

Documentation | EN

PS1111-2403-0002

Power supply 24 V DC, 3.8 A, 1-phase, AC 100-240 V



Table of contents

1 Overview	5
2 Foreword	6
2.1 Notes on the documentation	6
2.2 Safety instructions	7
2.3 Terminology and abbreviations	9
3 Technical data, mounting, wiring	10
3.1 AC input	10
3.2 DC input	11
3.3 Input inrush current	12
3.4 Output	13
3.5 Hold-up time	14
3.6 Efficiency and losses	15
3.7 Functional wiring diagram	16
3.8 Front side and operating elements	17
3.9 Terminals and wiring	18
3.10 Lifetime expectancy	19
3.11 MTBF	19
3.12 EMC	20
3.13 Environment	21
3.14 Protective functions and safety features	22
3.15 Dielectric strength	23
3.16 Declaration of conformity and approvals	24
3.17 Dimensions and weight	25
4 Application notes	26
4.1 Charging batteries	26
4.2 Series connection	26
4.3 Parallel use to increase power	26
4.4 Operation on two phases	26
4.5 Use in a tightly sealed enclosure	27
5 Disposal	28
6 Appendix	29
6.1 Documentation issue status	29
6.2 Support and Service	30

1 Overview

PS1111-2403-0002 | Power supply 24 V, 3.8 A, 1-phase



- 100-240V wide-range input
- Width only 36mm
- No PE connection required
- Efficiency of up to 93.8%
- Low no-load power losses
- Full power between -10°C and +60°C
- Push-in terminals

The PS1111-2403-0002 is a 1-phase 24 V power supply with an output current of 3.8 A and an output power of 90 W.

On the input side, the device has a wide-range input and an input inrush current limitation.

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 36 mm. A DC OK LED monitors the status of the output voltage. The power supply unit is designed in protection class II and does not require a protective conductor on the primary side.

Overview of technical data ^{*)}

Overview of technical data	PS1111-2403-0002
Output voltage	DC 24V (Nominal factory setting 24.1V)
Adjustment range	24 - 28V
Output current	3.8 - 3.2A (below +60°C) 2.8 - 2.4A (at +70°C) Linear load reduction between +60°C and +70°C
Input voltage AC	AC 100-240V ±10%
Mains frequency	50-60Hz ±6%
Input current AC	1.45 / 0.95A at 120 / 230Vac
Power factor	0.58 / 0.45 at 120 / 230 Vac
Efficiency	92.1 / 93.8% at 120 / 230Vac
Temperature range	-10°C to +70°C
Dimensions (W x H x D)	36 x 90 x 91 mm (without DIN rail)
Weight	270 g
Approvals/markings	CE, EAC, UKCA cULus

*) All values typical for 24V, 3.8A, 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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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.

The qualified personnel is obliged to always use the currently valid documentation.

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 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.

NOTICE

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 PS1111-2403-0002 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 reconnection.
- 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 spilled liquids.
- The device insulation is designed to withstand pulse voltages of overvoltage category III according to IEC 60664-1.
- The device is designed to meet the requirements of protection class II according to IEC 61140.
- 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.
- An isolating device must be provided for the device input.
- The device is designed for convection cooling and does not require an external fan. The air flow must not be obstructed, and the ventilation grille must not be covered!
- 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, 0 mm left and right. Increase the distance from 0 to 15 mm if the adjacent device is a heat source.
- The device is designed, tested and approved for junction circuits up to 20A without an additional protective device. If an external fuse is used, do not use circuit breakers with lower characteristic than 6A B or 4A C in order to avoid unwanted tripping of the circuit breaker.
- 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%.

2.3 Terminology and abbreviations

PE and the earthing symbol 	PE is the abbreviation for "protective earth" and has the same meaning as the earthing symbol 
Earth, ground	This document uses the term "earth" which is the same as the U.S. term "ground".
T.b.d.	Still to be defined, value or description will follow in due course.
AC 230 V	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).
230 Vac	A value followed by the unit Vac or Vdc is an instantaneous value that does not contain any additional tolerances.
50 Hz vs. 60 Hz	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.
may	A keyword indicating a choice without implied preference.
shall	A keyword indicating a mandatory requirement.
should	A keyword indicating a choice with a clearly preferred method of implementation.

3 Technical data, mounting, wiring

3.1 AC input

AC input			
AC input	Nom.	AC 100-240V	Suitable for TN, TT and IT networks
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.	75Vac	Static, see Fig. <i>Input voltage range</i>
Shut-down voltage	Typ.	54Vac	Static, see Fig. <i>Input voltage range</i>
External input protection	See recommendations in chapter <i>Safety and installation requirements</i> [► 8]		

AC input		AC100V	AC120V	AC230V	
Input current	Typ.	1.69A	1.45A	0.95A	At 24V, 3.8A, see Fig. <i>Input current over output current</i> ;
Power factor	Typ.	0.6	0.58	0.45	At 24V, 3.8A, see Fig. <i>Power factor over output current</i>
Start-up delay	Typ.	50ms	50ms	50ms	See Fig. <i>Switch-on behavior definitions</i>
Rise time	Typ.	21ms	21ms	20ms	At 24V, 3.8A constant current load, 0mF load capacitance, see Fig. <i>Switch-on behavior definitions</i>
	Typ.	42ms	42ms	40ms	At 24V, 3.8A constant current load, 2mF load capacitance, see Fig. <i>Switch-on behavior definitions</i>
Turn-on overshoot	Max.	100 mV	100 mV	100 mV	See Fig. <i>Switch-on behavior definitions</i>

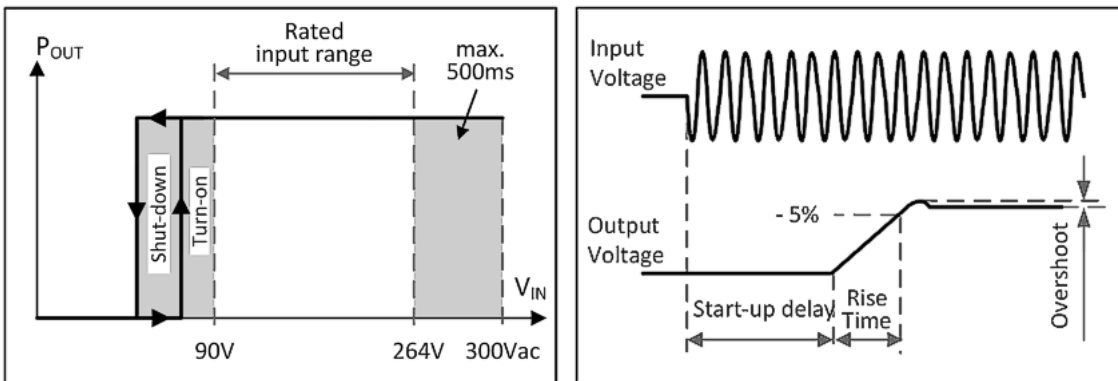


Fig. 1: Input voltage range; switch-on behavior definitions

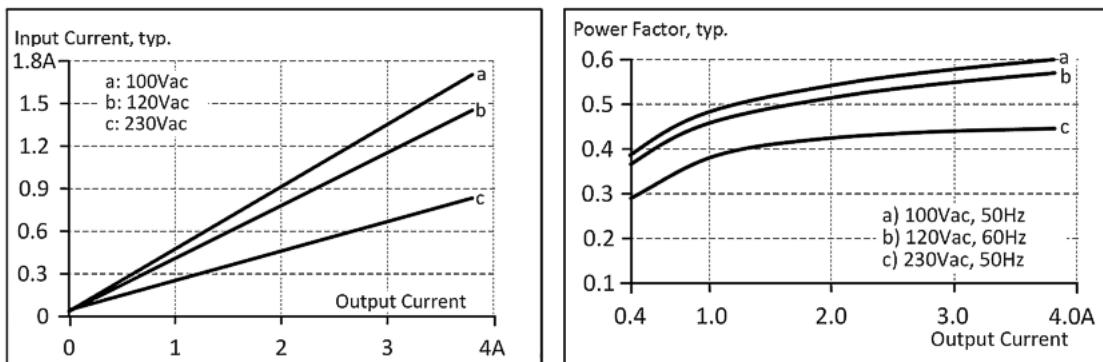


Fig. 2: Input current over output current; power factor over output current

3.2 DC input

Do not operate this power supply with DC input voltage!

3.3 Input inrush current

An NTC limits the input inrush current after the input voltage is switched on. The inrush current surge depends on the input voltage and the ambient temperature. The output load has no influence on the value of the inrush current surge.

The charge current of the interference suppression capacitors during the first few microseconds after switching on is not taken into account.

		AC 100V	AC 120V	AC 230V	
Input inrush current	Typ.	14A _{peak}	18A _{peak}	40A _{peak}	At +40°C, cold start
	Typ.	12A _{peak}	16A _{peak}	35A _{peak}	At +25°C, cold start
	Max.	17A _{peak}	22A _{peak}	48A _{peak}	At +40°C, cold start
	Max.	15A _{peak}	20A _{peak}	43A _{peak}	At +25°C, cold start
Inrush energy	Max.	0.3A ² s	0.4A ² s	1.7A ² s	At +40°C, cold start

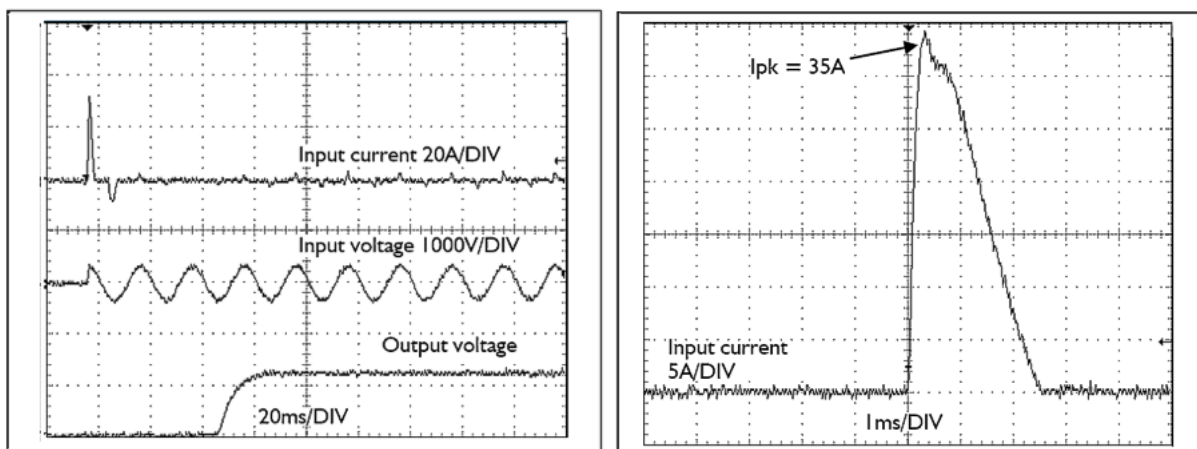


Fig. 3: Switch-on behavior at nominal load, typ., 230Vac@25°C; zoom inrush current surge

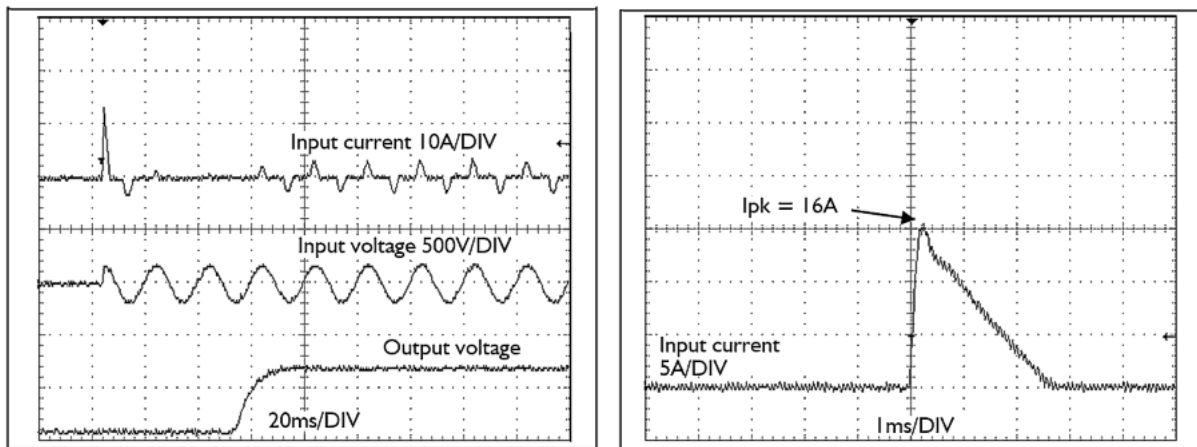


Fig. 4: Switch-on behavior at nominal load, typ., 120Vac@25°C; zoom inrush current surge

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. Capacitive loads should not exceed 5500µF with 3.8A or 7000µF with 1.9A additional current load.

In the event of severe overload (if the output voltage drops below 14V) the power supply delivers a continuous output current for 20ms. The output is then switched off for approx. 160ms before a new start attempt is automatically made. This cycle is repeated as long as the overload exists. The device starts operating normally again once the overload has been rectified.

Output voltage	Nom.	24V	
Adjustment range	Min.	24-28V	Guaranteed value
	Max.	29.5V	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 3.8A, static value, see Fig. <i>Output voltage over output current, typ.</i>
Residual ripple and ripple voltage	Max.	100mV _{ss}	Bandwidth 20 Hz to 20 MHz, 50 Ohm
Output current	Nom.	3.8A	At 24 V and ambient temperature below 60°C
	Nom.	3.2A	At 24V and 70°C ambient temperature.
	Nom.	2.8A	At 28 V and ambient temperature below 60°C
	Nom.	2.4A	At 28 V and 70°C ambient temperature
Overload protection	Yes		Electronic protection against open circuit, overload, and short circuit. In the event of a protection event, audible noises may occur.
Overload characteristics		Continuous current	Output voltage > 14Vdc, see Fig. <i>Output voltage over output current, typ.</i>
		Hiccup mode	Output voltage < 14Vdc, see Fig. <i>Output voltage over output current, typ.</i>
Overload/short circuit current	Max.	6.7A	Continuous current, see Fig. <i>Output voltage over output current, typ.</i>
	Typ.	8.6A	Intermittent current peak value for typ. 20ms Load impedance 150mOhm, see Fig. <i>Short circuit at the output</i> The discharge current of the output capacitors is not included
	Max.	3.2A	intermittent mean current value (rms.) Load impedance 150mOhm, see Fig. <i>Short circuit at the output</i>
Output capacity	Typ.	1600µF	Included in the power supply
Load feedback	Max.	35 V	The device is resistant and does not show any malfunction when a load feeds back voltage to 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.

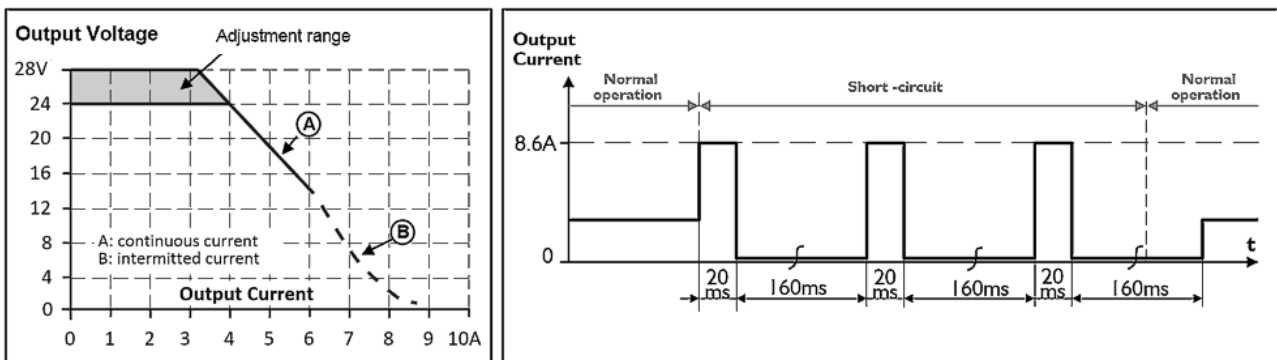


Fig. 5: Output voltage over output current, typ.; short circuit at the output.

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 LED also lights up.

		AC 100V	AC 120V	AC 230V	
Hold-up time	Typ.	14ms	25ms	119ms	At 24V, 3.8A
	Typ.	40ms	60ms	242ms	At 24V, 1.9A
	Min.	11.5ms	20ms	95ms	At 24V, 3.8A
	Min.	32ms	48ms	194ms	At 24V, 1.9A

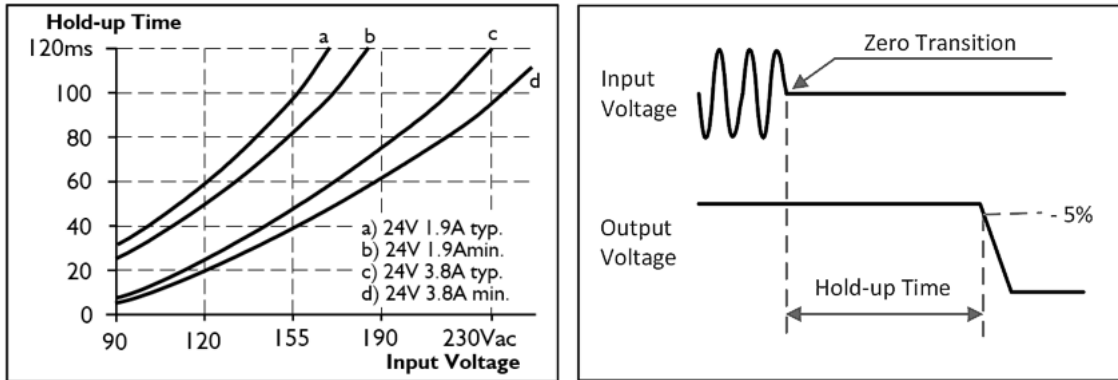


Fig. 6: Hold-up time over input voltage; switch-off behavior, definitions

3.6 Efficiency and losses

		AC 100V	AC 120V	AC 230V	
Efficiency	Typ.	90.6%	>92.1%	93.8%	At 24V, 3.8A, full load
Average efficiency ^{*)}	Typ.	90.5%	91.6%	92.0%	25% at 0.95A, 25% at 1.9A, 25% at 2.85A. 25% at 3.8A
Losses	Typ.	0.3W	0.3W	0.4W	At 24V, 0A (no load)
	Typ.	5.0W	4.3W	3.8W	At 24V, 1.9A (half load)
	Typ.	9.5W	7.9W	6.0W	At 24V, 3.8A (full load)

^{*)} 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.

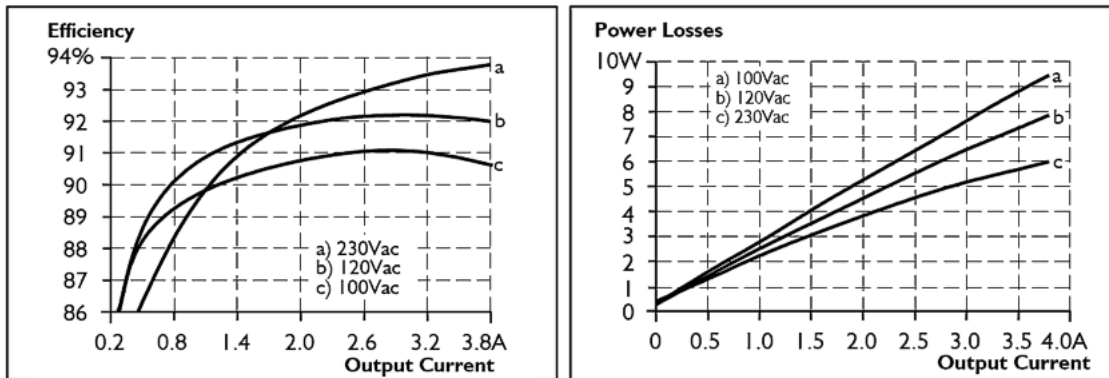


Fig. 7: Efficiency over output current; losses over output current

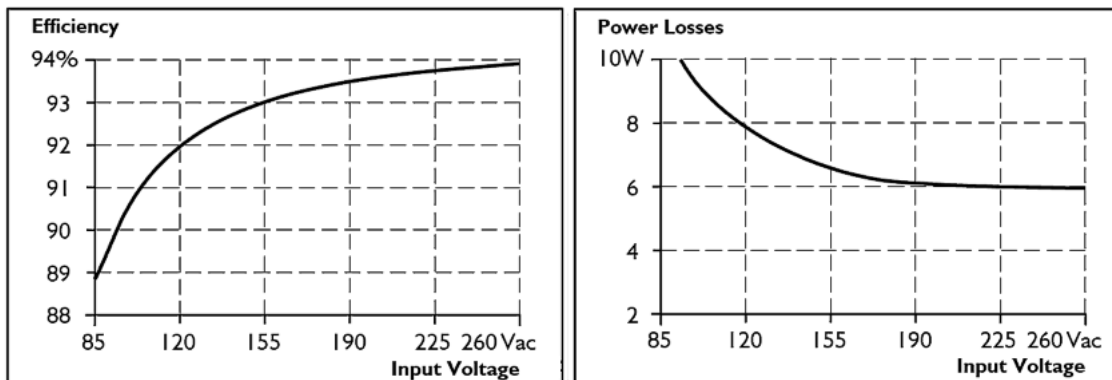


Fig. 8: Efficiency over input voltage; losses over input voltage

3.7 Functional wiring diagram

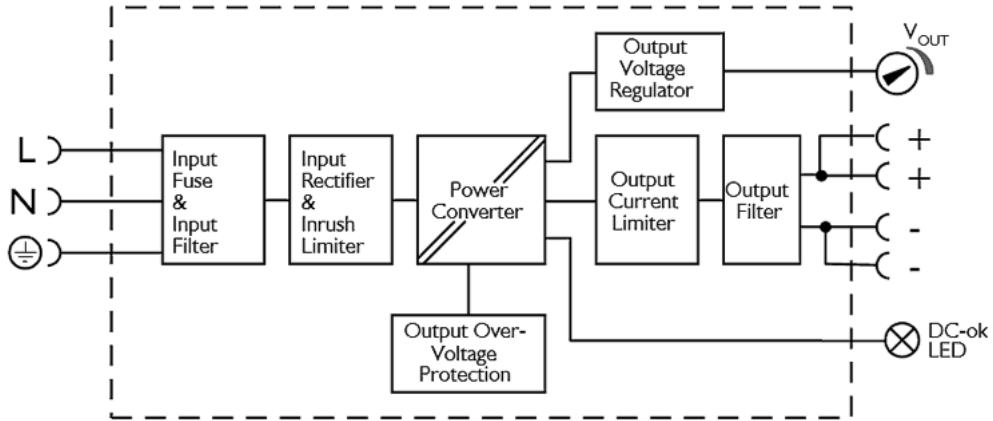


Fig. 9: Functional wiring diagram

3.8 Front side and operating elements



Fig. 10: Front PS1111-2403-0002

Input terminals (push-in terminals)

Designation (A)	Description
N	Mains input N
L	Mains input L

Output terminals (push-in 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 LED

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

3.9 Terminals and wiring

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

Technical data	All connections
Connection cross-section	e*: max. 2.5mm ² f*: max. 2.5mm ² a*: max. 1.5mm ² (d<2.3mm)
Connection cross section (AWG)	e*: AWG 24-12 f*: AWG 24-12 a* AWG 24-12 (d<2.3mm)
Strip length	10mm / 0.4inch

e* = solid wire

f* = stranded wire

a* = with ferrule

3.10 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.

Please note: 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 service life which can be used to compare devices.

	AC 100V	AC 120V	AC 230V	
Lifetime expectancy	39,000h	64,000h	102,000h	At 24V, 3.8A and +40°C
	260,000h	292,000h	309,000h	At 24V, 1.9A and +40°C
	91,000h	147,000h	287,000h	At 24V, 3.8A and +25°C
	640,000h	720,000h	815,000h	At 24V, 1.9A and +25°C

3.11 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	1,174,000h	1,273,000h	1,507,000h	At 24V, 3.8A and 40°C
	2,251,000h	2,406,000h	2,752,000h	At 24V, 3.8A and +25°C
MTBF MIL HDBK 217F	751,000h	760,000h	698,000h	At 24V, 3.8A and 40°C; Ground Benign GB40
	1,085,000h	1,099,000h	1,018,000h	At 24V, 3.8A and 25°C; Ground Benign GB25
	219,000h	224,000h	220,000h	At 24V, 3.8A and 40°C; Ground Fixed GF40
	288,000h	294,000h	293,000h	At 24V, 3.8A and 25°C; Ground Fixed GF25

3.12 EMC

The EMC characteristics of the device make it 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.

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.

Do not use this device on an AC 100V mains supply with a load of more than 2.9A, if the application is sensitive to a short circuit at the output, even with voltage drops during mains interruptions of less than 20ms.

EMC interference immunity			
Strong transients	VDE 0160	Over the entire load range	750V; 1.3ms

EMC interference emission	According to the generic standards: EN 61000-6-3 and EN 61000-6-4	
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	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	Limit values for the DC current connection are met
Interference emission	EN 55011, EN 55022, CISPR 11, CISPR 22	Class B
Harmonic input current	EN 61000-3-2	Class A requirements met
Voltage fluctuations, flicker	EN 61000-3-3	Met, tested with non-pulsating constant current loads.

Switching frequencies		
Main converter	40kHz to 140kHz	Input load and output voltage dependent

3.13 Environment

Environment		
Operating temperature ¹⁾	-10°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	0.1A/°C	Between +60°C and +70°C
Load reduction due to installation altitude ³⁾	0.25A/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 Do not energize if there is condensation.
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)	Input to PE According to IEC 60664-1, for altitudes up to 2000m
Degree of pollution	2	According to IEC 60664-1, non-conductive
Oscillation, sinusoidal ²⁾	2–17.8Hz: ±1.6mm; 17.8-500Hz: 2g 2 hours/axis	According to IEC 60068-2-6
Impacts ²⁾	30g 6ms, 20g 11ms 3 impacts/ direction, 18 impacts in total	According to IEC 60068-2-27

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⁾ 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.

³⁾ 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.

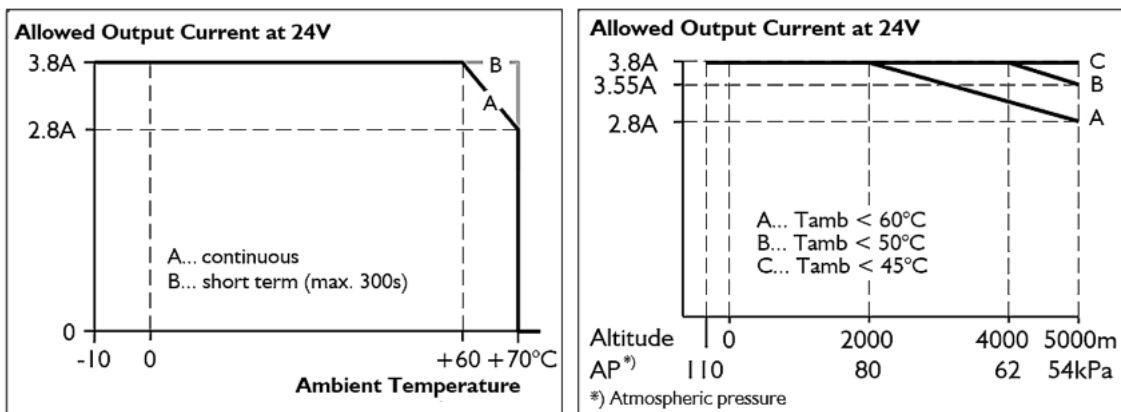


Fig. 11: Output current over ambient temperature; output current over installation altitude

3.14 Protective functions and safety features

Protective functions and safety features		
Insulation resistance	> 500MΩ	In the delivery state between input and output, measured with 500Vdc
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 to 32V. The output switches off. To attempt a restart, turn off the input voltage for at least 90 seconds.
Protection class	II	According to EN/IEC 61140
Protection class	IP 20	According to EN/IEC 60529
Overtemperature protection	-	.
Protection against input transients	MOV (metal oxide varistor)	For further information see EMC [► 20] chapter
Input fuse	included	Non-replaceable slow-blow fuse with high load capacity
Leakage current	Typ. 50µA / 120µA	At 100Vac, 50Hz, TN, TT / IT network
	Typ. 75µA / 170µA	At 120Vac, 60Hz, TN, TT / IT network
	Typ. 130µA / 270µA	At 230Vac, 50Hz, TN, TT / IT network
	Max. 80µA / 190µA	At 110Vac, 50Hz, TN, TT / IT network
	Max. 120µA / 270µA	At 132Vac, 60Hz, TN, TT / IT network
	Max. 210µA / 400µA	At 264Vac, 50Hz, TN, TT / IT network

3.15 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.

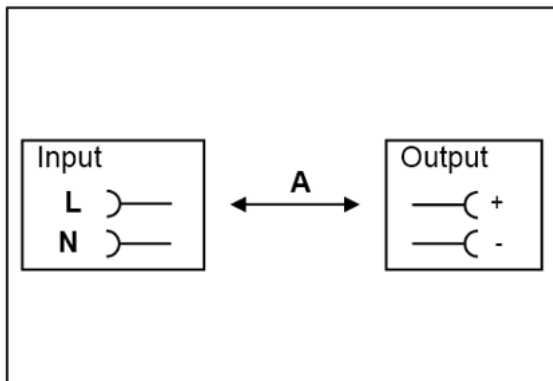


Fig. 12: Dielectric strength

		A
Type test	60s	3000Vac
Component test	5s	2500Vac
Field test	5s	2000Vac
Setting the cut-off current		> 4mA

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.

3.16 Declaration of conformity and approvals

	EU declaration of conformity
	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)
	Registration for the Eurasian Customs Union market (Russia, Kazakhstan and Belarus)
	UL Certificate: UL 61010-1/2-201, Applicable for US and Canada

3.17 Dimensions and weight

Dimensions and weight	
Overall width	36mm
Height	90mm
Depth	91mm 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	270g
Housing material	High-quality polycarbonate/ABS blend material
Installation clearances	See chapter on Safety instructions and installation requirements ▶ 8
Ingress protection	Small parts such as screws, nuts etc. with a diameter of more than 4.2 mm.

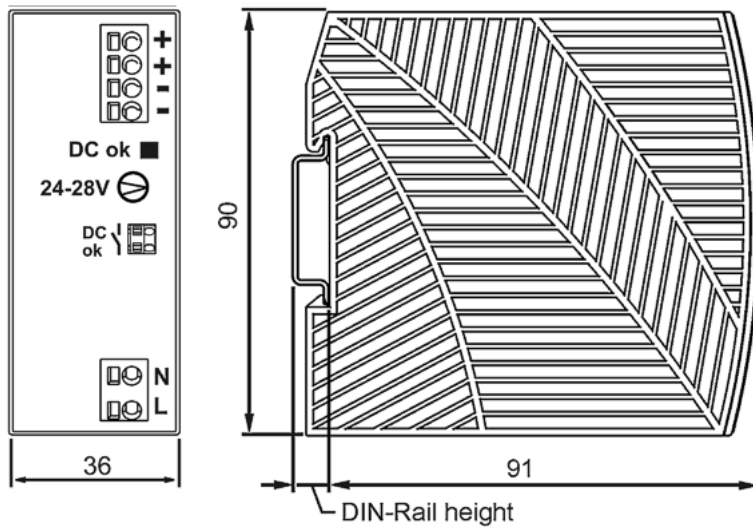


Fig. 13: Front/side view PS1111-2403-0002, all specifications in mm

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.

Restrictions: Keep a mounting distance of 15mm (left/right) between two power supplies and do not install the power supplies above each other.

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

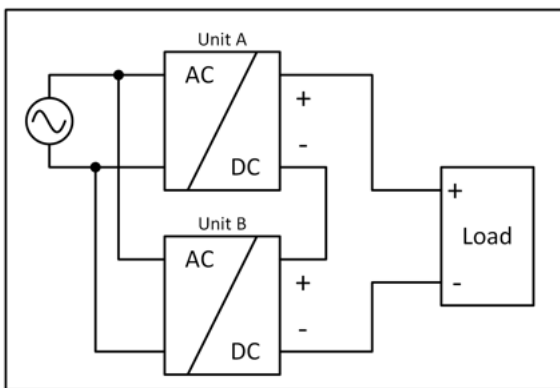


Fig. 14: Series connection

4.3 Parallel use to increase power

Do not connect devices for higher output currents in parallel.

Devices can be connected in parallel for 1+1 redundancy to achieve higher system availability. Redundant systems require a certain amount of additional power to support the load if one device fails. The simplest option is to connect two devices in parallel. This is called 1+1 redundancy. If one device fails, the other is automatically able to support the load current without interruption.

It is essential to use a redundancy module to decouple the devices from each other. This prevents the faulty device from becoming a load for the other device and being unable to maintain the output voltage.

This device does not have a way to report a faulty or non-functioning power supply. Since this is essential for redundant systems, select a redundancy module that monitors and reports insufficient input voltage or use a power supply that includes a DC OK signal.

4.4 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 240V+10%.

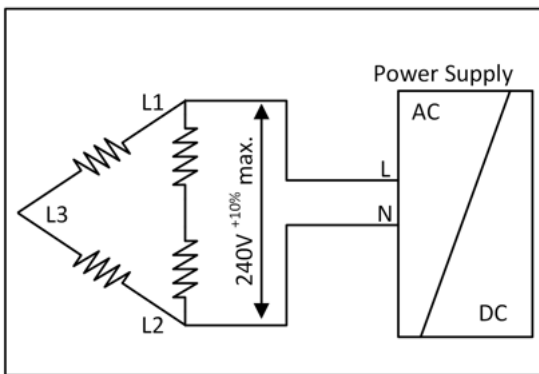


Fig. 15: Operation on two phases

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

4.5 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	110x180x165mm Rittal housing, protection class IP66 PK 9516 100, plastic	110x180x165mm Rittal housing, protection class IP66 PK 9516 100, plastic
Input voltage	230Vac	230Vac
Load	24V, 3.04A; (=80%)	24V, 3.8A; (=100%)
Temperature inside the housing	30.3°C	31.7 °C
Temperature outside the housing	21.0°C	21.0°C
Temperature increase	9.3K	10.7 K

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 Documentation issue status

Version	Comment
1.2	<ul style="list-style-type: none">- Update chapter "Output"- Update structure
1.1	<ul style="list-style-type: none">- Update chapter "Overview"- Update chapter "Declaration of conformity and approvals"- Update chapter "Series connection"- Chapter "Disposal" added- Update structure
1.0	<ul style="list-style-type: none">- First public issue
0.1	<ul style="list-style-type: none">- Preliminary documentation for PS1111-2403-0002

6.2 Support and Service

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Hotline: +49 5246 963 460
e-mail: service@beckhoff.com
web: www.beckhoff.com/service

Headquarters Germany

Beckhoff Automation GmbH & Co. KG

Hülshorstweg 20
33415 Verl
Germany

Phone: +49 5246 963 0
e-mail: info@beckhoff.com
web: www.beckhoff.com

More Information:

www.beckhoff.com/ps1111-2403-0002

Beckhoff Automation GmbH & Co. KG
Hülshorstweg 20
33415 Verl
Germany
Phone: +49 5246 9630
info@beckhoff.com
www.beckhoff.com

