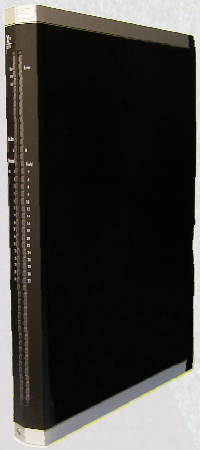


HIMax®

Analog Input Module Manual

SAFETY NONSTOP

HIMA

X-AI 32 01

8

Contact

HIMA contact details:

HIMA Paul Hildebrandt GmbH + Co KG

P.O. Box 1261

68777 Brühl, Germany

Phone: +49 6202 709-0

Fax: +49 6202 709-107

E-mail: info@hima.com

Revision index	Revisions	Type of Change	
		technical	editorial
4.00	New edition for SILworX V4	X	X

Table of Contents

1 Introduction

The present 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 is organized in the following main chapters:

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

Additionally, the following documents must be taken into account:

Name	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 Communication manual	Description of communication and protocols	HI 801 101 E
SILworX Online Help (OLH)	Instructions on how to use SILworX	-
First Steps	Introduction to SILworX	HI 801 103 E

Table 1: Additional Relevant Manuals

The latest manuals can be downloaded from the HIMA website at www.hima.com. The revision index on the footer can be used to compare the current version of existing manuals with the Internet edition.

1.2 Target Audience

This document addresses system planners, configuration engineers, programmers of automation devices and personnel authorized to implement, operate and maintain the devices and systems. Specialized knowledge of safety-related automation systems is required.

1.3 Formatting Conventions

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

Bold:	To highlight important parts Names of buttons, menu functions and tabs that can be clicked and used in SILworX.
Italics:	System parameter and variables
`Courier`	Literal user inputs
RUN	Operating state are designated by capitals
Chapter 1.2.3	Cross references are hyperlinks even though they are not particularly marked. When the cursor hovers over a hyperlink, it changes its shape. Click the hyperlink to jump to the corresponding position.

Safety notes and operating tips are particularly marked.

1.3.1 Safety Notes

The safety notes are represented as described below.
These notes must absolutely be observed to reduce the risk to a minimum. The content is structured as follows:

- Signal word: danger, warning, caution, notice
- Type and source of danger
- Consequences arising from the danger
- Danger prevention

⚠ SIGNAL WORD

Type and source of danger!
Consequences arising from the danger
Danger prevention

The signal words have the following meanings:

- Danger indicates hazardous situation which, if not avoided, will result in death or serious injury.
- Warning indicates hazardous situation which, if not avoided, could result in death or serious injury.
- Warning indicates hazardous situation which, if not avoided, could result in minor or modest injury.
- Notice indicates a hazardous situation which, if not avoided, could result in property damage.

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 corresponding to the 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 manual must be strictly observed. The product may only be used if all guidelines and safety instructions are adhered to.

This product is operated in accordance with SELV or PELV. No imminent danger results from the module itself. The use in Ex-Zone is 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

Requirement type	Range of values
Protection class	Protection class III in accordance with IEC/EN 61131-2
Ambient temperature	0...+60 °C
Storage temperature	-40...+85 °C
Pollution	Pollution degree II in accordance with IEC/EN 61131-2
Altitude	< 2000 m
Housing	Standard: IP20
Supply voltage	24 VDC

Table 2: Environmental Requirements

Exposing the HIMax system to environmental conditions other than those specified in this manual can cause the HIMax system to malfunction.

2.1.2 ESD Protective Measures

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

NOTE

Device damage due to electrostatic discharge!

- **When performing the work, make sure that the working area is free of static and wear an ESD wrist strap.**
- **If not used, ensure that the device is protected from electrostatic discharge, e.g., by storing it in its packaging.**

2.2 Residual Risk

No imminent danger results from a HIMax module itself.

Residual risk may result from:

- Faults in the engineering
- Faults in the user program
- Faults in the wiring

2.3 Safety Precautions

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

2.4 Emergency Information

A HIMax controller is a part of the safety equipment of a system. If the controller fails, the system adopts the safe state.

In case of emergency, no action that may prevent the HIMax systems from operating safely is permitted.

3 Product Description

The X-AI 32 01 analog input module is intended for use in the programmable electronic system (PES) HIMax.

The module can be inserted in any of the base plate slots with the exception of the slots reserved for system bus modules. For more information, refer to the System Manual (HI 801 001 E).

The module is used to evaluate up to 32 analog input signals.

The module has been certified by the TÜV for safety-related applications up to SIL 3 (IEC 61508, IEC 61511 and IEC 62061), Cat. 4 (EN 954-1) and PL e (EN ISO 13849-1).

Refer to the HIMax Safety Manual (HI 801 003 E) for more information on the standards used to test and certify the modules and the HIMax system.

3.1 Safety Function

The module measures the current of the connected devices with safety-related accuracy, providing the transmitter supply with a guaranteed minimum voltage.

The safety function is performed in accordance with SIL 3.

3.1.1 Reaction in the Event of a Fault

If a fault occurs, the module adopts the safe state and the assigned input variables transmit the initial value (default value = 0) to the user program.

The initial values must be set to 0 to ensure that the input variables transmit the value 0 to the user program if a fault occurs. If the raw value is evaluated instead of the process value, the user must program the monitoring function and the value in the event of faults from within the user program.

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

3.2 Scope of Delivery

The module must be installed on a suitable connector board to be able to operate. If a 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 3.6, the system cables are described in Chapter 3.7. The FTAs are described in own 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.)
- Software revision index (SW Rev.)
- Operating voltage (Power)
- Ex specifications (if applicable)
- Production year (Prod-Year:)

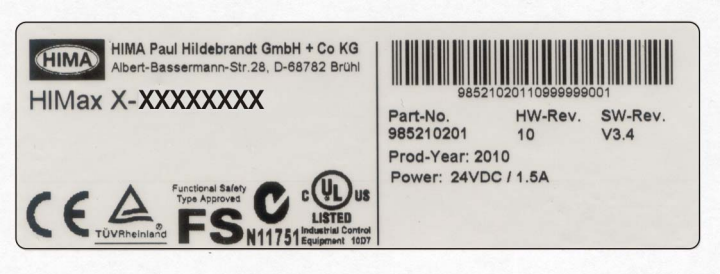


Figure 1: Sample Type Label

3.4 Structure

The module has 32 analog current inputs (0/4...20 mA), each input is measured and functionally tested using two internal measuring facilities. A short-circuit-proof transmitter supply is assigned to each input.

The 32 analog inputs can be used to evaluate the values measured for the transmitters, safety transmitters or wired contacts. Two-wire or three-wire transmitters with a maximum supply current of 30 mA can be connected to the module.

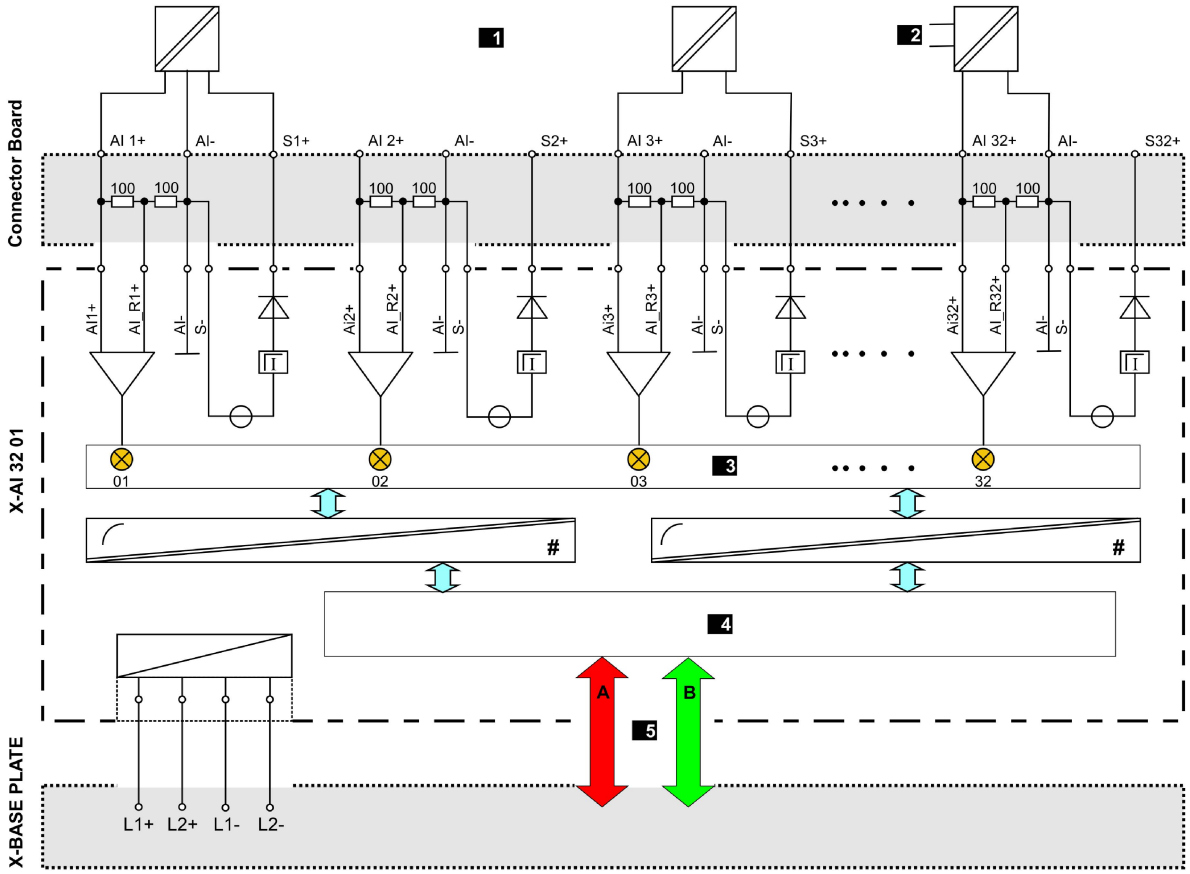
The functional units are electrically isolated to ensure that the input signals are non-reactive.

The safety-related 1oo2 processor system for the I/O module controls and monitors the I/O level. The data and states of the I/O module are made available 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 analog inputs, see Chapter 3.4.2.

3.4.1 Block Diagram

The following block diagram illustrates the structure of the module.



1 Field Side: Transmitter and Wired Contacts
2 External Transmitter Supply
3 Interface
4 Safety-Related Processor System
5 System Busses

Figure 2: Block Diagram

3.4.2 Indicators

The following figure shows the LED indicators for the module.

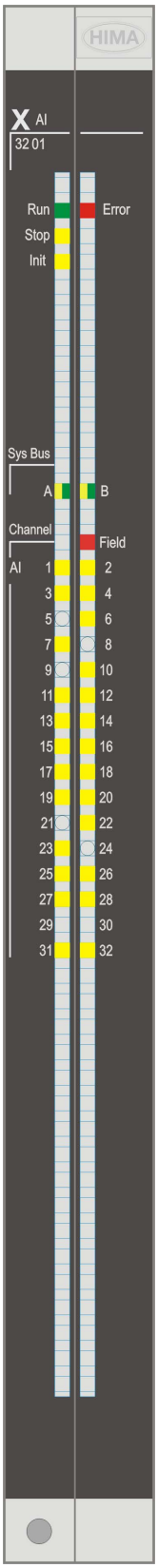


Figure 3: Indicators

The LEDs indicate the operating state of the module.

The LEDs on the module are divided into three groups:

- Module status indicators (Run, Error, Stop, Init)
- System bus indicators (A, B)
- I/O indicators (AI 1...32, Field)

When the supply voltage is switched on, a LED test is performed and all LEDs briefly flash simultaneously.

Definition of Blinking Frequencies

The following table defines the blinking frequencies of the LEDs:

Name	Blinking Frequencies
Blinking1	Long (approx. 600 ms) on, long (approx. 600 ms) off
Blinking2	Short (approx. 200 ms) on, short (approx. 200 ms) off, short (approx. 200 ms) on, long (approx. 600 ms) off
Blinking-x	Ethernet communication: Flashing in sync with data transfer

Table 3: Blinking Frequencies of LEDs

3.4.3 Module Status Indicators

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

LED	Color	Status	Description
Run	Green	On	Module in RUN, normal operation
		Blinking1	Module state: STOP/OS_DOWNLOAD or OPERATE (only with processor modules)
		Off	Module not in RUN, observe the other status LEDs
Error	Red	On/Blinking1	Internal module faults detected by self-tests, e.g., hardware, software or voltage supply. Fault while loading the operating system
		Off	Normal operation
Stop	Yellow	On	Module state: STOP / VALID CONFIGURATION
		Blinking1	Module state: STOP / INVALID CONFIGURATION or STOP / OS_DOWNLOAD
		Off	Module not in STOP, observe the other status LEDs
Init	Yellow	On	Module state: INIT, observe the other status LEDs
		Blinking1	Module state: LOCKED, observe to the other status LEDs
		Off	Module state: neither INIT nor LOCKED, observe the other status LEDs

Table 4: Module Status Indicators

3.4.4 System Bus Indicators

The system bus 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 5: System Bus Indicators

3.4.5 I/O Indicators

LED	Color	Status	Description
Channel 1...32	Yellow	On	The input current is > 4 mA or greater than the HIGH switching point (dig) configured in SILworX.
		Blinking2	Channel fault (module field or hardware fault). Input current > 20 mA
		Off	The input current is < 4 mA or less than the LOW switching point (dig) configured in SILworX.
Field	Red	Blinking2	Field fault on at least one channel or supply (open-circuit, short-circuit, over-current, etc.) Depending on the configured current thresholds.
		Off	No faults on the field zone.

Table 6: I/O Indicators

3.5 Product Data

General	
Supply voltage	24 VDC, -15 %...+20 %, $r_P \leq 5$ %, SELV, PELV
Current input	min. 500 mA (without channels/transmitter supplies) max. 1.5 A (in case of short-circuit of the transmitter supplies)
Current input per channel	min. 0 mA (without transmitter supply) min. 30 mA (with transmitter supply)
Operating temperature	0...+60 °C
Storage temperature	-40...+85 °C
Humidity	max. 95 % relative humidity, non-condensing
Type of protection	IP20
Dimensions (H x W x D) in mm	310 x 29.2 x 230
Weight	approx. 1.4 kg

Table 7: Product Data

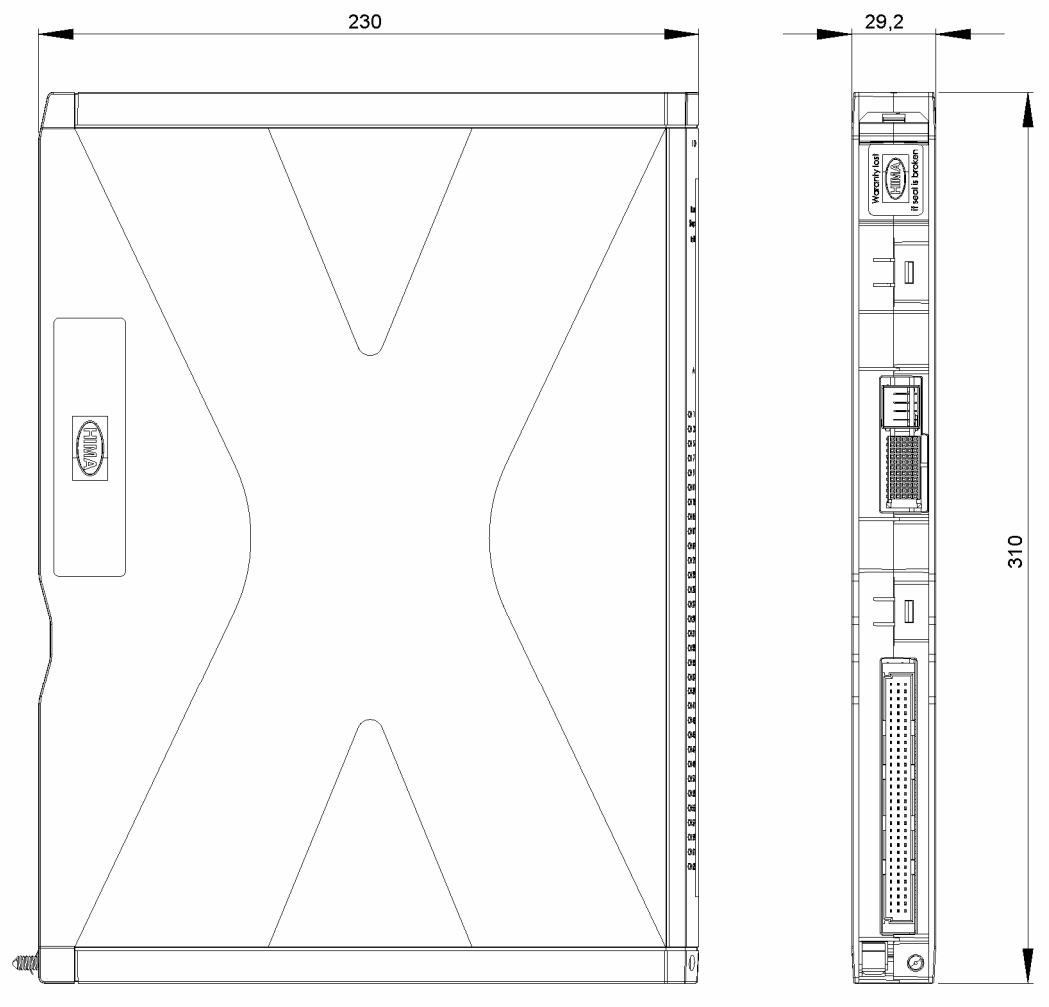


Figure 4: Views

Analog inputs	
Number of inputs (number of channels)	32 with common ground AI- (electrical isolation from the system bus and the 24 VDC supply voltage).
Nominal range	0/4...20 mA
Operating range	0...22.5 mA
Digital resolution	12-bit
Shunt for current measurement	200 Ω [1)]
Maximum permitted current via shunt	50 mA
Withstand voltage of the input	≤ 10 VDC
Interference voltage suppression	> 60 dB (common mode 50/60 Hz)
Refresh of measured values (in the user program)	Cycle time of the user program
Sampling time	2 ms
Metrological accuracy	
Metrological accuracy on the entire temperature range (-10 °C...70 °C)	± 0.15 % of final value
Settling time to 99 % of the process value when the input signal changes	15 ms
[1)] For high precision measurements see Table 11	

Table 8: Specifications for the Analog Inputs

Transmitter supply	
Number of transmitter supplies	32
Output voltage for transmitter supply	26.5 VDC, +0/-15 %
Output current of transmitter supply	max. 30 mA
Monitoring of transmitter supply	Undervoltage: 22.5 VDC Overvoltage: 30 VDC
Max. number of transmitter supplies that may be simultaneously short-circuited.	12 If more than 12 supplies are closed for longer than 3 seconds, the entire transmitter supply is switched off. If the overload disappears within 30 seconds, the transmitter supply is switched on again.
Maximum connectable load (transmitter + line)	≤ 750 Ω at 22.5 mA

Table 9: Product Data for the Transmitter Supply

3.6 Connector Boards

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

The following connector boards are available for the module:

Connector board	Description
X-CB 008 01	Connector board with screw terminals
X-CB 008 02	Redundant connector board with screw terminals
X-CB 008 03	Connector board with cable plug
X-CB 008 04	Redundant connector board with cable plug
X-CB 008 05	Redundant connector board with cable plug, redundant field termination assembly
X-CB 008 06	Three-fold redundant connector board with screw terminals
X-CB 008 07	Three-fold redundant connector board with cable plug

Table 10: Available Connector Boards

For high precision measurements, the following connector boards must be used:

Connector board	Description
X-CB 019 01	Connector board with screw terminals
X-CB 019 02	Redundant connector board with screw terminals
X-CB 019 03	Connector board with cable plug
X-CB 019 04	Redundant connector board with cable plug

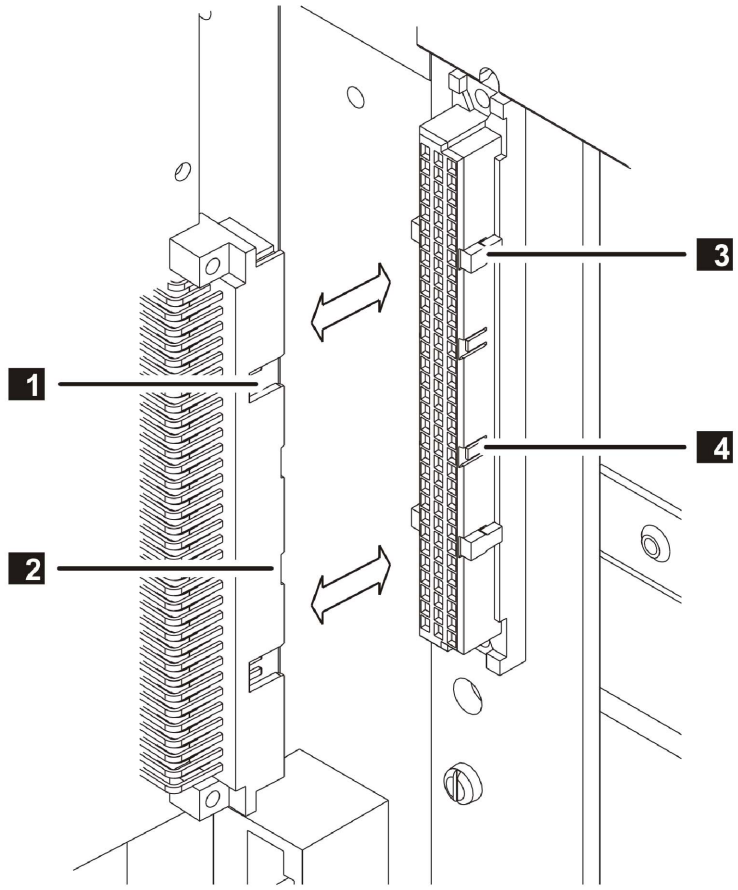
Table 11: Connector Boards for High Precision Measurements

3.6.1 Mechanical Coding of Connector Boards

I/O modules and connector boards are mechanically coded starting from hardware revision AS10 to prevent them from being equipped with improper I/O modules. Coding avoids incorrect installation of improper I/O modules thus preventing negative effects on redundant modules and field zone. A part from that, improper equipment has no effect on the HIMax system since only I/O modules that are correctly configured in SILworX enter the RUN state.

I/O modules and the corresponding connector boards have a mechanical coding in 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.

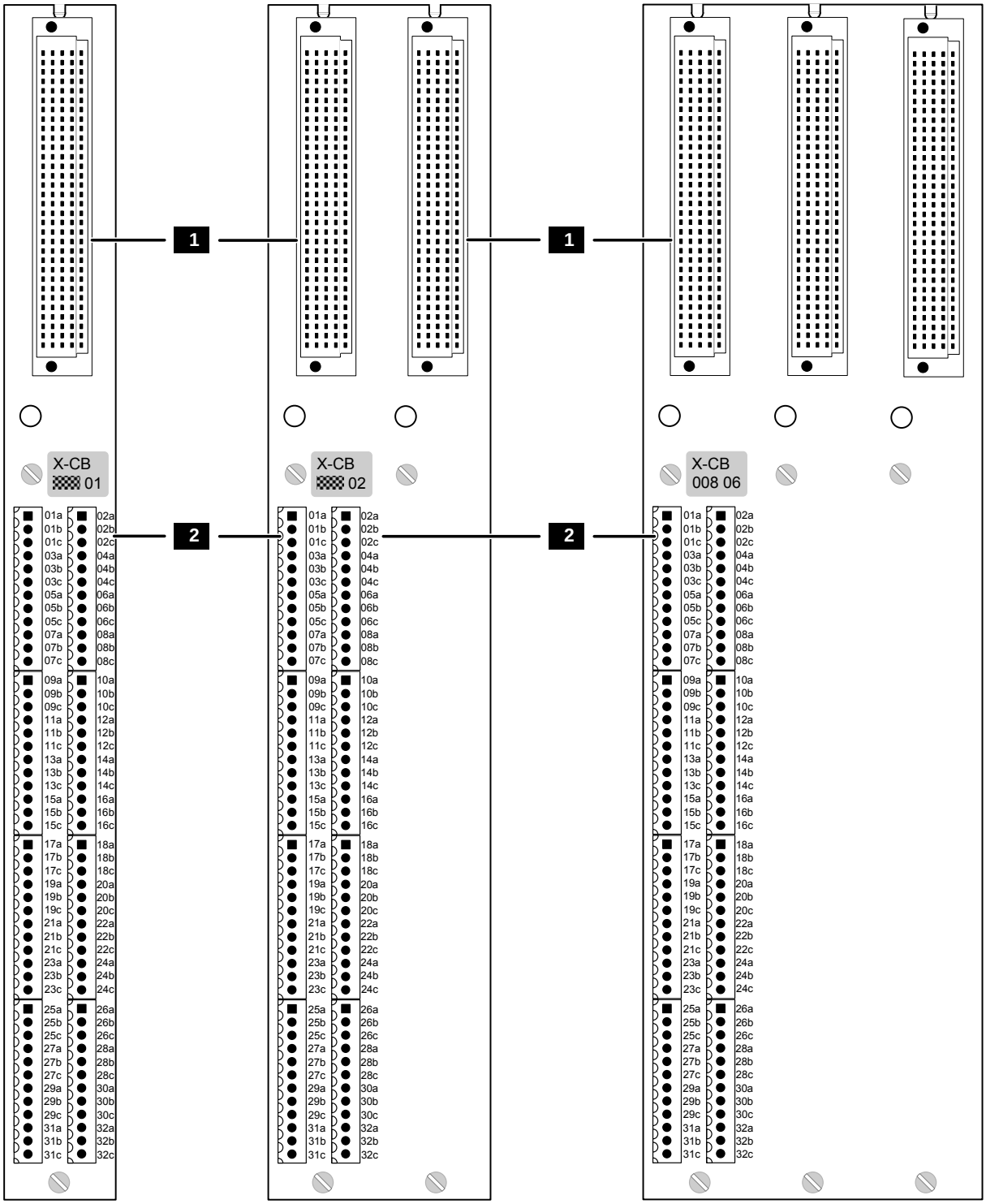
3.6.2 Coding of X-CB 008 Connector Boards

a7	a13	a20	a26	c7	c13	c20	c26
		X		X		X	

Table 12: Position of Coding Wedges

3.6.3 Pin Assignment for Connector Boards with Screw Terminals

Mono	Redundant	Three-fold redundant
X-CB 008 01 X-CB 019 01	X-CB 008 02 X-CB 019 02	X-CB 008 06



1 I/O Module Plug

2 Connection to the Field Zone (Screw Terminal Connector Block)

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	S1+	1	02a	S2+
2	01b	AI1+	2	02b	AI2+
3	01c	AI1-	3	02c	AI2-
4	03a	S3+	4	04a	S4+
5	03b	AI3+	5	04b	AI4+
6	03c	AI3-	6	04c	AI4-
7	05a	S5+	7	06a	S6+
8	05b	AI5+	8	06b	AI6+
9	05c	AI5-	9	06c	AI6-
10	07a	S7+	10	08a	S8+
11	07b	AI7+	11	08b	AI8+
12	07c	AI7-	12	08c	AI8-
Pin no.	Designation	Signal	Pin no.	Designation	Signal
1	09a	S9+	1	10a	S10+
2	09b	AI9+	2	10b	AI10+
3	09c	AI9-	3	10c	AI15+
4	11a	S11+	4	12a	S12+
5	11b	AI11+	5	12b	AI12+
6	11c	AI11-	6	12c	AI12-
7	13a	S13+	7	14a	S14+
8	13b	AI13+	8	14b	AI14+
9	13c	AI13-	9	14c	AI14-
10	15a	S15+	10	16a	S16+
11	15b	AI15+	11	16b	AI16+
12	15c	AI15-	12	16c	AI16-
Pin no.	Designation	Signal	Pin no.	Designation	Signal
1	17a	S17+	1	18a	S18+
2	17b	AI17+	2	18b	AI18+
3	17c	AI17-	3	18c	AI18-
4	19a	S19+	4	20a	S20+
5	19b	AI19+	5	20b	AI20+
6	19c	AI19-	6	20c	AI20-
7	21a	S21+	7	22a	S22+
8	21b	AI21+	8	22b	AI22+
9	21c	AI21-	9	22c	AI22-
10	23a	S23+	10	24a	S24+
11	23b	AI23+	11	24b	AI24+
12	23c	AI23-	12	24c	AI24-

Pin no.	Designation	Signal	Pin no.	Designation	Signal
1	25a	S25+	1	26a	S26+
2	25b	AI25+	2	26b	AI26+
3	25c	AI25-	3	26c	AI26-
4	27a	S27+	4	28a	S28+
5	27b	AI27+	5	28b	AI28+
6	27c	AI27-	6	28c	AI28-
7	29a	S29+	7	30a	S30+
8	29b	AI29+	8	30b	AI30+
9	29c	AI29-	9	30c	AI30-
10	31a	S31+	10	32a	S32+
11	31b	AI31+	11	32b	AI32+
12	31c	AI31-	12	32c	AI32-

Table 13: Terminal Assignment for Connector Boards with Screw Terminals

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

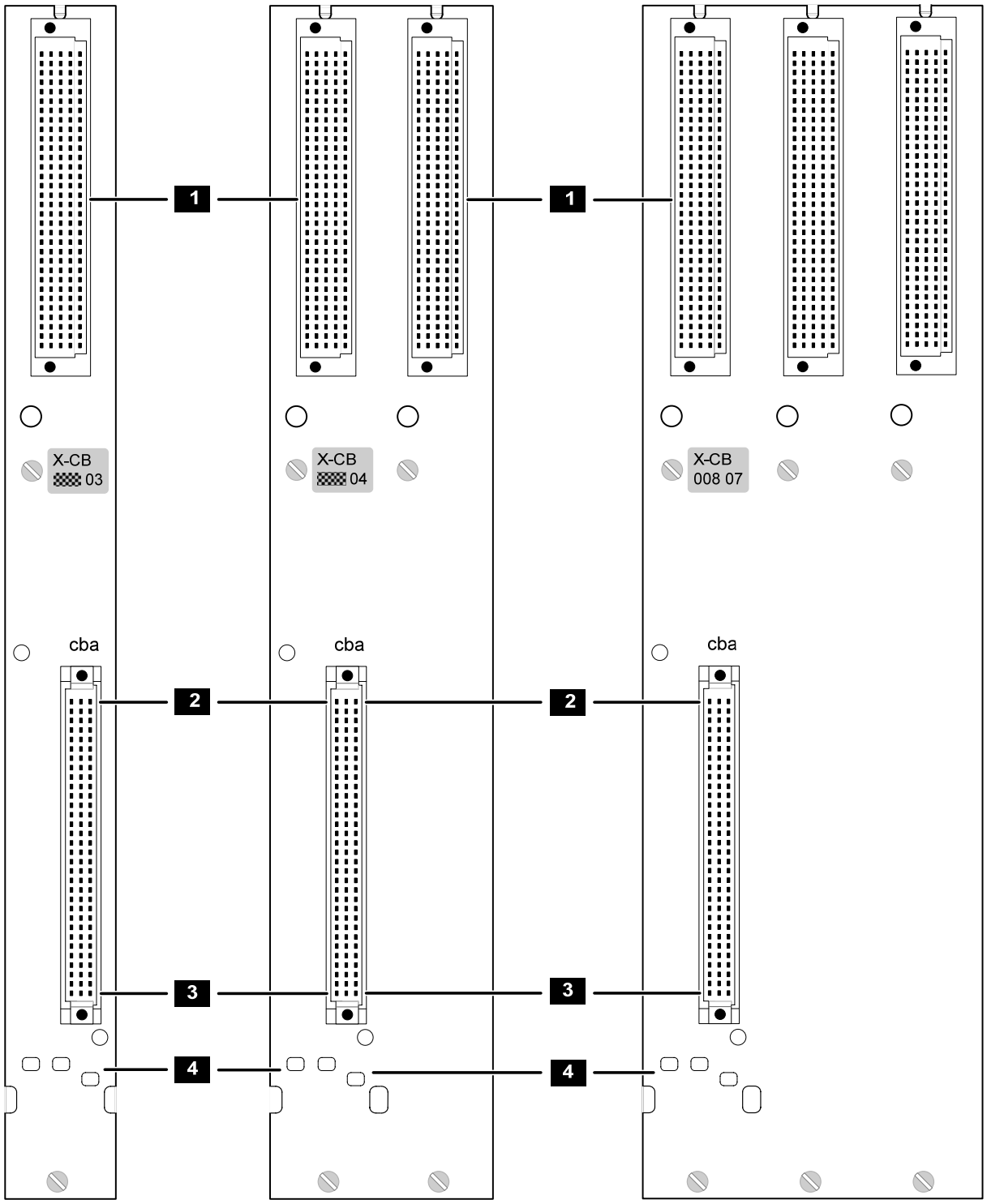
The cable plugs feature the following properties:

Connection to the field zone	
Cable plugs	8 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 14: Cable Plug Properties

3.6.5 Pin Assignment for Connector Boards with Cable Plug

Mono	Redundant	Three-fold redundant
X-CB 008 03 X-CB 019 03	X-CB 008 04 X-CB 019 04	X-CB 008 07



1 I/O Module Plug

2 Connection to the Field Zone (Cable Plug in Row 1)

3 Connection to the Field Zone (Cable Plug in Row 32)

4 Coding for 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.

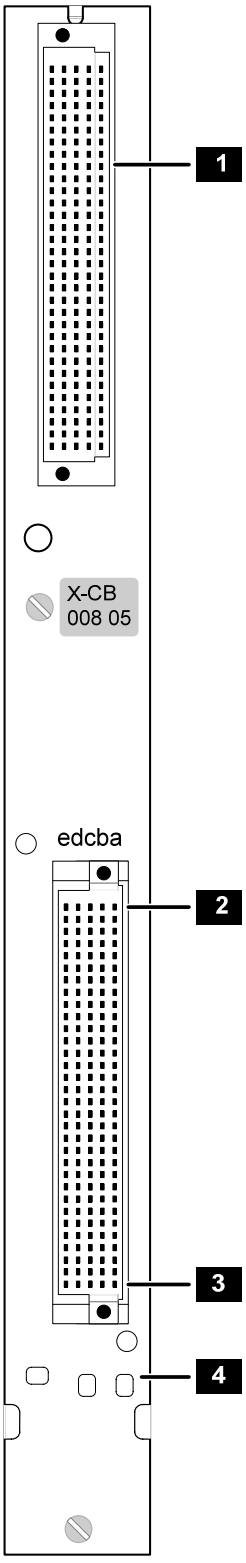
Lead marking based on DIN 47100:

Row	c		b		a	
	Signal	Color	Signal	Color	Signal	Color
1	S32+	PK-BN [1)]	AI32+	WH-PK [1)]	Reserved	YE-BU [1)]
2	S31+	GY-BN [1)]	AI31+	WH-GY [1)]	Reserved	GN-BU [1)]
3	S30+	YE-BN [1)]	AI30+	WH-YE [1)]	Reserved	YE-PK [1)]
4	S29+	BN-GN [1)]	AI29+	WH-GN [1)]	Reserved	PK-GN [1)]
5	S28+	RD-BU [1)]	AI28+	GY-PK [1)]	Not used	
6	S27+	VT [1)]	AI27+	BK [1)]	Not used	
7	S26+	RD [1)]	AI26+	BU [1)]	Not used	
8	S25+	PK [1)]	AI25+	GY [1)]	Not used	
9	S24+	YE [1)]	AI24+	GN [1)]	Not used	
10	S23+	BN [1)]	AI23+	WH [1)]	Not used	
11	S22+	RD-BK	AI22+	BU-BK	Not used	
12	S21+	PK-BK	AI21+	GY-BK	Not used	
13	S20+	PK-RD	AI20+	GY-RD	Not used	
14	S19+	PK-BU	AI19+	GY-BU	Not used	
15	S18+	YE-BK	AI18+	GN-BK	Not used	
16	S17+	YE-RD	AI17+	GN-RD	Not used	
17	S16+	YE-BU	AI16+	GN-BU	Not used	
18	S15+	YE-PK	AI15+	PK-GN	Not used	
19	S14+	YE-GY	AI14+	GY-GN	Not used	
20	S13+	BN-BK	AI13+	WH-BK	Not used	
21	S12+	BN-RD	AI12+	WH-RD	Not used	
22	S11+	BN-BU	AI11+	WH-BU	Not used	
23	S10+	PK-BN	AI10+	WH-PK	Not used	
24	S9+	GY-BN	AI9+	WH-GY	Not used	
25	S8+	YE-BN	AI8+	WH-YE	AI-	YE-GY [1)]
26	S7+	BN-GN	AI7+	WH-GN	AI-	GY-GN [1)]
27	S6+	RD-BU	AI6+	GY-PK	AI-	BN-BK [1)]
28	S5+	VT	AI5+	BK	AI-	WH-BK [1)]
29	S4+	RD	AI4+	BU	AI-	BN-RD [1)]
30	S3+	PK	AI3+	GY	AI-	WH-RD [1)]
31	S2+	YE	AI2+	GN	AI-	BN-BU [1)]
32	S1+	BN	AI1+	WH	AI-	WH-BU [1)]

[1)] Additional orange ring if one lead marking color is repeated.

Table 15: Pin Assignment for the System Cable Plug

3.6.7 Connector Board Redundancy using Two System Base Plates



1 I/O Module Plug
2 Connection to the Field Zone (Cable Plug in Row 1)
3 Connection to the Field Zone (Cable Plug in Row 32)
4 Coding for Cable Plugs

Figure 8: Connector Board with Cable Plug, Variant X-CB 008 05

3.6.8 Pin Assignment for X-CB 008 05

HIMA provides ready-made system cables for use with this connector board, 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.

Lead marking based on DIN 47100:

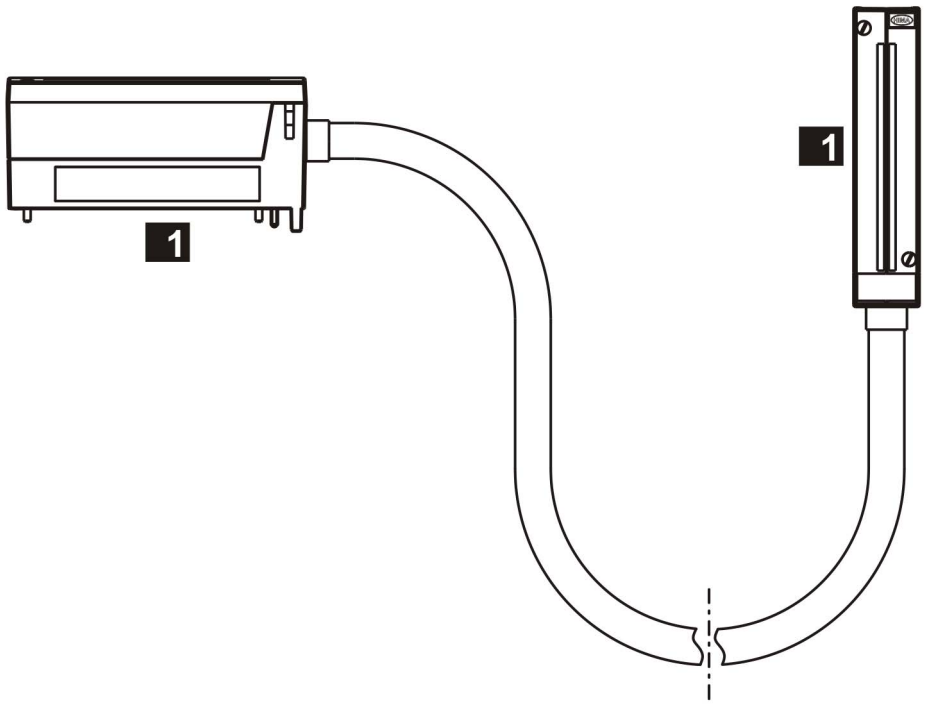
Row	e		d		c		b		a	
	Signal	Color	Signal	Color	Signal	Color	Signal	Color	Signal	Color
1	S32+	RD 2)	AI_R32+	PK-BN 1)	AI32+	WH-PK 1)			reserv.	YE-GY 2)
2	S31+	BU 2)	AI_R31+	GY-BN 1)	AI31+	WH-GY 1)			reserv.	GY-GN 2)
3	S30+	PK 2)	AI_R30+	YE-BN 1)	AI30+	WH-YE 1)			reserv.	BN-BK 2)
4	S29+	GY 2)	AI_R29+	BN-GN 1)	AI29+	WH-GN 1)			reserv.	WH-BK 2)
5	S28+	YE 2)	AI_R28+	RD-BU 1)	AI28+	GY-PK 1)			Not used	
6	S27+	GN 2)	AI_R27+	VT 1)	AI27+	BK 1)			Not used	
7	S26+	BN 2)	AI_R26+	RD 1)	AI26+	BU 1)			Not used	
8	S25+	WH 2)	AI_R25+	PK 1)	AI25+	GY 1)			Not used	
9	S24+	RD-BK 1)	AI_R24+	YE 1)	AI24+	GN 1)			Not used	
10	S23+	BU-BK 1)	AI_R23+	BN 1)	AI23+	WH 1)			Not used	
11	S22+	PK-BK 1)	AI_R22+	RD-BK	AI22+	BU-BK			Not used	
12	S21+	GY-BK 1)	AI_R21+	PK-BK	AI21+	GY-BK			Not used	
13	S20+	PK-RD 1)	AI_R20+	PK-RD	AI20+	GY-RD			Not used	
14	S19+	GY-RD 1)	AI_R19+	PK-BU	AI19+	GY-BU			Not used	
15	S18+	PK-BU 1)	AI_R18+	YE-BK	AI18+	GN-BK			Not used	
16	S17+	GY-BU 1)	AI_R17+	YE-RD	AI17+	GN-RD			Not used	
17	S16+	YE-BK 1)	AI_R16+	YE-BU	AI16+	GN-BU	S-	BN-RD 2)	Not used	
18	S15+	GN-BK 1)	AI_R15+	YE-PK	AI15+	PK-GN	S-	WH-RD 2)	Not used	
19	S14+	YE-RD 1)	AI_R14+	YE-GY	AI14+	GY-GN	S-	BN-BU 2)	Not used	
20	S13+	GN-RD 1)	AI_R13+	BN-BK	AI13+	WH-BK	S-	WH-BU 2)	Not used	
21	S12+	YE-BU 1)	AI_R12+	BN-RD	AI12+	WH-RD	S-	PK-BN 2)	Not used	
22	S11+	GN-BU 1)	AI_R11+	BN-BU	AI11+	WH-BU	S-	WH-PK 2)	Not used	
23	S10+	YE-PK 1)	AI_R10+	PK-BN	AI10+	WH-PK	S-	GY-BN 2)	Not used	
24	S9+	PK-GN 1)	AI_R9+	GY-BN	AI9+	WH-GY	S-	WH-GY 2)	Not used	
25	S8+	YE-GY 1)	AI_R8+	YE-BN	AI8+	WH-YE	AI-	YE-BN 2)	Not used	
26	S7+	GY-GN 1)	AI_R7+	BN-GN	AI7+	WH-GN	AI-	WH-YE 2)	Not used	
27	S6+	BN-BK 1)	AI_R6+	RD-BU	AI6+	GY-PK	AI-	BN-GN 2)	Not used	
28	S5+	WH-BK 1)	AI_R5+	VT	AI5+	BK	AI-	WH-GN 2)	Not used	
29	S4+	BN-RD 1)	AI_R4+	RD	AI4+	BU	AI-	RD-BU 2)	Not used	
30	S3+	WH-RD 1)	AI_R3+	PK	AI3+	GY	AI-	GY-PK 2)	Not used	
31	S2+	BN-BU 1)	AI_R2+	YE	AI2+	GN	AI-	VT 2)	Not used	
32	S1+	WH-BU 1)	AI_R1+	BN	AI1+	WH	AI-	BK 2)	Not used	

1) Additional orange ring if one lead marking color is repeated for the first time.
2) Additional violet ring if one lead marking color is repeated for the second time.

Table 16: Pin Assignment for the System Cable Plug

3.7 System Cable

The system cables are used to wire the connector boards with the field zone via field termination assemblies or inline terminals.



1 Identical Cable Plugs

Figure 9: System Cable

Depending on the type of connector board, two different types of system cables are available.

3.7.1 System Cable X-CA 005

The X-CA 005 system cable is used to connect the X-CB 008 03/04/07 and X-CB 019 03/04 connector boards to the field zone via field termination assemblies or inline terminals.

General	
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 laying Flexible application	 5 x d 10 x d
Combustion behavior	Flame resistant and self-extinguishing in accordance with IEC 60332-1-2, -2-2
Length	5…30 m
Color coding	Based on DIN 47100, see Table 15.

Table 17: Cable Data X-CA 005

The system cable is available in the following standard variants:

System cable	Description	Length
X-CA 005 01 8	Coded cable plugs on both sides	8 m
X-CA 005 01 15		15 m
X-CA 005 01 30		30 m

Table 18: Available System Cables X-CA 005

3.7.2 System Cable X-CA 009

The X-CA 009 system cable is used to connect the X-CB 008 05 connector board to the field zone via field termination assemblies.

General	
Cable	LIYCY-TP 58 x 2 x 0.14 mm²
Wire	Finely stranded
Average outer diameter (d)	approx. 18.3 mm
Minimum bending radius Fixed laying Flexible application	 5 x d 10 x d
Combustion behavior	Flame resistant and self-extinguishing in accordance with IEC 60332-1-2, -2-2
Length	8…30 m
Color coding	Based on DIN 47100, see Table 16.

Table 19: Cable Data X-CA 009

The system cable is available in the following standard variants:

System cable	Description	Length 448 kBytes
X-CA 009 01 8	Coded cable plugs on both sides	8 m
X-CA 009 01 15		15 m
X-CA 009 01 30		30 m

Table 20: Available System Cables X-CA 009

3.7.3 Cable Plug Coding

The cable plugs are equipped with three coding pins. Cable plugs only match connector boards and FTAs with the corresponding recesses, see Figure 7.

4 Start-up

This chapter describes how to install, configure and connect the module. For more information, refer to the Safety Manual (HI 801 003 E).

i The safety-related application (SIL 3 in accordance with IEC 61508) of the inputs and the sensors connected must comply with the safety requirements. For more information, refer to the HIMax Safety Manual.

4.1 Mounting

Observe the following points when mounting the module:

- Only operate the module with the appropriate fan components. For more information, see the System Manual (HI 801 001 E).
- Only operate the module with the suitable connector board. For more information, see Chapter 3.6.
- The module and its connected components must be mounted to provide protection of at least IP20 in accordance with EN 60529: 1991 + A1: 2000.

NOTE

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 zone.
  - Take the appropriate earthing measures when connecting the plugs and terminals to the field zone.
  - Use shielded cables with twisted pairs.
  - Connect one twisted pair of the shielded cable to each of the analog measurement inputs.
  - On the module side, the shielding must be connected to the cable shield rail (use SK 20 shield connection terminal block or similar).
  - When using stranded wires, 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 transmitter supply is used, use the one assigned to the input, e.g., S1+ with AI1+.
- HIMA recommends using the transmitter supply of the module.
  Failure of an external supply or measurement unit can lead to overload and damage of the affected measurement input on the module.
  If an external supply is used for the given application, check the zero and final values following a non-transient overload!
- The inputs may be wired redundantly using the corresponding connector boards, see Chapter 3.6.

4.1.1 Wiring Inputs Not in Use

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

4.2 Mounting and Removing the Module

When replacing an existing module or mounting a new one, follow the instructions given in this chapter.

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

4.2.1 Mounting a Connector Board

Tools and utilities

- Screwdriver, 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 figure). Fit the groove into the guiding rail pin.
2. Place the connector board on the cable shield rail.
3. Secure the two captive screws to the base plate. First screw in the lower than the upper screw.

To remove the connector board

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

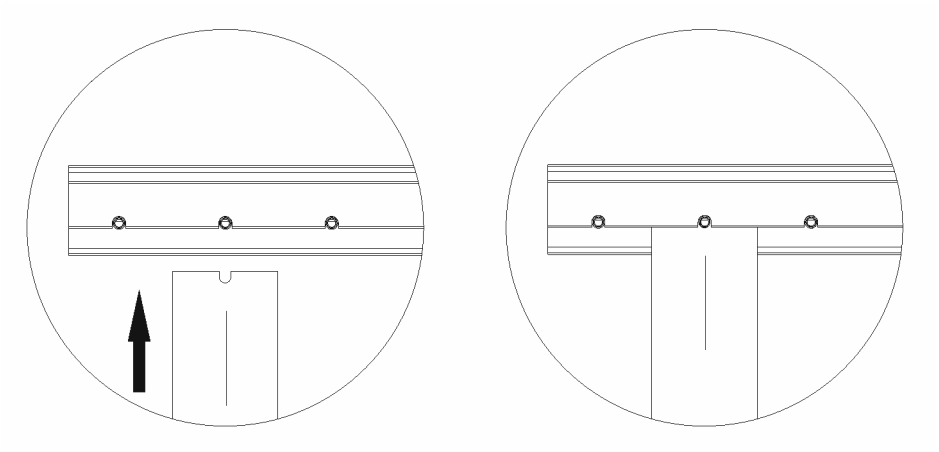


Figure 10: Inserting the Connector Board

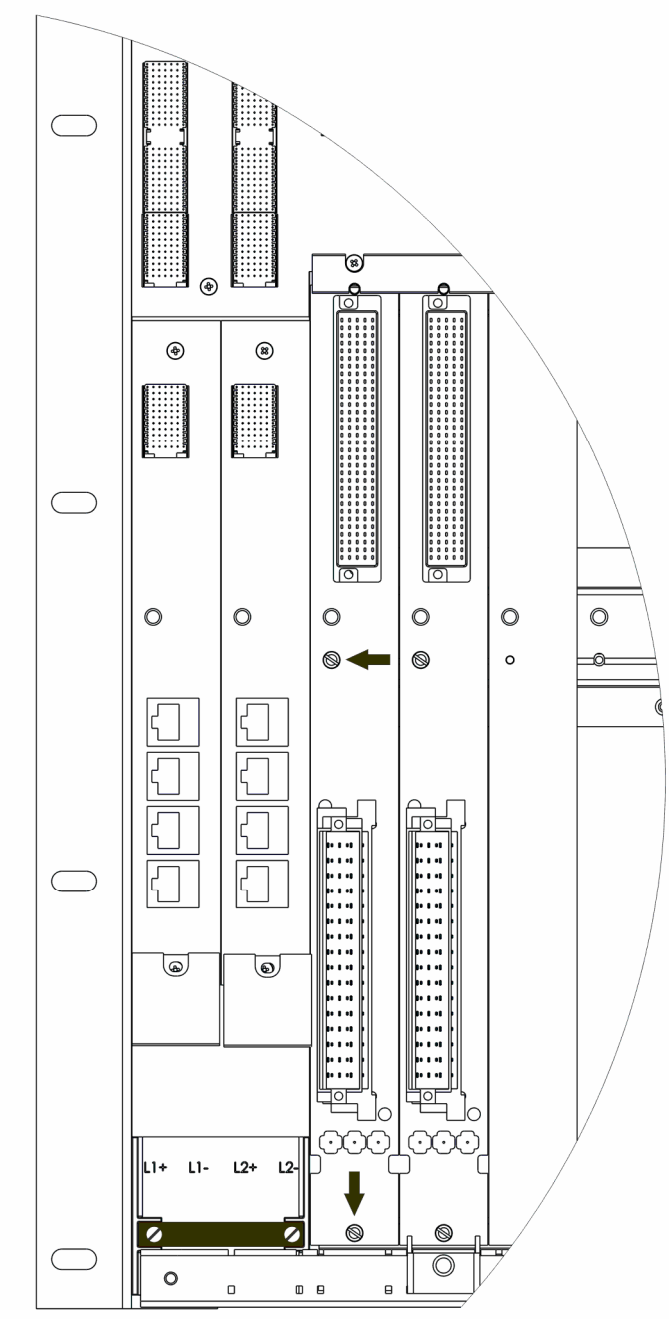


Figure 11: Securing the Connector Board with Captive Screws

4.2.2 Mounting and Removing the 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 observe this can damage the controller.

Always take care when inserting the module in the base plate.

Tools and utilities

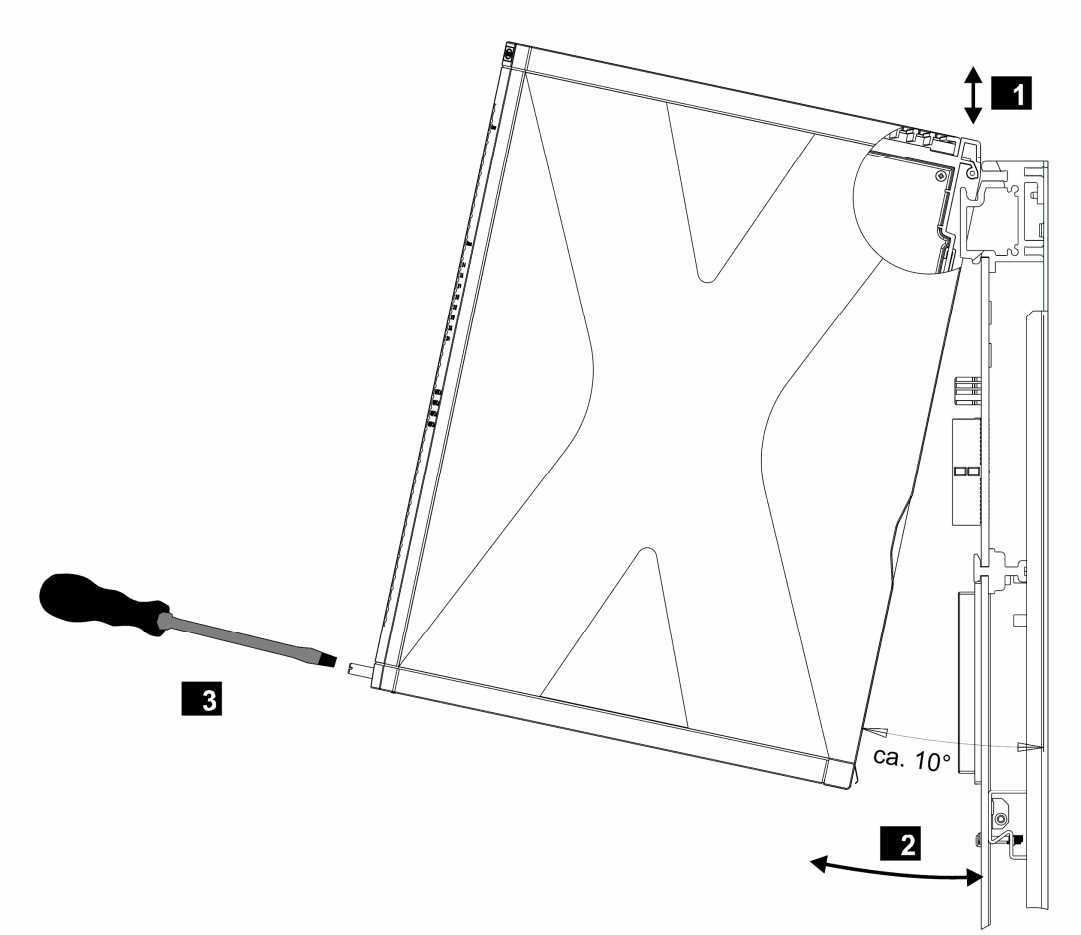
- Screwdriver, slotted 0.8 x 4.0 mm
- Screwdriver, slotted 1.2 x 8.0 mm

Installation

1. Open the cover plate on the fan rack:
   ☑ Move the locks to the *open* position.
   ☑ Lift the cover plate and insert 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.

Removal

1. Open the cover plate on the fan rack:
   ☑ Move the locks to the *open* position.
   ☑ Lift the cover plate and insert into the fan rack
2. Release the screw **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 a 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 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 more information on the statuses and parameters, refer to the tables starting with Chapter 4.3.1.
- If the 0 value is within the valid measuring range, the user program must evaluate the -> *Channel OK* status in addition to the -> *raw value.*This and other diagnostic statuses (such as short-circuits and open-circuits) allow the user to diagnose the external wiring and configure fault reactions in the user program.
- For the line diagnosis, the module defines two limits that are configured in SILworX. By default, the limits are set to the OC/SC values specified in NAMUR, Recommendation NE 43.
- If the transmitter supply of the module is used (i.e., *Supply ON* parameter), the *Sup. used* parameter must also be activated for the corresponding channel. To diagnose the transmitter supply in use, the status -> *Supply OK* can be evaluated within the user program. For more information on these system parameters, see Table 22 and Table 23.
- 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.

The transmitter supply is monitored.

If a fault occurs in the transmitter supply, the module reports a channel fault and sets the process value to the initial value of the connected global variables.

To evaluate the statuses from within the user program, assign the system parameters global variables. Perform this step in the module's detail view of the Hardware Editor.

The following tables present the statuses and parameters for the module in the same order given in the SILworX Hardware Editor.

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

4.3.1 Tab: Module

The **Module** tab contains the statuses and parameters for the module:

Name		R/W	Description
Enter these statuses and parameters directly in the Hardware Editor.			
Name		W	Module name
Spare Module		W	Activated: The module missing in the redundancy group is not considered as a fault. Deactivated: The module missing in the redundancy group is considered as a fault. Default setting: Deactivated **It is only displayed in the redundancy group tab!**
Noise Blanking		W	Noise blanking performed by processor module allowed (activated/deactivated). Default setting: Activated The processor modules defers the reaction to detected transient faults until the safety time has expired. The user program retains its last valid process value.
Name	**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. Redundant operation: At least one of the redundant modules is faultless (OR logic). FALSE: Module fault Channel fault (no external faults), the module is not inserted. Observe the *Module Status* parameter!
Module Status	DWORD	R	Module Status
Timestamp [µs]	DWORD	R	Microsecond fraction of the timestamp. Point in time at which the analog inputs were measured.
Timestamp [s]	DWORD	R	Second fraction of the timestamp. Point in time at which the analog 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 21: Module Tab in the Hardware Editor

4.3.2 Tab: I/O Submodule AI32_01

The **I/O Submodule AI32 01** tab contains the following statuses and parameters:

Name		R/W	Description
Enter these statuses and parameters directly in the Hardware Editor.			
Name		R	Module name
Supply ON		W	Use the transmitter supplies of the module. Activated: Transmitter supplies for channels 1 to 32 activated. Deactivated: Transmitter supplies for channels 1 to 32 deactivated. Default setting: Activated
Show Signal Overflow		W	The *Field* LED displays a potential signal overflow. Activated: Show signal overflow activated. Deactivated: Show signal overflow deactivated Default setting: Activated
Show Supply Overcurrent		W	Show supply overcurrent with *Field* LED. Activated: Show supply overcurrent activated. Deactivated: Show supply overcurrent deactivated. Default setting: Activated
Name	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* (see Chapter 4.3.5 for coding details).
Diagnostic Response	DINT	R	As soon as *Diagnostic Response* returns the ID of *Diagnostic Request* (see 4.3.5 for coding details), *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 free of faults
Restart on Error	BOOL	W	Using the parameter *Restart on Error*, each I/O module that has switched off permanently due to faults can be forced to re-adopt the RUN state. To do this, set the *Restart on Error* parameter 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
Submodule OK	BOOL	R	TRUE: No submodule fault. No channel faults. FALSE: Submodule fault. Channel fault (external faults included)
Submodule Status	DWORD	R	Bit-coded submodule status (For coding details, see Chapter 4.3.4)

Table 22: Tab: I/O Submodule AI32_01 in the Hardware Editor

4.3.3 Tab: I/O Submodule AI32_01: Channels

The **I/O Submodule AI32_01:Channels** tab contains the following parameters and statuses for each analog input. Global variables can be assigned to the statuses and parameters with **->** and used in the user program. The value without **->** must be directly entered.

Name	Data type	R/W	Description
Channel no.	---	R	Channel number, defined by default
-> Process Value [REAL]	REAL	R	Process value determined using the intermediate data points 4 mA and 20 mA.
4 mA	REAL	W	Intermediate data point used to calculate the process value on the lowest scale final value (4 mA) of the channel. Default setting: 4.0
20 mA	REAL	W	Intermediate data point used to calculate the process value on the highest scale final value (20 mA) of the channel. Default setting: 20.0
-> Raw Value [DINT]	DINT	R	Unprocessed measured value of the channel: 0...200 000 (0...20 mA). If the raw value is evaluated instead of the process value, the user must program the monitoring function and the value in the event of faults from within the user program.
-> Channel OK	BOOL	R	TRUE: Faultless channel The process value is valid. FALSE: Faulty channel The process value is set to 0.
Sup. used	BOOL	W	Activated: If a fault occurs in the transmitter supply, the module reports a channel fault and sets the input value to 0. Deactivated: If a fault occurs in the transmitter supply, the module reports no channel fault and the input value is not defined. Default setting: Activated
-> Sup. OK	BOOL	R	TRUE: No faults in the transmitter supply FALSE: The transmitter supply is faulty.
OC Limit	DINT	W	Threshold in mA for detecting an open-circuit If the analog measured value falls under *OC Limit*, the module detects an open-circuit and switches off the *Channel* LED for this channel. Default setting: 36 000 (3.6 mA)
-> OC	BOOL	R	TRUE: One open-circuit present FALSE: No open-circuit present Defined through *OC Limit*
SC Limit	DINT	W	Threshold in mA for detecting a short-circuit If the measured analog value exceeds *SC Limit*, the module detects a short-circuit and sets the *Channel* LED for this channel to Blinking2. Default setting: 213 000 (21.3 mA)
-> SC	BOOL	R	TRUE: One short-circuit present FALSE: No short-circuit present Defined through *SC Limit*
SP LOW	DINT	W	Upper limit of LOW level *SP LOW* (switching point LOW) is the limit value: if this limit is exceeded, the detects a LOW and switches the *Channel* LED off. Restriction: *SP LOW ≤ SP HIGH* Default setting: 39 500 (3.95 mA)

Name	Data type	R/W	Description
SP HIGH	DINT	W	Lower limit of high level *SP HIGH* (switching point HIGH) is the limit value: if this limit is exceeded, the module detects a HIGH and switches the *Channel* LED on. Restriction: *SP LOW* ≤ *SP HIGH* Default setting: 40 500 (4.05 mA)
-> Ch. value [BOOL]	[BOOL]	R	Boolean channel value in accordance with the limits *SP LOW* and *SP HIGH*.
Ton [µs]	UDINT	W	Time on delay The module only indicates a level change from LOW to HIGH if the HIGH level is present for longer than the configured time t_{on}. Important: The maximum reaction time T_R (worst case) for this channel is extended by the delay time, since a signal change is not detected until the delay time has expired. Range of values: 0…(2^{32}-1) Default setting: 0
Toff [µs]	UDINT	W	Time off delay The module only indicates a level change from HIGH to LOW if the LOW level is present for longer than the configured time t_{off}. Important: The maximum reaction time T_R (worst case) for this channel is extended by the delay time, since a signal change is not detected until the delay time has expired. Range of values: 0…(2^{32}-1) Default setting: 0
-> State LL	BOOL	R	TRUE: Value associated with the LL event state FALSE: Value out of the range associated with the LL event state
-> State L	BOOL	R	TRUE: Value associated with the L event state FALSE: Value out of the range associated with the L event state
-> State N	BOOL	R	TRUE: Value associated with the N (normal) event state FALSE: Value out of the range associated with the N (normal) event state
-> State H	BOOL	R	TRUE: Value associated with the H event state FALSE: Value out of the range associated with the H event state
-> State HH	BOOL	R	TRUE: Value associated with the HH event state FALSE: Value out of the range associated with the HH event state
Redund.	BOOL	W	Requirement: The redundant module must be configured. Acivated: Activate the channel redundancy for this channel Deactivated: Deactivate the channel redundancy for this channel Default setting: Deactivated.
Redundancy value	BYTE	W	Setting for determining the redundancy value. ▪ Min ▪ Max ▪ Average Default setting: Max **It is only displayed in the redundancy group tab!**

Table 23: Tab: I/O Submodule CI32_01:Channels in the Hardware Editor

4.3.4 Submodule Status [DWORD]

Coding of the **Submodule Status**

Coding	Description
0x00000001	Fault in hardware unit (submodule)
0x00000002	Reset of an E/A bus
0x00000004	Faults detected while configuring the hardware
0x00000008	Fault detected while verifying the coefficients
0x00000080	Reset of the chip select monitoring
0x10000000	Fault during AD conversion (conversion end)
0x20000000	Faulty operating voltages
0x40000000	Fault during AD conversion (conversion begin)
0x80000000	Test function transmitter monitoring overvoltage

Table 24: Submodule Status [DWORD]

4.3.5 Diagnostic Status [DWORD]

Coding of **Diagnostic Status**

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>0</td><td>Diagnostic values (100...2032) 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">Do not use it!</td></tr>
<tr><td>202</td></tr>
<tr><td>203</td></tr>
<tr><td>300</td><td>Comparator 24 V low voltage (BOOL)</td></tr>
<tr><td>1001...1032</td><td>Status of the channels 1...32
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x0001</td><td>Hardware unit fault (submodule) occurred.</td></tr>
<tr><td>0x0002</td><td>Reset of an E/A bus</td></tr>
<tr><td>0x0400</td><td>SC / OC limits exceeded or
channel/module fault</td></tr>
<tr><td>0x0800</td><td>Measured values invalid (potential failure in the measurement system)</td></tr>
<tr><td>0x1000</td><td>Measured values out of the safety-related accuracy</td></tr>
<tr><td>0x2000</td><td>Underflow/overflow of the measured value</td></tr>
<tr><td>0x4000</td><td>SC / OC limits exceeded or
channel/module fault</td></tr>
<tr><td>0x8000</td><td>Independent measurements of both measurement system malfunctioning</td></tr>
</table></td></tr>
<tr><td>2001...2032</td><td>Fault status of the power sources 1...32
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x1000</td><td>Undervoltage of transmitter monitoring</td></tr>
<tr><td>0x2000</td><td>Undervoltage of > 12 transmitter supplies</td></tr>
<tr><td>0x4000</td><td>Undervoltage of transmitter supply.</td></tr>
<tr><td>0x8000</td><td>Overvoltage of transmitter supply.</td></tr>
</table></td></tr>
</table>

Table 25: Diagnostic Information [DWORD]

4.4 Connection Variants

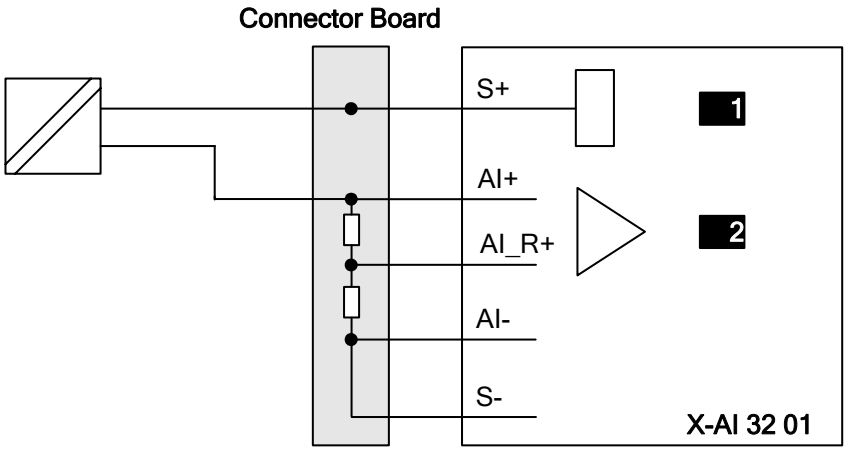
This chapter describes the correct wiring of the module in safety-related applications. The connection variants specified here are permitted.

4.4.1 Input Wiring

The inputs are wired via connector boards. Special connector boards are available for redundantly wiring the modules.

The transmitter supplies are decoupled using diodes. This ensures that the transmitter supplies of two modules can supply one transmitter if the modules are redundant to one another.

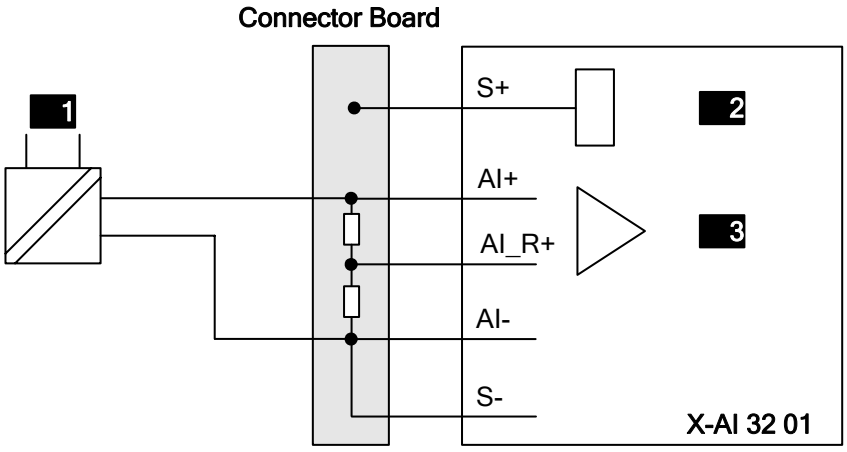
Connector boards X-CB 008 01 and X-CB 019 01 (with screw terminals) or X-CB 008 03 and X-CB 019 03 (with cable plug) can be used to perform the wiring such as described in Figure 13 and Figure 14.



1 Transmitter Supply

2 Analog Input

Figure 13: Single-Channel Connection of a Passive Two-Wire Transmitter



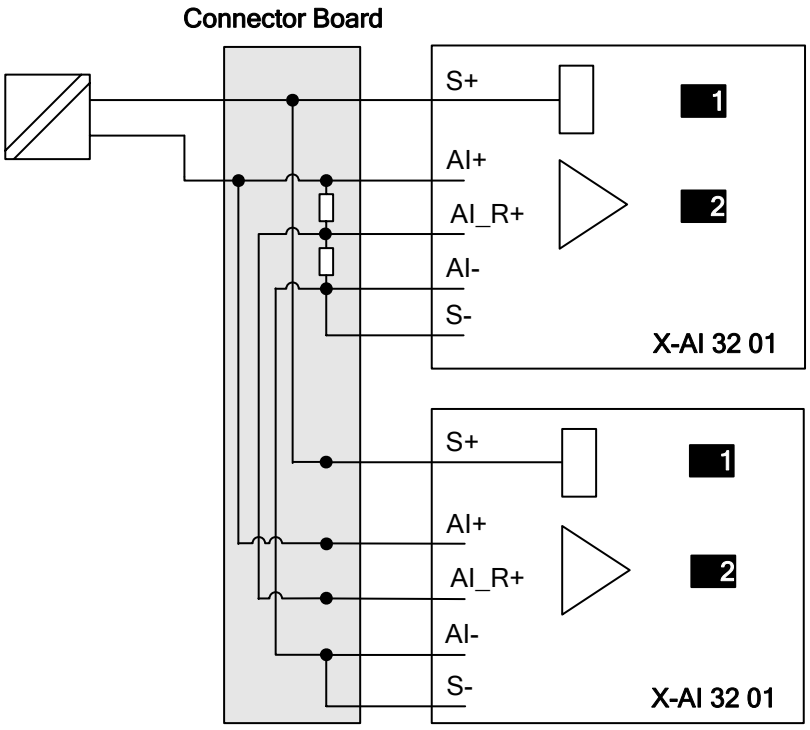
1 External Transmitter Supply

2 Transmitter Supply

3 Analog Input

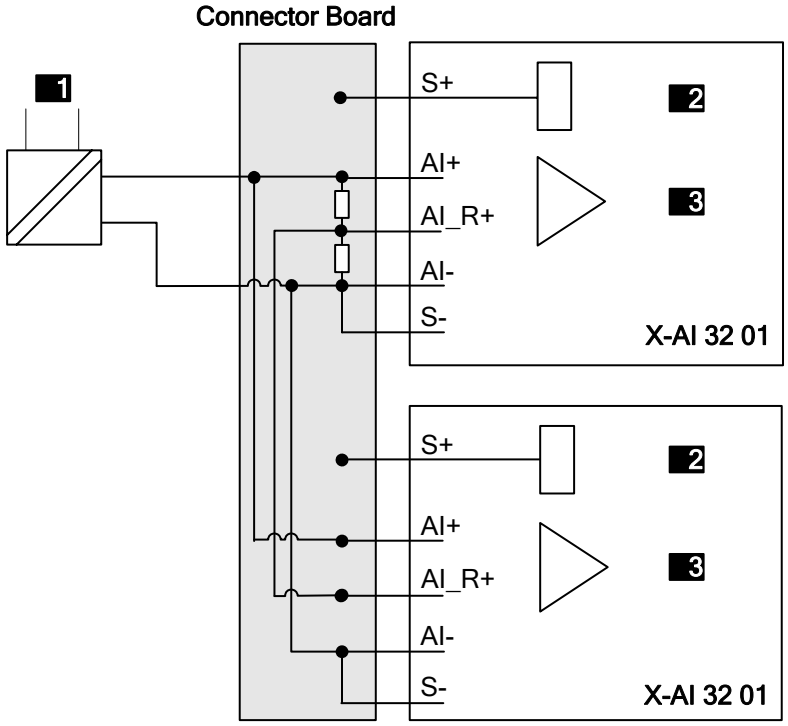
Figure 14: Single-Channel Connection of an Active Two-Wire Transmitter

When redundantly wired as specified in Figure 15 and Figure 16, the modules are inserted in the base plate next to each other and on a common connector board. Connector boards X-CB 008 02 and X-CB 019 02 (with screw terminals) or X-CB 008 04 and X-CB 019 04 (with cable plug) can be used.



1 Transmitter Supply 2 Analog Input

Figure 15: Redundant Connection of a Passive Two-Wire Transmitter

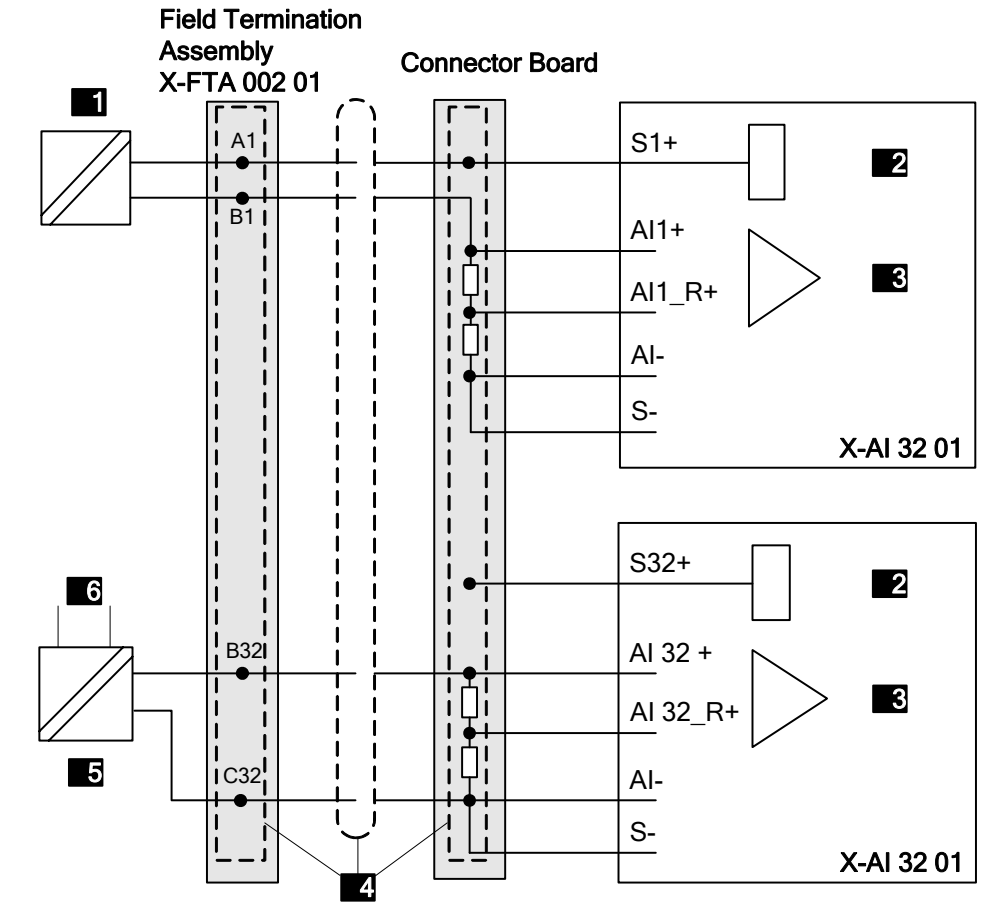


1 External Transmitter Supply
2 Transmitter Supply
3 Analog Input

Figure 16: Redundant Connection of an Active Two-Wire Transmitter

4.4.2 Wiring Transmitters via Field Termination Assembly

Passive and active two-wire transmitters are connected via the X-FTA 002 01 as described in Figure 17:. For further information, refer to the X-FTA 002 01 Manual (HI 801 117 E).

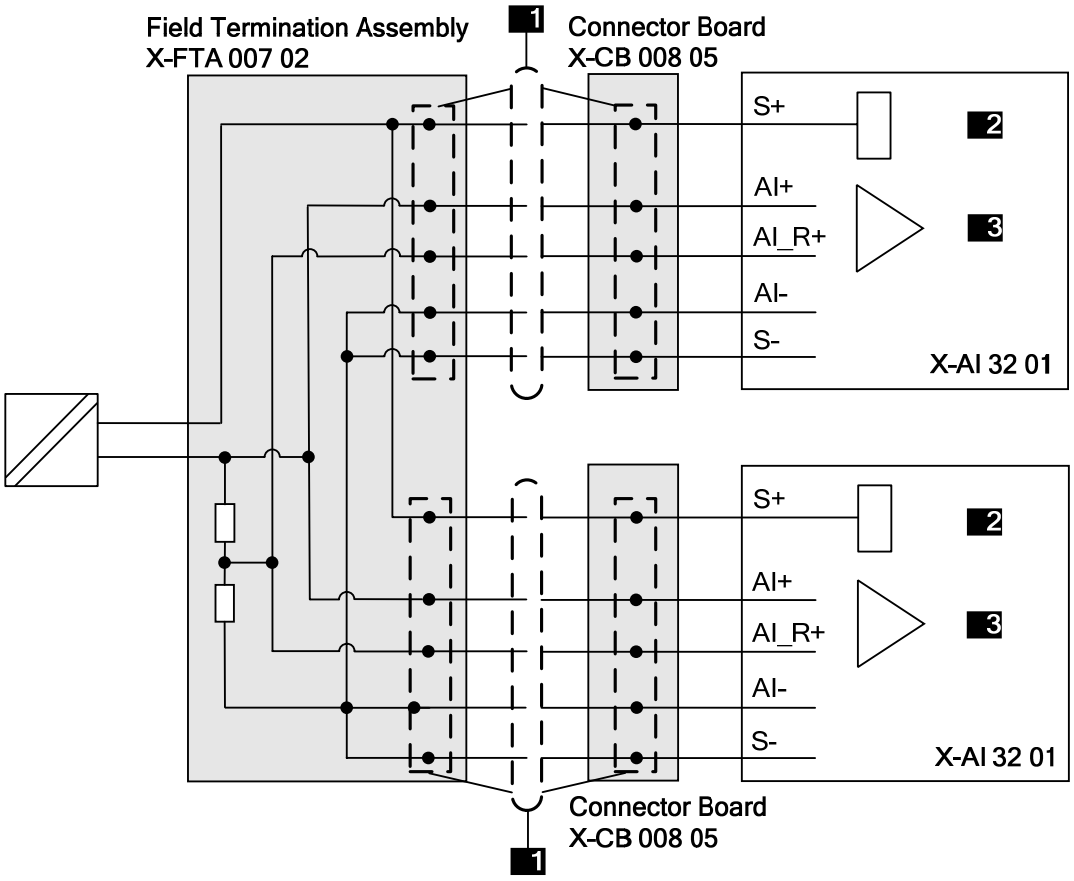


1 Passive Two-Wire Transmitter
2 Transmitter Supply
3 Analog Input
4 System Cable with Cable Plug
5 Active Two-Wire Transmitter
6 External Transmitter Supply

Figure 17: Connection via Field Termination Assembly

4.4.3 Redundant Connection via Two Base Plates

The figure shows the connection of one transmitter if the redundant modules inserted in different base plates or are not located in the base plate adjacently. The instrument shunts are placed on the field termination assembly.

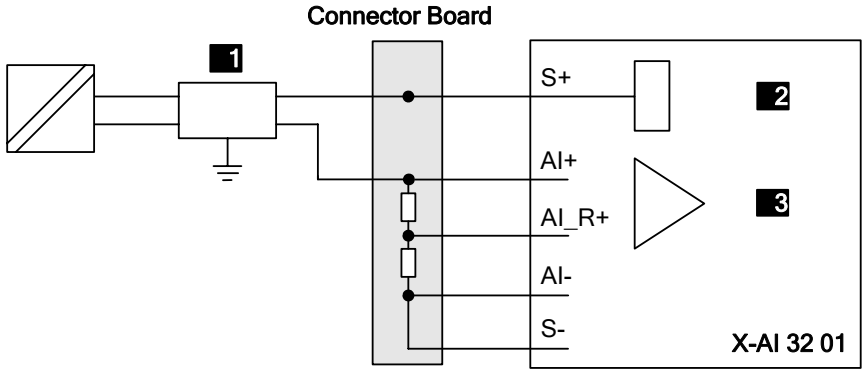


1 System Cable X-CA 009 01 n
2 Transmitter Supply
3 Analog Input

Figure 18: Redundant Connection via Two Base Plates

4.4.4 Ex-Protection with Zener Barriers

Zener barriers can be used for EX-protection, e.g., barriers of MTL, Type 7787+ or Pepperl+Fuchs, Type Z787.

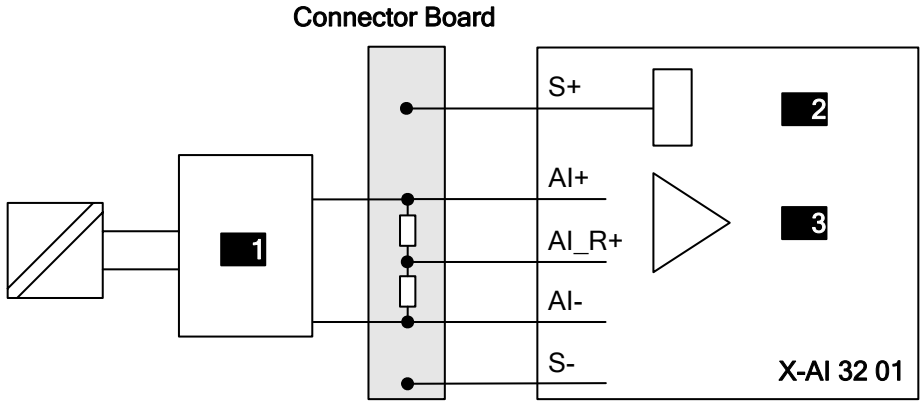


1 Barriers
2 Transmitter Supply
3 Analog Input

Figure 19: Single-Channel Transmitter Connection with Barrier

4.4.5 EX-Protection with Repeater Power Supply

Analog power supply isolators such as the H 6200A from HIMA can be implemented for EX-protection. The module's transmitter supply is not used when a power supply isolator is wired.



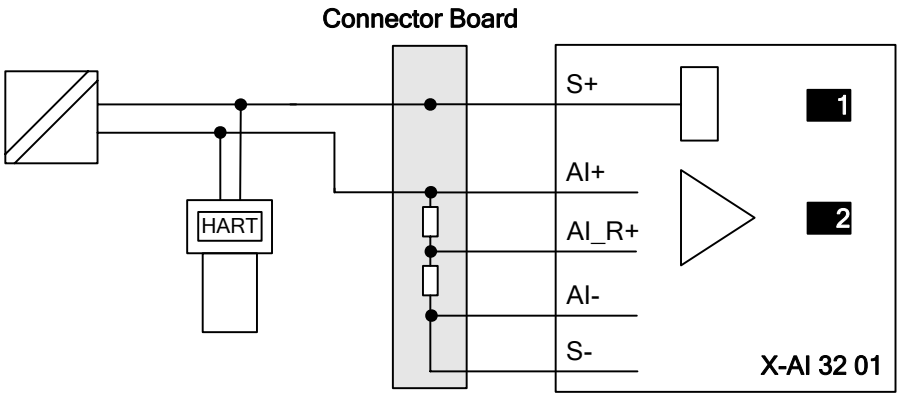
1 Analog Repeater Power Supply
2 Transmitter Supply
3 Analog Input

Figure 20: Single-Channel Wiring of One Analog Power Supply Isolator

4.4.6 Characteristics of HART Communication

To ensure HART communication, a HART handheld can be connected in parallel to the transmitter. The current fluctuation caused by the HART communications is removed using filters on the analog input so that the residual error of the analog measurement is 1%.

i Higher residual error with HART communication. Remove the HART terminal directly after the diagnosis!



1 Transmitter Supply 2 Analog Input

Figure 21: HART Handheld in Parallel to the Transmitter and Input Module

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 analog inputs. For more details, refer to the SILworX documentation.

5.2 Diagnosis

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 using SILworX. Chapter 4.3.4 and Chapter 4.3.5 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.

Only the manufacturer is authorized to repair the module.

When replacing modules, observe the instructions specified in the System Manual (HI 801 001 E) and Safety Manual (HI 801 003 E).

6.1 Maintenance Measures

6.1.1 Loading the Operating System

HIMA is continuously improving the operating system of the module. HIMA recommends to use system downtimes to load the current version of the operating system into the module.

For detailed instructions on how to load the operating system, see the system manual and the online help. The module must be in STOP to be able to load an operating system.

i The current version of the module in use is displayed in the SILworX Control Panel! The type label specifies the version when the module is delivered, see Chapter 3.3.

6.1.2 Proof Test

HIMax modules must be subjected to a proof test in intervals of 10 years. For more information, refer to the Safety Manual HI 801 003 E.

7 Decommissioning

To decommission the module, remove it from the base plate. For more information, see *Mounting and Removing the Module*.

8 Transport

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

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

9 Disposal

Industrial customers are responsible for correctly disposing of decommissioned HIMax 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
ARP	Address Resolution Protocol: Network protocol for assigning the network addresses to hardware addresses
AI	Analog Input
Connector Board	Connector board for the HIMax module
COM	Communication module
CRC	Cyclic Redundancy Check
DI	Digital Input
DO	Digital Output
EMC	Electromagnetic Compatibility
EN	European Norm
ESD	ElectroStatic Discharge
FB	Fieldbus
FBD	Function Block Diagram
FTT	Fault Tolerance Time
ICMP	Internet Control Message Protocol: Network protocol for status or error messages
IEC	International Electrotechnical Commission
MAC address	Hardware address of one network connection (Media Access Control)
PADT	Programming And Debugging Tool (in accordance with IEC 61131-3), PC with SILworX
PE	Protective Earth
PELV	Protective Extra Low Voltage
PES	Programmable Electronic System
PFD	Probability of Failure on Demand, probability of failure on demand of a safety function
PFH	Probability of Failure per Hour, probability of a dangerous failure per hour
R	Read
Rack ID	Base plate identification (number)
Non-reactive	Supposing that two input circuits are connected to the same source (e.g., a transmitter). An input circuit is termed "non-reactive" if it does not distort the signals of the other input circuit.
R/W	Read/Write
SB	System Bus (Module)
SELV	Safety Extra Low Voltage
SFF	Safe Failure Fraction, portion of safely manageable faults
SIL	Safety Integrity Level (in accordance with IEC 61508)
SILworX	Programming tool for HIMax
SNTP	Simple Network Time Protocol (RFC 1769)
SRS	System.Rack.Slot addressing of a module
SW	Software
TMO	TiMeOut
TMR	Triple Module Redundancy
W	Write
r_P	Peak value of a total AC component
Watchdog (WD)	Time monitoring for modules or programs. If the watchdog time is exceeded, the module or program enters the ERROR STOP state.
WDT	WatchDog Time

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HI 801 021 E

Albert-Bassermann-Str. 28
68782 Brühl, Germany
Phone +49 6202 709-0
Fax +49 6202 709-107
HIMax-info@hima.com
www.hima.com

SAFETY
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