

# BECKHOFF New Automation Technology

Documentation | EN

## PS1011-2420-0000

Power supply 24 V DC, 20 A, 1-phase, AC 100-240 V





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# 1 Overview

## PS1011-2420-0000 | Power supply 24 V, 20 A, 1-phase



- AC 100-240V wide-range input
- Active power factor correction (PFC)
- Width only 59mm
- Efficiency of up to 95.3%
- Safe hiccup overload mode
- Full power between -25°C and +55°C
- DC-OK relay contact

The PS1011-2420-0000 is a 1-phase 24 V power supply with an output current of 20 A and an output power of 480 W.

On the input side, the device features a wide-range input, active power factor correction (PFC) and inrush current limiting.

The output operates according to the UI characteristic curve and switches to the safe hiccup mode in case of overload/short-circuit.

The power supply is part of the PS1000 family and has a width of 59 mm. A DC OK LED and a potential-free relay contact monitor the status of the output voltage.

### Overview of technical data <sup>\*)</sup>

Overview of technical data	PS1011-2420-0000
Output voltage	DC 24V (nominal factory setting 24.1V)
Adjustment range	24 - 28V
Output current	20.0 - 17.1A (amb. below +55°C) 12.5 - 10.7A (amb. at +70°C) Linear load reduction between +55°C and +70°C
Input voltage AC	AC 100-240V ±10%
Mains frequency	50-60Hz ±6%
Input current AC	4.3 / 2.3A at 120 / 230Vac
Power factor	0.99 / 0.97 at 120 / 230 Vac
Efficiency	94.2 / 95.3% at 120 / 230Vac
Temperature range	-25°C to +70°C
Dimensions (W x H x D)	59 x 124 x 127mm (without DIN rail)
Weight	810 g
Approvals/markings	cULus IECEE CE, EAC, UKCA

\*) All values typical for 24V, 20A, 230Vac, 50Hz, +25°C ambient temperature and after a warm-up time of five minutes, unless otherwise stated.

## 2 Foreword

### 2.1 Notes on the documentation

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#### Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation at any time and without prior announcement.

No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

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#### Patent Pending

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents: EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702 with corresponding applications or registrations in various other countries.

#### Intended audience



This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.

It is essential that the documentation and the following notes and explanations are followed when installing and commissioning these components.

It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

## 2.2 Terminology and abbreviations

<b>PE and the earthing symbol</b> 	PE is the abbreviation for "protective earth" and has the same meaning as the earthing symbol 
<b>Earth, ground</b>	This document uses the term "earth" which is the same as the U.S. term "ground".
<b>T.b.d.</b>	Still to be defined, value or description will follow in due course.
<b>AC 230 V</b>	A value preceded by "AC" or "DC" represents a nominal voltage or a nominal voltage range. The nominal voltage or the nominal voltage range may be provided with tolerances. (e.g. AC 230 V $\pm 10\%$ ). The calculated total range then indicates the working range of the device.  Example: DC 12 V refers to a 12 V battery, regardless of whether it is fully charged (13.7 Vdc) or discharged (10 Vdc).
<b>230 Vac</b>	A value followed by the unit Vac or Vdc is an instantaneous value that does not contain any additional tolerances.
<b>50 Hz vs. 60 Hz</b>	Unless otherwise specified, AC 100 V and AC 230 V parameters are valid at a mains frequency of 50 Hz. AC 120 V parameters are valid for a mains frequency of 60 Hz.
<b>may</b>	A keyword indicating a choice without implied preference.
<b>shall</b>	A keyword indicating a mandatory requirement.
<b>should</b>	A keyword indicating a choice with a clearly preferred method of implementation.

## 2.3 Safety instructions

### Description of instructions

In this documentation the following instructions are used.  
These instructions must be read carefully and followed without fail!

#### **DANGER**

##### **Serious risk of injury!**

Failure to follow this safety instruction directly endangers the life and health of persons.

#### **WARNING**

##### **Risk of injury!**

Failure to follow this safety instruction endangers the life and health of persons.

#### **CAUTION**

##### **Personal injuries!**

Failure to follow this safety instruction can lead to injuries to persons.

#### **NOTE**

##### **Damage to environment/equipment or data loss**

Failure to follow this instruction can lead to environmental damage, equipment damage or data loss.

#### **Tip or pointer**

This symbol indicates information that contributes to better understanding.

### Intended use

This device is designed for installation in a housing and is intended for general professional use, for example in industrial control systems or office, communication and measuring equipment.

Do not use this power supply in installations where a malfunction could cause serious injury or danger to human life.

### Exclusion of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

### Personnel qualification

This description is only intended for trained specialists in control, automation and drive engineering who are familiar with the applicable national standards.

### Safety regulations

Please note the following safety instructions and explanations!  
Product-specific safety instructions can be found on following pages or in the areas mounting, wiring, commissioning etc.



**Safety instructions and installation requirements for the PS1011-2420-0000 power supply****⚠ DANGER****Danger of electric shock, fire, injuries, injuries resulting in death!**

- Do not use the power supply without proper grounding (protective conductor). Use the terminal at the input terminal strip for the earth connection, not one of the screws on the housing.
- Switch off the power supply before working on the device. Provide protection against unintentional re-connection.
- Ensure proper wiring by following all local and national regulations.
- Do not modify or attempt to repair the device.
- Do not open the device, as high voltages are present inside.
- Avoid foreign bodies entering the housing.
- Do not use the device in damp locations or in areas where moisture or condensation is likely to occur.
- Do not touch the device when it is switched on or immediately after it has been switched off. Hot surfaces can cause burns.

**● Further notes on installation requirements**

- I** This device contains no parts that require maintenance. If an internal fuse trips, this is due to an internal defect.
- If any damage or malfunction occurs during installation or operation, turn off the power supply immediately and return the device to the factory for inspection.
- Install the device in a housing that provides protection against electrical, mechanical and fire hazards.
- Install the device on a DIN rail according to EN 60715, with the input terminals at the bottom of the device.
- The device is designed for areas with a degree of pollution 2 in controlled environments. No condensation or frost is allowed.
- The device housing offers IP20 protection. The housing offers no protection against leaking liquids.
- The device insulation is designed to withstand surge voltages of overvoltage category III according to IEC 60664-1.
- The device is designed to meet the requirements of protection class I according to IEC 61140. Do not use the device without a proper PE connection (protective earth).
- The device is suitable for supply from TN, TT or IT networks. The continuous voltage between the input terminal and the PE potential must not exceed 300Vac.
- A disconnecter must be provided for the device input.
- This device is designed for convection cooling and does not require an external fan. Do not obstruct the air circulation. The ventilation grille must not be covered (e.g. by cable ducts)!
- The device is designed for altitudes up to 5000m (16400ft). Above 2000m (6560ft) the overvoltage category is reduced to level II, and a reduction of the output current is required.
- Observe the following minimum installation distances: 40 mm at the top, 20 mm at the bottom, 5 mm on the left and right. Increase the 5 mm distance to 15 mm if the adjacent device is a heat source. If the device continuously runs at less than 50%, the 5 mm distance can be reduced to zero.
- The device is designed, tested and approved for junction circuits up to 20A without an additional protective device. For higher junction circuits an additional protective device must be used. If an external input protection device is used, do not use a device with a lower characteristic than 10A B or 6A C in order to prevent unwanted circuit breaker tripping.
- The maximum ambient air temperature is +70°C (+158°F). The operating temperature corresponds to the ambient or ambient air temperature, per definition at 2 cm below the device.
- The device is designed for operation in the relative humidity range between 5% and 95%.

### 3 Technical data, mounting, wiring

#### 3.1 AC input

AC input			
AC input	Nom.	AC 100-240V	Suitable for TN, TT and IT networks with alternating voltage
AC input range	Min.	90-264Vac	Continuous operation
	Min.	264-300Vac	For up to 500 ms max.
Permissible voltage L or N to earth	Max.	300Vac	Continuous according to IEC 60664-1
Input frequency	Nom.	50-60Hz	±6%
Turn-on voltage	typ.	81Vac	Static, see Fig. <i>Input voltage range</i> ,
Shut-down voltage	typ.	63Vac/71Vac	At zero load / nominal load, static value, see Fig. <i>Input voltage range</i> ,
External input protection	See recommendations in chapter <a href="#">Safety instructions and installation requirements [► 9]</a>		

AC input		AC100V	AC120V	AC230V	
Input current	typ.	5.2A	4.3A	2.3A	At 24V, 20A, see Fig. <i>Input current over output current</i>
Power factor <sup>1)</sup>	typ.	0.99	0.99	0.97	At 24V, 20A, see Fig. <i>Power factor over output current</i>
Crest factor <sup>2)</sup>	typ.	1.6	1.7	2.0	At 24V, 20A
Start-up delay	typ.	420ms	300ms	230ms	See Fig. <i>Switch-on behavior definitions</i>
Rise time	typ.	100ms	100ms	100ms	At 24V, 20A constant current load, 0mF load capacity, see Fig. <i>Switch-on behavior definitions</i>
	typ.	140ms	140ms	140ms	At 24V, 20A constant current load, 20mF load capacity, see Fig. <i>Switch-on behavior definitions</i>
Turn-on overshoot	Max.	200 mV	200 mV	200 mV	See Fig. <i>Switch-on behavior definitions</i>

<sup>1)</sup> The power factor is the ratio of real (or active) power to apparent power in an AC circuit.

<sup>2)</sup> The crest factor is the mathematical ratio of the peak value over the RMS value of the input current waveform.

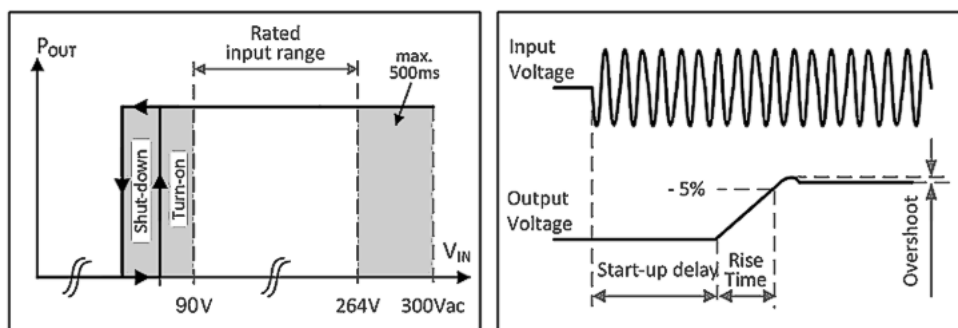


Fig. 1: Input voltage range; switch-on behavior definitions

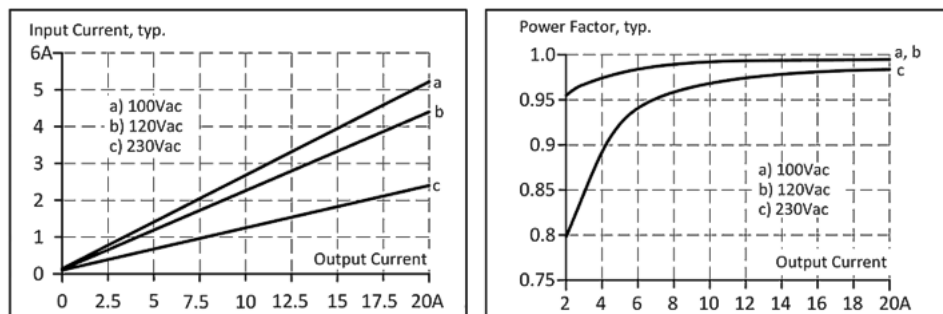


Fig. 2: Input current over output current; power factor over output current

## 3.2 DC input

Do not operate this power supply with DC input voltage!

### 3.3 Input inrush current

Active input inrush current limitation (with NTCs that are bridged by a relay contact) limits the input inrush current after the input voltage is switched on. The charge current in the EMI suppression capacitors is neglected in the first microseconds after power-on.

		AC 100V	AC 120V	AC 230V	
Input inrush current	Max.	15A <sub>peak</sub>	18A <sub>peak</sub>	42A <sub>peak</sub>	At +40°C, cold start
	typ.	13A <sub>peak</sub>	13A <sub>peak</sub>	25A <sub>peak</sub>	At +25°C, cold start
	typ.	13A <sub>peak</sub>	15A <sub>peak</sub>	35A <sub>peak</sub>	At +40°C, cold start
Inrush energy	Max.	3A <sup>2</sup> s	3A <sup>2</sup> s	3A <sup>2</sup> s	At +40°C, cold start

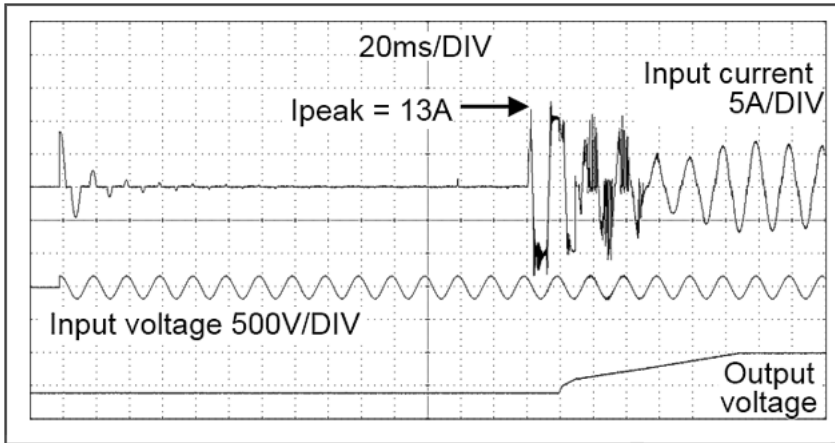


Fig. 3: Switch-on behavior at nominal load, typ., 120Vac@25°C; zoom inrush current surge

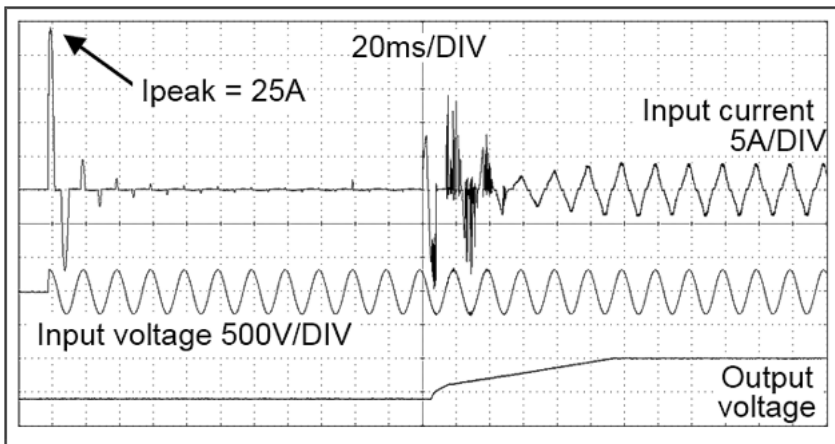


Fig. 4: Switch-on behavior at nominal load, typ., 230Vac@25°C; zoom inrush current surge

### 3.4 Output

The output provides an SELV/PELV nominal voltage that is electrically isolated from the input voltage. The output is designed to supply any type of load, including capacitive and inductive loads. If very large capacitors, such as EDLCs (electrical double-layer capacitors or "UltraCaps") with a capacitance > 3F are connected to the output, the device can charge the capacitor intermittently. The output is electronically protected against overload, no-load and short circuit. In the event of a protection event, audible noises may occur.

The output is electronically protected against overload, no-load and short circuit. In the event of a protection event, audible noises may occur.

Output voltage	Nom.	24V	
Adjustment range	Min.	24-28V	Guaranteed value
	Max.	30V	This is the maximum output voltage that can occur in the end position of the potentiometer in clockwise direction due to tolerances. It is not a guaranteed value that can be achieved.
Factory settings	typ.	24.1V	±0.2%, at full load (cold device)
Line regulation	Max.	10mV	Between 90 and 300Vac
Load regulation	Max.	100mV	Between 0 and 20A, static value, see Fig. <i>Output voltage over output current, typ.</i>
Residual ripple and ripple voltage	Max.	100mV <sub>ss</sub>	Bandwidth 20 Hz to 20 MHz, 50 Ohm
Output current <sup>1)</sup>	Nom.	20A	At 24V and an ambient temperature below 55°C, see Fig. <i>Output current over ambient temperature</i>
	Nom.	12.5A	At 24V and 70°C ambient temperature, see Fig. <i>Output voltage over output current, typ.</i>
	Nom.	17.1A	At 28V and an ambient temperature below 55°C, see Fig. <i>Output current over ambient temperature</i>
	Nom.	10.7A	At 28V and 70°C ambient temperature, see Fig. <i>Output voltage over output current, typ.</i>
Overload characteristics		Continuous current	Output voltage > 13Vdc, see Fig. <i>Output voltage over output current, typ.</i>
		Hiccup mode <sup>2)</sup>	Output voltage < 13Vdc, see Fig. <i>Output voltage over output current, typ.</i>
Overload/short circuit current	Max.	27.5A	Continuous current, see Fig. <i>Short-circuit at output, typ.</i>
	typ.	30A	Intermittent current peak value for typ. 1s Load impedance 50mOhm, see Fig. <i>Short circuit at the output</i> The discharge current of the output capacitors is not included
	Max.	11A	intermittent mean current value (rms.) Load impedance 50mOhm, see Fig. <i>Short circuit at the output</i>
Output capacity	typ.	6,800µF	Included in the power supply
Load feedback	Max.	35V	The device is robust and will not indicate a malfunction if a load voltage is fed back into the power supply. It does not matter whether the power supply is switched on or off. The absorbed energy can be calculated by means of the built-in large-size output capacitor.

<sup>1)</sup> Linear derating between +55°C and +70°

<sup>2)</sup> In case of severe overload (when the output voltage drops below 13V) the power supply delivers a continuous output current for 2-5 seconds. The output is then switched off for approx. 7 second before a new start attempt is automatically made for 1 second. This cycle is repeated as long as the overload exists. The device starts operating normally again once the overload has been rectified.

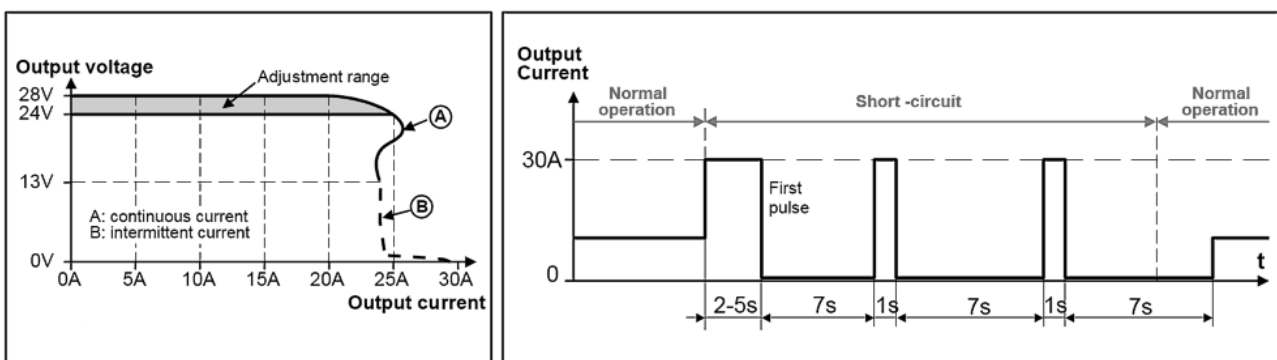


Fig. 5: Output voltage over output current, typ.; short circuit at the output.

### 3.5 Hold-up time

The hold-up time is the time during which the output voltage of a power supply remains within the specification after a loss of input power. The hold-up time depends on the output load.

At no load the hold-up time can be up to several seconds. During this time, the green DC OK lamp also lights up.

		AC 100V	AC 120V	AC 230V	
Hold-up time	typ.	54ms	54ms	54ms	At 24V, 10A, see Fig. <i>Hold-up time over input voltage</i>
	Min.	44ms	44ms	44ms	At 24V, 10A, see Fig. <i>Hold-up time over input voltage</i>
	typ.	27ms	27ms	27ms	At 24V, 20A, see Fig. <i>Hold-up time over input voltage</i>
	Min.	22ms	22ms	22ms	At 24V, 20A, see Fig. <i>Hold-up time over input voltage</i>

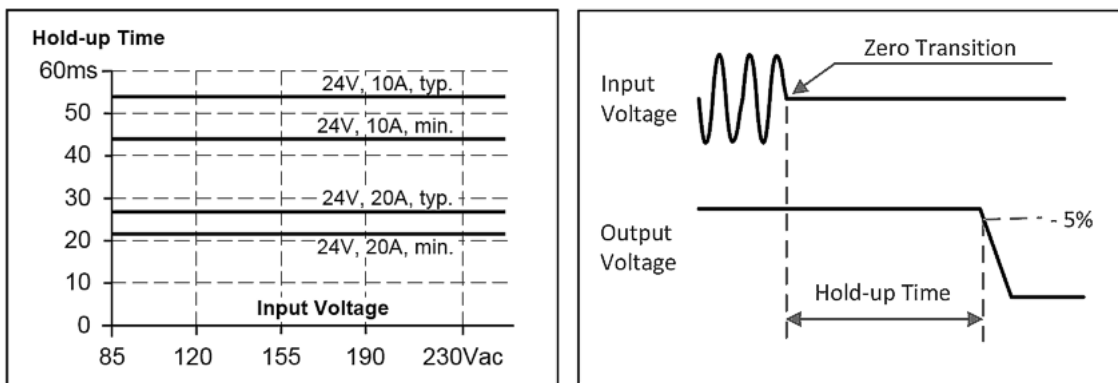


Fig. 6: Hold-up time over input voltage; switch-off behavior, definitions

### 3.6 DC-OK relay contact

This feature monitors the output voltage at the output terminals of an active power supply.

The contact closes	When the output voltage reaches 22V.
The contact opens	When the output voltage falls below 22V.
Switching hysteresis	0.3 V typ.
Contact load capacity	Maximum 60Vdc 0.3A, 30Vdc 1A, 30Vac 0.5A, ohmic load
	Minimum permissible load: 1mA at 5Vdc
Insulation voltage	See the dielectric strength table in the chapter on <a href="#">Safety features</a>   23

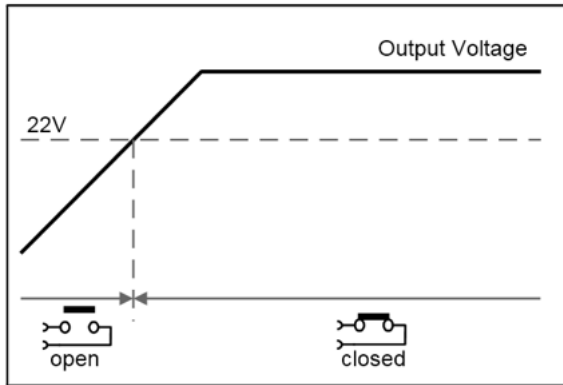


Fig. 7: Behavior of the DC-OK relay contact

### 3.7 Efficiency and losses

		AC 100V	AC 120V	AC 230V	
Efficiency	typ.	93.6%	94.2%	95.3%	At 24V, 20A, full load
Average efficiency <sup>*)</sup>	typ.	93.4%	93.8%	94.5%	25% at 5A, 25% at 10A, 25% at 15A. 25% at 20A
Losses	typ.	5.7W	4.6W	3.5W	At 24V, 0A (no load)
	typ.	15.6W	14.8W	13.2W	At 24V, 10A (half load)
	typ.	32.8W	29.6W	23.7W	At 24V, 20A (full load)

<sup>\*)</sup> The average efficiency is based on assumptions for a typical application with the power supply unit operating at 25% of the nominal load during 25% of the time, 50% of the nominal load during 25% of the time, 75% of the nominal load during 25% of the time and 100% of the nominal load during the remaining time.

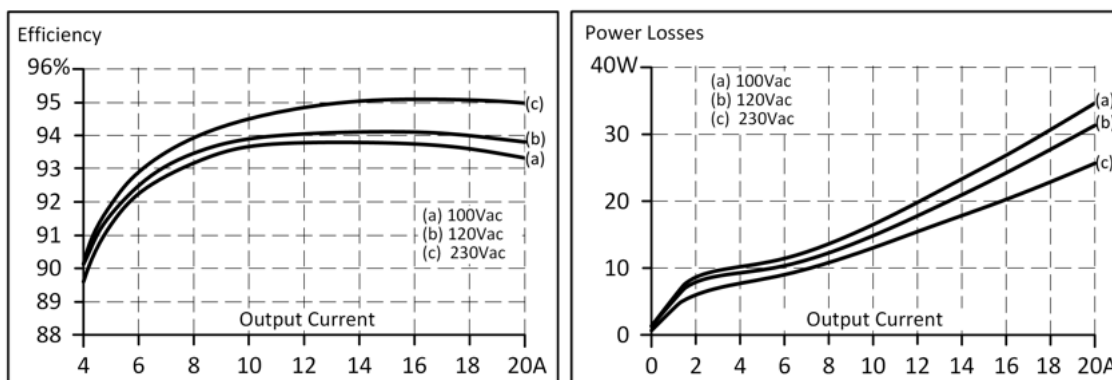


Fig. 8: Efficiency over output current; losses over output current

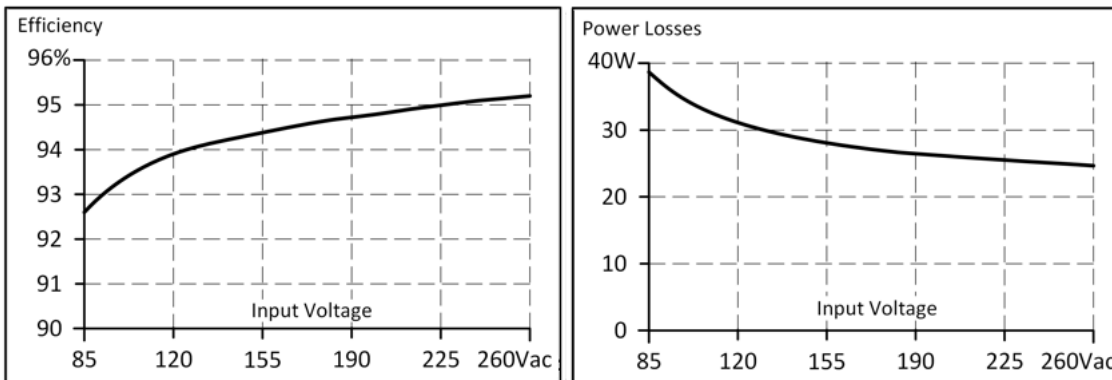


Fig. 9: Efficiency over input voltage; losses over input voltage



### 3.8 Functional wiring diagram

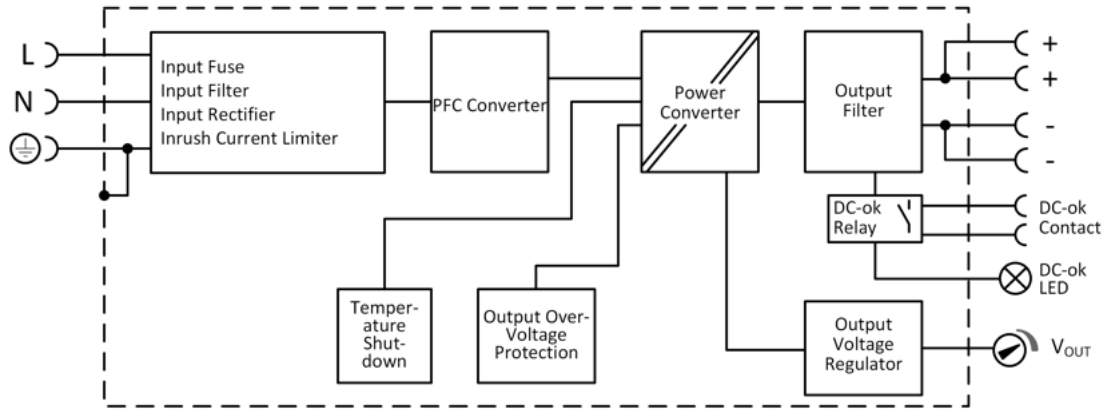



Fig. 10: Functional wiring diagram

### 3.9 Front side and operating elements



Fig. 11: Front PS1011-2420-0000

#### Input terminals (screw terminals)

Designation (A)	Description
N	Mains input N
L	Mains input L
	Protective conductor, PE

#### Output terminals (screw terminals)

Designation (B)	Description
+	two identical positive poles, positive output
-	two identical negative poles, negative output

#### Potentiometer for the output voltage

Designation (C)	Description
Potentiometer	Factory setting: 24.1 V

#### DC-OK relay contact (push-in terminals)

Designation (D)	Description
Terminals 13 / 14	The DC-OK relay contact is not synchronized with the DC-OK LED. See chapter <a href="#">DC-OK relay contact [► 15]</a> for details.

#### DC-OK LED

Designation (E)	Description
LED green	Lights up when the output voltage is above 18V.

### 3.10 Terminals and wiring

The terminals are designed to be finger-safe according to IP20 and are suitable for field or factory wiring.

Technical data	Input	Output	DC-OK signal
Connection cross-section	e*: max. 6mm <sup>2</sup> f*: max. 4mm <sup>2</sup> a*: max. 4mm <sup>2</sup> (d<2.8mm)	e*: max. 6mm <sup>2</sup> f*: max. 4mm <sup>2</sup> a*: max 4mm <sup>2</sup> (d<2.8mm)	e*: max. 1.5mm <sup>2</sup> f*: max. 1.5mm <sup>2</sup> a*: max. 1.5mm <sup>2</sup> (d<1.6mm)
Connection cross section (AWG)	e*: AWG 20-10 f*: AWG 20-10 a* AWG 20-10 (d<2.8mm)	e*: AWG 20-10 f*: AWG 20-10 a* AWG 20-10 (d<2.8mm)	e*: AWG 24-16 f*: AWG 24-16 a*: AWG 24-16 (d<1.6 mm)
Strip length	7mm / 0.28inch	7mm / 0.28inch	7mm / 0.28inch

e\* = solid wire  
f\* = stranded wire  
a\* = with ferrule

### 3.11 Lifetime expectancy

The lifetime expectancy shown in the table indicates the minimum number of operating hours (service life) and is determined by the lifetime expectancy of the built-in electrolytic capacitors. The lifetime expectancy is stated in operating hours and is calculated according to the specifications of the capacitor manufacturer.

The manufacturer of the electrolytic capacitors only guarantees a maximum life of up to 15 years (131,400h). Any number exceeding this value represents a calculated theoretical lifetime which can be used to compare devices.

	AC 100V	AC 120V	AC 230V	
Lifetime expectancy	72,000h	79,000h	102,000h	At 24V, 20A and +40°C
	167,000h	171,000h	197,000h	At 24V, 10A and +40°C
	203,000h	223,000h	288,000h	At 24V, 20A and +25°C
	472,000h	485,000h	557,000h	At 24V, 10A and +25°C

### 3.12 MTBF

MTBF stands for **Mean Time Between Failure**, which is calculated from the statistical failure rate of the components and indicates the reliability of a device. It is a statistical representation of the probability of equipment failure and does not necessarily represent the service life of a product.

The MTBF number is a statistical representation of the probability of equipment failure. An MTBF number of 1,000,000h, for example, means that statistically, if there are 10,000 devices in use, one device will fail every 100 hours. However, it is not possible to say whether the failed device has been in operation for 50,000 hours or only 100 hours.

For these device types the MTTF value (**Mean Time To Failure**) is identical to the MTBF value.

	AC 100V	AC 120V	AC 230V	
MTBF SN 29500, IEC 61709	595,000h	611,000h	704,000h	At 24V, 20A and 40°C
	1,090,000h	1,116,000h	1,252,000h	At 24V, 20A and +25°C
MTBF MIL HDBK 217F	274,000h	275,000h	289,000h	At 24V, 20A and 40°C; Ground Benign GB40
	368,000h	370,000h	386,000h	At 24V, 20A and 25°C; Ground Benign GB25
	59,000h	59,000h	63,000h	At 24V, 20A and 40°C; Ground Fixed GF40
	76,000h	76,000h	80,000h	At 24V, 20A and 25°C; Ground Fixed GF25

### 3.13 EMC

The power supply is suitable for application in industrial environments as well as in residential, commercial and light industrial areas and small businesses.

The device complies with the following standards: EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4, EN 61000-3-2 and EN 61000-3-3.

Without additional measures to reduce conducted emissions at the output (e.g. by using a filter), the device is not suitable for supplying local DC power networks in industrial, private, commercial or light industrial environments.

EMC interference immunity			
Strong transients	VDE 0160	Over the entire load range	750V, 0.3ms

EMC interference emission		
Conducted interference emission, input lines	EN 55011, EN 55015, EN 55022, FCC Part 15, CISPR 11, CISPR 22	Class B
Conducted interference emission, output lines <sup>2)</sup>	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	Limit values for the DC power connection according to EN 61000-6-3 not met
Interference emission	EN 55011, EN 55022	Class B
Harmonic input current	EN 61000-3-2	Met, class A limits
Voltage fluctuations, flicker	EN 61000-3-3	Met, tested with non-pulsating constant current loads.

This device complies with FCC Part 15.

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must be able to deal with any interference received, including interference that may cause undesired operation.

Switching frequencies		
PFC converter	80kHz to 130kHz	Input load and output voltage dependent
Main converter	75kHz to 180kHz	Output voltage and output load dependent
Auxiliary converter	60kHz	fixed frequency

### 3.14 Environment

Environment		
Operating temperature <sup>1)</sup>	-25°C to +70°C	Reduction of the output power according to Fig. <i>Output current over ambient temperature</i>
Storage temperature	-40°C to +85°C	For storage and transport
Output load reduction	12W/°C	Between +55°C and +70°C
Load reduction due to installation altitude <sup>2)</sup>	30W/1000m or 5°C/1000m	Above 2000m, see Fig. <i>Output current over installation altitude</i>
Moisture	5 to 95% r.h.	According to IEC 60068-2-30
Atmospheric pressure	110-54kPa	see Fig. <i>Output current over installation altitude</i>
Installation altitude	0 to 5000m	see Fig. <i>Output current over installation altitude</i>
Overvoltage category	II	According to IEC 60664-1, for altitudes up to 5000m
Surge voltage strength	4kV (according to overvoltage category III)	According to IEC 60664-1, for altitudes up to 2000m
Degree of pollution	2	According to IEC 60664-1, non-conductive
Oscillation, sinusoidal <sup>3)</sup>	2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g 2 hours/axis	According to IEC 60068-2-6
Impacts <sup>3)</sup>	30g 6ms, 20g 11ms 3 impacts/ direction, 18 impacts in total	According to IEC 60068-2-27
LABS-free	The device does not release any silicones or other paint-wetting impairment substances and is suitable for use in paint shops.	
Corrosive gas	Meets the requirements of ISA-71.04-1985, Severity Level G3, IEC 60068-2-60 Test Ke Method 4 for a service life of at least 10 years in these environments.	
Audible noises	The power supply may emit audible noises in the event of an overload, no-load or short circuit.	

1) The working temperature is identical to the room temperature or the ambient temperature and is defined as the air temperature 2cm below the device.

2) The derating is not hardware-controlled. The user must take this into account in order to stay below the reduced current limits, so that device overload is avoided.

3) Tested in conjunction with DIN rails according to EN 60715 with a height of 15mm and a thickness of 1.3mm and standard mounting position.

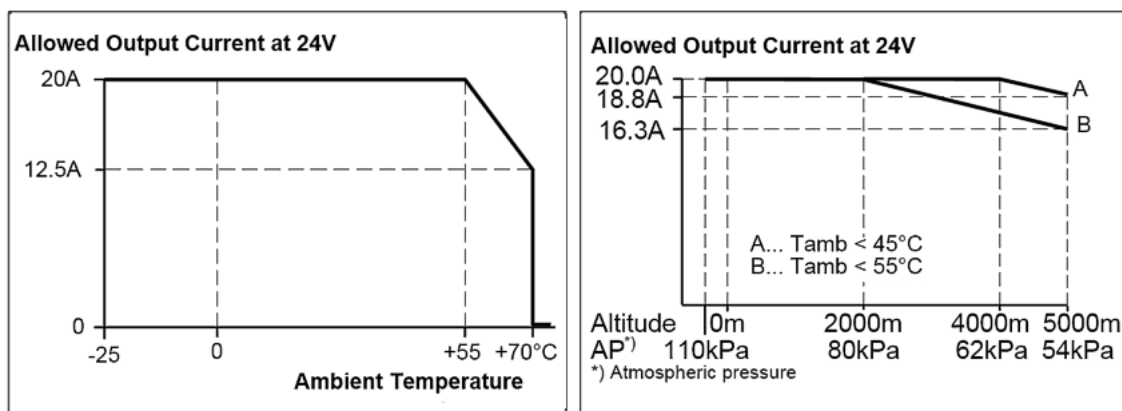


Fig. 12: Output current over ambient temperature; output current over installation altitude

### 3.15 Protective functions and safety features

Protective functions and safety features		
Insulation resistance	Min. 500MOhm	Under given conditions between input and output, measured with 500Vdc
	Min. 500MOhm	At given condition between input and PE, measured with 500Vdc
	Min. 500MOhm	At given condition between output and PE, measured with 500Vdc
	Min. 500MOhm	Under given conditions between output and DC OK contacts, measured with 500Vdc
PE resistance	Max. 0.1 ohm	Resistance between PE terminal and housing in the area of the DIN rail mounting bracket.
Output overvoltage protection	Typ. 30.5Vdc Max. 32Vdc	In the event of an internal power supply fault, a redundant circuit limits the maximum output voltage. The output switches off and automatically tries to switch on again.
Protection class	I	According to EN/IEC 61140 A PE connection (protective earth) is required.
Protection class	IP 20	According to EN/IEC 60529
Overtemperature protection	yes	Output shutdown with automatic restart. Temperature sensors are installed on critical components inside the device and switch off the device in safety-critical situations. This can happen, for example, if the ambient temperature is too high, ventilation is obstructed or derating requirements are not met. There is no correlation between the operating temperature and the switch-off temperature, as this depends on the input voltage, the load and the installation methods.
Protection against input transients	MOV (metal oxide varistor)	For further information see <a href="#">EMC chapter [▶ 21]</a>
Input fuse	included	Non-replaceable slow-blow fuse with high load capacity
Leakage current	Typ. 0.12mA / 0.30mA	At 100Vac, 50Hz, TN, TT / IT network
	Typ. 0.17mA / 0.45mA	At 120Vac, 60Hz, TN, TT / IT network
	Typ. 0.27mA / 0.71mA	At 230Vac, 50Hz, TN, TT / IT network
	Max. 0.15mA / 0.38mA	At 110Vac, 50Hz, TN, TT / IT network
	Max. 0.21mA / 0.56mA	At 132Vac, 60Hz, TN, TT / IT network
	Max. 0.35mA / 0.91mA	At 264Vac, 50Hz, TN, TT / IT network

### 3.16 Dielectric strength

The output voltage is earth-free and has no ohmic connection to earth.

The output is isolated from the input by double or reinforced insulation.

Type and component tests are carried out by the manufacturer. Field tests can be performed in the field using suitable test equipment that ramps up the voltage with a slow ramp (2s rising and 2s falling). Connect all input terminals and all output poles to each other before performing the tests. During the test, set the cut-off current to the value shown in the table below.

We recommend connecting either the positive or the negative pole to the protective conductor system. This avoids situations in which the load starts unexpectedly or cannot be disconnected if an unnoticed earth leakage occurs.

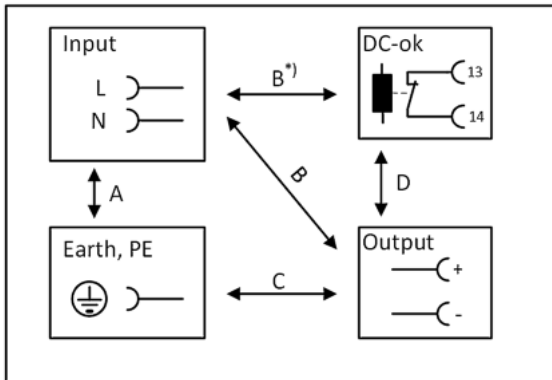


Fig. 13: Dielectric strength

B<sup>)</sup> When checking the input to DC-OK, make sure that the maximum voltage between DC-OK and the output is not exceeded (column D). We recommend connecting the DC-OK pins and the output pins when performing the test.

		A	B	C	D
Type test	60s	2500Vac	3000Vac	500Vac	500Vac
Component test	5s	2500Vac	2500Vac	500Vac	500Vac
Field test	5s	2000Vac	2000Vac	500Vac	500Vac
Setting the cut-off current		> 10mA	> 10mA	> 20mA	> 1mA



### 3.17 Declaration of conformity and approvals

	<p>EU declaration of conformity</p>
	<p>UK Declaration of Conformity          Trade conformity assessment for England, Scotland and Wales          The UKCA mark indicates conformity with the UK Statutory Instruments          2016 No. 1101 (LVD)          2016 No. 1091 (EMC) and          2012 No. 3032 (RoHS)</p>
	<p>Registration for the Eurasian Customs Union market          (Russia, Kazakhstan and Belarus)</p>
	<p>UL Certificate:          UL 61010-1/2-201          Applicable for US and Canada</p>

### 3.18 Dimensions and weight

Dimensions and weight	
Overall width	59mm
Height	124mm
Depth	127mm The height of the DIN rails must be added to the depth of the device to calculate the total installation depth required
DIN rail	Use 35 mm DIN rails according to EN 60715 or EN 50022 with a height of 7.5 or 15mm.
Weight	810g
Housing material	Housing: Aluminum alloy Cover: Galvanized steel
Installation clearances	See chapter on <a href="#">Safety instructions and installation requirements</a> [▶ 9]
Ingress protection	Small parts such as screws, nuts etc. with a diameter of more than 4.5 mm.

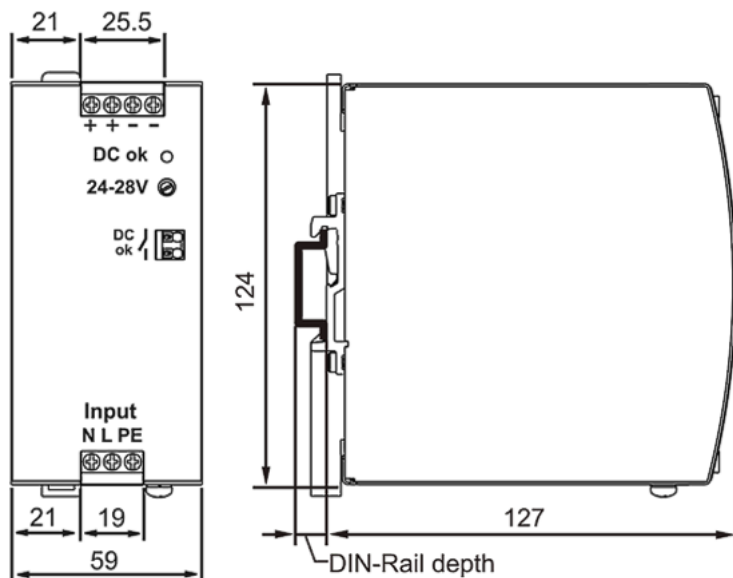


Fig. 14: Front/side view PS2001-2410-0000, all specifications in mm

## 4 Application notes

### 4.1 Charging batteries

Do not use the power supply to charge batteries.

### 4.2 Series connection

Power supplies of the same type can be connected in series to increase the output voltages. As many devices can be connected in series as necessary, as long as the sum of the output voltages does not exceed 150Vdc. Voltages with a potential higher than 60Vdc are no longer regarded as safety extra-low voltage and can be dangerous. Such voltages must be protected with a contact hazard protection.

Avoid application of return voltage (e.g., from a braking motor or battery) to the output terminals.

Keep an mounting distance of 15 mm (left / right) between two power supplies and avoid installing the power supplies on top of each other. Do not use power supplies in series in any orientation other than the standard mounting orientation.

Remember that leakage current, electromagnetic interference, input inrush current and harmonics increase when using multiple power supplies.

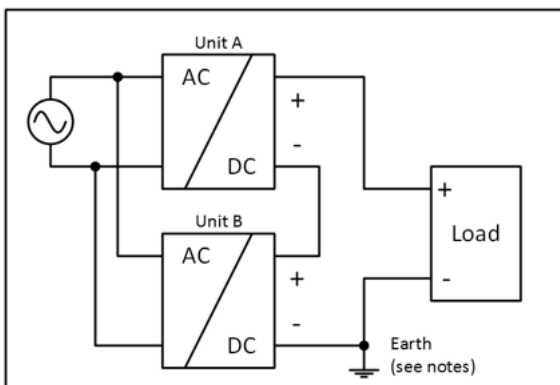


Fig. 15: Series connection

### 4.3 Parallel use to increase power

Do not connect devices for higher output currents in parallel.

### 4.4 Parallel use for 1+1 redundancy

It is possible to connect power supplies in parallel for redundancy operation in order to achieve better system availability. Redundant systems provide a certain amount of additional power to operate the load when a power supply unit fails. The simplest method is to connect two power supplies in parallel. This is called 1+1 redundancy. If one power supply fails, the other can automatically supply the load current without interruption.

The 1+1 redundancy allows ambient temperatures up to +70 °C.

#### Notes on parallel use for 1+1 redundancy

- Be sure to use a redundancy module in order to decouple devices from one another. This prevents the defective device from becoming a load for the other device and the output voltage no longer being maintainable.
- Note that leakage current, EMI, input inrush current and harmonics increase when using multiple devices.

#### Recommendations for the construction of redundant power supply systems:

- Power supplies that contain a DC-OK signal contact are best suited for the construction of redundant power supply systems.  
Use this DC-OK signal contact to monitor the individual power supply units.
- Use separate input fuses for each power supply.
- Use separate grids for each power supply whenever possible.
- It is recommended to set the output voltages of all devices to the same value ( $\pm 100$  mV) or to leave them at the factory setting.

#### Wiring example:

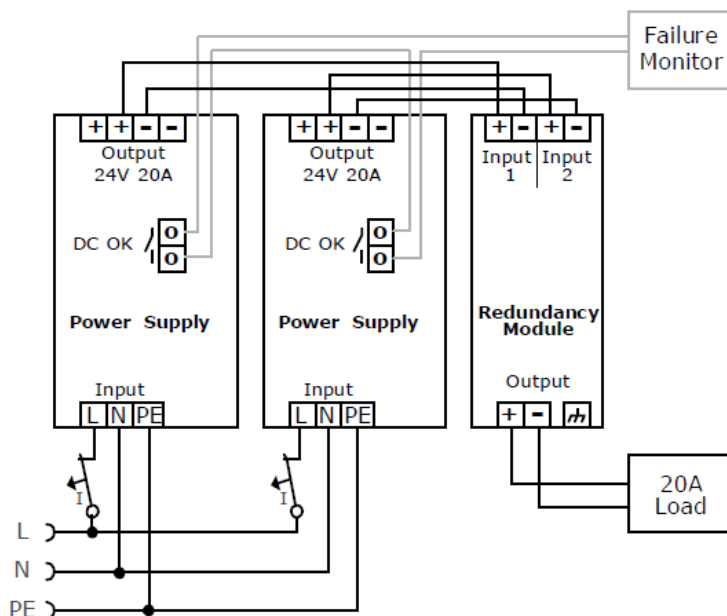


Fig. 16: Wiring for 1+1 redundancy with a PS9401-2440-0000 redundancy module

## 4.5 Operation on two phases

The power supply can also be used on two phases of a three-phase system. Such a phase-to-phase connection is permissible as long as the supply voltage is below 240 V+10 %.

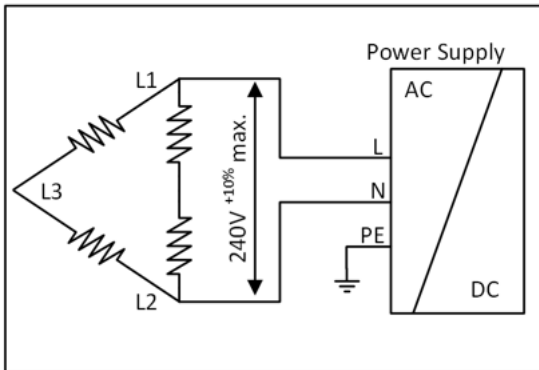


Fig. 17: Operation on two phases

Make sure that the conductor connected to the N terminal is fused appropriately.

The maximum permissible voltage between one phase and the PE must be below 300 Vac.

## 4.6 Use in a tightly sealed enclosure

When the power supply is installed in a tightly sealed enclosure, the temperature inside the housing is higher than outside. In this case, the temperature inside the housing is considered the ambient temperature for the power supply.

The power supply is positioned at the center of the housing. There are no other heat-generating elements in the housing

The temperature sensor in the housing is positioned at the center on the right side of the power supply with a distance of 1cm.

The following measurement results can be used as reference for estimating the temperature rise inside the housing.

	Case A	Case B
Housing size	180x180x165mm Rittal housing, protection class IP66 PK 9516 100, plastic	180x180x165mm Rittal housing, protection class IP66 PK 9516 100, plastic
Input voltage	230Vac	230Vac
Load	24V, 16A; (=80%)	24V, 20A; (=100%)
Temperature inside the housing	48.3°C	55.3°C
Temperature outside the housing	21.0°C	21.0°C
Temperature increase	27.3K	34.3K

## 5 Disposal



Products marked with a crossed-out wheeled bin shall not be discarded with the normal waste stream. The device is considered as waste electrical and electronic equipment. The national regulations for the disposal of waste electrical and electronic equipment must be observed.

## 6 Appendix

### 6.1 Accessories

Power supply	Accessories		
	Redundancy module	Buffer module	UPS component
PS1011-2420-0000	PS9401-2440-0000	PS9011-2420-0001	CU8130-0xxx

#### PS9401-2440-0000 – Redundancy Module



The PS9401-2440-0000 is a redundancy module that can be used for the construction of 1+1 and N+1 redundancy systems.

It has two input channels, to which power supplies with output currents of up to 20 A can be connected, and one output that can carry nominal currents of up to 40 A.

The redundancy module uses MOSFET technology instead of diodes for decoupling the two input channels. This reduces the heat development and the voltage drop between input and output. Due to the low power loss, the device is very narrow and requires a width of just 36 mm on the DIN rail.

Large connection terminals enable secure and fast installation.

The redundancy module requires no additional auxiliary voltage.

Due to the international approvals package, the device is suitable for virtually every application.

Observe the connection instructions in the chapter "[Parallel use for redundancy \[► 28\]](#)"

#### PS9011-2420-0001 – Buffer Module



The PS9011-2420-0001 buffer module is an additional device for 24 V DC power supply units. It supplies power to bridge typical mains power failures or extends the hold-up time after switching off the AC voltage.

If the power supply unit supplies sufficient voltage, the buffer module stores energy in the integrated electrolytic capacitors. In the event of a failure of the mains voltage, the stored energy is supplied to the DC bus in a controlled process.

The buffer module can be connected at any point in parallel with the load circuit and does not require any control wiring.

A buffer module can provide 20 A of additional power and can be added in parallel to increase the output current or hold-up time.

The PS9011-2440-0000 buffer module can optionally be used to achieve longer hold-up times.

**CU8130-0xxx – UPS component**

CU8130-0xxxs are battery-backed, uninterruptible power supplies (UPS). If the external 24 V DC input voltage is lost, the UPS takes over the supply of the devices connected to it thanks to its regulated and buffered 24 V DC output voltage.

The CU81xx UPS series is suitable for all Beckhoff components, particularly Industrial PCs, Embedded PCs, Panels and Panel PCs.

The main features of this UPS are:

- battery module based on NiMH cells
- mounting of the UPS on the DIN rail or on the rear panel of the control cabinet
- protocol-based communication with the Industrial PC either via OCT (**O**ne **C**able **T**echnology) or USB
- digital signals for communication with non-protocol-capable end devices
- TwinCAT PLC function blocks for querying the UPS operation

A special feature of the Beckhoff CU81xx devices is OCT (**O**ne **C**able **T**echnology) as communication technology between UPS and Industrial PC. This means that the two connecting lines (+24 V, 0 V) between Industrial PC and UPS are used not only to supply the Industrial PC, but also for bidirectional data transmission.

If both sides are OCT-capable, no further connection, e.g., via USB, is required.

Further information on UPS components can be found on the Beckhoff [homepage](#).



## 6.2 Documentation issue status

Version	Comment
1.2	- Chapter "Disposal" added - Update structure
1.1	- Chapter "Parallel operation for 1+1 redundancy" added - Chapter "Accessories" added - Update structure
1.0	- First public issue
0.2	- Corrections and addenda
0.1	- Preliminary documentation for PS1011-2420-0000

## 6.3 Support and Service

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