HIMatrix

Safety-Related Controller

Manual M-CPU 01

HIMA Paul Hildebrandt GmbH + Co KG

Industrial Automation

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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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		technical	editorial
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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	-
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-CPU 01** processor module is the central component of the HIMatrix M45 controller.

The module is always the leftmost HIMatrix M45 module on the DIN rail.

The M-CPU 01 module is used to store the operating system and the user program. The module executes all central functions, including communication with the PADT and other systems. The module monitors the supply voltage and operating temperature.

The configuration is performed using SILworX, see Chapter 4.3.

The module is suitable for sequence of events recording (SOE), see Chapter 3.4.6. The module supports multitasking and reload. For more details, refer to the system manual (HI 800 651 E).

i   A licence is required to use the events recording, the multitasking and the reload features.

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 CPU monitors the sequence and the proper, logical execution of the operating system and user program or the user programs. The following functions are monitored with respect to time:

- Hardware and software self-tests of the processor system
- RUN cycle of the processor system (including the user program)
- I/O tests and processing of I/O signals

3.1.1   Reaction in the Event of a Fault

If the self-tests detect errors, the processing of the user program and the process data is stopped.

For further information on the fault reaction of the processor module, refer to Chapter 6.1.

Module's faults are signaled by the *Err* LED located on the front plate, see Chapter 3.4.3.

3.2   Scope of Delivery

The module must be installed on a suitable M-SO CPU 01 socket to be able to operate. The socket is not included within the scope of delivery of the module.

The socket is described in Chapter 3.6.

3.2.1   IP Address and System ID (SRS)

A transparent label is delivered with the device to allow one to note the IP address and the system ID (SRS,System.Rack.Slot) after a change.

The label must be affixed such that the ventilation slots in the housing are not obstructed.

Refer to the *SILworX* First Steps manual for more information on how to modify the IP address and the system ID.

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

This chapter describes the layout and function of the module, and its communication via safe**ethernet**.

3.4.1   Block Diagram

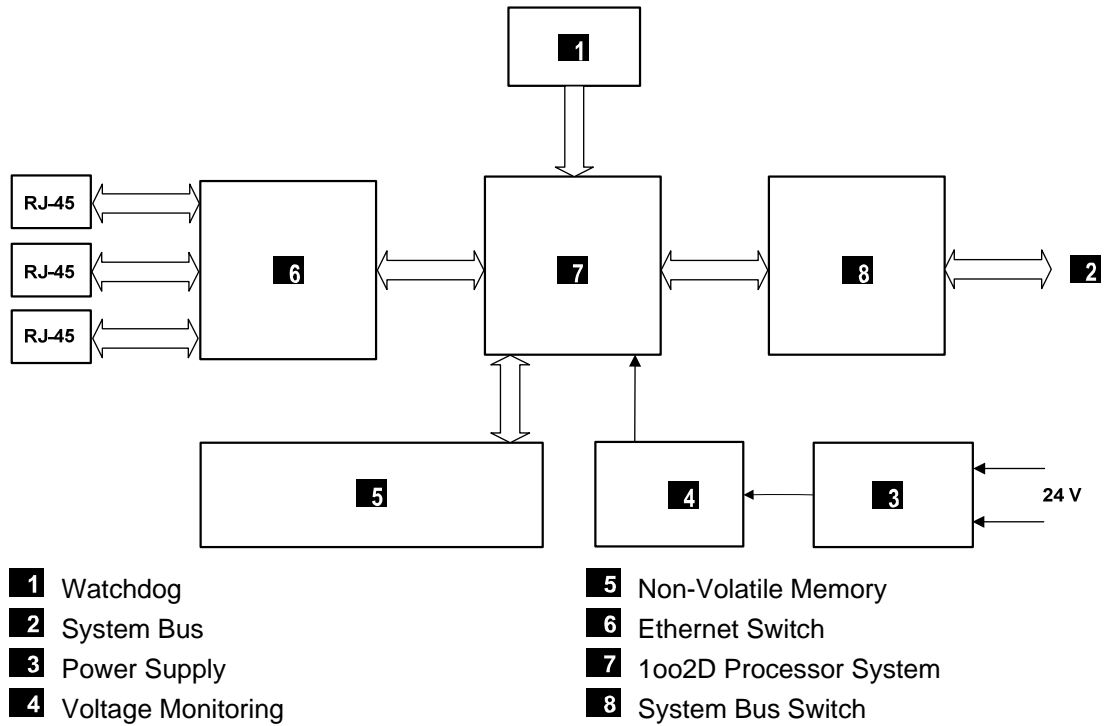|			
1 Watchdog		**5** Non-Volatile Memory
2 System Bus		**6** Ethernet Switch
3 Power Supply		**7** 1oo2D Processor System
4 Voltage Monitoring		**8** System Bus Switch

Figure 2:   Block Diagram
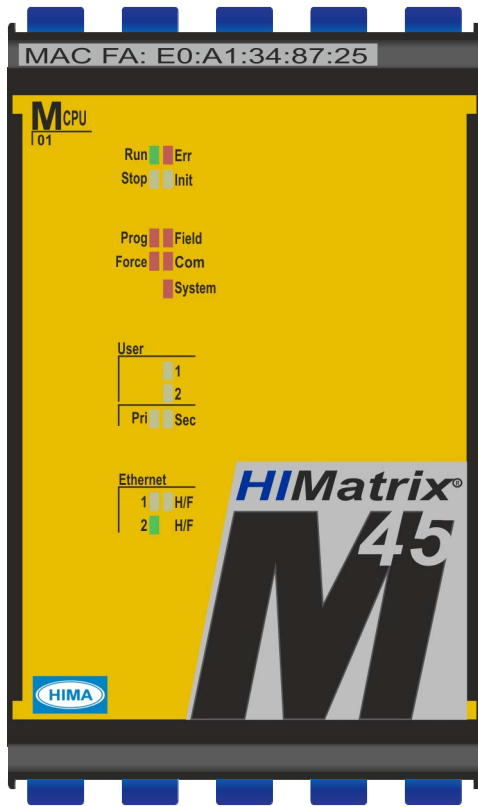
3.4.2 Front view

Figure 3:   Front View M-CPU 01

3.4.3 LED indicators

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

- System LEDs
- Program LEDs
- User and system bus LEDs
- Communication LEDs

When the supply voltage is switched on, a 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 3: Blinking Frequencies of LEDs

3.4.3.1 Module Status Indicators

The LEDs signal the following states:

LED	Color	Status	Description
Run	Green	On	▪ Module in RUN, normal operation ▪ Emergency loader active.
		Blinking1	▪ A new operating system is being loaded. ▪ Module in the OPERATE state, no user program started
		Off	Module is in none of the states described.
Err	Red	On	System warning, e.g.: ▪ Missing license for additional functions (communication protocols, reload), test mode. ▪ Temperature warning
		Blinking1	System error, e.g.: ▪ Internal module fault detected by self-tests, e.g., hardware or voltage supply. The processor system can only be restarted with a command from the PADT (reboot). ▪ System configuration fault. ▪ Fault while loading the operating system ▪ Emergency loader active.
		Off	No faults detected.
Stop	Yellow	On	▪ Module in the STOP / VALID CONFIGURATION state ▪ Emergency loader active.
		Blinking1	▪ Module in the STOP / INVALID CONFIGURATION state ▪ A new operating system is being loaded.
		Off	Module is in none of the states described.
Init	Yellow	On	▪ Module state: INIT ▪ Emergency loader active.
		Blinking1	A new operating system is being loaded.
		Off	Module is in none of the states described.

Table 4: Module Status Indicators

3.4.3.2 Program Light Emitting Diodes

The LEDs signal the following states:

LED	Color	Status	Description
Prog	Yellow	On	• The controller is being loaded with a new configuration. • Emergency loader active. • A new operating system is being loaded. • Watchdog time, safety time or SRS change. • Check for duplicate IP address. • A PADT write command is being processed.
		Blinking1	• Reload is performed • A duplicate IP address was detected. [1] • PROFINET has received an identify request. [1]
		Off	None of the described events occurred.
Force	Yellow	On	Forcing prepared: The force switch is set for a variable, the force main switch is still deactivated. The module is in the RUN or STOP state.
		Blinking1	• Forcing is active: At least one local or global variable has adopted the corresponding force value. • A duplicate IP address was detected. [1] • PROFINET has received an identify request. [1]
		Off	None of the described events occurred.
Field	Red	On	• A field warning occurred. • Operating system emergency loader active.
		Blinking1	A field error occurred.
		Off	None of the described events occurred.
COM	Red	On	• Warning related to external process data communication • Operating system emergency loader active.
		Blinking1	Fault in the external process data communication.
		Off	None of the described events occurred.
System	Red	On	• A system warning occurred. • Operating system emergency loader active.
		Blinking1	A system error occurred.
		Off	None of the described events occurred.
[1] If all the LEDs PROG and FORCE are blinking simultaneously.			

Table 5: Program Light Emitting Diodes

3.4.3.3 User and System Bus LEDs

The LEDs are labeled *User*. The LEDs signal the following states:

LED	Color	Status	Description
User 1, User 2	Yellow	On	These LEDs can be switched by the user program. The meaning of these LEDs is user-specific.
		Blinking1	
		Off	
Pri	Yellow	On	System bus connection established, no data transfer.
		Blinking-x	Data transfer through system bus.
		Off	System bus connection not established.
Sec	Yellow	On / Off	For future applications. *On* only when LED test, otherwise *Off*.

Table 6: User and System Bus LEDs

The meaning of the user LEDs must be defined during the engineering phase and must be described for the user. Labeling the LEDs on the front plate with user-specific names supports the user.

3.4.3.4 Ethernet Indicators

The Ethernet LEDs are labeled *Ethernet*. The LEDs signal the following states:

LED	Color	Status	Description
1 2	Green	On	Communication partner connected no communication detected on interface
		Blinking1	IP address conflict detected All Ethernet LEDs are blinking
		Blinking-x	Communication detected on interface
		Off	No communication partner connected
H/F	Yellow	On	Full duplex operation on Ethernet line
		Blinking1	IP address conflict detected. All Ethernet LEDs are blinking
		Blinking-x	Collisions detected on Ethernet line
		Off	Half duplex operation on Ethernet line

Table 7:   Ethernet Indicators

3.4.4 Operating System

The operating system loaded into the processor module contains all basic functions of the HIMatrix M45 programmable electronic system (PES), for example:

- Reading the inputs and writing to the outputs
- Processing the user program
- Performing all test routines for hardware and software
- Cycle time monitoring (watchdog)
- Communication with other systems

For a description of the operating system functions and the variables used to configure the systems and all modules, refer to the HIMatrix M45 system manual (HI 800 651 E).

3.4.5 User Program

The user program is created using the SILworX programming tool. It is then translated into a machine code using the code generator and transferred to the flash EPROM of the processor module.

3.4.6 Alarms&Events

The processor module records alarms and other events in its non-volatile memory. Up to 4000 events can be configured. The event buffer includes 1000 events.

For further details on alarms and events, their creation and recording, refer to the system manual (HI 800 651 E).

3.4.7 Communication

Communication with external systems occurs via the Ethernet interfaces of the M-CPU 01 module.

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i   When configuring safety-related communication, observe the instructions specified in the SILworX Communication Manual (HI 801 101 E).

3.4.7.1 Connections for Ethernet Communication

Ethernet interfaces	
Ports	3
Transfer standard	10BASE-T/100BASE-Tx, half and full duplex
Auto negotiation	Yes
Auto crossover	Yes
Connection socket	RJ-45
IP Address	Freely configurable[1]
Subnet Mask	Freely configurable[1]
Supported protocols	▪ safe**ethernet** ▪ Programming and debugging tool (PADT), SNTP
[1] The general rules for assigning IP address and subnet masks must be adhered to.	

Table 8: Connections for Fieldbus Communication

The three RJ-45 connectors are located on the front plate of the module. The status is indicated by LEDs, see Chapter 3.4.3.4.

The connection parameters are read based on the MAC address (media access control address) defined during manufacturing.

The MAC address of the module is specified on the label on the front plate.

Example of label: MAC: 00.E0.A1.00.0E.04

3.4.7.2 Network Ports Used for Ethernet Communication

UDP ports	Use
8000	Programming and operation with the programing tool
8004	Configuration of the remote I/O using the PES (SILworX)
6010	safe**ethernet** and OPC
123	SNTP (time synchronization between PES and remote I/O, PES and external devices)

Table 9: Network Ports (UDP Ports) in Use

3.4.8 Monitoring the Operating Voltage

The M-CPU 01 processor module monitors the 24 VDC operating voltage of the HIMatrix M45; reactions occur in accordance with the listed levels:

Voltage level	Reaction of the CPU
18...28.8 V	No reaction
< 18.0 V	Alarm state (the internal variables are written to)
< 13.0 V	Shutdown

Table 10: Operating Voltage Monitoring

The alarm can be evaluated with a PADT loaded with a programming tool, using the *Power Supply State* system parameter.

3.5 Product Data

General	
Operating voltage	24 VDC, -15...+20 %, $r_P \leq 5$ %, from a power supply unit with safe insulation in accordance with IEC 61131-2
Maximum supply voltage	30 V
Operating data	3.3 VDC / 1.5 A 5 VDC / 0.1 A
Microprocessor	PowerPC
Total program and data memory for all user programs	5 MB less 64 kB for CRCs
Data memory for retain variables	32 kB
Number of user programs	1...32
Number of event definitions	0...4000
Size of the non-volatile event buffer.	1000 Events
Ethernet interfaces	3 x RJ-45, 10BASE-T/100BASE-Tx with integrated switch
Buffer for date/time	Gold capacitor
Ambient temperature	0...+60 °C
Storage temperature	-40...+85 °C
Humidity	max. 95 % relative humidity, non-condensing
Type of protection	IP20

Space requirement
    Module housing (H x X D) in mm
    Socket (H x W) in mm
    Module housing + socket
	
	105 x 62.5 x 68
	165 x 65
	D 90 mm to DIN rail, 96 mm total

Weight
    Module
    Socket
	
	approx. 215 g
	approx. 180 g

Table 11:   Product Data

3.6   Socket M-SO CPU 01

The M-SO CPU 01 socket includes on its left side the M-CPU 01 Processor module slot and on its right side the M-PWR 01 power module slot. The power module supplies the processor module as well as the modules in their sockets on its right side. Refer to the power module manual (HI 800 659 E) for more details.
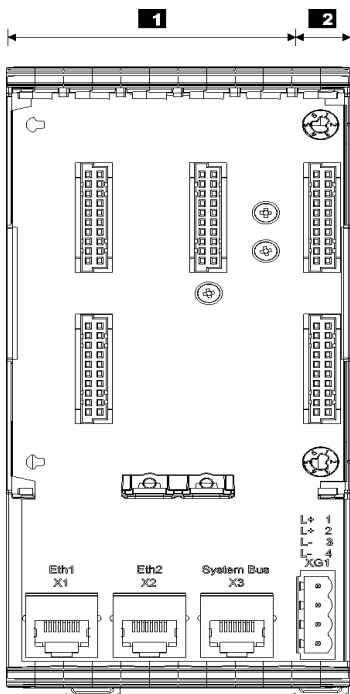
1 Processor Module Slot   **2** Power Module Slot

Figure 4:   Socket M-SO CPU 01

3.7   Certified HIMatrix M-CPU 01

M-CPU 01	
CE	EMC
TÜV	IEC 61508 1-7:2010 up to SIL 3
	IEC 61511:2004
	EN ISO 13849-1:2008
	IEC 62061:2005
	EN 50156-1:2004
	EN 298:2003
	EN 230:2005
PROFIBUS Nutzerorganisation (PNO)	Test Specification for PROFIBUS DP Slave, V3.0 November 2005

Table 12:   Certificates

Further safety standards and application standards are specified in the certificate. The certificate and the EC type test certificate are available on the HIMA website at www.hima.com.

4 Start-up

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

4.1 Mounting

The module is mounted on a 35 mm DIN rail using the corresponding M-SO CPU 01 socket.

When installing the HIMatrix M45 system, the socket must be mounted as the first one on the left side of the DIN rail. The remaining sockets must be mounted from the right side.

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

▪ Removing or replacing of sockets or modules is only permitted in the de-energized state.

⚠ WARNING

Removing and inserting the module is only permitted in the de-energized state.

4.2 Mounting and Removing the Modules and the 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 communication lines are connected to the socket.

4.2.1 Mounting a Socket

Tools and utilities:

▪ Screwdriver, slotted 1.0 x 5.5 mm

Mounting a socket

1. Setting the socket onto the DIN rail **1**.
2. Swiveling a Socket in **2**.
3. Moving the socket on the DIN rail and connecting it to another socket **3**.
4. Pressing the socket's latch upwards **4**.
   - ☑ The latch attaches the socket to the DIN rail and engages the socket with the socket on its left side.
5. Mounting the socket is completed, the field lines can be connected.

Removing a socket

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

1. Use a screwdriver to to push the blue latch downwards **4**.
2. Removing socket from adjacent socket **3**.
3. Swiveling socket out **2**.
4. Lifting and removing socket **1**.
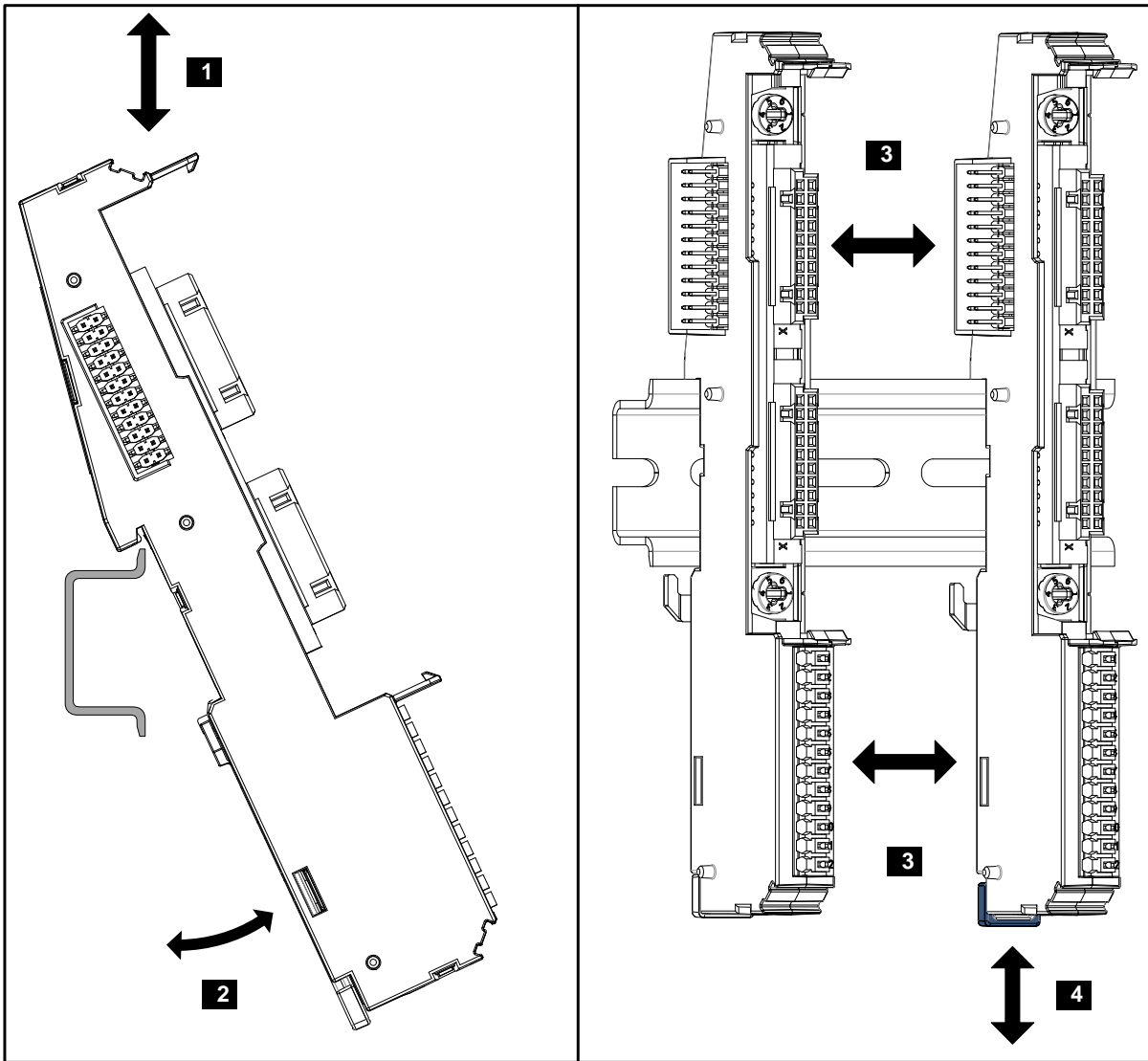
1   Setting and Lifting a Socket   **3**   Connecting and Disconnecting Sockets
2   Swiveling a Socket in and out   **4**   Closing and Opening the Latch

Figure 5:   Sample Mounting a Socket

4.2.2 Mounting and Removing the Modules

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

Mounting a module

1. Plug the module - without jamming is - onto the socket, until the locking mechanism is engaged.
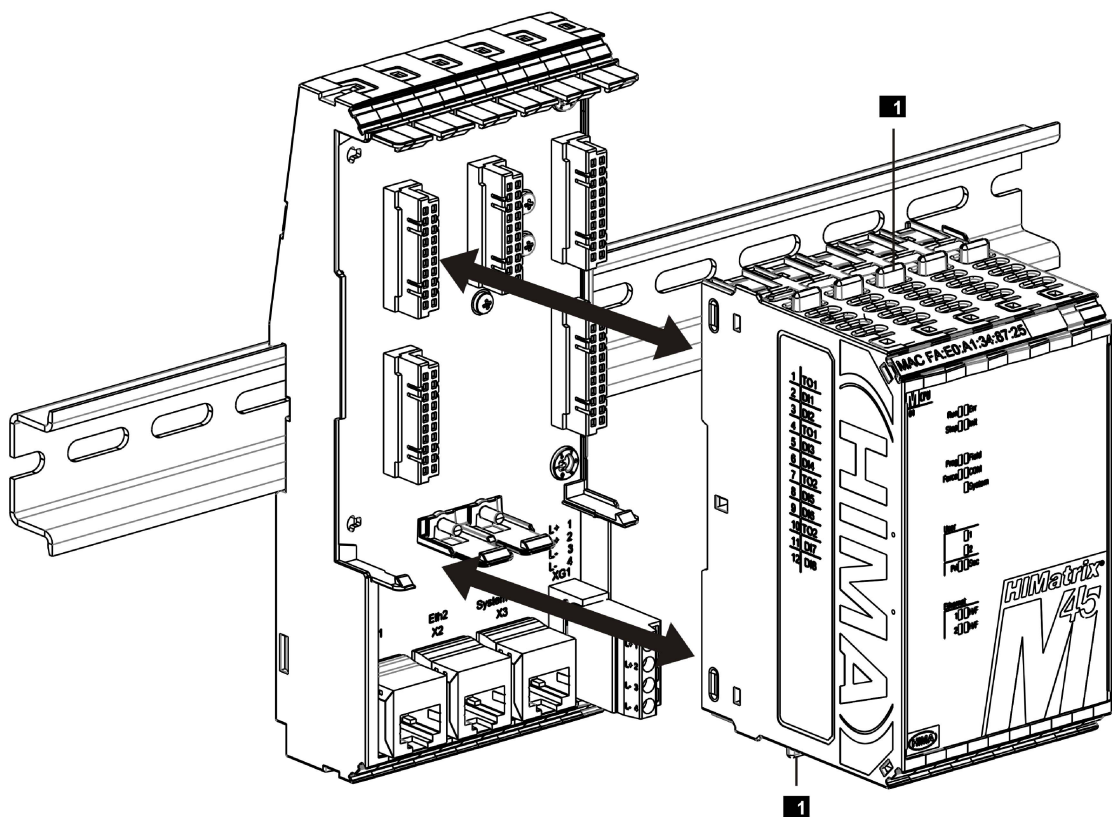
The module is mounted.

Removing a module

1. Press all 10 latches backwards as far as it can go. 5 latches are located each on the module's upper and lower sides.

   ☑ The locking mechanism is opened.

2. Loosen and remove module from the socket.

The module is removed.

1 10 Latches to Release the Module

Figure 6:   Mounting a Module onto the Socket

4.3 Configuration

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

To evaluate the statuses from within the user program, connect the module statuses to global variables. Perform this step in the Hardware Editor using the module's detail view.

The following tables present the parameters for the processor module (M-CPU-01) in the same order as given in the SILworX Hardware Editor.

4.3.1 Tab **Module**

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

Parameter	Description
Name	Module name
Activate Max. µP Budget for HH Protocol	▪ Activated: Use CPU load limit from the *Max. µP Budget for HH Protocol [%]* field. ▪ Deactivated: Do not use the CPU Load limit for safe**ethernet.** Default setting: Deactivated
Max. µP Budget for HH Protocol [%]	Maximum CPU load of module that can be used for processing the safe**ethernet** protocols. i The maximum load must be distributed among all the implemented protocols that use this processor module.
IP Address	IP address of the Ethernet interface. Default value: 192.168.0.99
Subnet Mask	32 bit address mask to split up the IP address in network and host address. Default value: 255.255.252.0
Standard Interface	Activated: the interface is used as standard interface for the system login. Default setting: Deactivated
Default Gateway	IP address of the default gateway. Default value: 0.0.0.0
ARP Aging Time [s]	A processor module stores the MAC addresses of the communication partners in a MAC/IP address assignment table (ARP cache). If in a period of 1x....2x *ARP Aging Time ...* ▪ ... messages of the communication are received, the MAC address remains stored in the ARP cache. ▪ ... no messages of the communication partner are received, the MAC address is erased from the ARP cache. The typical value for the *ARP Aging Time* in a local network ranges from 5...300 s. The user cannot read the contents of the ARP cache. Range of values: 1...3600 s Default value: 60 s **Note:** If routers or gateways are used, the user must adjust (increase) the *ARP Aging Time* due to the additional time required for two-way transmission. If the *ARP Aging Time* is too low, the MAC address of the communication partner is erased from the ARP cache, the communication is delayed or interrupted. For an efficient performance, the *ARP aging time* value must be less than the receive timeout set for the protocols in use.

Parameter	Description
MAC Learning	*MAC Learning* and *ARP Aging Time* are used to set how quick the Ethernet switch should learn the MAC address. The following settings are possible: ▪ Conservative (recommended): If the ARP cache already contains MAC addresses of communication partners, these are locked and cannot be replaced by other MAC addresses for at least 1 *ARP Aging Time* and a maximum of 2 *ARP Aging Time* periods. This ensures that data packets cannot be intentionally or unintentionally forwarded to external network subscribers (ARP spoofing). ▪ Tolerant: When a message is received, the IP address contained in the message is compared to the data in the ARP cache and the MAC address stored in the ARP cache is immediately overwritten with the MAC address from the message. The *Tolerant* setting must be used if the availability of communication is more important than the authorized access to the controller. Default setting: Conservative
IP Forwarding	Allow a processor module to operate as router and to forward data packets to other network nodes. Default setting: Deactivated
ICMP Mode	The Internet Control Message Protocol (ICMP) allows the higher protocol layers to detect error states on the network layer and optimize the transmission of data packets. Message types of Internet Control Message Protocol (ICMP) supported by the processor module: ▪ No ICMP Responses All the ICMP commands are deactivated. This ensures a high degree of safety against potential sabotage that might occur over the network. ▪ Echo Response If Echo Response is activated, the node responds to a ping command. It is thus possible to determine if a node can be reached. Safety is still high. ▪ Host Unreachable Not important for the user. Only used for testing at the manufacturer's facility. ▪ All Implemented ICMP Responses All ICMP commands are activated. This allows a more detailed diagnosis of network malfunctions. Default setting: Echo Response

Table 13:   Configuration Parameters, Module Tab

4.3.2 Tab **Routings**

The **Routings** tab contains the routing table. This table is empty if the module is new. A maximum of 8 routing entries are possible.

Parameter	Description
Name	Denomination of the routing settings
IP Address	Target IP address of the communication partner (with direct host routing) or network address (with subnet routing). Range of values: 0.0.0.0...255.255.255.255 Default value: 0.0.0.0
Subnet Mask	Define the target address range for a routing entry. 255.255.255.255 (with direct host routing) or subnet mask of the addressed subnet. Range of values: 0.0.0.0...255.255.255.255 Default value: 255.255.255.255
Gateway	IP address of the gateway to the addressed network. Range of values: 0.0.0.0...255.255.255.255 Default value: 0.0.0.1

Table 14: Routing Parameters for CPU and COM

4.3.3 Tab **Ethernet Switch**

The **Ethernet Switch** tab contains the following parameters:

Parameter	Description
Name	Name of the port (Eth1...Eth2) as printed on the housing; per port, only one configuration may exist.
Speed [Mbit/s]	10: Data rate 10 Mbit/s 100: Data rate 100 Mbit/s Autoneg: Automatic baud rate setting Default value: Autoneg
Flow Control	Full duplex: Simultaneous communication in both directions Half duplex: Communication in one direction Autoneg: Automatic communication control Default value: Autoneg
Autoneg also with fixed values	The *Advertising* function (forwarding the speed and flow control properties) is also performed if the parameters *Speed* and *Flow Control* have fixed values. This allows other devices with ports set to *Autoneg* to recognize the port settings. Default setting: Activated
Limit	Limit the inbound multicast and/or broadcast packets. Off: No limitation Broadcast: Limit broadcast packets (128 kbit/s) Multicast and Broadcast: Limit multicast and broadcast packets (1024 kbit/s) Default value: Broadcast

Table 15: Ethernet Switch Parameters

4.3.4   Tab **VLAN** (Port-Based VLAN)

For configuring the use of port-based VLAN.

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i   Should VLAN be supported, port-based VLAN should be off to enable each port to
         communicate with the other switch ports.

For each switch port, the user can define which other switch ports received Ethernet frames
may be sent to.
The table in the VLAN tab contains entries through which the connection between two ports can
be set to *active* or *inactive*.

	Eth1	Eth2
Eth1		
Eth2	active	
CPU	active	active

Table 16:   VLAN Tab

Default setting: All connection between ports *active*

4.3.5   Tab **LLDP**

With LLDP (Link Layer Discovery Protocol), information such as MAC address, device name,
port number is sent per multicast in periodic intervals via the own device and is received from
the neighboring devices.

The processor module supports LLDP on ports Eth1 and Eth2.

The following parameters define how a given port should work:

Off	LLDP is disabled on this port.
Send	LLDP sends LLDP Ethernet frames, received LLDP Ethernet frames are deleted without being processed.
Receive	LLDP sends no LLDP Ethernet frames, but received LLDP Ethernet frames are processed.
Send/Receive	LLDP sends and processes received LLDP Ethernet frames.

Default setting: Off

4.3.6   **Mirroring** Tab

Mirroring is used to configure whether the module should duplicate Ethernet packets on a given
port such that they can be read from a device connected to that port, e.g., for test purposes.

The following parameters define how a given port should work:

Off	This port does not participate to the mirroring process.
Egress:	Outgoing data of this port are duplicated.
Ingress:	Incoming data of this port are duplicated.
Ingress/Egress:	Incoming and outgoing data of this port are duplicated.
Dest Port:	This port is used to send duplicated data.

Default setting: Off

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.

Pulling and plugging of modules during operation is not allowed!

5.2   Diagnosis

The LEDs are used to give a overview of the operating state, see Chapter 3.4.3.

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 with the same type or with a replacement model approved by HIMA.

Replacing of modules is only permitted in the de-energized state.

Only the manufacturer is authorized to repair the module.

6.1 Errors

If the test harnesses detect safety-critical faults, 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 device and the outputs switch to the de-energized, safe state. The evaluation of diagnostics provides information on the fault cause.

Module's faults are signaled by the *Err* LED located on the front plate. Additionally, the status parameters can be evaluated in the user program.

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 4.2.2 must be observed when replacing an existing module or installing a new one.

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 a current version of the operating system into module.

Refer to the release notes to check the consequences 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 STOPP state. 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. Unplug the module from socket.

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
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 ERROR STOP state.
WDT	Watchdog time

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