0PS1050.3

1 General information

1.1 Order data

Order number	Short description	Figure
	Single-phase power supplies	
0PS1050.3	24 VDC power supply unit, 1-phase, 5 A, input 100 to 240 VAC, wide range, thin design, top-hat rail installation	

Table 1: 0PS1050.3 - Order data

1.1.1 Accessories

The following accessories can be ordered directly from Phoenix (phoenixcontact.net/products):

Description	Type	Article no.
Sealing plug to protect against tampering (adjusting the DC output voltage) by sealing the potentiometer opening	POTI SEALING PLUG	1175957

1.2 Module description

The power supply is characterized by a high power density simultaneously combined with a compact design in a robust housing.

Critical power supply situations during load startup as well as short-term overload situations during operation are safely intercepted thanks to the dynamic boost functionality.

The front push-in terminals enable fast and tool-free wiring of the power supply with rigid or flexible connecting cables with wire end sleeves.

Characteristics

- Minimum space requirement in the control cabinet due to a thin design
- Worldwide use thanks to AC and DC wide-range input
- Quick and easy commissioning due to tool-free push-in connection
- Optical and preventive function monitoring with three-color LED and dry switching contact
- Flexible installation by snapping onto a top-hat rail or screwing onto a flat surface

1.3 Safety notices

1.3.1 Organization of safety notices

Safety notices in this data sheet are organized as follows:

Safety notice	Description
Danger!	Failure to observe these safety guidelines and notices can result in death.
Warning!	Failure to observe these safety guidelines and notices can result in severe injury or substantial damage to property.
Caution!	Failure to observe these safety guidelines and notices can result in injury or damage to property.
Information:	These instructions are important for avoiding malfunctions.

Table 2: Description of the safety notices used in this documentation

1.3.2 Safety and warning notices

Danger!

Risk of death due to electrical shock!

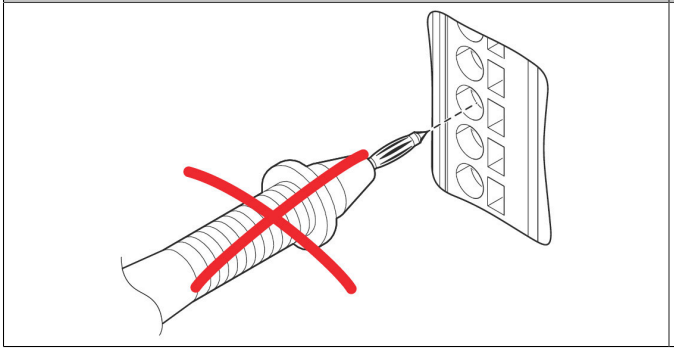
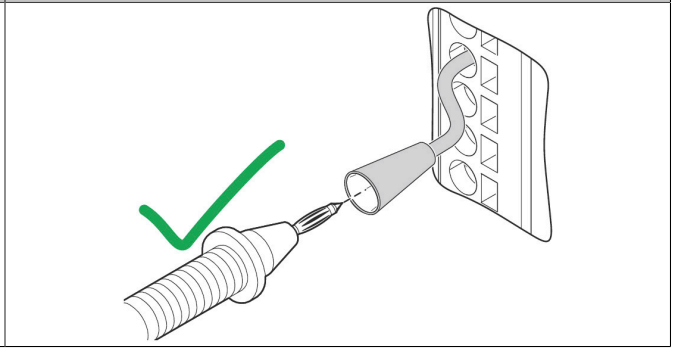
- **Only qualified personnel are permitted to install, start up and operate the device.**
- **Never work while voltage is applied.**
- **Make the connection correctly and ensure protection against electric shock.**
- **After installation, cover the terminal area to prevent impermissible contact with live parts (e.g. installation in the control cabinet).**

Information:

- **This power supply is used to convert the electrical energy supplied by the power grid. The AC input voltage is galvanically isolated from the DC output voltage. Adjustable DC output voltage U_{Out} is a SELV voltage.**
- **The protective function is limited if the device is not used as intended.**
- **National safety and accident prevention regulations must be observed.**
- **The power supply is maintenance-free. Repairs can only be carried out by the manufacturer. Opening the housing will void the guarantee.**
- **The assembly and electrical installation must correspond to the state of the art.**
- **The power supply is a panel mount device and designed for installation in a control cabinet.**
- **Use a suitable enclosure in the installation to protect against fire and against electrical hazards.**
- **IP20 protection of the power supply is intended for a clean and dry environment.**
- **Observe the mechanical and thermal limits.**
- **Install the power supply in the normal mounting position. The position of terminals L(+)/N(-) and ground are underneath.**
- **The power supply is approved for connection to TN, TT and IT power grids (star networks) with a protective ground connection (PE) and maximum line-to-line voltage of 240 VAC.**
- **Connect the housing to ground via the protective ground conductor device terminal.**
- **Adequately dimension and fuse primary and secondary wiring.**
- **Use copper cables with an operating temperature >75°C (ambient temperature <55°C) and >90°C (ambient temperature <75°C).**
- **For connection parameters such as the required wire stripping length for wiring with and without a wire end ferrule, see 2.1.4 "Cable data".**
- **The ingress of foreign bodies, such as paper clips or metal parts, must be prevented.**
- **When wiring the dry switching contact, the maximum permissible contact load must be observed.**

1.3.3 Using a test probe

When measuring with a multimeter, do not insert the test probe directly into the push-in terminal. The test probe should only be used in conjunction with a conductive test adapter.

Incorrect	Correct
	

The maximum plug-in depth of the wiring space of the push-in terminals is limited. In addition, when the test probe is inserted, the opening for the release may be covered so that it is not possible to insert a screwdriver sufficiently to activate the release mechanism.

The push-in terminal will be damaged if the release mechanism is not pressed properly when removing the attachment cable (see 2.4.3.1.2 "Opening the push-in terminal ").

Caution!

Damage to the push-in terminals is possible.

1.4 High-voltage testing (HIPOT)

This protection class I power supply is subject to the Low Voltage Directive and is factory tested. During the HIPOT test (high-voltage testing), for example, the insulation between the input and output circuits is tested for the specified dielectric strengths. The test voltage is applied in the high voltage range to the input and output terminals of the power supply. The operating voltage used in normal operation is much lower than the test voltage used.

Information:

High-voltage testing can be performed as described. The test voltage should ramp up and down. The respective rise and fall time of the ramp should be at least 2 seconds.

1.4.1 High voltage insulation test (dielectric strength test)

As electronic components directly connected to potentially hazardous voltages, power supplies are subject to increased safety requirements to protect the user. For this reason, it must always be ensured that there is permanent safe electrical isolation between the hazardous input voltage and the touch-safe output voltage as safety extra-low voltage (SELV).

In order to ensure permanent safe separation of the AC input circuit and DC output circuit, high-voltage testing is carried out during safety certification (type test) and production (routine test).

1.4.2 High voltage isolation test in the production process

In the production process of the power supply, a high-voltage test for insulation testing is carried out in accordance with the specifications of IEC/UL/EN 61010-1. Production testing is checked at regular intervals by a certificate authority.

1.4.3 High voltage isolation test on the customer side

Additional high-voltage testing on the power supply individual component by the end user in addition to the routine and type test to guarantee electrical safety is not required. During the high-voltage test, the power supply can be disconnected or installed only after high-voltage testing per EN 60204-1 (Safety of machinery - Electrical equipment of machines).

1.4.3.1 Performing high-voltage testing

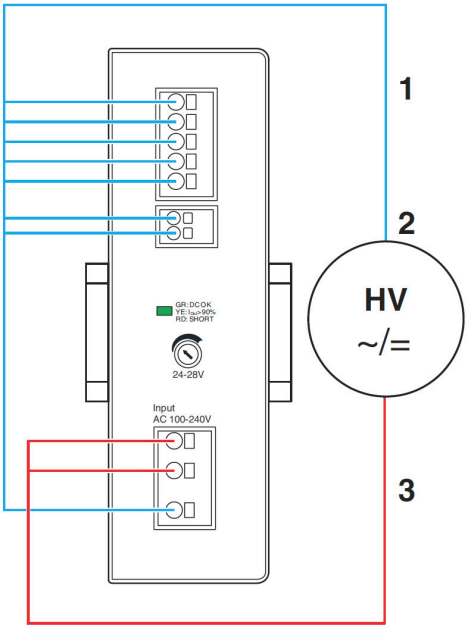
The following must be observed if high-voltage testing of the control cabinet or power supply is planned as an individual component in the final test.

- The power supply wiring must be as shown in the connection diagram.
- The maximum permissible test voltages is not permitted to be exceeded.

Unnecessary loads or irreparable damage to the power supply due to excessive test voltages must be avoided.

Information:

Valid insulation voltages are specified under "General information - Insulation voltages" in the technical data.



No.	Name	Color assignment	Potential level
1	DC output circuit	Blue	Potential 2
2	High voltage tester	--	--
3	AC input circuit	Red	Potential 1

2 Technical description

2.1 Technical data

Order number	0PS1050.3
General information	
Status display	Green LED (DC OK), threshold value U_{out} > 21 V
Power dissipation	
No-load operation	<2.14 W (120 VAC) <1.75 W (230 VAC)
Rated load	<8.54 W (120 VAC) <6.51 W (230 VAC)
Efficiency	Typ. 93% (120 VAC) Typ. 94% (230 VAC)
Insulation voltages	
Input - Output	3 kV AC (type test) 3.1 kV DC (routine test)
Input - Ground	1.5 kV AC (type test) 3.1 kV DC (routine test)
Input - Signal	3 kV AC (type test) 3.1 kV DC (routine test)
Active DC OK switch output	See section "Dry switching contact".
Connection type	Push-in connection [1)]
Certifications	
CE	Yes
UKCA	Yes
UL	cULus E534663 Industrial control equipment
DNV	Temperature: **D** (-25 to 55°C) Humidity: **B** (up to 100%) Vibration: **B** (4 g) EMC: A (all locations including bridge and open deck)
Input	
Nominal input voltage	100 to 240 VAC
Input voltage	100 to 240 VAC -15% to +10% 100 to 240 VDC ±10% 115 to 240 VAC ±10% (UL) 160 to 240 VDC ±10% (UL)
Network type	Star network (TN, TT, IT(PE))
Frequency	50 to 60 Hz ±10%
Inrush current	<33 A [2)]
Current consumption	1.3 A / 0.59 A (100 VAC / 240 VAC) 1.1 A / 0.6 A (120 VAC / 230 VAC) 1.29 A / 0.53 A (100 VDC / 240 VDC)
I^2t	<0.55 A^2s
Power failure bypass	Typ. 28 ms (120 VAC) Typ. 28 ms (230 VAC)
Leakage current to PE	<3.5 mA
Protective circuit	Varistor transient protection
Internal fuse	6.3 A
Required line fuse for device and line protection	See section "Input protection".
Output	
Nominal voltage	24 VDC
Output power [3)]	120 W / Max. 180 W (5 s)
Output voltage	24 to 28 VDC
Output current [4)]	5 A / Max. 7.5 A (5 s)
Setting range for output voltage	24 to 28 VDC
Control deviation	<0.1% (input voltage change ±10%) <3% (load change, dynamic) <1% (load change, static)
Rise time	≤1 s (U_{OUT} (10 to 90%))
Residual ripple	Typ. 50 mV_{SS}
Can be connected in parallel	Yes, for increased efficiency and redundancy
Can be connected in series	Yes, for increased output voltage (observe SELV limit)
Overvoltage protection	≤35 VDC (on the output (OVP))
Protection functions	Short-circuit protection
Feedback voltage resistance	≤35 VDC
Efficiency, reliability	
Efficiency	Typ. 93% (120 VAC) Typ. 94% (230 VAC)
MTBF [5)]	230 VAC / >3,300,000 h (25°C) 230 VAC / >1,900,000 h (40°C) 230 VAC / >880,000 h (60°C)

Table 3: 0PS1050.3 - Technical data

Order number	0PS1050.3
Power dissipation	
Rated load	<8.54 W (120 VAC) <6.51 W (230 VAC)
No-load operation	<2.14 W (120 VAC) <1.75 W (230 VAC)
Operating conditions	
Mounting orientation	
Horizontal	Yes
Vertical	No
Installation elevation above sea level	
Maximum	5000 m
Flammability class [6]	V0
Ventilation/Cooling	Normal convection, no fan required
Degree of protection per EN 60529	IP20
Ambient conditions	
Temperature	
Operation	-25 to 70°C
Derating	See section "Derating".
Starting temperature	-40°C [7]
Storage	-40 to 85°C
Transport	-40 to 85°C
Relative humidity	
Operation	Max. 95%, non-condensing
Vibration	
Operation	10 to 50 Hz, amplitude ±0.2 mm 50 to 150 Hz, 2.3 g, 90 min, per IEC 60068-2-6
Shock	
Operation	18 ms, 30 g, in each direction, per IEC 60068-2-27
Pollution degree	2
Climate category	3K3, per EN 60721
Overvoltage category	III (≤2000 m) / II (≤5000 m), per EN 61010-1 III (≤2000 m) / II (≤5000 m), per EN 61010-2-201
Mechanical properties	
Housing	
Material	Aluminum sheet, plastic cover PA
Coating	No protective coating
Installation	Easy top-hat rail installation (NS 35 rails, EN 60715)
Dimensions	
Width	35 mm
Height	135 mm
Depth	120 mm
Weight	450 g

Table 3: 0PS1050.3 - Technical data

1) For details, see section "Cable data".
2) No current flows into the filter capacities during the first microseconds.
3) Specification of nominal value (P_N) and maximum boost value ($P_{Dyn.Boost}$)
4) Specification of nominal value (I_N) and maximum boost value ($I_{Dyn.Boost}$)
5) Per IEC 61709, SN 29500
6) Per UL 94, housing and terminals
7) Minimum permissible ambient temperature in a voltage-free state at the time the power supply unit is switched on. During operation, the conditions according to the operating temperature continue to apply.

2.1.1 Starting temperature

The starting temperature describes the minimum permissible ambient temperature in a voltage-free state at the time the power supply unit is switched on. During operation, the conditions according to the specification of the operating temperature continue to apply.

Information:

It is important to absolutely ensure that there is no forced cooling by air currents in the closed control cabinet, e.g. due to the use of a fan or ventilation slots.

2.1.2 Standards

Safety of power supply units up to 1100 V (isolation distances)	DIN EN 61558-2-16
Electrical safety	IEC 61010-2-201 (SELV)
Equipment of high voltage installations with electronic devices	EN 50178/VDE 0160 (PELV)
Safety for measuring, control and laboratory equipment	IEC 61010-1
Protective extra-low voltage	IEC 61010-1 (SELV) IEC 61010-2-201 (PELV)
Safe insulation	IEC 61558-2-16 IEC 61010-2-201
Limitation of harmonic currents	EN 61000-3-2

Electromagnetic compatibility conformity to EMC Directive 2014/30/EU

Interference emission per EN 61000-6-3 (residential and commercial environments) and EN 61000-6-4 (industrial environments)		
CE base standard	**Normative minimum requirement**	**Higher practical requirement (passed)**
Conducted interference emissions EN 55016	EN 61000-6-4 (class A)	EN 61000-6-3 (class B)
Radio disturbance EN 55016	EN 61000-6-4 (class A)	EN 61000-6-3 (class B)
Harmonic current emissions EN 61000-3-2	EN 61000-3-2 (class A)	EN 61000-3-2 (class A)
Flicker EN 61000-3-3	Not required	EN 61000-3-3
Interference emission - Maritime certification	**Normative minimum requirement - DNV GL**	**Higher practical requirement - DNV GL (passed)**
DNV GL conducted interference emissions	Class A energy distribution area	Class A energy distribution area
DNV GL radio disturbance	Class A energy distribution area	Class B bridge and deck area

Immunity to interference per EN 61000-6-1 (residential area), EN 61000-6-2 (industrial area)		
CE base standard	**Normative minimum requirement EN 61000-6-2 (CE) (immunity in industrial environment)**	**Higher practical requirement (passed)**
Static electricity discharge EN 61000-4-2		
Housing contact discharge	4 kV (test severity level 2)	6 kV (test severity level 3)
Housing air discharge	8 kV (test severity level 3)	8 kV (test severity level 3)
Comment	Criteria B[2)]	Criteria B[2)]
Electromagnetic RF field EN 61000-4-3		
Frequency range	80 MHz to 1 GHz	80 MHz to 1 GHz
Test field strength	10 V/m (test severity level 3)	10 V/m (test severity level 3)
Frequency range	1.4 GHz to 6 GHz	1 GHz to 6 GHz
Test field strength	3 V/m (test severity level 2)	10 V/m (test severity level 3)
Comment	Criteria A[1)]	Criteria A[1)]
Fast transients (burst) EN 61000-4-4		
Input	Asymmetrical 2 kV (test severity level 3)	Asymmetrical 2 kV (test severity level 3)
Output	Asymmetrical 1 kV (test severity level 2)	Asymmetrical 2 kV (test severity level 4)
Comment	Criteria B[2)]	Criteria A[1)]
Surge voltage load (surge) EN 61000-4-5		
Input	Symmetrical 1 kV (test severity level 3) Asymmetrical 2 kV (test severity level 3)	Symmetrical 2 kV (test severity level 4) Asymmetrical 4 kV (test severity level 4)
Output	Symmetrical 0.5 kV (test severity level 2) Asymmetrical 1 kV (test severity level 2)	Symmetrical 1 kV (test severity level 3) Asymmetrical 2 kV (test severity level 3)
Signal	Asymmetrical 1 kV (test severity level 2)	Asymmetrical 1 kV (test severity level 2)
Comment	Criteria B[2)]	Criteria A[1)]
Conducted interference EN 61000-4-6		
Input/Output/Signal	Asymmetrical	Asymmetrical
Frequency range	0.15 MHz to 80 MHz	0.15 MHz to 80 MHz
Voltage	10 V (test severity level 3)	10 V (test severity level 3)
Comment	Criteria A[1)]	Criteria A[1)]
Voltage dips EN 61000-4-11 Input voltage (230 VAC, 50 Hz)		
Voltage dip	70%, 25 periods (class 3)	70%, 25 periods (class 3)
Comment	Criteria C[3)]	Criteria A[1)]
Voltage dip	40%, 10 periods (class 3)	40%, 10 periods (class 3)
Comment	Criteria C[3)]	Criteria B[2)]
Voltage dip	0%, 1 period (class 3)	0%, 1 period (class 3)
Comment	Criteria B[2)]	Criteria A[1)]

1) Normal operating behavior within the defined limits.
2) Temporary impairment of the operating behavior that the device corrects itself.
3) Temporary impairment of the operating behavior that can be corrected by the device itself or restored by actuating the operating elements.

2.1.3 Input protection

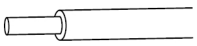
Input protection, AC (to be pre-connected externally)							
Input current I_{in} input protection	**Circuit breaker Type**					**Neozed fuse or equivalent**	**Circuit breaker**
Properties	**A**	**B**	**C**	**D**	**E**	**gG**	**≤13 x I_{in} (maximum magnetic trigger)**
6 A	-	✓	✓	✓	✓	✓	✓
10 A	-	✓	✓	✓	✓	✓	✓
16 A	-	✓	✓	✓	✓	✓	✓
20 A	-	✓	✓	✓	✓	✓	✓

2.1.3.1 SCCR value

> **Information:**
>
> **The short-circuit current rating (SCCR) value of the power supply unit corresponds to the SCCR value of the line fuse.**

2.1.4 Cable data

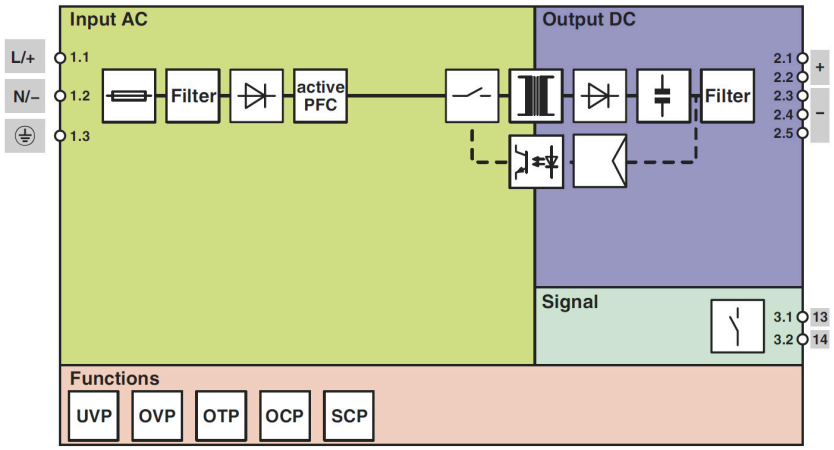
Connection type: Push-in connection
Wire stripping length: 10 mm
Wire end sleeves: 8 mm



	Cable cross section[1]		
	Inputs (1.1 to 1.3)	**Outputs (2.1 to 2.5)**	**Signal (3.1 to 3.2)**
1-wire rigid	0.2 to 4 mm² (1.5 mm²)	0.2 to 4 mm² (1.5 mm²)	0.2 to 1.5 mm² (0.5 mm²)
1-wire flexible	0.2 to 2.5 mm² (1.5 mm²)	0.2 to 2.5 mm² (1.5 mm²)	0.2 to 1.5 mm² (0.5 mm²)
1-wire flexible with wire end sleeve without plastic sleeve	0.25 to 2.5 mm² (1.5 mm²)	0.25 to 2.5 mm² (1.5 mm²)	0.25 to 1.5 mm² (0.5 mm²)
1-wire flexible with wire end sleeve with plastic sleeve	0.25 to 1.5 mm² (1.5 mm²)	0.25 to 1.5 mm² (1.5 mm²)	0.25 to 0.75 mm² (0.5 mm²)
1-wire rigid (AWG) (Cu)	24 to 12 (16)	24 to 12 (16)	24 to 16 (20)

1) Possible cable cross sections, recommended cross section in parentheses

2.2 Block diagram

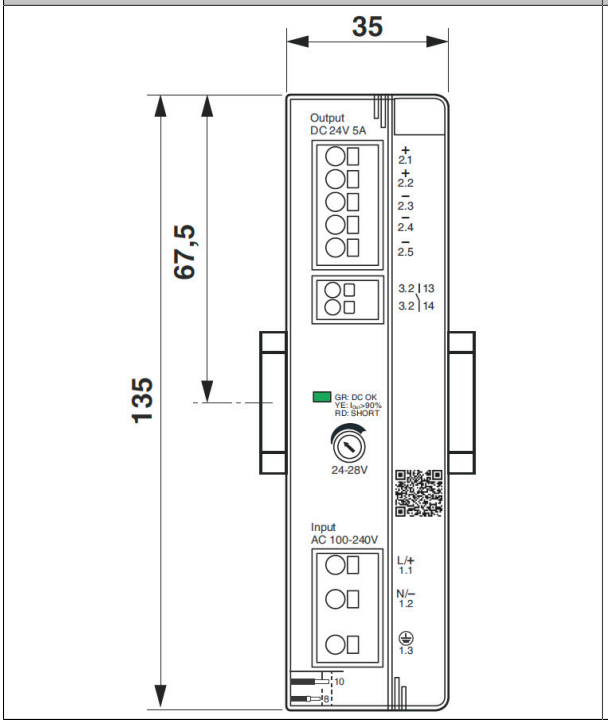
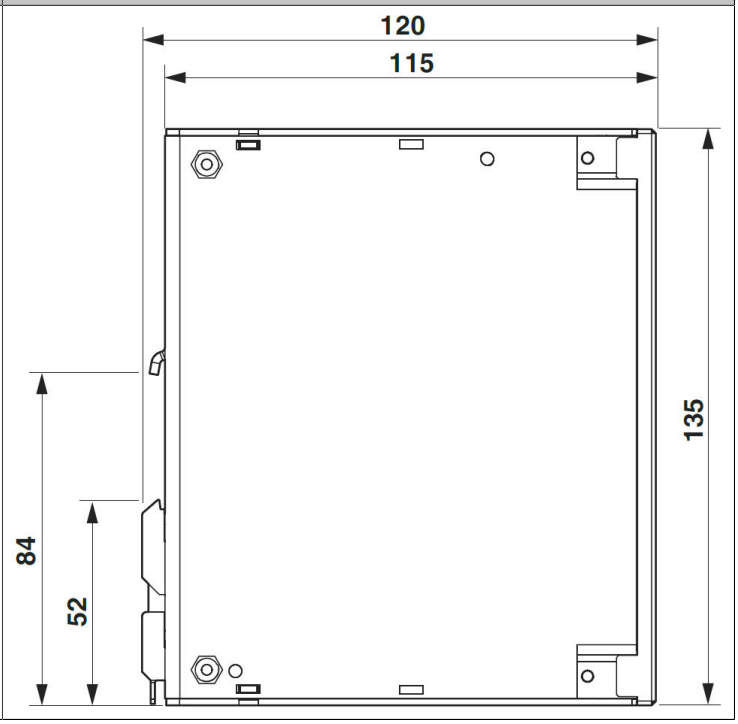


Symbol	Designation - Input AC, output DC
	Input fuse, internal device protection
Filter	EMC filter
	Rectification
aktive PFC	Power factor correction (PFC)
	Switching transistor
	Transmitter with galvanic isolation
	Smoothing capacitor
	Optocoupler (galvanically isolating)
	Control devices

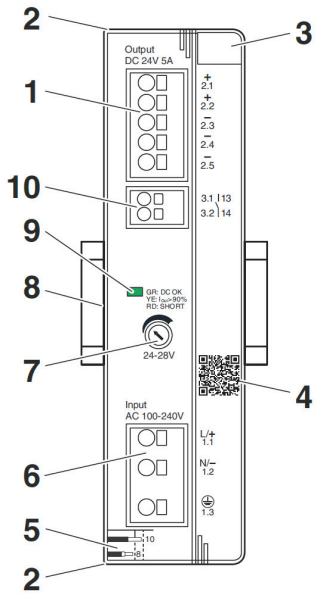
Symbol	Designation - Functions
UVP	The undervoltage protection protects the AC input of the power supply unit from damage in the event of AC undervoltage.
OVP	The overvoltage protection protects the DC output of the power supply unit and the connected load from damage in the event of overvoltage.
OTP	The overtemperature protection protects the power supply unit from damage in the event of impermissibly high self-heating from outside.
OCP	The overcurrent protection protects the DC output of the power supply unit from damage in the event of an impermissibly high current load.
SCP	Short-circuit protection protects the DC output of the power supply unit from damage in the event of a short circuit on the output side.

Symbol	Designation - Signal
	Dry switching contact, reports the operating state of the power supply unit to a higher-level control system. In normal operation, the dry switching contact is closed. U_{Out} > 21 VDC and I_{Out}Out < 0.9 x I_N

2.3 Dimensions

Front view	Side view
	

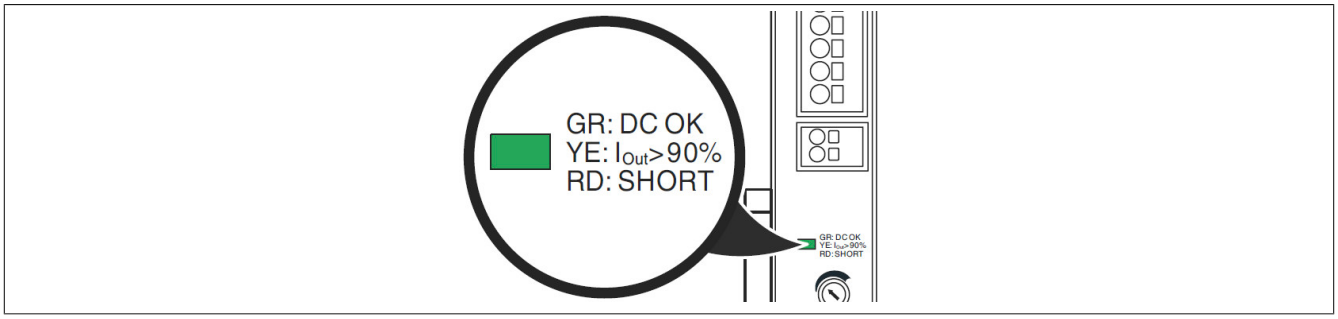
2.4 Operating and connection elements



No.:	Name	Connection label
1	Terminals for DC output voltage	2.1 to 2.5
2	Receptacle for cable ties	
3	Label holder	
4	QR code to B&R website	
5	Information for wire stripping length (with/without wire end sleeve)	
6	Terminals for AC input voltage	1.1 to 1.3
7	Output voltage potentiometer	
8	Universal top-hat rail adapter on rear of device	
9	LED status indicator (three-color, red, yellow, green)	
10	Terminals for dry switching contact	3.1 to 3.2

2.4.1 Indication

A three-color LED is available for visual and preventive function monitoring of the power supply. LED "DC OK" indicates 3 basic operating states of the power supply.



Color	Status	Description
No LED	Off	Primary side AC power supply is not available or too low.
Green 	On	DC OK: Power supply in normal operation Output voltage: U_{Out} > 21 VDC Output current: I_{Out} < 0.9 x I_N
Yellow 	On	I_{Out} > 90%: Operating state "Pre-alarm". Power supply in normal operation, but the pre-alarm threshold has been exceeded. Output voltage: U_{Out} > 21 VDC Output current: I_{Out} > 0.9 x I_N
Red 	On	I_{SHORT}: Operating state "Short circuit". Power supply impermissibly highly loaded or detected short circuit on the DC output side. Output voltage: U_{Out} < 21 VDC Output current: I_{Out} > 0.9 x I_N
	Blinking 5 s	U_{OUT}: Operating state "Overvoltage". An impermissibly high DC voltage was detected. The device's internal overvoltage protection (OVP) has been triggered.

2.4.2 Potentiometer

The basic operation of the power supply takes place via a stepless potentiometer on the device front. The axis of the potentiometer is equipped with a slot with arrow marking. The potentiometer can be used to set the required output voltage for the DC load power supply:

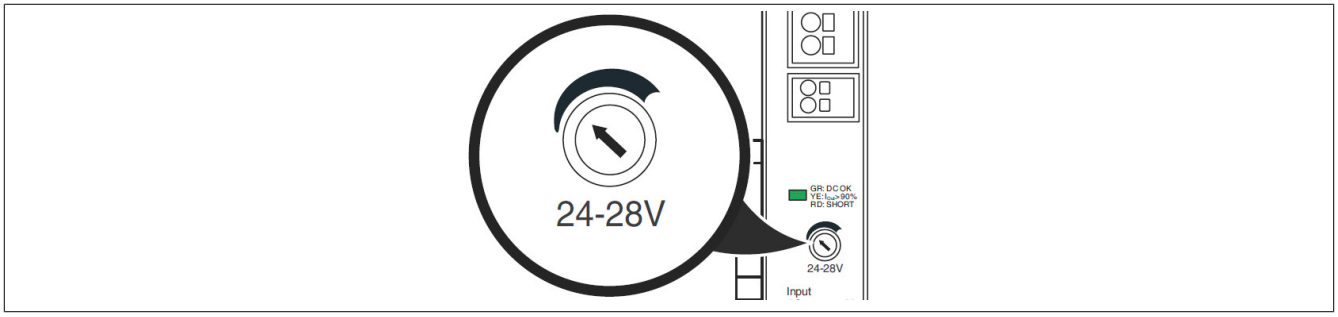
- Turning clockwise increases the output voltage.
- Turning counterclockwise reduces the output voltage.

The angle of rotation of the potentiometer setting range is approx. 270°.

Notice!

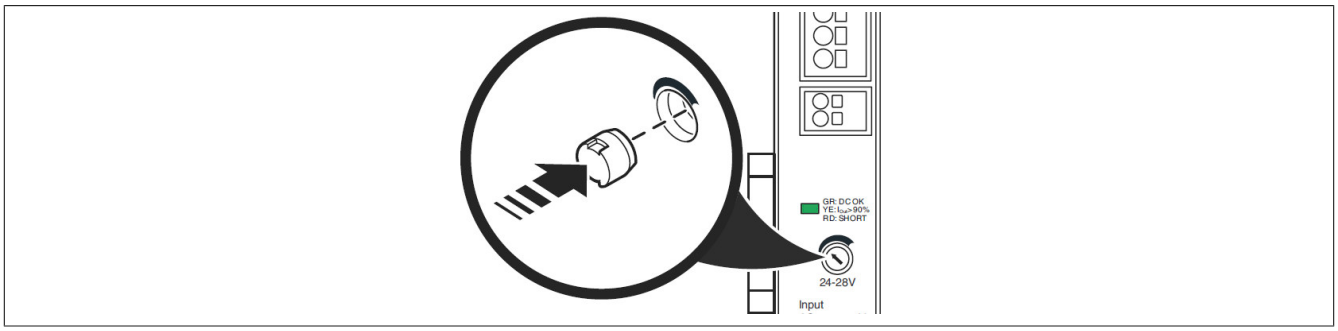
Damage possible, observe end stops of the potentiometer adjustment range.

The adjustment range of the potentiometer is limited by end stops. Accidentally exceeding the end stops can damage the potentiometer. Proper functionality is then no longer ensured.



2.4.2.1 Sealing plug (optional)

To protect against tampering (adjustment of the DC output voltage), the potentiometer opening can be closed with an optionally available sealing plug (see 1.1.1 "Accessories"). The sealing plug is provided with a hole at the back that encloses the potentiometer axis when connected. The sealing plug must be pushed into the potentiometer opening until it is flush with the front of the housing.



2.4.3 Terminals

Information:

This power supply unit is a special product. Only qualified personnel with electrical engineering knowledge are permitted to install, start up and operate this power supply unit.

Notice!

Observe national safety regulations for work on electrical equipment.

In Germany, this work is only permitted to be carried out by electricians with additional training.

In addition, the following 5 basic safety rules must be observed:

- Safe disconnection
- Ensure that the power cannot be switched on again.
- Check the safe disconnection from the power supply for all positions.
- Ground and short circuits
- Cover or fuse adjacent live parts.

2.4.3.1 Push-in connections

The front terminals of the power supply unit are designed as push-in connections.

For clear and definitive identification, the terminal is provided with a unique terminal marking. The terminal marking always includes 2 pieces of information: the position marking (position) and the pin marking (pole identifier).

Example

Position	Pin marking	Connection label
1.x	L/+ N/– ⏚ 1.1 1.2 1.3	Input
2.x	\+ \+ – – – 2.1 2.2 2.3 2.4 2.5	Output
3.x	3.1 | 13 3.2 | 14	Signal

Information:

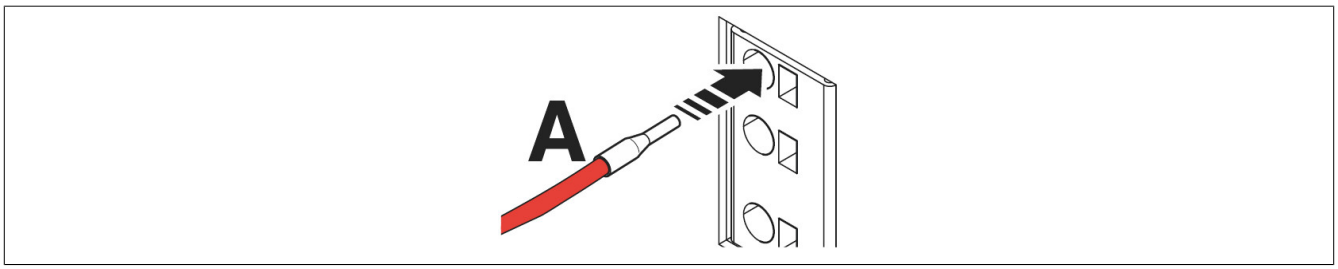
For the required connection parameters of the terminals, see 2.1.4 "Cable data".

In addition, the required wire stripping lengths for flexible and rigid connecting cables are printed on the front of the power supply.

2.4.3.1.1 Wiring the push-in terminal block

To wire the power supply with the attachment cables, proceed as follows:

1) Strip the insulation from the individual attachment cables and, if necessary, fit the conductor ends with wire end sleeves.
2) Insert the stripped end of the attachment cable into the center of the round contact opening of the terminal (A) until it reaches the end stop. The contact mechanism opens automatically when the attachment cable is inserted into the contact opening.
3) Then check whether the attachment cable is firmly seated in the contact opening.



Information:

If rigid attachment cables or flexible attachment cables with wire end sleeves are used for wiring the power supply, no additional tools are required.

If a flexible attachment cable without a wire end sleeve is used, the contact mechanism must be opened with a screwdriver (see 2.4.3.1.2 "Opening the push-in terminal ").

Information:

Observe the mechanical loads.

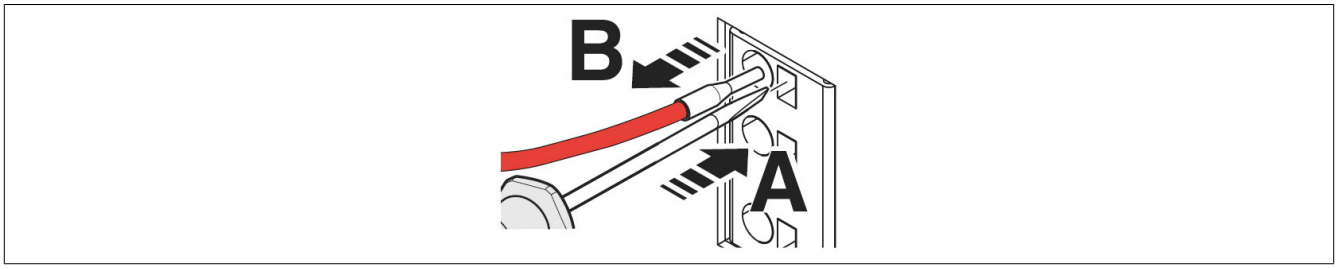
Avoid any mechanical stress on the attachment cables; otherwise, the electrical contact is at risk.

It is important to ensure that there is enough space for the wiring in the wiring compartment.

2.4.3.1.2 Opening the push-in terminal

To remove the attachment cable from the push-in terminals, proceed as follows:

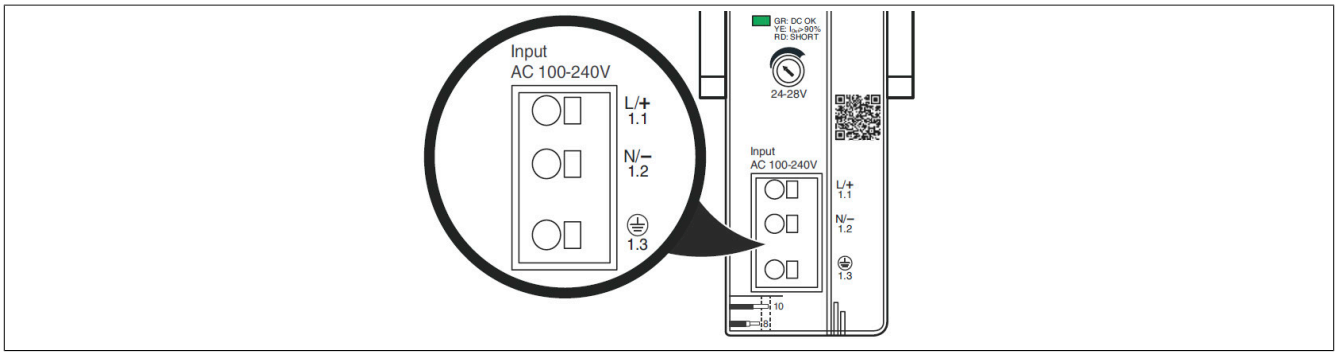
- Ensure that the power supply is disconnected from all power sources.
- To open the terminals, insert a suitable screwdriver into the square hole for loosening (A). Then carefully press the screwdriver to release the terminal. The contact mechanism opens, and the attachment cable is released.
- Pull the attachment cable out of the terminal (B). Secure the uninsulated end of the attachment cable with a suitable insulating clamp.
- Then remove the screwdriver from the square opening for unlatching. The contact mechanism closes again.



2.4.3.2 AC input terminals

The power supply unit is designed for operation on single-phase alternating current mains or on 2 line conductors of three-phase systems. The star network supports various network configurations, e.g. TT, TN and IT systems. Supplying from a DC network is also possible.

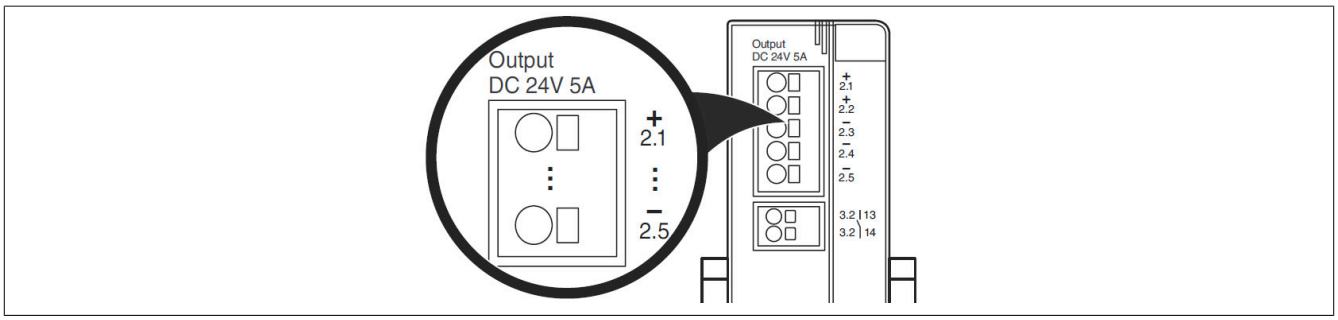
The power supply is connected on the primary side via the Input AC terminals (position 1.x, input).



2.4.3.3 DC output terminals

Connect the DC load to be supplied to the DC output terminals (position 2.x, output). By default, the power supply unit is set to a nominal output voltage of 24 VDC.

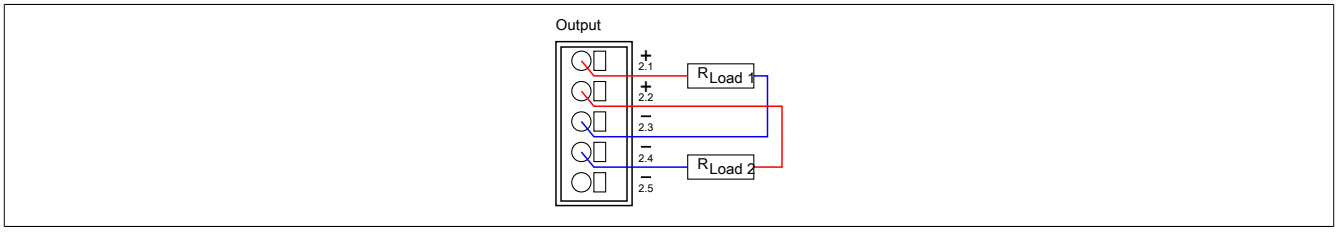
The level of the DC output voltage can be changed (see 2.4.2 "Potentiometer").



2.4.3.3.1 Wiring principle for DC output terminals

The power supply unit has terminals with positive and negative potential for supplying direct current loads. Connect the DC loads to be supplied to these terminals.

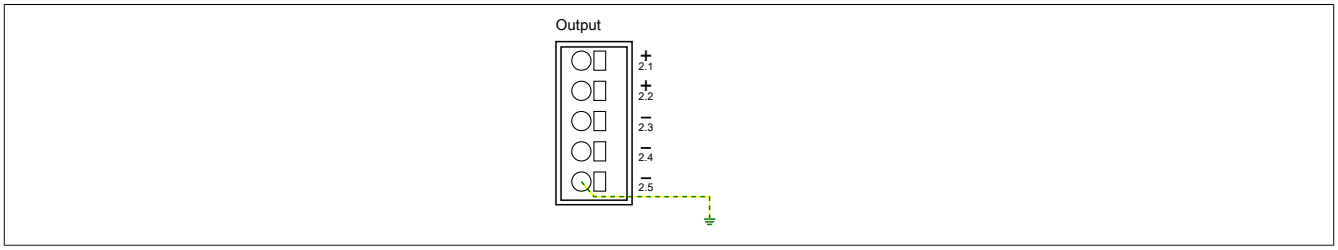
Wiring principle for DC output terminals



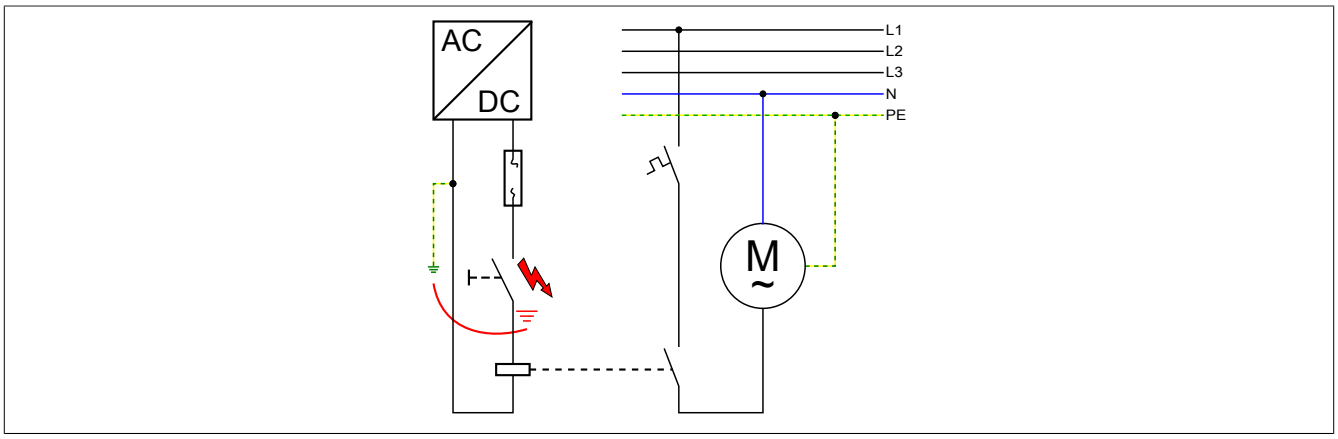
2.4.3.3.2 Additional minus terminal

According to the Machinery Directive DIN EN 60204-1 (VDE 0113-1), the protection of persons against electric shock must always be ensured. For operational reasons, the minus potential of the protective extra-low voltage (PELV) is grounded on the secondary side.

Wiring principle for the additional minus pole



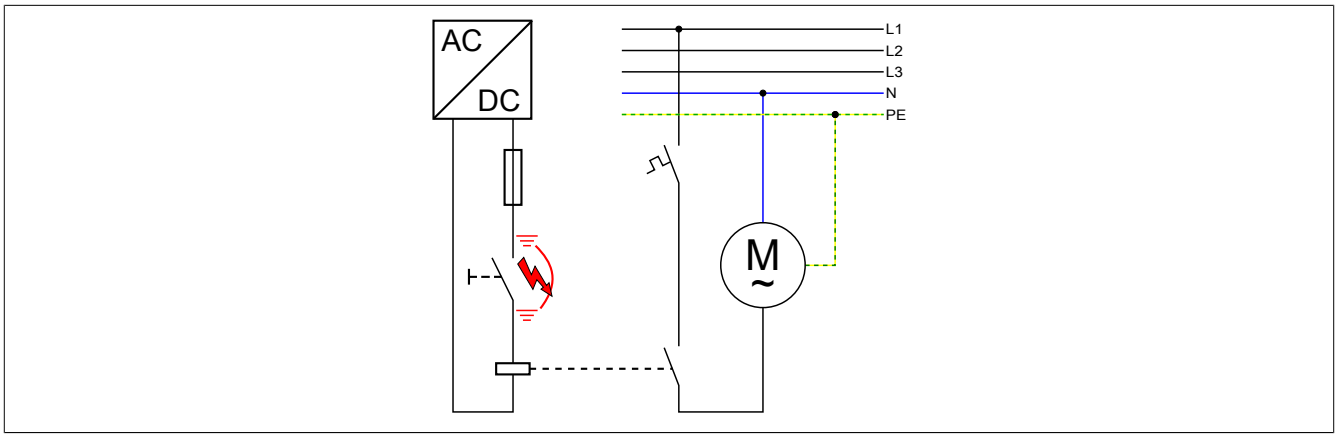
Example: Grounding on the secondary side



The secondary side grounding of the minus potential (additional minus terminal) defines an intentional ground fault. Any additional and unwanted ground fault on the secondary side will cause a short circuit of the output DC voltage. The upstream fuse trips and the faulty control circuit is switched off. An impermissible machine start, e.g. by motor startup, is not possible.

Example: No grounding on the secondary side

A ground fault is an impermissible connection to PE. A ground fault occurs when a conductor with damaged insulation touches the grounded housing. A double ground fault can mean that the short circuit via a button in the control circuit causes an unintentional machine start.



Warning!

A grounding fault can cause the machine to start.

2.4.3.3.3 Protection of the secondary side

The power supply is electronically short-circuit proof and open-circuit proof. In the event of a fault, the output voltage and current are limited.

Information:

If sufficiently long connecting cables are used, it is not necessary to fuse each individual consumer.

2.4.3.4 Dry switching contact

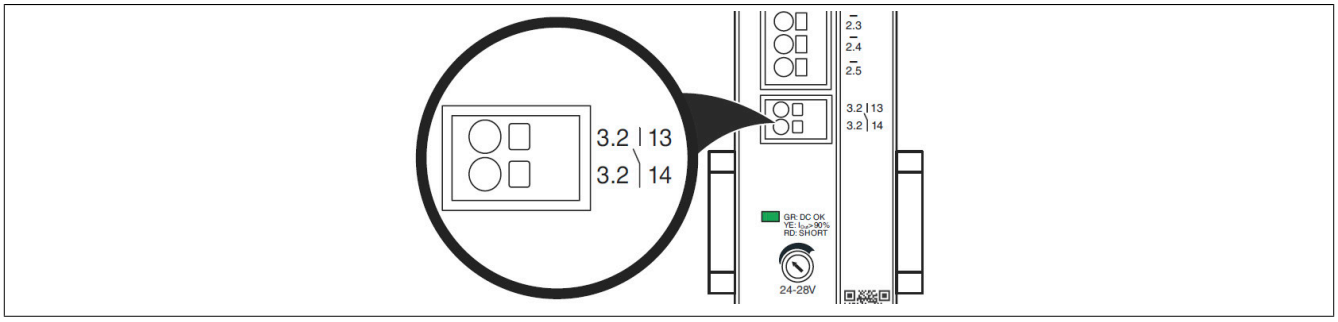
A dry switching contact for forwarding data to a higher-level control system is located at terminals 13/14 (position 3.x, signal).

Switching contact (dry)	OptoMOS
Switching voltage	Max. 30 VDC (SELV)
Current-carrying capacity	Max. 100 mA
State condition	
Contact closed	U_{Out} > 21 VDC and I_{Out} < 0.9 x I_N
Contact open	U_{Out} < 21 VDC or I_{Out} > 0.9 x I_N (averaging over 60 s)

Information:

Exclusion of false alarms

If the average value of output current I_{Out} > 0.9 x I_N over the last 60 seconds is detected as a precondition for switching, the contact opens. Averaging provides preventive protection against false alarms in the event of short-term voltage or current changes caused by the DC load.



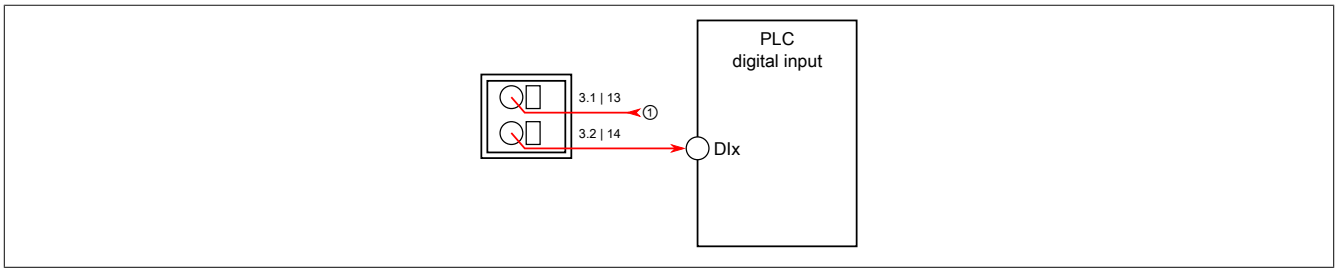
2.4.3.4.1 Wiring principle for the dry switching contact

In normal operation of the power supply, the dry switching contact (13/14) acts as a normally open contact (open circuit principle). To signal operational readiness to a higher-level control system, the dry switching contact must be connected to 24 VDC voltage, for example.

The following operating states of the power supply open the dry switching contact:

- If the supplied AC input voltage is below the minimum required AC voltage range.
- The output DC voltage drops below the threshold of U_{Out} < 21 VDC.
- The DC output current exceeds the threshold of I_{Out} > 0.9 x I_N (U_{Out} < 21 VDC).

Wiring principle for the dry switching contact



① Input voltage +24 VDC

Information:

Observe the maximum contact load.

The maximum permissible contact load when wiring the dry switching contact (30 VDC, 100 mA) must be observed.

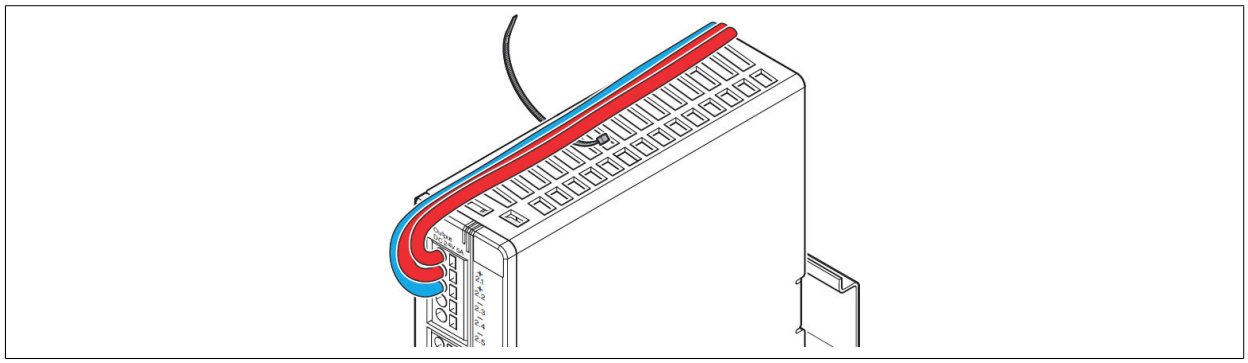
An impermissibly high load on the switching contact can result in malfunctions or irreversible damage. Correct signaling to the higher-level controller is then no longer ensured.

2.4.3.5 Securing the connecting cable

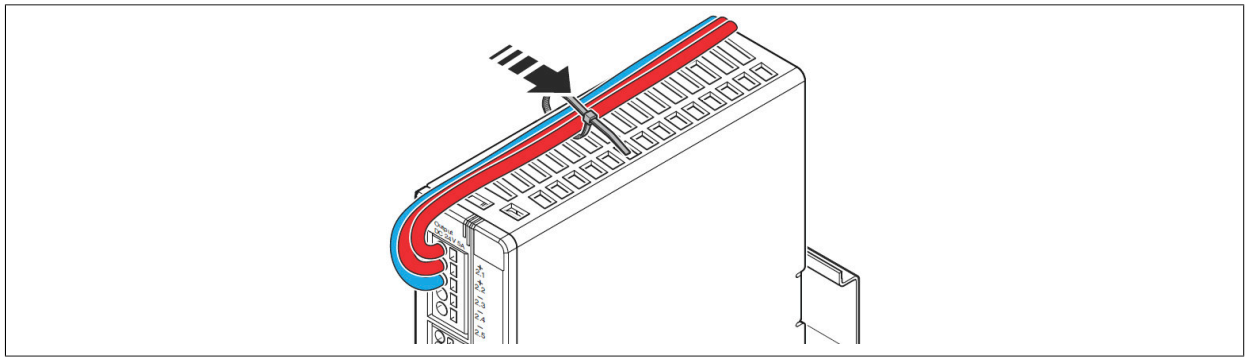
On the left side of the power supply housing (viewed from the front), receptacles are integrated at the top and bottom for bundled securing of the connecting cables using cable ties (3.6 x 140).

To secure the attachment cables, proceed as follows:

1) Wire the power supply with a sufficient connection reserve (input, output and signal terminals).
2) Bundle and align the connecting cables so that the cooling grids on the top and bottom of the housing are covered as little as possible.
3) Thread the cable ties into the receptacles for cable ties.



4) Align the attachment cables and secure the attachment cable bundle with the cable ties.

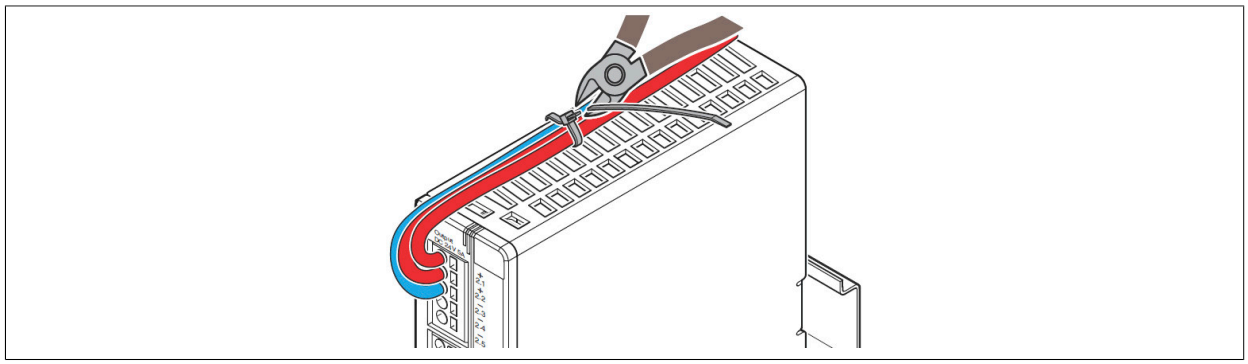


Notice!

Avoid damage to the connecting cables due to crushing.

When securing with cable ties, it is important to ensure that the attachment cables are fastened securely and without displacement. Do not damage the insulation of the attachment cables.

5) Then check once again that the attachment cables are securely fastened.
6) Shorten the protrusion of the cable tie.



2.5 Derating

2.5.1 Ambient temperature

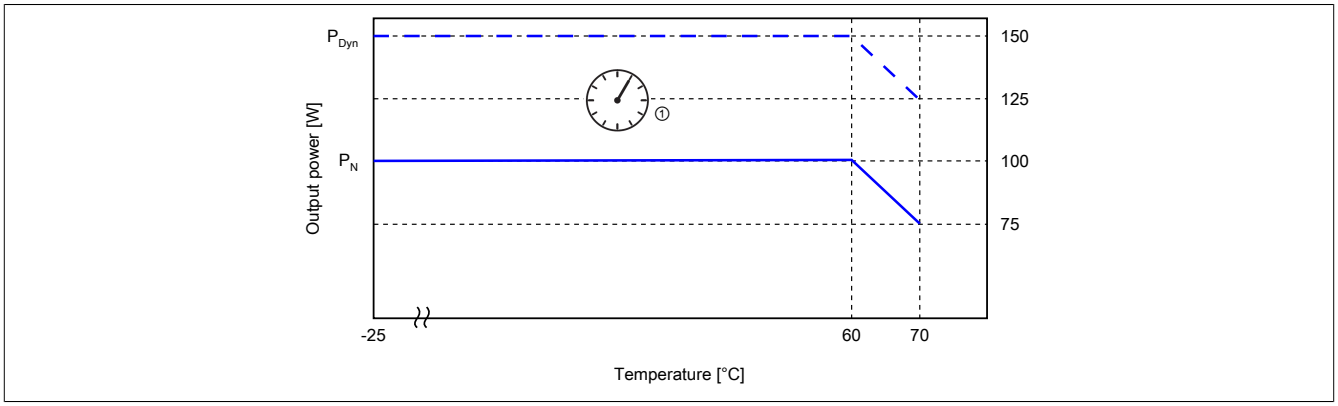
When installed in the standard mounting orientation and operated within the permissible temperature range for nominal operation, the power supply unit provides full output power. If the power supply unit is operated outside the temperature range for nominal values, the reduced output power for supplying DC loads must be observed.

Information:

Damage due to thermal overload

If the power supply unit is operated in a different temperature range, only reduced power can be drawn. Otherwise, the power supply unit will be subjected to a disproportionate thermal load and the device service life will be significantly reduced. This thermal load can even damage the power supply unit to such an extent that it is no longer operational.

Output power depending on ambient temperature

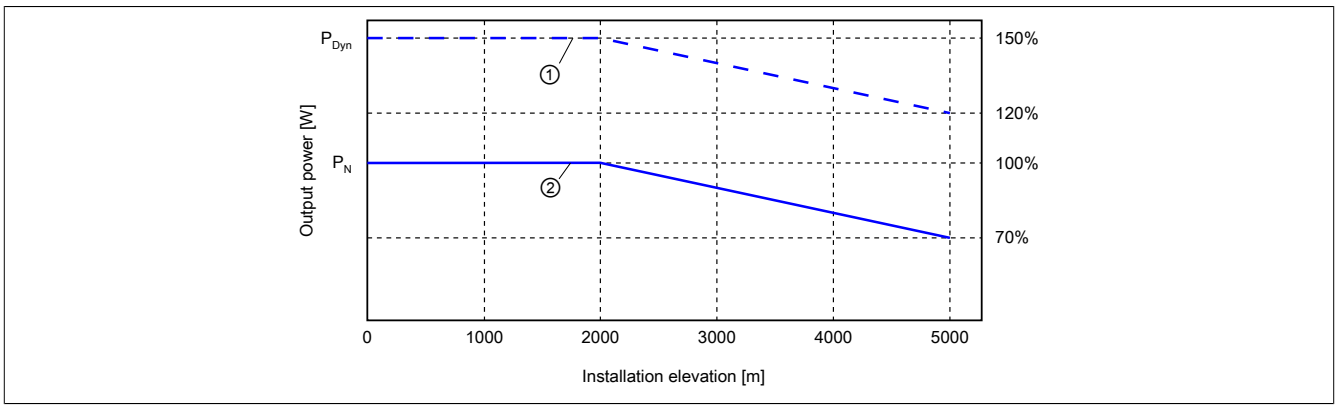


① Dynamic gain t ≥ 5 s

2.5.2 Installation elevation

The power supply can be operated up to an installation elevation of 2000 m without restrictions. For installation sites above 2000 m, different specifications apply due to the different air pressure and associated reduced convection cooling.

Output power depending on installation elevation



① **P_N** 100% ≤60°C
② **P_{Dyn}** 150% ≤60°C

2.5.3 Input voltage

Depending on the input voltage, it is important to note an additional derating of the output power.

Input voltage	Derating
<100 VAC	1% per V
<140 VDC	1% per V

Example

100 VAC corresponds to an output power of 120 W.

At 99 VAC input voltage, the output power drops by 1% to 118.8 W.

2.5.4 Position-dependent derating

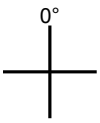
To ensure that the nominal power of the power supply can be used without restriction, the power supply should always be installed in the normal mounting orientation. Sufficient convection on the device side is always ensured when the unit is installed in the normal mounting orientation and the required clearances are observed.

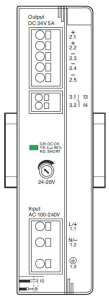
Notice!

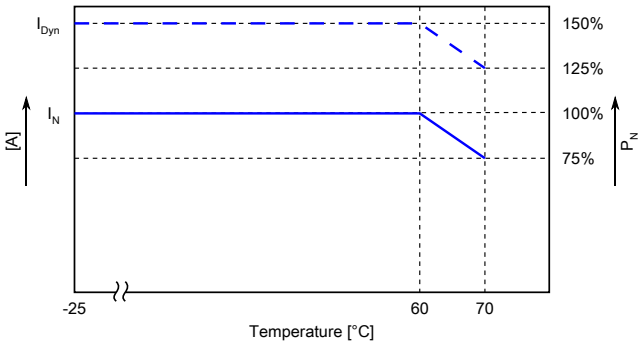
Damage due to thermal overload

If installation is carried out in a deviating mounting orientation, only reduced power consumption is possible. Otherwise, the power supply is subjected to disproportionate thermal loads and the device service life is severely limited.

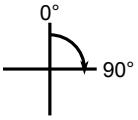
2.5.4.1 Normal mounting orientation

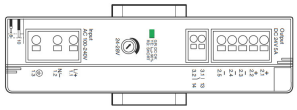


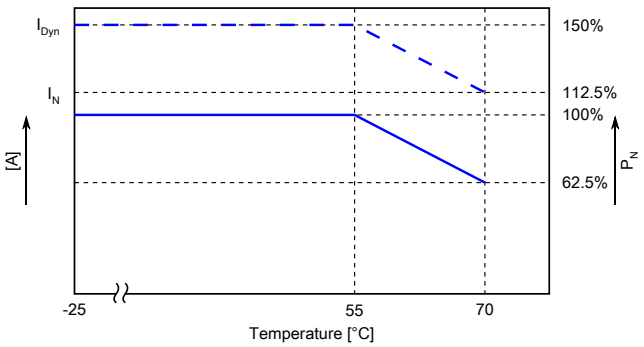




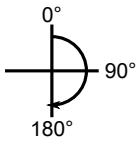
2.5.4.2 Mounting orientation rotated 90° on the z-axis

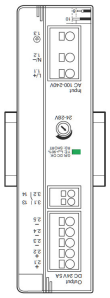


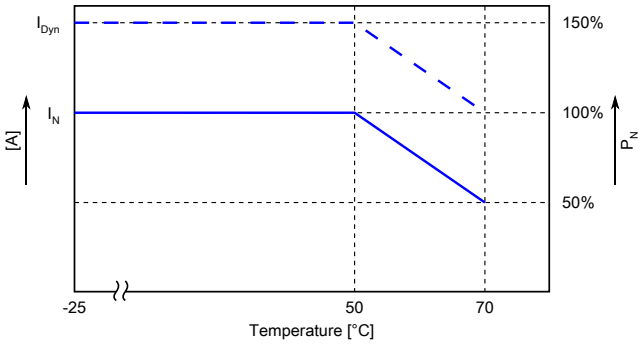




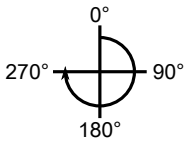
2.5.4.3 Mounting orientation rotated 180° on the z-axis

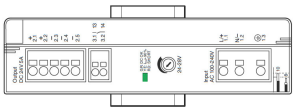


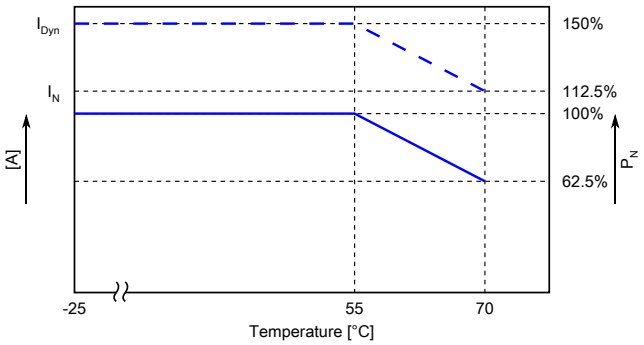




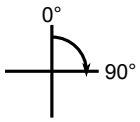
2.5.4.4 Mounting orientation rotated 270° on the z-axis

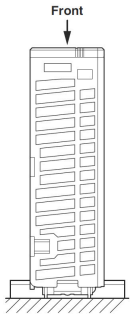


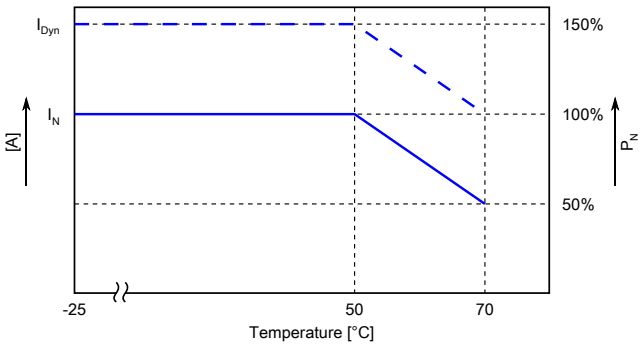




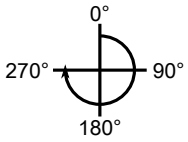
2.5.4.5 Mounting orientation rotated 90° on the x-axis

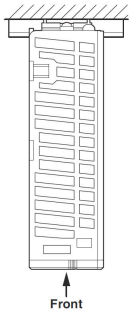


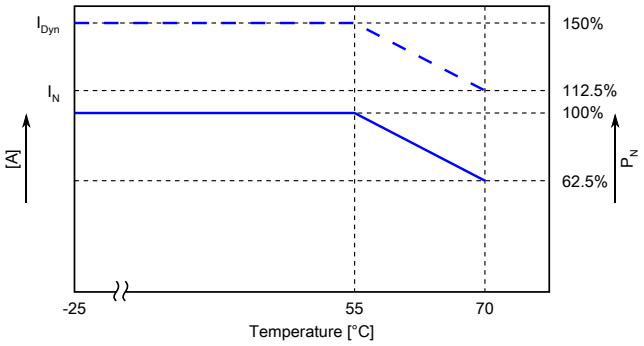




2.5.4.6 Mounting orientation rotated 270° on the x-axis





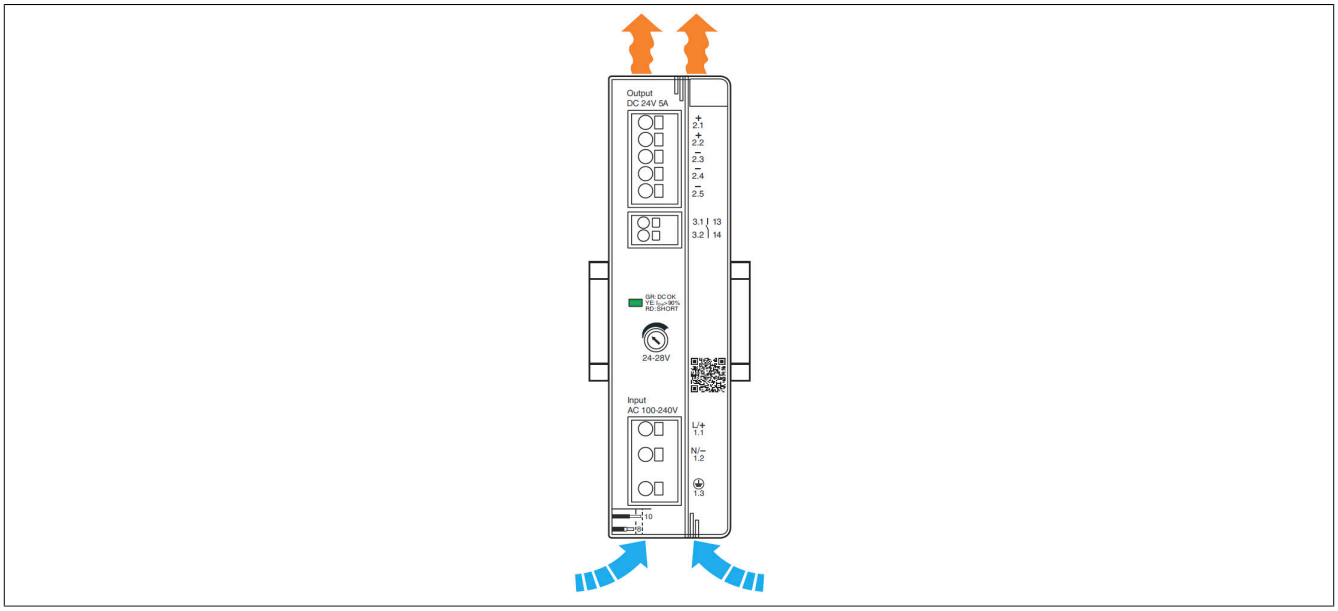


3 Installation/Removal

The fanless convection-cooled power supply can be snapped onto 35 mm top-hat rails (TH 35-7.5 / TH 35-15 mounting rail) per EN 60715.

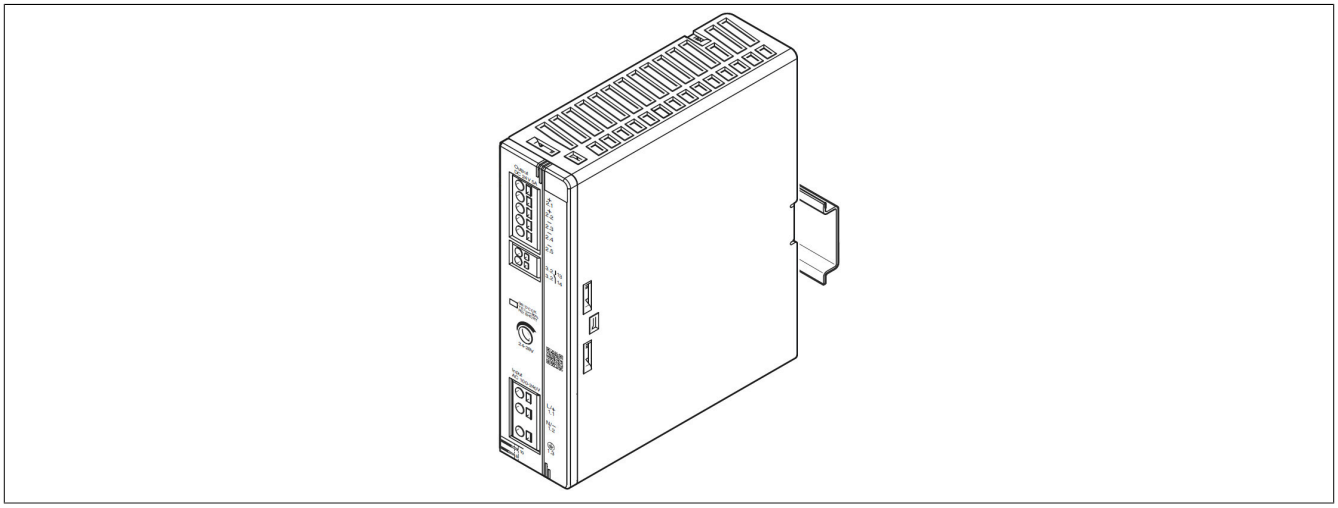
3.1 Convection

To allow sufficient convection, a minimum distance is required between the power supply and devices mounted above or below it. The minimum distances are designed for the normal mounting orientation with nominal operation of the power supply (see 3.4 "Clearance").



3.2 Mounting orientation

The specified technical data of the power supply refers to nominal operation in the normal mounting orientation. Deviating technical data, due to deviating mounting orientation or other ambient conditions, is marked accordingly (see 2.5 "Derating").



3.3 Installation elevation

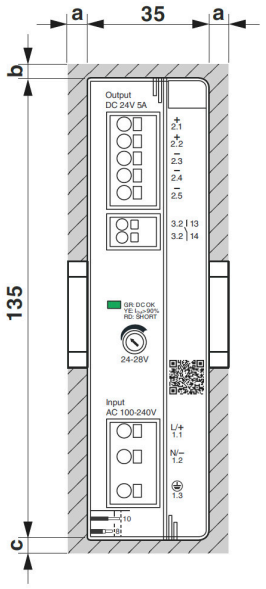
The power supply can be operated up to an installation elevation of 2000 m without any performance restrictions. Due to the deviating air pressure and associated reduced convection cooling, different specifications apply for installation sites higher than 2000 m (see 2.5 "Derating").

3.4 Clearance

To protect the power supply unit from thermal overload, clearances must be observed during configuration. The specified dimensions of the clearances refer to the normal mounting orientation of the power supply unit.

The required dimensions of the clearances may vary depending on the planned output power of the application.

Dimensions and minimum clearances (in millimeters)



The following minimum clearances must be maintained between the power supply unit and active components or passive components:

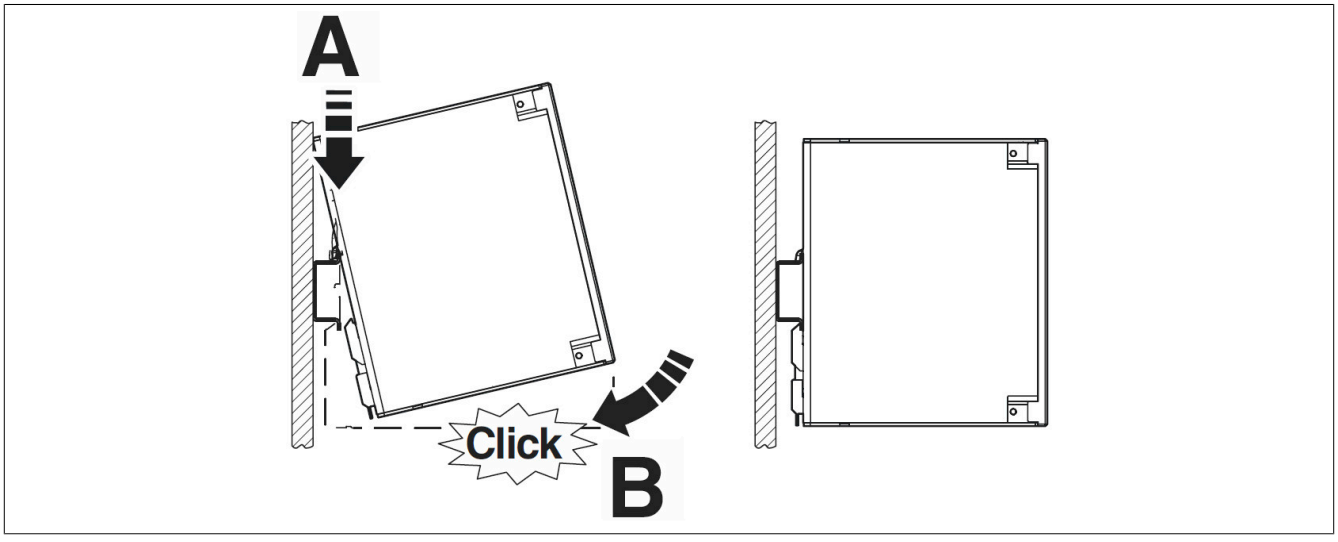
Output power P_{Out} = 100%		Clearances, spacing [mm]		
		a	b	c
Passive components	≤40°C	0	50	50
	>40°C	10	50	50
Active components		15	50	50

3.5 Installing/Removing the power supply

3.5.1 Installation on the top-hat rail (snap-in foot)

To install the power supply on a top-hat rail, proceed as follows:

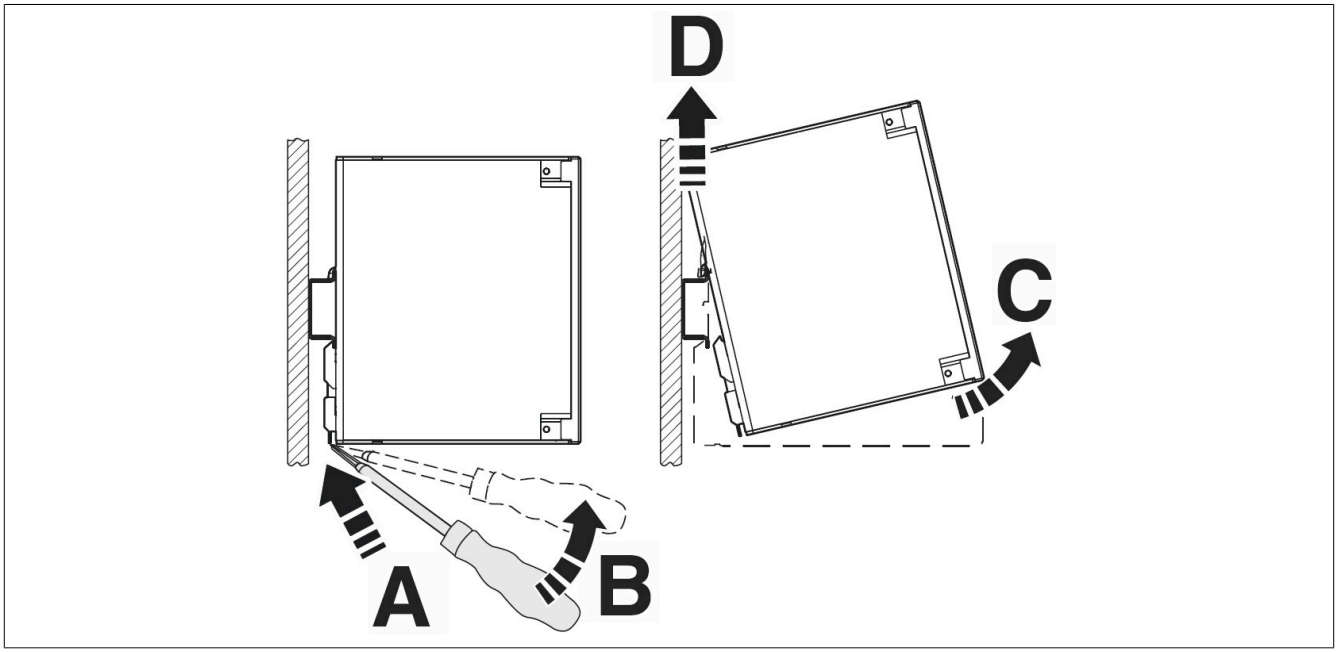
1) The device is placed on the top-hat rail from the top in the normal mounting orientation. Ensure that the universal top-hat rail adapter engages correctly behind the top-hat rail (A).
2) Then press the device down until the universal top-hat rail adapter audibly engages (B).
3) Check that the device is firmly seated on the top-hat rail.



3.5.2 Removal from the top-hat rail (snap-in foot)

To remove the power supply from the top-hat rail, proceed as follows:

1) Take a suitable screwdriver and insert it into the locking opening on the universal top-hat rail adapter (A).
2) Release the lock by levering the screwdriver upward (B).
3) Carefully swing the device forward (C) and allow the locking mechanism to slide back to its original position.
4) Then lift the device off the top-hat rail (D).



4 Output characteristics

Warning!

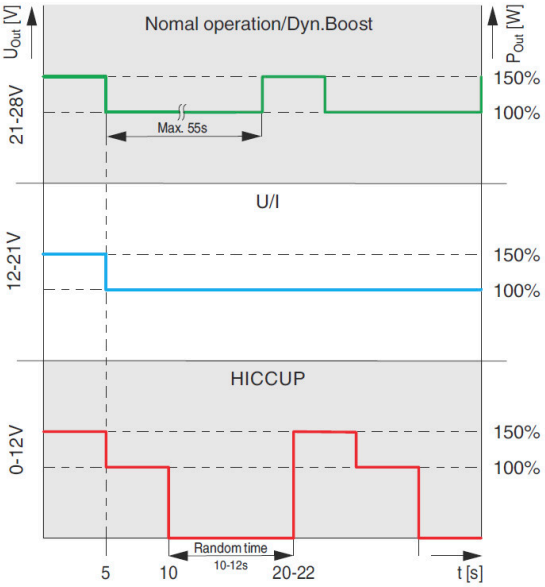
Hot surface

Depending on the ambient temperature and load on the power supply, the housing may become hot.

In normal operation, the power supply provides constant power output according to the nominal device data. On the device side, dynamic boost is considered an extended operating characteristic of normal operation.

The following operating characteristics are provided by the power supply depending on the load:

- Normal operation / Dynamic boost
- U/I operation
- HICCUP operation



4.1 Normal operation / Dynamic boost

In normal operation, the power supply provides a DC output voltage that is within the load-side voltage range of ≥21 to <28 VDC.

If the load-supplying DC output current increases due to increased current consumption ($I_{Out} > I_N$), the power supply switches to dynamic boost.

This operating behavior can occur when starting a DC drive or when DC loads are connected in parallel, for example. At this moment, the power supply provides an additional power of up to 150% of the nominal power for max. 5 s.

The three-color LED displays the current consumption (I_{Out} >90%) and lights up yellow. If the mean value of the output current is greater than 90% for 60 seconds, the dry switching contact (13/14) opens (see 2.4.1 "Indication").

The maximum available time of the dynamic boost is directly dependent on the required additional power and can be calculated specifically for the application (see example: 4.1.1 "Boost capability and recovery time").

Information:

If the supplying AC input voltage drops to a value <100 VAC during normal operation, the dynamic boost operating characteristic is not possible.

Information:

Observe the maximum nominal output values of the power supply. The average output power is not permitted to exceed the maximum nominal power limit (P_N).

4.1.1 Boost capability and recovery time

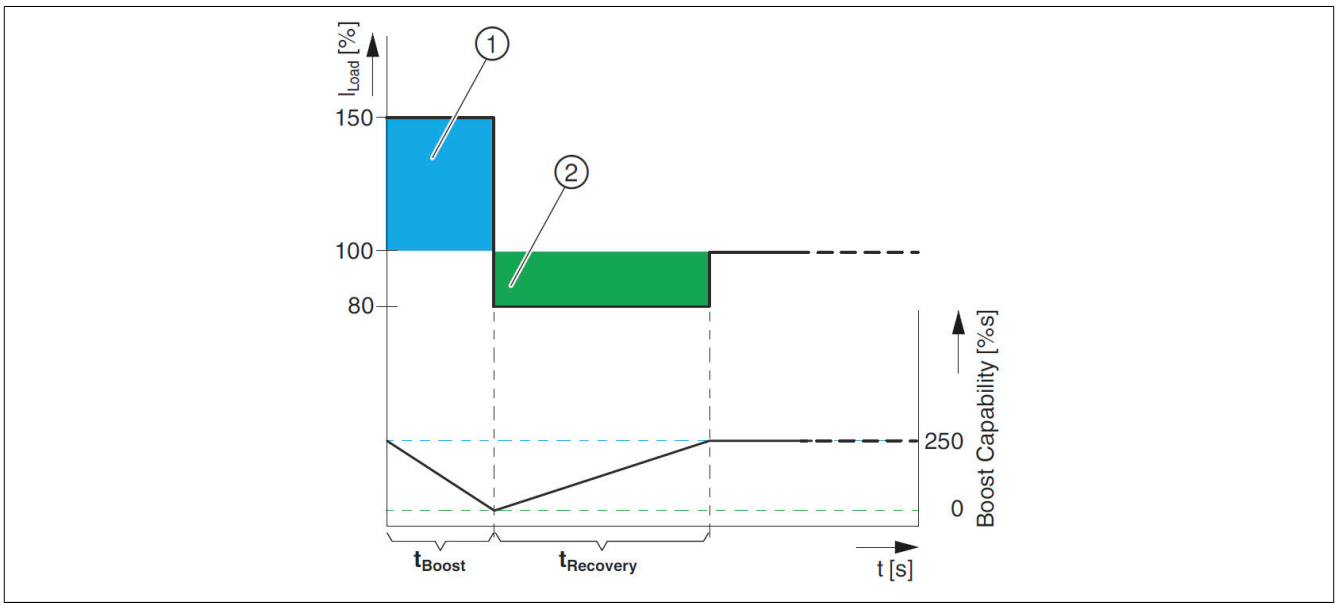
Depending on the DC load to be supplied, the max. boost time (t_{Boost}) and recovery time ($t_{Recovery}$) required for the power supply must be calculated.

The following specifications apply as the basis for calculating the boost time (t_{Boost}) and recovery time ($t_{Recovery}$):

Formulas for the calculation

$$T_{Boost} = \frac{Boost\ capability}{I_{Load} - I_N}$$

$$T_{Recovery} = \frac{Boost\ capability \times 3}{|I_{Load} - I_N|}$$



① Boost capacity: 50% x 5 s = 250% s
For $I_{Out} > I_N$: Boost capability is reduced.

② For $I_{Out} > I_N$: Boost capability is gained by a factor of 3.

Legend:

Name	Description
t_{Boost}	Min. time [s] in which the boost current is provided
I_{Boost}	Max. expected boost current (100 to 150%)
I_N	Nominal current of the power supply (100%)
Boost capability	Max. boost capability [% s]
$t_{Recovery}$	Recovery time [s]

4.1.2 Example: Calculation of t_{Boost}, $t_{Recovery}$

The following example shows you the applicable formulas for the principle calculation of t_{Boost} and $t_{Recovery}$.

This example assumes that your application uses the maximum extra power of 50% at the minimum time (5 s) of the dynamic boost.

Calculation assumptions

Max. boost capability:	250%s
Δ I_{Boost} (max.) to I_N (100%) = 50%:	I_N x 1.5
I_{Out} in normal operation, 80%:	I_N x 0.8

Calculated values

t_{Boost}:	5 s
$t_{Recovery}$:	37.5 s

Calculation example

$$T_{Boost} = \frac{250\ \%s}{150\% - 100\%} = 5s$$

$$T_{Recovery} = \frac{250\ \%s\ x\ 3}{|80\% - 100\%|} = 37.5s$$

4.2 U/I operation

If the DC output voltage of the power supply is driven into the voltage range <21 to ≥12 VDC on the load side, the power supply switches to U/I operation. The DC load power supply follows the U/I output characteristic. In U/I operation, the permanent power consumption is limited to 100%.

The three-color LED simultaneously displays the detected operating state to the DC load power supply, LED DC OK (red) is off and the dry switching contact (13/14) is open (see 2.4.1 "Indication").

4.3 HICCUP operation

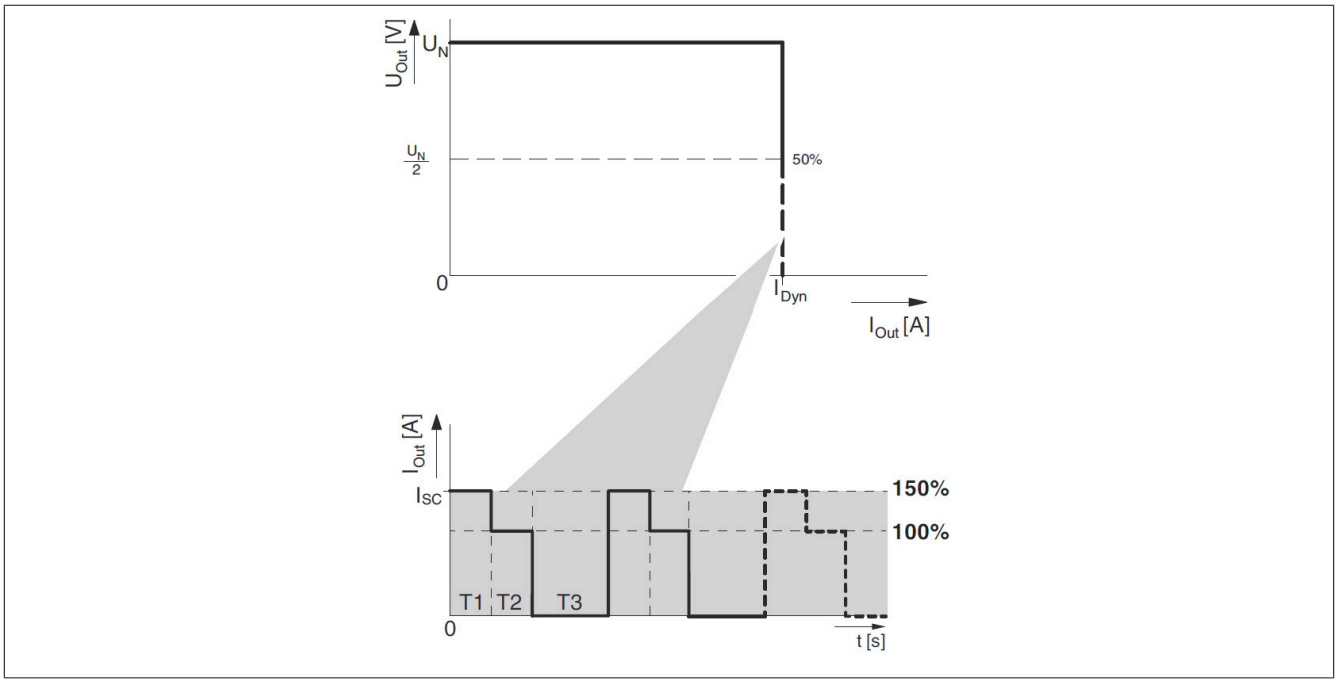
If the DC voltage on the output side drops below the threshold ($U_N/2$ = 24 VDC), for example due to a load-side fault cause, HICCUP operation begins.

In HICCUP operation, the power supply attempts to restore the DC load power supply on the output side. The characteristic of the HICCUP output curve reduces the thermal load of the output-side connecting cables due to permanent overload.

This procedure is repeated until the cause of the current increase, e.g. due to overload or short circuit, has been eliminated.

The power supply then switches the DC output back on, and the DC load is supplied.

The three-color LED simultaneously displays the detected operating state for the DC load power supply, SHORT (red) or I_{Out} > 90% (yellow), (see 2.4.1 "Indication").



Legend:

Name	Value	HICCUP description
I_{SC}	Max. 7.5 A	Maximum output current (short-circuit current)
T1	5 s	Pulse time (ON) at I_{SC} (150%)
T2	5 s	Pulse time (ON) at IN (100%)
T3	10 to 12 s	Variable recovery time (OFF)

5 Primary fuse protection and connection

The power supply must be installed in accordance with the regulations in EN 61010. It must be possible to disconnect the power supply from outside via a suitable disconnect device. Line protection on the primary side is suitable for this purpose, for example (see 2.1.3 "Input protection").

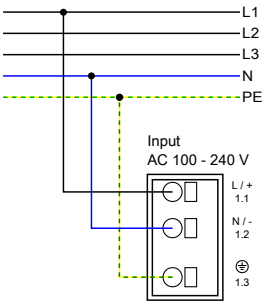
5.1 1AC mains power supply

Information:

Observe the maximum permissible input voltage.

The power supply unit is approved for connection to TN, TT and IT (PE) power systems with a maximum phase-to-phase voltage of 240 VAC.

Schematic diagram, single-phase fuse protection



5.2 3AC mains power supply (2-phase operation)

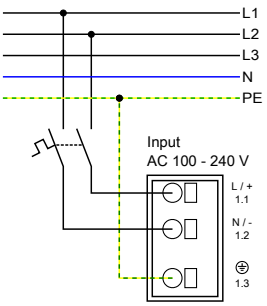
Danger!

Dangerous voltage

When operating the power supply unit on a three-phase power system, observe the maximum permissible phase-to-phase voltage (see 2.1 "Technical data" → Input data).

The primary-side fuse protection for 2-phase operation must be provided for all poles.

Schematic diagram, 2-phase fuse protection



5.3 DC mains power supply

Gefahr!

Dangerous voltage

When operating the power supply unit on a DC mains power supply, observe the maximum permissible input voltage (see 2.1 "Technical data" → Input data).

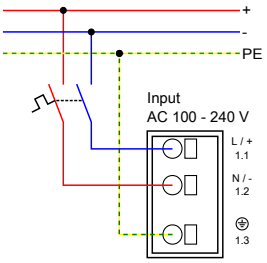
The primary-side fuse protection for DC operation must be provided for all poles.

Information:

Damage possible due to incorrect fuse protection

In DC operation, only use fuses that are approved for DC voltages.

Schematic diagram, 2-phase fuse protection



6 Connection variants

Depending on the purpose of the power supply, the DC output side can be connected in different connection variants.

A distinction is made between the following purposes:

- Increasing power
- Parallel operation

6.1 Increasing power

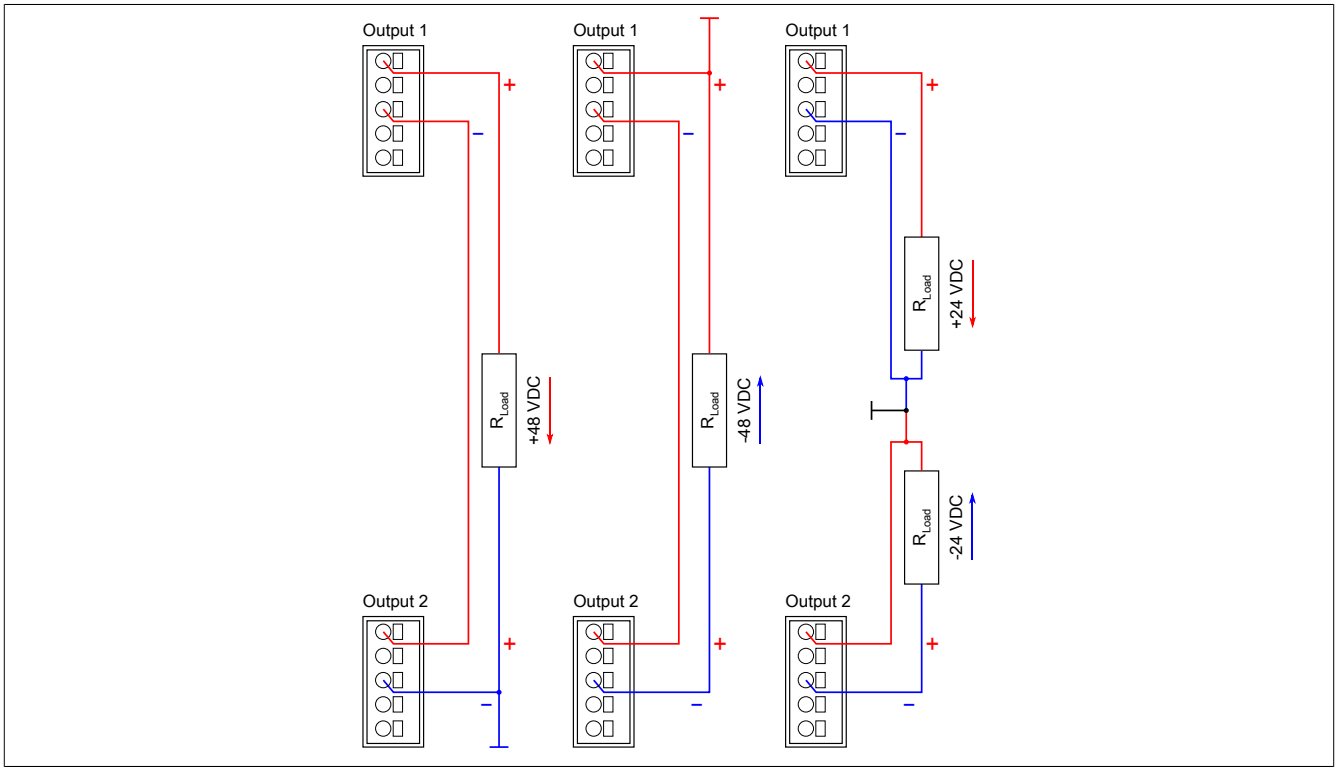
Depending on the application, the power is increased either by connecting 2 power supplies in series or in parallel.

6.1.1 Series operation

To increase the DC output power depending on the output voltage, 2 power supplies must be connected in series operation. Only power supplies of the same type and power rating with identical configurations can be used for this.

The following DC output voltage potentials are possible depending on the common output-side ground reference point of the power supplies:

- +48 VDC
- -48 VDC
- ±24 VDC

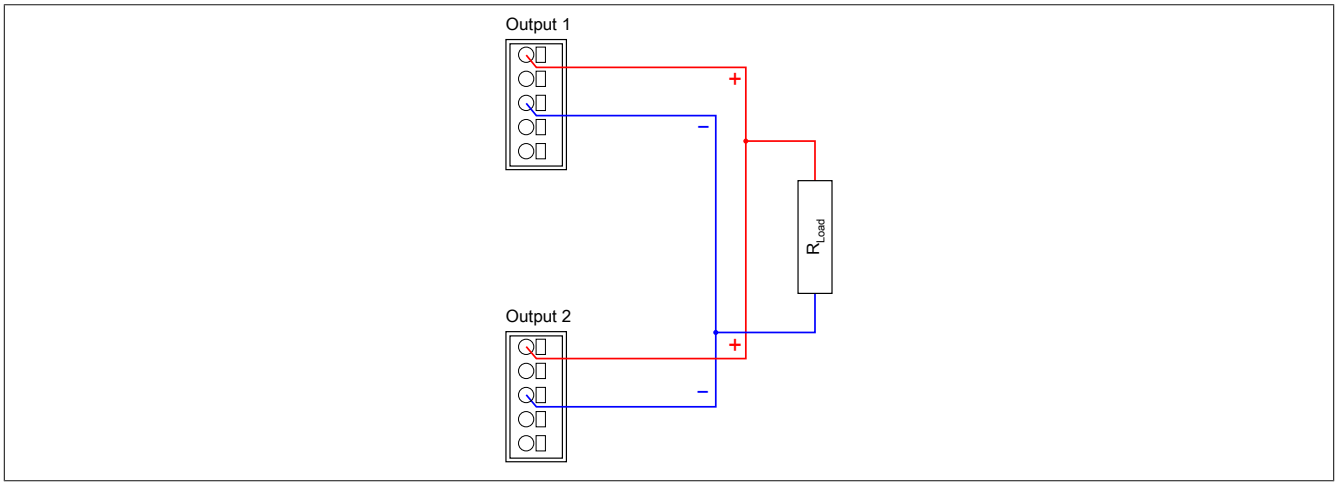


6.1.2 Parallel operation

With n DC outputs of the power supplies connected in parallel, the output current is increased to n x I_N. The parallel connection to increase the power is used for the expansion of existing systems. Parallel connection of power supplies is useful if the single power supply does not cover the current consumption of the most powerful consumer.

Information:

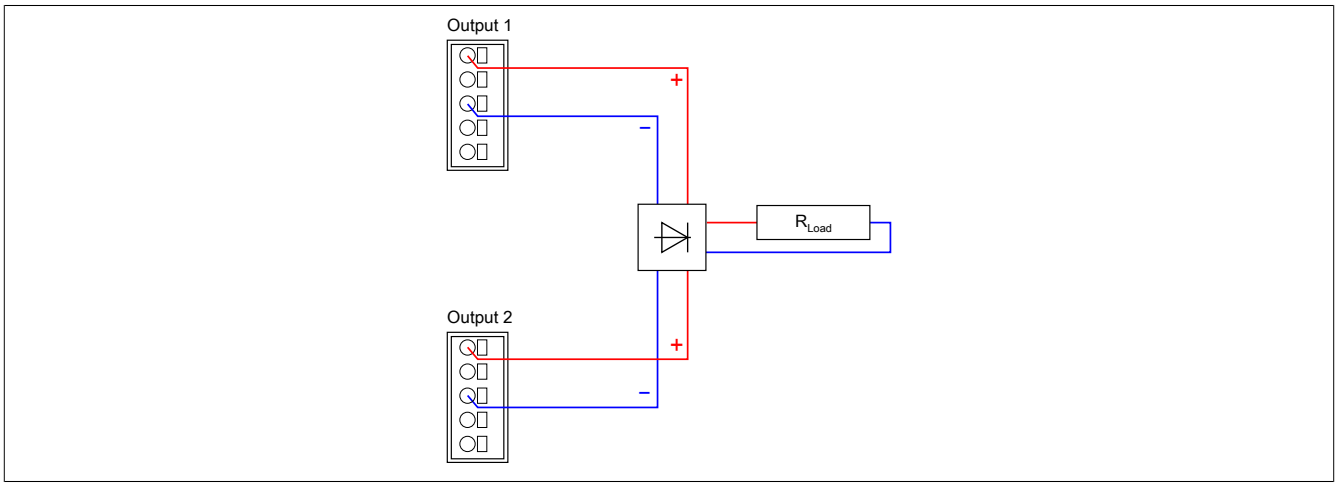
Basic requirements apply to the parallel operation of power supplies. For additional information, see 6.3 "Basic requirements for parallel operation (power increase, redundancy operation)".



6.2 Redundant operation

Redundant circuits are suitable for the DC supply of systems and system parts that place particularly high demands on operational reliability. If the DC load supply should be provided with 1+1 redundancy, it is necessary to use power supplies of the same type and power rating with identical configurations.

In the event of a fault, it must be ensured that a single power supply can provide the entire required output power of the DC load to be supplied. The output line required for normal operation is therefore provided by 2 power supplies connected in parallel on the output side. In normal operation, each power supply is then loaded at 50%.



6.3 Basic requirements for parallel operation (power increase, redundancy operation)

The following rules must be observed to ensure proper parallel operation:

DC output voltage: On each power supply in no-load operation, the DC output voltage must be set so that an identical voltage value is present. If necessary, voltage drops occurring with long line lengths must be taken into account.

Line length: To ensure symmetrical loading of the power supplies, the connecting cables to the DC load power supply must have identical line lengths.

Cable cross sections: The connecting cables to the DC load power supply must be designed for the maximum summation current of all power supplies. This is equally true for redundant operation, where the single power supply carries only 50% of the DC load.

Ambient conditions: The installation location of the power supplies must be selected so that identical ambient conditions prevail. Especially when the power supplies are installed at different installation locations. Large temperature differences between installation locations have a negative effect on the operating points of the power supplies. The operating behavior of the power supplies is then no longer the same.

Information:

If more than 2 power supplies are connected in parallel for the required power increase, separate fuse protection of the DC outputs is recommended. Appropriate circuit breakers must be used for this. Alternatively, the DC outputs are decoupled from each other using redundancy modules (active or passive).

7 Disposal and recycling

	**Ensure correct disposal of electronic components.** Do not dispose of the power supply unit as household waste. Applicable national standards and regulations must be observed.
	**Ensure correct disposal or recycling.** Packaging material that is no longer needed must be disposed of as household waste or recycled. Applicable national standards and regulations must be observed.