Manual

HIMax®

X-CI 24 51

Counter Module

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1 Introduction

This manual describes the technical characteristics of the module and its use. It provides information on how to install, start up and configure the module in SILworX.

1.1 Structure and Use of This Manual

The content of this manual is part of the hardware description of the HIMax programmable electronic system.

This manual contains the following main chapters:

- Introduction
- Safety
- Product description
- Start-up
- Operation
- Maintenance
- Decommissioning
- Transport
- Disposal

Additionally, the following documents must be taken into account:

Document	Content	Document no.
HIMax system manual	Hardware description of the HIMax system	HI 801 001 E
HIMax safety manual	Safety functions of the HIMax system	HI 801 003 E
HIMax maintenance manual	Description of significant operational and maintenance actions.	HI 801 171 E
Communication manual	Description of safeethernet communication and of the available protocols.	HI 801 101 E
Automation security manual	Description of automation security aspects related to the HIMA systems.	HI 801 373 E
SILworX first steps manual	Introduction to SILworX	HI 801 103 E
SILworX online help (OLH)	Instructions on how to use SILworX	---

Table 1: Additional Applicable Manuals

The current manuals can be obtained upon request by sending an e-mail to: documentation@hima.com. Registered customers can download the product documentation from the HIMA Extranet.

1.2 Target Audience

This document is aimed at the planners, design engineers, programmers and the persons authorized to start up, operate and maintain the automation systems. Specialized knowledge of safety-related automation systems is required.

1.3 Writing Conventions

To ensure improved readability and comprehensibility, the following writing conventions are used in this document:

Bold	To highlight important parts. Names of buttons, menu functions and tabs that can be clicked and used in the programming tool.
Italics	Parameters and system variables, references.
`Courier`	Literal user inputs.
RUN	Operating states are designated by capitals.
Chapter 1.2.3	Cross-references are hyperlinks even if they are not specially marked. In the electronic document (PDF): When the mouse pointer hovers over a hyperlink, it changes its shape. Click the hyperlink to jump to the corresponding position.

Safety notices and operating tips are specially marked.

1.3.1 Safety Notices

Safety notices must be strictly observed to ensure the lowest possible risk.

The safety notices are represented as described below.

- Signal word: warning, caution, notice.
- Type and source of risk.
- Consequences arising from non-observance.
- Risk prevention.

The signal words have the following meanings:

- Warning indicates hazardous situations which, if not avoided, could result in death or serious injury.
- Caution indicates hazardous situation which, if not avoided, could result in minor or moderate injury.
- Notice indicates a hazardous situation which, if not avoided, could result in property damage.

⚠ SIGNAL WORD

Type and source of risk!

Consequences arising from non-observance.

Risk prevention.

NOTICE

Type and source of damage!

Damage prevention.

1.3.2 Operating Tips

Additional information is structured as presented in the following example:

i The text giving additional information is located here.

Useful tips and tricks appear as follows:

TIP The tip text is located here.

2 Safety

All safety information, notes and instructions specified in this document must be strictly observed. The product may only be used if all guidelines and safety instructions are adhered to.

The product is operated with SELV or PELV. No imminent risk results from the product itself. Use in the Ex zone is only permitted if additional measures are taken.

2.1 Intended Use

HIMax components are designed for assembling safety-related controller systems.

When using the components in the HIMax system, comply with the following general requirements.

2.1.1 Environmental Requirements

All the environmental requirements specified in this manual must be observed when operating the HIMax system. The environmental requirements are listed in the product data.

2.1.2 ESD Protective Measures

Only personnel with knowledge of ESD protective measures may modify or extend the system or replace components.

NOTICE

Damage to the HIMax system due to electrostatic discharge!

- **When performing the work, make sure that the workspace is free of static, and wear a grounding strap.**
- **If not used, ensure that the components are protected from electrostatic discharge, e.g., by storing them in their packaging.**

2.2 Residual Risk

No imminent risk results from a HIMA system itself.

Residual risk may result from:

- Faults related to engineering.
- Faults in the user program.
- Faults related to the wiring.

2.3 Safety Precautions

Observe all local safety requirements and use the protective equipment required on site.

3 Product Description

The X-CI 24 51 module is a NonSIL counter module, which is intended for use in the programmable electronic system (PES) HIMax.

The counter module is used to count the pulses, to measure the frequency and the rotational speed and, if defined, to recognize the rotation direction. Two channels are required to use the detection of rotation direction function, see Chapter 4.5.4.

Proximity switches in accordance with EN 60947-5-6 (NAMUR) or switching devices of type 3 in accordance with EN 61131-2 can be connected to the counter module. Simultaneous operation of proximity switches and switching devices is not possible.

The counter module can be inserted into any of the base plate slots with the exception of the slots reserved for system bus modules. Refer to the system manual (HI 801 001 E) for details.

The module can be operated with safety-related modules and other NonSIL modules within one base plate. Safety-related and NonSIL modules may not be wired redundantly.

The module is interference-free. In particular with respect to EMC, electrical safety, communication to the X-SB and X-CPU modules, and the user program.

Module and connector boards are mechanically coded, see Chapter 3.6. Coding prevents installation of unsuitable I/O modules.

Refer to the HIMax safety manual (HI 801 003 E) for further information on the standards used to test and certify the modules and the HIMax system.

The certificates and the EU type test certificate are available on the HIMA website.

3.1 Safety Function

The module does not perform any safety-related functions.

The parameters and status for this module must not be used for safety functions.

3.1.1 Response in the Event of a Fault

If a fault occurs, 0 is issued as rotational speed and the user program retains its last valid process value for the counter reading.

The module activates the *Error* LED on the front plate.

3.2 Scope of Delivery

To operate, the module must be installed on a matching connector board. If a field termination assembly (FTA) is used, a system cable is required to connect the connector board to the FTA. Connector boards, system cables and FTAs are not included within the scope of delivery.

The connector boards are described in Chapter 3.7, the system cables are described in Chapter 3.8. The FTAs are described in separate manuals.

3.3 Type Label

The type label specifies the following important details:

- Product name
- Mark of conformity
- Bar code (2D or 1D code)
- Part number (Part-No.)
- Hardware revision index (HW-Rev.)
- Operating system revision index (OS-Rev.)
- Supply voltage (Power)
- Ex specifications (if applicable)
- Production year (Prod-Year:)

Figure 1: Sample Type Label

3.4 Structure

The counter module has 24 inputs that can measure frequencies in the range of 0…20 kHz for switching devices type 3 and in the range of 0…10 kHz for proximity switches. A short-circuit-proof supply is assigned to each input.

The 24 inputs of the counter module can either be configured for proximity switches or for switching devices. Which configuration should be used is defined by plugging in the sensor selection plug to the rear side of the connector board in use, see Chapter 4.2.2.

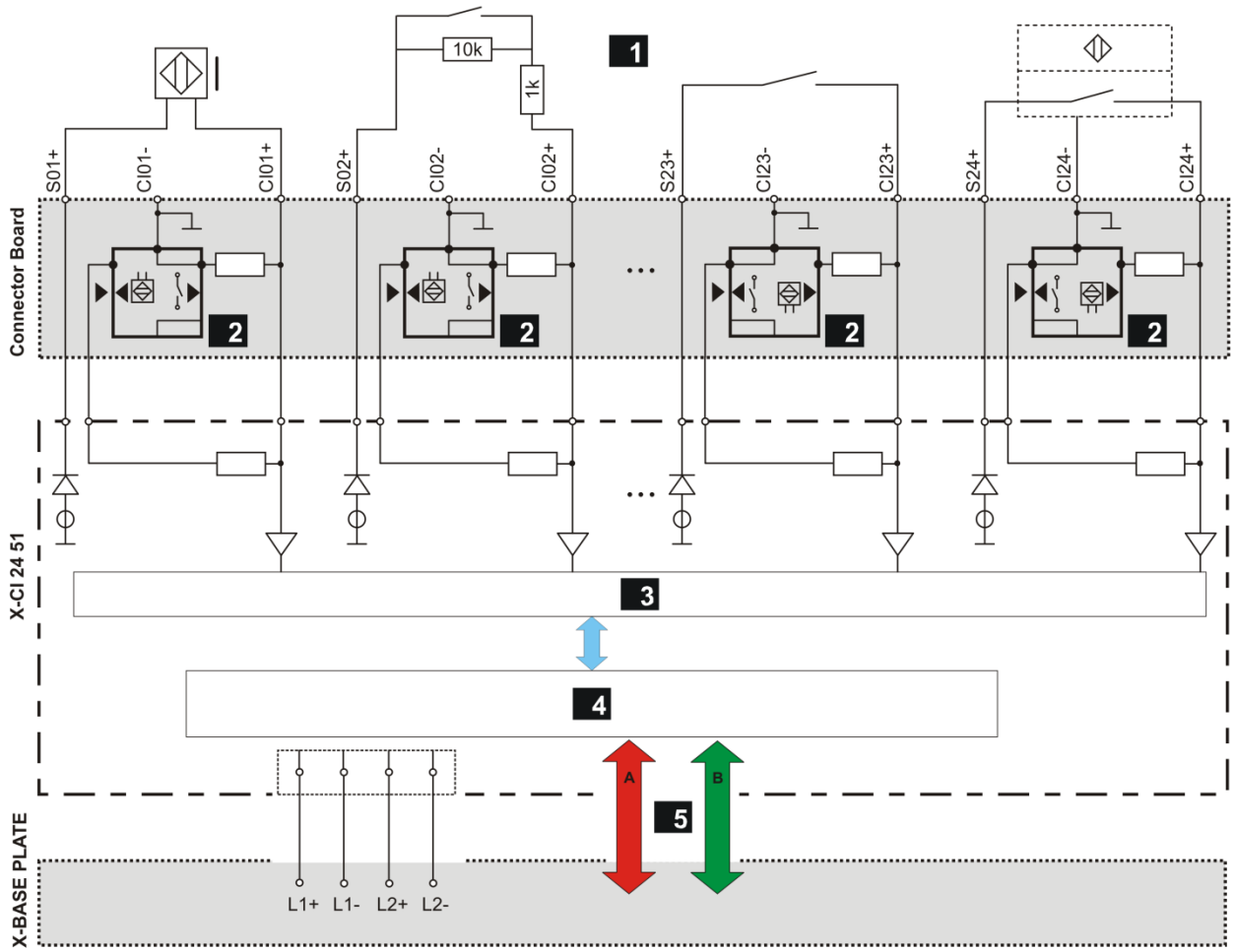
If proximity switches are used, the switching thresholds for open-circuits (OC) and short-circuits (SC) are preset in accordance with EN 60947-5-6 (NAMUR). Short-circuit (SC) and open-circuit (OC) monitoring is only possible if the *Proximity Switch* setting is used.

The processor system within the I/O module controls and monitors the I/O level. The data and states of the I/O module are provided to the processor modules via the redundant system bus. The system bus has a redundant structure for reasons of availability. Redundancy is only ensured if both system bus modules are inserted in the base plates and configured in SILworX.

The module is equipped with LEDs to indicate the status of the counter outputs, see Chapter 3.4.2.

3.4.1 Block Diagram

The following block diagram illustrates the structure of the module.



1 Field level: proximity switches and switching devices
2 Sensor selection plug
3 Counter
4 Processor system
5 System buses

Figure 2: Block Diagram

Sensor selection plug

The sensor selection plug is drawn multiple times in the block diagram (2). This serves only for the better representation of the individual wiring variants!

3.4.2 Indicators

The following figure shows the front view of the module with the LEDs:

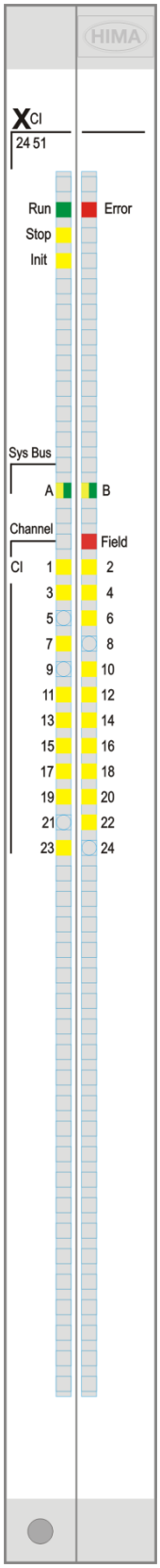


Figure 3: Indicators

The LEDs indicate the operating state of the module. All LEDs should be considered together. The LEDs on the module are divided into the following groups:

- Module status indicators (Run, Error, Stop, Init)
- System bus indicators (A, B)
- I/O indicators (CI 1…24, Field)

After connecting the supply voltage, an LED test is performed and all the LEDs are lit for at least 2 s. The color of two-color LEDs changes once during the test.

Definition of blinking frequencies

The following table defines the blinking frequencies:

Definition	Blinking frequencies
Blinking1	Long (600 ms) on, long (600 ms) off.
Blinking2	Short (200 ms) on, short (200 ms) off, short (200 ms) on, long (600 ms) off.
Blinking-x	Ethernet communication: Blinking synchronously with data transmission.

Table 2: Blinking Frequencies of the LEDs

Some LEDs can report warnings (On) and faults or errors (Blinking1), see the following tables. The indication of errors or faults has priority over the indication of warnings. Warnings cannot be reported if errors or faults are being signaled.

3.4.3 Module Status Indicators

These LEDs are located on the upper part of the front plate.

LED	Color	Status	Description
Run	Green	On	Module in the RUN state, normal operation.
		Blinking1	Module state STOP / LOADING OS
		Off	Module not in the RUN state, observe the other status LEDs.
Error	Red	On	System warning, for example: ▪ No license for additional functions (e.g., communication protocols), test mode. ▪ Temperature warning
		Blinking1	System error, for example: ▪ Internal module faults detected by self-tests, e.g., hardware or voltage supply faults. ▪ Fault while loading the operating system.
		Off	No faults detected
Stop	Yellow	On	Module state STOP / VALID CONFIGURATION
		Blinking1	The module is in one of the following states: ▪ STOP / INVALID CONFIGURATION ▪ STOP / LOADING OS
		Off	Module not in the STOP state, observe the other status LEDs.
Init	Yellow	On	Module state: INIT
		Blinking1	The module is in one of the following states: ▪ LOCKED ▪ STOP / LOADING OS
		Off	Module is in none of the states described, observe the other status LEDs.

Table 3: Module Status Indicators

3.4.4 System Bus Indicators

The system bus indicator LEDs are labeled *Sys Bus.*

LED	Color	Status	Description
A	Green	On	Physical and logical connection to the system bus module in slot 1.
		Blinking1	No physical connection to the system bus module in slot 1.
	Yellow	Blinking1	The physical connection to the system bus module in slot 1 has been established. No connection to a (redundant) processor module running in system operation.
B	Green	On	Physical and logical connection to the system bus module in slot 2.
		Blinking1	No physical connection to the system bus module in slot 2.
	Yellow	Blinking1	The physical connection to the system bus module in slot 2 has been established. No connection to a (redundant) processor module running in system operation.
A+B	Off	Off	Neither physical nor logical connection to the system bus modules in slot 1 and slot 2.

Table 4: System Bus Indicators

3.4.5 I/O Indicators

The LEDs of the I/O indicators are labeled *Channel*.

LED	Color	Status	Description
CI 1…24	Yellow	On	Frequency < 20 Hz with high level Frequency > 20 Hz with high and low level: No distinction between high and low level is made for the LED.
		Blinking2	Channel fault
		Off	Frequency < 20 Hz with low level Channel not configured.
Field	Red	Blinking2	Field fault on at least one channel or supply (open-circuit, short-circuit, over-current, etc.)
		Off	No faults at the field level!

Table 5: I/O Indicators

Effect on the Channel LED during two-phase operation and fault in one of the channels of a channel pair!

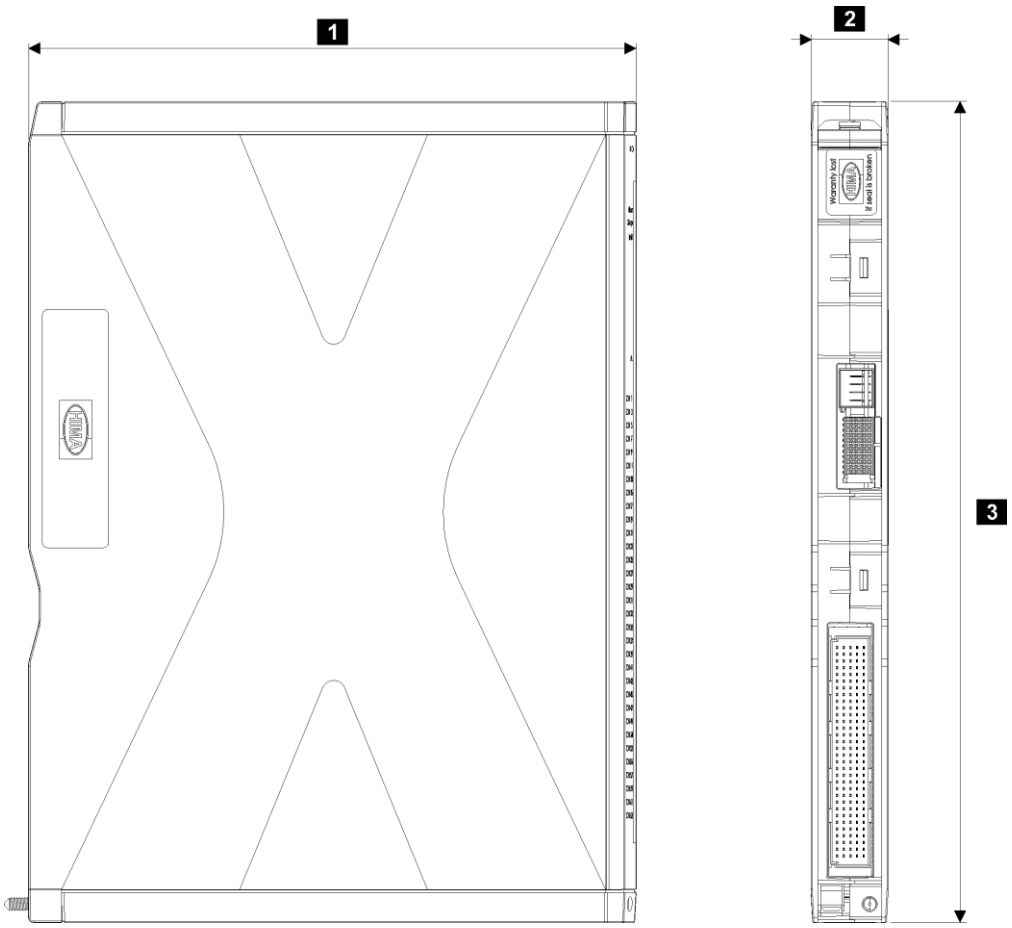
0 Hz (default value) is displayed for the *Rot. Speed (scaled) [REAL]* process value.

The **Channel** LED of the faulty channel adopts the Blinking2 status and the faulty-free channel reports the input signal state. At frequencies of > 20 Hz, the **Channel** LED cannot be updated every time the state changes.

3.5 Product Data

General Information	
Supply voltage	24 VDC, -15…+20 %, $r_p \leq 5$ % SELV, PELV
Current consumption	0.33 A at 24 VDC without load
Current consumption for 24 V per channel and high level	Proximity switch: typ. 1 mA, max. 10 mA Switching device of type 3: typ. 5.5 mA, max. 30 mA
Module cycle time	2 ms
Protection class	Protection class III in accordance with IEC/EN 61131-2
Ambient temperature	0…+60 °C
Transport and storage temperature	-40…+70 °C
Humidity	Max. 95 % relative humidity, non-condensing
Pollution	Pollution degree II in accordance with IEC/EN 60664-1
Installation height	< 2000 m
Degree of protection	IP20
Dimensions (H x W x D) in mm	310 x 29.2 x 230
Weight	Approx. 0.9 kg

Table 6: Product Data



1 Depth: 230 mm
2 Width: 29.2 mm
3 Height: 310 mm

Figure 4: Views

Counter module inputs	
Number of inputs (number of channels)	24 with common ground CI- (galvanically separated from the system bus).
Number of channel pairs (Detection of rotation direction)	12, Channel pair 1 = CI01 and CI02 Channel pair 2 = CI03 and CI04 … Channel pair 12 = CI23 and CI24
Sensors (Selection via sensor selection plug)	Proximity switches in accordance with EN 60947-5-6 (NAMUR), wired mechanical contacts or Switching devices of type 3 in accordance with EN 61131-2, power sources.
Count frequency	0…10 kHz for proximity switches 0…20 kHz for switching devices of type 3 0…10 kHz for switching devices of type 3 and evaluation type 2 phases / 4 edges
Resolution	0.1 Hz
Counter resolution	32-bit
Pulse width in one-phase operation	Min. 16.66 µs at 20 kHz Min. 33.33 µs at 10 kHz
Minimum edge distance between two phases during two-phase operation	6 µs
Accuracy of pulse count	±1 pulse
Accuracy of frequency and rotational speed measurement	
1 phase, 1 edge	±1 Hz
1 phase, 2 edges	±15 Hz, with symmetric input signal
2 phases, 1 edge	±1 Hz
2 phases, 2 edges	±15 Hz, with symmetric input signals
2 phases, 4 edges, f_{max} = 10 kHz	±20 Hz, with symmetric input signals
Proximity switch in accordance with EN 60947-5 [1)]	
Max. line resistance	50 Ω
Switch-on threshold L → H	1.8 mA
Switch-off threshold H → L	1.4 mA
Open-circuit	< 0.2 mA
Short-circuit	> 6.5 mA
Switching devices in accordance with EN 61131-2	
Cable length	1000 m
Switch-on threshold Low → High	> 10 V
Switch-off threshold High → Low	< 8 V
[1)] The values of the proximity switch must be consistent with the defined values.	

Table 7: Specifications for the Counter Inputs

Supply	
Number of supplies	24
Output voltage (depending on the sensors)	8.2 VDC ± 10 %, proximity switch 24 VDC -15…+20 %, control circuit device of type 3
Max. output current for each supply	15 mA
Nominal short-circuit current per channel (sensor short-circuit)	8.2 mA at 8.2 V, proximity switch 5.45 mA at 24 V, switching devices of type 3
Assignment of Supply Outputs	
The voltage output assigned to each input must be used for power supply.	
S01+…S24+	CI1+…CI24+

Table 8: Supply Specifications

3.6 Connector Boards

A connector board connects the counter module to the field level. Module and connector board together form a functional unit. Insert the connector board into the appropriate slot prior to mounting the module.

The sensor selection plug is located on the rear side of the connector boards and is used to select the type of sensor for the module (proximity switch or switching device of type 3). The sensor selection plug is included within the scope of delivery of the connector boards.

The following connector boards are available for the module:

Connector board	Description
X-CB 013 51	Mono connector board with screw terminals.
X-CB 013 52	Redundant connector board with screw terminals
X-CB 013 53	Mono connector board with cable plug.
X-CB 013 54	Redundant connector board with cable plug
Sensor selection plug	
X-SS CB 01	Sensor selection plug (standard)
X-SS CB 02	Sensor selection plug of type 5

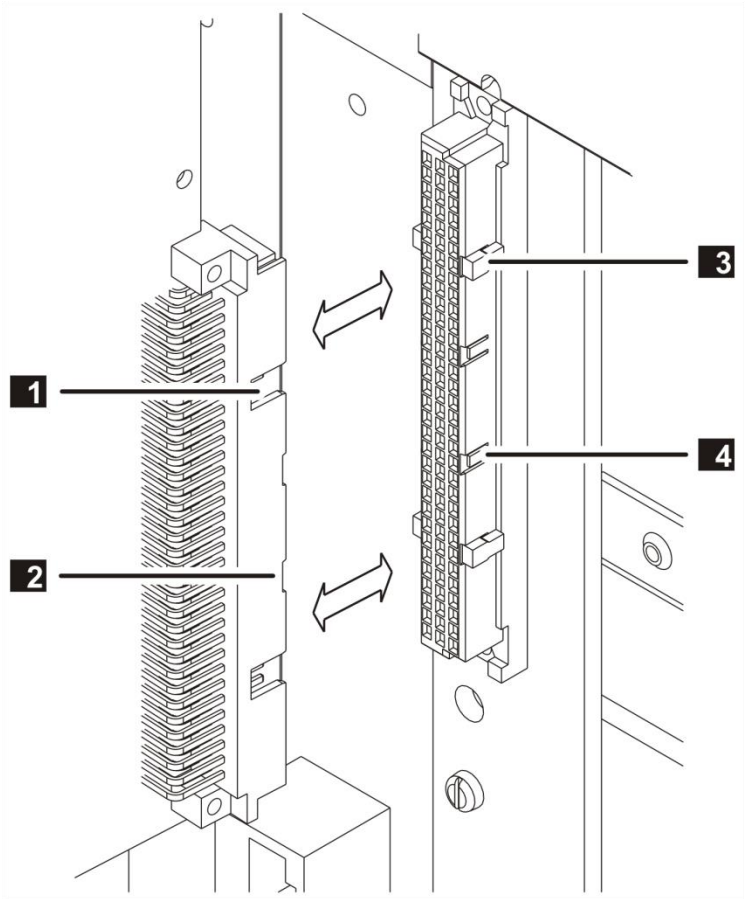
Table 9: Available Connector Boards

3.6.1 Mechanical Coding of Connector Boards

I/O modules and connector boards are mechanically coded starting from hardware revision index (HW-Rev.) 00. Coding avoids installation of improper I/O modules thus preventing negative effects on redundant modules and the field level.
Apart from that, improper equipment has no effect on the HIMax system since only I/O modules properly configured in SILworX can enter the RUN state.

I/O modules and the corresponding connector boards have a mechanical coding in the form of wedges. The coding wedges in the female connector of the connector board match with the male connector recesses of the I/O module plug, see Figure 5.

Coded I/O modules can only be plugged in to the corresponding connector boards.



1 Male connector recess
2 Prepared male connector recess
3 Coding wedge
4 Guideway for coding wedge

Figure 5: Coding Example

Coded I/O modules can be plugged in to uncoded connector boards. Uncoded I/O modules cannot be plugged in to coded connector boards.

3.6.2 Coding of X-CB 013 5x Connector Boards

The following table specifies the position of the coding wedges on the I/O module plug:

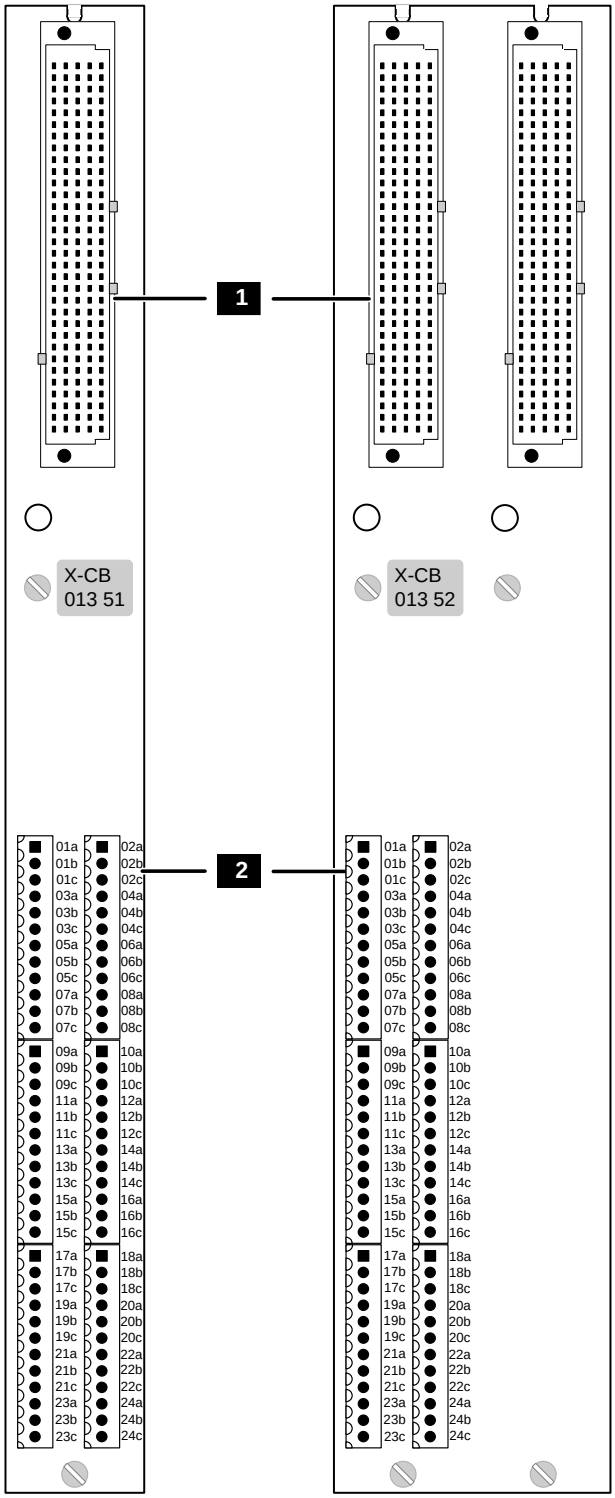
a7	a13	a20	a26	c7	c13	c20	c26
			X		X	X	

Table 10: Position of Coding Wedges

3.6.3 Connector Boards with Screw Terminals

Mono **Redundant**

X-CB 013 51 X-CB 013 52



1 I/O module plug

2 Connection to the field level (screw terminals)

Figure 6: Connector Boards with Screw Terminals

3.6.4 Terminal Assignment for Connector Boards with Screw Terminals

Pin no.	Designation	Signal	Pin no.	Designation	Signal
1	01a	S01+	1	02a	S02+
2	01b	CI1+	2	02b	CI2+
3	01c	CI1-	3	02c	CI2-
4	03a	S03+	4	04a	S04+
5	03b	CI3+	5	04b	CI4+
6	03c	CI3-	6	04c	CI4-
7	05a	S05+	7	06a	S06+
8	05b	CI5+	8	06b	CI6+
9	05c	CI5-	9	06c	CI6-
10	07a	S07+	10	08a	S08+
11	07b	CI7+	11	08b	CI8+
12	07c	CI7-	12	08c	CI8-
Pin no.	Designation	Signal	Pin no.	Designation	Signal
1	09a	S09+	1	10a	S10+
2	09b	CI9+	2	10b	CI10+
3	09c	CI9-	3	10c	CI10-
4	11a	S11+	4	12a	S12+
5	11b	CI11+	5	12b	CI12+
6	11c	CI11-	6	12c	CI12-
7	13a	S13+	7	14a	S14+
8	13b	CI13+	8	14b	CI14+
9	13c	CI13-	9	14c	CI14-
10	15a	S15+	10	16a	S16+
11	15b	CI15+	11	16b	CI16+
12	15c	CI15-	12	16c	CI16-
Pin no.	Designation	Signal	Pin no.	Designation	Signal
1	17a	S17+	1	18a	S18+
2	17b	CI17+	2	18b	CI18+
3	17c	CI17-	3	18c	CI18-
4	19a	S19+	4	20a	S20+
5	19b	CI19+	5	20b	CI20+
6	19c	CI19-	6	20c	AI20-
7	21a	S21+	7	22a	S22+
8	21b	CI21+	8	22b	CI22+
9	21c	CI21-	9	22c	CI22-
10	23a	S23+	10	24a	S24+
11	23b	CI23+	11	24b	CI24+
12	23c	CI23-	12	24c	CI24-

Table 11: Terminal Assignment for Connector Boards with Screw Terminals

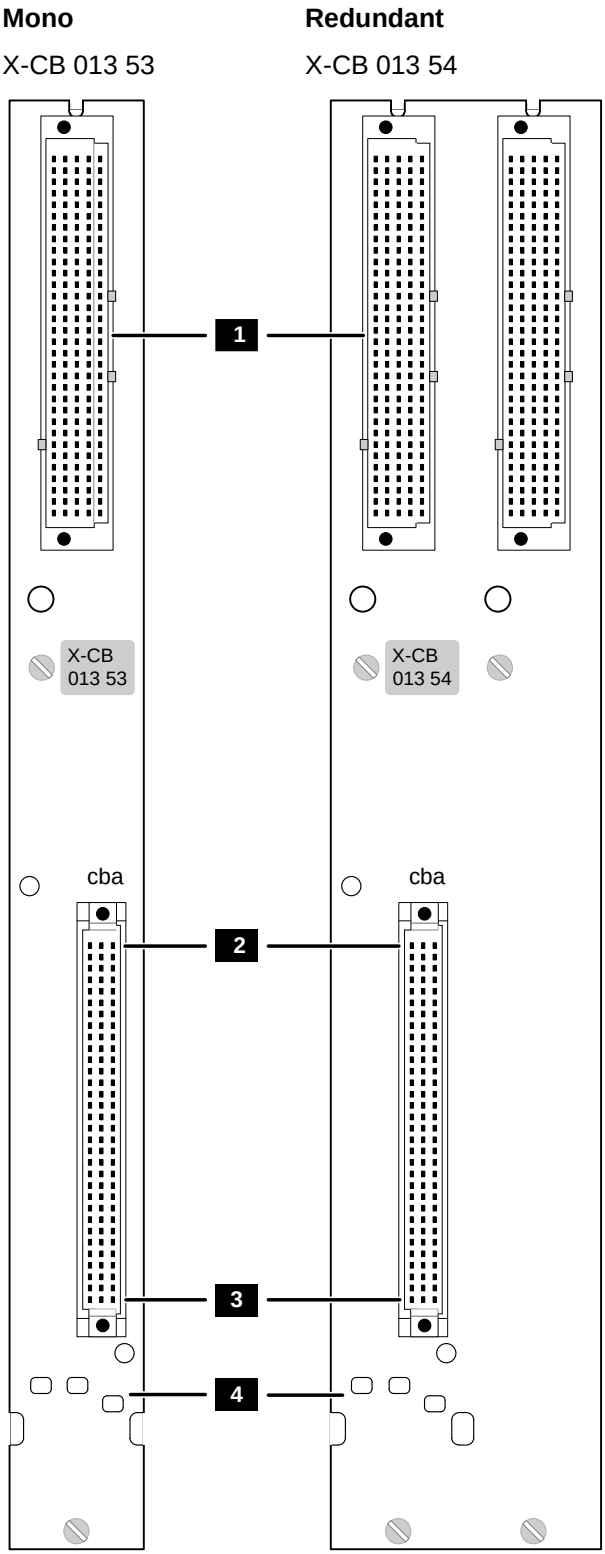
Cable plugs attached to the connector board pin headers are used to connect to the field level.

The cable plugs feature the following characteristics:

Connection to the field level	
Cable plugs	6 pieces, with 12 poles
Wire cross-section	0.2…1.5 mm^2 (single-wire) 0.2…1.5 mm^2 (finely stranded) 0.2…1.5 mm^2 (with wire end ferrule)
Stripping length	6 mm
Screwdriver	Slotted 0.4 x 2.5 mm
Tightening torque	0.2…0.25 Nm

Table 12: Cable Plug Characteristics

3.6.5 Connector Boards with Cable Plug



1 I/O module plug
2 Connection to the field level (cable plug in row 1)
3 Connection to the field level (cable plug in row 32)
4 Coding of cable plugs

Figure 7: Connector Boards with Cable Plug

3.6.6 Pin Assignment for Connector Boards with Cable Plug

HIMA provides ready-made system cables for use with these connector boards, see Chapter 3.7. The cable plug and the connector boards are coded.

Connector pin assignment!

The following table describes the connector pin assignment of the system cable plug.

The wire color coding complies with IEC 60304. The color abbreviations used are in accordance with IEC 60757.

The following table applies to system cables X-CA 005:

Row	c		b		a	
	Signal	Color	Signal	Color	Signal	Color
1		PKBN 1)		WHPK 1)	Internal use 2)	YEBU 1)
2		GYBN 1)		WHGY 1)		GNBU 1)
3		YEBN 1)		WHYE 1)		YEPK 1)
4		BNGN 1)		WHGN 1)		PKGN 1)
5		RDBU 1)		GYPK 1)		
6		VT 1)		BK 1)		
7		RD 1)		BU 1)		
8		PK 1)		GY 1)		
9	S24+	YE 1)	CI24+	GN 1)	CI-	
10	S23+	BN 1)	CI23+	WH 1)	CI-	
11	S22+	RDBK	CI22+	BUBK	CI-	
12	S21+	PKBK	CI21+	GYBK	CI-	
13	S20+	PKRD	CI20+	GYRD	CI-	
14	S19+	PKBU	CI19+	GYBU	CI-	
15	S18+	YEBK	CI18+	GNBK	CI-	
16	S17+	YERD	CI17+	GNRD	CI-	
17	S16+	YEBU	CI16+	GNBU	CI-	
18	S15+	YEPK	CI15+	PKGN	CI-	
19	S14+	YEGY	CI14+	GYGN	CI-	
20	S13+	BNBK	CI13+	WHBK	CI-	
21	S12+	BNRD	CI12+	WHRD	CI-	
22	S11+	BNBU	CI11+	WHBU	CI-	
23	S10+	PKBN	CI10+	WHPK	CI-	
24	S09+	GYBN	CI9+	WHGY	CI-	
25	S08+	YEBN	CI8+	WHYE	CI-	YEGY 1)
26	S07+	BNGN	CI7+	WHGN	CI-	GYGN 1)
27	S06+	RDBU	CI6+	GYPK	CI-	BNBK 1)
28	S05+	VT	CI5+	BK	CI-	WHBK 1)
29	S04+	RD	CI4+	BU	CI-	BNRD 1)
30	S03+	PK	CI3+	GY	CI-	WHRD 1)
31	S02+	YE	CI2+	GN	CI-	BNBU 1)
32	S01+	BN	CI1+	WH	CI-	WHBU 1)

1) Additional orange ring if one wire color is repeated.

2) The wires must be isolated individually! No other use is permitted!

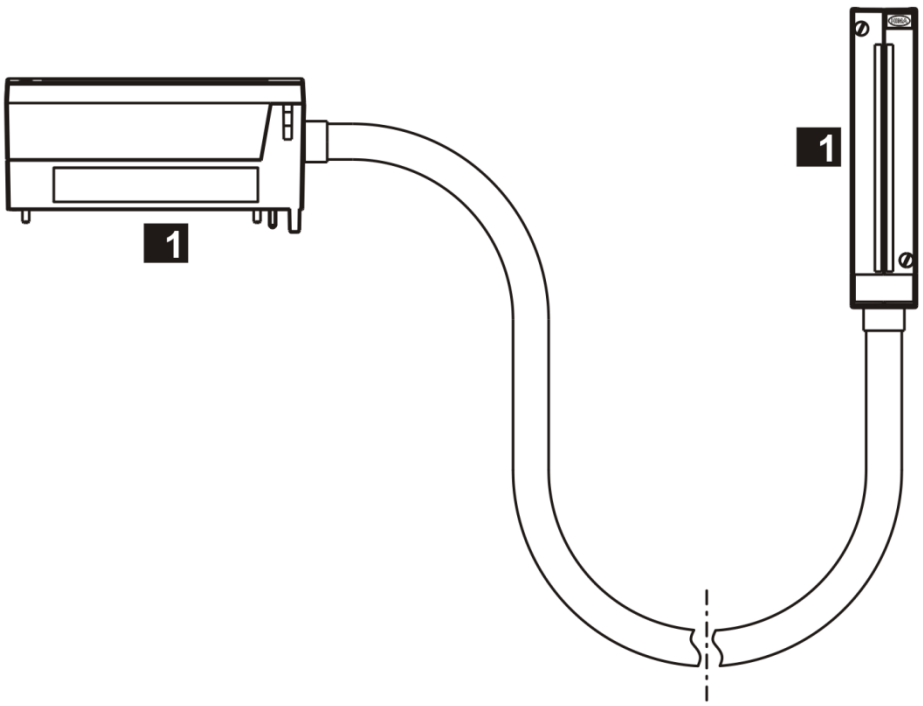
Table 13: Pin Assignment for the Cable Plugs of System Cable X-CA 005

3.7 System cables

System cable X-CA 005 is used to connect the X-CB 013 53/54 connector board to the field termination assembly.

General Information	
Cable	LIYCY-TP 38 x 2 x 0.25 mm²
Wire	Finely stranded
Average outer diameter (d)	Approx. 16.8 mm
Minimum bending radius Fixed installation Flexible application	 5 x d 10 x d
Burning behavior	Flame retardant and self-extinguishing in accordance with IEC 60332-1-2, IEC 60332-2-2
Length	8…30 m
Color coding	Based on DIN 47100, see Table 13.

Table 14: Cable Data



1 Identical cable plugs

Figure 8: System Cable X-CA 005 01 n

The system cable is available in the following standard variants:

System cables	Description	Length	Weight
X-CA 005 01 8	Coded cable plugs on both sides.	8 m	4.1 kg
X-CA 005 01 15		15 m	7.5 kg
X-CA 005 01 30		30 m	15 kg

Table 15: Available System Cables

3.7.1 Cable Plug Coding

The cable plugs are equipped with three coding pins. Therefore, cable plugs only match connector boards and FTAs encoded accordingly, see Figure 7.

4 Start-Up

This chapter describes how to install, configure and connect the module. For further details, refer to the HIMax system manual (HI 801 001 E).

4.1 Mounting

Observe the following points when mounting the module:

- Only operate the module with the appropriate fan components. For further details, see the system manual (HI 801 001 E).
- Only operate the module with the suitable connector board. For further details, see Chapter 3.6.
- Prior to being mounted, the connector boards must be equipped with a sensor selection plug, see Chapter 4.2.2.
- The module, including its connected components, must be installed to ensure compliance with the requirements for degree of protection IP20 or higher in accordance with EN 60529:1991 + A1:2000.

NOTICE

Damage due to incorrect wiring!

Failure to comply with these instructions can damage the electronic components.

Observe the following points.

- Plugs and terminals connected to the field level.
  - Take the appropriate grounding measures when connecting the plugs and terminals to the field level.
  - An unshielded cable may be used for connecting the proximity switches and switching devices to the digital inputs.
  - The shielding must be connected on both sides. On the module side, the shielding must be connected to the cable shield rail (use SK 20 shield connection terminal block or similar).
  - If finely stranded wires are used, HIMA recommends fastening ferrules to the wire ends. The terminals must be suitable for fastening the cross-sections of the cables in use.
- If the supply is used, utilize the voltage output used for the assigned input (e.g. S1+ with CI1+).
- For proximity switches, only the counter module supply must be used. **External supplies are not permitted for proximity switches!**
- HIMA recommends using the counter module supply for switching devices and wired contacts. Failure of an external supply or measurement unit can lead to overload and damage of the affected input on the counter module.
- The inputs can be interconnected redundantly using the corresponding connector boards, see Chapters 3.6 and 4.4.1.

4.1.1 Wiring Unused Inputs

Inputs that are not being used may stay open and need not be terminated. To prevent short-circuits and sparks in the field, never connect a wire to a connector board if it is open on the field level.

4.2 Mounting and Removing the Module

This chapter describes how to replace an existing module or mount a new one.

When removing the module, the connector board remains in the HIMax base plate. This saves additional wiring effort at the clamp terminals since all field terminals are connected via the connector board of the module.

4.2.1 Mounting a Connector Board

Tools and utilities:

- Screwdriver, cross PH 1 or slotted 0.8 x 4.0 mm.
- Matching connector board.

To install the connector board

1. Insert the connector board into the guiding rail with the groove facing upwards (see following drawing). Fit the groove into the guiding rail pin.
2. Place the connector board on the cable shield rail.
3. Secure the captive screws to the base plate. First screw in the lower screws than the upper ones.

To remove the connector board

1. Release the captive screws from the base plate.
2. Carefully lift the lower section of the connector board from the cable shield rail.
3. Remove the connector board from the guiding rail.

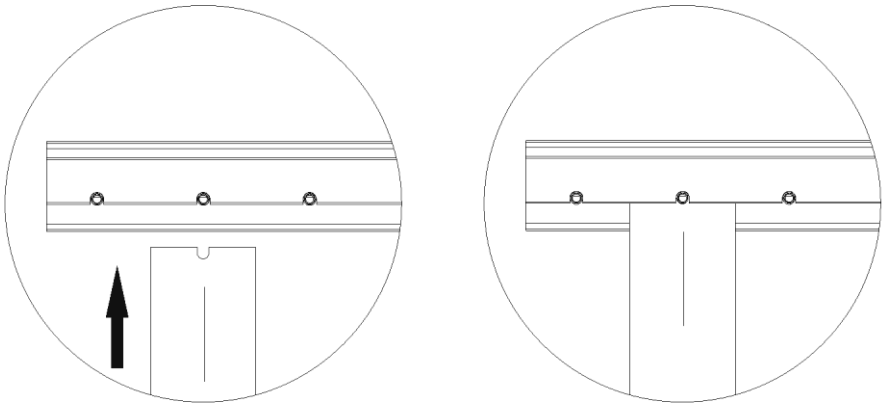


Figure 9: Example of how to Insert the Mono Connector Board

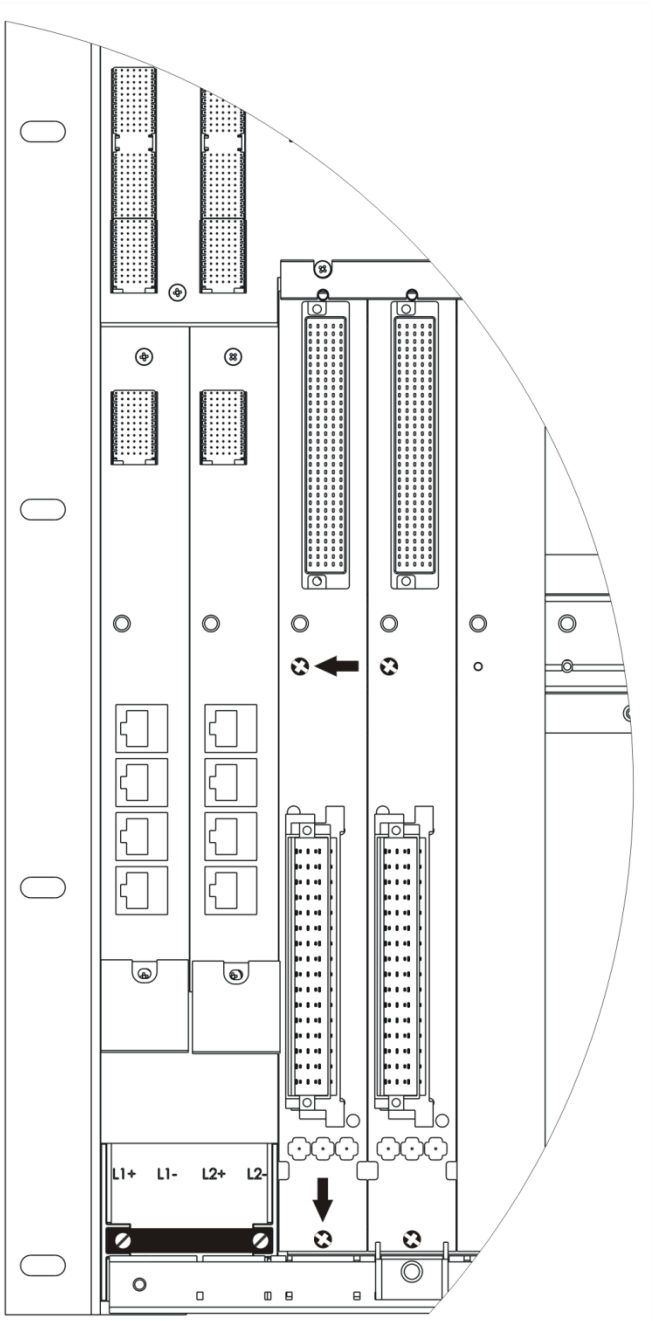


Figure 10: Example of how to Secure the Mono Connector Board with Captive Screws

i These instructions also apply for redundant connector boards. The number of used slots varies in accordance with the connector board type. The number of captive screws depends on the connector board type.

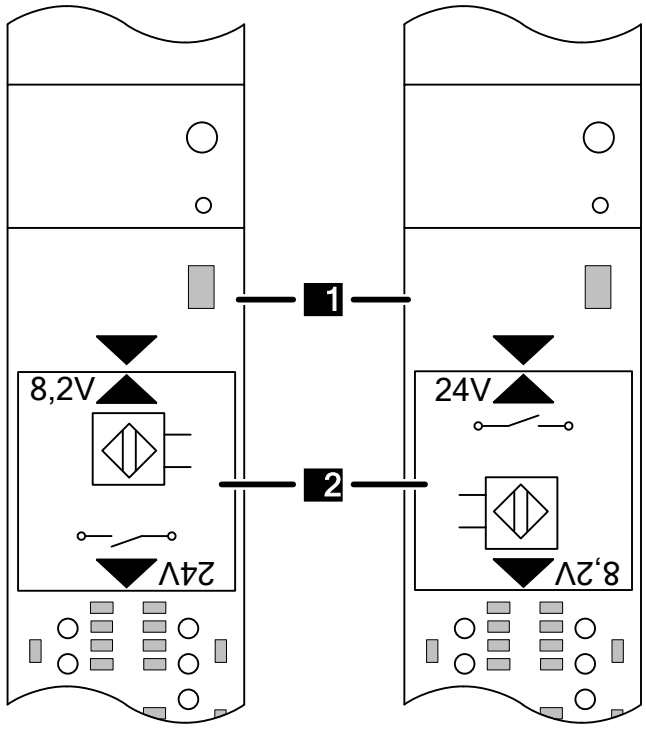
4.2.2 Using the Sensor Selection Plug to Define the Sensors

A sensor selection plug plugged in to the rear side of the X-CB 013 connector board is used to either select the configuration with proximity switch in accordance with EN 60947-5-6 or with switching devices of type 3 in accordance with EN 61131-2, see Figure 11.

Proximity switches in accordance with EN 60947-5-6 are operated with a supply voltage of 8.2 V. For this reason, select the appropriate input signal type in the SILworX Hardware Editor.

Switching devices of type 3 in accordance with EN 61131-2 are operated with a supply voltage of 24 V. Select the type of input signals accordingly.

For **proximity switches** For **switching devices**



1 Rear side of X-CB 013 connector board **2** Sensor selection plug

Figure 11: Plugging-In the Sensor Selection Plug

The configuration with proximity switches or switching devices is defined as follows:

- Plug in the sensor selection plug to the connector board such that the arrowheads point at each other, see Figure 11.

i The sensor selection plug must be plugged in prior to mounting the connector board.
The sensor selection plug can only be replugged if the connector board is removed!

Additionally, the type of the input signals must be defined in the SILworX Hardware Editor, see Chapter 4.4.2.

i If the input signal type set in SILworX does not correspond to that defined on the connector board rear side, the module is not able to complete the initialization.

4.2.3 Mounting and Removing a Module

This chapter describes how to mount and remove the HIMax module. A module can be mounted and removed while the HIMax system is operating.

NOTICE

Damage to bus and power sockets due to module jamming!

Failure to comply with these instructions can damage the controller.

Always insert the module in the base plate carefully.

Tools and utilities:

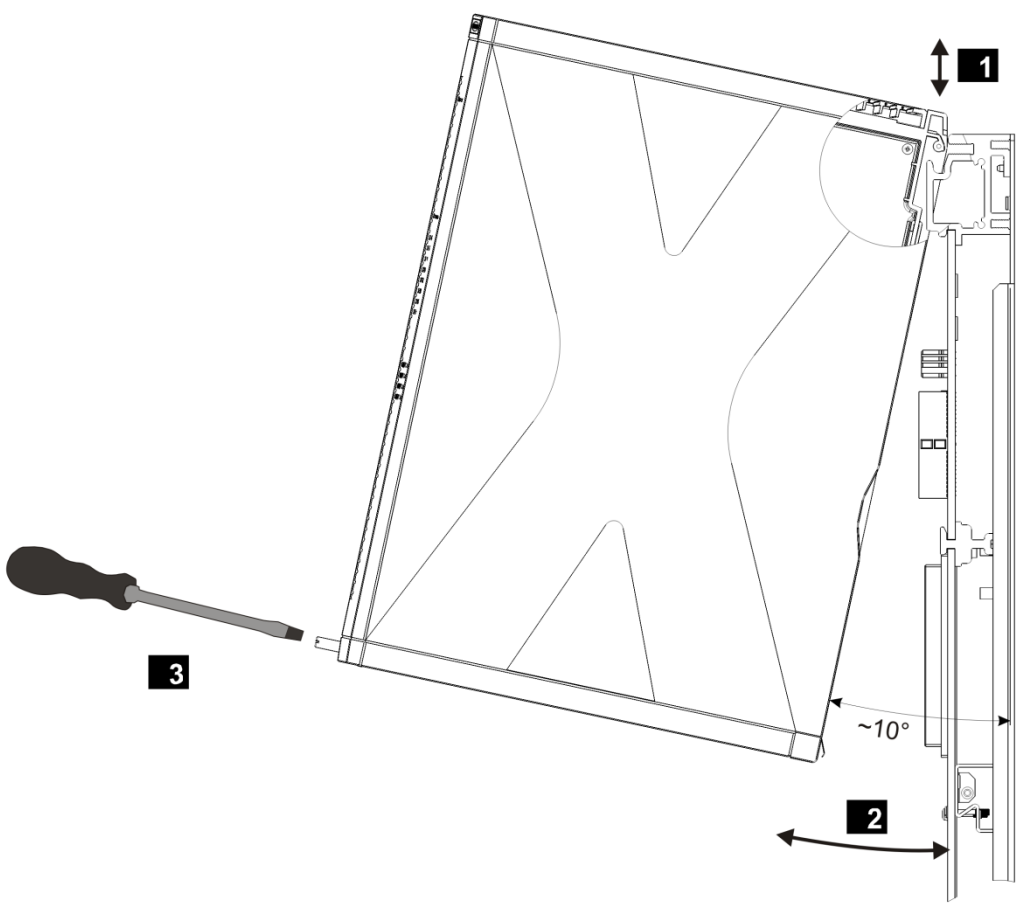
- Screwdriver, slotted 0.8 x 4.0 mm.
- Screwdriver, slotted 1.2 x 8.0 mm.

To insert the modules

1. Open the cover plate on the fan rack:
   ☑ Move the locks to the *open* position.
   ☑ Lift the cover plate and insert it into the fan rack.
2. Insert the top of the module into the hook-in rail, see 1.
3. Swivel the lower edge of the module towards the base plate and apply light pressure to snap it into place, see 2.
4. Tighten the screws, see 3.
5. Pull the cover plate out of the fan rack and close it.
6. Lock the cover plate.

To remove the modules

1. Open the cover plate on the fan rack:
   ☑ Move the locks to the *open* position.
   ☑ Lift the cover plate and insert it into the fan rack.
2. Release the screw, see 3.
3. Swivel the lower edge of the module away from the base plate. Lift and apply light pressure to remove the module from the hook-in rail, see 2 and 1.
4. Pull the cover plate out of the fan rack and close it.
5. Lock the cover plate.



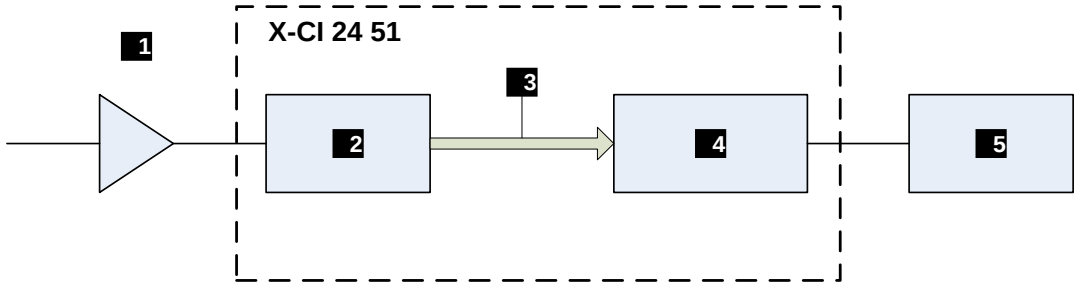
1 Inserting and removing a module
2 Swiveling the module in and out
3 Securing and releasing a module

Figure 12: Mounting and Removing a Module

i If the HIMax system is operating, do not open the cover plate of the fan rack for more than a few minutes (< 10 min) since this affects the forced cooling.

4.3 Counter Module Sampling

The following chapter describes how the input signal is sampled.



1 Input signal
2 Counter
3 Processing cycle
4 Safety-related processor system
5 X-CPU 01

Figure 13: Input Signal Evaluation

The input signal is sampled by the counter 2 in accordance with SIL 3 and is provided to the processor system of the counter module. The counter 2 increments each pulse in the -> *Counter Reading Revolving [UDINT]* parameter.

This parameter is used to determine the following values:

- -> Counter Reading [UDINT]
- -> Rotational Speed in mHz [DINT]

The processor module (5) reads the -> *Counter Reading Revolving [UDINT]* parameter. The last valid value is subtracted from the read value and the difference is added to the -> *Counter Reading [UDINT]* parameter value. The parameter is limited to a maximum value of 2^{32}-1. If the maximum value is exceeded, the counting process restarts at 0 and the excess counter pulses are added. The -> *Overflow* status is activated!

The processor system (4) calculates the rotational speed for the duration of one process cycle (3) and outputs the result to the -> *Rotational Speed [mHz] [DINT]* parameter.

If the frequency changes, a valid rotational speed value is only issued upon completion of an entire processing cycle.

If the frequency changes from a high rotational speed value to a very low value, the rotational speed can only be determined with the next pulse. Until the next pulse starts, the rotational speed has no measured value and is determined using the following formula:

$$f = \frac{1}{(n \cdot 2\ \text{ms})} \qquad n = \frac{t}{2\ \text{ms}}$$

t = Time without pulse

4.3.1 Counting Pulse Evaluation Type

The evaluation type for inputs is selected from a drop-down menu located in the **I/O Submodule CI24_51: Channels** tab:

- 1 phase, 1 edge, no rotation direction
- 1 phase, 2 edges, no rotation direction
- 2 phases, 1 edge
- 2 phases, 2 edges
- 2 phases, 4 edges
- 2 phases, 1 edge, static rotation direction

The evaluation type is always set for a channel pair (channel 1 and 2, channel 3 and 4 through channel 23 and 24). The evaluation types are also represented in Figure 14.

4.3.1.1 1 Phase, 1 Edge, no Rotation Direction

This evaluation type is used to count the rising edges of the input signal. This evaluation type cannot be used to recognize the rotation direction.

4.3.1.2 1 Phase, 2 Edges, no Rotation Direction

This evaluation type is used to count the rising and falling edges of the input signal. To do this, a symmetric input signal is required (pulse duty factor 1:1). This evaluation type has the advantage of being able to determine the process value two times faster than with the evaluation type 1 Phase, 1 Edge, no Rotation Direction. This evaluation type cannot be used to recognize the rotation direction.

4.3.1.3 2 Phases, 1 Edge

This evaluation type is used to recognize the rotation direction. To this end, a channel pair (e.g., CI1+ and CI2+) with its input signals phase-delayed by ±90 ° is required. The odd input is used to count the rising edge and the even input is used to determine the rotation direction via the phase-delayed input signal.

4.3.1.4 2 Phases, 2 Edges

This evaluation type is used to recognize the rotation direction. To this end, a channel pair (e.g., CI1+ and CI2+) with its input signals phase-delayed by ±90 ° is required. A symmetric input signal (pulse duty factor 1:1) is required for the input signals. The odd input is used to count the rising and falling edges, and the even input is used to determine the rotation direction via the phase-delayed input signal. This evaluation type has the advantage of being able to determine the process value two times faster than with the evaluation type 2 Phases, 1 Edge.

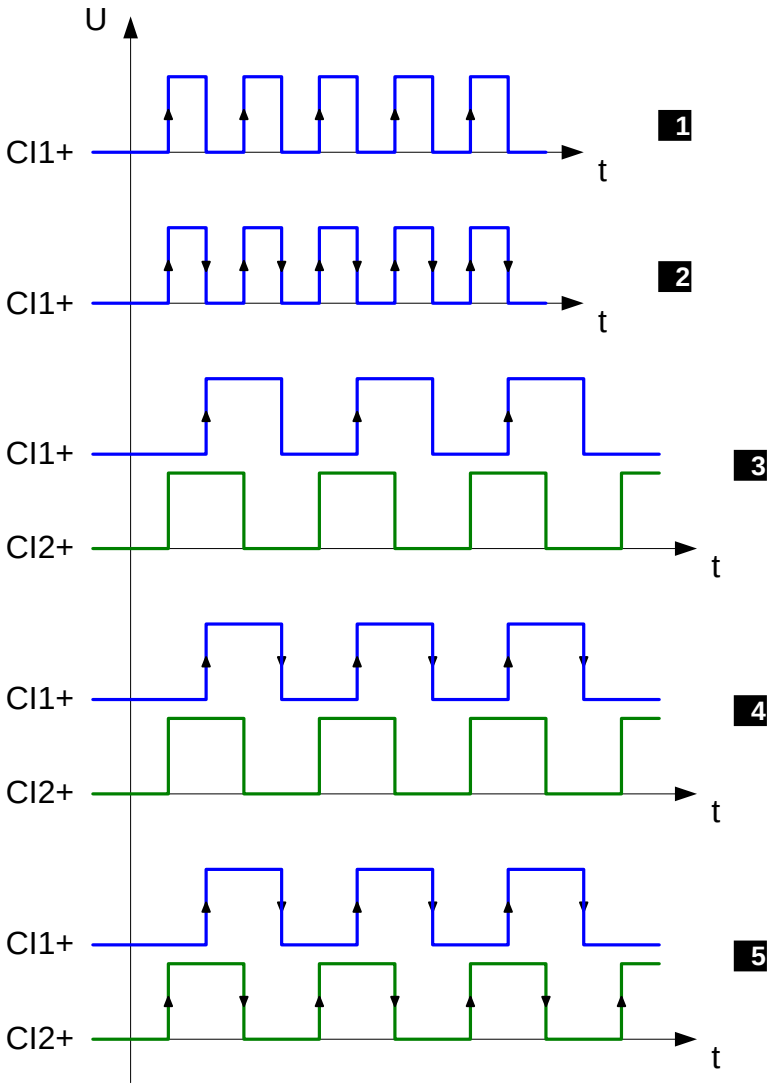
4.3.1.5 2 Phases, 4 Edges

This evaluation type allows to recognize the rotation direction up to a frequency of 10 kHz. To this end, a channel pair (e.g., CI1+ and CI2+) with its input signals phase-delayed by ±90 ° is required. A symmetric input signal (pulse duty factor 1:1) is required for the input signals. Both inputs are used to count the rising and falling edges, and the even input is also used to determine the rotation direction via the phase-delayed input signal. This evaluation type has the advantage of being able to determine the process value four times faster than with the evaluation type 2 Phases, 1 Edge.

4.3.1.6 2 Phases, 1 Edge, Static Rotation Direction

With this evaluation type, the sensor provides a static rotation direction signal which changes the level whenever the rotation direction changes. A channel pair (e.g., CI1+ and CI2+) is required for this evaluation type. The odd input is used to count the rising edge and the even input is used to output the static rotation direction.

The -> *Leading [BOOL] (Rotation Direction)* system parameter can be used to evaluate the current rotation direction in the user program.



1 1 phase, 1 edge, no rotation direction
2 1 phase, 2 edges, no rotation direction
3 2 phases, 1 edge
4 2 phases, 2 edges
5 2 phases, 4 edges

Figure 14: Evaluation Type, Detection of Rotation Direction with CI1+ and CI2+ Channel Pair

4.4 Configuring the Module in SILworX

The module is configured in the Hardware Editor of the SILworX programming tool.

Observe the following points when configuring the module:

- To diagnose the module and channels, both the statuses and the measured value can be evaluated within the user program. For further details on the system parameters, refer to the following tables.
- Short-circuit (SC) and open-circuit (OC) monitoring is only possible in SILworX if the *Type of Input Signals* system parameter is set to *Proximity Switch*. The monitoring function is defined for each channel using the -> *OC* and -> *SC* system parameters. The detection of a short-circuit or open-circuit triggers the fault response of the affected channel.
- If one of the parameters *Input Signal Type* or *Counting Pulses Evaluation Type* are changed, or both simultaneously, the counter module must be restarted. To do this, remove the module and reinsert it into the base plate. If the parameter *Type of Input Signals* is changed, the sensor selection plug must be replugged into the connector board, see Chapter 4.2.2.
- If a redundancy group is created, its configuration is defined in the tabs. The tabs specific to the redundancy group differ from those of the individual modules, see the following tables.

To evaluate the system parameters in the user program, they must be assigned to global variables. Perform this step in the Hardware Editor using the module's detail view.

The following tables present the system parameters for the module in the same order as in the SILworX Hardware Editor.

TIP A scientific calculator such as the Windows® calculator with the corresponding view can be used to convert hexadecimal values to bit strings.

4.4.1 The **Module** Tab

The **Module** tab contains the following system parameters for the module:

System parameter	Data type	R/W	Description
Name	---	W	Module name.
Spare Module	---	W	Activated: It is not considered a fault if a module of the redundancy group is missing in the base plate. Deactivated: It is considered a fault if a module of the redundancy group is missing in the base plate. Default setting: Deactivated **It is only displayed in the redundancy group tab!**
Noise Blanking	---	W	Allow noise blanking performed by the process module (Activated/Deactivated). Default setting: Deactivated The processor module delays its response to transient interference until the safety time. The user program retains its last valid process value. Refer to the system manual (HI 801 001 E) for further details on noise blanking.
System parameter	Data type	R/W	Description
The following statuses and parameters can be assigned global variables and used in the user program.			
Module OK	BOOL	R	TRUE: • Mono operation: No module faults. • Redundancy operation: At least one of the redundant modules has no module fault (OR logic). FALSE: • Module fault. • Channel fault on one channel (no external faults). • The module is not plugged in. Observe the *Module Status* parameter!
Module Status	DWORD	R	Status of the module.
Timestamp [µs]	DWORD	R	Microsecond fraction of the timestamp. Point in time at which the counter inputs were measured.
Timestamp [s]	DWORD	R	Second fraction of the timestamp. Point in time at which the counter inputs were measured.

Coding	Description
0x00000001	Module fault.[1)]
0x00000002	Temperature threshold 1 exceeded.
0x00000004	Temperature threshold 2 exceeded.
0x00000008	Incorrect temperature value.
0x00000010	Voltage on L1+ is defective.
0x00000020	Voltage on L2+ is defective.
0x00000040	Internal voltage is defective.
0x80000000	No connection to the module. [1)]

[1)] These faults affect the *Module OK* status and need not be separately evaluated in the user program.

Table 16: The **Module** Tab in the Hardware Editor

4.4.2 The **I/O Submodule CI 24_51** Tab

The **I/O Submodule CI24_51** tab contains the following statuses and parameters:

System parameter	Data type	R/W	Description
Enter these statuses and parameters directly in the Hardware Editor.			
Name	---	W	Tab name
Type of Input Signals	---	W	Selection of the sensors connected to the input: ▪ Type 3 (switching devices) ▪ Initiator (proximity switch) Default setting: Type 3 (switching devices)
System parameter	Data type	R/W	Description
The following statuses and parameters can be assigned global variables and used in the user program.			
Diagnostic Request	DINT	W	To request a diagnostic value, the appropriate ID must be sent to the module using the parameter *Diagnostic Request* (for coding details, see Chapter 4.4.5).
Diagnostic Response	DINT	R	As soon as *Diagnostic Response* returns the ID of *Diagnostic Request* (for coding details, see Chapter 4.4.5), *Diagnostic Status* contains the diagnostic value requested.
Diagnostic Status	DWORD	R	Requested diagnostic value in accordance with *Diagnostic Response*. The IDs of *Diagnostic Request* and *Diagnostic Response* can be evaluated in the user program. *Diagnostic Status* only contains the requested diagnostic value when both *Diagnostic Request* and *Diagnostic Response* have the same ID.
Background Test Error	BOOL	R	TRUE: Background test is faulty. FALSE: Background test is not faulty.
Restart on Error	BOOL	W	The *Restart on Error* parameter can be used to cause any I/O module that is shut down permanently due to errors or faults to once again enter the RUN state. To do so, set the *Restart on Error* parameter from FALSE to TRUE. The I/O module performs a complete self-test and only enters the RUN state if no faults are detected. Default setting: FALSE
Supply 1 OK	BOOL	R	Function is not currently supported.
Supply 2 OK	BOOL	R	Function is not currently supported.
Submodule OK	BOOL	R	TRUE: No submodule fault, no channel faults. FALSE: Submodule fault, channel faults (external faults included).
Submodule Status	DWORD	R	Bit-coded submodule status. For coding details, see Chapter 4.4.4.

Table 17: The **I/O Submodule CI24_51** Tab in the Hardware Editor

4.4.3 The **I/O Submodule CI24_51: Channels** Tab

The **I/O Submodule CI 24_51: Channels** tab contains the following system parameters for each counter input:
Global variables can be assigned to the system parameters with **->** and used in the user program. The value without **->** must be directly entered.

System parameter	Data type	R/W	Description
Channel no.	---	R	Channel number, preset and cannot be changed.
-> Counter Reading [UDINT]	UDINT	R	Channel counter reading: 0…2^{32}-1, the value is calculated by the X-CPU based on -> *Counter Reading Revolving [UDINT]*. **Behavior upon overflow:** The value is added up to a maximum value (2^{32} - 1). If the maximum value is exceeded, the -> *Overflow [BOOL]* status is set to TRUE, the counting process restarts at 0 and the excess counter pulses are added. The -> *Overflow [BOOL]* status is reset to FALSE with the next cycle. The -> *Overflow [BOOL]* status must be evaluated in the user program.
Counter	LREAL	W	Counter scaling factor. Default setting: 1.0
-> Count.Read. (Scaled) [REAL]	REAL	R	Counter reading (scaled) = counter scaling factor x counter reading. **Behavior upon overflow:** With overflow, the value is derived from the last counter reading, see -> *Counter Reading [UDINT].*
-> Rotational Speed [mHz] [DINT]	DINT	R	Unhandled value measured for the channel. 0…20 000 000 mHz, (rotational speed 1000 = 1 Hz)
Rot. Speed (Scaled)	LREAL	W	Rotational speed scaling factor. Default setting: 0.001
-> Rot. Speed (scaled) [REAL]	REAL	R	Rotational speed (scaled) = rotational speed scaling factor * rotational speed in mHz
-> Channel OK	BOOL	R	TRUE: Fault-free channel. The process value is valid. FALSE: Faulty channel. Rotational speed (frequency) is set to 0 and the counter reading is frozen. Reset with the system parameter *Reset [BOOL]* ->
-> OC [BOOL]	BOOL	R	TRUE: Open-circuit. FALSE: No open-circuit. Only applies to proximity switches.
-> SC [BOOL]	BOOL	R	TRUE: Short-circuit. FALSE: No short-circuit. Only applies to proximity switches.
Counting Pulse Evaluation Type	BYTE	W	▪ 1 Phase, 1 Edge, no Rotation Direction ▪ 1 Phase, 2 Edges, no Rotation Direction ▪ 2 Phases, 1 Edge ▪ 2 Phases, 2 Edges ▪ 2 Phases, 4 Edges ▪ 2 Phases, 1 Edge, Static Rotation Direction Default setting: 1 Phase, 1 Edge, no Rotation Direction, see Chapter 4.3.1.

System parameter	Data type	R/W	Description
-> Overflow [BOOL]	BOOL	R	TRUE: Counter overflow. FALSE: No counter overflow.
-> Level [BOOL]	BOOL	R	TRUE: High level present on the channel. FALSE: Low level present on the channel. During two-phase operation, this parameter must be assigned a global variable for both channels of the channel pair. **It must not be used for safety-related applications.**
-> Leading [BOOL] (rotation direction)	BOOL	R	TRUE: Leading signal. FALSE: Lagging signal.
Reset [BOOL] ->	BOOL	W	TRUE: Counter reading (process value) reset to 0. FALSE: Counter reading (process value) not reset.
Lock Restart [BOOL] ->	BOOL	W	TRUE: Prevents a restart after channel or module fault. FALSE: Allow restarts even after a channel or module fault.
-> Count.Read. (Revolv.) [UDINT]	UDINT	R	It adds the values sampled by the counter up to a maximum value of (2^{32}-1). A revolving reset of the counter reading is not possible. Noise blanking has no effect on this value. **Behavior upon overflow:** If the maximum value is exceeded, the *Counter Reading Revolving* restarts at 0 and adds the excess counter pulses. **It must not be used for safety-related applications.**
Redund.	---	R W	TRUE: Redundancy group created. FALSE: Module in mono operation. The redundancy group can only be created and deleted using the corresponding context menu.
Redundancy Value	BYTE	W	Enter the value that should be adopted! ▪ Min ▪ Max ▪ Average Default setting: Max **It is only displayed in the redundancy group tab!**
-> Reserved [UDINT]	UDINT	R	Without function! **It is only displayed in the redundancy group tab!**

Table 18: The **I/O Submodule CI24_51: Channels** in the Hardware Editor.

4.4.3.1 System Parameters with Redundant Input Wiring

The chapter describes the process values of the system parameters for counter modules with redundant input wiring.

System parameter	Process values with redundantly connected counter modules.
-> Counter Reading [UDINT]	The process value is the largest individual value (maximum value) of the two redundant modules. If one of the two redundant counter modules is replaced, the newly inserted module adopts the last valid process value stored in the processor module (X-CPU).
-> Count.Read. (Scaled) [REAL]	It is derived from the -> *Counter Reading [UDINT]* parameter.
-> Rotational Speed [mHz] [DINT]	The process value is the highest (max.) or lowest (min.) individual value of the two redundant modules, or the arithmetic mean (average) of the two individual values. The *Redundancy Value* parameter defines which value should be determined, see Chapter 4.4.3.
-> Rot. Speed (scaled) [REAL]	It is derived from the -> *Rotational Speed [mHZ] [DINT]* parameter.
-> Channel OK [BOOL]	TRUE: Fault-free redundant channel. The input value is valid. FALSE: Faulty redundant channel. Rotational speed (frequency) is set to 0 and the counter reading is frozen.
-> OC [BOOL]	AND operation of redundant value
-> SC [BOOL]	AND operation of redundant value
-> Overflow [BOOL]	TRUE: Counter overflow at redundant process value *-> Counter Reading [UDINT].* FALSE: No counter overflow with redundant process value *-> Counter Reading [UDINT].*
-> Level [BOOL]	OR gate of the redundant values
-> Leading [BOOL] (rotation direction)	AND operation of the redundant values. If a different rotation direction is detected, the status provides the last valid value.

Table 19: System Parameter Behavior with Redundancy

4.4.4 Description of *Submodule Status [DWORD]*

The following table specifies the coding of the *Submodule Status* parameter:

Coding	Description
0x00000001	Fault in hardware unit (submodule).
0x00000002	Reset of an I/O bus.
0x00000004	Fault detected while configuring the hardware.
0x00000008	Fault detected while checking the coefficients.

Table 20: Coding of *Submodule Status [DWORD]*

4.4.5 Description of *Diagnostic Status [DWORD]*

The following table specifies the coding of the *Diagnostic Status* parameter:

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>0</td><td>Diagnostic values are indicated consecutively.</td></tr>
<tr><td>100</td><td>Bit-coded temperature status.
0 = normal.
Bit0 = 1: Temperature threshold 1 has been exceeded.
Bit1 = 1: Temperature threshold 2 has been exceeded.
Bit2 = 1: Fault in temperature measurement.</td></tr>
<tr><td>101</td><td>Measured temperature (10 000 digits/ °C).</td></tr>
<tr><td>200</td><td>Bit-coded voltage status.
0 = normal.
Bit0 = 1: L1+ (24 V) is faulty.
Bit1 = 1: L2+ (24 V) is faulty.</td></tr>
<tr><td>201</td><td rowspan="3">Not used!</td></tr>
<tr><td>202</td></tr>
<tr><td>203</td></tr>
<tr><td>300</td><td>Comparator 24 V undervoltage (BOOL).</td></tr>
<tr><td>1001 … 1024</td><td>Status of the channels 1…24
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x0001</td><td>Fault occurred in hardware unit (submodule).</td></tr>
<tr><td>0x0002</td><td>Channel fault due to internal fault.</td></tr>
<tr><td>0x0010</td><td>Short-circuit detected.</td></tr>
<tr><td>0x0020</td><td>Open-circuit detected.</td></tr>
<tr><td>0x0040</td><td>Channel fault, fault in the even channel of a channel pair.</td></tr>
<tr><td>0x2000</td><td>Defective channel configuration.</td></tr>
</table></td></tr>
</table>

Table 21: Coding of *Diagnostic Status [DWORD]*

4.5 Connection Variants

This chapter describes the technically proper wiring of the module. The following connection variants are permitted.

The inputs are wired via connector boards equipped with the corresponding sensor selection plug. Specific connector boards are available for redundant wiring, see Chapter 3.6.

The supplies are decoupled via diodes; this ensures that the supplies of two redundant modules can supply one proximity switch or a control switching device of type 3.

NOTICE

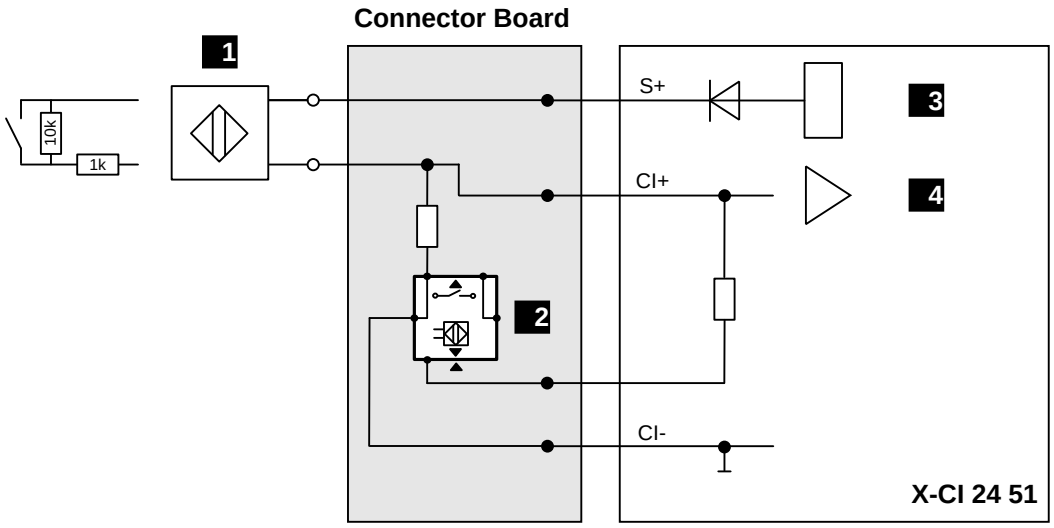
If the sensor selection plug is used, observe the following notes:

- **Ensure proper mounting positions of the sensor selection plug and the connected sensors!**
- **If the proximity switches are redundantly wired, ensure that the connector boards are equipped differently, with X-SS CB 01 or X-SS CB 02, see Figure 21.**

Failure to observe these instructions may result in malfunctions.

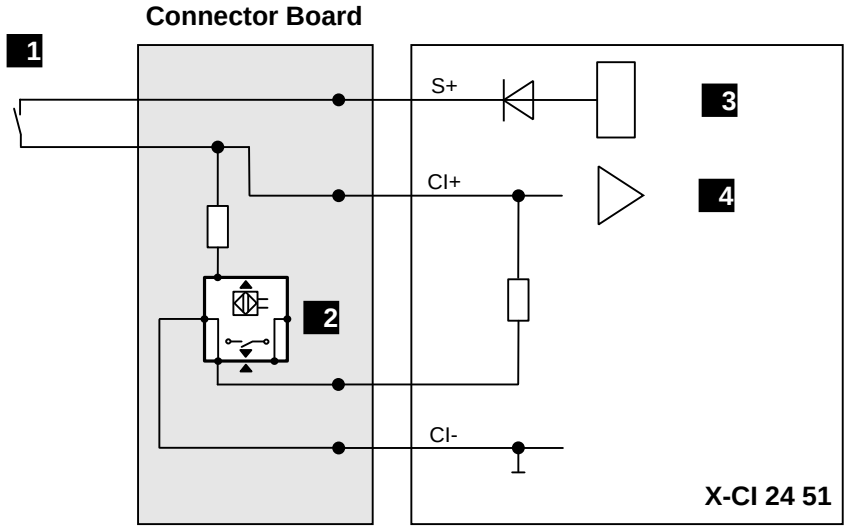
4.5.1 1-Channel Input Wiring Variants

In the wiring variants presented in Figure 15 through Figure 19, the counter modules use the mono connector boards X-CB 013 51 (with screw terminals) or X-CB 013 53 (with cable plug).



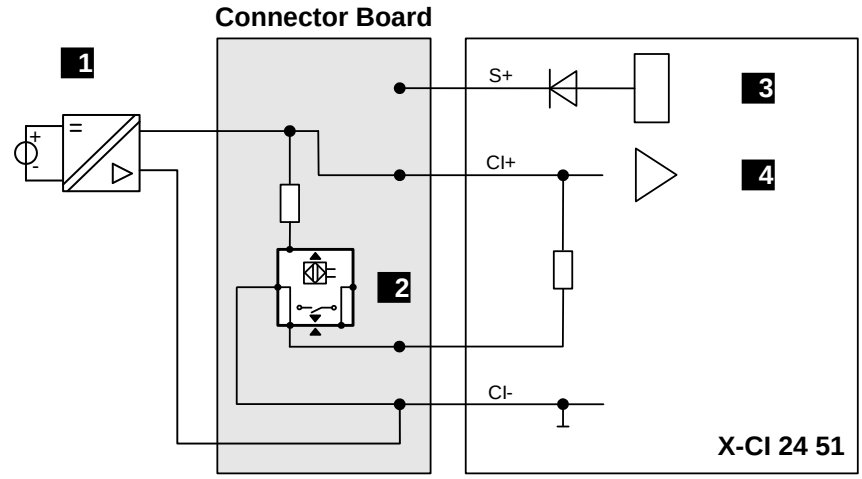
1 Proximity switch or wired mechanical contact
2 Sensor selection plug X-SS CB 01
3 Supply
4 Counter Input

Figure 15: 1-Channel Connection of a Proximity Switch



1 Switching device of type 3
2 Sensor selection plug X-SS CB 01
3 Supply
4 Counter Input

Figure 16: 1-Channel Connection of a Switching Device of Type 3



1 Digital signal source
2 Sensor selection plug X-SS CB 01
3 Supply
4 Counter Input

Figure 17: Wiring of a Digital Signal Source with Galvanically Separated Supply

NOTICE

Ensure proper polarity, when connecting the signal sources.

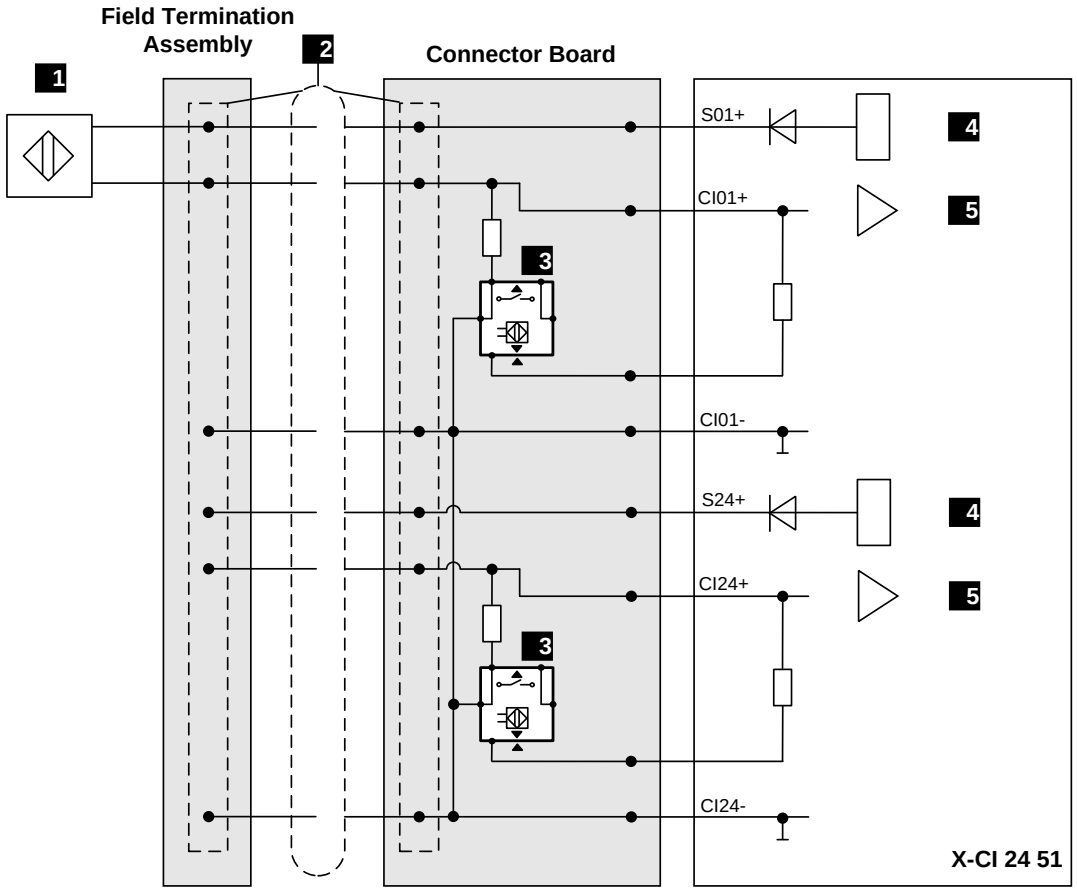
Reverse connector polarity on the counter input can damage the connector board.

4.5.2 1-Channel Input Wiring via X-FTA 002

The X-FTA 002 field termination assembly is used to connect the sensors, whereas the X-CA 005 system cable is used to connect the X-CB 013 53 mono connector board with cable plug.

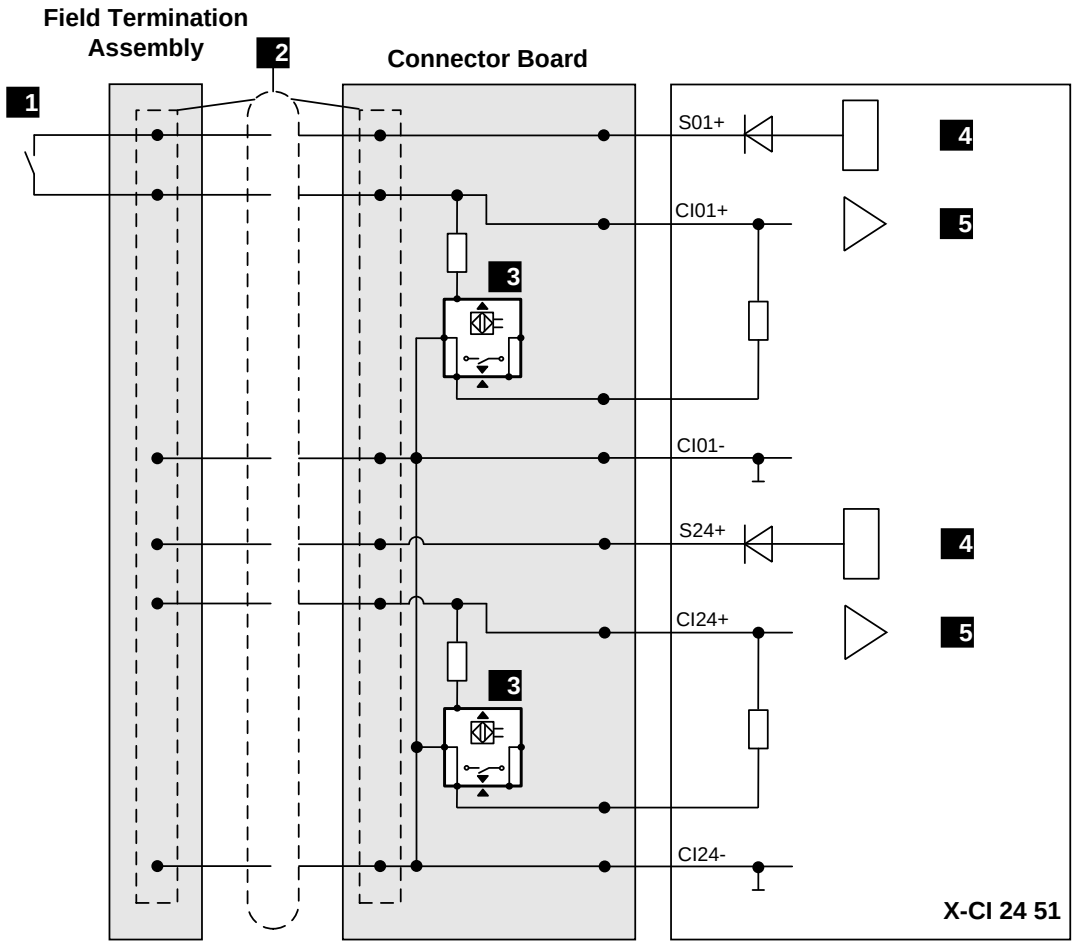
Sensor selection plug

The sensor selection plug (3) in Figure 18 and Figure 19 is drawn two times. This serves only for the better representation of the wiring variants!



1 Field level: proximity switch
2 System cable X-CA 005
3 Sensor selection plug X-SS CB 01
4 Supply
5 Counter input

Figure 18: Input Wiring via X-FTA 002 and Proximity Switch



1 Field level switching device of type 3
2 System cable X-CA 005
3 Sensor selection plug X-SS CB 01
4 Supply
5 Counter input

Figure 19: Input Wiring via X-FTA 002 and Switching Device of Type 3

4.5.3 Redundant Input Wiring Variants

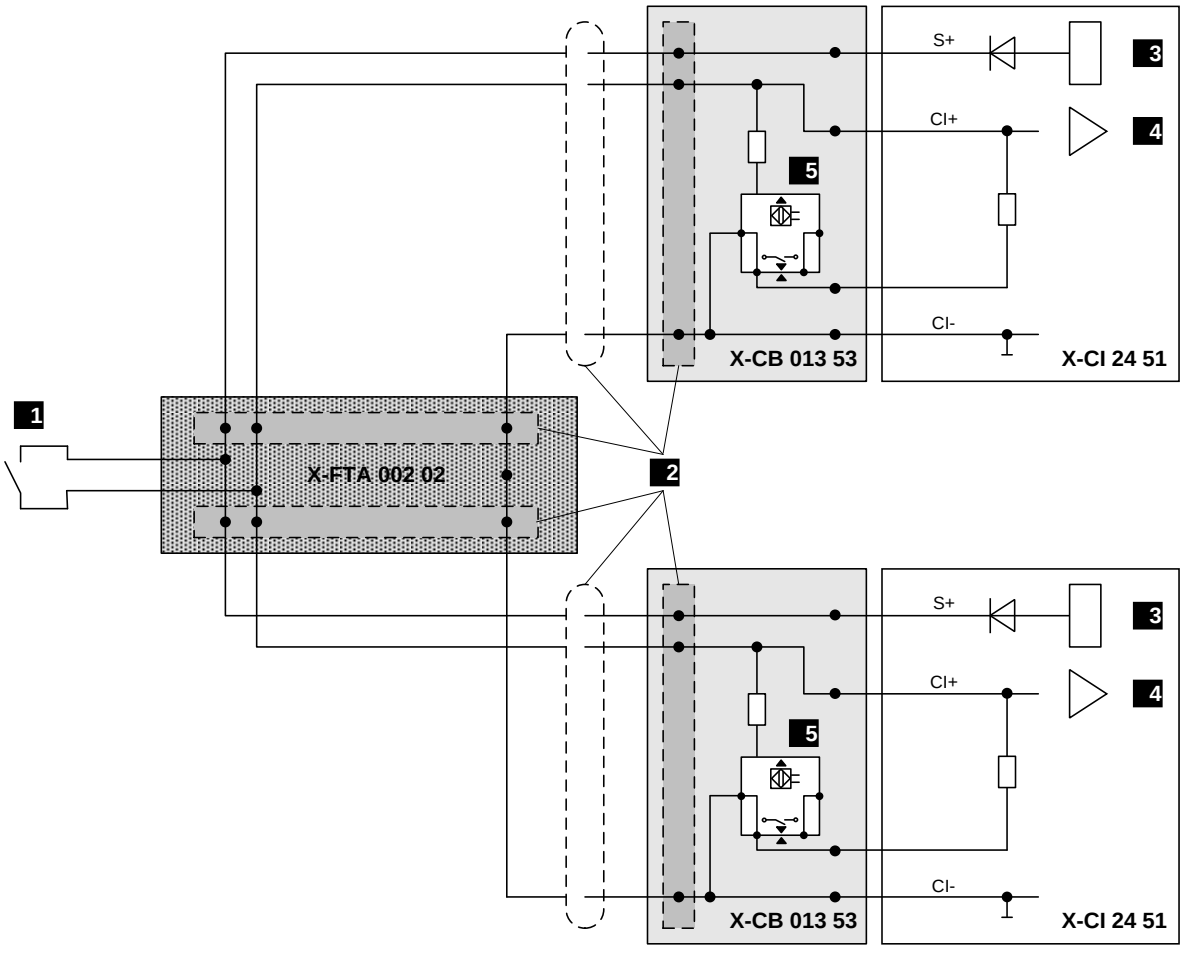
The inputs are redundantly wired via the redundant X-FTA 002 02; in this configuration, two counter modules are inserted into each mono connector board. The counter modules can also be inserted into two system base plates that are physically separated from one another.

4.5.3.1 Counter Modules with Redundant Connector Board

In this variant, the counter modules use the redundant X-FTA 002 02 field termination assembly. Each of the counter modules is inserted into one X-CB 013 53 mono connector board and is connected to the field termination assembly via the X-CA 005 system cables. The counter modules can be located adjacently to one another in the same base plate or be inserted into system base plates that are physically separated from one another.

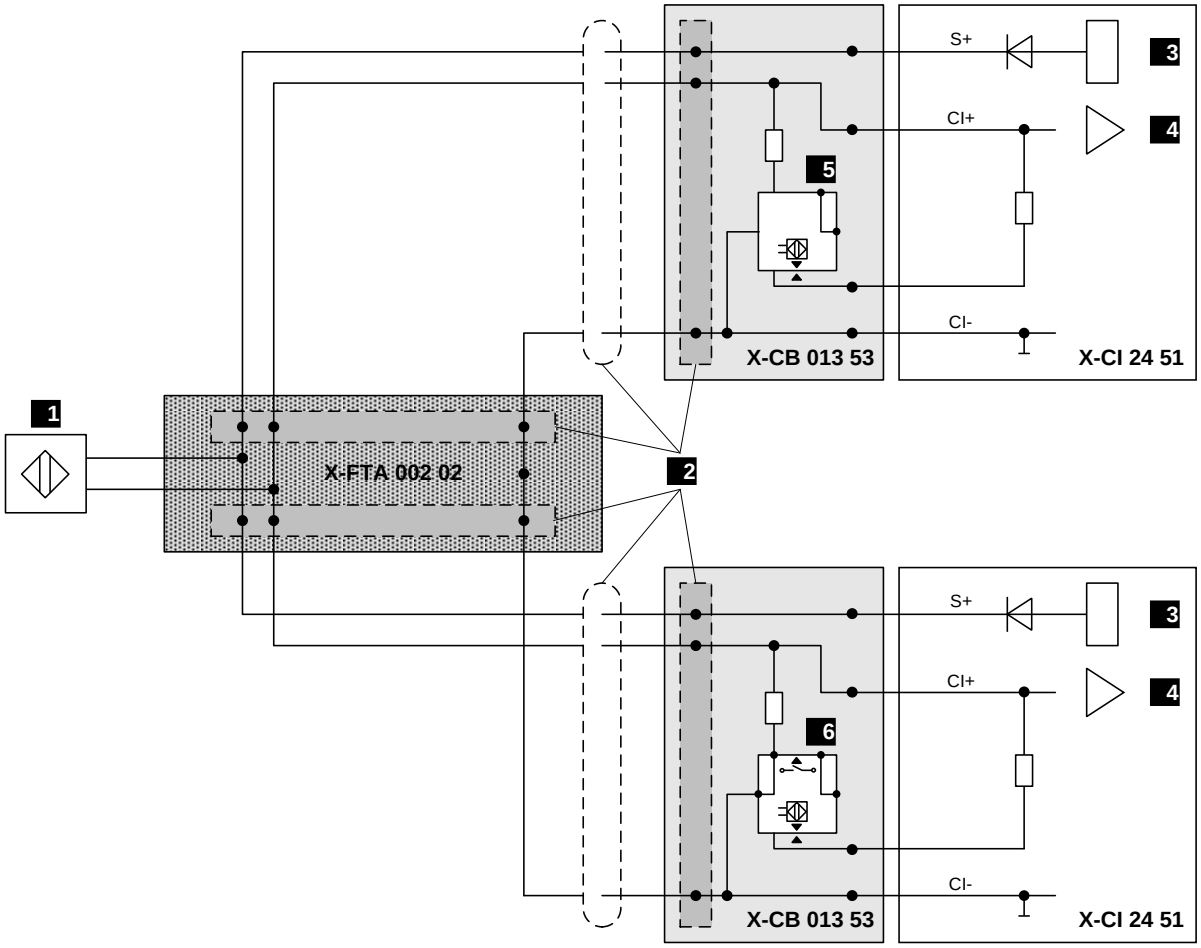
If a switching device of type 3 is used, the connector boards must be equipped with an X-SS CB 01 sensor selection plug, see Chapter 4.2.2.

If a proximity switch is connected, one of the connector boards must be equipped with an X-SS CB 01 sensor selection plug and the other must be fitted with an X-SS CB 02 sensor selection plug, see Figure 21.



1 Switching device of type 3
2 System cable X-CA 005
3 Supply
4 Counter input
5 Sensor selection plug X-SS CB 01

Figure 20: Switching Device of Type 3 Redundantly Connected via X-FTA 002 02



1 Proximity Switch
2 X-CA 005 system cable with cable plug
3 Supply
4 Counter input
5 Sensor selection plug X-SS CB 02
6 Sensor selection plug X-SS CB 01

Figure 21: Proximity Switches Redundantly Connected via X-FTA 002 02

4.5.4 Measuring the Rotational Speed with Detection of Rotation Direction

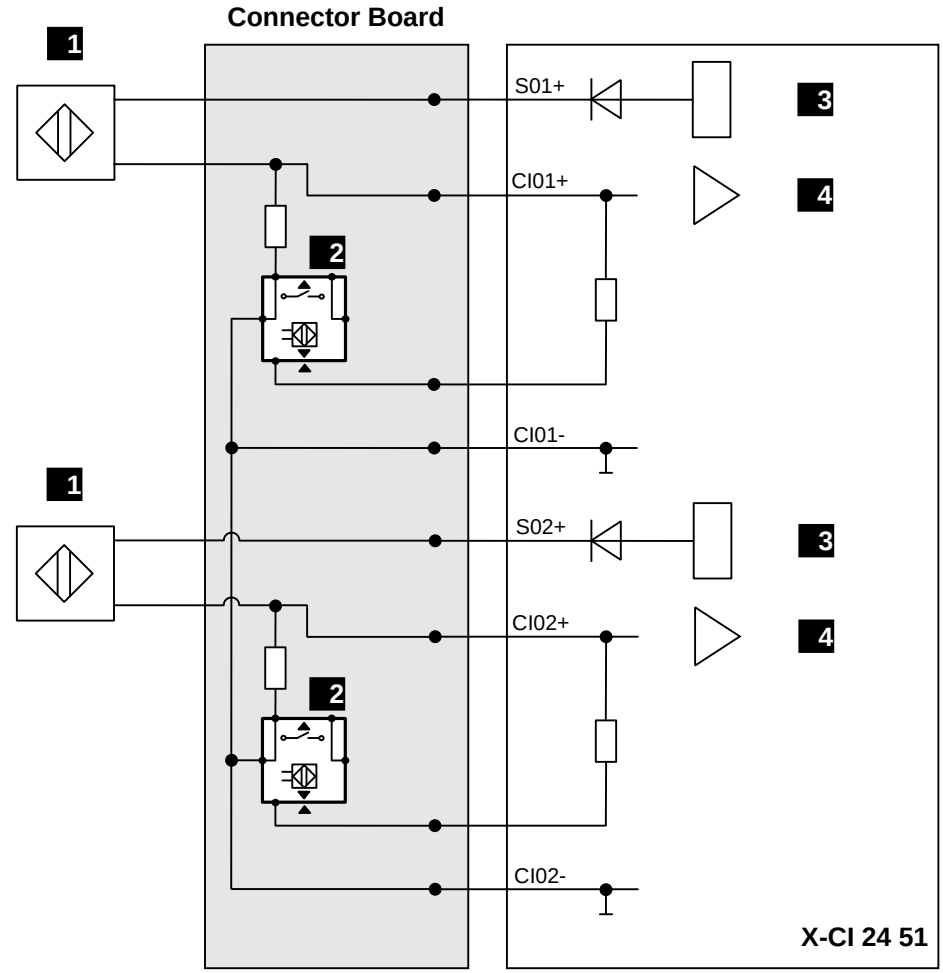
Two input signals are required for measuring the rotational speed with detection of rotation direction. The signals are led to one channel pair (e.g., CI01 and CI02).

NOTICE

This wiring is only permitted if the two input signals are led to one channel pair 1…12 of the module, see Figure 22 and Figure 23

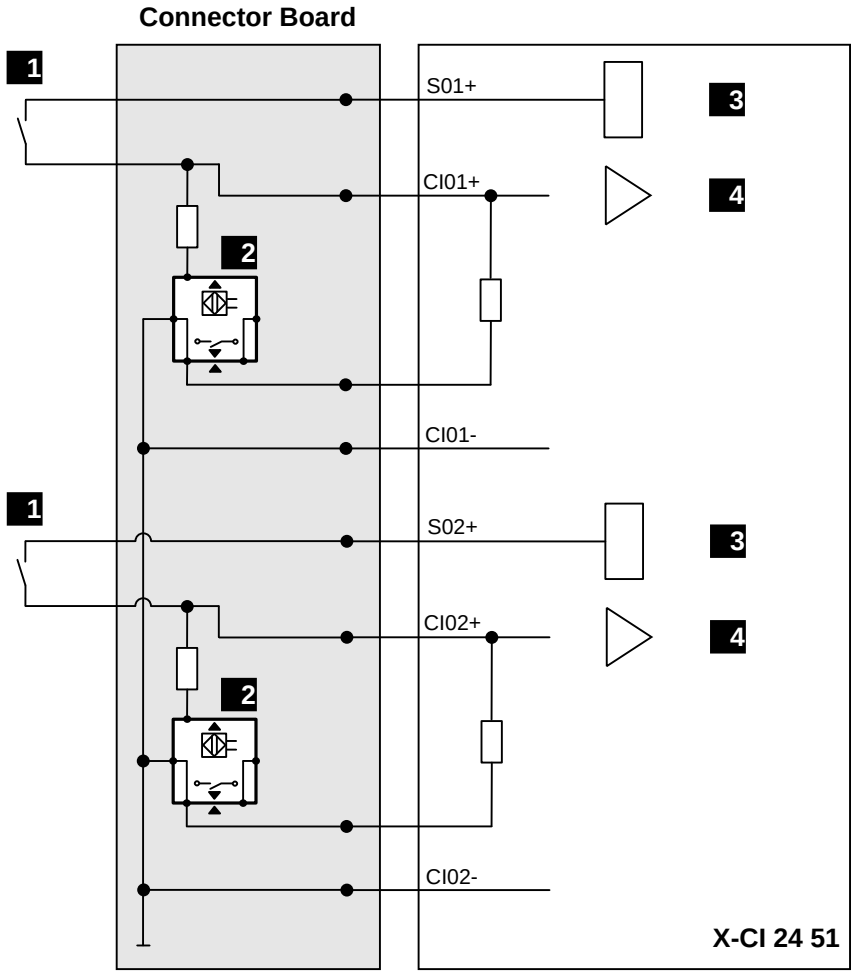
Sensor selection plug

The sensor selection plug (2) in Figure 24 and Figure 25 is drawn two times. This serves only for the better representation of the wiring variants!



1 Field level: proximity switch
2 Sensor selection plug X-SS CB 01
3 Supply
4 Counter input

Figure 22: Rotational Speed Measurement with Detection of Rotation Direction - Proximity Switch



1 Field level: switching device of type 3
2 Sensor selection plug X-SS CB 01
3 Supply
4 Counter input

Figure 23: Rotational Speed Measurement with Detection of Rotation Direction - Switching Device of Type 3

5 Operation

The module runs within a HIMax base plate and does not require any specific monitoring.

5.1 Handling

Direct handling of the module is not foreseen.

The module is operated from within the PADT, e.g., for forcing the counter outputs. For further details, refer to the SILworX documentation.

5.2 Diagnostics

LEDs on the front side of the module indicate the module state, see Chapter 3.4.2.

The diagnostic history of the module can also be read out using SILworX. Chapter 4.4.4 and Chapter 4.4.5 describe the most important diagnostic statuses.

i If a module is plugged in to a base plate, it generates diagnostic messages during its initialization phase indicating faults such as incorrect voltage values.

These messages only indicate a module fault if they occur after the system starts operation.

6 Maintenance

Defective modules must be replaced with a faultless module of the same type or with an approved replacement model.

When replacing modules, observe the instructions specified in the system manual (HI 801 001 E).

6.1 Maintenance Measures

As part of product maintenance, HIMA is continuously improving the operating systems of the modules. HIMA recommends using system downtimes to load the current operating system versions into the modules.

i The current operating system versions of modules are displayed in the SILworX Control Panel. The type label specifies the delivered module version, see Chapter 3.3.

Before loading operating systems into the modules, check the system compatibilities and restrictions of the operating system versions. To this end, use the applicable release notes. Use SILworX to load the operating systems into the modules and ensure that these are in the STOP state.

7 Decommissioning

To decommission the module, remove it from the base plate. For more details, refer to Chapter *Mounting and Removing the Module*.

8 Transport

To avoid mechanical damage, the components must be transported in packaging.

Always store the components in their original product packaging. This packaging also provides protection against electrostatic discharge (ESD). Note that the product packaging alone is not sufficient for transport.

9 Disposal

Industrial customers are responsible for correctly disposing of decommissioned hardware. Upon request, a disposal agreement can be arranged with HIMA.

All materials must be disposed of in an ecologically sound manner.

Appendix

Glossary

Term	Description
AI	Analog input
AO	Analog output
ARP	Address resolution protocol, network protocol for assigning the network addresses to hardware addresses
COM	Communication module
CRC	Cyclic redundancy check
DI	Digital input
DO	Digital output
EMC	Electromagnetic compatibility
EN	European standard
ESD	Electrostatic discharge
FB	Fieldbus
FBD	Function block diagrams
HW	Hardware
ICMP	Internet control message protocol, network protocol for status or error messages
IEC	International electrotechnical commission
Interference-free	Inputs are designed for interference-free operation and can be used in circuits with safety functions
MAC	Media access control address, hardware address of one network connection
PADT	Programming and debugging tool (in accordance with IEC 61131-3), PC with SILworX
PELV	Protective extra low voltage
PES	Programmable electronic system
R	Read, the variable is read out
R/W	Read/Write, column title for system variable type
Rack ID	Base plate identification (number)
r_P	Peak value of a total AC component
SB	System bus (module)
SC/OC	Short-circuit/open-circuit
SELV	Safety extra low voltage
SFF	Safe failure fraction, portion of faults that can be safely controlled
SIL	Safety integrity level (in accordance with IEC 61508)
SILworX	Programming tool
SNTP	Simple network time protocol (RFC 1769)
SRS	System.Rack.Slot, addressing of a module
SW	Software
TMO	Timeout
W	Write, the variable receives a value, e.g., from the user program
WD	Watchdog, device for monitoring the system's correct operation. Signal for fault-free process
WDT	Watchdog time

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