
HIMA
SMART SAFETY.
Manual
HIQuad X®
F-PWR 01

## Contact

HIMA Paul Hildebrandt GmbH

P.O. Box 1261

68777 Brühl

Phone: +49 6202 709-0

Fax: +49 6202 709-107

E-mail: info@hima.com

| Document designation | Description |
|---|---|
| HI 803 224 D, Rev. 1.00 (1825) | German original document |
| HI 803 225 E, Rev. 1.00.00 (1828) | English translation of the German original document |

# Table of Contents

# 1 Introduction

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

## 1.1 Structure and Use of the Document

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

This manual contains the following main chapters:

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

Additionally, the following documents must be taken into account:

| Document | Content | Document no. |
|---|---|---|
| HIQuad X system manual | Hardware description of the HIQuad X system | HI 803 211 E |
| HIQuad X safety manual | Safety functions of the HIQuad X system | HI 803 209 E |

Table 1: Additional Applicable Manuals

The current manuals can be obtained upon request by sending an e-mail to: documentation@hima.com. The revision index in the footer can be used to compare the manuals in use with the Internet edition and determine if they are up to date.

## 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.<br>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

HIQuad X components are designed for assembling safety-related controller systems.

When using the components in the HIQuad X 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 HIQuad X 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 HIQuad X 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 F-PWR 01 supply unit is intended for use in the programmable electronic system (PES) HIQuad X.

A maximum of 2 power supply units can be used in the slots foreseen in the base rack of the H41X system and a maximum of 5 power supply units are permitted in the H51X system. The permitted slots are specified in Chapter 4.1.1.

The power supply unit monitors the 24 V supply voltages (L1+/L2+) and supplies a regulated 5 V supply voltage. This supplies the modules within and outside the base rack with a nominal current of up to 10 A.

If the power supply units in use are connected in parallel, the 5 V supply voltage is regulated in such a way that the total load current is uniformly distributed among all power supply units.

Refer to the HIMA website and the HIQuad X safety manual (HI 803 209 E) for more information on the standards used to test and certify the power supply units and the HIQuad X system.

## 3.1 Safety Function

No safety function is performed by the power supply unit.

### 3.1.1 Response in the Event of a Fault

If faults occur, the power supply unit switches off the 5 VDC output voltage.

The power supply unit reports failure of the 24 V supply voltages (L1+/L2+) and of the 5 V supply voltage through the LEDs on the front plate.

## 3.2 Scope of Delivery

The power supply unit is delivered with no additional accessories.

## 3.3 Type Label

The type label specifies the following important details:

- Product name
- Mark of conformity
- Part no.
- Serial number
- Hardware revision index (HW-Rev.)
- Operating system revision index (OS-Rev.)
- Ex specifications (if applicable)
- Production year (Prod-Year:)

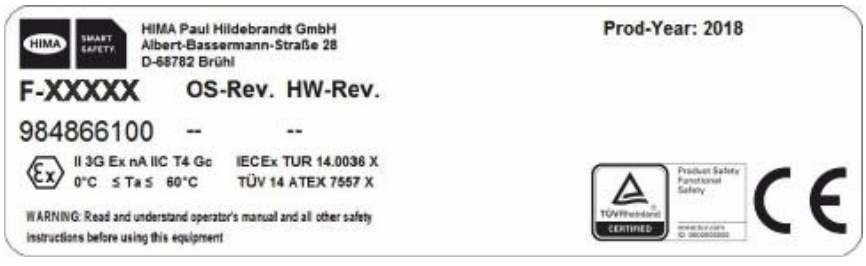



Figure 1: Sample Type Label

## 3.4 Structure

The power supply unit supplies a 5 V supply voltage with a nominal current of 10 A (short-circuit-proof) and bridges voltage dropouts of up to 20 ms. All power supply units inserted in a base rack operate redundantly.

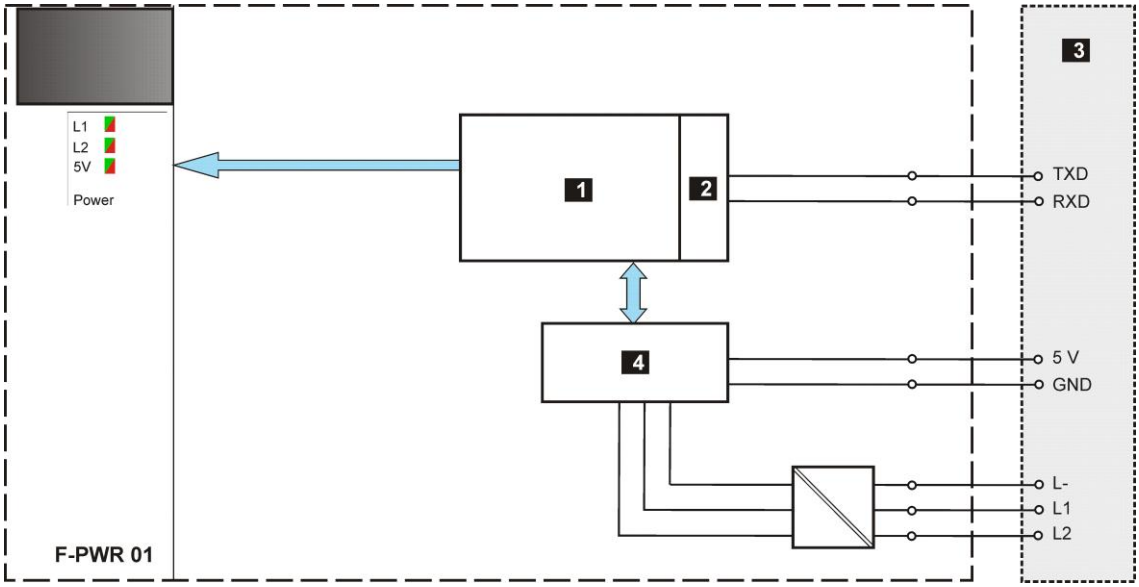
Functional units of the power supply:

- Microcontroller
- Infobus
- 5 VDC control level for the 5 V supply voltage

LEDs on the indicator panel displaying the status, see Chapter 3.4.2.

### 3.4.1 Block Diagram, Functional Units

The following block diagram illustrates the structure of the power supply unit.




1 Microcontroller MSP430
2 UART (Infobus to the processor module)
3 Backplane PCB
4 Control level for the 5 V supply voltage

Figure 2: Block Diagram

The non-safety-related microcontroller controls and monitors the power supply unit and provides the default values to the control level. The power supply unit and the processor modules exchange data via the Infobus.

The Infobus transmits the current voltage, current and temperature values of all plugged-in power supply units to the processor modules. The processor modules use this data for the system diagnostics and send the currently measured 5 V supply voltages and currents back to all plugged-in power supplies.

The power supply units connected in parallel (Infobus slaves) use the Infobus exchange the measured current values via the processor modules (Infobus master). If the power supply units in use are connected in parallel, the 5 V supply voltages are automatically regulated in such a way that the total load current is uniformly distributed among all power supply units.

The power supply unit state and the monitored voltage values are indicated by LEDs on the front side of the power supply unit and are also displayed in the SILworX online view, see Chapter 3.4.2.

### 3.4.2 Indicators

The following figure shows the front view of the module with the LEDs.


Figure 3: Front View

The LEDs indicate the operating state of the power supply unit. All LEDs should be considered together. The LEDs on the module are divided into the following groups:

- 24 VDC system voltage (L1+, L2+)
- 5 VDC system voltage (5 V)

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 of the LEDs:

| Definition | Blinking frequencies |
|---|---|
| Blinking1 | Long (600 ms) on, long (600 ms) off |

Table 2: Blinking Frequencies of the LEDs

The indication of errors or faults has priority over the indication of warnings. Warnings cannot be reported if errors or faults are being signaled.

### 3.4.2.1 Power Status Indicators

The power status indicator LEDs are labeled *Power*.

| LED | Color | Status | Description |
|---|---|---|---|
| L1 | Green | On | The 24 V supply voltage for L1 is o. k. |
| | Red | On | Warning:<br>▪ Rail L1 has no voltage.<br>▪ Undervoltage of < 20.4 V on L1 and L2.<br>▪ Overvoltage of > 28.8 V on at least one of the L1 or L2. |
| | | Blinking1 | Error:<br>▪ Undervoltage of < 18.0 V on L1 and L2.<br>▪ Overvoltage of > 32 V on at least one of the L1 or L2. |
| | | Off | The L1 monitoring is switched off. |
| L2 | Green | On | The 24 V supply voltage for L2 is o. k. |
| | Red | On | Warning:<br>▪ Rail L2 has no voltage.<br>▪ Undervoltage of < 20.4 V at L1 and L2.<br>▪ Overvoltage of > 28.8 V at least at one of the L1 or L2. |
| | | Blinking1 | Error:<br>▪ Undervoltage of < 18 V on L1 and L2.<br>▪ Overvoltage of > 32 V on at least one of the L1 or L2. |
| | | Off | The L2 monitoring is switched off. |
| 5 V | Green | On | The 5 V supply voltage is o. k. |
| | Red | On | Warning.<br>▪ Overvoltage > 5.4 V.<br>▪ Undervoltage < 5.2 V.<br>▪ Overvoltage on the output > 10.5 A for longer than 10 s. |
| | | Blinking1 | Error:<br>▪ Overvoltage > 5.5 V.<br>▪ Undervoltage < 5.1 V.<br>▪ Overvoltage on the output > 12.5 A for longer than 10 s.<br>▪ The 5 V output is defective and provides insufficient to no current. |
| | | Off | The module is in one of the following states:<br>▪ Not in operation.<br>▪ No supply voltage.<br>▪ Defective voltage monitoring. |

Table 3: Power Status Indicators

## 3.5 Product Data

| General | |
|---|---|
| Supply voltage | 24 VDC, -15...+20 %, $r_p \leq 5$ %,<br>SELV, PELV |
| Maximum supply voltage | 30 VDC |
| Output voltage | 5 VDC |
| Nominal load | 10 A |
| Current consumption | 3 A at 24 V |
| Microprocessor | MSP430 |
| Protection class | Protection class III in accordance with<br>IEC/EN 61131-2. |
| Ambient temperature | 0...+60 °C |
| Transport and storage temperature | -40...+70 °C |
| Humidity | Max. 95 % relative humidity, non-condensing |
| Pollution | Pollution degree II in accordance with<br>IEC/EN 60664-1 |
| Altitude | < 2000 m |
| Degree of protection | IP20 |
| Dimensions | 4 HP |
| Weight | Approx. 350 g |

Table 4: Product Data

# 4 Start-Up

To start up the power supply unit, insert the power supply unit into a permissible base rack slot, see Chapter 4.1.1.

The power supply unit starts to operate as soon as the supply voltage is connected.

**NOTICE**

**Permanent damage to the internal fuses of the power supply unit is possible!**

**Ripple supply voltage of > 5 % must be avoided. Since the voltage peaks of the ripple load the buffer capacitors, pulsating input currents greater than the fuse value are possible**

**The 24 V supply voltage of the power supply unit must be provided from a SELV/PELV source.**

## 4.1 Mounting

Observe the following points when mounting the module:

- The module is intended for use within a HIQuad X base rack. For further information on how to structure the base rack, refer to the corresponding system documentation.
- Only operate the processor module in the permissible slot, see Chapter 4.1.1.
- Only operate the module with forced cooling (fan rack).
- Modifications or extensions to the system wiring must be performed by personnel with knowledge of ESD protective measures.

**NOTICE**

**Electrostatic discharge!**

**Failure to comply with these instructions can destroy the power supply unit.**

- **Make sure that the workspace is free of static and wear a grounding strap.**
- **If not used, ensure that the device is protected from electrostatic discharge, e.g., by storing it in its packaging.**

- Effects due to EMC influences

  Exposing the module to environmental influences other than those specified in the manual may lead to malfunctions or even the destruction of the power supply unit.

**NOTICE**

**Damage to the controller or system malfunction possible!**

**Only expose the modules to permissible environmental influences, see Chapter 3.5.**

### 4.1.1 Slots Permitted for the Power Supply Unit

The following points must be observed when assigning the slots to the power supply units, including the Hardware Editor:

- In the H41X system, a maximum of 2 power supply units can be used in slots 20 and 21 of the base rack (F-BASE RACK 02).
- In the H51X system, a maximum of 5 power supply units can be used in slots 1 through 5 of the base rack (F-BASE RACK 01).

## 4.2 Mounting and Removing the Module

This chapter describes how to mount and remove a module.

The following points must be adhered to when mounting and removing modules:

- Strictly observe the following instructions when removing and reinserting the modules of the HIQuad X system.
- Quickly disconnect the modules from the backplane to avoid faulty signals in the system that could cause its shutdown.
- Only use the module in the designated slot.

i HIMA cannot be made liable for consequential loss caused by improperly removing and reinserting the modules.

**NOTICE**

**Damage to bus and power sockets due to module jamming!**

**Failure to comply with these instructions can damage the controller.**

**Always insert the modules in the racks carefully.**

Tools

- Screwdriver, cross PH1

**Installation:**

1. Pull back as far as possible the fastening screws on the module's front plate.
2. Insert the module into the guiding rail of the intended slot and push it in the rack as far as it can go.
3. Push the red release button bottom up to unlock the extractor handle.
4. With your thumbs, press the module carefully, but quickly inwards as far as it can go to ensure that no faulty signals are triggered within the system.
5. Press the extractor handle down until it snaps into position.
6. Tighten the fastening screws (max. 0.35 Nm).
7. If provided, insert the Ethernet and fieldbus cables.

► The module is mounted.

**Removal:**

1. Completely release the fastening screws from the module.
2. Push the red release button bottom up to unlock the extractor handle.
3. Completely push the extractor handle upwards to rapidly separate the module from the backplane. This avoids faulty signals in the system.
4. Press the extractor handle down once again until it snaps into position.
5. Remove the module from the rack holding it by the extractor handle.

► The module is removed.

## 4.3 Configuring the Module in SILworX

The module icon can be created in the Hardware Editor of the SILworX programming tool. No configuration is provided for the power supply module.

To evaluate the *Power Supply Status* system parameter in the user program, it must be assigned to a global variable. Perform this step in the Hardware Editor using the power supply unit's detail view.

### 4.3.1 The **System** Tab

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

| System parameters | Data type | R/W | Description |
|---|---|---|---|
| Power Supply Input Voltage 1…<br>Power Supply Input Voltage 5 | UINT | R | 24 V supply voltage of the power supply unit.<br>Range of values: UINT<br>Resolution: 0.1 V |
| Power Supply Status | WORD | R | For bit-coded information on the power supply unit status, refer to Chapter 4.3.1.1. |

Table 5: System Parameters

#### *4.3.1.1* The *Power Supply Status* System Parameter

The three neighboring bits in each power supply unit are coded in the *Power Supply Status* system parameter as follows:

| Bit | Description |
|---|---|
| 0…2 | H51X slot 1 or H41X slot 20 |
| 0 | 1: Power supply unit 1 detected<br>0: No power supply unit detected |
| 1 | 1: At least one warning detected for power supply unit 1<br>0: No warning detected for power supply unit 1 |
| 2 | 1: At least one fault detected for power supply unit 1<br>0: No fault detected for power supply unit 1 |
| 3…5 | H51X slot 2 or H41X slot 21 |
| 3 | 1: Power supply unit 2 detected<br>0: No power supply unit detected |
| 4 | 1: At least one warning detected for power supply unit 2<br>0: No warning detected for power supply unit 2 |
| 5 | 1: At least one fault detected for power supply unit 2<br>0: No fault detected for power supply unit 2 |
| 6…8 | H51X slot 3 |
| 6 | 1: Power supply unit 3 detected<br>0: No power supply unit detected |
| 7 | 1: At least one warning detected for power supply unit 3<br>0: No warning detected for power supply unit 3 |
| 8 | 1: At least one fault detected for power supply unit 3<br>0: No fault detected for power supply unit 3 |
| 9…11 | H51X slot 4 |
| 9 | 1: Power supply unit 4 detected<br>0: No power supply unit detected |
| 10 | 1: At least one warning detected for power supply unit 4<br>0: No warning detected for power supply unit 4 |
| 11 | 1: At least one fault detected for power supply unit 4<br>0: No fault detected for power supply unit 4 |
| 12…14 | H51X slot 5 |
| 12 | 1: Power supply unit 5 detected<br>0: No power supply unit detected |
| 13 | 1: At least one warning detected for power supply unit 5<br>0: No warning detected for power supply unit 5 |
| 14 | 1: At least one fault detected for power supply unit 5<br>0: No fault detected for power supply unit 5 |
| 15 | Reserved (setting fixed to 0) |

Table 6: The *Power Supply Status* System Parameter

# 5 Operation

The module is operated within a HIQuad X base rack. No specific monitoring is required.

Only operate the module with forced cooling (fan rack).

## 5.1 Handling

Direct handling of the module is not foreseen.

## 5.2 Diagnostics

The power supply unit state and the monitored voltage values are indicated by LEDs on the front side of the module and are also displayed in the SILworX online view, see Chapter 3.4.2. Additionally, the *Power Supply Status* system parameter is available for evaluation purposes, see Chapter 4.3.

The diagnostic status of the power supply unit is stored to the diagnostic history of the processor module and can be read using the SILworX programming tool.

# 6 Maintenance

Defective modules must be replaced with a faultless module of the same type or with an approved replacement model.

Only the manufacturer is authorized to repair the module.

When replacing modules, observe the instructions specified in the system manual (HI 803 211 E) and safety manual (HI 803 209 E).

## 6.1 Maintenance Measures

In rare cases, the following measures are required for the power supply unit:

- Perform the proof test.

### 6.1.1 Loading the Operating System

Loading an operating system is not intended for the power supply unit.

### 6.1.2 Proof Test

HIMA safety systems must be subject to a proof test in regular intervals. The proof test interval for HIMA controllers must be in accordance with the interval required by the application-specific safety integrity level (SIL). For more information, refer to the HIQuad X safety manual (HI 803 209 E).

# 7 Decommissioning

To decommission the module, remove it from the base rack. For more details, refer to the Chapter *Mounting and Removing the Module*.

# 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 |
| DI | Digital input |
| DO | Digital output |
| EMC | Electromagnetic compatibility |
| EN | European standard |
| ESD | Electrostatic discharge |
| FBD | Function block diagrams |
| IEC | International electrotechnical commission |
| Interference-free | Supposing that two input circuits are connected to the same source (e.g., a transmitter). An input circuit is termed interference-free if it does not distort the signals of the other input circuit. |
| PADT | Programming and debugging tool (in accordance with IEC 61131-3), PC with SILworX |
| PE | Protective ground |
| PELV | Protective extra low voltage |
| PES | Programmable electronic system |
| R | Read: The system variable or signal provides a value, e.g., to the user program |
| R/W | Read/Write (column title for system variable/signal type) |
| Rack ID | Base rack identification (number) |
| $r_{PP}$ | Peak-to-peak value of a total AC component |
| SELV | Safety extra low voltage |
| SFF | Safe failure fraction, portion of faults that can be safely controlled |
| SIL | Safety integrity level (in accordance with IEC 61508) |
| SILworX | Programming tool for HIQuad X systems |
| SRS | System.Rack.Slot addressing of a module |
| SW | Software |
| TMO | Timeout |
| W | Write, the system variable or signal receives a value, e.g., from the user program |
| Watchdog (WD) | Time monitoring facility for modules or programs If the watchdog time is exceeded, the module or program enters the error stop state |
| WDT | Watchdog time |

## Index of Figures

## Index of Tables

## Index

MANUAL
**F-PWR 01**
**HI 803 225 E**

For further information, please contact:

**HIMA Paul Hildebrandt GmbH**
Albert-Bassermann-Str. 28
68782 Brühl, Germany

Phone +49 6202 709-0
Fax +49 6202 709-107
E-mail info@hima.com

Learn more about HIMA solutions online:

www.hima.com/en/

HIMA SMART SAFETY.

www.hima.com