Manual

HIMatrix® F

F35 03

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Table of Contents

1 Introduction

This manual describes the technical characteristics of the device 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 programmable electronic system.

This manual contains the following main chapters:

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

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i Compact controllers and remote I/Os are referred to as **devices**.

Additionally, the following documents must be taken into account:

Document	Content	Document number
HIMatrix system manual	Hardware description of the HIMatrix compact systems and the F60 modular system.	HI 800 141 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
Communication manual	Description of the communication protocols, ComUserTask and their configuration in SILworX.	HI 801 101 E
SILworX online help	Instructions on how to use SILworX.	-
SILworX first steps manual	Introduction to SILworX using the HIMax system as an example	HI 801 103 E

Table 1: Additional Applicable Documents

All the current manuals can be obtained upon request by sending an e-mail to: documentation@hima.com. The documentation is available for registered HIMA customers in the download area https://www.hima.com/en/downloads/.

1.2 Target Audience

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

1.3 Writing Conventions

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

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

Safety notices and operating tips are particularly marked.

1.3.1 Safety Notices

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

The safety notices are represented as described below.

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

The signal words have the following meanings:

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

⚠ SIGNAL WORD

Type and source of risk!

Consequences arising from non-observance.

Risk prevention.

NOTICE

Type and source of damage!

Damage prevention.

1.3.2 Operating Tips

Additional information is structured as presented in the following example:

i The text giving additional information is located here.

Useful tips and tricks appear as follows:

TIP The tip text is located here.

2 Safety

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

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

2.1 Intended Use

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

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

2.1.2 ESD Protective Measures

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

NOTICE

Damage to the HIMatrix system due to electrostatic discharge!

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

2.2 Residual Risk

No imminent risk results from a HIMA system itself.

Residual risk may result from:

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

2.3 Safety Precautions

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

2.4 Emergency Information

A HIMA system is a part of the safety equipment of a plant. If the controller fails, the system enters the safe state.

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

3 Product Description

The safety-related **F35 03** controller is a compact system in a metal housing with 24 digital inputs, 8 digital outputs, 2 counters and 8 analog inputs.

The controller is available in various model variants, see Chapter 3.2.

SILworX is used to configure it, see Chapter 4.3.

The controller is suitable for sequence of events recording (SOE), see Chapter 4.2. The controller supports multitasking and reload. For more details, refer to the system manual (HI 800 141 E).

i A license is required to use the sequence of events recording, the multitasking and the reload features.

The device 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 50129).

Further safety standards, application standards and test standards are specified in the certificates available on the HIMA website.

3.1 Safety Function

The controller includes safety-related digital inputs and outputs, safety-related counters and safety-related analog inputs.

3.1.1 Safety-Related Digital Inputs

The controller is equipped with 24 digital inputs. The state (HIGH, LOW) of each input is indicated by an LED.

i The LEDs for the digital inputs are only activated by the program if the F35 is in RUN.

The input signals are recorded analogically and provided to the program as INT values from 0...3000 (0...30 V).

i The digital inputs must not be used as safety-related analog inputs!

Configurable limit values are used to create BOOL values.

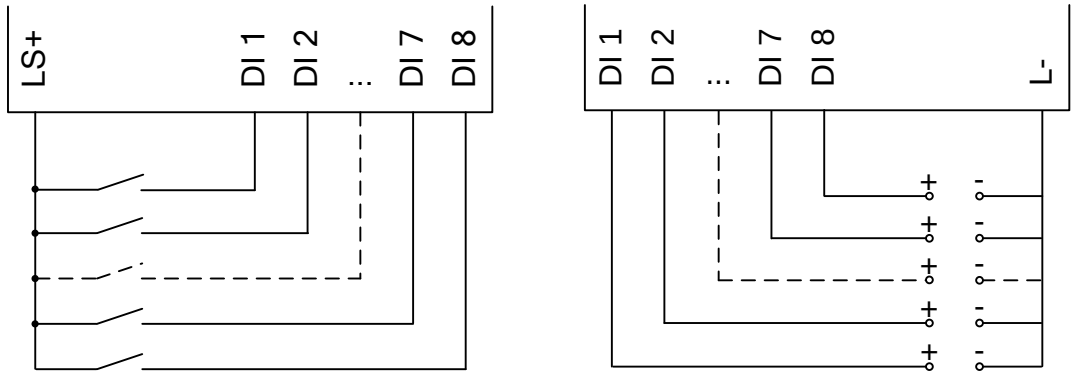
The default is set the the following values:

Low level: < 7 V High level: > 13 V

System parameters are used to set the thresholds, see Table 46. A difference of at least 2 V must be maintained between the thresholds.

Mechanical contacts without own power supply or signal power sources can be connected to the inputs. Potential-free mechanical contacts without own power supply are fed via an internal short-circuit-proof 24 V power source (LS+). Each of them supplies a group of 8 mechanical contacts. Figure 1 shows how the connection is to be performed.

The reference potential of signal voltage sources must be connected to the input (L-), see Figure 1.



Connection of potential-free mechanical contacts

Connection of signal power sources

Figure 1: Connections to Safety-Related Digital Inputs

For external wiring and connection to sensors, apply the de-energize to trip principle. Thus, if a fault occurs, the de-energized state (low level) is adopted as the safe state for input signals.

The external wire is not monitored, but a line break is considered as safe low level.

3.1.1.1 Response in the Event of a Fault

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

The device activates the *FAULT* LED.

For diagnostic purposes, the signal value of the channel as well as the corresponding error code can be evaluated in the user program. The error code evaluation provides additional options for configuring fault responses in the user program.

3.1.1.2 Line Control

The detection of short-circuits and open circuits cannot be configured for the F35 system, e.g., on emergency stop inputs complying with Cat. 4 and PL e in accordance with EN ISO 13849-1.

Wired mechanical contact can be used to detect short-circuits and open-circuits on digital inputs, see Chapter 4.4.2.

Line monitoring for digital outputs is possible, see Chapter 3.1.4.1.

3.1.2 Safety-Related Digital Outputs

The controller is equipped with 8 digital outputs. The state (HIGH, LOW) of each output is indicated by an LED.

At the maximum ambient temperature, each of the outputs 1...3 and 5...7 can be loaded with 0.5 A, the outputs 4 and 8 with 1 A, at an ambient temperature of up to 50 °C with 2 A.

Within a temperature range of 60…70 °C, all outputs of the F35 032 and F35 034 can be loaded with 0.5 A, see Table 22 and Table 26.

If an overload occurs, one or all digital outputs are switched off. If the overload is removed, the outputs are automatically switched on again, see Table 20.

The external wire of an output is not monitored, however, a detected short-circuit is signaled.

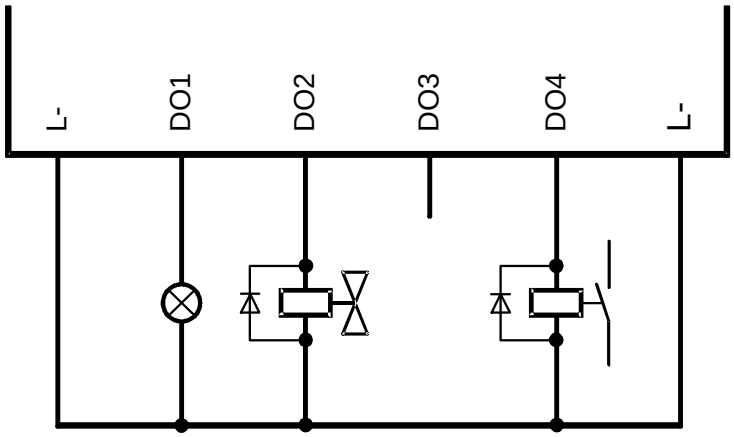


Figure 2: Connection of Actuators to Outputs

Diodes must be used to decouple the redundant connection of two outputs.

⚠ WARNING

To connect a load to a 1-pole switching output, use the L- reference potential of the corresponding channel group (2-pole connection) to ensure that the internal protective circuit will function.

Inductive loads may be connected without free-wheeling diode on the actuator. However, HIMA strongly recommends connecting a protective diode directly to the actuator.

3.1.2.1 Response in the Event of a Fault

If the device detects a faulty signal on a digital output, the affected output is set to the safe (de-energized) state using the safety switches.

If a device fault occurs, all digital outputs are switched off.

In both cases, the device activates the *FAULT* LED.

For diagnostic purposes, the signal value of the channel as well as the corresponding error code can be evaluated in the user program. The error code evaluation provides additional options for configuring fault responses in the user program.

3.1.3 Safety-Related Counters

The controller is equipped with 2 independent counters with inputs that can be configured for 5 V or 24 V level.

The required voltage level is defined with the *Counter[0x].5/24V Mode* system parameter.

Input A is the counter input, B is the count direction input and input Z (zero track) can be used to reset.

Alternatively, all inputs are 3-bit Gray code inputs (in decoder operation).

The following modes of operation can be implemented:

- Counter function 1 (depending on the count direction input signal)
- Counter function 2 (irrespective of the count direction input signal)
- Decoder operation with attached absolute rotary transducer

Refer to Chapter 3.4.3 for more details on how to configure the counters.

The safety-related counter has a 24-bit resolution, the maximum counter reading is $2^{24} - 1$ (= 16 777 215).

3.1.3.1 Response in the Event of a Fault

If the device detects a fault in the counter section, a status bit is set for evaluation in the user program.

The device activates the *FAULT* LED.

In addition to the status bit, the user program must also consider the corresponding error code.

The error code evaluation provides additional options for configuring fault responses in the user program.

3.1.4 Safety-Related Analog Inputs

The controller includes 8 analog inputs with transmitter supplies for the unipolar measurement of voltages of 0...10 V, referenced to L-. Using a shunt, also currents of 0...20 mA can be measured.

Input channels	Polarity	Current, voltage	Range of values in the application	
			FS1000 [1]	FS2000 [1]
8	Unipolar	0…+10 V	0…1000	0…2000
8	Unipolar	0…20 mA	0…500 [2] 0…1000 [3]	0…1000 [2] 0…2000 [3]

[1] can be configured by selecting the type in the programming tool
[2] with external Z 7301 shunt adapter, see 4.1.4.1
[3] with external Z 7302 shunt adapter, see 4.1.4.1

Table 2: Input Values for the Analog Inputs

The resolution of the voltage and current values depends on the parameter set in the properties of the controller.

In SILworX, the *FS 1000 / FS 2000* system parameter can be configured in the **Module** tab (module of the digital and analog inputs MI 24/8). Depending on the selection, different resolutions for the *-> AI[xx].Value* system parameter are available in the user program, see Chapter 4.3.6.1.

To monitor the *-> Value [INT]* parameter, the corresponding *AI.Error Code* value can be evaluated in the user program.

The input signals are evaluated in accordance with the de-energize to trip principle.

If an open-circuit occurs during the voltage measurement (the line is not monitored), random input values are processed at the high-resistance inputs. The value resulting from this floating input voltage is not reliable. For voltage inputs, the channels must therefore be terminated with a 10 kW resistor. The internal resistance of the source must be taken into account.

If a shunt is used and connected in parallel, the 10 kW resistor is not required for the current measurement.

The analog inputs have a common L- reference potential.

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

Wired mechanical contact can be used to detect short-circuits and open-circuits on analog inputs, see Chapter 4.4.1.

3.1.4.1 Line Monitoring for Digital Outputs

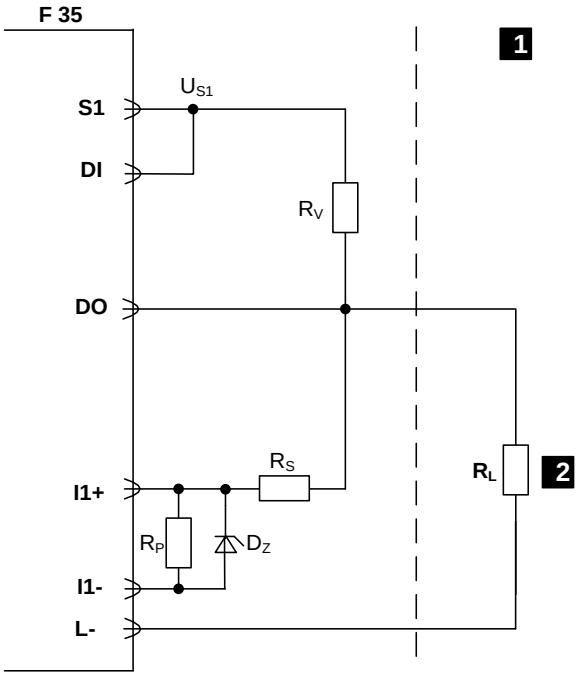
The analog inputs can be used to monitor the digital outputs for short-circuits and open-circuits.

Figure 3 shows a circuitry for line monitoring (open-circuits and short-circuits) that complies with SIL 3. Additionally, the S1 supply voltage is monitored via a digital input DI.

In this application, the actuator (e.g., solenoid valve) is connected to the digital output between DO and L-.

All specified electronic components must be directly attached to the clamps.

The response to open-circuits and short-circuits must be configured in the user program.



1 Field level 2 Actuator

Figure 3: Circuitry for Line Monitoring

Designation	Value	Description
U_{S1}	26.7…27.3 V	Supply voltage S1
R_V	2.0 kΩ / 0.5 W	Resistor
R_S	2.0 kΩ / 0.5 W	Resistor
R_P	100 kΩ	Resistor
D_Z	11 V ± 5 % / 0.3 W	Z-diode
R_L	75 Ω	Load resistor (e.g., solenoid valve)

Table 3: Values for Circuitry for Line Monitoring

3.1.4.2 Response 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 device fault occurred, the *Module Error Code* parameter is set to a value greater than 0.

In both cases, the device activates the *FAULT* LED.

In addition to the analog value, the error code must be evaluated. A safety-related response can occur if previously programmed.

The error code evaluation provides additional options for configuring fault response in the user program.

3.2 Equipment, Scope of Delivery

The following table specifies the available controller variants:

Designation	Description
F35 03 SILworX	Controller (24 digital inputs, 8 digital outputs, 2 counters, 8 analog inputs) Ambient temperature: 0...+60 °C
F35 032 SILworX	Controller (24 digital inputs, 8 digital outputs, 2 counters, 8 analog inputs) Ambient temperature -25…+70 °C Subsea type approval in accordance with ISO 13628-6 and API 17F.
F35 034 SILworX	Controller (24 digital inputs, 8 digital outputs, 2 counters, 8 analog inputs) Ambient temperature: -25...+70 °C (temperature class T1) Vibration and shock tested in accordance with EN 50125-3 and EN 50155, class 1B in accordance with IEC 61373.

Table 4: Available Variants

3.2.1 IP Address and System ID (SRS)

A transparent label for specifying the IP addresses of the CPU and the COM and the system ID (SRS, System.Rack.Slot) after a change is delivered with the device.

Default value for CPU IP address: 192.168.0.99

Default value for COM IP address: 192.168.0.100

Default value for SRS: 60 000.0.0

The label must be affixed so 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 label specifies the following details:

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

Figure 4: Sample Type Label

3.4 Structure

This chapter describes the layout and function of the controller and the connections for communication.

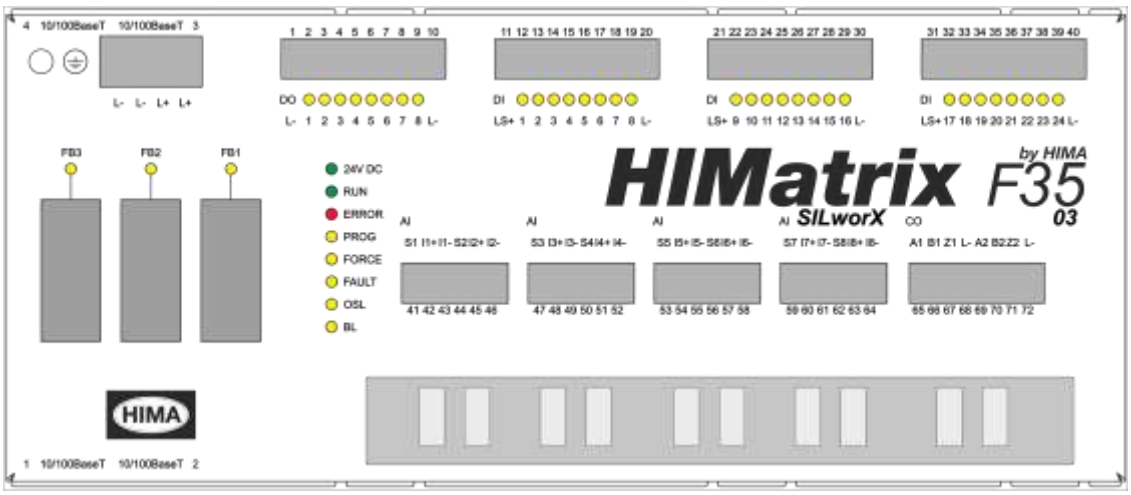
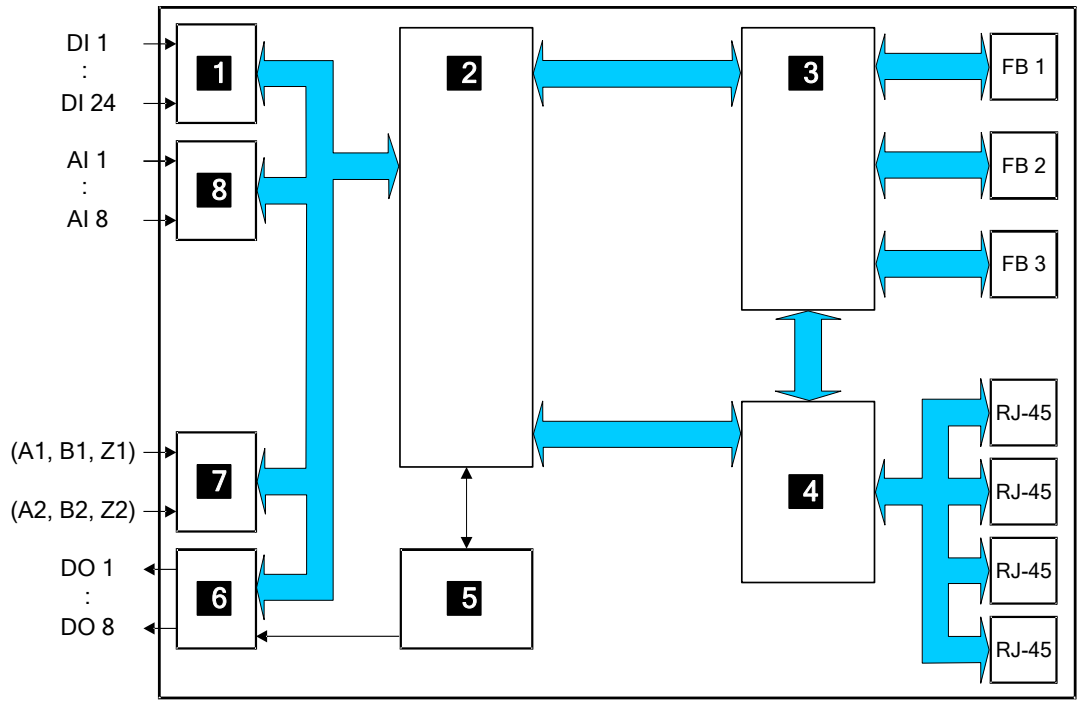


Figure 5: Front View



1 Digital inputs
2 Safety-related processor system (CPU)
3 Communication system (COM)
4 Switch
5 Watchdog
6 Digital outputs
7 Counter, 2 channels
8 Analog inputs

Figure 6: Block Diagram

3.4.1 LED Indicators

The light-emitting diodes (LEDs) indicate the operating state of the controller. The LEDs are classified as follows:

- Operating voltage LED
- System LEDs
- Communication LED
- I/O LEDs
- Fieldbus LEDs

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

Definition of blinking frequencies

The following table defines the blinking frequencies:

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

Table 5: Blinking Frequencies of the LEDs

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

3.4.1.1 Operating Voltage LED

The LED signals the following states:

LED	Color	Status	Description
24 VDC	Green	On	24 VDC operating voltage present
		Off	No operating voltage

Table 6: Operating Voltage LED

3.4.1.2 System LEDs

While the device is booting, all LEDs are lit simultaneously.

LED	Color	Status	Description
RUN	Green	On	▪ Device in the RUN state, normal operation ▪ A loaded user program is being processed ▪ The emergency loader is active
		Blinking1	▪ Device in STOP ▪ A new operating system is being loaded
		Off	The device is not in the RUN or STOP state
ERR	Red	On	System warning, for example: ▪ No license for additional functions (communication protocols, re-load), test mode ▪ Temperature warning
		Blinking1	System error, for example: ▪ The device is in the ERROR STOP state Internal faults detected by self-tests, e.g., hardware or voltage supply faults The processor system can only be restarted with a command from the PADT (reboot) ▪ Error while loading the operating system ▪ The emergency loader is active
		Off	No faults detected.
PROG	Yellow	On	▪ The emergency loader is active ▪ A new configuration is being loaded into the device ▪ A new operating system is being loaded ▪ Change to watchdog time or safety time ▪ Duplicate IP address check ▪ SRS change
		Blinking1	▪ Reload is being 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, but no local or global variables are currently being forced. Example: the force switch for a variable is set, the force main switch is still deactivated The device is in the RUN or STOP state ▪ The emergency loader is active
		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
FAULT	Yellow	On	▪ The emergency loader is active ▪ There is a warning related to the field level
		Blinking1	▪ The new operating system is corrupted (after its download) ▪ Fault while loading a new operating system ▪ The loaded configuration is not valid ▪ At least one fault related to the field level has occurred ▪ A duplicate IP address was detected [1)] ▪ PROFINET has received an identify request [1)]
		Off	None of the described faults occurred
OSL	Yellow	Blinking1	▪ Operating system emergency loader is active ▪ A duplicate IP address was detected [1)] ▪ PROFINET has received an identify request [1)]
		Off	None of the described events occurred
BL	Yellow	On	Warning related to external process data communication

LED	Color	Status	Description
		Blinking1	▪ OS and OSL binary defective or INIT_FAIL hardware fault ▪ Fault in the external process data communication ▪ A duplicate IP address was detected [1)] ▪ PROFINET has received an identify request [1)]
		Off	None of the described events occurred
[1)] If all the LEDs PROG, FORCE, FAULT, OSL and BL are blinking simultaneously			

Table 7: System LEDs

3.4.1.3 Communication LEDs

All RJ-45 connectors are provided with a green and a yellow LEDs. The LEDs signal the following states:

LED	Status	Description
Green	On	Full duplex operation
	Blinking1	IP address conflict, all communication LEDs are blinking
	Blinking-x	Collision
	Off	Half duplex operation, no collision
Yellow	On	Connection available
	Blinking1	IP address conflict, all communication LEDs are blinking
	Blinking-x	Interface activity
	Off	No connection available

Table 8: Ethernet Indicators

3.4.1.4 I/O LEDs

The LEDs signal the following states:

LED	Color	Status	Description
DI 1…24	Yellow	On	Input with high level (energized).
		Off	Input with low level (de-energized).
DO 1…8	Yellow	On	Output with high level (energized).
		Off	Output with low level (de-energized).

Table 9: I/O LEDs

3.4.1.5 Fieldbus LEDs

LEDs FB1…FB3 are used to display the state of communication occurring via the serial interfaces. The function of the LED depends on the used protocol.

Refer to the communication manual (HI 801 101 E) for a functional description of the LEDs.

3.4.2 Communication

The controller communicates with remote I/Os via safe**ethernet**. Refer to the communication manual (HI 801 101 E) for a description of the characteristics and configuration of safe**ethernet**.

3.4.2.1 Connections for Ethernet Communication

Property	Description
Port	4 x RJ-45.
Transmission standard	10BASE-T/100BASE-Tx, half and full duplex.
Autonegotiation	Yes
Autocrossover	Yes
IP address	Freely configurable [1)]
Subnet mask	Freely configurable [1)]
Supported protocols	▪ Safety-related: safe**ethernet**, PROFIsafe ▪ Standard protocols: Programming and debugging tool (PADT), OPC, Modbus TCP, TCP-SR, SNTP, ComUserTask, PROFINET.
[1)] The general rules for assigning IP addresses and subnet masks must be adhered to.	

Table 10: Ethernet Interface Properties

Two RJ-45 connectors with integrated LEDs are located on the top and on the bottom left-hand side of the housing. Refer to Chapter 3.4.1.3 for a description of the LEDs' function.

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

CPU and COM have their own MAC addresses. The CPU MAC address is specified on a label located above the two RJ-45 connectors (1 and 2).

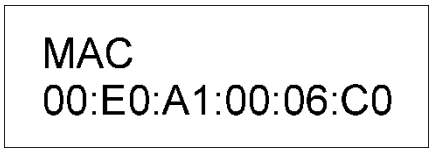


Figure 7: Sample MAC Address Label

The COM MAC address corresponds to the CPU MAC address, except for the last byte which is increased by 1.

Example:

CPU MAC address: 00:E0:A1:00:06:C0

COM MAC address: 00:E0:A1:00:06:C1

The controller includes an integrated switch for Ethernet communication. For further information on switches and safe**ethernet**, refer to the system manual (HI 800 141 E).

3.4.2.2 Network Ports in Use for Ethernet Communication

UDP ports	Use
123	SNTP (time synchronization between PES and remote I/O, PES and external devices)
502	Modbus slave (can be changed by the user)
6010	safe**ethernet** and OPC
6005 / 6012	If TCS_DIRECT was not selected in the HH network
8000	Programming and operation with SILworX
8004	Configuration of the remote I/Os using the PES (SILworX)
34 964	PROFINET endpoint mapper (required for establishing the connection)
49 152	PROFINET RPC server
49 153	PROFINET RPC client

Table 11: Network Ports (UDP Ports) in Use

TCP ports	Use
502	Modbus salve (can be changed by the user)
xxx	TCP SR assigned by the user

Table 12: Network Ports (TCP Ports) in Use

i The ComUserTask can use any port if it is not already used by another protocol.

3.4.2.3 Connections for Fieldbus Communication

The three 9-pole D-sub connectors are located on the front plate of the housing.

The fieldbus interfaces FB1 and FB2 can be equipped with fieldbus submodules. The fieldbus submodules are optional and must be installed by the manufacturer. The available fieldbus submodules are described in the communication manual (HI 801 101 E).

The fieldbus interfaces are not functional without fieldbus submodules.

Ex-factory, the FB3 fieldbus interface includes an RS485 for Modbus (master or slave) or ComUserTask.

3.4.3 Mode of Operation of the Counters

System variables, which are described in 4.3.5, are used to configure both F35 counters.

The following modes of operation can be implemented:

- Counter function 1 (depending on the count direction input signal)
- Counter function 2 (irrespective of the count direction input signal)
- Decoder operation with attached absolute rotary transducer

3.4.3.1 Counter Function 1 (Depending on the Count Direction Input Signal)

The *Counter[0x].Auto. Detection of Rotation Direction* system variable is set to TRUE, counting with falling edge at input A1 (A2).

Low level on count direction input B1 (B2) increments (increases) the counter value.
High level on count direction input B1 (B2) decrements (decreases) the counter value.

For this mode of operation, the Z1 input (Z2) must be set to high level. The counter can be reset with a short-term low level.

Configuration of counter function 1:

System variables	Description	Value
Counter[0x].5/24V Mode	Inputs 24 V 5 V	TRUE FALSE
Counter[0x].Auto. Detection of Rotation Direction	Counter function 1 active	TRUE
Counter[0x].Direction	No function	FALSE
Counter[0x].Gray Code	Pulse operation active	FALSE
Counter[0x].Reset	Standard Reset short-time	TRUE FALSE

Table 13: Configuration of Counter Function 1

3.4.3.2 Counter Function 2 (Irrespective of the Count Direction Input Signal)

The *Counter[0x].Auto. Detection of Rotation Direction* is set to FALSE, counting with falling edge on input A1 (A2).

The counter increment or decrement is controlled by the user program and not externally via the input B1 (B2).

The *Counter[0x].Direction* system variable is set to FALSE: the counter value increments (increases).
The *Counter[0x].Direction* system variable is set to TRUE: The counter value decrements (decreases).

Input B1 (B2) has no function.

The *Counter[0x].Reset* system variable can be used to reset the counter from within the programming tool.

Configuration of counter function 2:

System variables	Description	Value
Counter[0x].5/24V Mode	Inputs 24 V 5 V	TRUE FALSE
Counter[0x].Auto. Detection of Rotation Direction	Counter function 2 active	FALSE
Counter[0x].Direction	Increment Decrement	FALSE TRUE
Counter[0x].Gray Code	Pulse operation active	FALSE
Counter[0x].Reset	Standard Reset short-time	TRUE FALSE

Table 14: Configuration of Counter Function 2

3.4.3.3 Decoder Operation for Gray Code

The 3-bit Gray code of a rotary transducer connected to the inputs A1, B1, Z1 (A2, B2, Z2) is evaluated.

The *Counter[0x].Gray Code* system variable is used in the user program to define this mode of operation for each individual counter.

Configuration of decoder operation:

System variables	Description	Value
Counter[0x].5/24V Mode	Inputs 24 V 5 V	TRUE FALSE
Counter[0x].Auto. Detection of Rotation Direction	Counter function 1 passive	FALSE
Counter[0x].Direction	No function	FALSE
Counter[0x].Gray Code	Decoder operation active	TRUE
Counter[0x].Reset	Default (no function)	TRUE

Table 15: Configuration of Decoder Operation

3.4.3.4 Comparing the Codes in Use

When the counter is operated as a decoder in Gray code, only 1 bit may change if a value on the inputs changes.

3-bit Gray code	Decimal value	Counter[0x].Value
000	0	0
001	1	1
011	2	3
010	3	2
110	4	6
111	5	7
101	6	5
100	7	4

Table 16: Comparison of the Codes in Use

3.4.4 The Reset Key

The controller is equipped with a reset key. The key is only required if the user name or password for administrator access is not known. If only the IP address set for the controller does not match the PADT (PC), the connection can be established with a `Route add` entry on the PC.

The key can be accessed through a small round hole located approximately 5 cm from the upper left-hand side of the housing. The key is engaged using a suitable pin made of insulating material to avoid short-circuits within the controller.

The reset is only effective if the controller is rebooted (switched off and on) while the key is simultaneously engaged for at least 20 s. Engaging the key during operation has no effect.

⚠ CAUTION

Fieldbus communication may be disturbed!

Prior to switching on the controller with the reset key engaged, all fieldbus plugs must be unplugged to ensure that the fieldbus communication among other stations is not disturbed.

The fieldbus plugs may only be plugged in again when the controller is in the RUN or STOP state.

Properties and behavior of the controller after a reboot with engaged reset key:

- Connection parameters (IP address and system ID) are set to the default values.
- All user groups are deactivated except for the standard group *Administrator* with empty password.
- Loading a user program or operating system with default connection parameters is inhibited!

  Loading is only allowed after the connection parameters and the user group have been configured on the controller and the controller has been rebooted.

After a new reboot with unengaged reset key, the following user groups and connection parameters (IP address and system ID) become effective:

- Those configured by the user.
- Those valid prior to rebooting with the reset key engaged, if no changes were performed.

3.4.5 Hardware Clock

In case of loss of operating voltage, the power provided by an integrated gold capacitor is sufficient to buffer the hardware clock for approximately one week.

3.5 Product Data

General	
Supply voltage L+	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 VDC
Current consumption	max. 9 A (with maximum load) Idle: 0.5 A at 24 V
Fuse (external)	10 A time-lag (T)
Microprocessor	PowerPC
Total program and data memory for all user programs	5 MB less 64 kB for CRCs
Data memory for retain variables	Up to CPU OS V10.16 8 kBytes CPU OS V10.32 and higher: 32 kBytes
Response time	≥ 6 ms
Ethernet interfaces	4 x RJ-45, 10BASE-T/100BASE-Tx with integrated switch
Fieldbus interfaces	3 x 9-pole D-sub FB1 and FB2 with fieldbus submodule equippable FB3 with RS485 for Modbus (master or slave) or ComUserTask
Buffer for date/time	Min. 5 days, gold capacitor
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
Degree of protection	IP20
Max. dimensions (without plug)	Width: 257 mm (with housing screws) Height: 114 mm (with fixing bolt) Depth: 97 mm (with grounding screw)
Weight	Approx. 1.2 kg

Table 17: Product Data

Digital inputs	
Number of inputs	24 (not galvanically separated)
Type of input	Current sinking logic, 24 V, type 1 in accordance with IEC 61131-2
High level: Voltage	Freely configurable up to 30 VDC
Current consumption	Approx. 3.5 mA at 24 VDC Approx. 4.5 mA at 30 VDC
Low level: Voltage	Freely configurable up to a max. high level of -2 V safety distance and a min. of 2 V
Current consumption	Max. 1.5 mA (1 mA at 5 V)
Input resistance	< 7 kΩ
Overvoltage protection	-10 V, +35 V
Supply	3 x 20 V / 100 mA, short-circuit-proof
Metrological accuracy at 25 °C	Max. ±0.2 % of full scale
Metrological accuracy on the temperature range 0...60 °C	Max. ±1 % of full scale
Temperature coefficient [1)]	Max. ±0.023 % of full scale
[1)] for the permissible temperature range	

Table 18: Specifications for Digital Inputs

Analog inputs	
Number of inputs	8 (unipolar, non-galvanically separated)
External shunt adapter for current measurement	Z 7301 (250 Ω) Z 7302 (500 Ω)
Nominal range	0…+10 VDC 0...+20 mA with shunt 500 Ω
Operating range	-0.1…+11.5 VDC -0.4...+23 mA with shunt 500 Ω
Input resistance	1 MΩ
Internal resistance of the signal source	≤ 500 Ω
Digital resolution	12-bit
Metrological accuracy at 25 °C	Max. ±0.1 % of full scale
Metrological accuracy on the temperature range 0...60 °C	Max. ±0.5 % of full scale
Temperature coefficient [1)]	Max. ±0.011 % of full scale
Measured value refresh	Once per cycle of the controller
Sampling time	Approx. 45 µs
Transmitter supplies	8 x 24...28 V / ≤ 46 mA, short-circuit-proof
[1)] for the permissible temperature range	

Table 19: Specifications for the Analog Inputs

Digital outputs	
Number of outputs	8 (non-galvanically separated, common reference potential L-)
Output voltage	L+ minus 2 V
Output current	Channels 1...3 and 5...7: 0.5 A up to 60 °C The output current of the channels 4 and 8 depends on the ambient temperature. Ambient temperature / Output current < 50 °C / 2 A 50…60 °C / 1 A
Minimum load	2 mA for each channel
Internal voltage drop	Max. 2 V at 2 A
Leakage current (with low level)	Max. 1 mA at 2 V
Behavior upon overload	The affected output is switched off and cyclically switched on again
Total output current	Max. 7 A Upon overload, all outputs are switched off and cyclically switched on again

Table 20: Specifications for the Digital Outputs

Counters	
Number of counters	2 (not galvanically separated)
Inputs	3 on each (A, B, Z)
Input voltages High level (5 V) High level (24 V) Low level (5 V) Low level (24 V)	5 V and 24 V 4…6 V 13…33 V 0…0.5 V -3…+5 V
Input currents	1.4 mA at 5 V 6.5 mA at 24 V
Input impedance	3.7 kΩ
Counter resolution	24-bit
Min. pulse length	5 µs
Max. input frequency	100 kHz (at 5 V and 24 V input voltage)
Triggered	With falling edge
Edge steepness	1 V/µs
Pulse duty factor	1 : 1 (at 100 kHz)

Table 21: Specifications for the Counters

3.5.1 Product Data for the F35 032

The F35 032 model variant is intended for use in subsea applications in accordance with ISO 13628-6 and API 17F. The electronic components are coated with a protective lacquer. The housing of the controller is made of V2A stainless steel. The controller is intended for mounting on a mounting plate. The housing is equipped screwed to a massive aluminum plate, see Figure 8. Figure 9 specifies the center hole distances.

<table>
<tr><th colspan="2">HIMatrix F35 032</th></tr>
<tr><td>Housing material</td><td>V2A stainless steel</td></tr>
<tr><td>Operating temperature</td><td>-25…+70 °C</td></tr>
<tr><td>Output current of the digital outputs</td><td>Channels 1...3 and 5...7: 0.5 A
The output current of the channels 4 and 8 depends on the ambient temperature.
<table>
<tr><th>Ambient temperature</th><th>Output current</th></tr>
<tr><td>< 50 °C</td><td>2 A</td></tr>
<tr><td>50…60 °C</td><td>1 A</td></tr>
<tr><td>> 60 °C</td><td>0.5 A</td></tr>
</table></td></tr>
<tr><td>Max. dimensions (without connectors and aluminum plate)</td><td>Width: 257 mm (with housing screws)
Height: 114 mm (with fixing bolt)
Depth: 97 mm (with grounding bar)</td></tr>
<tr><td>Dimensions: Aluminum plate (W x H x D)</td><td>(200 x 136 x 6) mm</td></tr>
<tr><td>Weight</td><td>Approx. 1.7 kg</td></tr>
</table>

Table 22: Product Data for the F35 032

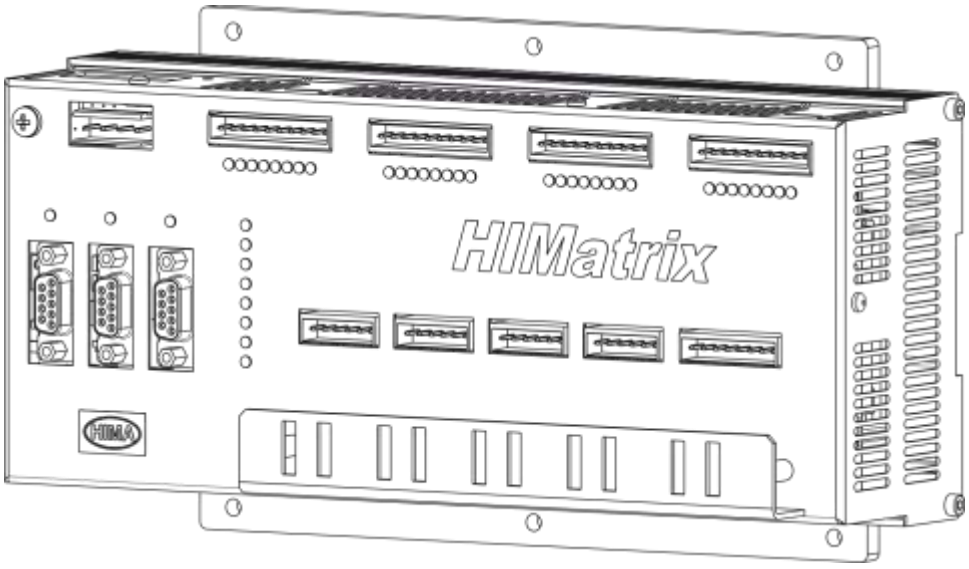


Figure 8: HIMatrix F35 032 with Aluminum Plate

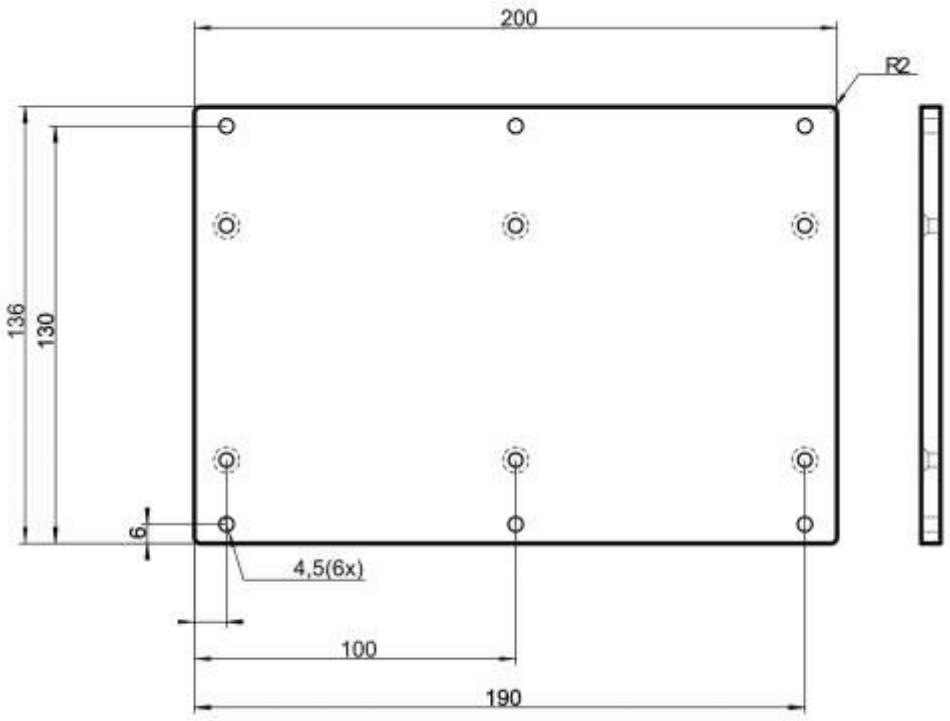


Figure 9: Aluminum Plate with Dimensions

In accordance with ISO 13628-6 and API 17F, the F35 032 model variant has been subject to the following additional tests.

Climatic Requirements

The following table lists the most important tests and limits for climatic requirements:

Standard	Climatic tests
IEC 60068-2-1:2007 Test Ae	Immunity test in the design supply voltage range at design temperature + 70 °C, 48 h duration time
IEC 60068-2-2:2007 Test Be	Immunity test in the design supply voltage range at design temperature -25 °C, 48 h duration time
-	Immunity test in the design supply voltage range 10 cycles from 70 °C to -25 °C with rise of 5 K/min and 30 min. hold time

Table 23: Climatic Requirements

Mechanical Requirements

The following table lists the most important tests and limits for mechanical requirements:

Standard	Mechanical tests
IEC 60068-2-6:2007 Test Fc	Sinusoidal vibration, 1 octave per min. 1 cycle on 3 perpendicular axis (Q2) 5…25 Hz with ± 2 mm displacement 25…150 Hz, 5 g acceleration
IEC 60068-2-27:2008 Test Ea	4 shocks, each on 3 perpendicular axis (Q2) 10 g acceleration, 11 ms half sine
IEC 60068-2-64:2008	Random vibration on axis perpendicular to PCB 20…80 Hz at 3 dB per octave rise 80...350 Hz at 0.04 g²/Hz 350…2000 Hz at − 3 dB per octave roll-off Composite excitation level of 6 g rms, 2 h

Table 24: Mechanical Requirements

Routine Test

The following table lists the most important tests and limits for routine tests:

Standard	Routine test
-	Immunity test 10 cycles from 70 °C to -25 °C with rise of 5 K/min and 30 min. hold time
IEC 60068-2-1:200 Test Ae	Burn-in with voltage supply + 70 °C, 48 h

Table 25: Routine Test

3.5.2 Product Data for the F35 034

The F35 034 model variant is intended for use in railway applications. The electronic components are coated with a protective lacquer.

F35 034	
Ambient temperature	-25…+70 °C
Output current of the digital outputs	Channels 1...3 and 5...7: 0.5 A The output current of the channels 4 and 8 depends on the ambient temperature.

Ambient temperature	Output current
< 50 °C	2 A
50…60 °C	1 A
> 60 °C	0.5 A

Weight	Approx. 1.2 kg

Table 26: Product Data for the F35 034

The F35 034 controller meets the vibration and shock requirements in accordance with EN 61373, Category 1, Class B.

3.6 Certified HIMatrix F35 03

Refer to the HIMatrix safety manual for more information on the standards used to certify the HIMatrix system.

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

4 Start-Up

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

4.1 Installation and Mounting

The controller is mounted on a 35 mm DIN rail or on a mounting plate for the F35 032.

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

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

4.1.1 Connecting the Digital Inputs

Use the following terminals to connect the digital inputs:

Terminal	Designation	Function
11	LS+	Sensor supply of the inputs 1...8
12	1	Digital input 1
13	2	Digital input 2
14	3	Digital input 3
15	4	Digital input 4
16	5	Digital input 5
17	6	Digital input 6
18	7	Digital input 7
19	8	Digital input 8
20	L-	Reference potential
Terminal	Designation	Function
21	LS+	Sensor supply of the inputs 9...16
22	9	Digital input 9
23	10	Digital input 10
24	11	Digital input 11
25	12	Digital input 12
26	13	Digital input 13
27	14	Digital input 14
28	15	Digital input 15
29	16	Digital input 16
30	L-	Reference potential
Terminal	Designation	Function
31	LS+	Sensor supply of the inputs 17...24
32	17	Digital input 17
33	18	Digital input 18
34	19	Digital input 19
35	20	Digital input 20
36	21	Digital input 21
37	22	Digital input 22
38	23	Digital input 23
39	24	Digital input 24
40	L-	Reference potential

Table 27: Terminal Assignment for the Digital Inputs

4.1.2 Connecting the Digital Outputs

Use the following terminals to connect the digital outputs:

Terminal	Designation	Function
1	L-	Channel group reference potential
2	1	Digital output 1
3	2	Digital output 2
4	3	Digital output 3
5	4	Digital output 4 (for increased load)
6	5	Digital output 5
7	6	Digital output 6
8	7	Digital output 7
9	8	Digital output 8 (for increased load)
10	L-	Channel group reference potential

Table 28: Terminal Assignment for the Digital Outputs

4.1.3 Connecting the Counters

In the safety-related application (SIL 3 in accordance with IEC 61508) of the counters, the overall plant including the sensors or encoders connected must comply with these safety requirements. For more information, refer to the HIMatrix safety manual (HI 800 023 E).

Only shielded cables may be connected to the counter inputs. Each counter input input must be connected to a twisted pair of wires. The shielding must be connected at both ends.

All L- connections are interconnected on the controller as a common reference potential.

The counters are connected to the following terminals:

Terminal	Designation	Function
65	O1	Input A1 or bit 0 (LSB)
66	B1	Input B1 or bit 1
67	Z1	Input Z1 or bit 2 (MSB)
68	L-	Common reference potential
69	A2	Input A2 or bit 0 (LSB)
70	B2	Input B2 or bit 1
71	Z2	Input Z2 or bit 2 (MSB)
72	L-	Common reference potential

Table 29: Terminal Assignment for the Counters

Inputs that are not being used need not be terminated.

NOTICE

Using the invalid terminal plugs may damage the controller or the sensors or encoders connected to it!

Reverse polarity of the counter inputs is not allowed!

4.1.4 Connecting the 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 and actuator housing and grounded only on the controller side to form a Faraday cage.

Unused analog inputs must be short-circuited.

Use the following terminals to connect the analog inputs:

Terminal	Designation	Function
41	S1	Transmitter supply 1
42	I1+	Analog input 1
43	i1-	Reference potential
44	S2	Transmitter supply 2
45	I2+	Analog input 2
46	i2-	Reference potential
Terminal	Designation	Function
47	S3	Transmitter supply 3
48	I3+	Analog input 3
49	i3-	Reference potential
50	S4	Transmitter supply 4
51	I4+	Analog input 4
52	i4-	Reference potential
Terminal	Designation	Function
53	S5	Transmitter supply 5
54	I5+	Analog input 5
55	i5-	Reference potential
56	S6	Transmitter supply 6
57	I6+	Analog input 6
58	i6-	Reference potential
Terminal	Designation	Function
59	S7	Transmitter supply 7
60	I7+	Analog input 7
61	i7-	Reference potential
62	S8	Transmitter supply 8
63	I8+	Analog input 8
64	i8-	Reference potential

Table 30: Terminal Assignment for the Analog Inputs

4.1.4.1 Shunt Adapter

The shunt adapter is a plug-in module for the analog inputs of the safety-related HIMatrix F35 controller.

Four variants are available:

Model	Equipment
Z 7301	Shunt 250 Ω
Z 7302	Shunt 500 Ω
Z 7306	▪ Shunt 250 Ω ▪ Overvoltage protection ▪ HART series resistor (current limiting)
Z 7308	▪ Voltage divider ▪ Overvoltage protection

Table 31: Shunt Adapter

Refer to the corresponding manuals for further information on the shunt adapters.

4.1.5 Cable Plugs

Cable plugs attached to the pin headers of the devices are used to connect to the power supply and to the field level. The cable plugs are included within the scope of delivery of the HIMatrix devices and modules.

The devices power supply connections feature the following properties:

Connection to the power supply	
Cable plugs	4 poles, screw terminals
Wire cross-section	0.2…2.5 mm^2 (single-wire) 0.2…2.5 mm^2 (finely stranded) 0.2…2.5 mm^2 (with wire end ferrule)
Stripping length	10 mm
Screwdriver	Slotted 0.6 x 3.5 mm
Tightening torque	0.4…0.5 Nm

Table 32: Power Supply Cable Plug Properties

Connection to the field level	
Number of cable plugs	4 pieces, 10 poles, screw terminals 1 pieces, 8 poles, screw terminals 4 pieces, 6 poles, screw terminals
Wire cross-section	0.2…1.5 mm^2 (single-wire) 0.2…1.5 mm^2 (finely stranded) 0.2…1.5 mm^2 (with wire end ferrule)
Stripping length	6 mm
Screwdriver	Slotted 0.4 x 2.5 mm
Tightening torque	0.2…0.25 Nm

Table 33: Input and Output Cable Plug Properties

The F35 032 is delivered with spring terminals.

4.1.6 Mounting the Controller in Zone 2

The controller is suitable for mounting in the explosive atmospheres of zone 2. The special X conditions specified in the HIMatrix safety manual (HI 800 023 E) must be observed for use in zone 2.

These conditions require the controller to be mounted in an enclosure that is able to safely dissipate the generated heat.

Depending on the output load and supply voltage, the HIMatrix F35 03 has a power dissipation ranging between 15 W and 29 W.

The remote I/O must be labeled with the following Ex marking:

 II 3G Ex nA IIC T4 Gc

i When using the controller in zone 2, the permissible ambient temperature must be observed, see Chapter 3.5.

4.2 Sequence of Events Recording (SOE)

The global variables of the controller can be monitored using sequence of events recording. Global variables to be monitored are configured using SILworX; refer to the online help and the communication manual (HI 801 101 E) for further details. Up to 4000 events can be configured.

An event is composed of:

Entry data	Description
Event ID	The event ID is assigned by the PADT
Timestamp	Date (e.g., 21/11/2008) Time (e.g., 9:31:57.531)
Event state	Alarm/Normal (Boolean event) LL, L, N, H, HH (scalar event)
Event quality	Quality good/ Quality bad, see www.opcfoundation.org

Table 34: Event Description

Events are recorded within the cycle of the user program. The processor system uses global variables to create the events and stores them in its non-volatile event buffer.

The event buffer includes 1000 events. If the event buffer is full, an overflow system event entry is created. Thereafter, events are no longer recorded until existing events have been read and space is once again available in the event buffer.

4.3 Configuration with SILworX

In the Hardware Editor, the controller is represented as a base plate equipped with the following modules:

- Processor module (CPU)
- Communication module (COM)
- Output module (DO 8)
- Counter module (CI 2)
- Input module (MI 24/8)

Double-click on 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 variables of the corresponding module.

4.3.1 Processor Module

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

4.3.1.1 The **Module** Tab

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 IP data transmission Default setting: Deactivated
Max. µP Budget for HH Protocol [%]	Module's maximum CPU load that can be used for processing the IP data transmission. i The maximum load must be distributed among all the implemented protocols that use this communication module.
Code Generation	Prior to V6: Setting compatible with existing projects V6 and higher: Setting recommended for new projects to support safe**ethernet** reload Default setting: V6 and higher
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 into network and host address Default value: 255.255.252.0
Standard Interface	Activated: The interface is used as standard interface for system login Default setting: Deactivated
Default Gateway	IP address of the default gateway Default value: 0.0.0.0

Parameter	Description
ARP Aging Time [s]	A processor or COM module stores the MAC addresses of the communication partners in a MAC/IP address assignment table (ARP cache). The MAC address remains stored in the ARP cache if messages from the communication partner are received within 1x...2x *ARP Aging Time*. The MAC address is erased from the ARP cache if no messages from the communication partner are received within 1x...2x *ARP Aging Time*. The typical value for the *ARP Aging Time* in a local network ranges from 5...300 s. The contents of the ARP cache cannot be read out. Range of values: 1...3600 s Default value: 60 s **Note:** If routers or gateways are used, the *ARP Aging Time* must be adjusted (increased) due to the additional time required for two-way transmission. If the *ARP Aging Time* is too low, the processor or the COM module deletes the MAC address of the communication partner from the ARP cache and communication is either delayed or breaks down entirely. For an efficient performance, the *ARP Aging Time* value must be greater than the receive timeout set for the protocols in use.
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

Parameter	Description
ICMP Mode	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 35: CPU and COM Configuration Parameters, **Module** Tab

4.3.1.2 The **Routings** Tab

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	Designation 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: 255.255.252.0
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 36: Routing Parameters for CPU and COM

4.3.1.3 The **Ethernet Switch** Tab

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

Parameter	Description
Name	Name of the port (Eth1...Eth4) 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 whose ports are set to *Autoneg* to detect the settings of the HIMax port settings. Default setting: Activated
Limit	Limit the inbound multicast and/or broadcast packets Off: No limitation Broadcast: Limit broadcast (128 kbit/s) Multicast and broadcast: Limit multicast and broadcast (1024 kbit/s) Default value: Broadcast

Table 37: Ethernet Switch Parameters

4.3.1.4 The **VLAN** Tab (Port-Based VLAN)

For configuring the use of port-based VLAN.

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

Für jeden Port eines Switches kann eingestellt werden, zu welchem anderen Port des Switches empfangene Ethernet-Frames gesendet werden dürfen, siehe Bild XX.

The table in the VLAN tab contains entries through which the connection between two ports can be set to active or inactive.

	Eth1	Eth2	Eth3	Eth4	COM
Eth1					
Eth2	Active				
Eth3	Active	Active			
Eth4	Active	Active	Active		
COM	Active	Active	Active	Active	
CPU	Active	Active	Active	Active	Active

Table 38: **VLAN** Tab

4.3.1.5 The **LLDP** Tab

LLDP (Link Layer Discovery Protocol) periodically sends information on the own device via multicast (e.g., MAC address, device name, port number) and receives the same information from the neighboring devices.

Abhängig davon, ob PROFINET auf dem Kommunikationsmodul konfiguriert ist, werden von LLDP folgende Werte verwendet:

PROFINET on the COM module	Chassis ID	TTL (Time to Live)
Used	Device name	20 s
Not used	MAC Address	120 s

Table 39: Values for LLDP

The processor and communication modules support LLDP on the Eth1, Eth2, Eth3 and Eth4 ports.

The following parameters define how a given port should work:

Off	LLDP ist auf diesem Port deaktiviert.
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.

4.3.1.6 The **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 in the mirroring process.
Egress	Outgoing data of this port are duplicated.
Ingress/Egress	Incoming and outgoing data of this port are duplicated.
Dest Port	Duplicated data are sent to this port.

Default setting: Off.

4.3.2 Communication Module

The communication module contains the **Module** and the **Routings** tabs. Their content is identical to that of the processor module, see Table 35 and Table 36.

4.3.3 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.

4.3.4 Digital Outputs for F35

The following tables present the statuses and parameters for the output module (DO 8) in the same order as in the SILworX Hardware Editor.

4.3.4.1 The **Module** Tab

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

<table>
<tr><th>System parameters</th><th>Data type</th><th>R/W</th><th>Description</th></tr>
<tr><td>DO.Error Code</td><td>WORD</td><td>R</td><td>Error codes for all digital outputs:
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x0001</td><td>Fault within the digital outputs.</td></tr>
<tr><td>0x0002</td><td>Test of safety switch 1 returns a fault [1)].</td></tr>
<tr><td>0x0004</td><td>Test of safety switch 2 returns a fault [1)].</td></tr>
<tr><td>0x0008</td><td>Test of test pattern faulty.</td></tr>
<tr><td>0x0010</td><td>Test of output switch test pattern faulty [1)].</td></tr>
<tr><td>0x0020</td><td>Test of output switch test pattern (shutdown test of the outputs) faulty [1)].</td></tr>
<tr><td>0x0040</td><td>Test: Active shutdown via WD faulty [1)].</td></tr>
<tr><td>0x0200</td><td>All outputs are switched off, total current exceeded.</td></tr>
<tr><td>0x0400</td><td>Test: 1st temperature threshold exceeded.</td></tr>
<tr><td>0x0800</td><td>Test: 2nd temperature threshold exceeded.</td></tr>
<tr><td>0x1000</td><td>Test: Monitoring of auxiliary voltage 1: Undervoltage.</td></tr>
</table></td></tr>
<tr><td>Module Error Code</td><td>WORD</td><td>R</td><td>Module error code:
<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, setpoint: 0x00B4 [180_{dec}].</td></tr>
<tr><td colspan="4">1) If the error or fault is present for longer than 24 h, the safety-related reaction is triggered.</td></tr>
</table>

Table 40: System Parameter for Digital Outputs, **Module** Tab

4.3.4.2 Tab **DO 8: Channels**

The **DO 8: Channels** tab contains the following system parameters:

System parameters	Data type	R/W	Description
Channel no.	---	R	Channel number, preset and cannot be changed.
-> Error Code [BYTE]	BYTE	R	Error codes for the digital output channels: Coding: Description 0x01: Fault in the digital output module. 0x02: Channel shutdown due to overload. 0x04: Error while reading back the digital outputs. 0x08: Error while reading back the status of the digital outputs.
Value [BOOL] ->	BOOL	W	Output value for DO channels: 1 = output energized. 0 = output de-energized.

Table 41: System Parameters for Digital Outputs, **DO 8: Channels** Tab

4.3.5 Counter F35

The following tables present the statuses and parameters for the counter module (CI 2) in the same order as in the SILworX Hardware Editor.

4.3.5.1 The **Module** Tab

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

<table>
<tr><th>System parameters</th><th>Data type</th><th>R/W</th><th>Description</th></tr>
<tr><td>Module Error Code</td><td>WORD</td><td>R</td><td>Module error code:
<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, setpoint: 0x0003 [3_{dec}].</td></tr>
<tr><td>Counter.Error Code</td><td>WORD</td><td>R</td><td>Error code for the counter module:
<table>
<tr><th>Coding</th><th>Description</th></tr>
<tr><td>0x0001</td><td>Error in counter module.</td></tr>
<tr><td>0x0002</td><td>Error while comparing the time base.</td></tr>
<tr><td>0x0004</td><td>Address error while reading the time base.</td></tr>
<tr><td>0x0008</td><td>Parameters for time base faulty.</td></tr>
<tr><td>0x0010</td><td>Address error while reading the values of the counters.</td></tr>
<tr><td>0x0020</td><td>Counter configuration corrupted.</td></tr>
<tr><td>0x0040</td><td>Address error while reading the Gray code.</td></tr>
<tr><td>0x0080</td><td>Test of test pattern faulty.</td></tr>
<tr><td>0x0100</td><td>Test: Fault detected while checking the coefficients.</td></tr>
<tr><td>0x0200</td><td>Fault during the initial module configuration.</td></tr>
</table></td></tr>
</table>

Table 42: System Parameters for Counters, **Module** Tab

4.3.5.2 The **CI 2: Channels** Tab

The **CI 2: Channels** tab contains the following system parameters:

System parameters	Data type	R/W	Description
Counter[0x].5/24V Mode	BOOL	R/W	5 V or 24 V counter input: TRUE: 24 V. FALSE: 5 V.
Coun-ter[0x].Auto.Advance Sense	BOOL	R/W	Automatic detection of count direction: TRUE: Automatic detection on. FALSE: Count direction set manually.
Counter[0x].Error Code	BYTE	R	Error codes of counter channels 1 and 2: Coding / Description 0x01: Error in counter module. 0x02: Error while comparing the counter readings. 0x08: Error while setting the parameters (reset).
Counter[0x].Gray Code	BOOL	R/W	Decoder / pulse operation: TRUE: Gray code decoder. FALSE: Pulse operation.
Coun-ter[0x].Spare1...Coun ter[0x].Spare3	BOOL	R/W	No function.
Counter[0x].Reset	BOOL	R/W	Counter reset: TRUE: No reset. FALSE: Reset.
Counter[0x].Direction	BOOL	R/W	Count direction of the counter (only if *Counter[0x].Auto. Detection of Rotation Direction* = FALSE): TRUE: Downwards (decrement). FALSE: Upwards (increment).
Counter[0x].Value	UDINT	R	Content of counters: 24 bit for pulse counter, 3 bit for Gray code.
Counter[0x].Value Overflow	BOOL	R	Counter overflow indication. TRUE: 24-bit overflow since last cycle (only if *Counter[0x].Auto. Advance Sense* is FALSE) FALSE: No overflow since last cycle
Counter[0x]. Timestamp	UDUNT	R	Timestamp for *Counter[0x].Value* 24 bits, 1 µs time resolution
Counter[0x].Time Overflow	BOOL	R	Overflow indication for the timestamp of the counters: TRUE: 24-bit overflow since last measurement. FALSE: No 24-bit overflow since last measurement.

Table 43: System Parameters for Counters, the **CI 2: Channels** Tab

4.3.6 Analog and Digital Inputs F35

The following tables present the system parameters for the analog and digital input module (MI 24/8) in the same order as in the SILworX Hardware Editor.

4.3.6.1 The **Module** Tab

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

System parameters		R/W	Description
Enter these parameters directly in the Hardware Editor.			
FS 1000 / FS 2000		W	Resolution of the -> *Value [INT]* parameter for the analog input channels. FS1000: 0…1000 (0…10 V). FS2000: 0…2000 (0…10 V).
System parameters	Data type	R/W	Description
AI.Error Code	WORD	R	Error codes for all analog and digital outputs:

Coding	Description
0x0001	Module fault.
0x0004	Test of conversion time monitoring [1)].
0x0008	Test: Walking bit of data bus faulty.
0x0010	Test: Error while checking coefficients.
0x0020	Test: Operating voltages faulty.
0x0040	A/D conversion faulty (DRDY_LOW)
0x0080	Test: Cross links of MUX faulty [1)].
0x0100	Test: Walking bit of data bus faulty [1)].
0x0200	Test: Multiplexer addresses faulty [1)].
0x0400	Test: Operating voltages faulty [1)].
0x0800	Test: Measuring system (characteristic) faulty (unipolar) [1)].
0x1000	Test: Measuring system (final values, zero point) faulty (unipolar) [1)].
0x8000	A/D conversion faulty (DRDY_HIGH)

Module Error Code	WORD	R	Module error code:

Coding	Description
0x0000	I/O processing, if required with errors, see other error codes.
0x0001	No I/O processing (CPU not in RUN).
0x0002	No I/O processing during the booting test.
0x0004	Manufacturer interface operating.
0x0010	No I/O processing: invalid configuration.
0x0020	No I/O processing: fault rate exceeded.
0x0040/ 0x0080	No I/O processing: configured module not plugged in.

Module SRS	UDINT	R	Slot number (System.Rack.Slot).
Module Type	UINT	R	Type of module, setpoint: 0x00D2 [210_{dec}]
[1)] If the error or fault is present for longer than 24 h, the safety-related reaction is triggered.			

Table 44: System Parameter for Inputs, **Module** Tab

4.3.6.2 The **MI 24/8: AI Channels** Tab

The **MI 24/8: AI Channels** tab contains the following system parameters:

<table>
<tr><th>System parameters</th><th>Data type</th><th>R/W</th><th>Description</th></tr>
<tr><td>Channel no.</td><td>---</td><td>R</td><td>Channel number, preset and cannot be changed.</td></tr>
<tr><td>-> Error Code [BYTE]</td><td>BYTE</td><td>R</td><td>Error codes for the analog input channels (1...8):
<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>Not used</td></tr>
<tr><td>0x04</td><td>A/D converter faulty, measured values invalid.</td></tr>
<tr><td>0x08</td><td>Measured value not compliant with the specified 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 is faulty.</td></tr>
</table></td></tr>
<tr><td>-> Value [INT]</td><td>INT</td><td>R</td><td>Analog value of the AI channels (1...8) [INT] from 0...1000 (version: FS1000), 0...2000 (version: FS2000) (0…+10 V).

The validity depends on AI.Error Code.</td></tr>
<tr><td>Channel Used [BOOL] -></td><td>BOOL</td><td>W</td><td>Configuration of channels 1...8:
1 = Channel operating.
0 = Channel not operating.</td></tr>
</table>

Table 45: System Parameter for Inputs, **MI 24/8: AI Channels** Tab

4.3.6.3 The **MI 24/8: DI Channels** Tab

The **MI 24/8: DI Channels** tab contains the following system parameters:

<table>
<tr><th>System parameters</th><th>Data type</th><th>R/W</th><th>Description</th></tr>
<tr><td>Channel no.</td><td>---</td><td>R</td><td>Channel number, preset and cannot be changed.</td></tr>
<tr><td>-> Error Code [BYTE]</td><td>BYTE</td><td>R</td><td>Error codes for the digital input channels (1...24):
<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>Not used</td></tr>
<tr><td>0x04</td><td>A/D converter faulty, measured values invalid.</td></tr>
<tr><td>0x08</td><td>Measured value not compliant with the specified 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 is faulty.</td></tr>
</table></td></tr>
<tr><td>-> Value [BOOL]</td><td>BOOL</td><td>R</td><td>Digital value of the DI channels (1...24) [BOOL] in accordance with the hysteresis.

The validity depends on -> Error Code [BYTE].</td></tr>
<tr><td>-> Value - analog [INT]</td><td>INT</td><td>R</td><td>Analog value of the DI channels (1...24) [INT] from 0...3000 (0...30 V).

The validity depends on -> Error Code [BYTE].</td></tr>
<tr><td>Channel Used [BOOL] -></td><td>BOOL</td><td>W</td><td>Configuration of channels 1...24:
1 = Channel operating.
0 = Channel not operating.</td></tr>
<tr><td>Hysteresis LOW [INT] -></td><td>INT</td><td>W</td><td>Upper limit of the low level voltage range -> Value [BOOL] [1].</td></tr>
<tr><td>Hysteresis HIGH [INT] -></td><td>INT</td><td>W</td><td>Lower limit of the high level voltage range -> Value [BOOL][1].</td></tr>
<tr><td colspan="4">[1] Safety distance between the limits of the voltage ranges: min. 2 V.</td></tr>
</table>

Table 46: System Parameter for Inputs, **MI 24/8: DI Channels** Tab

4.4 Connection Variants

This chapter describes the proper wiring of the controller in safety-related applications.

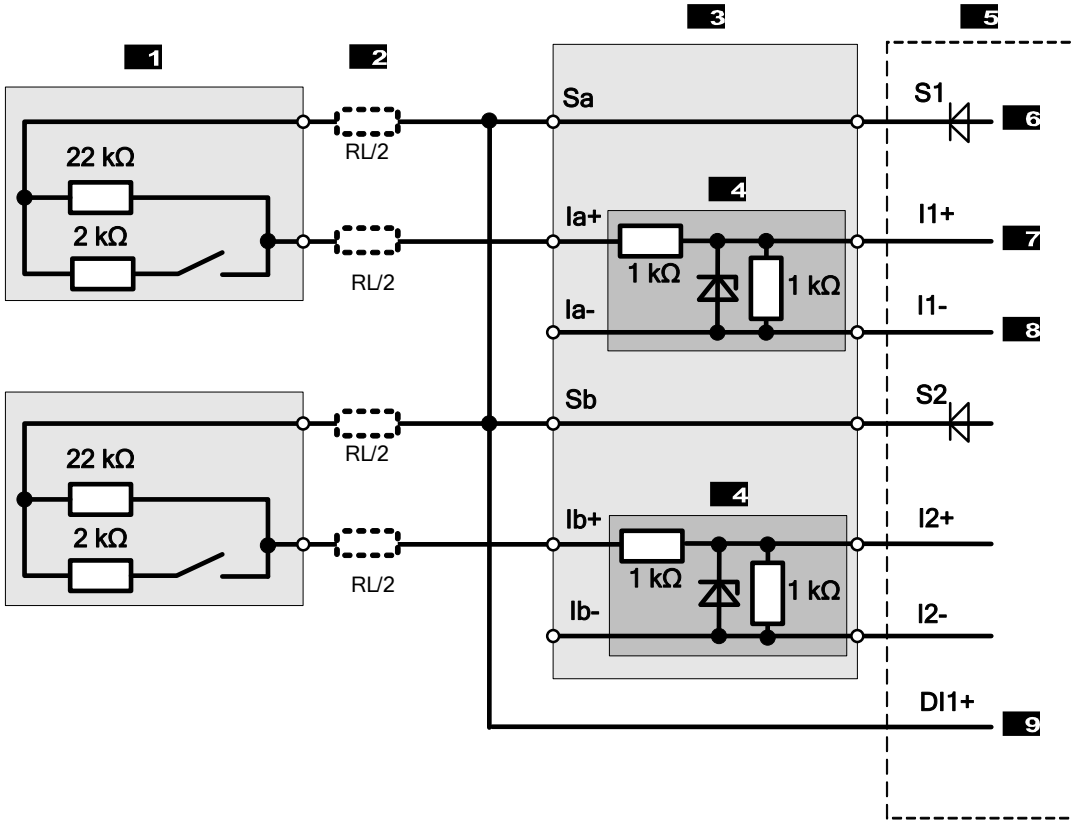
Only the connection variants specified here are permitted for SIL 3 applications.

4.4.1 Wired Mechanical Contacts on Analog Inputs

Wired mechanical contacts are connected to the analog inputs using the Z 7308 shunt adapter, see Figure 10. The shunt adapter protects the analog inputs against overvoltage and short-circuits from the field level.

Each analog input has a supply output that is fed by a common AI power source. The supply voltage is between 26.7 V and 27.3 V.

The supply of the analog inputs must be monitored. To do so, the used supply outputs (S1...S8) must be connected in parallel and attached to a digital input. The digital input is evaluated similarly and must be configured in the programming tool accordingly.



1 Wired mechanical contact
2 Line resistance of < 50 Ω
3 Z 7308 shunt adapter
4 Protective circuit within Z 7308
5 F35 controller
6 26.7...27.3 V supply
7 Analog input
8 Reference potential
9 Digital input used for monitoring

Figure 10: Wired Mechanical Contact on Analog Inputs

4.4.1.1 Switching Thresholds of the Analog Inputs for Mechanical Contacts

For FS2000 resolution, the switch-on and switch-off thresholds, the open-circuit (OC) and short-circuit (SC) thresholds and the corresponding fault response must be configured in the user program.

The values specified in the following table apply to wired mechanical contacts with resistance values of 2 kΩ und 22 kΩ.

Switching thresholds	Range of 2000 digits	Description
Switch-on threshold L →·H	6 V [1200 digits]	Transition from Low to High
Switch-off threshold H → L	3 V [600 digits]	Transition from High to Low
OC threshold	≤ 0.5 V [100 digits]	Fault response to be configured: Set the input value to faulty.
SC threshold	≥ 8.4 V [1680 digits]	Fault response to be configured: Set the input value to faulty.

Table 47: Thresholds for the Analog Inputs

4.4.1.2 LImit Values Used for Monitoring the Supply

For monitoring purposes, a digital input must read back the supply of the analog inputs. Additionally, the supply value muss be within the following limits:

Supply limits	Value
Lower limit	< 26 V [2600 digits]
Upper limit	> 28 V [2800 digits]

Table 48: Switching Thresholds for the Digital Inputs Used for Monitoring the Supply

If the supply voltage is outside of the defined limits, the value of the measuring inputs must be set to faulty. The values of the mechanical contacts must not be further processed in the user program.

If the supply voltage is once again within the defined range limits, operation can be resumed.

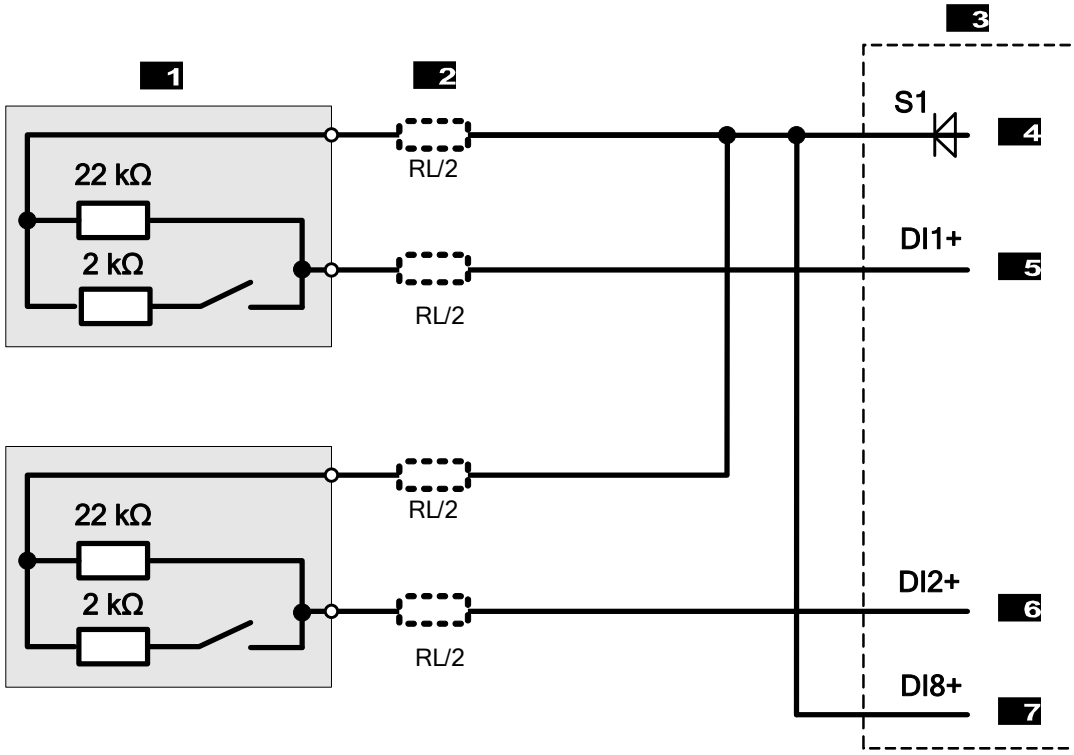
4.4.2 Wired Mechanical Contacts on Digital Inputs

Wired mechanical contacts are connected as described in Figure 11 and Figure 12.

Each of the 3 supply outputs feeds a group of 8 digital inputs. The supply voltage is between 16.7 V and 26.9 V.

The 3 supply outputs must be monitored. To do so, each of the used supply outputs must be connected to a digital input. The digital input is evaluated similarly and must be configured in the programming tool accordingly.

4.4.2.1 Wired Mechanical Contacts with Resistance Values of 2 kΩ and 22 kΩ



1 Wired mechanical contact
2 Line resistance of < 50 Ω
3 F35 controller
4 16.7...26.9 V DI supply
5 Digital input mechanical contact 1
6 Digital input mechanical contact 2
7 Digital input used for monitoring

Figure 11: Wired Mechanical Contact on Digital Inputs

Switching Thresholds for the Digital Inputs

The switch-on and switch-off thresholds, the open-circuit (OC) and short-circuit (SC) thresholds and the corresponding fault response must be configured in the user program. The SC threshold must be determined in the user program by reading back the supply voltage. The SC threshold is equal to the measured supply value minus 1.1 V.

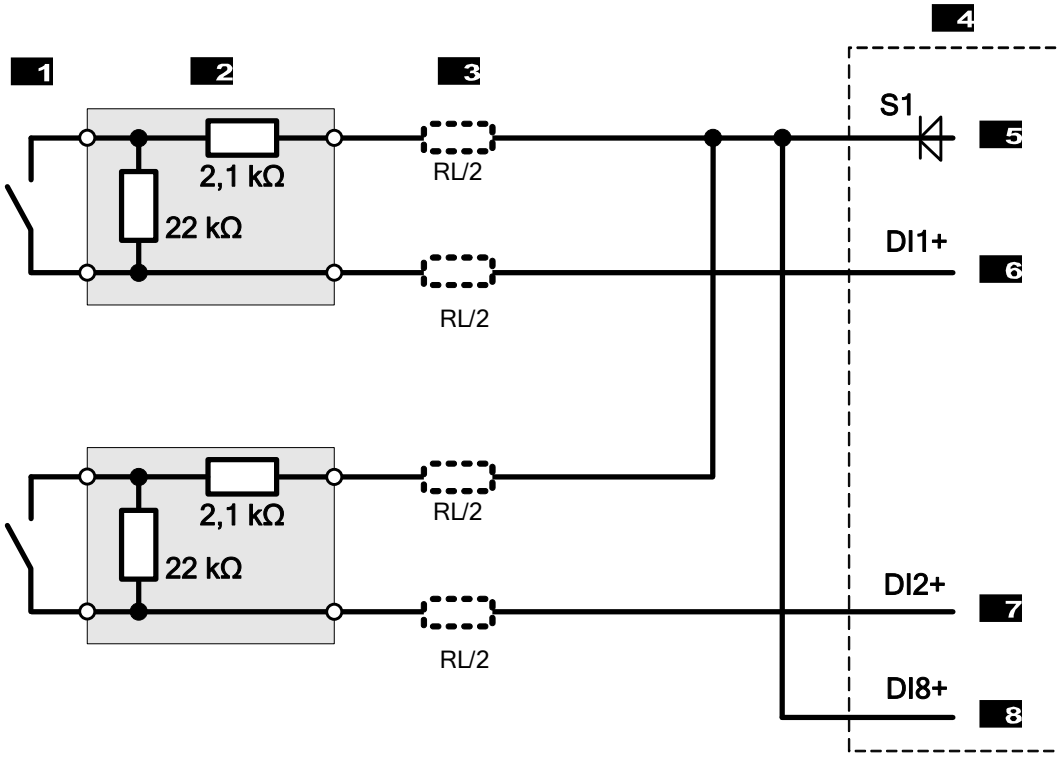
The values specified in the following table apply to wired mechanical contacts with resistance values of 2 kΩ und 22 kΩ.

Switching thresholds	Value	Description
Switch-on threshold L → H	> 12 V [1200 digits]	Transition from Low to High
Switch-off threshold H → L	< 10 V [1000 digits]	Transition from High to Low
OC threshold	< 2 V [200 digits]	Fault response to be configured: Set the input value to zero.
SC threshold	Supply - 1.1 V [110 digits]	Fault response to be configured: Set the input value to zero.

Table 49: Switching Thresholds of Digital Inputs for Wired Mechanical Contacts with Resistance Values of 2 kΩ and 22 kΩ

4.4.2.2 Wired Mechanical Contacts with Resistance Values of 2.1 kΩ and 22 kΩ

A BARTEC resistive coupling element (2, HIMA part no. 88 0007829) is connected upstream to the mechanical contact, see Figure 12.



1 Mechanical contact
2 Resistive coupling element
3 Line resistance of < 50 Ω
4 F35 controller
5 16.7...26.9 V DI supply
6 Digital input mechanical contact 1
7 Digital input mechanical contact 2
8 Digital input used for monitoring

Figure 12: Mechanical Contact with Resistive Coupling Element

Switching Thresholds for the Digital Inputs

The switch-on and switch-off thresholds, the open-circuit (OC) and short-circuit (SC) thresholds and the corresponding fault response must be configured in the user program. The SC threshold must be determined in the user program by reading back the supply voltage. The SC threshold is equal to the measured supply value minus 1.1 V.

The value for the switching thresholds specified in Table 50 apply for wired mechanical contacts with resistance values of 2.1 kΩ and 22 kΩ, see Figure 12.

Switching threshold	Value	Description
Switch-on threshold L →·H	> 11.5 V [1150 digits]	Transition from Low to High
Switch-off threshold H → L	< 9.5 V [950 digits]	Transition from High to Low
OC threshold	< 2 V [200 digits]	Fault response to be configured: Set the input value to zero.
SC threshold	Supply - 1.1 V [110 digits]	Fault response to be configured: Set the input value to zero.

Table 50: Switching Thresholds for the Digital Inputs for Mechanical Contacts with Resistive Coupling Element

5 Operation

The controller F35 is ready for operation. No specific monitoring is required for the controller.

5.1 Handling

Handling of the controller during operation is not required.

5.2 Diagnostics

A first diagnosis results from evaluating the LEDs, see Chapter 3.4.1.

The device 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 response of digital inputs.

Refer to Chapter 3.1.2.1, for more information on the fault response of digital outputs.

Refer to Chapter 3.1.3.1, for more information on the fault response of counters.

Refer to Chapter 3.1.4.2, for more information on the fault response of analog inputs.

If the test harness detects 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.

6.2 Maintenance Measures

In rare cases, the following measures are required for the device:

- Loading the operating system, if a new version is required.
- Performing the proof test.

6.2.1 Loading the Operating System

HIMA is continuously improving the operating system of the devices.

HIMA recommends using system downtimes to load a current version of the operating system into the devices.

Refer to the release list to check the impact 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 device must be in STOP (displayed in the programming tool). If this is not the case, stop the device.

Refer to the system manual (HI 800 141 E) for further details on how to load operating systems.

6.2.2 Proof Test

HIMatrix devices and modules must be subject 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 to decommission the device. Afterwards pull out the pluggable screw terminals for inputs and outputs and the Ethernet cables.

8 Transport

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

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

9 Disposal

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

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

Appendix

Glossary

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

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