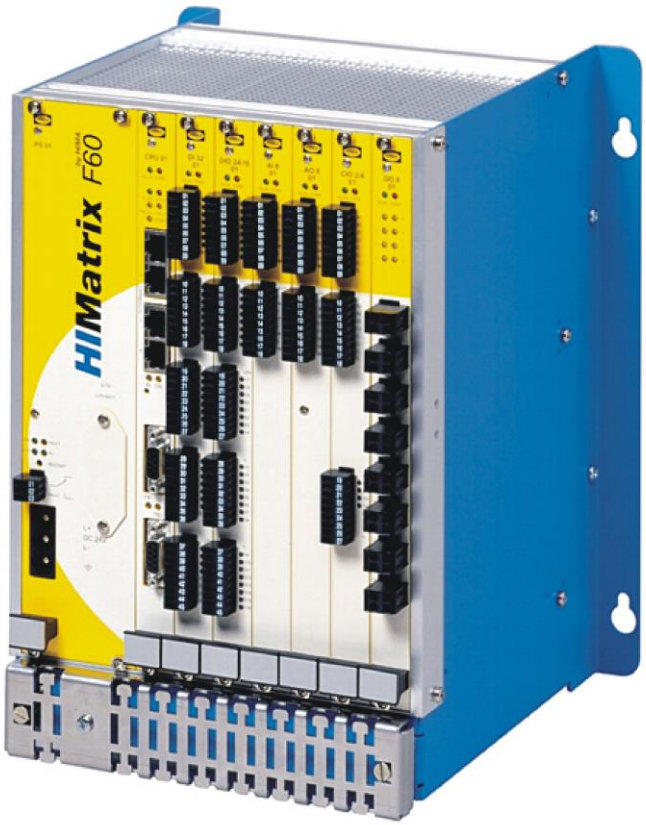
HIMatrix

Safety-Related Controller

MI 24 01 Manual



HIMA Paul Hildebrandt GmbH
Industrial Automation

Rev. 2.00

HI 800 209 E

All of the instructions and technical specifications in this manual have been written with great care and effective quality assurance measures have been implemented to ensure their validity. For questions, please contact HIMA directly. HIMA appreciates any suggestion on which information should be included in the manual.

Equipment subject to change without notice. HIMA also reserves the right to modify the written material without prior notice.

For further information, refer to the HIMA DVD and our website at `http://www.hima.de` and `http://www.hima.com`.

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Revision index	Revisions	Type of change	
		technical	editorial
1.00	Added: Configuration with SILworX	X	X
2.00	Added: MI 24 014, SIL 4 certified according to EN 50126, EN 50128 and EN 50129, Chapter 4.1.6	X	X

Table of Contents

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.

1.1 Structure and Use of this Manual

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

This manual is organized in the following main chapters:

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

The HIMatrix F60 is available for the programming tools SILworX and ELOP II Factory. Which programming tool can be used, depends on the processor operating system of the HIMatrix F60, refer to the following table:

Programming tool	Processor operating system	Communication operating system
SILworX	CPU OS V7 and higher	COM OS V12 and higher
ELOP II Factory	CPU OS up to V6.x	COM OS up to V11.x

Table 1: Programming Tools for HIMatrix F60

In the manual, the differences are specified by using:

- Separated chapters
- Tables differentiating among the versions

i **Projects created with ELOP II Factory cannot be edited with SILworX, and vice versa!**

i The manual usually refers to the plug-in cards of the modular controller F60 as *modules*. *Modules* is also the term used in SILworX.

Additionally, the following documents must be taken into account:

Name	Content	Document number
HIMatrix System Manual Compact Systems	Hardware description of the HIMatrix compact systems	HI 800 141 E
HIMatrix System Manual Modular System F60	Hardware description of the HIMatrix modular system	HI 800 191 E
HIMatrix Safety Manual	Safety functions of the HIMatrix system	HI 800 023 E
HIMatrix Safety Manual for Railway Applications	Safety functions of the HIMatrix system using the HIMatrix in railway applications	HI 800 437 E
SILworX Online Help	Instructions on how to use SILworX	-
ELOP II Factory Online Help	Instructions on how to use ELOP II Factory, Ethernet IP protocol	-
SILworX First Steps	Introduction to SILworX using the HIMax system as an example	HI 801 103 E
ELOP II Factory First Steps	Introduction to ELOP II Factory	HI 800 006 E

Table 2: Additional Relevant Documents

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 modules 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 the programming tool.
Italics	For parameters and system 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: warning, caution, notice
- Type and source of risk
- Consequences arising from non-observance
- Risk prevention

⚠ SIGNAL WORD

Type and source of risk!
Consequences arising from non-observance
Risk prevention

The signal words have the following meanings:

- Warning indicates hazardous situation which, if not avoided, could result in death or serious injury.
- Caution 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.

NOTE

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

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

2.1 Intended Use

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

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

2.1.1 Environmental Requirements

Requirement type	Range of values [1]
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

[1] The values specified in the technical data apply and are decisive for devices with extended environmental requirements.

Table 3: Environmental Requirements

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

NOTE

Device damage due to electrostatic discharge!

- **When performing the work, make sure that the workspace 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 risk results from a HIMatrix system itself.

Residual risk may result from:

- Faults related to engineering
- Faults related to 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.

2.4 Emergency Information

A HIMatrix system is a part of the safety equipment of a site. If a device or a module fails, the system enters the safe state.

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

3 Product Description

The MI 24 01 is a module for the modular F60 HIMatrix system.

The MI 24 01 module has 24 digital input channels. The analog inputs AI are inputs for measuring currents of 0/4...20 mA. The digital inputs DI can be used with proximity switches in accordance with EN 60947-5-6, safety proximity switches or contacts (wired with resistors).

i Analog and digital inputs cannot be used simultaneously, but one or the other depending on the channel configuration

Ensure proper configuration of the inputs. Each channel must be configured individually.

The module can be inserted in the F60 subrack's slot 3...8. Slots 1 and 2 are reserved for the power supply module and central module, respectively.

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 and PL e (EN ISO 13849-1) and SIL 4 (EN 50126, EN 50128 and EN 129).
Further safety standards, application standards and test standards are specified in the certificates available on the HIMA website.

3.1 Safety Function

The module is equipped with safety-related inputs that can be used as analog or digital inputs.

3.1.1 Safety-Related Analog Inputs

The analog inputs are inputs for measuring currents of 0/4...20 mA.

3.1.1.1 Reaction in the Event of a Fault

If the device detects a fault on an analog input, the *AI.Error Code* parameter is set to a value greater than 0. If a module fault occurred, the SILworX system parameter *Module Error Code* is set to a value greater than 0, or if ELOP II Factory is used, the *Module.Error Code* signal is set to a value greater than 0.

In both cases, the module activates the *ERR* LED.

In addition to the analog value the the error code must be evaluated. The analog value must be configured to ensure a safety-related reaction.

The error code allows the user to configure additional fault reactions in the user program.

3.1.2 Safety-Related Digital Inputs

The digital inputs of the module operate as analog inputs, but return digital values due to the configuration of switching thresholds.

3.1.2.1 Reaction in the Event of a Fault

If the module detects a fault on a digital input, the user program processes a low level in accordance with the de-energized to trip principle.

The module activates the *ERR* LED.

In addition to the channel signal value, the user program must also consider the corresponding error code.

The error code allows the user to configure additional fault reactions in the user program.

3.2 Equipment, Scope of Delivery

The filter and protective modules H 7032 und H 7033 are available for connecting transmitters to the MI 24 01. The modules H 7032 and the H 7033 are not included within the scope of delivery of MI 24 01.

The following table specifies the available module variants:

Designation	Description
MI 24 01	Module with 24 analog inputs or inputs for proximity switches
MI 24 014	Module with 24 analog inputs or inputs for proximity switches Operating temperature: -25...+70 °C (temperature class T1), Vibration and shock tested according to EN 50125-3 and EN 50155, class 1B according to IEC 61373
H 7032	Filter and protective module for connecting two-wire transmitters to the HIMatrix MI 24 up to SIL 3.
H 7033	Filter and protective module for connecting three-wire transmitters to the HIMatrix MI 24 up to SIL 3.

Table 4: Available Variants

3.3 Type Label

The type plate contains the following details:

- Product name
- Bar code (1D or 2D code)
- Part no.
- Production year
- Hardware revision index (HW Rev.)
- Firmware revision index (FW Rev.)
- Operating voltage
- Mark of conformity

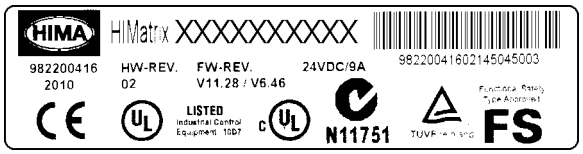
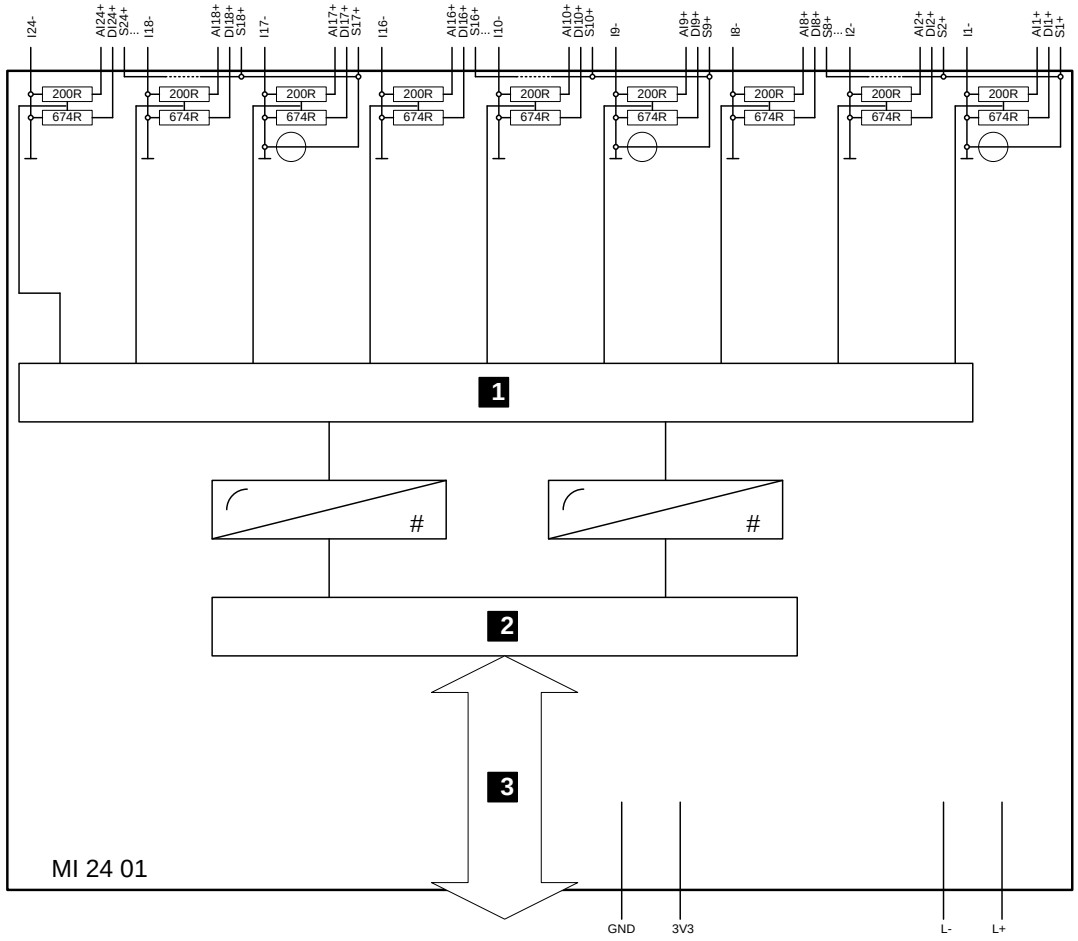


Figure 1: Sample Type Label

3.4 Structure

This chapter describes the layout and function of the module.

3.4.1 Block diagram



1 Multiplexer

2 I/O Module

3 I/O Bus

Figure 2: Block Diagram

3.4.2 Front View

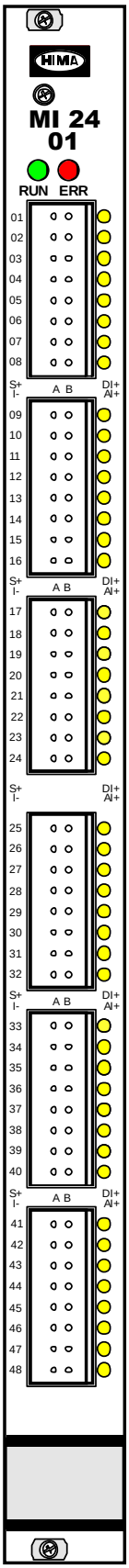


Figure 3: Front View

3.4.3 Status Indicators

LED	Color	Status	Description
RUN	Green	On	Operating voltage present
		Off	No operating voltage
ERR	Red	On	Module faulty or external faults Reaction as dictated by the diagnosis
		Off	No module faults and / or no channel faults

Table 5: Status Indicators

3.4.4 I/O LEDs

LED	Color	Status	Description
I 1...24	Yellow	On	Use as DI: The related channel is active (energized). Use as AI: The upper limit has been achieved.
		Off	Use as DI: The related channel is inactive (de-energized). Use as AI: The lower limit has been achieved.

Table 6: I/O LEDs

The status of the digital input signals is displayed by LEDs located on the front plate next to the terminal plugs. The second LED for each terminal pin, is not used (see Chapter 4.1.4).

3.4.5 Outputs for Transmitter and Proximity Switch Supply

To supply the external (analog and digital) sensors, the module has 24 outputs divided into 3 groups:

Group	Outputs	Maximum total current
Group 1	Channels 1...8	200 mA
Group 2	Channels 9...16	200 mA
Group 3	Channels 17...24	200 mA

Table 7: Outputs for Transmitter and Proximity Switch Supply

The supply outputs are short-circuit-proof. Within a group, the current of 200 mA can be distributed as required. The transmitter supply is switched off if its total current is exceeded. If the overload disappears within 30 s, the supply is switched on again. If the overload is still present after 30 s, the module attempts to restart the supply in intervals of 60 s.

Short transient interferences (< 5 ms) do not cause the transmitter supply to switch off.

If an external supply is used or is faulty, the module measurement input may be overloaded and permanently damaged. If the measurement input is overloaded over a longer time period, the zero and final values must be checked. For this reason, HIMA recommends to use the internal module supply and to configure it using the corresponding signal (*Transmitter Used [BOOL]* -> set to TRUE).

The transmitter supply is also switched off if the module's transmitter supply is used (*Transmitter Used [BOOL]* -> set to TRUE) and the module's measurement input is overloaded. The module attempts to restart the supply in intervals of 60 s. Switching off the transmitter supply means that all the outputs of this group are switched off. This also applies to transient overloads (e.g., by connecting a transmitter). If these cases occur, the *Transmitter Used [BOOL]* -> signal must be set to FALSE for the duration of the failure, e.g., by forcing the signal or by configuring a time function in the user program.

If the module is in STOP, no monitoring for overload is performed, even if *Transmitter Used [BOOL]* -> is set to TRUE.

The current limiting voltage outputs can be switched between 8.2 VDC and 26 VDC. The switching value must be set individually for each output. An operating voltage must be selected even if it is not used, otherwise the module enters the error state with invalid configuration. The outputs cannot be forced and may only be defined during the parameter setting.

The voltage limits of the outputs are safely monitored. If the error limits are exceeded, an error bit is set.

For supplying a channel, the voltage output assigned to the input must be used (e.g., S1+ with AI1+).

3.5 Product Data

General	
Number of inputs	24, configurable as: ▪ Analog current inputs 0/4...20 mA ▪ Digital signal inputs for proximity switches, e.g., in accordance with EN 60947-5-6, safety proximity switches or contacts wired with resistors
Operating voltage	24 VDC, -15...+20 %, $r_{PP} \leq 15$ %, from a power supply unit with safe insulation, in accordance with IEC 61131-2
Operating data	3.3 VDC / 0.3 A 24 VDC / 1.5 A
Max. permanent overload	50 mA / 10 V
max. overload duration (short-circuit S+ → AI+)	60 ms
Data format	Integer
Ambient temperature	0...+60 °C
Storage temperature	-40...+85 °C
Space requirement	6 RU, 4 HP
Weight	580 g

Table 8: Product Data

Analog inputs	
Inputs	24 (unipolar, non-galvanically separated)
Nominal range	0...20 mA
Operating range	-1...+25 mA
Input resistance	200 Ω
Digital resolution	12-bit
Measurement accuracy at 25 °C, max.	±0.2 % of final value
Metrological accuracy on full temperature, max.	±0.5 % of final value
Temperature coefficient, max.	±0.0086 %/K of final value
Safety-related accuracy, max.	±1 % of final value
Measured value refresh	once per F60 cycle
Sampling time	approx. 45 µs per channel

Table 9: Specifications for the Analog Inputs

Analog inputs, default values	
Open-circuit and short-circuit monitoring	Freely configurable values, e.g., OC[1] 3.6 mA (360 digits) Parameter *Threshold LOW [INT] ->* LS[2] 21 mA (2100 digits) Parameter *Limit Value HIGH [INT] ->* (in accordance with NE 43)
[1] OC = open-circuit [2] SC = Short-circuit	

Table 10: Default Values for the Analog Inputs

Digital inputs	
Inputs	24 unipolar ground I-, non-galvanically separated from one another, analog measurement processing
Nominal range	0...20 mA, freely configurable switching threshold
Nominal input resistance	674 Ω
Nominal short-circuit current with proximity switch supply	12.2 mA
Delay time L → H H → L	2 x cycle time F60

Table 11: Specifications for Digital Inputs

Digital inputs, default values	
Proximity switch in accordance with EN 60947-5-6:	The values must be configured and verified for the proximity switch in use:
Switching threshold L → H	1.7 mA (170 digits), parameter *Hysteresis HIGH [INT] ->*
Switching threshold H → L	1.5 mA (150 digits), parameter *Hysteresis LOW [INT] ->*
Open-circuit	0.125 mA (13 digits), parameter *Limit Value LOW [INT] ->*
Short-circuit	8.5 mA (850 digits), parameter *Limit Value HIGH [INT] ->*
Safety proximity switches in accordance with EN 60947-5-6:	The values must be configured and verified for the proximity switch in use:
Switching threshold L → H	1.9 mA (190 digits), parameter *Hysteresis HIGH [INT] ->*
Switching threshold H → L	1.7 mA (170 digits), parameter *Hysteresis LOW [INT] ->*
Open-circuit	0.125 mA (13 digits), parameter *Limit Value LOW [INT] ->*
Short-circuit	5.5 mA (550 digits), parameter *Limit Value HIGH [INT] ->*
Contacts wired with resistors (1 k/10 k):	The values must be configured and verified for the contact in use:
Switching threshold L → H	1.7 mA (170 digits), parameter *Hysteresis HIGH [INT] ->*
Switching threshold H → L	1.5 mA (150 digits), parameter *Hysteresis LOW [INT] ->*
Open-circuit	0.125 mA (13 digits), parameter *Limit Value LOW [INT] ->*
Short-circuit	8.5 mA (850 digits), parameter *Limit Value HIGH [INT] ->*

Table 12: Default Values for the Digital Inputs

Supply outputs	
Nominal voltages	8.2 VDC / 26 VDC, switchable for each group
Tolerance	± 5 %
Safely monitored limits Range 8.2 V Range 26 V	 7.6...8.8 V, (tolerance range: 7.3...9.1 V) 24.3...27.7 V, (tolerance range: 24.0...28.0 V)
Current limiting	> 200 mA (0 V each group) the output is switched off

Table 13: Specifications for the Supply Outputs

3.5.1 Product Data MI 24 014

The MI 24 014 model variant is intended for use in railway applications. The electronic components are coated with a protective lacquer.

MI 24 014	
Operating temperature	-25…+70 °C (temperature class T1)

Table 14: Product Data MI 24 014

The module MI 24 014 meets the conditions for vibrations and shock test according to EN 61373, category 1, class B.

4 Start-up

To start up the controller, it must be mounted, connected and configured in the programming tool.

4.1 Installation and Mounting

The module is mounted in the subrack of the modular HIMatrix F60 system.

When laying cables (long cables, in particular), take appropriate measures to avoid interference, e.g., by separating the signal lines from the power lines.

When dimensioning the cables, ensure that their electrical properties have no negative impact on the measuring circuit.

4.1.1 Mounting and Removing the Modules

To mount and remove the modules, the connection cable clamp terminals must be unplugged.

Additionally, personnel must be protected from electrostatic discharge. For details, refer to Chapter 2.1.2.

Mounting the Modules

To mount a module into the subrack

1. Insert the module as far as it can go – without jamming it – into the two guiding rails which are located on the housing's upper and lower part.
2. Apply pressure to the upper and lower extremity of the front plate until the module plugs snap into the backplane socket.
3. Secure the module with the screws located on upper and lower extremity of the front plate.

The module is mounted.

Removing the Modules

To remove a module from the subrack

1. Remove the plugs from the module front plate.
2. Release the locking screws located on the upper and lower extremity of the front plate.
3. Loosen the module using the handle located on the lower part of the front plate and remove it from the guiding rails.

The module is removed.

i The inputs of the MI 24 01 must not be wired redundantly.

i Inputs that are not being used need not be terminated. However, no open wire may be connected.

4.1.2 Analog Inputs

Only shielded cables may be connected to the analog inputs. Each analog input must be connected to a twisted pair of wires. The shielding must be connected to the controller and the sensor housing and earthed on one end to the controller side to form a Faraday cage.

The cable length depends on its resistor. Typically, the maximum total resistance permitted (cable + additional resistors) is 250 Ω:

$$R_B = \frac{U_{TC} - U_{Tmin}}{I_{max}} - R_E = \frac{24\ V - 14\ V}{21.5\ mA} - R_E \approx 250\ \Omega$$

U_{TC} Switch-off threshold for monitoring the transmitter supply voltage

U_{Tmin} Minimum supply voltage for the transmitters

I_{max} Maximum measuring current

R_E Input resistor of the analog input (approx. 200 Ω)

Number of input channels	Measurement procedure	Current	Range of values in the application
24	Unipolar [1)]	Nominal value: 0…20 mA	0…2000
		Operating value: -1…24 mA	-100…2500
[1)] Measurement with fixed ground			

Table 15: Range of Values for the Analog Inputs

The analog inputs are designed to retain the metrological accuracy for 10 years. A proof test must be performed every 10 years.

4.1.3 Digital Inputs

Only shielded cables may be connected to the digital inputs. Each digital input must be connected to a twisted pair of wires. The shielding must be connected to the controller and the sensor housing and earthed on one end to the controller side to form a Faraday cage.

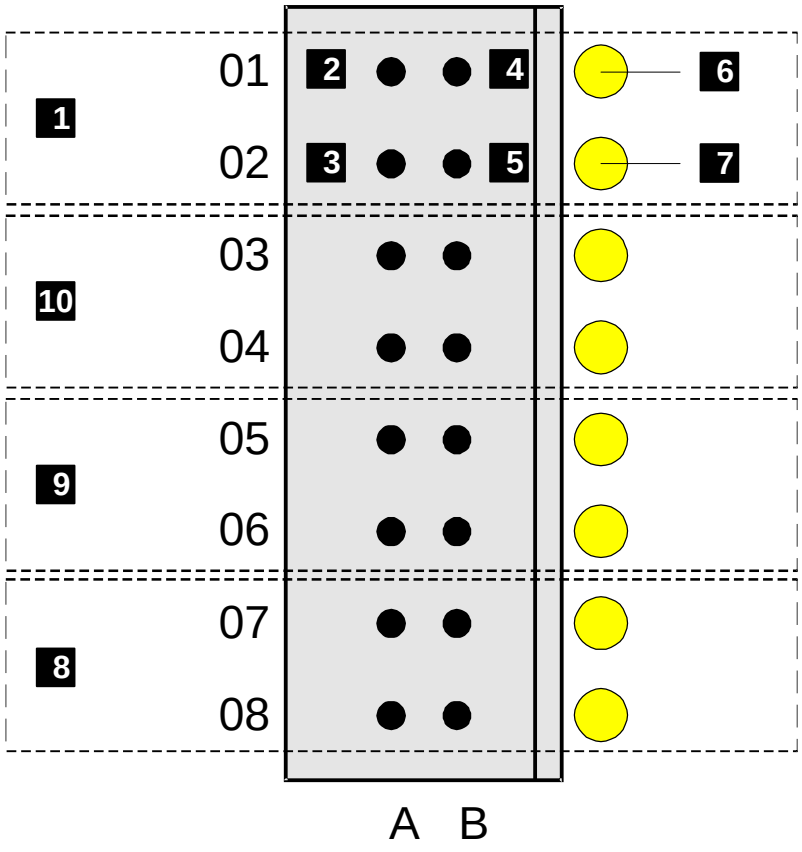
The cable length depends on its resistor: The maximum total resistance permitted is < 50 Ω in accordance with EN 60947-5-6.

The status of the inputs is displayed via LEDs that are controlled by the user program: the LED is activated with high level.

In the event of STOP or ERROR STOP, the LEDs are no longer operated by the user program.

4.1.4 Pin Designation

The pin designation consists of column designation (A, B) and row designation (01, 02, 03, ...).



1 Terminal Pin Channel 1
2 Terminal A 01: Supply 1 (S1+)
3 Terminal A 02: Ground 1 (I1-)
4 Terminal B 01: Digital Input 1 (DI1+)
5 Terminal B 02: Analog Input 1 (AI1+)
6 Status LED Channel 1
7 LED without Function
8 Terminal Pin Channel 4
9 Terminal Pin Channel 3
10 Terminal Pin Channel 2

Figure 4: Pin Designation for the MI 24 01 Module

4.1.5 Pin Assignment for the MI 24 01 Module

Pin assignment of group 1: channels 1..8:

Pin designation	Function, channel	Description
A 01	S1+	Supply channel 1 (for channels 1...8)
A 02	I1-	Ground channel 1
B 01	DI1+	Digital input 1
B 02	AI1+	Analog input 1
A 03	S2+	Supply channel 2 (for channels 1...8)
A 04	I2-	Ground channel 2
B 03	DI2+	Digital input 2
B 04	AI2+	Analog input 2
A 05	S3+	Supply channel 3 (for channels 1...8)
A 06	I3-	Ground channel 3
B 05	DI3+	Digital input 3
B 06	AI3+	Analog input 3
A 07	S4+	Supply channel 4 (for channels 1...8)
A 08	I4-	Ground channel 4
B 07	DI4+	Digital input 4
B 08	AI4+	Analog input 4
Pin designation	Function, channel	Description
A 09	S5+	Supply channel 5 (for channels 1...8)
A 10	I5-	Ground channel 5
B 09	DI5+	Digital input 5
B 10	AI5+	Analog input 5
A 11	S6+	Supply channel 6 (for channels 1...8)
A 12	I6-	Ground channel 6
B 11	DI6+	Digital input 6
B 12	AI6+	Analog input 6
A 13	S7+	Supply channel 7 (for channels 1...8)
A 14	I7-	Ground channel 7
B 13	DI7+	Digital input 7
B 14	AI7+	Analog input 7
A 15	S8+	Supply channel 8 (for channels 1...8)
A 16	I8-	Ground channel 8
B 15	DI8+	Digital input 8
B 16	AI8+	Analog input 8

Table 16: Pin Assignment of Channels 1...8

Pin assignment of group 2: channels 9..16:

Pin designation	Function, channel	Description
A 17	S9+	Supply channel 9 (for channels 9...16)
A 18	I9-	Ground channel 9
B 17	DI9+	Digital input 9
B 18	AI9+	Analog input 9
A 19	S10+	Supply channel 10 (for channels 9...16)
A 20	I10-	Ground channel 10
B 19	DI10+	Digital input 10
B 20	AI10+	Analog input 10
A 21	S11+	Supply channel 11 (for channels 9...16)
A 22	I11-	Ground channel 11
B 21	DI11+	Digital input 11
B 22	AI11+	Analog input 11
A 23	S12+	Supply channel 12 (for channels 9...16)
A 24	I12-	Ground channel 12
B 23	DI12+	Digital input 12
B 24	AI12+	Analog input 12
Pin designation	Function, channel	Description
A 25	S13+	Supply channel 13 (for channels 9...16)
A 26	I13-	Ground channel 13
B 25	DI13+	Digital input 13
B 26	AI13+	Analog input 13
A 27	S14+	Supply channel 14 (for channels 9...16)
A 28	I14-	Ground channel 14
B 27	DI14+	Digital input 14
B 28	AI14+	Analog input 14
A 29	S15+	Supply channel 15 (for channels 9...16)
A 30	I15-	Ground channel 15
B 29	DI15+	Digital input 15
B 30	AI15+	Analog input 15
A 31	S16+	Supply channel 16 (for channels 9...16)
A 32	I16-	Ground channel 16
B 31	DI16+	Digital input 16
B 32	AI16+	Analog input 16

Table 17: Pin Assignment of Channels 9...16

Pin assignment of group 3: channels 17..24:

Pin designation	Function, channel	Description
A 33	S17+	Supply channel 17 (for channels 17...24)
A 34	I17-	Ground channel 17
B 33	DI17+	Digital input 17
B 34	AI17+	Analog input 17
A 35	S18+	Supply channel 18 (for channels 17...24)
A 36	I18-	Ground channel 18
B 35	DI18+	Digital input 18
B 36	AI18+	Analog input 18
A 37	S19+	Supply channel 19 (for channels 17...24)
A 38	I19-	Ground channel 19
B 37	DI19+	Digital input 19
B 38	AI19+	Analog input 19
A 39	S20+	Supply channel 20 (for channels 17...24)
A 40	I20-	Ground channel 20
B 39	DI20+	Digital input 20
B 40	AI20+	Analog input 20
Pin designation	Function, channel	Description
A 41	S21+	Supply channel 21 (for channels 17...24)
A 42	I21-	Ground channel 21
B 41	DI21+	Digital input 21
B 42	AI21+	Analog input 21
A 43	S22+	Supply channel 22 (for channels 17...24)
A 44	I22-	Ground channel 22
B 43	DI22+	Digital input 22
B 44	AI22+	Analog input 22
A 45	S23+	Supply channel 23 (for channels 17...24)
A 46	I23-	Ground channel 23
B 45	DI23+	Digital input 23
B 46	AI23+	Analog input 23
A 47	S24+	Supply channel 24 (for channels 17...24)
A 48	I24-	Ground channel 24
B 47	DI24+	Digital input 24
B 48	AI24+	Analog input 24

Table 18: Pin Assignment of Channels 17...24

4.1.5.1 Surges on Digital Inputs

Due to the short cycle time of the HIMatrix systems, a surge pulse as described in EN 61000-4-5 can be read in to the digital inputs as a short-term high level.

The following measures ensure proper operation in environments where surges may occur:

1. Install shielded input wires
2. Program noise blanking in the user program. A signal must be present for at least two cycles before it is evaluated. The fault reaction is triggered with a corresponding delay.

i The measures specified above are not necessary if the plant design precludes surges from occurring within the system.

In particular, the design must include protective measures with respect to overvoltage, lightning, earth grounding and plant wiring in accordance with the relevant standards and the instructions specified in the System Manual (HI 800 141 E or HI 800 191 E).

4.1.6 Cable Plugs

Cable plugs attached to the pin headers of the module are used to connect to the field zone. The cable plugs are included within the scope of delivery of the HIMatrix modules.

Connection to the field zone	
Number of cable plugs	6 pieces, 16 poles, tension clamp terminal
Wire cross-section	0.2…1 mm^2 (single-wire) 0.2…1 mm^2 (finely stranded) 0.13…0.34 mm^2 (with wire end ferrule)
Stripping length	7 mm

Table 19: Cable Plug Properties

4.1.7 Mounting the MI 24 01 in Zone 2

(EC Directive 94/9/EC, ATEX)

The module is suitable for mounting in zone 2. Refer to the corresponding declaration of conformity available on the HIMA website.

When mounting the device, observe the special conditions specified in the following section.

Specific Conditions X

1. Mount the HIMatrix F60 controller in an enclosure that meets the EN 60079-15 requirements and achieves a type of protection of at least IP54, in accordance with EN 60529. Provide the enclosure with the following label:

   Work is only permitted in the de-energized state

   Exception:
   If a potentially explosive atmosphere has been precluded, work can also performed when the controller is under voltage.
2. The enclosure in use must be able to safely dissipate the generated heat. The maximum power dissipation of the MI 24 01 module is 16 W.
3. The 24 VDC power must come from a power supply unit with safe isolation. Use power supply units of type PELV or SELV only.
4. Applicable standards:

VDE 0170/0171 Part 16,	DIN EN 60079-15: 2004-5
VDE 0165 Part 1,	DIN EN 60079-14: 1998-08

Pay particular attention to the following sections:

DIN EN 60079-15:	
Chapter 5	Design
Chapter 6	Terminals and cabling
Chapter 7	Air and creeping distances
Chapter 14	Connectors
DIN EN 60079-14:	
Chapter 5.2.3	Equipment for use in zone 2
Chapter 9.3	Cabling for zones 1 and 2
Chapter 12.2	Equipment for zones 1 and 2

The module is additionally equipped with the label represented below:

Figure 5: Label for Ex Conditions

4.1.8 Power Dissipation of the MI 24 01

The power dissipation resulting from the measurement checks performed on the MI 24 01 in idle state is:

24 V x 230 mA = 5.5 W (power dissipation in idle state)

The following chapter examines how the power dissipation varies if transmitters or proximity switches are connected.

4.1.8.1 Connecting an Active Transmitter

Based on the specifications for the analog inputs, the following values result:

Maximum current for each channel: 25 mA
Nominal input resistor: 200 Ω

These values lead to a power dissipation on the internal shunt of:

$P_{Vinternal}$ = 0.125 W (shunt power dissipation)

For each channel, the power dissipation with active transmitter is therefore:

$P_V = P_{Vinternal}$ = 0.125 W

4.1.8.2 Connecting a Passive Transmitter

Power provided to the MI 24 module:

24 V x 990 mA = 23.8 W

Electrical power of 24 transmitter supplies:

24 x 26 V x 25.5 mA = 16 W

Power dissipation in idle state: 5.5 W

Therefore, the following power dissipation remains for the 24 transmitter supply channels:

23.8 W – 16 W – 5.5 W = 2.3 W.

Which means that each transmitter supply channel has the following power dissipation:

P_{VT} = 0.1 W (transmitter supply channel)

Additionally, the power converted on the internal shunt is for each channel:

$P_{Vinternal}$ = 0.125 W

The power dissipation if a passive transmitter is connected is therefore:

$P_V = P_{VT} + P_{Vinternal}$ =0.1 W + 0.125 W = 0.225 W

4.1.8.3 Connecting Proximity Switches (Contact Wired with Resistors)

The following specifications apply to a proximity switch (see digital inputs):

Supply voltage: 8.2 V
Nominal input resistor: 674 Ω

Power dissipation for each proximity switch:

P_V = 8.2 V x 8.2 V / 674 Ω = 0.1 W

4.2 Configuration

The module can be configured using a programming tool, SILworX or ELOP II Factory. Which programming tool should be used, depends on the revision status of the operating system (firmware):

- SILworX is required for CPU operating system version 7 and higher.
- ELOP II Factory is required for CPU operating system versions up to 6.x.

i How to switch between operating systems is described in Chapter *Loading Operating Systems* of the system manual for the modular F60 system (HI 800 191 E).

Observe the following points when configuring the module:

- In SILworX, the *Transmitter Voltage[0x]* system parameter must be assigned a global variable. This global variable is used to set the value for the transmitter supply, see Table 21.
- In ELOP II Factory, the *Transmitter Voltage[xx] [USINT]* system signal must be assigned a signal. This signal is used to set the value for the transmitter supply, see Table 23.

i **The transmitter supply must be configured even if it is not used.**

4.2.1 Module Slots

Slots 1 and 2 on the F60 subrack are reserved for the PS 01 power supply module and the central module, respectively. Any type of I/O modules can be plugged in to slots 3...8.

The module slots in SILworX and ELOP II Factory are numbered as follows:

Module	Slot on the rack	Slot in SILworX	Slot in ELOP II Factory
PS 01	1	-	-
CPU/COM	2	0/1	-
I/O	3	2	1
I/O	4	3	2
I/O	5	4	3
I/O	6	5	4
I/O	7	6	5
I/O	8	7	6

Table 20: Module Slots

i
- The PS 01 power supply module is not configured.
- CPU and COM are both on the central module. In the programming tools, however, they are represented as separate items.

4.2.2 Line Control

Line control is not possible for the MI 24 01 module, e.g., on EMERGENCY STOP inputs complying with Cat. 4 and PL e in accordance with EN ISO 13849-1.

However, the digital and analog inputs can be configured for detecting short-circuits or open-circuits as follows:

- Definition of the values for the parameters:
  Limit Value LOW [INT]-> (low limit for a valid low level with a digital signal, upper limit for the under scale range with an analog signal) and
  Limit Value HIGH [INT]-> (upper limit for a valid high level with a digital signal, low limit for the over scale range for an analog signal).
- Evaluation of the parameters -> *Underflow [BOOL]* (open-circuit) and -> *Overflow [BOOL]* (short-circuit) compared to these limit values performed in the user program.

4.3 Configuration with SILworX

In the Hardware Editor, the F60 is represented with the following modules:

- one processor module (CPU)
- one communication module (COM)
- 6 slots available for I/O modules

To insert I/O modules, drag them from the module list onto an available slot.

Double-click the module to open the Detail View with the corresponding tabs. The tabs are used to assign the global variables configured in the user program to the system parameters of the corresponding module.

4.3.1 Parameters and Error Codes for the Inputs and Outputs

The following tables specify the system parameters that can be read and set for the inputs and outputs, including the corresponding error codes.

In the user program, the error codes can be read using the variables assigned within the logic.

The error codes can also be displayed in SILworX.

4.3.2 Analog and Digital Outputs

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

4.3.2.1 Tab **Module**

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

<table>
<tr><th>System parameter</th><th>Data type</th><th>R/W</th><th>Description</th></tr>
<tr><td>MI.Error Code</td><td>WORD</td><td>R</td><td>Error codes for all analog inputs
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x0001</td><td>Module fault</td></tr>
<tr><td>0x0004</td><td>time monitoring of conversion faulty</td></tr>
<tr><td>0x0008</td><td>FTT test: Walking bit of data bus faulty</td></tr>
<tr><td>0x0010</td><td>FTT test: Error while checking coefficients</td></tr>
<tr><td>0x0020</td><td>FTT test: Operating voltages faulty</td></tr>
<tr><td>0x0040</td><td>A/D conversion faulty (DRDY_LOW)</td></tr>
<tr><td>0x0080</td><td>Cross links of MUX faulty</td></tr>
<tr><td>0x0100</td><td>Walking bit of data bus faulty</td></tr>
<tr><td>0x0200</td><td>Multiplexer addresses faulty</td></tr>
<tr><td>0x4000</td><td>Faulty operating voltages</td></tr>
<tr><td>0x0800</td><td>Measuring system (characteristic) faulty (unipolar)</td></tr>
<tr><td>0x1000</td><td>Measuring system (final values, zero point) faulty (unipolar)</td></tr>
<tr><td>0x8000</td><td>A/D conversion faulty (DRDY_HIGH)</td></tr>
</table></td></tr>
<tr><td>Module Error Code</td><td>WORD</td><td>R</td><td>Error codes for the module
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x0000</td><td>I/O processing, if required with errors
see other error codes</td></tr>
<tr><td>0x0001</td><td>No I/O processing (CPU not in RUN)</td></tr>
<tr><td>0x0002</td><td>No I/O processing during the booting test</td></tr>
<tr><td>0x0004</td><td>Manufacturer interface operating</td></tr>
<tr><td>0x0010</td><td>No I/O processing: invalid configuration</td></tr>
<tr><td>0x0020</td><td>No I/O processing: fault rate exceeded</td></tr>
<tr><td>0x0040/
0x0080</td><td>No I/O processing: configured module not plugged in</td></tr>
</table></td></tr>
<tr><td>Module SRS</td><td>UDINT</td><td>R</td><td>Slot number (System.Rack.Slot)</td></tr>
<tr><td>Module Type</td><td>UINT</td><td>R</td><td>Type of module, target value: 0xF609 [62 985_{dec}]</td></tr>
<tr><td>Transmitter.
Error Code</td><td>WORD</td><td>R</td><td>Error codes for the transmitter unit
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x0001</td><td>Fault in the transmitter supply</td></tr>
<tr><td>0x0400</td><td>FTT test: 1st temperature threshold exceeded</td></tr>
<tr><td>0x0800</td><td>FTT test: 2nd temperature threshold exceeded</td></tr>
</table></td></tr>
<tr><td>Transmitter[0x].Error Code</td><td>BYTE</td><td>R</td><td>Error codes for each transmitter group
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x01</td><td>Module fault of transmitter supply</td></tr>
<tr><td>0x02</td><td>Overcurrent of transmitter supply</td></tr>
<tr><td>0x04</td><td>Undervoltage of transmitter supply.</td></tr>
<tr><td>0x08</td><td>Overvoltage of transmitter supply.</td></tr>
</table></td></tr>
</table>

System parameter	Data type	R/W	Description
Transmitter Voltage[0x]	USINT	W	Switching of the transmitter supply for each group: 1 8.2 V 2 26.0 V

Table 21: SILworX - System Parameters for Analog and Digital Outputs, **Module** Tab

4.3.2.2 Tab **MI 24 01_1: Channels**

The **MI 24 01_1: Channels** tab contains the following system parameters:

System parameter	Data type	R/W	Description
-> Error Code	BYTE	R	Error codes for the analog input channels Coding: Description 0x01: Fault in the analog input module 0x02: Limit values exceeded (*MI[xx].Overflow*, *MI[xx].Underflow*) 0x04: A/D converter faulty or measured values invalid 0x08: Measured value out of the safety-related accuracy 0x10: Measured value overflow 0x20: Channel not operating 0x40: Address error of both A/D converters 0x80: Configuration of the hysteresis faulty
-> Value [INT]	INT	R	Analog value of the channel [INT] from 0...2000 (0...20 mA). The validity depends on *MI[xx].Error Code*
-> Value [BOOL]	BOOL	R	Boolean value of the channels 1...24 in accordance with hysteresis The validity depends on *MI[xx].Error Code*
Channel Used [BOOL]	BOOL	W	Channel configuration: 1 = operating 0 = not operating
Hysteresis LOW [INT] ->	INT	W	Upper limit for low level of *MI[xx].DI Value*
Hysteresis HIGH [INT] ->	INT	W	Low limit for HIGH level of *MI[xx].DI Value*
Threshold LOW [INT] ->	INT	W	Use as DI: Low limit for a valid low level Use as AI: Upper limit for an under scale range
Limit Value HIGH [INT] ->	INT	W	Use as DI: Upper limit for a valid high level Use as AI: Low limit for an over scale range
Transmitter Used [BOOL] ->	BOOL	W	MI channel used with transmitter supply: TRUE = used FALSE = not used
-> Underflow [BOOL]	BOOL	R	The value of *MI[xx].AI Value* is less than *MI[xx].Limit Value LOW* The validity depends on *MI[xx].Error Code*
-> Overflow [BOOL]	BOOL	R	The value of *MI[xx].AI Value* is less than *MI[xx].Limit Value LOW* The validity depends on *MI[xx].Error Code*

Table 22: SILworX - System Parameters for Analog and Digital Outputs, **MI 24 01_1: Channels** Tab

4.4 Configuration with ELOP II Factory

4.4.1 Configuring the Inputs and Outputs

The signals previously defined in the Signal Editor (Hardware Management) are assigned to the individual channels (inputs and outputs) using ELOP II Factory. Refer to the system manual for the modular F60 system or the online help for more details.

The following chapter describes the system signals used for assigning signals in the controller.

4.4.2 Signals and Error Codes for the Inputs and Outputs

The following tables specify the system signals that can be read and set for the inputs and outputs, including the corresponding error codes.

In the user program, the error codes can be read using the signals assigned within the logic.

The error codes can also be displayed in ELOP II Factory.

4.4.3 Analog and Digital Inputs

<table>
<tr><th>System signal</th><th>R/W</th><th>Description</th></tr>
<tr><td>Mod.SRS [UDINT]</td><td>R</td><td>Slot number (System.Rack.Slot)</td></tr>
<tr><td>Mod.Type [UINT]</td><td>R</td><td>Type of module, target value: 0xF609 [62 985$_{dec}$]</td></tr>
<tr><td>Mod. Error Code [WORD]</td><td>R</td><td>Error codes for the module
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x0000</td><td>I/O processing, if required with errors
see other error codes</td></tr>
<tr><td>0x0001</td><td>No I/O processing (CPU not in RUN)</td></tr>
<tr><td>0x0002</td><td>No I/O processing during the booting test</td></tr>
<tr><td>0x0004</td><td>Manufacturer interface operating</td></tr>
<tr><td>0x0010</td><td>No I/O processing: invalid configuration</td></tr>
<tr><td>0x0020</td><td>No I/O processing: fault rate exceeded</td></tr>
<tr><td>0x0040/
0x0080</td><td>No I/O processing: configured module not plugged in</td></tr>
</table></td></tr>
<tr><td>MI.Error Code [WORD]</td><td>R</td><td>Error codes for all analog inputs
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x0001</td><td>Module fault</td></tr>
<tr><td>0x0004</td><td>time monitoring of conversion faulty</td></tr>
<tr><td>0x0008</td><td>FTT test: Walking bit of data bus faulty</td></tr>
<tr><td>0x0010</td><td>FTT test: Error while checking coefficients</td></tr>
<tr><td>0x0020</td><td>FTT test: Operating voltages faulty</td></tr>
<tr><td>0x0040</td><td>A/D conversion faulty (DRDY_LOW)</td></tr>
<tr><td>0x0080</td><td>Cross links of MUX faulty</td></tr>
<tr><td>0x0100</td><td>Walking bit of data bus faulty</td></tr>
<tr><td>0x0200</td><td>Multiplexer addresses faulty</td></tr>
<tr><td>0x4000</td><td>Faulty operating voltages</td></tr>
<tr><td>0x0800</td><td>Measuring system (characteristic) faulty (unipolar)</td></tr>
<tr><td>0x1000</td><td>Measuring system (final values, zero point) faulty (unipolar)</td></tr>
<tr><td>0x8000</td><td>A/D conversion faulty (DRDY_HIGH)</td></tr>
</table></td></tr>
<tr><td>MI[xx].Error Code [BYTE]</td><td>R</td><td>Error codes for the analog input channels
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x01</td><td>Fault in the analog input module</td></tr>
<tr><td>0x02</td><td>Limit values exceeded (MI[xx].Overflow, MI[xx].Underflow)</td></tr>
<tr><td>0x04</td><td>A/D converter faulty or measured values invalid</td></tr>
<tr><td>0x08</td><td>Measured value out of the safety-related accuracy</td></tr>
<tr><td>0x10</td><td>Measured value overflow</td></tr>
<tr><td>0x20</td><td>Channel not operating</td></tr>
<tr><td>0x40</td><td>Address error of both A/D converters</td></tr>
<tr><td>0x80</td><td>Configuration of the hysteresis faulty</td></tr>
</table></td></tr>
<tr><td>MI[xx].AI Value [INT]</td><td>R</td><td>Analog value of the channel [INT] from 0...2000 (0...20 mA)
The validity depends on MI[xx].Error Code</td></tr>
<tr><td>MI[xx].Used [BOOL]</td><td>W</td><td>Channel configuration:
1 = operating
0 = not operating</td></tr>
<tr><td>MI[xx].DI Value [BOOL]</td><td>R</td><td>Boolean value of the channels 1...24 in accordance with hysteresis
The validity depends on MI[xx].Error Code</td></tr>
</table>

<table>
<tr><th>System signal</th><th>R/W</th><th>Description</th></tr>
<tr><td>MI[xx].Hysteresis LOW [INT]</td><td>W</td><td>Upper limit for low level of MI[xx].DI Value</td></tr>
<tr><td>MI[xx].Hysteresis HIGH [INT]</td><td>W</td><td>Low limit for HIGH level of MI[xx].DI Value</td></tr>
<tr><td>MI[xx].Transmitter Used [BOOL]</td><td>W</td><td>MI channel used with transmitter supply:
TRUE = used
FALSE = not used</td></tr>
<tr><td>Transmitter Voltage[xx] [USINT]</td><td>W</td><td>Switching of the transmitter supply for each group:
1 8.2 V
2 26.0 V</td></tr>
<tr><td>Transmitter. Error Code [WORD]</td><td>R</td><td>Error codes for the transmitter unit
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x0001</td><td>Fault in the transmitter supply</td></tr>
<tr><td>0x0400</td><td>FTT test: 1st temperature threshold exceeded</td></tr>
<tr><td>0x0800</td><td>FTT test: 2nd temperature threshold exceeded</td></tr>
</table></td></tr>
<tr><td>Transmitter[xx]. Error Code [BYTE]</td><td>R</td><td>Error codes for each transmitter group
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x01</td><td>Module fault of transmitter supply</td></tr>
<tr><td>0x02</td><td>Overcurrent of transmitter supply</td></tr>
<tr><td>0x04</td><td>Undervoltage of transmitter supply.</td></tr>
<tr><td>0x08</td><td>Overvoltage of transmitter supply.</td></tr>
</table></td></tr>
<tr><td>MI[xx].Underflow [BOOL]</td><td>R</td><td>The value of MI[xx].AI Value is less than MI[xx].Limit Value LOW
The validity depends on MI[xx].Error Code</td></tr>
<tr><td>MI[xx].Overflow [BOOL]</td><td>R</td><td>The value of MI[xx].AI Value is less than MI[xx].Limit Value LOW
The validity depends on MI[xx].Error Code</td></tr>
<tr><td>MI[xx].Threshold LOW [INT]</td><td>W</td><td>Use as DI: Low limit for a valid low level
Use as AI: Upper limit for an under scale range</td></tr>
<tr><td>MI[xx].Threshold HIGH [INT]</td><td>W</td><td>Use as DI: Upper limit for a valid high level
Use as AI: Low limit for an over scale range</td></tr>
</table>

Table 23: ELOP II Factory - Digital and Analog Input System Signals

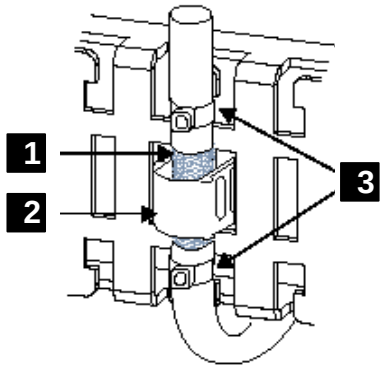
4.5 Connection Variants

In the following examples, external devices are connected to the inputs of the MI 24 01 module. All cables are shielded and the shielding is connected to the F60 earth grid.

4.5.1 Connecting the Shielding to the F60 Earth Grid

The cables are led vertically downwards and secured with 2 cable straps to the earth grid guide.

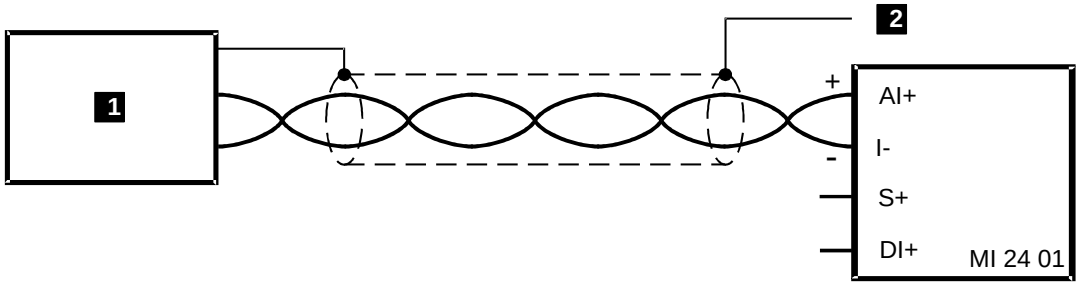
Each cable shielding is connected to the earth grid with a clip. To this end, place the clamp over the surface of the stripped cable shielding and press from both sides into the oblong holes of the earth grid until it snaps into position.



1 Cable Shielding
2 Earth Clamp
3 Cable Straps

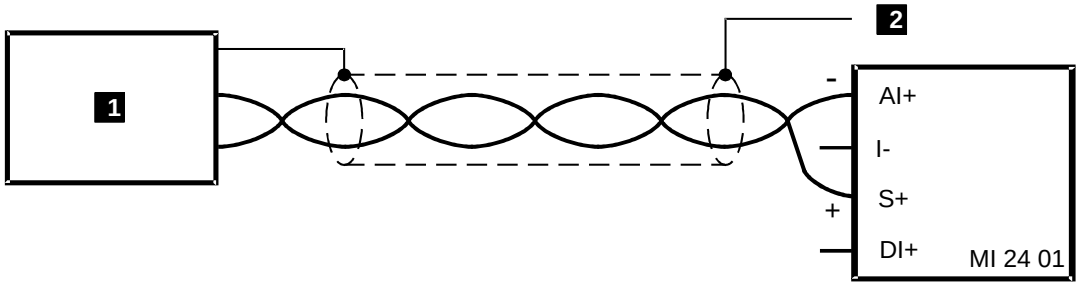
Figure 6: Connection of the Shielding to the F60 Earth Grid

4.5.2 Connection Example



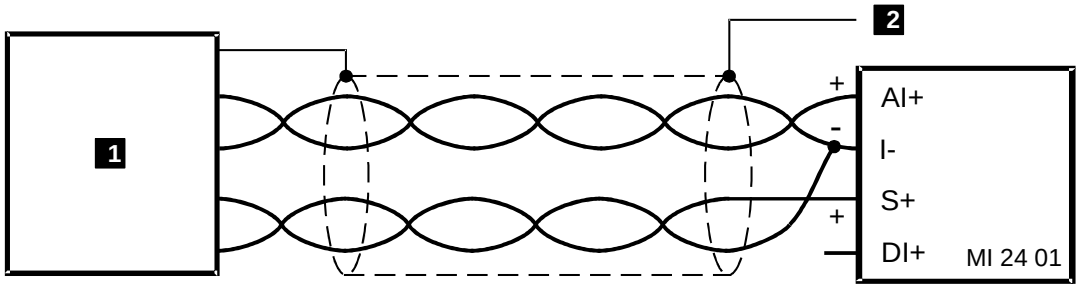
1 Cable Links on the Connector Board
2 F60 Earth Grid

Figure 7: Connection to a Current Source



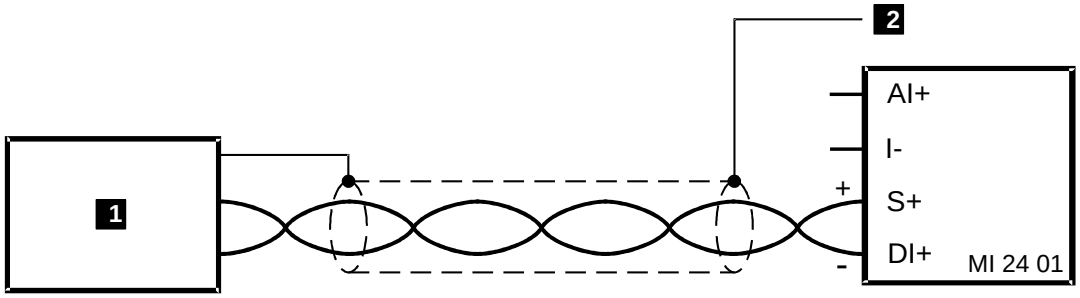
1 Transmitter 2 F60 Earth Grid

Figure 8: Connection to a Two-Wire Transmitter



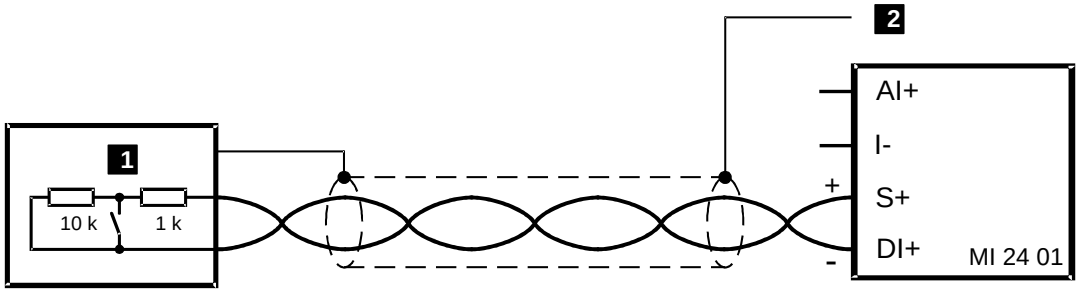
1 Transmitter 2 F60 Earth Grid

Figure 9: Connection to a Three-Wire Transmitter



1 Proximity Switch 2 F60 Earth Grid

Figure 10: Connection to a Proximity Switch



1 Contact 2 F60 Earth Grid

Figure 11: Connection to a Mechanical Contact

i Safety-related applications other than those specified here are not permitted.

5 Operation

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

5.1 Handling

Handling of the controller during operation is not required.

5.2 Diagnosis

A first diagnosis results from evaluating the LEDs, see Chapter 3.4.3.

The module diagnostic history can also be read using the programming tool.

6 Maintenance

No maintenance measures are required during normal operation.

If a failure occurs, the defective module or device must be replaced with a module or device of the same type or with a replacement model approved by HIMA.

Only the manufacturer is authorized to repair the device or module.

6.1 Faults

Refer to Chapter 3.1.1.1, for more information on the fault reaction of analog inputs.

Refer to Chapter 3.1.2.1, for more information on the fault reaction of digital inputs.

NOTE

If a failure occurs, the module must be replaced to ensure the plant's safety.

A module may only be replaced while the power is switched off.

i Modules may not be removed or inserted during operation.

The instructions specified in Chapter 4.1.1 must be observed when replacing an existing module or installing a new one.

6.2 Maintenance Measures

The following measures are required for the modular F60 system:

- Load the operating system, if a new version is required
- Perform the proof test

6.2.1 Loading the Operating System

HIMA is continuously improving the operating system of the F60 central module. HIMA recommends to use system downtimes to load the current version of the operating system into the F60 controller.

Refer to the release list to check the consequences of the new operation system version on the system!

The operating system is loaded using the programming tool.

Prior to loading the operating system, the F60 controller must be in STOP (displayed in the programming tool). Otherwise, stop the controller.

For more information, refer to the programming tool documentation and the system manual for the modular F60 system (HI 800 191 E).

6.2.2 Proof Test

HIMatrix devices and modules must be subjected to a proof test in intervals of 10 years. For more information, refer to the safety manual (HI 800 023 E).

7 Decommissioning

Remove the supply voltage of the PS 01 supply module to decommission the module. Afterwards pull out the pluggable screw terminal connector blocks for inputs and outputs and the Ethernet cables.

8 Transport

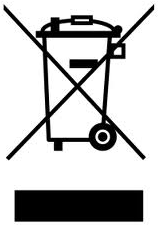
To avoid mechanical damage, HIMatrix components must be transported in packaging.

Always store HIMatrix 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 HIMatrix 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
AO	Analog output
COM	Communication module
CRC	Cyclic redundancy check
DI	Digital input
DO	Digital output
ELOP II Factory	Programming tool for HIMatrix systems
EMC	Electromagnetic compatibility
EN	European norm
ESD	Electrostatic discharge
FB	Fieldbus
FBD	Function block diagrams
FTT	Fault tolerance time
ICMP	Internet control message protocol: Network protocol for status or error messages
IEC	International electrotechnical commission
MAC address	Media access control address: Hardware address of one network connection
PADT	Programming and debugging tool (in accordance with IEC 61131-3), PC with SILworX or ELOP II Factory
PE	Protective earth
PELV	Protective extra low voltage
PES	Programmable electronic system
R	Read: The system variable or signal provides value, e.g., to the user program
Rack ID	Base plate identification (number)
Interference-free	Supposing that two input circuits are connected to the same source (e.g., a transmitter). An input circuit is termed *interference-free* if it does not distort the signals of the other input circuit.
R/W	Read/Write (column title for system variable/signal type)
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 for HIMatrix systems
SNTP	Simple network time protocol (RFC 1769)
SRS	System.rack.slot addressing of a module
SW	Software
TMO	Timeout
W	Write: System variable/signal is provided with value, e.g., from the user program
r_{PP}	Peak-to-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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