



Manual

# HIMatrix<sup>®</sup>F

## Maintenance Manual Railway Applications



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All the current manuals can be obtained upon request by sending an e-mail to: [documentation@hima.com](mailto:documentation@hima.com).

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# 1 Introduction

This document describes all relevant activities for servicing and operating safety-related HIMatrix controllers.

- Chapter 2 lists the activities in a table.
- Chapter 3 lists the manuals to be observed and other applicable documents.
- Chapter 4 includes maintenance action details.

## 1.1 Target Audience and Required Know-How

This manual is aimed at the planners, design engineers, programmers and maintenance personnel of automation systems. Specialized knowledge of safety-related automation systems is required.

Additional knowledge is necessary for maintenance activities on the HIMatrix system hardware and software, e.g., for reading and evaluating diagnostics.

For work on safety-related automation systems, the safety standards demand proof of the qualifications required for maintenance personnel.

Qualified HIMA service personnel can be requested to perform maintenance tasks in accordance with the manufacturer's instructions. HIMA also offers specific training seminars to qualify the maintenance personnel.

HIMA recommends the following seminars for performing maintenance tasks:

- **FS 101** Functional safety for maintenance and operation
- **PT 230** SILworX HIMatrix Maintenance

## 1.2 Writing Conventions

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

<b>Bold</b>	To highlight important parts. Names of buttons, menu functions and tabs that can be clicked and used in the programming tool.
<i>Italics</i>	Parameters and system variables, references.
<code>Courier</code>	Literal user inputs.
<b>RUN</b>	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.

### 1.2.1 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.**

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### 1.2.2 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.

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### 1.3 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:

<b>Onsite+ / On-Site Engineering</b>	In close cooperation with the customer, HIMA performs changes or extensions on site.
<b>Startup+ / Preventive Maintenance</b>	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.
<b>Lifecycle+ / Lifecycle Management</b>	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.
<b>Hotline+ / 24 h Hotline</b>	HIMA's safety engineers are available by telephone around the clock to help solve problems.
<b>Standby+ / 24 h Call-Out Service</b>	Faults that cannot be resolved over the phone are processed by HIMA's specialists within the time frame specified in the contract.
<b>Logistics+ / 24 h Spare Parts Service</b>	HIMA maintains an inventory of necessary spare parts and guarantees quick, long-term availability.

#### Contact details:

<b>Safety Lifecycle Services</b>	<a href="https://www.hima.com/en/about-hima/contacts-worldwide/">https://www.hima.com/en/about-hima/contacts-worldwide/</a>
<b>Technical Support</b>	<a href="https://www.hima.com/en/products-services/support/">https://www.hima.com/en/products-services/support/</a>
<b>Seminar Program</b>	<a href="https://www.hima.com/en/products-services/seminars/">https://www.hima.com/en/products-services/seminars/</a>



## 2 Operating and Maintenance Activities

The operating and maintenance activities of the individual system components are listed in the following sections.

### 2.1 Activities Recurring in the Short Term

The HiMatrix system must be tested by the operator at short recurring intervals in line with the Automation Security policy. The operator must specify the test details in a security risk analysis; refer to the automation security manual (HI 801 373 E).

### 2.2 Activities Recurring on an Annual Basis

The chapter specifies the activities recurring on an annual basis.

#### 2.2.1 Mechanical Test (Visual Inspection)

The table specifies the maintenance activities for the mechanics:

Activity	Who	Reference
Check whether the compact systems are securely fastened to the DIN rail (DIN).	Operating company, assembler, maintenance personnel	D1
Check the module screws for firm connection, tighten if necessary (HiMatrix F60).	Operating company, assembler, maintenance personnel	D2
Check the data cables for firm connection, including to the communication interfaces.	Operating company, assembler, maintenance personnel	D1, D2
Check the fans for proper function (HiMatrix F60).	Operating company, assembler, maintenance personnel	D2

Table 1: Annual Activities for the Mechanics

#### 2.2.2 Power Supply Test

The table specifies the maintenance activities for the power supply:

Activity	Who	Reference
Check the 230 VAC/24 VDC power supply for compliance with tolerances, 24 VDC, -15...+20 %, $r_p \leq 5$ %.	Operating company, assembler, maintenance personnel	D1, D2
Check the 24 VDC distribution. Check any existing decoupling diodes for proper function.	Operating company, assembler, maintenance personnel	D1, D2
Check the redundant supply for proper function.	Operating company, assembler, maintenance personnel	D1, D2

Table 2: Annual Activities for the Power Supply

### 2.3 Activities Recurring in the Long Term

The chapter specifies activities recurring in the long term.

#### 2.3.1 Hardware

The table specifies the maintenance activities for the hardware:

Activity	Who	Reference
At an operating temperature of $> 40$ °C: Replace the fans every <b>3</b> years (HiMatrix F60).	Operating company, assembler, maintenance personnel	D2
At an operating temperature of $\leq 40$ °C: Replace the fans every <b>5</b> years (HiMatrix F60).	Operating company, assembler, maintenance personnel	D2

Table 3: Activities for the Hardware Recurring in the Long Term

## 2.4 Activities as Required

The chapter specifies activities to be carried out as required.

### 2.4.1 Hardware

The table specifies the maintenance activities for the hardware:

Activity	Who	Reference
Replace the compact system.	Operating company, assembler, maintenance personnel	D1, D6
Replace the modules (HIMatrix F60).	Operating company, assembler, maintenance personnel	D2, D7 Chapter 4.2.2

Table 4: Activities for the Hardware to be Carried out as Required

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

#### NOTICE



##### Damage 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 component is protected from electrostatic discharge, e.g., by storing it in its packaging.

Use a grounding strap and connect it to the ESD connection point on the control cabinet before touching the module to preclude any potential residual charge during module replacement. This also applies when inserting the plugs of cables and data lines.

If the control cabinet is not provided with an ESD connection point, get in contact with a grounded part of the control cabinet before touching the module.

Avoid any direct contact with electronic module components and their PCBs. Only touch the modules by their handles.

### 2.4.2 Software

The table specifies the maintenance activities for the software:

Activity	Who	Reference
Loading the user program.	Operating company, assembler, maintenance personnel	D1
Load new operating systems.	Operating company, assembler, maintenance personnel	D1, Chapter 4.3
Change the system parameters.	Operating company, assembler, maintenance personnel	D1, D2, D3, D5, D6, D7

Table 5: Activities for the Software to be Carried out as Required

### 3 Other Applicable Documents

The following table specifies other applicable documents.

Reference	Standard/Document ID	Description
N1	IEC 61511-1, Section 12	Functional safety - Safety instrumented systems for the process industry sector – Part 1: Framework, definitions, system, hardware and software requirements
D1	HI 800 141 E	HiMatrix system manual for compact systems
D2	HI 800 191 E	HiMatrix system manual for modular systems
D3	HI 800 437 E	HiMatrix safety manual for railway applications
D4	HI 801 373 E	Automation security manual
D5	-	SILworX online help
Reference	Standard/Document ID	Description
D6	<b>HiMatrix manuals for compact systems</b>	
	HI 800 153 E	F1 DI 16 01 manual
	HI 800 155 E	F2 DO 4 01 manual
	HI 800 157 E	F2 DO 8 01 manual
	HI 800 159 E	F2 DO 16 01 manual
	HI 800 139 E	F2 DO 16 02 manual
	HI 800 161 E	F3 AIO 8/4 01 manual
	HI 800 179 E	F3 DIO 8/8 01 manual
	HI 800 177 E	F3 DIO 16/8 01 manual
	HI 800 345 E	F3 DIO 20/8 02 manual
	HI 800 473 E	F30 03 manual
	HI 800 477 E	F35 03 manual
Reference	Standard/Document ID	Description
D7	<b>HiMatrix manuals for the modular system</b>	
	HI 800 195 E	AI 8 01 manual
	HI 800 199 E	CIO 2/4 01 manual
	HI 800 479 E	CPU 03 manual
	HI 800 203 E	DI 32 01 manual
	HI 800 205 E	DIO 24/16 01 manual
	HI 800 207 E	DO 8 01 manual
	HI 800 183 E	GEH 01 manual
	HI 800 209 E	MI 24 01 manual
	HI 800 211 E	PS 01 manual

Table 6: Other Applicable Documentation

Derived variants: Variants derived from some compact devices (the corresponding manuals are specified in Table 6) were developed for special application fields. These derived variants require the same maintenance actions valid for the basic variants.

## 4 Maintenance Actions in Details

This chapter describes individual maintenance actions for the components of the HIMatrix system.

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### i

Only qualified personnel may perform maintenance actions to supply, signal and data lines, taking all ESD protection measures into account. Personnel must be electrostatically discharged prior to any direct contact with these supply or signal lines!

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### 4.1 Compact Systems

Defective compact systems must be replaced with systems of the same type.

When replacing compact systems, observe the instructions specified in the system manual for compact systems (HI 800 141 E) and safety manual (HI 800 437 E).

#### 4.1.1 Replacing the Compact Systems

##### To remove compact systems from the DIN rail

1. Remove all connector plugs from the compact system:
    - Pluggable screw terminals.
    - Ethernet plugs.
    - Fieldbus plugs, if existing.
  2. Insert a flathead screwdriver into the gap between the housing and the latch, using it as a lever to move the latch downward and simultaneously lift the compact system from the rail.
- The compact system is removed from the DIN rail.

##### To mount the compact system on the DIN rail

1. Shift the latch on the rear side of the compact system downwards, press it against the housing frame and snap it into position.
  2. Attach the guiding rail located on the rear side of the compact system to the upper edge of the DIN rail.
  3. Press the compact system against the rail and release the latch again to secure the compact system to the DIN rail.
  4. Insert all plugs into the correct sockets:
    - Pluggable screw terminals.
    - Ethernet plugs.
    - Fieldbus plugs, if existing.
- The device is mounted on the DIN rail.

## 4.2 F60 Modular Systems

Modular systems may require the following maintenance actions:

- Replace the fans.
- Replace the modules.
- Replace the base plate.

### 4.2.1 Replacing the Fans

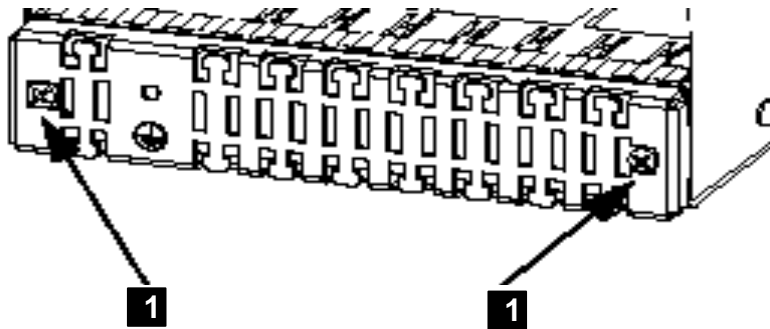
HIMA recommends replacing the fans of the HIMatrix F60 on a regular basis to prevent the fans to fail:

- At increased temperatures, > 40 °C: every 3 years.
- At normal temperatures, < 40 °C: every 5 years

The fans may be replaced while the controller is operating, the controller needs not be shut down.

#### To replace the fans in the base plate

1. Unscrew both fastening screws located on the left and right of the ground grid, see Figure 1.



**1** Fastening Screws

Figure 1: Ground Grid with Fastening Screws

2. Position the ground grid (including the attached cables) to allow removal of the fan mounting plate located behind it.
  3. Release the plugs for the fan voltage supply and remove the fan mounting plate completely.
  4. Unscrew and remove the 4 fastening screws on each fan to allow replacement of the old fans.
  5. Attach the new fans using the fastening screws; in doing so, pay attention the direction of the air flow.
  6. Place the mounting plate with the new fans into position and plug in the connectors for the power supply of the fans.
  7. Place the ground grid into position and tighten the two fastening screws.
- The fans are replaced.

#### 4.2.2 Replacing the Modules

Defective modules must be replaced with modules of the same type or with approved replacement models.

When replacing modules, observe the instructions specified in the system manual (HI 800 191 E) and the safety manual (HI 800 437 E).

##### NOTICE



**Damage to the controller possible!**

**Only replace the modules if the controller is shut down!**

##### To remove a module from the base plate

1. Remove the plugs from the module front plate.
  2. Release the locking screws located on the upper and lower end of the front plate.
  3. Loosen the module using the handle located on the lower part of the front plate and remove it from the guiding rails.
- The module is removed.

##### To mount a module in the base plate

1. Insert the module as far as it can go – without jamming it – into the two guiding rails located on the upper and lower part of the housing.
  2. Apply pressure to the upper and lower extremity of the front plate until the module plugs snap into the backplane socket.
  3. Secure the module with the screws located on the upper and lower end of the front plate.
  4. Depending on the type of module, insert the plugs of the communication cables or field cables into the front plate.
- The module is mounted.

#### 4.2.3 Replacing the Base Plate of the F60

Defective base plates must be replaced with new ones.

##### To replace the base plate in the F60

1. Switch the voltage supply off to put the controller out of operation.
  2. Remove all the modules from the base plate, see Chapter 4.2.2.
  3. Remove the base plate from the support, e.g., the cabinet.
  4. Mount the new base plate on the support.
  5. Insert all modules into the new base plate, see Chapter 4.2.2.
  6. Connect the voltage supply and restart the controller.
- The base plate is replaced.

### 4.3 Loading Operating Systems

The processor and communication systems have different operating systems that are stored in the rewritable flash memories and can be replaced, if necessary.

#### NOTICE



**Interruption of safety-related operation!**

**The controller must be in the STOP state to enable the programming tool to load new operating systems.**

**During this time period, the operator must ensure the plant safety, e.g., by taking organizational measures.**

**i**

- The programming tool prevents controllers from loading operating systems in the RUN state and reports this accordingly.
- Interruption or incorrect termination of the loading process causes the controller to be no longer functional. It is possible, however, to repeat loading.

The operating system for the processor system (CPU operating system) must be loaded before that for the communication system (COM operating system).

Operating systems for controllers differ from those for remote I/Os.

A new operating system can only be loaded, if previously stored in a directory accessible to the programming tool.

**i**

The current operating system versions of modules are displayed in the SILworX Control Panel. The type label specifies the delivered module version.

#### To load the new operating system

1. Set the controller to the STOP state, if this has not yet been done.
  2. Open the online view of the hardware and log in to the controller with administrator rights.
  3. Right-click the module (processor or communication module) to be loaded
  4. The context menu appears. Click **Maintenance/Service->Load Module Operating System**.
  5. In the *Load Module Operating System* dialog box, select the type of firmware that should be loaded.
  6. A dialog box for selecting a file appears. Select the file with the operating system that should be loaded and click **Open**.
- SILworX loads the new operating system into the controller.





## 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)
$I_P$	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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MANUAL  
**HIMatrix Maintenance Manual Railway Applications**  

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**HI 800 673 E**

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