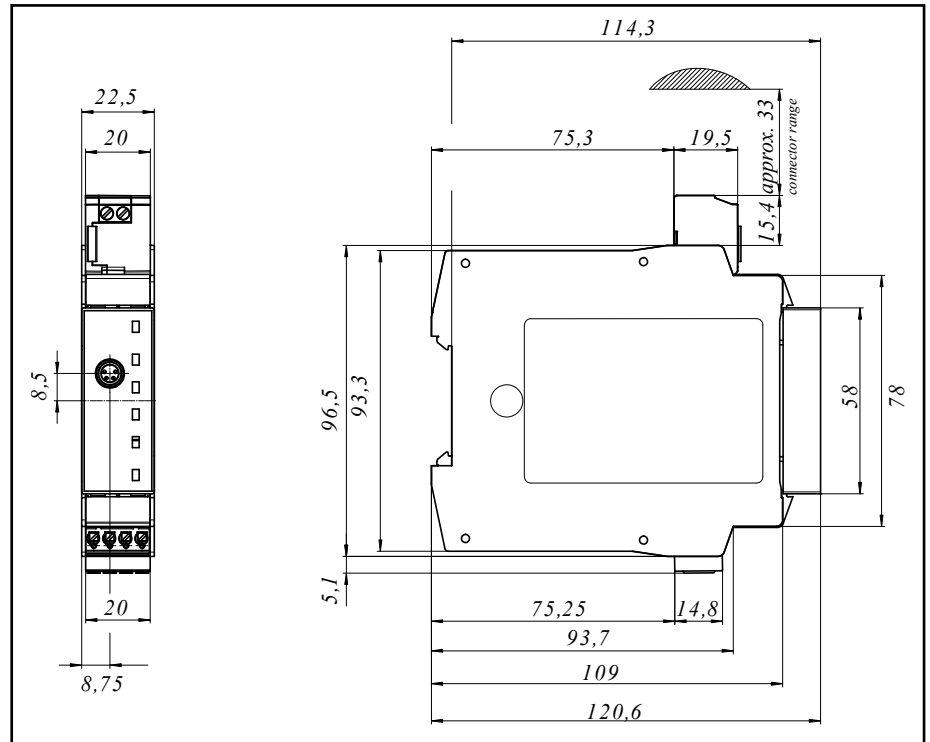


Fig. 12-7: Dimensional drawing of the SLC-3-CPUx (in mm)

Technical data

12.3.2 Input/output extension SLC-3-XTIO, SLC-3-XTDS and SLC-0-STIO, input extension SLC-3-XTDI, relay output modules SLC-A-UE410-2RO and SLC-A-UE410-4RO

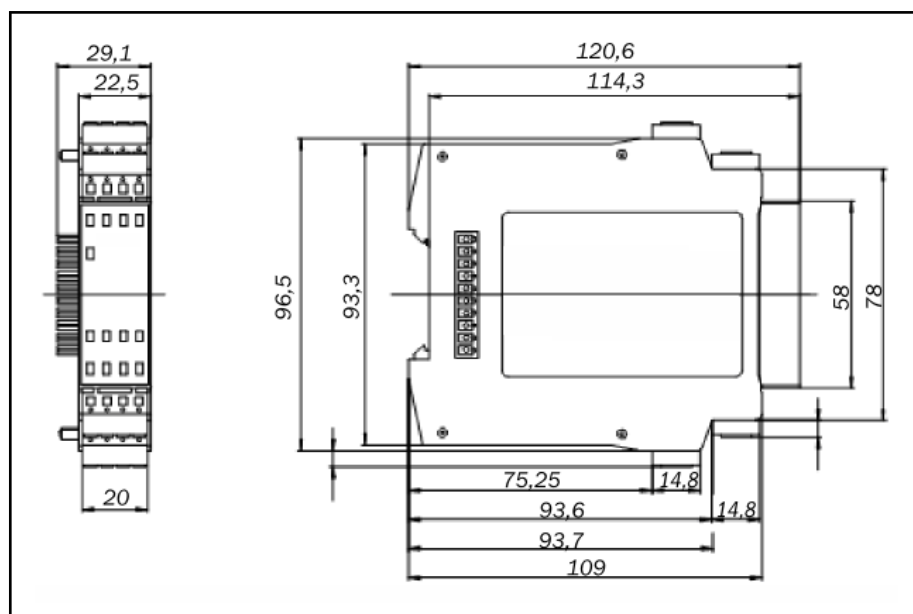


Fig. 12-8: Dimensional drawing of the SLC-3-XTIO, SLC-3-XTDI, SLC-3-XTDS, SLC-0-STIO, SLC-A-UE410-2RO and SLC-A-UE410-4RO (in mm)

12.3.3 Drive monitor SLC-3-MOC0

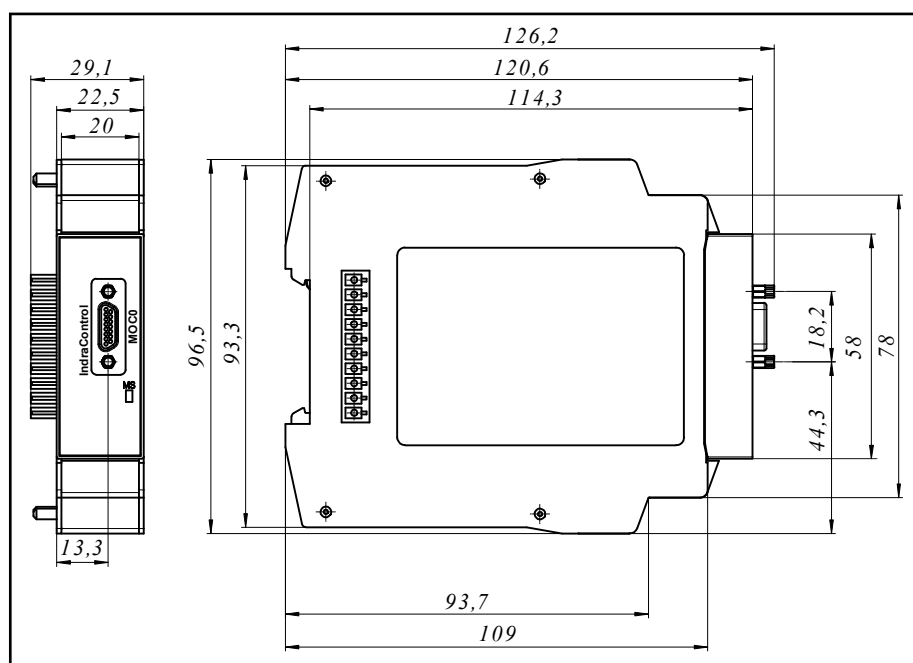


Fig. 12-9: Dimensional drawing of the SLC-3-MOC0 (in mm)

12.3.4 Motor feedback splitter box

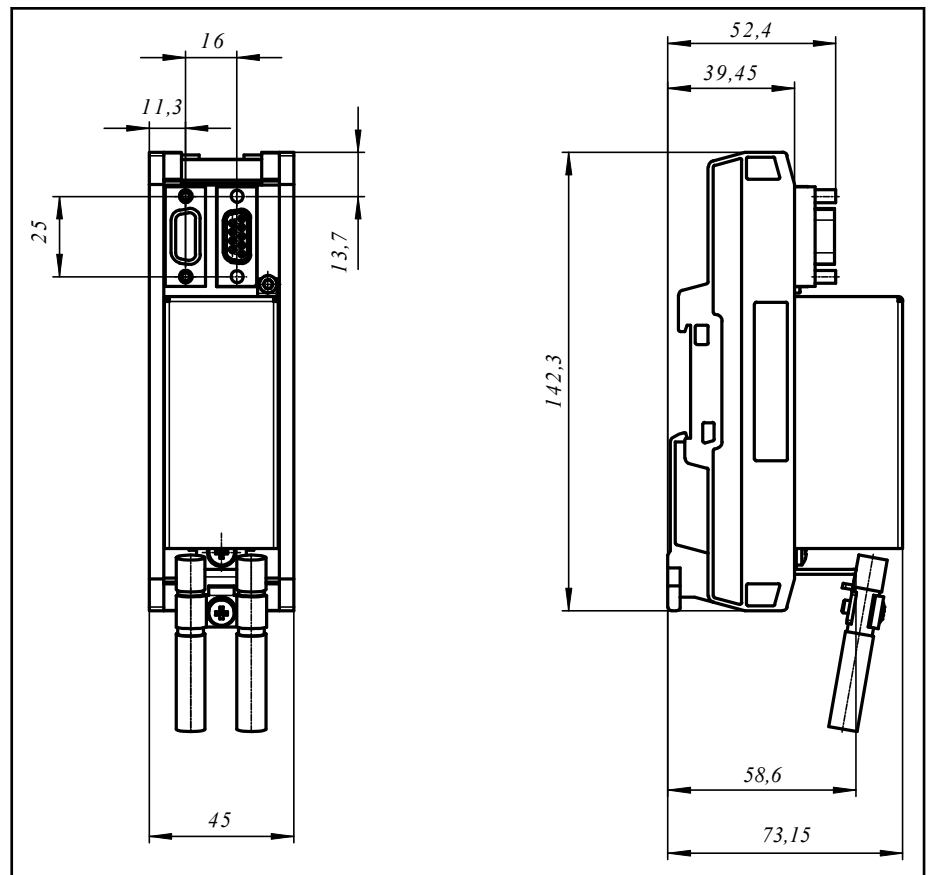


Fig. 12-10: Dimensional drawing of the motor-feedback splitter box (specifications in mm)

Technical data

12.3.5 Dual encoder connection box

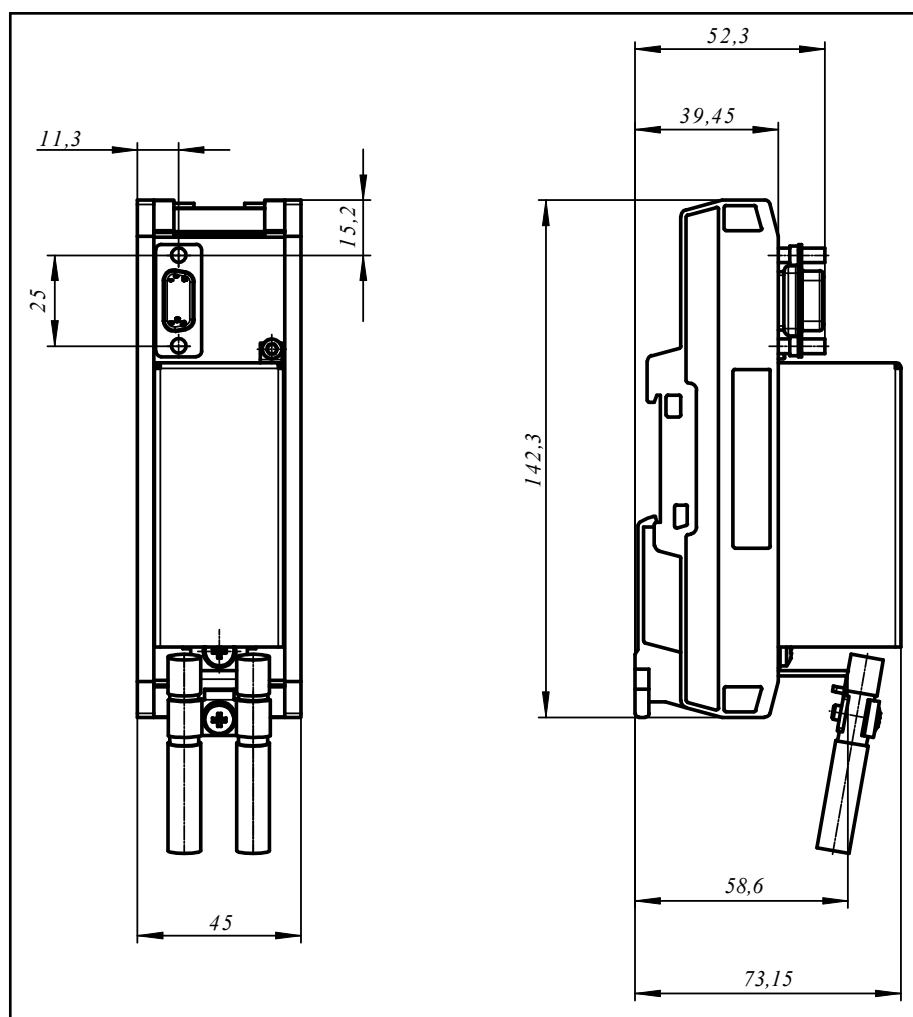


Fig. 12-11: Dimensional drawing of the dual encoder connection box (specifications in mm)

13 Ordering data of modules and accessories

Device type	Part	Part number
Memory plug		
SLC-3-MPL000301	Memory plug for SLC-3-CPU0 and SLC-3-CPU1	R911172286
SLC-3-MPL000301	Memory plug for SLC-3-CPU3	R911173403
Main modules		
SLC-3-CPU000300	Main module SLC-3-CPU0, dual level spring clamp terminals	R911172284
SLC-3-CPU130302	Main module SLC-3-CPU1, 2 EFI connections, dual level spring clamp terminals	R911172285
SLC-3-CPU320302	Main module SLC-3-CPU3, 2 EFI connections, 1 Flexi line connection, dual level spring clamp terminals	R911173402
Gateways		
SLC-0-GPNT00300	Profinet I/O diagnostic gateway	R911172290
SLC-0-GPRO00300	Profibus diagnostic gateway	R911172287
SLC-3-GS3S00300	Sercos gateway	R911172765
Extension modules		
SLC-3-XTIO84302	Input/output extension, 8 inputs/4 outputs, dual level spring clamp terminals	R911172291
SLC-3-XTDI80302	Input extension, 8 inputs, dual level spring clamp terminals	R911172292
SLC-3-XTDS84302	Input/output extension, 8 safe inputs, 4 or 6 non-safe outputs, dual level spring clamp terminals	R911173404
SLC-0-STIO68302	Input/output extension 6 or 8 non-safe inputs, 8 or 6 non-safe outputs, dual level spring clamp terminals	R911173405
SLC-3-MOC000300	Drive monitor connection of two encoders	R911173406
Relay modules		
SLC-A-UE410-2RO4	Output module, 2 N/O contacts and 1 24 V DC signal output, plug-in block terminals	R911172293
SLC-A-UE410-4RO4	Output module, 4 N/O contacts and 2 24 V DC signal outputs, plug-in block terminals	R911172294
SLC-A-UE10-2FG3D0	Safety relay, plug-in screw terminals	R911172295
SLC-A-UE12-2FG3D0	Cascadable safety relay, plug-in screw terminals, with cascade plug	R911172296
Accessories		
Plug set SLC-A-PLSET01	Plug-in connector for I/O modules and relay modules, screw terminals	R911172297
Plug set SLC-A-PLSET02	Plug-in connector for I/O and relay modules, dual level spring clamp terminals	R911172298
Plug set FKCS 2.5/ 3-ST	Plug-in connector for SLC-A-UE10/SLC-A-UE12, spring force connection, cable feed: straight Vendor: Phoenix Contact, part no.: 1974740	–

Ordering data of modules and accessories

Device type	Part	Part number
Plug set FKCVR 2.5/ 3-ST BK	Plug-in connector for SLC-A-UE10/SLC-A-UE12, spring force connection, cable feed: angular Vendor: Phoenix Contact, part no.: 1968196	–
Coding pins CP-MSTB	Coding pins, suitable for plug-in connectors of the I/O modules and relay modules of the SafeLogic compact system Vendor: Phoenix Contact, part no.: 1734634	–
Diode module DM8-A4K	Diode module for decoupling and multiplying the test outputs X1/X2 at the SLC-3-XTIO module Vendor: SICK, part. no.: 6026142	–
SLC-A-MOC-MFSB-RX	Motor feedback splitter box for SLC-3-MOC0	R911173410
SLC-A-MOC-DECB-RX	Dual encoder connection box for SLC-3-MOC0	R911173411
	Connection line between SLC-3-MOC0 and dual encoder connection box/motor feedback splitter box, shielded, twisted pair, 1 Micro-D sub 15-pin, 1 D-Sub HD 15-pin	
SLC-A-MOC-C-EB-02M	• Primary connecting cable 2 m	R911173413
SLC-A-MOC-C-EB-10M	• Primary connecting cable 10 m	R911173414
SLC-A-MOC-C-EO-02M	Connecting cable for direct encoder connection, shielded, twisted pair, 1 Micro-D sub 15-pin, open cable end, 2 m	R911173412
	Connection line for two motor feedback splitter boxes, shielded, twisted pair, 1 D-Sub 9-pin, 1 D-Sub HD 15-pin:	
SLC-A-MOC-C-BB-02M	• Extension cable of 2 m	R911173415
SLC-A-MOC-C-BB-10M	• Extension cable of 10 m	R911173416
EFI Link cable 2 × 2 × 0.25 mm ²	EFI link cable for an EFI total cable length of up to 40 m, 2 × 2 × 0.25 mm ² , per meter	R911170145
EFI Link cable 2 × 2 × 0.34 mm ²	EFI Link cable for an EFI total cable length of up to 100 m: Using the cable UNITRONIC BUS CAN UL/CSA 2 × 2 × 0.34 mm ² , by the manufacturer LAPP KABEL, ordering no. 2170264, is recommended	–
Flexi Line cable 2 × 0.34 mm ²	Flexi Line cable for a total cable length up to 125 m: Using the cable UNITRONIC BUS CAN UL/CSA 1 × 2 × 0.34 mm ² , by the manufacturer LAPP KABEL, ordering no. 2170263, is recommended	–
Flexi Line cable 2 × 0.75 mm ²	Flexi Line cable for a total cable length up to 1.000 m: Using the cable UNITRONIC BUS CAN UL/CSA 1 × 2 × 0.75 mm ² , by the manufacturer LAPP KABEL, ordering no. 2170269, is recommended	–
Configuration cable SLC-A-RS232/A/2.0	2 m, M8, D-Sub	R911172299
Configuration cable SLC-A-USB/A/2.0	Configuration line USB on M8	R911173417
SafeLogic Designer SWA-SLC***-SLD- **VRS-D0-CD650-COPY	Installation data carrier	R911334897

Tab. 13-1: Ordering data

14 Appendix

14.1 EC declarations of conformity

The EC declaration of conformity is available upon request.

14.2 Checklist for the manufacturer

Bosch Rexroth AG Checklist for the manufacturer and installer for installation of the SafeLogic compact safety controller. The specifications for the following items listed must be available at least for the initial commissioning. The specifications depend on the application, whose requirement must be checked by the manufacturer and installer. This checklist should be retained/stored with the machine documentation so that you can use the checklist as a reference for periodical tests.			
1.	Have the safety rules and regulations been observed in compliance with the directives and standards applicable to the machine?	Yes ☐	No ☐
2.	Are the applied directives and standards listed in the declaration of conformity?	Yes ☐	No ☐
3.	Does the protective device comply with the required category?	Yes ☐	No ☐
4.	Are the required protective measures against electric shock in effect (protection class)?	Yes ☐	No ☐
5.	Has the protective function been checked in compliance with the test notes in this documentation? Especially: • Functional check of the command devices, sensors and actuators connected to the safety controller • Test of all switch-off paths	Yes ☐	No ☐
6.	Is it ensured that the safety controller has been tested comprehensively for safety functionality after each configuration change?	Yes ☐	No ☐
This checklist does not replace initial commissioning and regular tests by qualified personnel.			

15 Service and support

Our worldwide service network provides an optimized and efficient support. Our experts offer you advice and assistance should you have any queries. You can contact us **24/7**.

Service Germany Our technology-oriented Competence Center in Lohr, Germany, is responsible for all your service-related queries for electric drive and controls.

Contact the **Service Hotline** and **Service Helpdesk** under:

Phone: **+49 9352 40 5060**
Fax: **+49 9352 18 4941**
E-mail: service.svc@boschrexroth.de
Internet: <http://www.boschrexroth.com>

Additional information on service, repair (e.g. delivery addresses) and training can be found on our internet sites.

Service worldwide Outside Germany, please contact your local service office first. For hotline numbers, refer to the sales office addresses on the internet.

Preparing information To be able to help you more quickly and efficiently, please have the following information ready:

- Detailed description of malfunction and circumstances
- Type plate specifications of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your e-mail address)

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