HIMatrix M45

Safety-Related Controller

Manual M-DI 8 01

HIMA Paul Hildebrandt GmbH

Industrial Automation

Rev. 1.01

HI 800 661 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`.

Contact

HIMA contact details:

HIMA Paul Hildebrandt GmbH

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
1.00	First edition of the HIMatrix M45 manual		
1.01	Editorial revisions		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 in SILworX.

1.1 Structure and Use of this Manual

The content of this manual is part of the hardware description of the HIMatrix M45 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.
HIMatrix M45 Safety Manual	Safety functions of the HIMatrix system	HI 800 653 E
HIMatrix M45 System Manual	Hardware description of the HIMatrix M45	HI 800 651 E
SILworX Communication Manual	Description of communication and protocols	HI 801 101 E
SILworX Online Help (OLH)	Instructions on how to use SILworX	-
SILworX First Steps Manual	Introduction to SILworX	HI 801 103 E

Table 1: 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 if 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.

The 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
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 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 M45 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 M45 system is a part of the safety equipment of a plant. If a device or a module fails, the system enters the safe state.

In case of emergency, no action that may prevent the HIMatrix M45 systems from operating safely is permitted.

3 Product Description

The **M-DI 8 01** digital input module is intended for use in the HIMatrix M45 system.

Up to 62 I/O modules can be used in a HIMatrix M45 system, if the structuring conditions as of the system manual HI 800 651 E are met.

The module is equipped with the following inputs and outputs:

Inputs/outputs	Number	Function
Safety-Related Digital Inputs	8	Depending on the selected mode of operation - Standard (DI) - Line Control - Test Pulse Blanking
Digital Outputs (non-safety-related)	2	Depending on the selected mode of operation - Supply - Pulsed Output - DO Non-Safety-Related

Table 3: Module Inputs and Outputs

The module has been certified by the TÜV for safety-related applications up to SIL 3 (IEC 61508, IEC 61511, IEC 62061 and EN 50156) as well as PL e (EN ISO 13849-1). Further safety standards, application standards and test standards are specified in the certificates available on the HIMA website.

3.1 Safety Function

The module evaluates the digital input signals and provides them to the user program.

The safety function is performed in accordance with SIL 3.

3.1.1 Reaction in the Event of a Fault

If the safety-related processor system of the module detects a module fault or a channel fault during operation, the module adopts the safe state. All the outputs are in accordance with the de-energize to trip principle and low level is processed by the inputs.

In both cases, the *Err* LED is blinking.

3.2 Scope of Delivery

To be able to operate, the module must be installed on a suitable socket. The socket is not included within the scope of delivery of the module.

The socket is described in Chapter 3.6.

3.3 Type Label

The type plate contains the following details:

- Product name
- Mark of conformity
- Bar code (2D code)
- Part number (Part-No.)
- Hardware revision index (HW-Rev.)
- Operating system revision index (OS-Rev.)
- Operating data (Power:)
- Production year (Prod-Year:)

Figure 1: Sample Type Label

3.4 Structure

The chapter contains the following sections:

- Safety-Related Digital Inputs
- Digital Outputs
- Block Diagram
- LED Indicators

The module is equipped with a safety-related 1oo2D processor system and performs the following functions:

- Evaluation of the digital inputs and outputs
- Control and monitoring of the I/O level

The process data and states of the module are provided to the processor module (M-CPU) via the system bus.

3.4.1 Safety-Related Digital Inputs

The module is equipped with 8 digital inputs that are not galvanically separated from one another.

The digital inputs can be configured for the following options:

- *Standard* (safety-related digital input)
- *Line Control*
- *Test Pulse Blanking*

3.4.1.1 *Standard* Mode of Operation

The *Standard* mode of operation evaluates digital input signals of electromechanical control circuit devices (mechanical contact) and proximity switches (2 or 3-wire device).

3.4.1.2 *Line Control* Mode of Operation

The *Line Control* mode of operation evaluates digital input signals of electromechanical control circuit devices (mechanical contact) and proximity switches (2 or 3-wire device).

Additionally, the inputs were checked for open-circuit and short-circuit, see Chapter 4.3.

3.4.1.3 *Test Pulse Blanking* Mode of Operation

A low level must be present for at least two module cycles to be detected as low signal. This ensures that test pulses are pulsed out, e.g., from light grids.

3.4.2 Digital Outputs

The module is equipped with 2 non-safety-related outputs, each of which is led outwards through two clamps (1 and 7 or 4 and 10). The outputs are current limited. The state (HIGH, LOW) of each output is signaled by an individual LED (HIGH, LOW).

The outputs can be configured for the following options:

- *Supply*
- *Pulsed Output*
- *DO Non-Safety-Related*

The setting is configured via the *Mode of Output X* system parameter. Each of the two outputs can be configured individually.

3.4.2.1 *Supply* Mode of Operation

In this mode of operation, a voltage is present permanently at the output terminals, which can be used to supply control circuit devices and proximity switches. The *Supply* mode of operation is the default setting.

3.4.2.2 *Pulsed Output* Mode of Operation

In this mode of operation, the module pulses the outputs to detect open-circuits and short circuits. Refer to Chapter 4.3 for configuring the mode of operation for the use of line control. The pulse signal can not be configured.

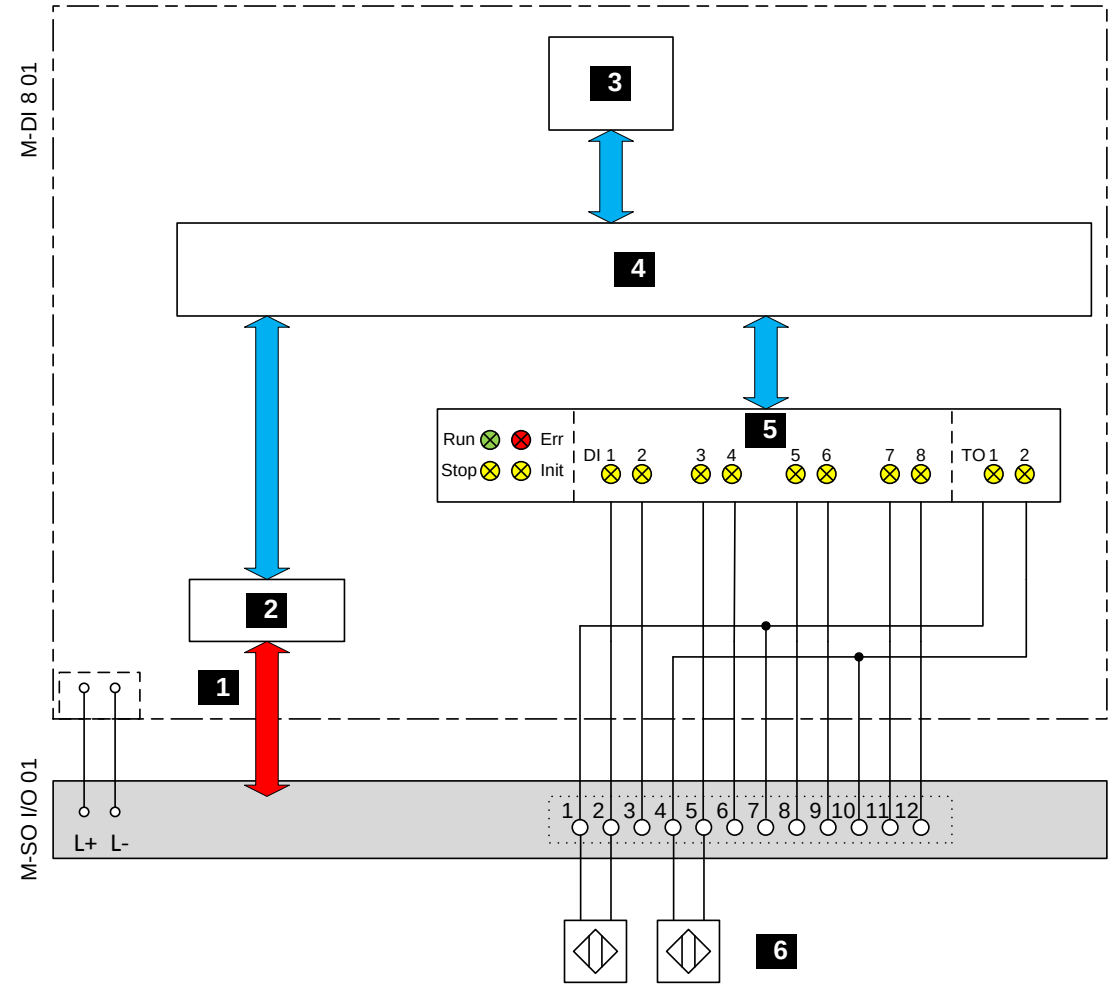
3.4.2.3 *DO Non-Safety-Related* Mode of Operation

In this mode of operation, the outputs can be activated via the user program. To do this, global variables must be assigned to the parameters *Output 1* and *Output 2*. The two outputs can be used as non-safety-related digital outputs.

Ensure proper polarity when connecting external voltage to the outputs or the redundant wiring.

3.4.3 Block Diagram

The following block diagram illustrates the structure of the module.



1 System Bus
2 Switch
3 Watchdog
4 Safety-Related Processor System
5 Interface
6 Field Zone: Proximity Switch and Mechanical Contact

Figure 2: Block Diagram

3.4.4 Front View

The following figure shows the front view of the module:

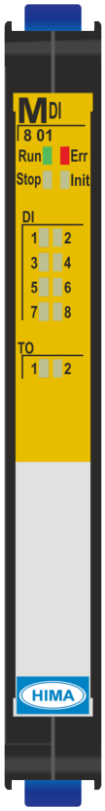


Figure 3: Front View

3.4.5 LED Indicators

The LEDs indicate the operating state of the module. The LEDs are classified as follows:

- Module status indicators
- I/O indicators

When the supply voltage is switched on, an LED test is performed and all LEDs are briefly lit.

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: Blinking synchronously with data transfer

Table 4: Blinking Frequencies of LEDs

3.4.5.1 Module Status Indicators

The LEDs signal the following states:

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.
Err	Red	On	Warning, e.g.: No license for additional functions (e.g., communication protocols), test mode.
		Blinking1	Fault, e.g.: ▪ Internal module fault detected by self-tests, e.g., hardware or voltage supply. ▪ Error while loading the operating system.
		Blinking2	Field fault, but no internal fault
		Off	Normal operation
Stop	Yellow	On	Module state: STOP / VALID CONFIGURATION
		Blinking1	Module state: STOP / INVALID CONFIGURATION or STOP / LOADING OS
		Off	Module not in STOP, observe the other status LEDs.
Init	Yellow	On	Module state: INIT
		Blinking1	Module state: LOCKED or STOP / LOADING OS
		Off	Module state: neither INIT nor LOCKED, observe the other status LEDs.

Table 5: Module Status Indicators

3.4.5.2 I/O Indicators

The LEDs of the I/O indicators are labeled *DI* and *TO*.

LED	Color	Status	Description
DI 1…8	Yellow	On	The related input is active (energized).
		Blinking2	The related channel is faulty.
		Off	The related input is inactive (de-energized).
TO 1…2	Yellow	On	The related output is active (energized).
		Blinking2	The related channel is faulty.
		Off	The related output is inactive (de-energized).

Table 6: I/O LEDs

3.5 Product Data

General	
Supply voltage	24 VDC, -15...+20 %, r_p ≤ 5 %, PELV, SELV
Max. supply voltage	30 VDC
Current input	80 mA at 24 VDC Max. 90 mA
Max. reaction time of the module [1)]	6.2 ms
Ambient temperature	0…+60 °C
Storage temperature	-40…+85 °C
Humidity	Max. 95 % relative humidity, non-condensing
Type of protection	IP20
Dimensions without socket (H x W x D) in mm	105 x 12.5 x 72
Dimensions with socket up to DIN rail (H x W x D) in mm	105 x 12.7 x 90
Weight Module Socket	 approx. 65 g approx. 55 g
[1)] In case of an internal fault	

Table 7: Product Data

Digital inputs	
Number of inputs (number of channels)	8, non-galvanically separated, common ground L-
Type of input	Current sinking logic, 24 V, type 1 and type 3 in accordance with IEC 61131-2
Rated input voltage	24 VDC
Low level	-3…+5 VDC
High level	+15…+30 VDC at min. 2 mA
Switching point	Typ. 10 VDC

Table 8: Specifications for Digital Inputs

Digital Outputs	
Number of outputs (number of channels)	2, non-galvanically separated, common ground L-
Output voltage	L+ minus 2 V
Output current	Max. 200 mA
Leakage current per channel (with low level)	Max. 1 mA at 2 V
Switching time	On: ≤ 30 µs Off: ≤ 80 µs

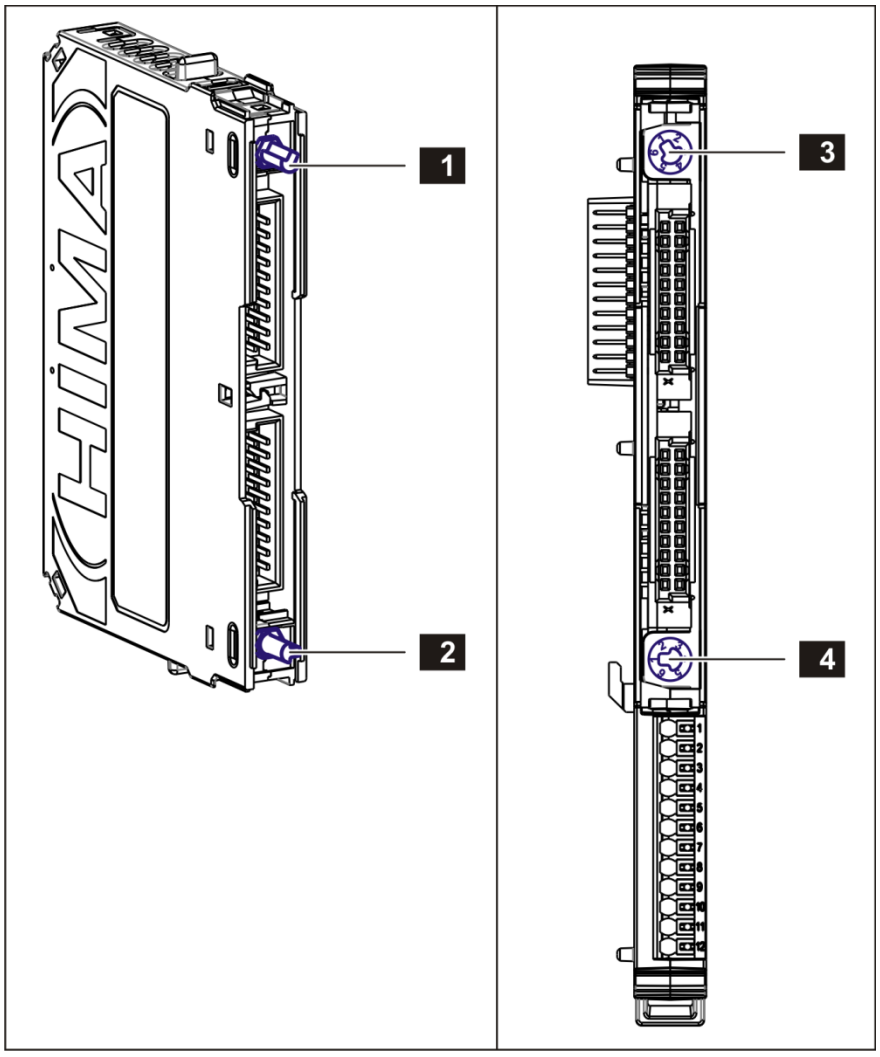
Table 9: Specifications for the Outputs

3.6 Socket

Socket and module form together a functional unit. The module is connected to the system bus, the power supply and the field zone via a socket. The field lines are connected to the socket's tension clamp terminals, see Figure 5.

3.6.1 Mechanical Coding

Module and socket are mechanically coded, see Figure 4. The position of the coding pins determines the module's coding and is defined by the manufacturer. Two coding sockets accept the coding pins and must be configured in the selected module, see Chapter 3.6.2. Coding prevents the socket from improper assembling.



1 Upper Coding Pin
2 Lower Coding Pin
3 Upper Coding Socket
4 Lower Coding Socket

Figure 4: Example of Module and Socket Coding

3.6.2 Coding the M-DI 8 01 Module and Socket

To attach the module, the coding of the M-SO I/O 01 socket must be set as follows:

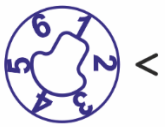
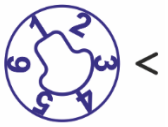
Order	Module coding (rear view)	Position	Coding socket
Upper		2	
Lower		3	

Table 10: Module and Socket Coding

3.6.2.1 Configuring the Socket Coding

Tools and utilities:

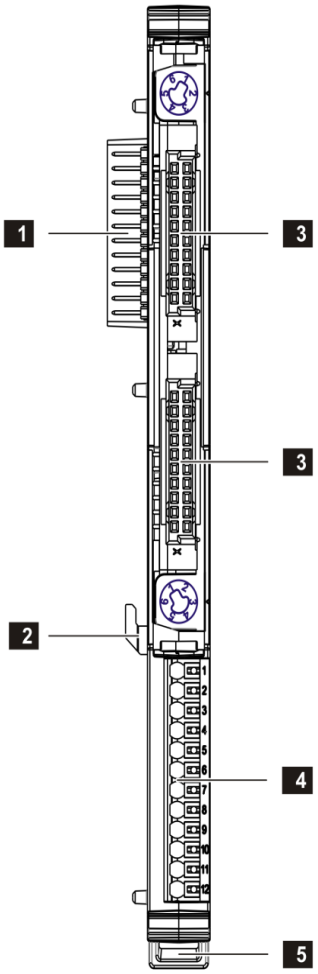
- Screwdriver, slotted 0.8 x 4.0 mm

Configuring the upper and lower coding socket

1. Insert the screwdriver into the opening of the upper coding socket.
2. Turn the screwdriver until the required coding is set.
3. Repeat these steps for the lower coding socket.
4. Insert the module into the socket to check the coding.
5. Remove the module

3.6.3 Socket M-SO I/O 01

Universal socket for being equipped with different modules, see system manual HI 800 651 E.



1 System Bus with Power Supply
2 Latch (Connection to the Left Socket)
3 I/O Plug
4 Field Terminals (Tension Clamp Terminals)
5 Latch (Securing to DIN Rail)

Figure 5: M-SO I/O 01 Socket

The latches are used to secure the socket (2, 5) to the DIN rail and simultaneously to ensure connection to the socket on the left hand-side. Socket and module are connected to the processor module and the power supply via the system bus. The I/O plugs provide the connection between module and socket. The sensors are connected to the field terminals, see Chapter 3.6.3.1 and Chapter 4.5.

3.6.3.1 Terminal Assignment for the Field Terminals

Terminal	Signal	Function
1	TO1+	Pulsed Output 1
2	DI1+	Digital input 1
3	DI2+	Digital input 2
4	TO2+	Pulsed Output 2
5	DI3+	Digital input 3
6	DI4+	Digital input 4
7	TO1+	Pulsed Output 1
8	DI5+	Digital input 5
9	DI6+	Digital input 6
10	TO2+	Pulsed Output 2
11	DI7+	Digital input 7
12	DI8+	Digital input 8

Table 11: Terminal Assignment for Field Terminals

3.6.3.2 Field Terminal Properties

The field terminals are implemented as tension clamp terminals with the following properties:

Connection to the field zone	
Tension clamp terminal	12-pole
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) 0.2…0.75 mm^2 (with wire end ferrule with collar)
Stripping length	8 mm
Screwdriver	Slotted, 0.6 x 3.5

Table 12: Tension Clamp Terminal Properties

4 Start-up

This chapter describes how to install, configure and connect the module. For more information, refer to HIMatrix M45 system manual (HI 800 651 E).

4.1 Mounting

The module is plugged in to the corresponding socket, which is mounted on a 35 mm DIN rail.

Observe the following points when mounting the module and the socket:

Sockets or modules may only be removed or replaced in the de-energized state.

4.1.1 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, 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 800 651 E).

4.1.2 Wiring Inputs Not in Use

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

4.2 Mounting Module and Socket

This chapter describes how to mount and remove the modules and sockets. When replacing modules, the sockets remain on the DIN rail. This saves additional wiring effort since all field lines are connected to the socket.

4.2.1 Mounting and Removing the Sockets

Tools and utilities:

- Screwdriver, slotted 1.0 x 5.5 mm

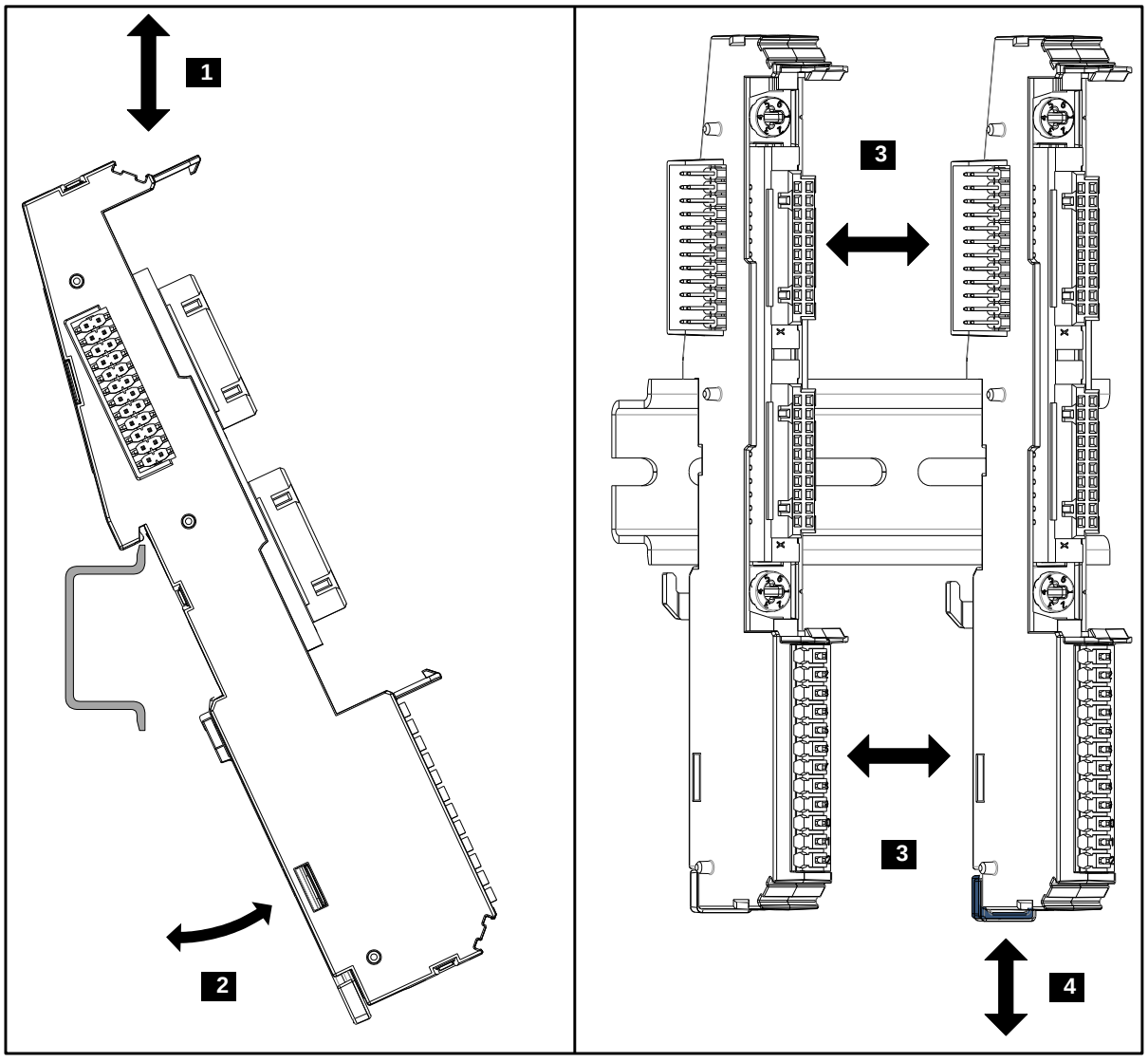
To insert the socket

1. Set the socket onto the DIN rail 1.
2. Swivel the socket in 2.
3. Move the socket on the DIN rail and connect it to another socket 3.
4. Press the socket's latch upwards 4.
   ☑ The latch is used to attach the socket to the DIN rail, and is secured to the socket located on its left-hand side.
5. The socket mounting is completed, the field lines can be connected.

To remove the socket

Prior to removing the socket, the module must be removed and the field lines must be released from the terminals.

1. Use a screwdriver to push the blue latch downwards 4.
2. Remove the sockets from the adjacent sockets 3.
3. Swivel the socket out 2.
4. Lift the socket and remove it 1.



1 Setting and Lifting the Socket
2 Swiveling the Socket In and Out
3 Connecting and Disconnecting Sockets
4 Closing and Opening the Latch

Figure 6: Example of Socket Mounting

4.2.2 Inserting and Removing the Module

This chapter describes how to mount and remove a module in the M45 system.

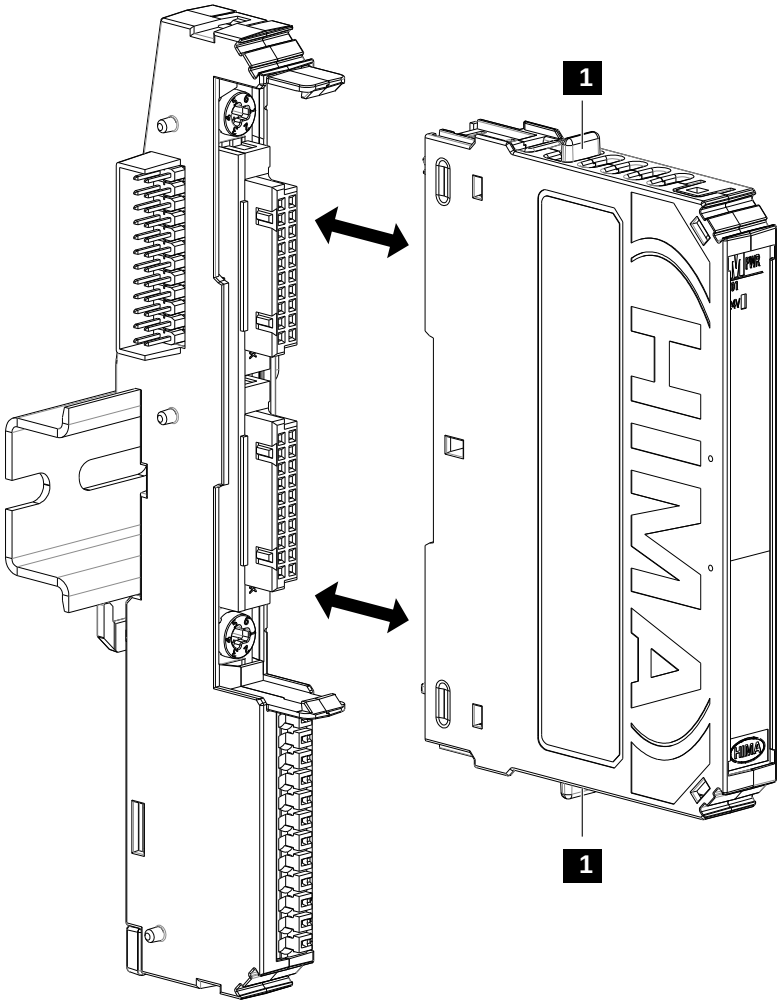
Coding prevents the module from improper assembling.

To insert the module

1. Plug the module onto the socket, until the locking mechanism is engaged.

To remove the module

1. Press the latch **1** backwards as far as it can go. The locking mechanism is released.
2. Remove the module from the socket.



1 Latch for Releasing the Module

Figure 7: Example of Mounting and Removing the Module

4.3 Line Control

Line control is used to detect short-circuits or open-circuits, e.g., on EMERGENCY STOP inputs complying with PL e in accordance with EN ISO 13849-1.

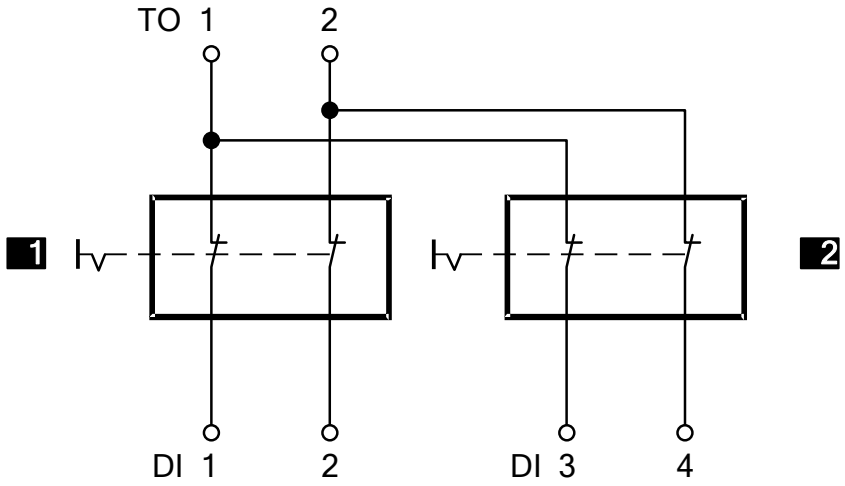
The following line faults can be detected by using line control:

- Cross-circuit between two parallel wires
- Invalid connections of two lines (e.g., TO 2 to DI 3)
- Earth fault on one wire (with earthed ground only)
- Open-circuit or open contacts, i.e., including when one of the two EMERGENCY STOP switches mentioned below has been engaged

4.3.1 Connecting Pulsed Outputs

Using line control, the pulsed outputs must be connected as follows:

- Connect odd pulsed output TO 1 with the odd inputs (DI 1, 3, 5, 7), see Figure 8.
- Connect even pulsed output TO 2 with the even inputs (DI 2, 4, 6, 8), see Figure 8.



1 EMERGENCY STOP 1
2 EMERGENCY STOP 2

Use EMERGENCY STOP switches in accordance with EN 60947-5-1 and EN 60947-5-5 only!

Figure 8: Line Control

4.3.2 Configuring Line Control

Using SILworX, line control must be configured as follows:

- In the **Module** tab
  - Select *Pulsed Output* from the drop-down field **Mode of Output 1**.
    (default setting: Supply)
  - Select *Pulsed Output* from the drop-down field **Mode of Output 2**.
    (default setting: Supply)
- In the **M-DI 8 01: Channels** tab
  - Select *Line Control* for the corresponding channel from the drop-down field in the column **Channel Mode**.
    (default setting: Standard)
  - Select *Line Control* for the corresponding channel from the drop-down field in the column **Channel Mode**.
    (default setting: Standard)

4.4 Configuration with SILworX

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

Observe the following points when configuring the module:

- The inputs and outputs must be configured in accordance with the corresponding application. Using line control, e.g., one output must be configured as *Pulsed Output* and the corresponding inputs must be configured as *Line Control*.

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

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

4.4.1 Tab Module

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

Name		R/W	Description
Enter these statuses and parameters directly in the Hardware Editor.			
Name		W	Module name
Mode of Output 1		W	Output 1 mode of operation, configurable to: ▪ Supply ▪ Pulsed Output ▪ DO Non-Safety-Related Default setting: *Supply*
Mode of Output 2		W	Such as *Mode of Output 1*
Name	Data type	R/W	Description
The following statuses and parameters can be assigned global variables and used in the user program.			
Output 1	BOOL	W	Mode of Output 1 = *DO Non-Safety-Related* TRUE: High level, channel energized FALSE: Low level, channel de-energized
Output 2	BOOL	W	Such as *Output 1*
Data valid	BOOL	R	TRUE: Current values are processed. FALSE: Initial values are processed.
Module OK	BOOL	R	Module State TRUE: No faults detected FALSE: Module fault or channel fault
Power supply state	BYTE	R	Bit-coded state of the power supply units 0 = normal Bit0 = 1: Supply voltage (24 V) faulty
Temperature state	BYTE	R	Bit-coded temperature state of the module 0 = normal Bit0 = 1: Temperature threshold 1 has been exceeded Bit1 = 1: Temperature threshold 2 has been exceeded Bit2 = 1: Fault in temperature measurement For further details, refer to chapter *Monitoring the Temperature State* integrated in the system manual.

Table 13: System Parameter for Inputs and Outputs, Module Tab

4.4.2 Tab M-DI 8 01_1: Channels

The **M-DI 8 01_01: Channels** tab contains the following parameters and statuses for each digital 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, preset and not changeable
-> Channel Value [BOOL]	BOOL	R	Boolean value of the digital input, LOW or HIGH TRUE: High level, input energized FALSE: Low level, input energized
-> Channel OK	BOOL	R	TRUE: Faultless channel. FALSE: Faulty channel. For all channels, the parameter is either TRUE or FALSE!
Channel mode	BYTE	W	Mode of operation for the digital input channel: ▪ Default ▪ Line Control ▪ Test Pulse Blanking Default setting: Standard
-> SC/OC [BOOL]	BOOL	R	Channel mode of operation = *Line Control* TRUE: Line fault detected FALSE: No line fault detected

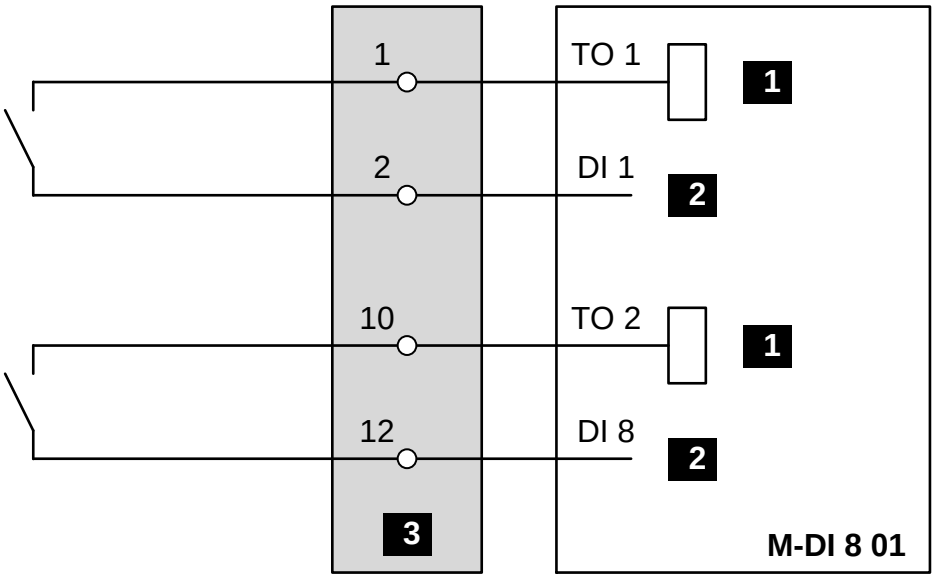
Table 14: Tab M-DI 8 01_01: Channels in the Hardware Editor

4.5 Connection Variants

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

4.5.1 Connection of Electromechanical Control Circuit Devices

Electromechanical control circuit devices are connected as follows:

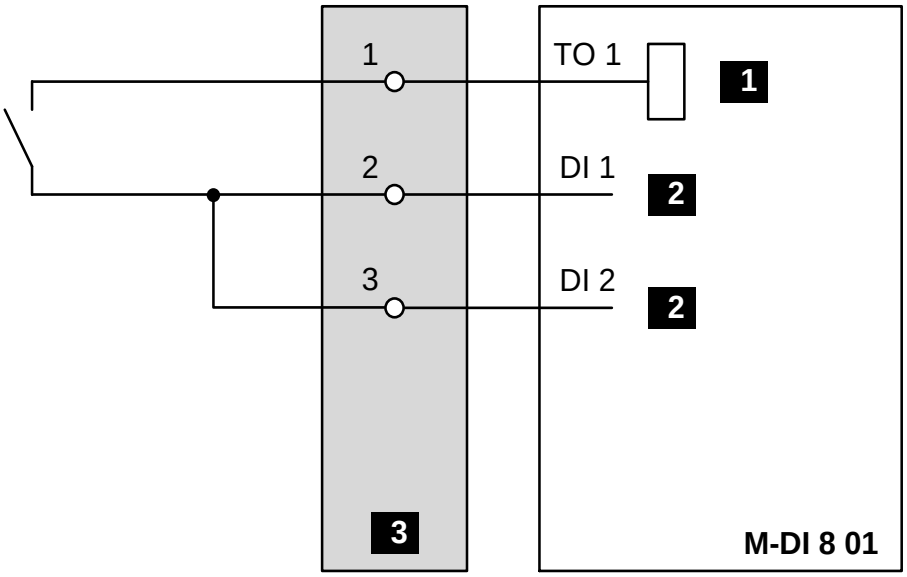


1 Pulsed Output
2 Digital Input
3 Socket M-SO I/O 01

Figure 9: Wiring with Control Circuit Devices or 2-Wire Proximity Switch

4.5.2 Redundant Wiring

To improve availability, wiring inputs in parallel is permitted. The input signals must be evaluated in the user program.

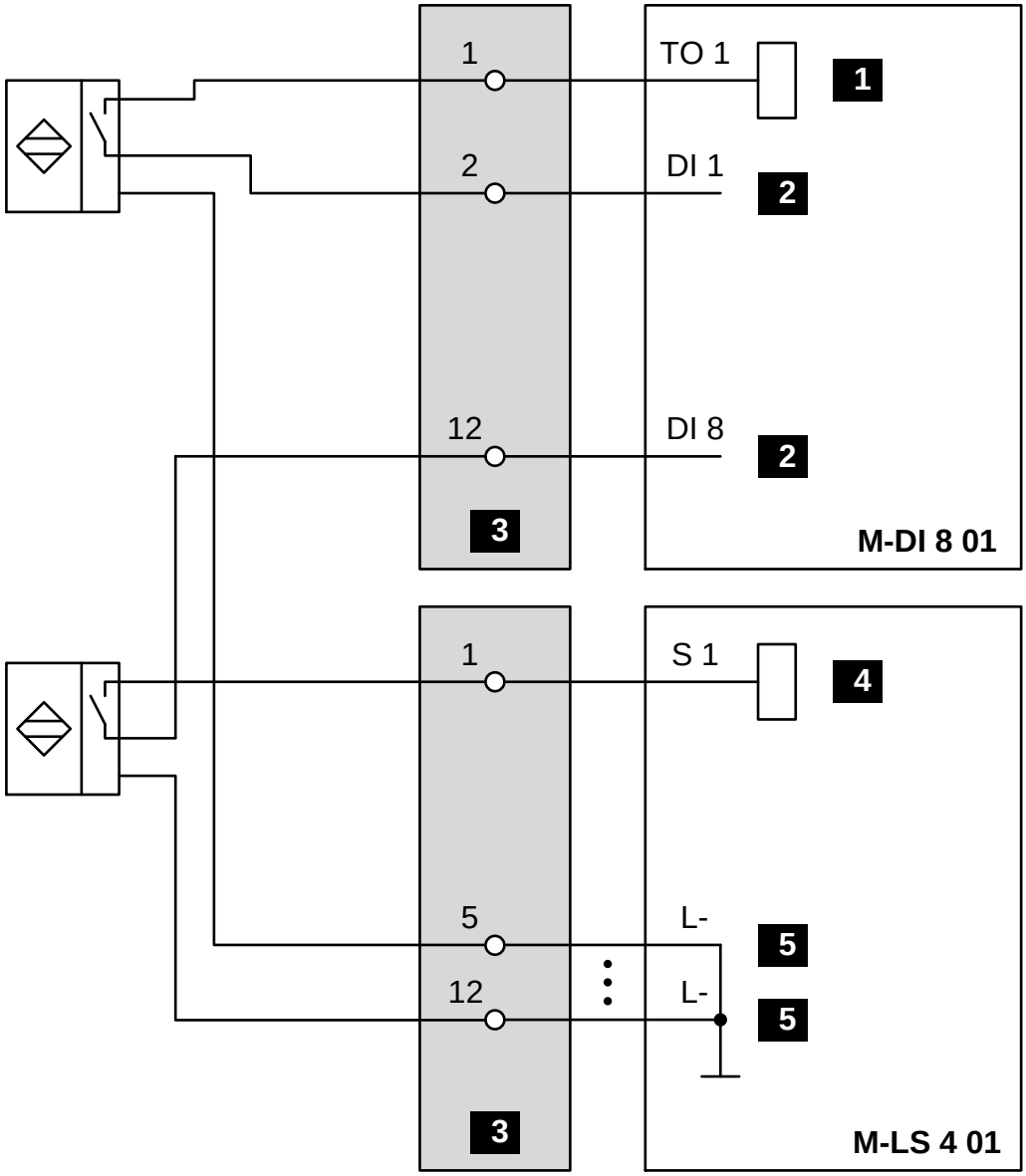


1 Pulsed Output
2 Digital Input
3 Socket M-SO I/O 01

Figure 10: Wiring Digital Inputs in Parallel

4.5.3 Connecting 3-Wire Proximity Switches

Interconnect the module and the DI extension module M-LS 4 01 to connect 3-wire proximity switches. The DI extension module provides four additionally supplies and eight L- ports, see module M-LS 4 01 manual.



1 Pulsed Output, *Supply* Mode of Operation
2 Digital Input
3 Socket M-SO I/O 01
4 Supply
5 Common Ground

Figure 11: Wiring with DI Extension Module

5 Operation

The module runs within the HIMatrix M45 system and does not require any specific monitoring.

When operating the system, ensure that the air circulation is not obstructed.

5.1 Handling

Handling of the module and the HIMatrix M45 system during operation is not required.

Do not pull or plug the modules during operation!

5.2 Diagnosis

The LEDs are used to give a overview of the operating state, see Chapter 3.4.5.

The diagnostic history of the M45 system can also be read using SILworX.

6 Maintenance

No maintenance measures are required during normal operation.

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

Modules may only be replaced in the de-energized state.

Only the manufacturer is authorized to repair the module.

6.1 Errors

Refer to Chapter 3.1.1, for more information on the fault reaction of inputs.

If the test harnesses of the module detect safety-critical faults (module faults), the module is rebooted. If the fault is still present, the module is rebooted again. This process is repeated as long as the fault is present. If no fault is detected, the module is restarted (RUN state).

If the restart after a module fault must be prevented, the user program must be configured accordingly. To this end, use the system parameters *Emergency Stop 1*…*Emergency Stop 4*. If the system parameters *Emergency Stop 1*…*Emergency Stop 4* are used, the entire M45 system enters the STOP state.

If the test harnesses detect module faults, the module is rebooted. If a further module fault occurs within the first minute after restart, the module enters the STOP_INVALID state and will remain in this state. This means that the input signals are no longer processed by the module and the outputs switch to the de-energized, safe state. The evaluation of diagnostics provides information about the fault cause.

6.2 Maintenance Measures

The following measures are required for the module:

- 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 modules.
HIMA recommends to use system downtimes to load the current version of the operating system into the module.

Refer to the release notes to check the impact of the operation system version on the system!

The operating system can be loaded into the module using SILworX. To this end, the HIMatrix M45 system must be in STOP. Otherwise, stop the system.

For more information, refer to the system manual (HI 800 651 E).

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.

6.2.2 Proof Test

HIMatrix M45 modules must be subjected to a proof test in intervals of 10 years. For more information, refer to the safety manual (HI 800 653 E).

7 Decommissioning

The decommissioning of the module is carried out after de-energization. Following steps are necessary:

1. Stop the HIMatrix M45 system.
2. Disconnect the system from the power supply.
3. Remove the module from the socket.

8 Transport

To avoid mechanical damage, HIMatrix M45 components must be transported in packaging.

Always store HIMatrix components in their original product packaging. This packaging also provides protection against electrostatic discharge.

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
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
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)
SB	System bus
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 is provided with value, e.g., from the user program
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 STOP_ERROR state.
WDT	Watchdog time

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HIMA Paul Hildebrandt GmbH
P.O. Box 1261
68777 Brühl, Germany
Phone: +49 6202 709-0
Fax: +49 6202 709-107
E-mail: info@hima.com Internet: www.hima.com

(1350)