Manual

HIJunction Box®

System Manual

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Document designation	Description
HI 801 512 D, Rev. 1.03 (2005)	German original document
HI 801 520 E, Rev. 1.03.00 (2005)	English translation of the German original document

Table of Contents

1 Introduction

The system manual describes the configuration and use of the HIJunction Box with safety-related HIMA controller systems.

The HIJunction Box can be used for different tasks in process automation.

1.1 Structure and Use of the Document

This system manual is composed of the following chapters:

Safety	Information on how to safely use the system.
Product description	Structure of the system.
Diagnostics	Summary of the diagnostic options.
Product Data, Equipment	Specifications related to the entire system. Specifications for the individual components are included in the corresponding manual.
Lifecycle	Phases of the system lifecycle: ▪ Installation ▪ Start-up ▪ Maintenance and repairs
Documentation	Overview of the documentation.
Appendix	▪ Configuration examples ▪ Glossary ▪ Index of tables and index of figures ▪ Index

1.2 Other Applicable Documents

In addition to HIMA components, the HIJunction Box also contains components from other manufacturers. For these components, the respective operating instructions and manuals must be observed in their current form. Refer to Chapter 7 for the corresponding list.

1.3 Target Audience

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

All specialist staff (planning, installation, start-up) must be instructed concerning the risks and the associated possible consequences which can arise as a result of modifications to a safety-related automation system.

Planners and configuration engineers must have additional knowledge about the selection and use of electrical and electronic safety systems in automated plants, e.g., to prevent improper connections or faulty programming.

The operator is responsible for qualifying the operating and maintenance personnel and providing them with appropriate safety instructions.

Only staff members with knowledge of industrial process measurement and control, electrical engineering, electronics and the implementation of PES and ESD protective measures may modify or extend the system wiring.

1.4 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 specially marked. In the electronic document (PDF): When the mouse pointer hovers over a hyperlink, it changes its shape. Click the hyperlink to jump to the corresponding position.

Safety notices and operating tips are specially marked.

1.4.1 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 situation which, if not avoided, could result in minor or moderate 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.

1.4.2 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.

1.5 Safety Lifecycle Services

HIMA provides support throughout all the phases of a plant's safety lifecycle, from planning and engineering through commissioning to maintenance of safety and security.

HIMA's technical support experts are available for providing information and answering questions about our products, functional safety and automation security.

To achieve the qualification required by the safety standards, HIMA offers product or customer-specific seminars at HIMA's training center or on site at the customer's premises. The current seminar program for functional safety, automation security and HIMA products can be found on HIMA's website.

Safety Lifecycle Services:	
Onsite+ / On-Site Engineering	In close cooperation with the customer, HIMA performs changes or extensions on site.
Startup+ / Preventive Maintenance	HIMA is responsible for planning and executing preventive maintenance measures. Maintenance actions are carried out in accordance with the manufacturer's specifications and are documented for the customer.
Lifecycle+ / Lifecycle Management	As part of its lifecycle management processes, HIMA analyzes the current status of all installed systems and develops specific recommendations for maintenance, upgrading and migration.
Hotline+ / 24 h Hotline	HIMA's safety engineers are available by telephone around the clock to help solve problems.
Standby+ / 24 h Call-Out Service	Faults that cannot be resolved over the phone are processed by HIMA's specialists within the time frame specified in the contract.
Logistics+/ 24 h Spare Parts Service	HIMA maintains an inventory of necessary spare parts and guarantees quick, long-term availability.

Contact details:	
Safety Lifecycle Services	https://www.hima.com/en/about-hima/contacts-worldwide/
Technical Support	https://www.hima.com/en/products-services/support/
Seminar Program	https://www.hima.com/en/products-services/seminars//

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

This chapter describes the conditions for using the HIJunction Box.

2.1.1 Scope

The HIJunction Box can be used in process controller, protective systems, burner systems, and machine controllers, and is tailored to the HIMA system scope of application. For further details, refer to the system manuals (Chapter 7).

2.1.2 Environmental Requirements

All the environmental requirements and assembly details specified in this manual (Chapter 5) must be observed when operating the HIJunction Box.

2.2 Tasks of Operators and Machine and System Manufacturers

Operators as well as machine and system manufacturers are responsible for safely operating the HIJunction Box in automated systems and plants.

Machine and system manufacturers must sufficiently validate proper programming of the HIMA system within a HIJunction Box.

HIJunction Boxes with Ex design are certified and must not be modified. Any change will void the Ex protection certificate and may cause loss of the Ex protection functions.

If HIJunction Boxes are used in potentially explosive atmospheres, work in these areas can endanger the safety of persons and equipment. Compliance with all relevant safety regulations is therefore particularly important. Persons performing any assembly and maintenance work bear special responsibility. Precise knowledge of the applicable rules and regulations is an important prerequisite for preparation and execution of the work.

Work on HIJunction Boxes may only be performed by properly trained professionals and must be carried out in compliance with the safety regulations applicable on site.

2.2.1 Connecting to Communication Partners

Only devices with electrically protective separation may be connected to the communication interfaces.

2.2.2 Use of Safety-Related Communication

When implementing safety-related communications between various devices, ensure that the overall response time of a system does not exceed its process safety time.

All requirements related to the configuration of communication and specified in the safety manuals must be met (see Chapter 7).

2.3 ESD Protective Measures

Only personnel with knowledge of ESD protective measures may work on the HIJunction Box system.

NOTICE

Damage to the HIJunction Box 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.**

2.4 Residual Risk

No imminent risk results from a HIJunction Box itself.

Residual risk may result from:

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

2.5 Safety Precautions

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

WARNING

Use of HIJunction Boxes in potentially explosive atmospheres!

Work in potentially explosive atmospheres can endanger the safety of persons and equipment.

Observe the safety regulations applicable on site!

If HIJunction Boxes are used in potentially explosive atmospheres, work in these areas can endanger the safety of persons and equipment. Compliance with all relevant safety regulations is therefore particularly important. Persons performing any assembly and maintenance work bear special responsibility. Precise knowledge of the applicable rules and regulations is an important prerequisite for preparation and execution of the work.

Work on HIJunction Boxes may only be performed by properly trained professionals and must be carried out in compliance with the safety regulations applicable on site.

i Prior to opening a HIJunction Box, it must be disconnected.

2.6 Emergency Information

A HIMA system is a part of the safety equipment of an overall system. 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 HIJunction Box is part of a safety-related control system designed for continuous operation and high availability. The HIJunction Box is designed for use in applications in the process industry, the railway sector and for other areas with harsh environments (up to Ex zone 2). Communication with other components of a safety controller takes place via a bus connection. By using HIJunction Boxes, it is possible to minimize the use of marshalling panels and cable routes or to omit them completely.

Depending on the application, a HIJunction Box can be equipped with HIMatrix compact systems or HIMax components. Approved HIMA components are listed in Chapter 5.1.

For a detailed description of the individual components, refer to the corresponding HIMax manuals (see Chapter 7.2).

3.1 HIJunction Box Variants

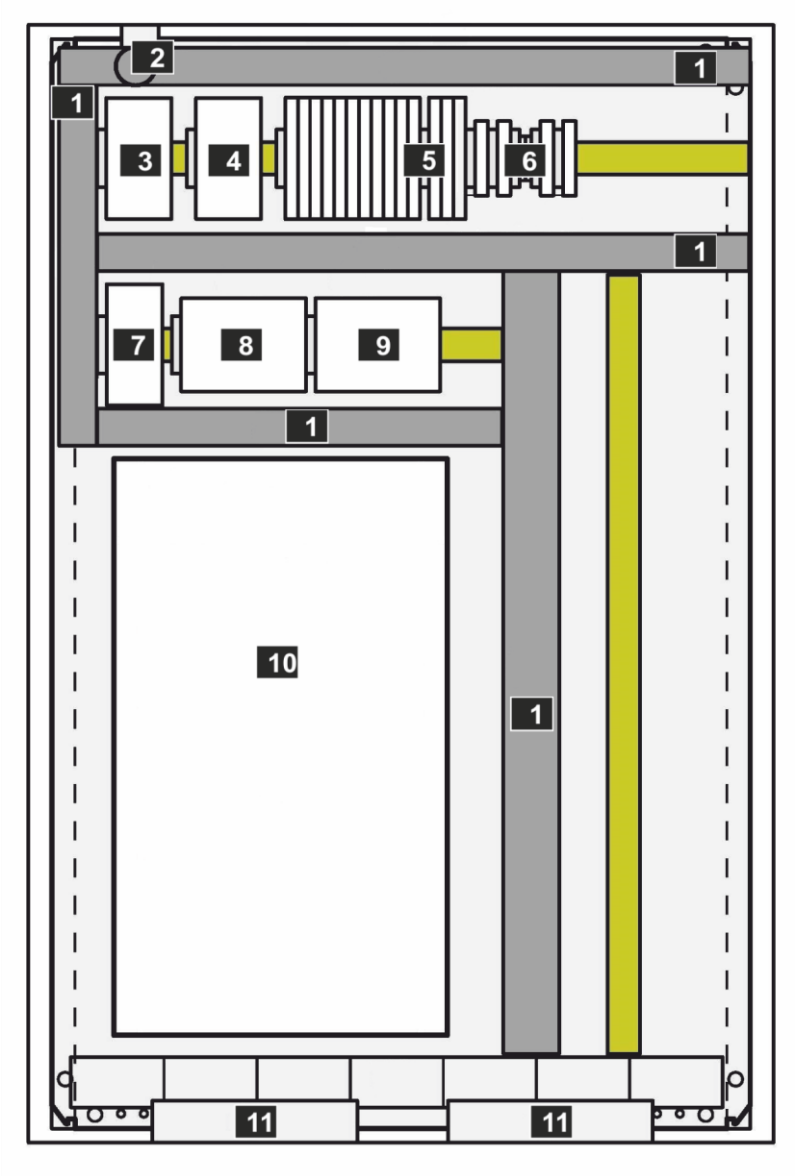
The following table specifies the available HIJunction Box variants:

Designation	Description
HIJB HIMatrix EX	HIJunction Box for HIMatrix, Ex design for zone 2
HIJB HIMatrix C EX	HIJunction Box for HIMatrix, with thermoelectric cooler, Ex design for zone 2
HIJB HIMax 10 01 EX	HIJunction Box for HIMax I/O modules, Ex design for zone 2
HIJB HIMax 10 31 EX	HIJunction Box for HIMax X-CPU 31 and I/O modules, Ex design for zone 2
HIJB HIMax 10 01 C EX	HIJunction Box for HIMax I/O modules, with thermoelectric cooler, Ex design for zone 2
HIJB HIMax 10 31 C EX	HIJunction Box for HIMax X-CPU 31 and I/O modules, with thermoelectric cooler, Ex design for zone 2

Table 1: Available Variants

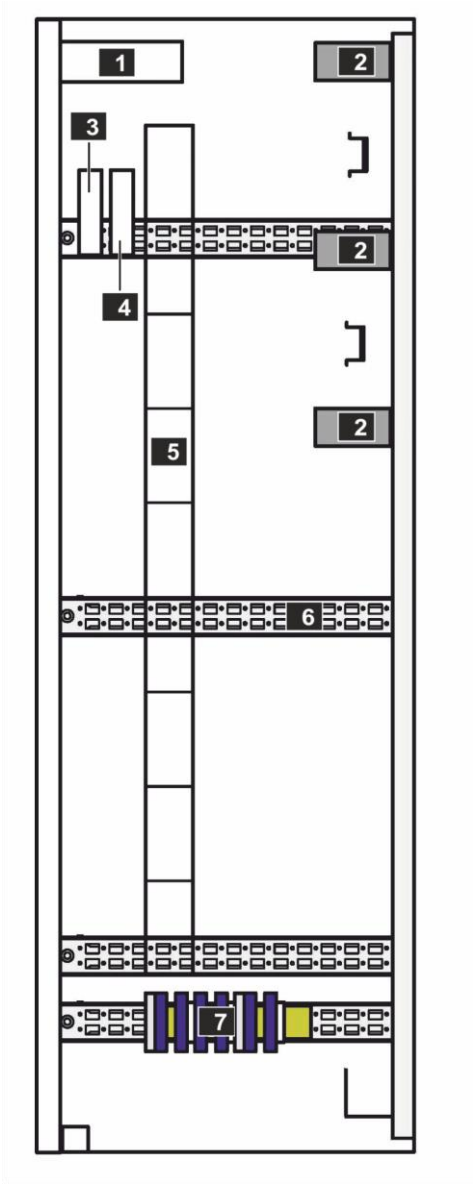
3.2 HIJunction Box Basic Components

The following figures show the essential components of a HIJunction Box, independently of whether HIMatrix or HIMax components are used.



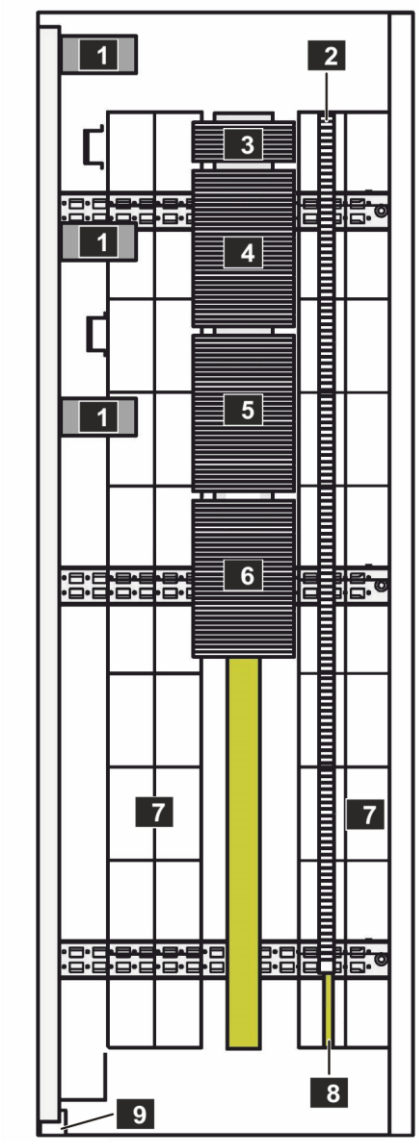
1 Cable duct
2 Door contact
3 Power supply unit A
4 Power supply unit B
5 24 VDC circuit breakers
6 Temperature control
7 Power supply cooling (optional)
8 Communication A
9 Communication B
10 Mounting space for HIMA components
11 Grounding bar

Figure 1: HIJunction Box Basic Components, Inside Center



1 Door contact
2 Cable duct
3 Cooling thermostat (optional)
4 Heating thermostat (optional)
5 Cable tray
6 Fastening element
7 AC fuses

Figure 2: Side View of HIJunction Box Basic Components, Inside Left



Cable duct	X3 terminals
Copper rail	Cable tray
XM1 terminals	Shield connection (ground)
X1 terminals	Pressure compensation element
X2 terminals	

Figure 3: Side View of HIJunction Box Basic Components, Inside Right

3.2.1 Power Supply Units

Power supply units for 24 VDC supply of the components in SELV/PELV version are installed in the HIJunction Box. Versions with redundant I/O modules also use redundant power supply units.

3.2.2 Fuses

To secure the circuits, the HIJunction Box is equipped with fuses. Special fuses are used to comply with the requirements for Ex zone 2.

3.2.3 Communication Components

Communication components are installed in the HIJunction Box for communication between the HIJunction Box and the safety controller. Depending on requirements, communication connections can be established via Ethernet cable or optical connections. The optical connections are designed as OP IS due to the requirements for Ex zone 2. Versions with redundant I/O modules also use redundant communication components.

NOTICE

Communication interference possible!

Use communication cables compliant with industrial standards!

In harsh environments (e.g., subject to temperature changes, electromagnetic interference), low-quality communication cables may cause communication to fail.

3.2.4 Terminals

Double-level terminals on a vertical 35 mm DIN rail are available for connection of the I/O signals. The terminals are equipped with a knife disconnect device to facilitate commissioning and maintenance work in the field.

3.2.5 Cable Entries

Up to 100 cables can be inserted into each HIJunction Box:

- 2 entries for redundant power supply.
- 2 entries for redundant communication connections.
- 96 entries for I/O signal or other cables.

3.2.6 Door Contact

The door contact reports an open door. It is wired as standard together with further messages to create a collective message and connected to one input terminal. If a separate message is required for the door contact, this contact can be used individually (also see Chapter 4.1.4).

3.2.7 Ventilation/Climate Control (Optional)

The HIJunction Box has a closed enclosure (IP66) that does not allow air exchange.

Depending on its equipment, a low-maintenance cooling element is required to ensure that the internal temperature does not exceed the maximum permissible value in case of elevated ambient temperatures. This is installed in the door of the HIJunction Box, if required, see Table 7 and Table 9.

In addition, if low ambient temperatures are to be expected, an optional cabinet heater can be installed to ensure an internal temperature > 0 °C.

3.2.8 Temperature Monitoring

HIMax and HIMatrix modules monitor their own temperature. Use the SILworX programming tool to display the temperature level and evaluate it for programming the corresponding response. For further details, see the product-specific manuals.

4 Diagnostics

The following describes options for fast initial diagnosis of basic components.

The diagnostic history in SILworX provides detailed information.

4.1 Basic Components Diagnostics

4.1.1 Fuses

When switched on, the fuse release levers are in the upper position.

After a fuse has tripped, its release lever is in the lower position.

4.1.2 Power Supply Units

The power supply units of the HIJunction Box indicate their operating status with an LED:

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

Table 2: Operating Voltage LED

4.1.3 Communication Components

The communication components of the HIJunction Box indicate their operating status with LEDs:

LED	Color	Status	Description
ON	Green	On	Normal operation.
	Red	On	Communication error.
	---	Off	No operating voltage.
DC1, DC2	Green	On	Operating voltage present.
	Red	On	Undervoltage.
	---	Off	No operating voltage.

Table 3: Communication Components Operating State

The description of the other LEDs can be found in the data sheet of the manufacturer, refer to Chapter 7.3.

4.1.4 Collective Fault Message

The collective fault message of the HIJunction Box can be used to report faults. The collective fault message comprises the following:

- Fuse tripped.
- Power supply failure.
- Fan failure.
- Door open.

The fault message contacts of the individual components are connected in series. If there are no faults, the contacts are closed. The collective fault message signal is "on". A fault in one of the components opens the circuit so that the collective fault message changes to "off". If required, the fault messages can also be evaluated individually for each component. To do this, the signaling circuit must be rewired (see the cabinet diagrams supplied with the HIJunction Box).

4.2 HIMatrix Components Diagnostics

The evaluation of the diagnostic messages is described in detail in the HIMatrix documentation, refer to Chapter 7.1.

4.3 HIMax Components Diagnostics

The evaluation of the diagnostic messages is described in detail in the HIMax documentation, refer to Chapter 7.2.

5 Product Data, Equipment

5.1 Environmental Requirements

Condition type	Range of values
Ambient temperature	-20…+55 °C (depending on the equipment)
Storage temperature	-20…+85 °C
Humidity	Max. 95 % relative humidity, non-condensing
Installation height	< 2000 m

Table 4: Environmental Requirements

Exposing the HIJunction Box to environmental conditions other than those indicated can cause it to malfunction.

5.2 Specifications

General	
Housing material	Stainless steel 316L, wall thickness 2 mm
Dimensions (H x W x D)	(1200 x 800 x 400) mm
Degree of protection	IP66 / NEMA 4X in accordance with IEC 60529
Coating	None
Weight	120…150 kg (depending on the equipment, without packaging)
Type of mounting	Wall mounting
Door	Right door handing
Door lock	Lockable with key
Ex Marking	▪ ⟨Ex⟩ II 3G ▪ Ex db eb ec ic nA nC [op is] [op pr] [ia] [ic] IIC T3/T4 Gc (depending on the design)
Cable entries	Via cable entry system: 2 entries for power supply, 2 entries for communication connections, max. 96 entries for I/O signal cable and other cables. Min. cable diameter: 3.5 mm Max. cable diameter: 32.5 mm
Supply voltage	100…240 VAC (-15…+10 %) 110…250 VDC (-18…+40 %)
Current consumption	Typical values per power supply 6.8 A (100 VAC) 5.5 A (120 VAC) 2.8 A (230 VAC) 2.7 A (240 VAC)
Fuse protection for input circuits	Circuit breaker C10 A
Internal circuits	24 VDC, max. 20 A, protected with 10 A fuses
Communication	Optical fiber, single mode or patch cable Cat. 6, Ethernet 100/1000 BASE-Tx

Table 5: Specifications for the HIJunction Box

5.3 Equipment

This chapter describes the use of HIMA systems HIMatrix and HIMax in the HIJunction Box.

5.3.1 General Information on Equipment

The environmental requirements specified in Chapter 5.1 must be observed to ensure that the function of the components is not impaired.

During operation, the supply voltage should be provided via a UPS.

The components of the HIMA systems HIMatrix and HIMax are suitable for mounting in potentially explosive atmospheres within zone 2. Refer to the components' safety manuals (Chapter 7.1 and Chapter 7.2) for further details.

5.3.2 Equipment with HIMatrix Components

HIMatrix compact systems are compactly constructed, safety-related controllers including one safety-related processor system, a number of inputs and outputs and communication interfaces in its housing.

In addition to the controllers, HIMatrix compact system also comprise remote I/Os, which are connected to the controllers via safe**ethernet** and expand the controllers by additional inputs and outputs.

In the version for HIMatrix components, the HIJunction Box has 35 mm DIN rails to accommodate the HIMatrix components.

The following HIMatrix components can be used:

Module	Description
F35 03 SILworX	Controller (24 digital inputs, 8 digital outputs, 2 counters, 8 analog inputs). Integrated 4-port switch 100BASE-Tx with safe**ethernet**, 3 fieldbus interfaces. SIL 3, Cat. 4, PL e, CENELEC SIL 4.
F1 DI 16 01 SILworX	Remote I/O (16 digital inputs with cross-circuit monitoring, 4 pulsed outputs). Integrated 2-port switch 100BASE-Tx with safe**ethernet**. SIL 3, Cat. 4, PL e, CENELEC SIL 4.
F2 DO 16 01 SILworX	Remote I/O (16 digital outputs 24 VDC with 1 A output current). Integrated 2-port switch 100BASE-Tx with safe**ethernet**. SIL 3, Cat. 4, PL e, CENELEC SIL 4.
F3 AIO 8/4 01 SILworX	Remote I/O (8 analog inputs, 4 analog non-safety-related outputs). Integrated 2-port switch 100BASE-Tx with safe**ethernet**. SIL 3, Cat. 4, PL e, CENELEC SIL 4.
F3 DIO 20/8 02 SILworX	20 digital inputs (with cross-circuit monitoring), 8 digital outputs Integrated 2-port switch 100BASE-Tx with safe**ethernet**. SIL 3, Cat. 4, PL e, CENELEC SIL 4.

Table 6: Overview of the HIMatrix Modules

For the module descriptions, refer to the corresponding product manuals. For further information, refer to Chapter 7.1.

The following combinations of HIMatrix components are possible in the HIJunction Box:

Combination	AI	DI	DO	TOTAL		35 °C [1]	45 °C [1]	55 °C [1]
Controller with AI + DI + DO	32	44	16	92		X [2]	X [2]	C [3]
Controller with AI + DI + DO	8	56	24	88		X [2]	X [2]	C [3]
I/O combination of AI + DI + DO	32	40	16	88		X [2]	X [2]	C [3]
I/O combination of DI + DO	0	60	24	84		X [2]	X [2]	C [3]
I/O combination of DI	0	96	0	96		X [2]	X [2]	C [3]

[1] Specified ambient temperature.

[2] X: Operation without thermoelectric cooler is possible.

[3] C: Thermoelectric cooler necessary for operation.

Table 7: Permitted Combinations

i Depending on the individual equipment with HIMatrix components, cooling via a cooling element is required at an ambient temperature of 55 °C and above. This is indicated with a “C” in the table.

5.3.3 Equipment with HIMax Components

HIMax is a modular system. Functions such as signal processing, input and output or communication are distributed on pluggable modules. These modules must be inserted in one or multiple base plates. A HIMax controller tailored to the concrete application can be created by selecting appropriate modules.

The controller can be easily adapted to future extensions of the process to be controlled, e.g., by adding modules.

To increase availability, HIMax is intended for redundant operation. The system can also be used as mono, non-redundant system.

In either case, if the corresponding module types are used, safety-related operation up to SIL 3 is possible.

In the version for HIMax components, a base plate with 10 slots (X-BASE PLATE 10 01 or X-BASE PLATE 10 31) is installed in the HIJunction Box.

A total of one module and one connector board can be plugged in to each slot.

Slot 1 and slot 2 are reserved for system bus modules or the X-CPU 31 module. The remaining slots can be used for other modules.

The following I/O modules can be used:

Module	Description	Remark
X-CPU 31	Processor module with system bus connection, SIL 3, Cat. 4, PL e, CENELEC SIL 4.	Max. 2, only slots 1 and 2 for X-BASE PLATE 10 31
X-SB 01	System bus module, SIL 3, Cat. 4, PL e, CENELEC SIL 4.	Max. 2, only slots 1 and 2 for X-BASE PLATE 10 01
X-DI 32 01	Digital input module (32 channels, 24 VDC) SIL 3, Cat. 4, PL e, CENELEC SIL 4.	
X-AI 32 01	Analog input module (32 channels, 4…20 mA, line monitoring), SIL 3, Cat. 4, PL e, CENELEC SIL 4.	
X-AI 16 51	Analog input/temperature module (16 galvanically separated channels, for thermocouples, Pt100, 4…20 mA, +/-280 mV), SIL 1.	
X-DO 32 01	Digital output module (32 channels, 24 VDC, 0.5 A, short-circuit monitoring (SC)) SIL 3, Cat. 4, PL e, CENELEC SIL 4.	
X-DO 24 01	Digital output module (24 channels, 24 VDC, 0.5 A, line monitoring (SC/OC), individual channel shut-off, SIL 3)	
X-AO 16 01	Analog output module (16 channels, 4…20 mA, pairwise galvanically separated, SIL 3)	
X-HART 32 01	HART interface module (32 modems, SIL 3)	
X-BLK 01	Blank module (1 slot, X-I/O)	
X-BLK 02	Blank module (1 slot, X-CPU 01, X-COM 01)	
X-BLK 03	Blank module (1 slot, X-CPU 31, X-SB 01)	

Table 8: Overview of the HIMax Modules

For the module descriptions, refer to the corresponding product manuals. For further information, refer to Chapter 7.2.

i Up to 10 HIJunction Boxes can be integrated into a HIMax system in one project.

The following combinations of modules are approved for the HIJunction Box:

Combination	AI	AO	DI	DO	TOTAL		35 °C [1]	45 °C [1]	55 °C [1]
Red. AI + HART, Red. AO + HART, Red. DO	32	8	0	32	72		X [2]	C [3]	n.a. [4]
Red. AI + HART, Red. AO + HART, Red. DO LM	32	8	0	24	64		X [2]	C [3]	n.a. [4]
Red. AI + HART, Red. AO + HART, Red. AI	64	8	0	0	72		X [2]	C [3]	n.a. [4]
Red. AI, Red. AO, Red. DO	32	8	0	32	72		X [2]	C [3]	n.a. [4]
Red. AI, Red. AO, Red. DO LM	32	8	0	24	64		X [2]	C [3]	n.a. [4]
Red. AI + HART, Red. AI + HART, Red. DO	64	0	0	32	96		X [2]	C [3]	n.a. [4]
Red. AI + HART, Red. AI + HART, Red. DO LM	64	0	0	24	88		X [2]	C [3]	C [3]
Red. AI, Red. AI, Red. DO	64	0	0	32	96		X [2]	C [3]	C [3]
Red. AI, Red. AI, Red. DO LM	64	0	0	24	88		X [2]	C [3]	C [3]
Red. DI, Red. DI, Red. DO	0	0	64	32	96		X [2]	C [3]	C [3]
Red. DI, Red. DI, Red. DO LM	0	0	64	24	88		X [2]	C [3]	C [3]
Red. AI + HART, Red. DI, Red. DO	32	0	32	32	96		X [2]	C [3]	C [3]
Red. AI + HART, Red. DI, Red. DO LM	32	0	32	24	88		X [2]	C [3]	C [3]
Red. AI, Red. DI, Red. DO	32	0	32	32	96		X [2]	C [3]	C [3]
Red. AI, Red. DI, Red. DO LM	32	0	32	24	88		X [2]	C [3]	C [3]
AI TC	96	0	0	0	96		X [2]	X [2]	C [3]
Red. AI + HART, Red. AI + HART, Red. DI	64	0	32	0	96		X [2]	C [3]	C [3]
Red. AI, Red. AI, Red. DI	64	0	32	0	96		X [2]	C [3]	C [3]
Red. AI, Red. AI, Red. AI	96	0	0	0	96		X [2]	C [3]	C [3]
Red. DI, Red. DI, Red. DI	0	0	96	0	96		X [2]	C [3]	C [3]

[1] Specified ambient temperature.

[2] X: Operation without thermoelectric cooler is possible.

[3] C: Thermoelectric cooler is necessary for operation.

[4] n.a. = Operation in this combination is not possible.

Table 9: Permitted Combinations

i Depending on the individual equipment with HIMax components, cooling via a cooling element is required at an ambient temperature of 45 °C and above. This is indicated with a “C” in the table.

Non-permissible combinations are indicated by “n.a.”.

6 Lifecycle

This chapter describes the following lifecycle phases:

- Transport and storage.
- Installation.
- Start-up.
- Maintenance and repairs.

Instructions for a correct decommissioning and disposal of the products are provided in the manuals for the individual components.

6.1 Transport and Storage

HIJunction Boxes are delivered in suitable packaging. To protect the device against damage, only remove this packaging shortly before installation.

If the HIJunction Boxes must be stored temporarily before installation, ensure that the interim storage facility is suitable for its purpose and meets all environmental requirements (see Chapter 5.1). HIMA recommends storage in a secure shelter with no extreme fluctuation of the environmental conditions or strong vibrations.

A HIJunction Box can be transported either by forklift truck or by crane. To lift it, suitable lifting eyebolts must be screwed into the top of the HIJunction Box. Observe the specifications of the hoisting and transport equipment. After installation, remove the lifting eyebolts and replace them by screws.

6.2 Installation

HIJunction Boxes are delivered pre-assembled and tested. A HIJunction Box must be mounted at the installation site, and the connections for supply voltage, communication and I/O signals must be made. This is described in the following.

6.2.1 Enclosed Documentation

HIMA supplies additional documentation for each HIJunction Box, which includes the following:

- Job cover sheet.
- List of drawings.
- Mechanical construction drawings.
- Arrangement of terminal rails.
- Arrangement of equipment.
- Allocation of I/O modules.
- Power supply and power distribution.
- Circuit diagrams.
- Terminal drawings / connector diagrams.

Drawings are generated in accordance with DIN EN 61355 and DIN EN 61346-2 and include the project name.

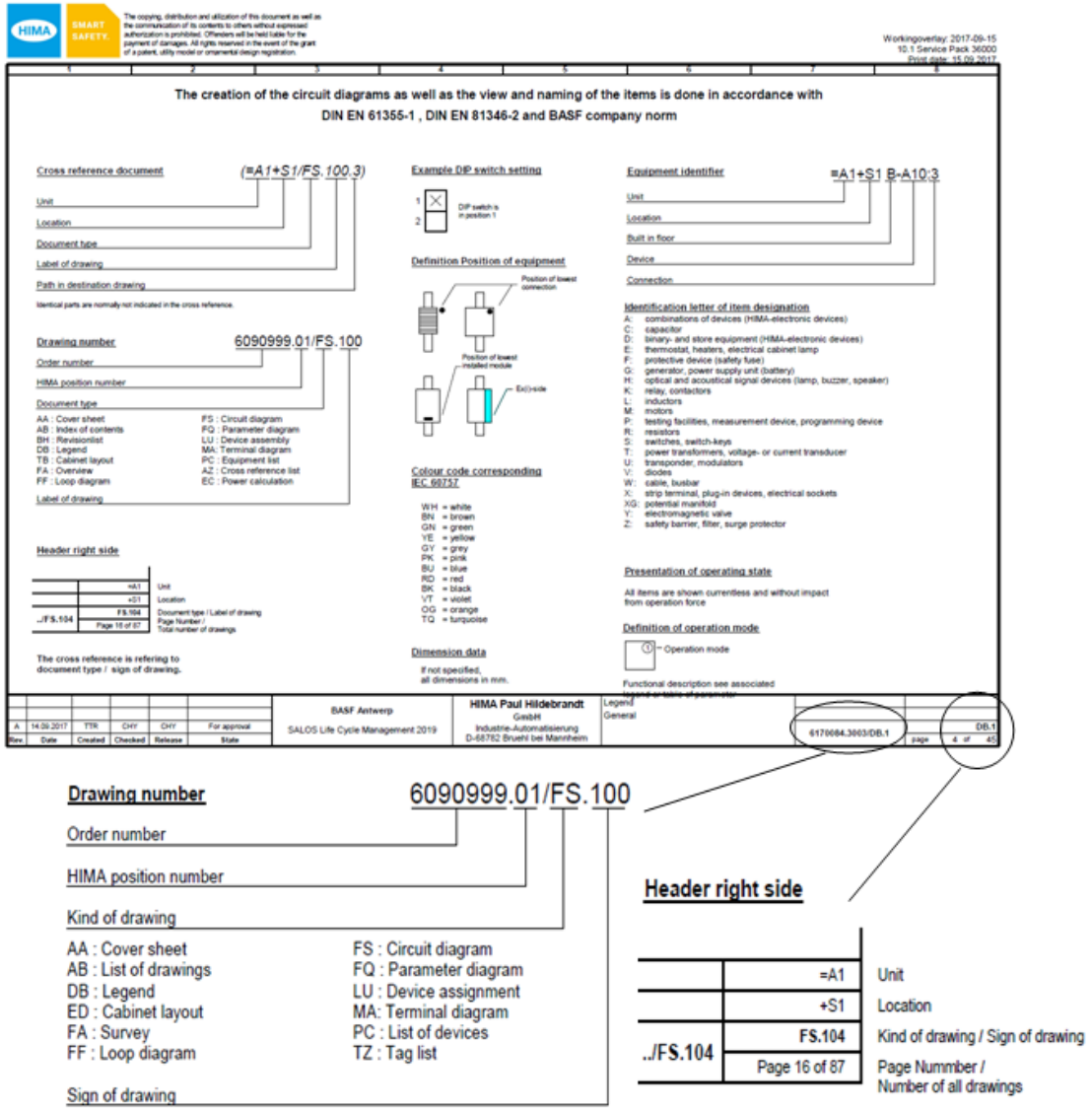


Figure 4: Drawing Description

6.2.2 Mounting a HIJunction Box

To ensure faultless operation, choose a suitable mounting location in accordance with the operating requirements, see Chapter 2.1.2.

HIJunction Boxes are designed for mounting outdoors. HIJunction Boxes must be protected from direct sunlight to prevent it from heating up.

HIJunction Boxes must not be heated by other heat emitting devices or enclosures. The distance to these devices or housings must be chosen so that no heat transfer occurs.

Observe the following points when mounting a HIJunction Box:

- Select a suitable mounting surface.
- Use suitable fasteners designed for the weight of the HIJunction Box (up to 150 kg).
- Use all 4 mounting lugs.

CAUTION

Danger due to insufficient fastening of the HIJunction Box!
Risk of injury due to falling equipment!
Observe the installation instructions!

6.2.3 Connecting the Field Level to the I/O Terminals

Various I/O signals can be connected to a HIJunction Box. Terminal blocks with 32 terminals each are available for this purpose.

Depending on the respective I/O module configuration, not all terminals may be occupied.

The detailed use of the terminals is described in the supplied cabinet diagrams.

Additional wiring options require higher planning efforts and are not described in this manual. If required, HIMA recommends contacting a HIMA sales office.

6.2.4 Grounding

The requirements specified in the low voltage directives SELV (Safety Extra Low Voltage) and PELV (Protective Extra Low Voltage) must be observed.

Functional ground is prescribed to improve the electromagnetic compatibility (EMC). Implement the functional ground in HIJunction Boxes so that it meets the requirements for protective ground.

6.2.4.1 Ungrounded Operation

Ungrounded operation of HIJunction Boxes is not recommended as faulty signals can be triggered if several undetected ground faults occur. If a project requires ungrounded operation, please request a special design from your HIMA sales office.

6.2.4.2 Grounded Operation

Requirements for grounded operation are proper ground conditions and, whenever possible, separate ground connection, in which no parasitic currents may flow. Only the negative pole L- may be grounded. The positive pole L+ must not be grounded since a potential ground fault on the sensor wire would bridge the affected sensor.

L- can only be grounded at one point within the system, preferably directly behind the power supply unit (e.g., on the busbar). Grounding should be easy to access and well separate. The grounding resistance must be ≤ 2 Ω.

6.2.4.3 Grounding Connectors

An M8 x 18 mm bolt is located on the outside of the HIJunction Box to connect the protective ground cable on site.

NOTICE

Ensure proper installation of grounding connectors!

Observe the instructions in the IEC 60079-14 standard on grounding connections in potentially explosive atmospheres!

6.2.5 Electrical Connections

The following chapter provides information on how to connect to field cables and supply voltage.

6.2.5.1 Shielding within the Input and Output Areas

Lay field cables for sensors and actuators separately from the power supply lines and at a sufficient distance from electromagnetically active devices (electric motors, transformers).

To avoid interferences, ensure that the field cables are provided with continuous shielding. Connect the shielding on both ends of the field cables. This applies, in particular, to field cables of analog inputs and proximity switches.

If high compensation currents are expected, the shielding must be applied on at least one end. Further measures, e.g., galvanic separation, must be implemented to avoid compensation currents.

For further details on shielding and grounding requirements, refer to the module-specific manuals.

NOTICE

Observe the instructions in the IEC 60079-14 standard on grounding connections in potentially explosive atmospheres!

6.2.5.2 Lightning Protection for Data Lines in HIMA Communication Systems

To minimize problems due to lightning, the following measures can be implemented:

- Completely shield the field wiring of the HIMA communication systems.
- Properly ground the system.

Implement additional lightning protection measures in places outside of buildings and exposed to lightning.

6.2.5.3 Cable Colors

The cable colors are designed in accordance with the HIMA standard described in the respective cabinet diagrams.

6.2.5.4 Cable Entries

Observe the instructions of the manufacturer Roxtec for installing the cables (refer to Chapter 7.3).

6.2.5.5 Connecting the Supply Voltage

The supply voltage infeed lines must be connected to the clamp terminals XE1 and XE2.

6.2.5.6 Connecting the Field Devices

Terminals X1 to X3 are available for connecting the field devices.

Depending on the respective I/O module configuration, not all terminals may be occupied.

i Wiring depends on the application. Observe the following points:

- Proper wiring.
- Cable/wire bending radius.
- Cable/wire load capacity.
- Installation instructions of the terminal manufacturer.
- Strain relief.

6.2.6 Connection of Communication Connectors

Depending on the selected version, a HIJunction Box is equipped with either an optical or an electrical communication connectors.

6.2.6.1 Connection to Optical Communication Connectors

Optical communication connectors (glass fiber) are connected by at least 4 fibers. HIMA recommends to plan for reserve fibers. The installation of a splice box in the HIJunction Box is not possible.

6.2.6.2 Connection to Electrical Communication Connectors

If the communication connections are established via patch cables, at least Cat. 6 Ethernet cable with RJ45 connectors in industrial design must be used.

6.2.7 Considerations about Heat

The high integration level of electronic components causes heat loss, which also depends on the external load of the modules. Low ambient temperature increases the product life and the reliability of the electronic components within the system.

i Observe the instructions in Chapter 5.3 regarding permissible combinations depending on the ambient temperature!

The permissible environmental requirements of the modules must be met during operation.

6.2.7.1 Heat Dissipation

Depending on the ambient temperature and the equipment of a HIJunction Box, the heat occurring in the interior is dissipated via the surface.

Some equipment variants require a cooling element (see Chapter 5.3).

6.3 Start-Up

This chapter describes how to start up HIJunction Boxes.

WARNING

Use of HIJunction Boxes in potentially explosive atmospheres!

Work in potentially explosive atmospheres can endanger the safety of persons and equipment.

Only perform start-up in an Ex-free atmosphere!

Only power up the system after the hardware is completely mounted and all the cables are connected. First start up the basic components of a HIJunction Box, then the PES.

NOTICE

System damage possible!

Possible system damage caused by safety-related automation systems improperly connected or programmed.

Check all connections and test the entire system before start-up!

6.3.1 Starting Up the HIJunction Box

Prior to connecting the supply voltage, check if all cables are properly connected, thus ensuring that no risk exists for controller and system.

6.3.1.1 Testing all Inputs and Outputs

Impermissible parasitic voltage (e.g., 230 VAC against ground or L-) can be measured using a universal measuring instrument.

HIMA recommends testing every individual terminal for impermissible parasitic voltage.

When testing external cables for isolation resistance, potential short-circuits or open-circuits, no cable ends must be connected to prevent potential damage or destruction of modules caused by high voltage.

Separate the supply voltages for the sensors from the minus pole of the actuators.

If the negative pole is grounded during operation, the ground connection must be interrupted for the duration of the ground fault check. The same applies to the ground connection of ground fault measuring facility, which may be connected to the system.

A megohmmeter or a special measuring facility must be used to check each connection against ground.

6.3.1.2 Voltage Connection

Requirement: All configured modules must be inserted and the corresponding cables must be connected.

Proper polarity, voltage and ripple must be checked prior to connecting the supply voltage.

6.3.2 Starting Up an HIJunction Box with HIMatrix Components

Start-up of HIMatrix compact systems includes the following phases:

- Establishing the electrical connections for power supply, grounding, sensors, and actuators.
- Configuration:
  - Creation of the user program
  - Definition of safety, communication and other parameters.

For further details, refer to the documentation in Chapter 6.3.2.

6.3.3 Starting Up an HIJunction Box with HIMax Components

Depending on whether an X-CPU 31 is used, start-up differs as follows.

6.3.3.1 Starting Up an HIJunction Box with X-CPU 31

If a HIJunction Box is equipped with an X-CPU 31, the PADT can be connected to the processor module. The SILworX programming tool can be used to configure the HIMax system and test the I/O modules. The online mode can be used to display the current values of the I/O signals in SILworX.

6.3.3.2 Starting Up an HIJunction Box with I/O Modules

If a HIJunction Box is equipped with system bus modules and I/O modules, slot 3 is usually not occupied. In this case, the X-CB 001 01 connector board for an X-CPU 01 processor module is installed in slot 3. For the duration of the start-up, an X-CPU 01 processor module can be plugged in and the PADT can be connected to this processor module. The SILworX programming tool can be used to configure the HIMax system and test the I/O modules. The online mode can be used to display the current values of the I/O signals in SILworX. For regular operation, the processor module must be removed and replaced by an empty module X-BLK 02.

If slot 3 is occupied by an I/O module, a processor module in another rack (e.g., rack 0) must be used to configure and test the I/O modules.

6.3.3.3 Faults

- A processor module does not start redundant operation or quits it, in case of malfunction.
- The system enters the STOP / INVALID CONFIGURATION state if the project in SILworX does not match the hardware.

NOTICE

Controller malfunction due to inconsistent rack IDs!

The rack ID is a safety-critical parameter and may only be changed as described in the HIMax system manual (HI 801 001 E).

6.4 Maintenance and Repairs

The lifetime of the system fans depends on the operating temperature.

HIMA recommends observing the instructions for replacing the system fans:

- Every 6 years, at operating temperature < 40 °C.
- Every 3 years, at operating temperature > 40 °C.

i For safety-related applications, the controllers must be subject to a proof test at regular intervals. Refer to the components' safety manuals (Chapter 7.1 and Chapter 7.2) for further details.

i If HIJunction Boxes are used in potentially explosive atmospheres, they must be disconnected from the power supply before opening them.

NOTICE

Malfunction due to electrostatic discharge!

Damage to the controller or electronic devices connected to it!

Only qualified personnel may perform maintenance actions to supply, signal and data lines. ESD protection measures must be implement. Personnel must be electrostatically discharged prior to any contact with the supply or signal lines!

6.4.1 Connecting the Power Supply after a Service Interruption

After connecting to the power supply, the modules of a system start in random order.

6.4.2 Repair

NOTICE

Malfunction of a controller due to insufficient repair!

Only HIMA is authorized to repair a safety-related HIMax system or the modules contained in it.

In case of unauthorized intervention in the device, functional safety and explosion protection cannot be ensured. The warranty and certification lapse in this case.

6.5 Special Operating States

A HIJunction Box can achieve particular operating states if the components have failed or the user has intentionally stopped the operating states.

In these cases, the operating systems of the HIMatrix or HIMax modules ensure that a system enters a predefined state.

For further details, refer to the documents in Chapter 7.1 and Chapter 7.2.

7 HIJunction Box Documentation

The following chapters list the product documentation for the HIMA system families HIMatrix and HIMax, as well as the basic components of the HIJunction Box.

7.1 HIMatrix System Documentation

The following documents are available:

Document	Content	Document no.
System manual	Hardware description of the HIMatrix system	HI 800 141 E
Safety manual	Safety functions of the HIMatrix system	HI 800 023 E
F35 03	Controller	HI 800 477 E
F1 DI 16 01	Remote I/O	HI 800 153 E
F2 DO 16 01	Remote I/O	HI 800 159 E
F3 AIO 8/4 01	Remote I/O	HI 800 161 E
F3 DIO 20/8 02	Remote I/O	HI 800 345 E
SILworX first steps manual	Introduction to SILworX	HI 801 103 E
SILworX online help (OLH)	Instructions on how to use SILworX	
Communication manual	Description of safe**ethernet** communication and list of the available protocols	HI 801 101 E

Table 10: Overview of the HIMatrix Documents

The current manuals can be obtained upon request by sending an e-mail to: documentation@hima.com. Registered customers can download the product documentation from the HIMA Extranet.

7.2 HIMax System Documentation

The following documents are available:

Document	Content	Document no.
System manual	Hardware description of the HIMax system	HI 801 001 E
Safety manual	Safety functions of the HIMax system	HI 801 003 E
X-BASE PLATE	Base plate for X-CPU 01	HI 801 025 E
X-BASE PLATE	Base plate for X-CPU 31	HI 801 371 E
X-FAN	System fan	HI 801 033 E
X-CPU 31	Processor module with system bus, SIL 3	HI 801 355 E
X-SB 01	System bus module, SIL 3	HI 801 007 E
X-AI 16 51	Analog input module, 16 channels, SIL 1	HI 801 179 E
X-AI 32 01	Analog input module, 32 channels, SIL 3	HI 801 021 E
X-AO 16 01	Analog output module, 16 channels, SIL 3	HI 801 111 E
X-DI 32 01	Digital input module, 32 channels, SIL 3	HI 801 015 E
X-DO 24 01	Digital output module, 24 channels, SIL 3	HI 801 019 E
X-DO 32 01	Digital output module, 32 channels, SIL 3	HI 801 097 E
X-HART 32 01	HART module	HI 801 307 E
SILworX first steps manual	Introduction to SILworX	HI 801 103 E
SILworX online help (OLH)	Instructions on how to use SILworX	
Communication manual	Description of safe**ethernet** communication and list of the available protocols.	HI 801 101 E

Table 11: Overview of the HIMax Documents

The current manuals can be obtained upon request by sending an e-mail to: documentation@hima.com. Registered customers can download the product documentation from the HIMA Extranet.

7.3 Documentation of HIJunction Box Basic Components

The following modules are available for the basic components:

Basic components	Document
Control cabinet	Eldon / ASR1208040PEOG
Power supply units	Phoenix Contact QUINT4-PS/1AC/24DC/20/+ (2904617) If the optional cooling element is used: Phoenix Contact QUINT-PS/1AC/24DC/10/CO (2320911)
Communication devics	Westermo RFI-207-F4G-T3G-EX
Circuit breakers	R.Stahl / 8562/53-2024-100
Fuses	▪ Mains: - 6.3A 5x20 G-fuse in accordance with EN 60127-2 with sand filling - Optional R. Stahl / Series 8562 ▪ 24 VDC: - E-T-A ESX 10 - Optional: R. Stahl / Series 8562
Electric heater	Intertec Hess GmbH / CP Multitherm
Thermoelectric cooler	Elmeko / Series PK 150
Thermostat	Intertec Hess GmbH / TAE 10D
Terminal	Wago / Type 2002-2951
Cable entries	Roxtec / CF 16 AISI 304 or HD 32/xx BG EX

Table 12: Overview of the Documents for HIJunction Box Basic Components

The document version at the time of delivery is up-to-date.

The current manuals can be obtained from the respective manufacturer upon request.

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
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
Rack ID	Base plate identification (number)
r_P	Peak value of a total AC component
SB	System bus (module)
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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MANUAL

HIJunction Box

HI 801 520 E

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