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STEP-UPS/24DC/24DC/3

Uninterruptible power supply

Data sheet
105623_en_00

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1 Description

Uninterruptible power supply units continue to deliver power even in the event of mains breakdowns or failures.

The product described here is an uninterruptible power supply (UPS) with integrated battery module. In the event of mains breakdowns or failures, it switches to battery operation without interruption so that connected loads continue to be consistently supplied.

Features

Maximum energy efficiency

- 98% efficiency in mains operation with charged battery module

Comprehensive signaling

- LED indicators, switching outputs

Integrated battery module

- High power density due to lithium polymer technology



Make sure you always use the latest documentation.
It can be downloaded from the product at phoenixcontact.net/products.

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3 Ordering data

Description	Type	Order No.	Pcs. / Pkt.
Uninterruptible power supply with integrated battery module. The STEP-BAT/LIPO/18.5 DC/1.4 AH battery module can be re-ordered separately.	STEP-UPS/24DC/24DC/3	2868703	1
Accessories	Type	Order No.	Pcs. / Pkt.
Replacement battery module, lithium polymer, 18.5 V DC, 1.4 Ah.	STEP-BAT/LIPO/18.5DC/1.4AH	2320364	1
DIN rail power supply unit 24 V DC/4.2 A, primary switched-mode, 1-phase.	STEP-PS/ 1AC/24DC/4.2	2868664	1



Our range of accessories is being continually extended, our current range can be found in the download area.

4 Technical data

Input data

Nominal input voltage	24 V DC
Nominal input voltage range	22.5 V DC ... 29.5 V DC
Max. current consumption ($I_{IN} = I_{CHARGE} + I_{BOOST}$)	4.7 A
No load ($I_{CHARGE} = 0, I_{OUT} = 0$)	< 30 mA
Charging process ($I_{CHARGE} = \text{max.}, I_{OUT} = 0$)	< 0.5 A
Fixed connect threshold	< 22.5 V
Variable connect threshold	1 V / 1 s
Typical response time	< 0.5 s
Input fuse, integrated	7 A (slow-blow, internal)

General output data

Nominal output voltage	24 V DC
Output current	3 A (0°C ... 40°C)
Output current limit	In mains mode according to connected upstream current limiting device > 4 A (Battery operation)
Connection in parallel	No
Connection in series	No

Output data (mains operation)

Nominal output voltage	24 V DC
Output voltage range	22.5 V DC ... 29.5 V DC ($U_{OUT} = U_{IN} - 0,3 \text{ V DC}$)
Nominal output current I_N	3 A (0°C ... 40°C)
Max. output current	ax. 4 A (0 °C ... 35°C)
Power dissipation (mains mode)	
Idle	0.6 W
Nominal Load	2 W
I_{Max}	4.4 W
Efficiency ($I_{CHARGE} = 0, I_{OUT} = I_N$)	> 98 % (Mains operation, with charged power storage)

Output data (battery operation)

Nominal output voltage	24 V DC
Output voltage range	23 V DC ... 26.5 V DC ($U_{OUT} = U_{IN (t-1)}$)
Nominal output current I_N	3 A (0°C ... 40°C)
Max. output current	max. 4 A (0 °C ... 35°C)
Power dissipation (battery operation)	
Idle	1.1 W
Nominal Load	3.8 W
I_{Max}	10 W
Efficiency ($I_{CHARGE} = 0, I_{OUT} = I_N$)	> 95 % (Battery operation)

Battery module

Nominal voltage U_N	18.5 V DC
Memory medium	Lithium polymer
End-of-charge voltage	18.5 V DC ... 21 V DC
Nominal capacity	1400 Ah
Charge current	400 mA
Battery presence check (time interval)	60 s
Quality check of battery	Yes, every time it is charged and cyclically once a month
Deep discharge protection	< 15 V DC
Buffer period	50 min (1 A) 25 min (2 A) 17 min (3 A)
Rotary selector switch	Service ∞ 5 min. 10 min. 20 min.

Status and diagnostic indicator POWER IN OK

Status indication	LED (green) , static on
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Status and diagnostic indicator overload

Status indication	LED (green) , flashing
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Status and diagnostic indicators/signal outputs Battery Mode

Switching output	Transistor
Status indication	LED (yellow) , static on

Status and diagnostic indicators/signal outputs Battery Charge

Switching output	Transistor
Status indication	LED (yellow) , flashing

Status and diagnostic indicators/signal outputs Alarm

Switching output	Transistor
Status indication	LED (red) , static on

Status and diagnostic indicator Service/Battery Error

Status indication	LED (red) , flashing
-------------------	------------------------

Remote control

Version 1 : Output R1 to input R2	Plug-in bridge
Version 2 : Input R2	+ 24 V DC
Input current R2	20 mA

Housing

Housing material	polycarbonate
Foot latch material	Plastic POM
Dimensions W / H / D	108 mm / 90 mm / 61 mm
Mounting position	horizontal DIN rail NS 35, EN 60715

General data

Weight	0.45 kg
MTBF	> 1401000 h

Security

Degree of protection	IP20
Protection class	III

Input connection data

Connection method	Screw connection
Conductor cross section, solid	0.2 mm ² ... 2.5 mm ²
Conductor cross section, stranded	0.2 mm ² ... 2.5 mm ²
Conductor cross section AWG/kcmil	24 ... 12
Stripping length	6.5 mm
Screw thread	M3
Tightening torque	0.6 Nm ... 0.8 Nm

Output connection data

Connection method	Screw connection
Conductor cross section, solid	0.2 mm ² ... 2.5 mm ²
Conductor cross section, stranded	0.2 mm ² ... 2.5 mm ²
Conductor cross section AWG/kcmil	24 ... 12
Stripping length	6.5 mm
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Signal connection data

Conductor cross section, solid	0.2 mm ² ... 2.5 mm ²
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Stripping length	6.5 mm
Screw thread	M3
Tightening torque	0.5 Nm ... 0.6 Nm

Ambient conditions

Ambient temperature (operation)	0 °C ... 40 °C
Ambient temperature (storage/transport)	-20 °C ... 45 °C
Max. permissible relative humidity (operation)	≤ 95 % (at 25 °C, no condensation)
Vibration (operation)	< 15 Hz, amplitude ±2.5 mm (according to IEC 60068-2-6) 15 Hz ... 150 Hz, 2.3g, 90 min.
Shock	30 g in each direction, according to IEC 60068-2-27
Pollution degree in acc. with EN 50178	2
Climatic class	3K3 (in acc. with EN 60721)

Standards

Electrical safety (of information technology equipment)	EN 60950-1/VDE 0805 (SELV)
Electronic equipment for use in electrical power installations	EN 50178/VDE 0160 (PELV)

Approvals

UL approvals	UL Listed UL 508 UL/C-UL Recognized UL 60950
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Current approvals can be found for the product in the download area.

Conformance with EMC Directive 2004/108/EC**Noise immunity according to EN 61000-6-2**

	EN 61000-6-2 requirement	Tested
Electrostatic discharge EN 61000-4-2		
Housing contact discharge	4 kV (Test intensity 2)	6 kV (Test intensity 3)
Housing air discharge	8 kV (Test intensity 3)	8 kV (Test intensity 3)
Comments	Criterion B	Criterion A
Electromagnetic HF field EN 61000-4-3		
Frequency range	80 MHz ... 1 GHz	80 MHz ... 1 GHz
Test field strength	10 V/m	10 V/m
Frequency range	1.4 GHz ... 2 GHz	1 GHz ... 2 GHz
Test field strength	3 V/m	10 V/m
Frequency range	2 GHz ... 2.7 GHz	2 GHz ... 3 GHz
Test field strength	1 V/m	10 V/m
Comments	Criterion A	Criterion A
Fast transients (burst) EN 61000-4-4		
Input	2 kV (Test intensity 3 - asymmetrical)	2 kV (Test intensity 3 - asymmetrical)
Output	2 kV (Test intensity 3 - asymmetrical)	2 kV (Test intensity 3 - asymmetrical)
Signal	1 kV (Test intensity 3 - asymmetrical)	2 kV (Test intensity 4 - asymmetrical)
Comments	Criterion B	Criterion A
Surge current loads (surge) EN 61000-4-5		
Input	0.5 kV (Test intensity 1 - symmetrical) 0.5 kV (Test intensity 1 - asymmetrical)	1 kV (Test intensity 2 - symmetrical) 2 kV (Test intensity 3 - asymmetrical)
Output	0.5 kV (Test intensity 1 - symmetrical) 0.5 kV (Test intensity 1 - asymmetrical)	1 kV (Test intensity 2 - symmetrical) 2 kV (Test intensity 3 - asymmetrical)
Signal	1 kV (Test intensity 2 - asymmetrical)	1 kV (Test intensity 2 - asymmetrical)
Comments	Criterion B	Criterion A
Conducted interference EN 61000-4-6		
Input/Output/Signal	asymmetrical	asymmetrical
Frequency range	0.15 MHz ... 80 MHz	0.15 MHz ... 80 MHz
Voltage	10 V (Test intensity 3)	10 V (Test intensity 3)
Comments	Criterion A	Criterion A

Criterion A

Normal operating behavior within the specified limits.

Criterion B

Temporary impairment to operational behavior that is corrected by the device itself.

Emitted interference in acc. with EN 61000-6-3

Radio interference voltage in acc. with EN 55011

EN 55011 (EN 55022) Class B, area of application: Industry and residential

Emitted radio interference in acc. with EN 55011

EN 55011 (EN 55022) Class B, area of application: Industry and residential



All technical specifications are nominal values and refer to a room temperature of 25°C and 70% relative humidity at 100 m above sea level.

5 Intended use

The uninterruptible power supply features IP20 protection and is intended for installation in housing. It is suitable for the uninterruptible power supply of industrial applications. The technical specifications must therefore be taken into consideration and observed.

6 Structure

6.1 Device elements

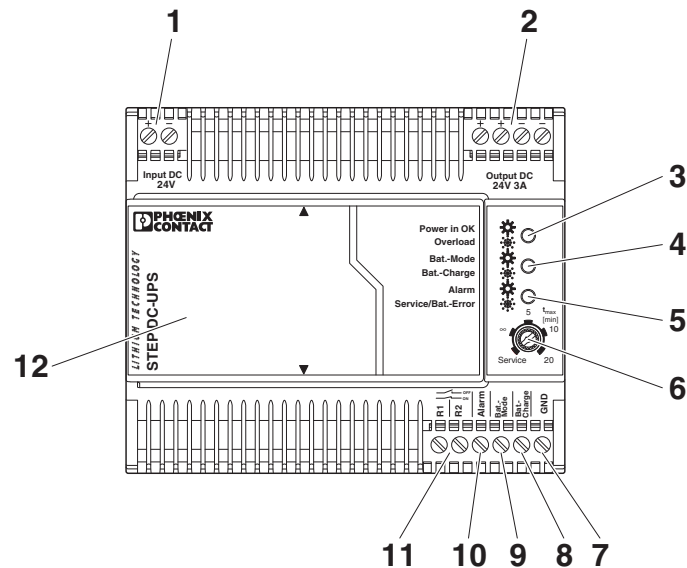
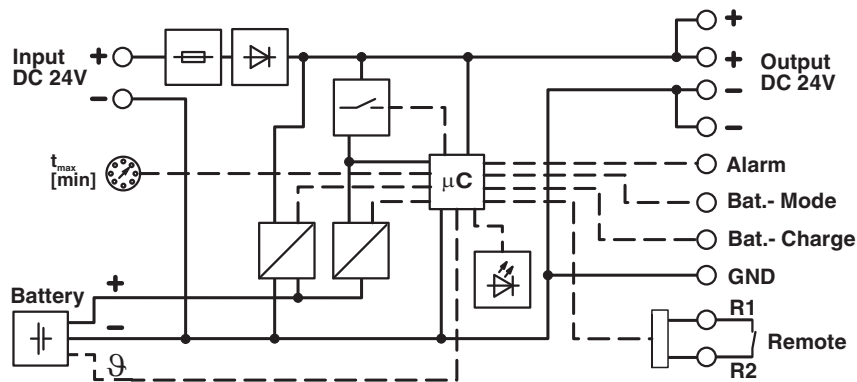











Figure 1 Device elements

No.	Device elements
1	Connection terminal blocks for DC input
2	Connection terminal blocks for DC outputs
3	Green LED indicator: Power in OK (mains operation), Overload (overload at output)
4	Yellow LED indicator: Battery-Mode (battery operation), Battery-Charge (battery charging)
5	Red LED indicator: Alarm, service/battery error
6	Rotary selector switch for setting service mode and the buffer time
7	GND, reference potential
8	Active signal output battery charge
9	Active signal output battery mode
10	Active signal output alarm
11	Battery mode remote shutdown
12	Battery module

6.2 Block diagram



Element	Meaning
	Fuse
	Decoupling
	Switch
	Microprocessor
	Charging unit
	LED
	Temperature sensor
	Selector switch
	Battery module

7 Assembly

7.1 Unpacking

Before mounting the uninterruptible power supply, it must be checked for damage:

- Take the device out of its packaging.
- Check the device for any damage sustained during transport.
- Retain the package slip for future use.
- Dispose of packaging in an environmentally-friendly way.

7.2 Mounting the uninterruptible power supply



The uninterruptible power supply is intended for installation in a distributor box or control cabinet.



The uninterruptible power supply is designed for convection cooling. Maintain a minimum distance from other devices in order to ensure convection cooling.

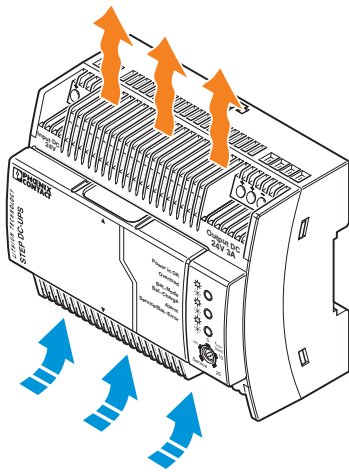
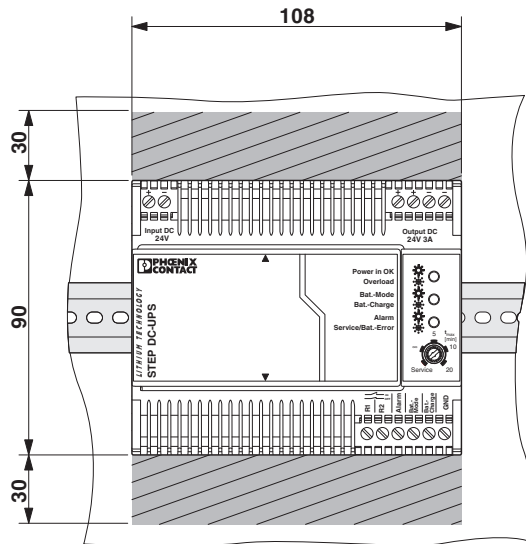


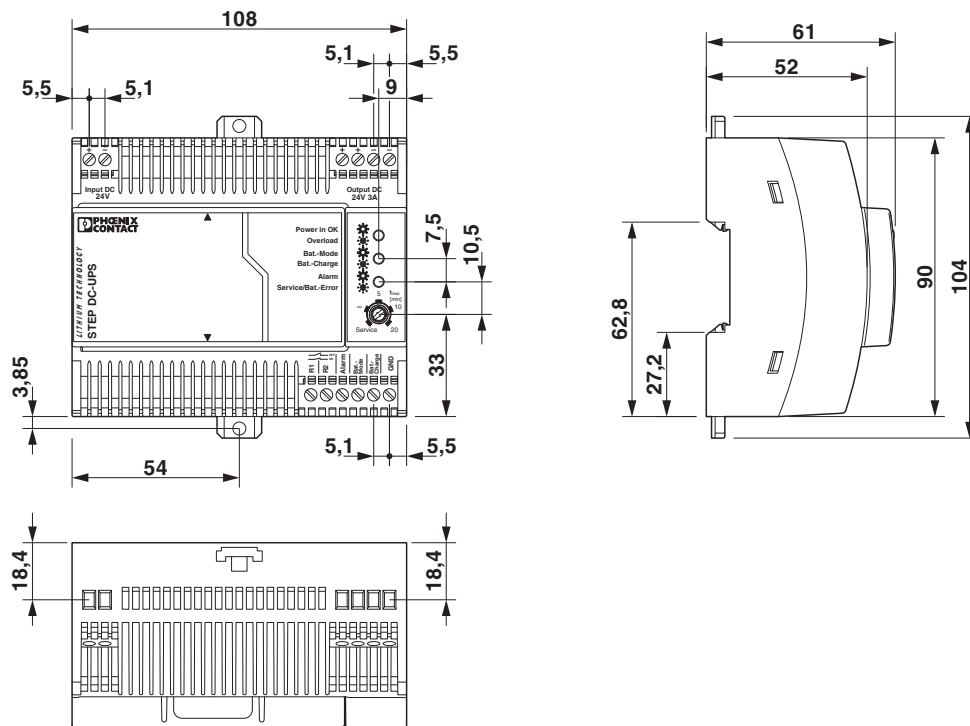
Figure 2 Convection

Please note the following before mounting the uninterruptible power supply:

- The minimum distance from other devices that must be observed in order to ensure convection cooling is: 30 mm vertically, 0 mm horizontally



- The device dimensions



7.3 Mounting on a DIN rail

The uninterruptible power supply can be installed on all 35 mm DIN rails according to EN 60175. Simply snap the UPS directly onto the DIN rail.

If the UPS is to be fixed directly onto an even surface, press the orange base latch upward and down. Place a washer between the pulled out base latch and the even surface (maximum outside diameter of 8.5 mm, maximum thickness of 1.3 mm, e.g., spring washer for M4 according to DIN 127-B or toothed lock washer according to DIN 6797).

Then secure the device with two screws (maximum thread diameter of 4 mm, maximum head diameter of 8.5 mm).

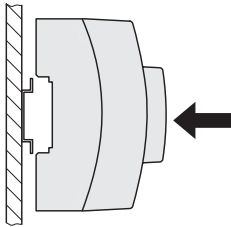


Figure 3 Mounting on a DIN rail

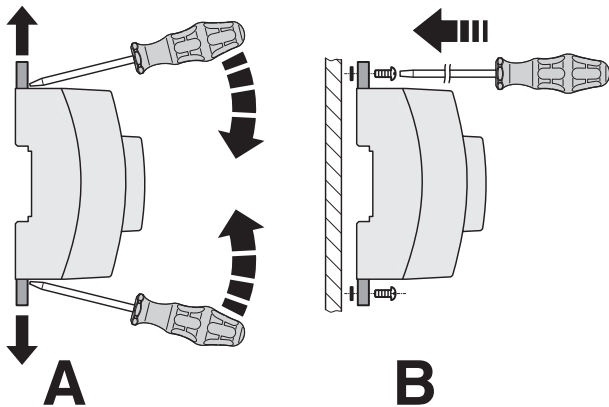


Figure 4 Wall mounting

7.4 Mounting positions

For the normal mounting position of the UPS, mount the device so that the input terminal blocks are at the bottom and the output terminal blocks at the top. Alternative mounting positions are possible.



There is no voltage/position-dependent derating.

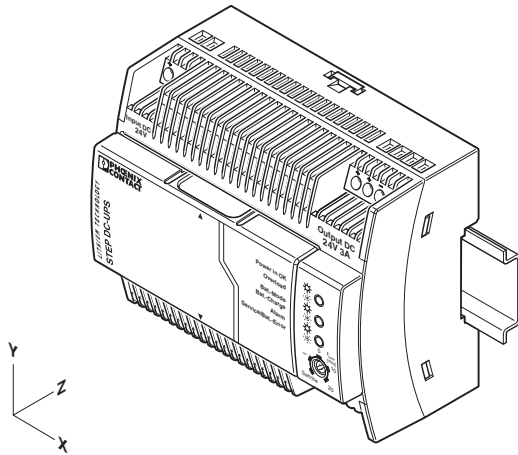


Figure 5 Normal mounting position

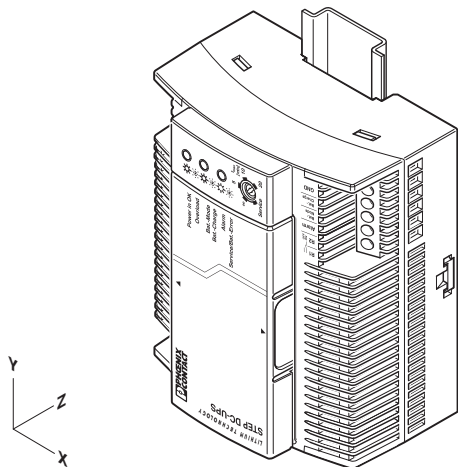


Figure 6 Rotated mounting position 90° X-axis

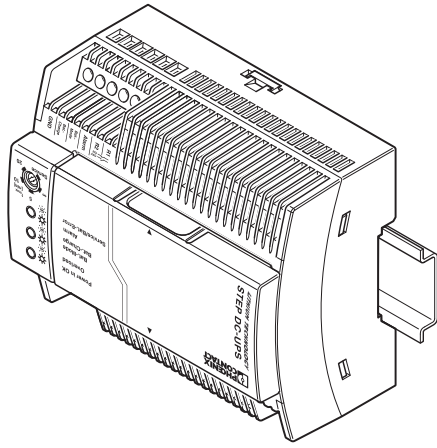


Figure 7 Rotated mounting position 180° X-axis

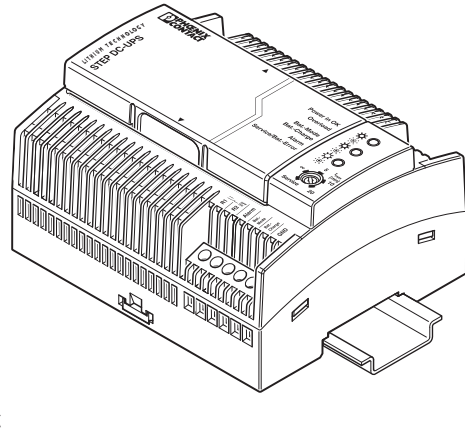


Figure 9 Rotated mounting position 270° Z-axis

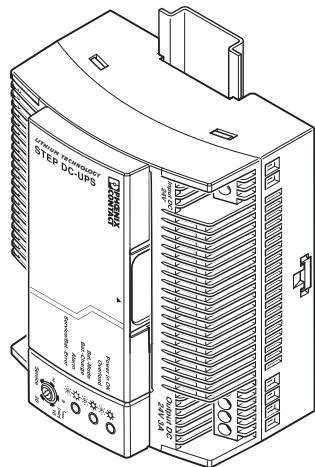


Figure 8 Rotated mounting position 270° X-axis

8 Installation

8.1 Safety regulations and installation notes

**WARNING: risk of electric shock!**

Only qualified specialist personnel may install, start up, and operate the device. Observe the national safety and accident prevention regulations.

Mains connection must be performed by specialist personnel and protection against electric shock ensured.

Cover termination area after installation in order to avoid accidental contact with live parts (e.g., by installing in a control cabinet).

Protect the device against ingress by foreign bodies, e.g., paper clips or metal parts.

**WARNING:**

Make sure that all supply lines are sufficiently dimensioned and have sufficient fuse protection.

Make sure that all output cables are dimensioned accordingly for the maximum device output current or have separate fuse protection.

**NOTE:**

Never open or repair the device yourself.

Internal fuses will only blow in the event of device malfunction. Do not modify or attempt to repair the device. Send the device to the factory for examination.



Installation of the uninterruptible power supply must correspond to EN 60950 regulations.

8.2 Installation of individual components

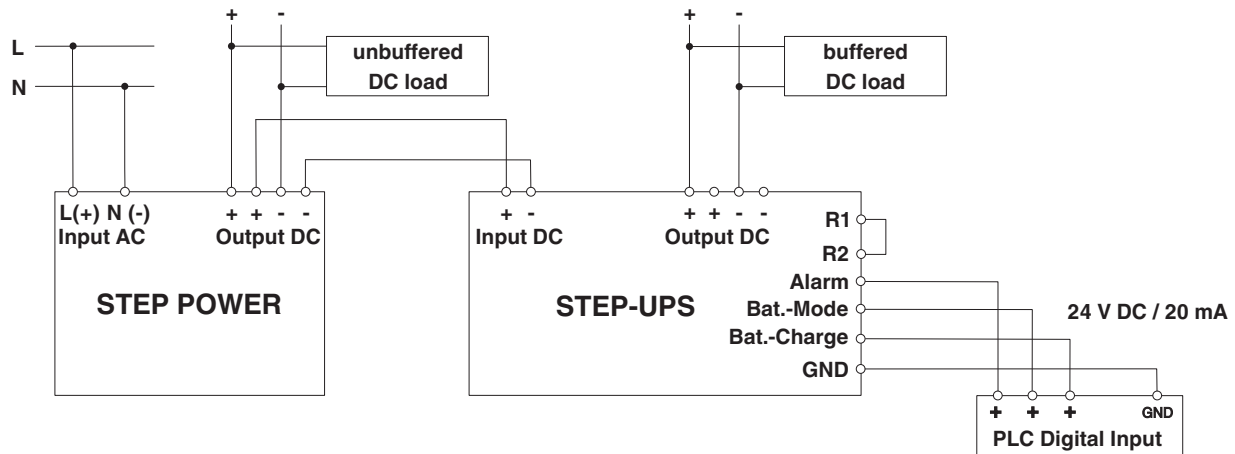


Figure 10 Schematic design



The image is a schematic representation of the design and does not contain all parts. Observe the installation instructions.

Power supply

Use a current-limited source (e.g., STEP POWER power supply) or connect a suitable fuse upstream.



CAUTION:

It must be possible to disconnect the power supply unit connected upstream (e.g., STEP POWER) from the outside (e.g., by line protection on the primary side).



Use copper cables with an operating temperature $> 75^{\circ}\text{C}$ (ambient temperature $< 55^{\circ}\text{C}$) and $> 90^{\circ}\text{C}$ (ambient temperature $< 75^{\circ}\text{C}$).



To ensure symmetrical current distribution, all cable connections from the power supply unit to the busbar must be the same length and have the same conductor cross section.

STEP-UPS uninterruptible power supply

- Input: the input is supplied with 22.5 ... 29.5 V DC.
- Output: in the event of mains interruption or failure, the connected DC load is supplied with voltage without interruption.
- Battery module: the required power is made available by the integrated battery module.
- Signal R1, R2: activation/deactivation of the UPS functionality

8.3 Connection and protection

Input and protection of the primary side

Connect the supply lines to the input DC +/- screw connections.

Therefore use a current-limited source (e.g., STEP POWER) or a suitable fuse.

All cables must have large cross sections in order to keep voltage drops as small as possible.

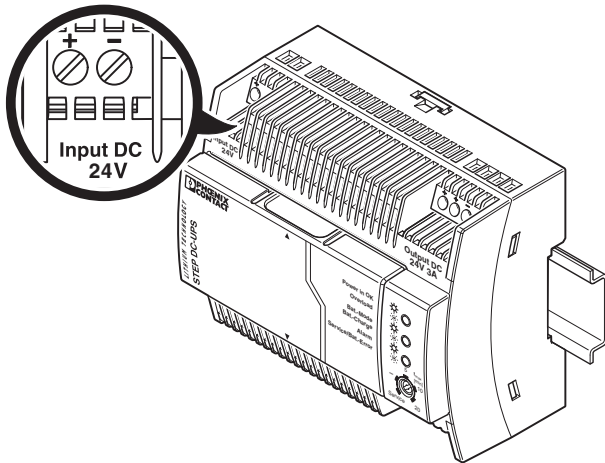


Figure 11 Input



If loads must not be supplied in the event of a mains breakdown or failure, they must be connected directly to the output of the power supply as unbuffered DC load.

Output and protection on the secondary side

Connect the output cables to the output DC screw connections.

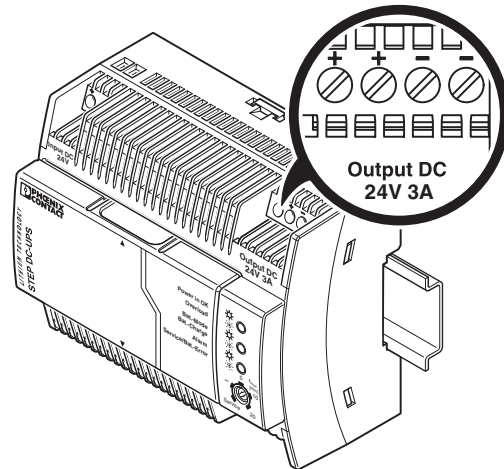


Figure 12 Output

9 Operating behavior

9.1 Mains operation

In mains operation (DC input voltage present), the load connected to the output of the uninterruptible power supply is supplied by the mains.

The output voltage corresponds to the applied input voltage reduced by 0.3 V. The input voltage is monitored and supplied by the UPS.

9.2 Battery operation

In battery operation, the load connected to the DC output of the uninterruptible power supply is supplied by the battery module.

The output voltage in battery operation corresponds to the previous output voltage.

9.3 Charging the battery module

In mains operation of the uninterruptible power supply, supplying the load connected to the DC output of the UPS is of paramount importance. The battery module is charged using the power reserve of power supply.



The charging time of the battery module depends on the capacity and the power supplied by the power supply. The maximum charging time can last up to several hours.

9.4 Temperature response

At ambient temperatures from 0°C to 35°C, the uninterruptible power supply provides the maximum output current. At ambient temperatures upwards of 35°C, the output power must be reduced by 4% per Kelvin temperature increase (temperature-dependent derating).

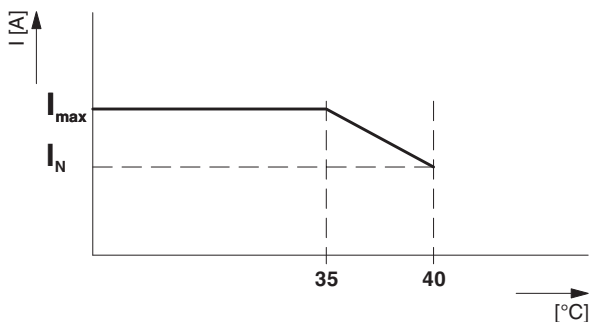


Figure 13 Temperature response

10 Signaling

Various LED indicators are available for visual function monitoring of uninterruptible power supplies. Moreover, active signal outputs can be used to forward this data to a higher-level control system.

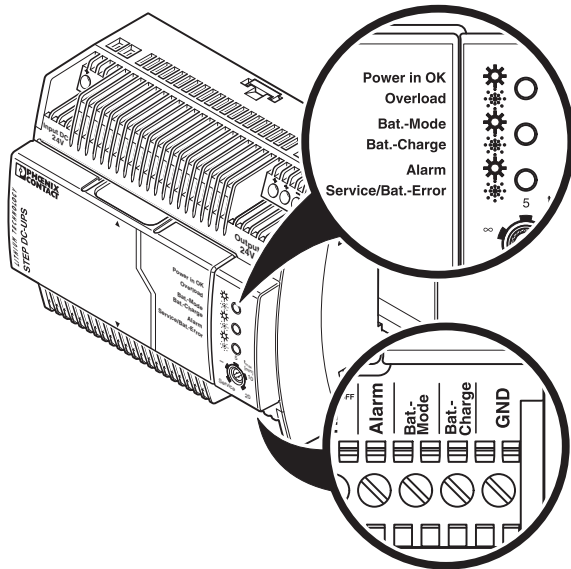


Figure 14 LED indicators and signal outputs

LED indicators and signal outputs

For UPS signaling and the corresponding states, please refer to the table.

Status LED			Switching output			Note
Green	Yellow	Red	Bat.-Mode	Bat.-Charge	Alarm (active low)	
●	●	●	OFF	OFF	ON	System initialization (3 sec.)
●	○	○	OFF	OFF	ON	Normal operation, DC-OK
● 2 Hz	○	○	OFF	OFF	ON	Overload at the output
●	● 1 Hz	○	OFF	ON	ON	Battery is charging
●	● 1 Hz	○	OFF	ON	ON	Waiting for valid temperature range (LED flashing: Pulse-Pause-Ratio: 0,25/0,75)
●	○	● 2 Hz	OFF	OFF	OFF	Quality check fail / battery error / no battery
● 2 Hz	○	● 2 Hz	OFF	OFF	OFF	Overload / Quality check fail
○	●	○	ON	OFF	ON	Battery mode, buffering the load
○	●	●	ON	OFF	OFF	Warning, battery voltage low (min. 90 s in operation)
●	○	● 1 Hz	OFF	OFF	ON	Service mode for battery change
○	○	○	OFF	OFF	ON	Remote off

... Hz LED flashing
 LED on
 LED off

Figure 15 LED indicators and signal outputs

Active signal outputs

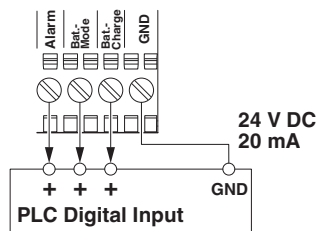


Figure 16 Active signal outputs

11 Operation

11.1 Change battery module

To change the battery module, select service mode via the rotary selector switch on the front of the UPS.

Remove battery module

Select service mode.

Press the locking buttons on the battery module and remove the module.

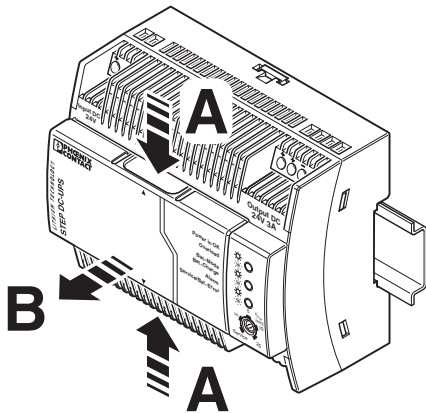


Figure 17 Remove battery module



The alarm signal output is activated if the battery is not removed in service mode!

Insert battery module

Correctly position and insert the battery module into the UPS until it audibly snaps in.

Set the buffer time.

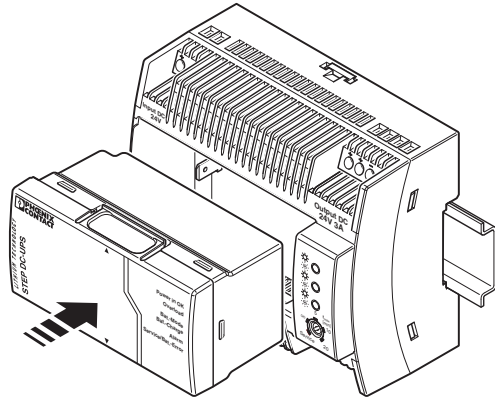


Figure 18 Insert battery module

11.2 Setting the buffer time

You can set the time for exiting battery mode via the rotary selector switch on the front of the device. For this purpose use a screwdriver.

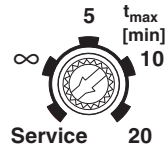


Figure 19 Buffer time selector switch

t_{\max} [min] setting	Meaning
5, 10, 20	The UPS switches off after the set buffer time.
∞ (unlimited, delivery state)	Buffering with the total stored power

Using the chart select the resulting values for the buffer time and discharge current.

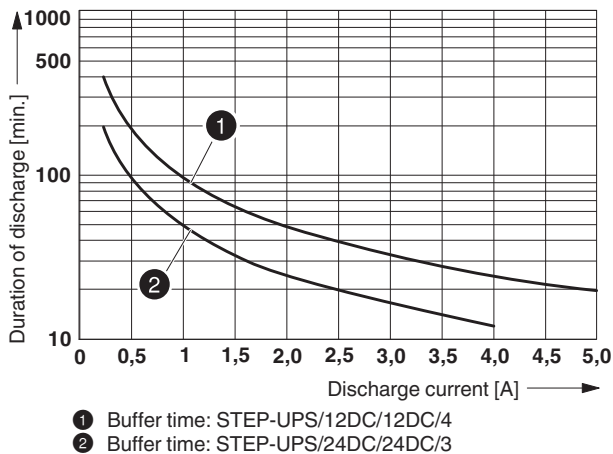


Figure 20 Buffer time/discharge current diagram

11.3 Remote control (contact R1, R2)

Battery operation of the UPS can be switched on and off via a signal to contacts R1/R2. Shutdown can take place during mains operation or active battery operation.

Remote shutdown is deactivated

UPS in function (delivery state)

- The "R1" and "R2" terminal points are short circuited (delivery with plug-in bridge) OR 24 V DC is present at terminal point "R2".
- In the event of a voltage supply failure, the UPS switches over to battery mode.

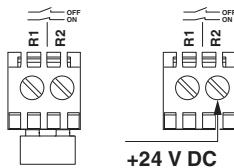


Figure 21 Remote shutdown is deactivated



NOTE:

In the event of a supply voltage failure, the UPS switches over to battery operation. The load connected to the DC output is supplied by the battery module.

11.4 Remote shutdown is activated

- Terminal points "R1" and "R2" are not short circuited and 0 V is applied at terminal point "R2".
- In the event of a voltage supply failure, the UPS does not switch over to battery mode. The device switches off.

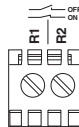


Figure 22 Remote shutdown active

Example 1

The remote shutdown can be used to suppress the buffering of selective machine shutdowns. In doing so, the auxiliary contact of the main switch is connected to R1 and R2 connection terminal blocks.

Example 2

End the buffering at a specific time (e.g., following shutdown of another machine part). Remote shutdown can be activated with a relay (N/C contact).

12 Removal

12.1 Removing the UPS

To dismantle from the EN DIN rail, press the orange base latch outward and pull the device off of the DIN rail.

In the case of wall mounting, loosen the screws and press the base latch inwards again.

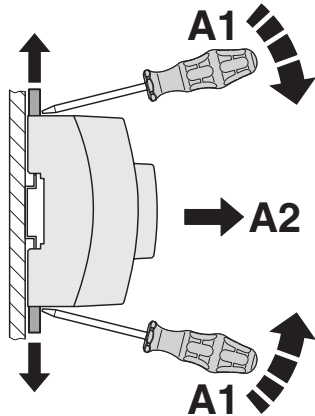


Figure 23 Removal

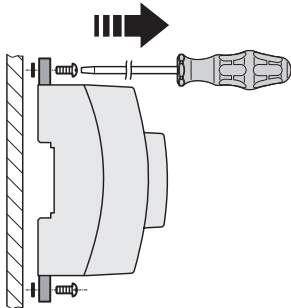


Figure 24 Removal

12.2 Notes on disposal



Do not dispose of the UPS and battery module with household waste. They should be disposed of in accordance with the currently applicable national regulations.



You can return old batteries and accumulators to Phoenix Contact.