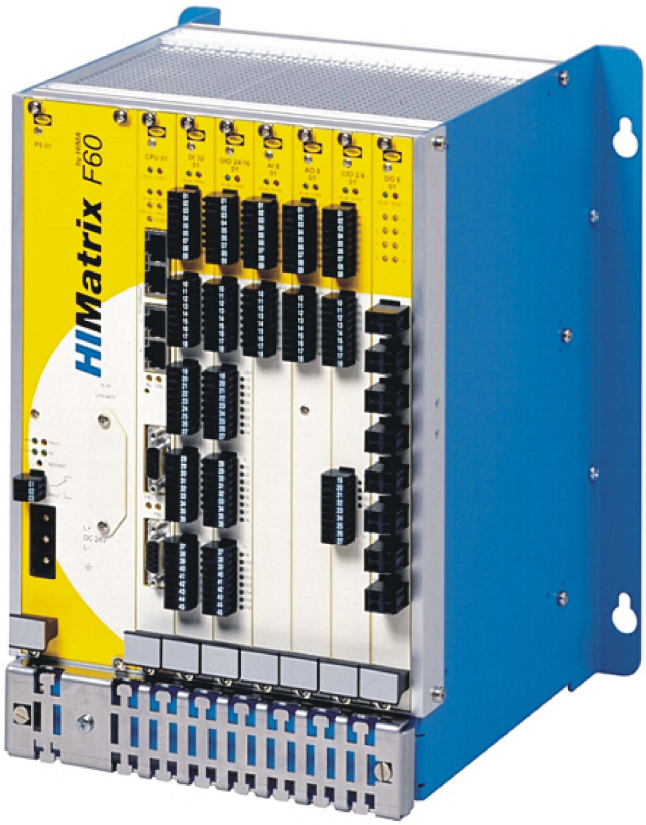
HIMatrix

Safety-Related Controller

DI 32 01 Manual



HIMA Paul Hildebrandt GmbH + Co KG
Industrial Automation

Rev. 2.00

HI 800 203 E

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

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

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

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Revision index	Revisions	Type of change	
		technical	editorial
1.00	Added: Configuration with SILworX	X	X
2.00	Added: DI 32 014, SIL 4 certified according to EN 50126, EN 50128 and EN 50129, Chapter 4.1.3	X	X

Table of Contents

1 Introduction

This manual describes the technical characteristics of the module and its use. It provides information on how to install, start up and configure the module.

1.1 Structure and Use of this Manual

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

This manual is organized in the following main chapters:

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

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

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

Table 1: Programming Tools for HIMatrix F60

In the manual, the differences are specified by using:

- Separated chapters
- Tables differentiating among the versions

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

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

Additionally, the following documents must be taken into account:

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

Table 2: Additional Relevant Documents

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

1.2 Target Audience

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

1.3 Formatting Conventions

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

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

Safety notes and operating tips are particularly marked.

1.3.1 Safety Notes

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

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

⚠ SIGNAL WORD

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

The signal words have the following meanings:

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

NOTE

Type and source of damage!
Damage prevention

1.3.2 Operating Tips

Additional information is structured as presented in the following example:

i The text corresponding to the additional information is located here.

Useful tips and tricks appear as follows:

TIP The tip text is located here.

2 Safety

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

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

2.1 Intended Use

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

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

2.1.1 Environmental Requirements

Requirement type	Range of values [1]
Protection class	Protection class III in accordance with IEC/EN 61131-2
Ambient temperature	0...+60 °C
Storage temperature	-40...+85 °C
Pollution	Pollution degree II in accordance with IEC/EN 61131-2
Altitude	< 2000 m
Housing	Standard: IP20
Supply voltage	24 VDC

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

Table 3: Environmental Requirements

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

2.1.2 ESD Protective Measures

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

NOTE

Device damage due to electrostatic discharge!

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

2.2 Residual Risk

No imminent risk results from a HIMatrix system itself.

Residual risk may result from:

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

2.3 Safety Precautions

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

2.4 Emergency Information

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

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

3 Product Description

The DI 32 01 is a module with 32 digital inputs and is used for the modular F60 system. The inputs are galvanically separated to the I/O bus.

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

The module has been certified by the TÜV for safety-related applications up to SIL 3 (IEC 61508, IEC 61511 and IEC 62061), Cat. 4 and PL e (EN ISO 13849-1) and SIL 4 (EN 50126, EN 50128 and EN 129).
Further safety standards, application standards and test standards are specified in the certificates available on the HIMA website.

3.1 Safety Function

3.1.1 Safety-Related Inputs

The module is equipped with safety-related inputs.The module is equipped with safety-related inputs. These inputs are divided in 4 groups of 7 inputs and 1 group of 4 inputs (I29...I32). Refer to Table 10 for more information about terminal assignment. Each group is equipped with a common short-circuit-proof supply LS+.

3.1.1.1 Reaction in the Event of a Fault

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

The module activates the *ERR* LED.

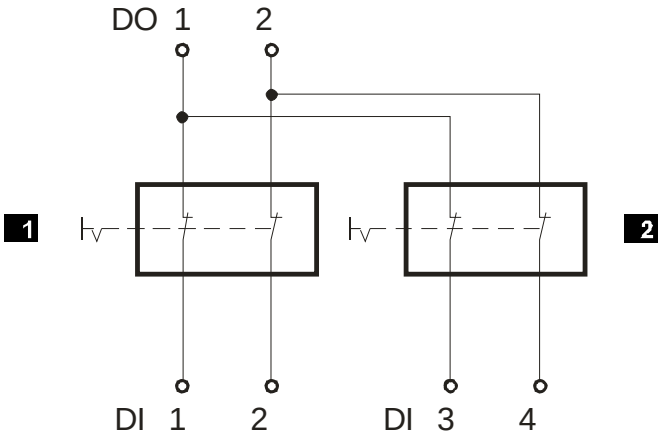
In addition to the channel signal value, the user program must also consider the corresponding error code.

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

3.1.1.2 Line Control

Line control is used to detect short-circuits or open-circuits, e.g., on EMERGENCY STOP inputs complying with Cat. 4 and PL e in accordance with EN ISO 13849-1. Line control can be configured for the F60 system.

Application example: The outputs DO 1 and DO 2 of the DIO 24/16 01 module are connected to the digital inputs (DI) of the same module or of the F60 DI 32 01 module as follows:



1 EMERGENCY STOP 1
2 EMERGENCY STOP 2

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

Figure 1: Line Control

The digital outputs are pulsed. This allows monitoring of the wires to the digital inputs of the F60 DI 32 01 or F60 DIO 24/16 01 module.

A fault reaction is triggered if one of the following faults occurs:

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

The fault reaction includes the following actions:

- The *ERROR* LED on the controller's front plate blinks.
- The inputs are set to 0.
- An evaluable error code is created.

3.2 Equipment, Scope of Delivery

The following table specifies the available module variants:

Designation	Description
DI 32 01	Module with 32 digital inputs
DI 32 014	Module with 32 digital inputs, Operating temperature: -25...+70 °C (temperature class T1), Vibration and shock tested according to EN 50125-3 and EN 50155, class 1B according to IEC 61373

Table 4: Available Variants

3.3 Type Label

The type plate contains the following details:

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

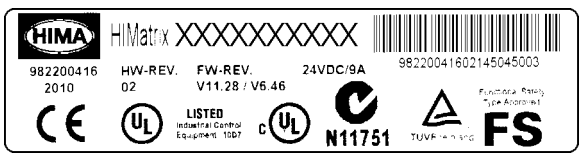
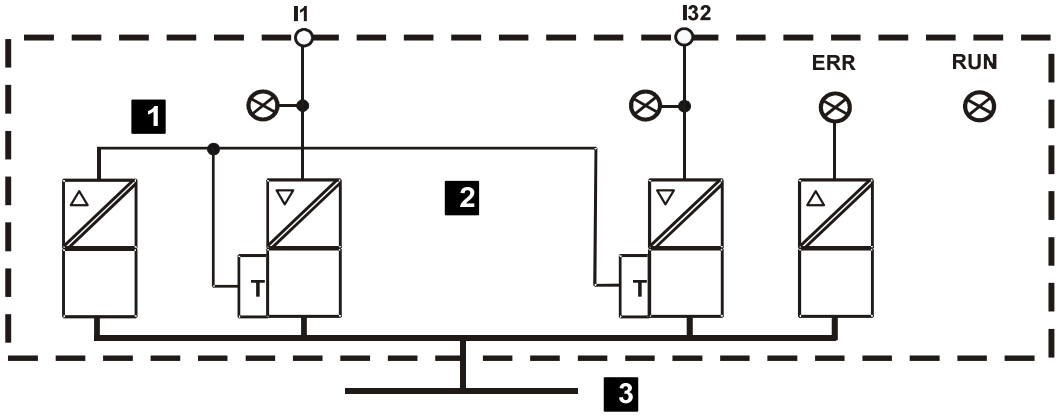


Figure 2: Sample Type Label

3.4 Structure

This chapter describes the layout and function of the module.

3.4.1 Block Diagram



1 Test
2 32 Channels
3 I/O Bus

Figure 3: Block Diagram

3.4.2 Front View

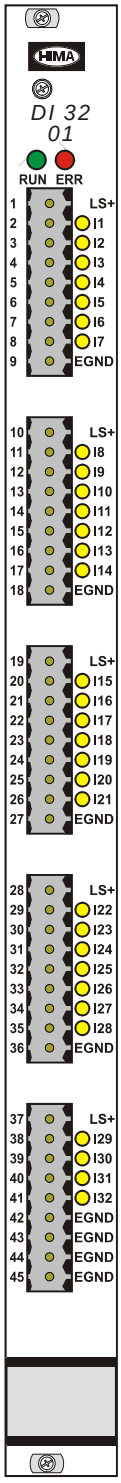


Figure 4: Front View

3.4.3 Status Indicators

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

Table 5: Status Indicators

3.4.4 I/O LEDs

LED	Color	Status	Description
I 1...32	Yellow	On	The related channel is active (energized).
		Off	The related channel is inactive (de-energized).

Table 6: I/O LEDs

3.5 Product Data

General	
Operating voltage	24 VDC, -15...+20 %, $r_{PP} \leq 15$ %, from a power supply unit with safe insulation, in accordance with IEC 61131-2
Operating data	3.3 VDC / 0.05 A 24 VDC / 0.2 A
Ambient temperature	0...+60 °C
Storage temperature	-40...+85 °C
Space requirement	6 RU, 4 HP
Weight	260 g

Table 7: Product Data

Digital inputs	
Number of inputs	32, galvanically separated
Input voltage High level Low level	nom. 24 VDC 10...30 V max. 5 V
Input current High level Low level	 2 mA at 10 V, 5 mA at 24 V 1 mA at 5 V
Switching point	typ. 7.5 V
Supply	5 x 20 V / 100 mA (at 24 V), short-circuit-proof, current limited

Table 8: Specifications for Digital Inputs

3.5.1 Product Data DI 32 014

The DI 32 014 model variant is intended for use in railway applications. The electronic components are coated with a protective lacquer.

DI 32 014	
Operating temperature	-25…+70 °C (temperature class T1)

Table 9: Product Data DI 32 014

The DI 32 014 module meets the vibration and shock requirements in accordance with EN 61373, Category 1, Class B.