Manual

Power Supply

PS 1000/230 01

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Document designation	Description
HI 800 052 D, Rev. 3.01 (2008)	German original document
HI 800 053 E, Rev. 3.01.00 (2009)	English translation of the German original document

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1 Introduction

This manual describes the technical characteristics of the power supply unit and its use. It provides information on how to install and start up the devices.

1.1 Structure and Use of This Manual

This manual contains the following main chapters:

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

All 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.

1.2 Target Audience

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

1.3 Writing Conventions

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

Bold	To highlight important parts. Names of buttons, menu functions and tabs that can be clicked and used in the programming tool.
Italics	Parameters and system variables, references.
`Courier`	Literal user inputs.
RUN	Operating states are designated by capitals.
Chapter 1.2.3	Cross-references are hyperlinks even if they are not 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.

1.3.1 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 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.

1.3.2 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.

2.1 Intended Use

The product is designed for assembling safety-related controller systems.

When using the product, comply with the following general requirements.

2.1.1 Environmental Requirements

All the environmental requirements specified in this manual must be observed when operating the product. 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 modules.

NOTICE

Device 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 device is protected from electrostatic discharge, e.g., by storing it in its packaging.**

2.2 Residual Risk

No imminent risk results from the power supply unit itself.

Residual risk may result from:

- Faults related to engineering.
- 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

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

3 Product Description

The electronic power supply unit is designed for the power supply of safety-related HIMA controller.

The power supply unit supplies an output voltage of 24 VDC with a nominal current of 40 A.

The output voltage meets the requirements for SELV and PELV.

The power supply is available in the following variants:

Variant	Design	Mounting
PS 1000/230 010	Cartridge	M 3421 19-inch subrack
PS 1000/230 011 coated	Cartridge	M 3421 19-inch subrack
PS 1000/230 016	Wall mounting	Backplane
PS 1000/230 017 coated	Wall mounting	Backplane

Table 1: Power Supply Unit Variants

The variants PS 1000/230 010 and PS 1000/230 011 are modular cartridges for use in the 19-inch M 3421 subrack with 4 RU, see the M 3421 data sheet. The M 3421 subrack is designed for up to three power supply units and is used for the HIMA PS 1000 series of power supply units. The subrack variants are mechanically coded to ensure that the proper power supply unit is used in the base plate, see Chapter 4.1.2.4.

The variants PS 1000/230 016 and PS 1000/230 017 are secured to a backplane (e.g., mounting plate), see Chapter 4.1.1.

Variants PS 1000/230 011 and PS 1000/230 017 are suitable for use in zone 2, see Chapter 4.2.1.

3.1 Safety Function

The PS 1000 ensures that no voltage greater than 30 V is issued at the voltage output even if a fault occurs.

3.1.1 Response in the Event of a Fault

In cases of output short-circuit or overheating, the voltage output is de-energized. The power supply unit is implemented without automatic restart. After the faults have been removed, the power supply unit must be first switched off using the thermal overcurrent circuit breaker and then switched on again.

Optical and acoustic detectors with a current consumption of up to 1 A can be connected to the fault relay's contacts. The fault relay is activated during normal operation and trips if the following faults occur:

- The fan speed is too low.
- The fan is blocked.
- The output voltage is too low.
- The temperature is too high.
- The power supply unit is defective.

The following table describes the statuses of the fault relay contacts:

Contact (Fail)	State
C-NC closed (C-NO open)	Relay energized, normal function
C-NC open (C-NO closed)	Relay de-energized, fault within the power supply unit

Table 2: Fault Relay States

3.2 Scope of Delivery

The scope of delivery of the variants PS 1000/230 016 and PS 1000/230 017 includes:

Designation	Description
Power supply unit with wall bracket	Wall bracket with four fastening points
High-current female connector (XG.1)	Connection to output voltage L-, L+, R+
Female connector (XG.2)	Fault relay connection NO, C, NC
Female connector (XG.3)	Connection to power supply L, N, PE
Label kit	Labels for female connectors and power supply unit

Table 3: Scope of Delivery of PS 1000/230 016 and PS 1000/230 017

3.3 Type Label

The type label specifies the following important details:

- Product name
- Mark of conformity
- Bar code (2D code)
- Part no.
- Production year

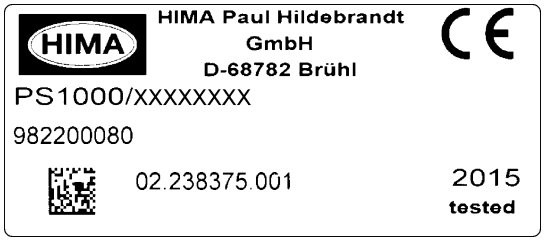


Figure 1: Sample Type Label

3.4 Structure

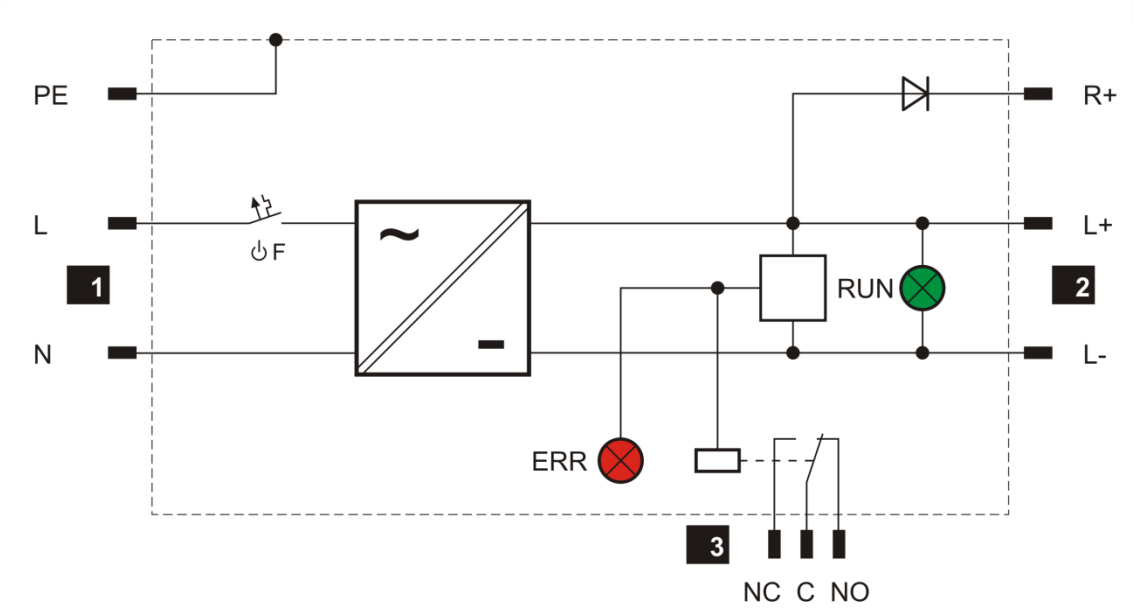
The power supply unit supplies 24 VDC to the L+/L- or R+/L- terminals with a nominal current of 40 A (short-circuit-proof) and is able to compensate for voltage dropouts of up to 20 ms. For redundancy operation, the power supply units can be connected in parallel via the decoupled R+ terminals, see Chapter 4.

The power supply unit is equipped with a fan on the front side. If the fan fails, the fault relay trips, see Chapter 3.1.1. The fault relay's contact is lead through to the rear side of the power supply unit.

Two LEDs on the front plate indicate the functioning of power supply unit. The green *RUN* LED is lit if sufficient output voltage is available. The red *ERR* LED is lit if the fan speed is too low, the fan is idle or the output voltage is too low.

A ΔU potentiometer is located on the front side for adjusting the voltage, see Chapter 4.3.

3.4.1 Block Diagram

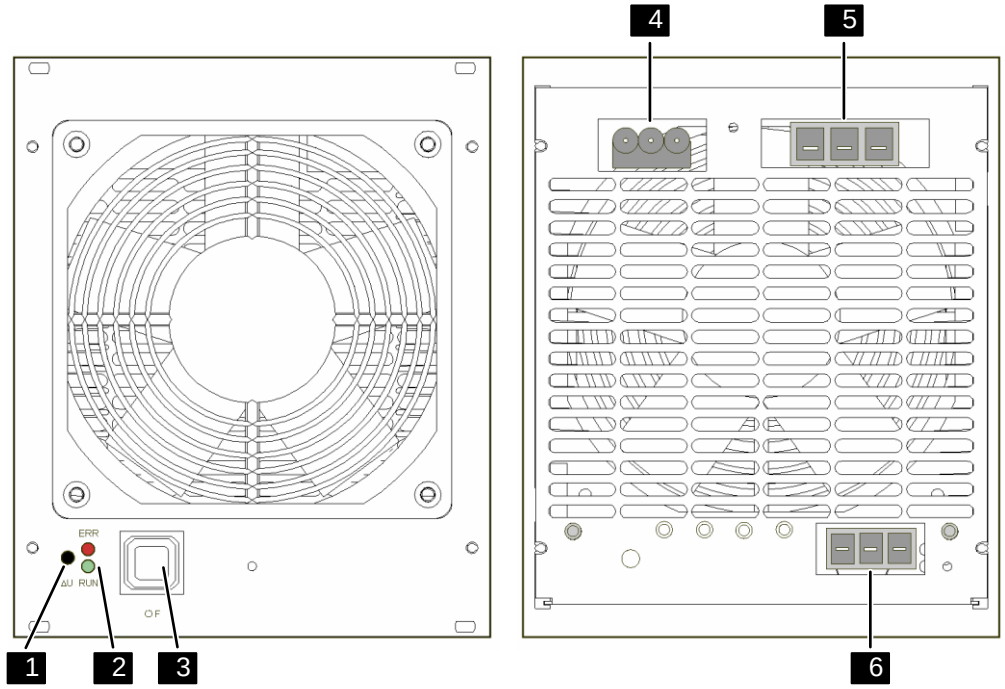


1 230 VAC
2 24 VDC
3 Fault relay

Figure 2: Block Diagram

3.4.2 Indicators

The following figures show the front and the rear view of the power supply unit.



1 ΔU potentiometer
2 LEDs
3 Thermal overcurrent circuit breaker
4 Fault relay connection
5 Output voltage connection
6 Input voltage connection

Figure 3: Front und Rear ViewPS 1000/230 01

The LEDs indicate the operating state of the power supply unit.

LED	Color	Status	Description
ERR	Red	On	Fault within the power supply unit, e.g., ▪ The fan speed is too low. ▪ The fan is blocked. ▪ The output voltage is too low.
		Off	No faults detected
RUN	Green	On	Output voltage present
		Off	No output voltage present

Table 4: Status Indicators

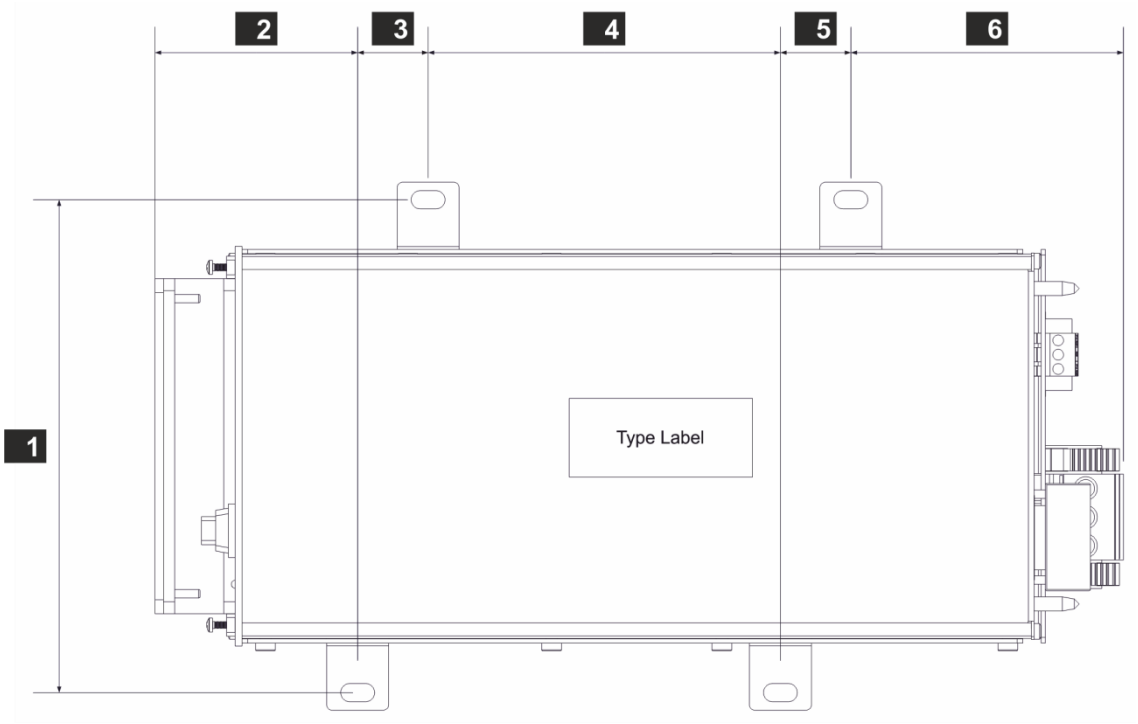
3.5 Product Data

General	
Input voltage	230 VAC, -15…+10 % and 240 VAC, -15…+10 %, 50…60 Hz
Output voltage L+	24 VDC, short-circuit-proof 23…26.4 VDC, adjustable using the ΔU potentiometer
Output voltage R+	(L+) - 0.2 VDC at 40 A
Thermal overcurrent circuit breaker	250 VAC, 10 A
Load	40 A continuous load
Maximum inrush current	7 A
Regulation	< 100 mV under load
Efficiency	> 89 %
Power dissipation	< 110 W
Power failure bridging	20 ms
Degree of protection	IP20
Humidity	< 95 % relative humidity, non-condensing
Ambient temperature	0…60 °C
Transport and storage temperature	-40…+85 °C
Dimensions Cartridge Wall mounting	 28 RU, 4 HP W x H x D: 142 x 173 x 281 mm W x H x D: 187.5 x 174.5 x 343.6 mm
Weight	Approx. 6 kg
External fusing	16 A
Connectors L, N, PE (XG.3) L+, R+, L- (XG.1) NC, C, NO (XG.2)	Minimum cross-section for wiring: 240 VAC 1.5 mm^2 24 VDC 10 mm^2 Fail 0.5 mm^2
Fault contact (Fail) Switching current	Potential-free change-over contact, connection via terminals 3 x 1.5 mm^2 within the subrack 30 VDC / 1 A 30 VAC / 0.5 A
MTTF	30 years

Table 5: Product Data

3.5.1 Dimension Drawing

The following figure shows the variants for wall mounting:



1	175.00 mm	4	125.00 mm
2	71.90 mm	5	25.00 mm
3	25.00 mm	6	96.70 mm

Figure 4: Dimension Drawing of the Wall Mounting Variants

4 Start-Up

Only use the thermal circuit breaker on the front side (soft start) to switch on the power supply unit and thus the connected control unit. To switch on, press the overcurrent circuit breaker until it is engaged.

To allow the soft start electronics to regulate the inrush current, wait at least 1 min after switching the power supply unit off and before switching it on again.

All connections are established using separate female connectors located on the back of the power supply unit.

The decoupled R+ terminal must be used when multiple power supply units are connected in parallel to increase power or implement redundancy.

4.1 Mounting

The following chapters describe how the various power supply unit variants are mounted.

4.1.1 Mounting the PS 1000/230 016 And PS 1000/230 017

Observe the following points when mounting the variants PS 1000/230 016 and PS 1000/230 017:

- Maintain a distance of 30 mm in front of the fan grille to ensure sufficient aeration.
- When performing the wiring, observe the minimum cross-sections specified in Table 5.
- The power supply unit is equipped with four fastening points and can be secured vertically or horizontally. The fastening points are spaced in 25 mm intervals so that the power supply unit fits the mounting frame's profile rails within the HIMA control cabinet, see the scale drawing in Figure 4.
- If the four power supply units are mounted vertically on the profile rails, they can be located adjacently to one another in an 800 mm wide control cabinet, see Figure 6.
- To secure the power supply unit to the profile rails, use the enclosed M 2212 fastening parts kit consisting of cage nuts, Phillips head bolts (M6 x 16) and washers. For the 4.5 mm drilled holes, use B 5.5 x 13 tapping screws in accordance with DIN 7981.
- To secure the power supply unit to a mounting plate, use M6 screws and washers.

Tools and utilities:

- Screwdriver, slotted 1.0 x 5.5 for high-current female connector (XG.1)
- Screwdriver, slotted 0.6 x 3.5 for female connector (XG.2, XG.3)

Installation:

1. Secure the power supply units to the profile rail or backplane (e.g., mounting plate). For the profile rail, use fastening parts kit M 2212 or tapping screws.
2. Wire the female connectors using the corresponding screwdriver.
3. Plug the wired female connectors into the power supply unit and use the corresponding screwdriver to secure them, see Figure 5.
4. Ensure that strain is relieved from the connected cables.
5. The power supply units must have a conductive connection to the ground of the mounting frame or backplane.

Removal:

1. Switch off the power supply unit using the thermal overcurrent circuit breaker on the front plate.
2. Unscrew and disconnect the female connectors from the power supply unit.
3. Remove the power supply unit from the profile rail or mounting plate.

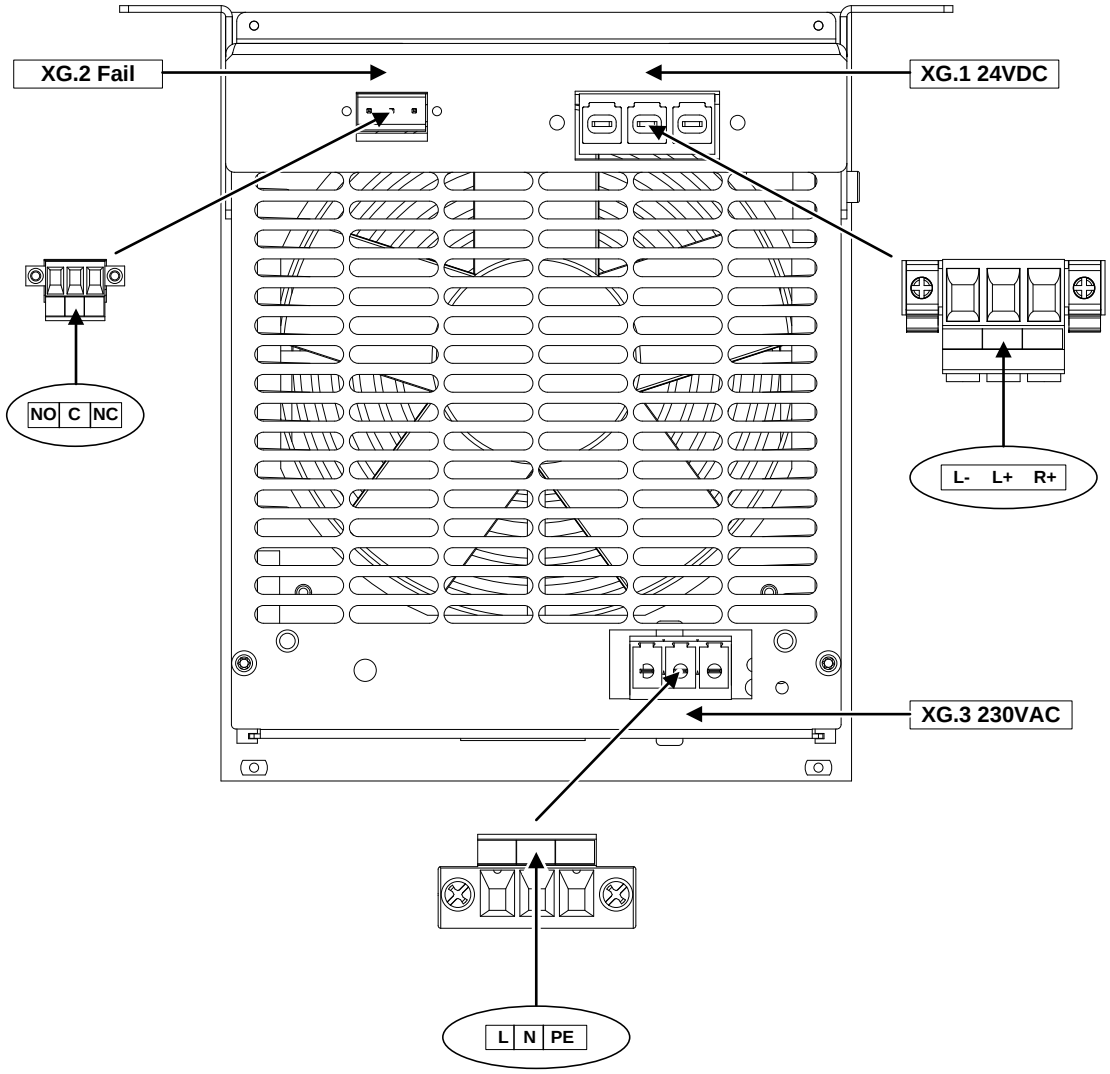


Figure 5: Location of Labels and Female Connectors

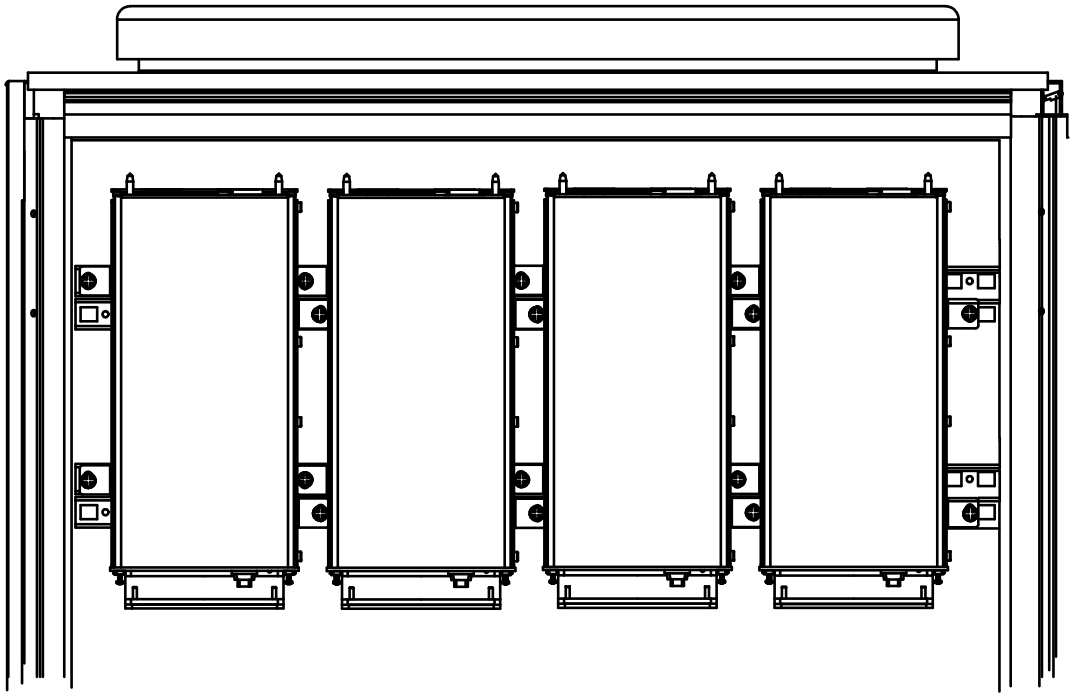


Figure 6: Four Power Supply Units Vertically Secured in the 800 mm Wide Control Cabinet

4.1.2 Mounting the PS 1000/230 010 and PS 1000/230 011 in the M 3421 Subrack

The equipment depends on the wiring connecting to the M 3421 subrack. Slots not in use can be fitted with the M 4413 dummy front plate (part no. 60 5240002). Maintain a distance of 30 mm in front of the fan of the power supply unit.

4.1.2.1 ESD Protective Measures During Installation

Only personnel with knowledge of ESD protective measures may install and remove a power supply unit.

⚠ CAUTION

Electrostatic discharge can damage the electronic components within the systems.

- Touch a grounded object to discharge any static in your body.
- When performing the work, make sure that the workspace is free of static, and wear a grounding strap.
- If not used, ensure that the power supply unit is protected from electrostatic discharge, e.g., by storing it in its packaging.

4.1.2.2 Mounting the Power Supply Unit

A Phillips screwdriver PH1 must be used for mounting the power supply unit.

1. Check the mechanical coding on the subrack.
2. When switched off, completely plug the power supply unit in the subrack.
3. Use the four captive screws to secure the power supply unit to the subrack enclosure.
4. M 4413 dummy front plates may be secured to unused slots.

⚠ CAUTION

Prior to inserting the power supply unit, check for proper coding on the subrack. Inserting a 48 V instead of a 24 V power supply unit causes the electronic components to be completely damaged.

4.1.2.3 Removing the Power Supply Unit

A Phillips screwdriver PH1 must be used for removing the power supply unit.

1. Switch off the power supply unit using the overcurrent circuit breaker.
2. Release the four captive screws in the subrack.
3. Remove the power supply unit from the subrack.

4.1.2.4 Operating Multiple Power Supply Units in the M 3421 Subrack

All connections for the power supply unit are established using separate female connectors located on the rear side of the subrack.

The decoupled R+ terminal must be used if several power supply units are connected in parallel to increase power or implement redundancy.

If power supply units are used redundantly, a power supply unit may be replaced during operation. To this end, prior to removing the power supply unit, it must be switched off using the thermal overcurrent circuit breaker on the front side.

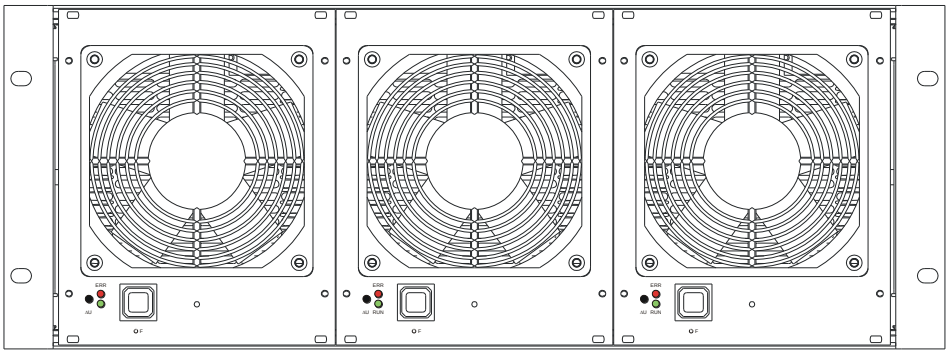


Figure 7: Front View of a Fully Equipped M 3421 Subrack

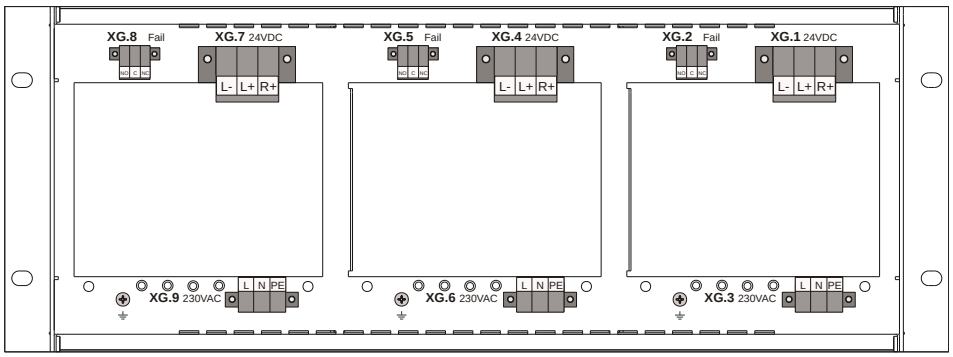
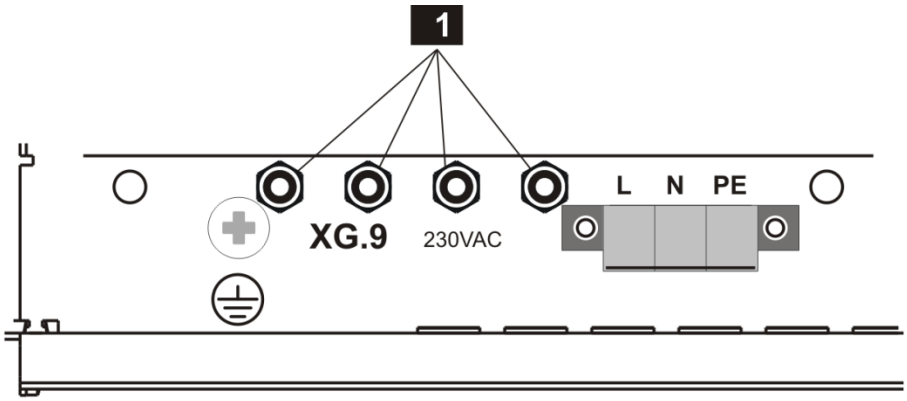


Figure 8: Rear View of the M 3421 Subrack with Terminals

4.1.2.5 Mechanical Coding

The variants for the 19-inch subrack M 3421 are mechanically coded on the rear side. Coding is implemented using up to four coding pins and the corresponding coding screws that are screwed into the rear side of the M 3421 subrack.

The variants PS 1000/230 010 and PS 1000/230 011 are not coded. To ensure that no coded power supply unit is used, all the coding screws provided with the power supply unit must be screwed into the M 3421 subrack, see Figure 9.



1 4 coding screws

Figure 9: Securing the Coding Screws to the M 3421 Subrack

4.2 Installation Requirements

The power supply unit is suitable for use in burner applications in accordance with EN 298. The following points must be observed:

- A surge absorber must be used before the primary connection of the power supply unit (PS 1000), e.g., DEHNrail M, DR M 2P 255 for 230 VAC nominal voltage.
- The mains filter H 7013 (for HIMatrix and HIMax) or H 7034 (for HIQuad X) must be used on the secondary side.
- The maximum cable length for connecting to the fault relay (XG.2) is 10 m (in both directions).
- Power and signal cables must be laid separately, even if short wires are used.

The power supply unit is suitable for use in zone C in accordance with EN 61131-2. The following points must be observed:

A surge absorber must be used before the primary connection of the power supply unit (PS 1000), e.g., DEHNrail M, DR M 2P 255 for 230 VAC nominal voltage.

- The mains filter H 7013 (for HIMatrix and HIMax) or H 7034 (for HIQuad X) must be used on the secondary side.
- The maximum cable length for connecting to the fault relay (XG.2) is 30 m (in both directions).

To meet the requirements of EN 61326-1, the mains filter H 7013 (for HIMatrix and HIMax) or H 7034 (for HIQuad X) must also be used on the secondary side.

If the PS 1000 is used in conjunction with the HIMax system, the secondary mains filter H 7013 is no longer required to supply the base plates. The base plates are already equipped with the appropriate filters (X-FILTER 01) at the supply point.

If the HIMax X-DO 12 02 and X-DO 24 02 are supplied with 24 VDC via the PS 1000, the H 7013 mains filter must be used. The filter must be installed as close as possible to the power supply of the connector board.

4.2.1 Use of PS 1000/230 01 in Zone 2

Power supply units PS 1000/230 011 and PS 1000/230 017 are suitable for mounting in the explosive atmospheres of zone 2. To this end, the special conditions must be observed.

The power supply unit meets the requirements of the following directives and standards:

Conformance	Standard	Description
IECEx	IEC 60079-0:2011	Explosive atmospheres - Part 0: Equipment - General requirements
ATEX 2014/34/EU	EN 60079-0:2012 + A11:2013	
IECEx	IEC 60079-15:2010	Explosive atmospheres - Part 15: Equipment protection by degree of protection "n"
ATEX 2014/34/EU	EN 60079-15:2010	

Table 6: Standards for HIMA Components in Zone 2

The power supply unit must be provided with the following Ex marking and indication of the temperature range:

 II 3G Ex nA nC IIC T4 Gc

Marking	Description
	Explosion protection marking complying with the relevant directive.
II	Equipment group, for all areas with explosive atmosphere, other than underground mines.
3G	Equipment category, for use in areas where explosive gas atmosphere is unlikely to occur or, if it does occur, will persist for a short period only.
Ex	Explosion protection marking complying with the relevant standard.
nA	Type of protection for non-sparking equipment.
nC	Type of protection for sparking, sealed equipment.
IIC	Gas group for explosive gas atmospheres, typical gas is hydrogen.
T4	Temperature class T4, with a maximum surface temperature of 135 °C.
Gc	Equipment protection level, corresponds to ATEX equipment category 3G.

Table 7: Ex Marking Description

Special Conditions for PS 1000/230 01

1. To ensure compliance with category 3G, the power supply unit must be installed in an enclosure that fulfils the requirements of the EN/IEC 60079-15 with degree of protection IP54 or better.
2. The device must be provided with a warning:

   Warning: Work is only permitted in the de-energized state

   Exception:

   If a potentially explosive atmosphere has been precluded, work can also be performed when the device is under voltage.
3. The device is designed for operation not exceeding pollution degree 2.
4. The enclosure must be able to safely handle a power dissipation of 130 W.

Applicable standards:

IEC 60079-14:2013 / EN 60079-14:2014

Explosive atmospheres - Part 14: Electrical installations design, selection and erection

The requirements for type of protection "n" must be observed.

4.3 Female Connectors

The female connectors feature the following characteristics:

XG.1 24 VDC	
Female connector	1 plug, 3 poles, screw terminals
Wire cross-section	0.2…16 mm² (single-wire) 0.5…16 mm² (finely stranded) 0.25…16 mm² (with wire end ferrule)
Stripping length	12 mm
Screwdriver	Slotted, 1.0 x 5.5
Tightening torque	1.2…1.5 Nm
XG.2 Fail	
Female connector	1 plug, 3 poles, screw terminals
Wire cross-section	0.2…2.5 mm² (single-wire) 0.2…2.5 mm² (finely stranded) 0.2…2.5 mm² (with wire end ferrule)
Stripping length	7 mm
Screwdriver	Slotted, 0.6 x 3.5
Tightening torque	0.4…0.5 Nm
XG.3 230 VAC	
Female connector	1 plug, 3 poles, screw terminals
Wire cross-section	0.2…4 mm² (single-wire) 0.2…4 mm² (finely stranded) 0.25…4 mm² (with wire end ferrule)
Stripping length	7 mm
Screwdriver	Slotted, 0.6 x 3.5
Tightening torque	0.4…0.5 Nm

Table 8: Female Connector Properties

i When performing the wiring, observe the minimum cross-sections specified in the product data.

4.4 Adjusting Power Supplies Connected in Parallel

With 40 A load applied to L+, the output voltage of the power supply units is factory set to 24.2 V ± 10 mV. Decoupling reduces the output voltage on R+ by the amount of voltage drop, see Table 5. For parallel operation, connect wires of the same length to R+ to avoid load differences.

The power supply units are adjusted to other voltage ranges using the ΔU potentiometer under load located on the front side.

1. Measure the output voltage on each power supply unit's R+.
2. Turn the ΔU potentiometer until the required output voltage has been reached.
3. Repeat step 2 with all power supply units connected in parallel.
4. Use a clamp meter to verify that the current is distributed uniformly among all power supply units connected in parallel.
5. If the current is not distributed uniformly, use the ΔU potentiometer to adjust the output voltage.

5 Operation

The power supply unit does not require any specific monitoring.

5.1 Handling

The power supply unit is switched on and off using the thermal overcurrent circuit breaker on the front side.

Additional handling of the power supply unit is not foreseen.

5.2 Diagnostics

LEDs on the front plate indicate the state of the power supply unit, see Chapter 3.4.2.

6 Maintenance

Defective power supply units must be replaced with a faultless power supply unit of the same type or with an approved replacement model.

Only the manufacturer is authorized to repair the power supply unit.

6.1 Maintenance Measures

The following maintenance measures are required:

6.1.1 Replacing the Fans

HIMA strongly recommends replacing the power supply unit fan in accordance with the specified maintenance interval. HIMA cannot be held liable for damages caused by improper maintenance.

Operating temperature	Maintenance interval
≤ 40 °C	Every 5 years
> 40 °C	Every 3 years

Table 9: Maintenance Intervals

The fan may only be replaced by HIMA.

6.1.2 Replacing the Electrolytic Capacitors

The electrolytic capacitors of the PS 1000 must be replaced in intervals of ≤ 10 years.

The electrolytic capacitors may only be replaced by HIMA!

7 Decommissioning

The power supply unit is decommissioned by switching off the power supply unit and removing the female connectors.

8 Transport

To avoid mechanical damage, the power supply units must be transported in packaging.

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

9 Disposal

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

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

Appendix

Glossary

Term	Description
AI	Analog input
AO	Analog output
ARP	Address resolution protocol, network protocol for assigning the network addresses to hardware addresses
COM	Communication module
CRC	Cyclic redundancy check
DI	Digital input
DO	Digital output
EMC	Electromagnetic compatibility
EN	European standard
ESD	Electrostatic discharge
FB	Fieldbus
FBD	Function block diagrams
HW	Hardware
ICMP	Internet control message protocol, network protocol for status or error messages
IEC	International electrotechnical commission
Interference-free	Inputs are designed for interference-free operation and can be used in circuits with safety functions
MAC	Media access control address, hardware address of one network connection
PADT	Programming and debugging tool (in accordance with IEC 61131-3), PC with SILworX
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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