CP10.241-R1 CP10.241-R2
CP10.241-R2-C1



REDUNDANCY POWER SUPPLY — AC 24V 240W

- AC 100-240 V wide-range input
- Width only 39 mm
- Built-in decoupling MOSFET for 1+1 and N+1 redundancy
- Efficiency up to 94.7 %
- 20 % output power reserves (PowerBoost)
- Safe Hiccup^{PLUS} overload mode
- Easy fuse breaking - 3 times nominal current for 12ms
- Active power factor correction (PFC)
- Minimum inrush current surge
- Full power between -25 °C and +60 °C
- DC-OK relay contact
- Current sharing feature included
- 3 year warranty

PRODUCT DESCRIPTION

The Dimension CP-Series are cost optimized power supplies without compromising quality, reliability and performance. The most outstanding features of the CP10.241-Rx-xx units are the high efficiency, electronic inrush current limitation, active PFC, wide operational temperature range and the extraordinary small size. The units include a decoupling MOSFET for building 1+1 or N+1 redundant power supply systems. The devices also offer PowerBoost: Power reserves of 20 %, which may even be used continuously at temperatures up to +45 °C.

These redundancy power supplies come with three connection terminal options; screw terminals, spring-clamp terminals or plug connector terminals which allows replacement on an active application.

High immunity to transients and power surges as well as low electromagnetic emission, a DC-OK relay contact and a large international approval package for a variety of applications makes this unit suitable for nearly every situation.

SHORT-FORM DATA

Output voltage	DC 24 V Factory setting 24.1 V	0 % / +6 %
Output current	10 A 7.5 A DerAte linearly between +60 °C and +70 °C	up to +60 °C ambient at +70 °C ambient
PowerBoost	12 A Linear decrease to nominal power between +45 °C and +60 °C	up to +45 °C ambient
Input voltage AC	AC 100-240 V	
Mains frequency	50-60 Hz	±6 %
Input current AC	2.17 / 1.14 A	at 120 / 230 Vac
Power factor	0.99 / 0.97	at 120 / 230 Vac
Input voltage DC	DC 110-150 V	±20 %
Input current DC	2.35 A	at 110 Vdc
AC Inrush current	6 / 9 A_{peak}	at 120 / 230 Vac
Efficiency	93 / 94.7 %	at 120 / 230 Vac
Power losses	18.1 / 13.4 W	at 120 / 230 Vac
Hold-up time	37 / 37 ms	at 120 / 230 Vac
Temperature range	-25 °C to +70 °C	
Size (w x h x d)	39x124x117 mm	without DIN rail
Weight	600 g	

ORDER NUMBERS

CP10.241-R1	Quick-connect spring-clamp terminals
CP10.241-R2	Hot swappable plug connectors (preferred item)
CP10.241-R2-C1	Conformal coated pc-boards

Accessories:

ZM10.WALL	Wall/panel mount bracket
ZM12.SIDE	Side mount bracket

MAIN APPROVALS

For details and the complete approval list, see chapter 21.

UL 61010-2-201 IECEx ATEX

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Terminology and Abbreviations

PE and ⏚ Symbol	PE is the abbreviation for **P**rotective **E**arth and has the same meaning as the symbol ⏚.
Earth, Ground	This document uses the term “earth” which is the same as the U.S. term “ground”.
t.b.d.	To be defined, value or description will follow later.
AC 230 V	A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances (usually ±15 %) included. E.g.: DC 12 V describes a 12 V battery disregarding whether it is full (13.7 V) or flat (10 V)
230 Vac	A figure with the unit (Vac) at the end is a momentary figure without any additional tolerances included.
50 Hz vs. 60 Hz	As long as not otherwise stated, AC 230 V parameters are valid at 50 Hz mains frequency.
may	A key word indicating flexibility of choice with no implied preference.
shall	A key word indicating a mandatory requirement.
should	A key word indicating flexibility of choice with a strongly preferred implementation.
1+1 Redundancy	Use of two identical power supplies in parallel to provide continued operation following most failures in a single power supply.
N+1 Redundancy	Use of three or more identical power supplies in parallel to provide continued operation following most failures in a single power supply. E.g.: To achieve a 40 A redundant system, five 10 A power supplies are needed in a N+1 redundant system.

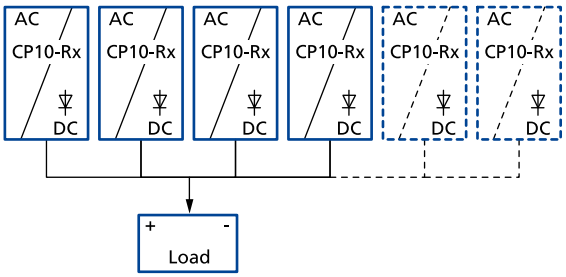


Fig. 1: N+1 Redundancy

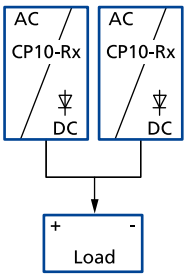


Fig. 2: 1+1 Redundancy

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1. Intended Use

This device is designed for installation in an enclosure and is intended for commercial use, such as in industrial control, process control, monitoring, measurement, Audio/Video, information or communication equipment or the like.

Do not use this device in equipment, where malfunctioning may cause severe personal injury or threaten human life without additional appropriate safety devices, that are suited for the application. If this device is used in a manner outside of its specification, the protection provided by the device may be impaired.

2. Installation Instructions

⚠ WARNING **Risk of electrical shock, fire, personal injury or death.**

- Turn power off before working on the device. Protect against inadvertent re-powering.
- Do not open, modify or repair the device.
- Use caution to prevent any foreign objects from entering the housing.
- Do not use in wet locations or in areas where moisture or condensation can be expected.
- Do not touch during power-on, and immediately after power-off. Hot surfaces may cause burns.

ⓘ NOTE

Notes for use in hazardous location areas:

The device is suitable for use in Class I Division 2 Groups A, B, C, D locations and for use in Group II Category 3 (Zone 2) environments.

Classification: ATEX: EPS 15 ATEX 1 101 X, II 3G Ex ec nC IIC T4 Gc / IECEx EPS 15.0079X

⚠ CAUTION **WARNING EXPLOSION HAZARDS!**

- Do not use with DC input voltages.
- Use only in standard vertical mounting orientation with the input terminals on bottom of the unit. Substitution of components may impair suitability for this environment.
- Do not disconnect the device or operate the voltage adjustment unless power has been switched off or the area is known to be non-hazardous.
- A suitable enclosure must be provided for the end product, which has a minimum protection of IP54 and fulfils the requirements of the EN 60079-0.

This device may only be installed and put into operation by qualified personnel. This device does not contain serviceable parts. The tripping of an internal fuse is caused by an internal defect. If damage or malfunction should occur during installation or operation, immediately turn power off and send the device to the factory for inspection.

Install the device in an enclosure providing protection against electrical, mechanical and fire hazards. Install the device onto a DIN rail according to EN 60715 with the input terminals on the bottom of the device. Other mounting orientations require a reduction in output current.

Make sure that the wiring is correct by following all local and national codes. Use appropriate copper cables that are designed for a minimum operating temperature of +60 °C for ambient temperatures up to +45 °C, +75 °C for ambient temperatures up to +60 °C and +90 °C for ambient temperatures up to +70 °C. Ensure that all strands of a stranded wire enter the terminal connection. Unused screw terminals should be securely tightened.

The device is designed for pollution degree 2 areas in controlled environments. No condensation or frost is allowed.

The enclosure of the device provides a degree of protection of IP20. The enclosure does not provide protection against spilled liquids. The isolation of the device is designed to withstand impulse voltages of overvoltage category III according to IEC 60664-1.

The device is designed as “Class of Protection I” equipment according to IEC 61140. Do not use without a proper PE (Protective Earth) connection.The device is suitable to be supplied from TN, TT or IT mains networks. The continuous voltage between the input terminal and the PE potential must not exceed 300 Vac.

The input can also be powered from batteries or similar DC sources. The continuous voltage between the supply voltage and the PE/ground potential must not exceed 375 Vdc. A disconnecting means shall be provided for the input of the device.

The device is designed for convection cooling and does not require an external fan. Do not obstruct airflow and do not cover ventilation grid! The device is designed for altitudes up to 5000 m. Above 2000 m a reduction in output current and over voltage category is required. Keep the following minimum installation clearances: 40 mm on top, 20 mm on the bottom, 5 mm left and right side. Increase the 5 mm to 15 mm in case the adjacent device is a heat source. When the device is permanently loaded with less than 50 %, the 5 mm can be reduced to zero.

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The device is designed, tested and approved for branch circuits up to 32 A (IEC) and 30 A (UL) (for CP10.241-R1) or 20 A (for CP10.241-R2 and CP10.241-R2-C1) and without additional protection device. If an external fuse is utilized, do not use circuit breakers smaller than 6 A B- or C-Characteristic to avoid a nuisance tripping of the circuit breaker. The maximum surrounding air temperature is +70 °C. The operational temperature is the same as the ambient or surrounding air temperature and is defined 2 cm below the device. The device is designed to operate in areas between 5 % and 95 % relative humidity.

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3. AC Input

The device is suitable to be supplied from TN-, TT- or IT-mains networks with AC voltage. For suitable DC supply voltages see chapter 4.

AC input	nom.	AC 100-240 V	
AC input range		85-264 Vac	
		264-300 Vac	occasionally for maximum 500 ms
Allowed voltage L or N to earth	max.	300 Vac	continuous, according to IEC 60664-1
Input frequency	nom.	50-60 Hz	±6 %
Turn-on voltage	typ.	80 Vac	steady-state value, see Fig. 3-1
Shut-down voltage	typ.	70 Vac	steady-state value, see Fig. 3-1
	typ.	55 Vac	dynamic value for maximum 250 ms
External input protection	See recommendations in chapter 2.		

		AC 100 V	AC 120 V	AC 230 V	
Input current	typ.	2.63 A	2.17 A	1.14 A	at 24 V, 10 A, see Fig. 3-3
Power factor *)	typ.	0.99	0.99	0.97	at 24 V, 10 A, see Fig. 3-4
Crest factor **)	typ.	1.5	1.5	1.65	at 24 V, 10 A
Start-up delay	typ.	300 ms	290 ms	240 ms	see Fig. 3-2
Rise time	typ.	30 ms	30 ms	30 ms	at 24 V, 10 A const. current load, 0 mF load capacitance, see Fig. 3-2
	typ.	75 ms	75 ms	75 ms	at 24 V, 10 A const. current load, 20 mF load capacitance, see Fig. 3-2
Turn-on overshoot	max.	200 mV	200 mV	200 mV	see Fig. 3-2

*) The power factor is the ratio of the true (or real) power to the apparent power in an AC circuit.
**) The crest factor is the mathematical ratio of the peak value to RMS value of the input current waveform.

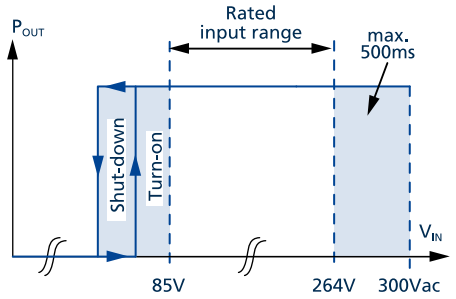


Fig. 3-1: Input voltage range

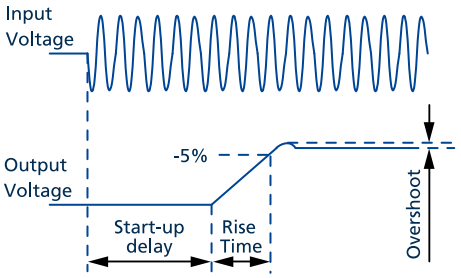


Fig. 3-2: Turn-on behavior, definitions

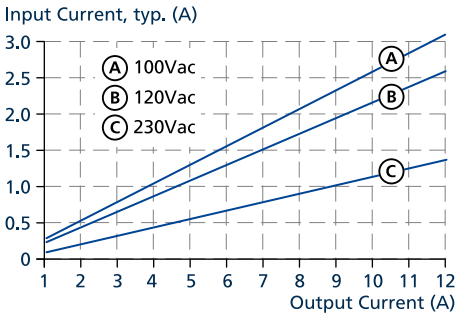


Fig. 3-3: Input current vs. output current at 24V output voltage

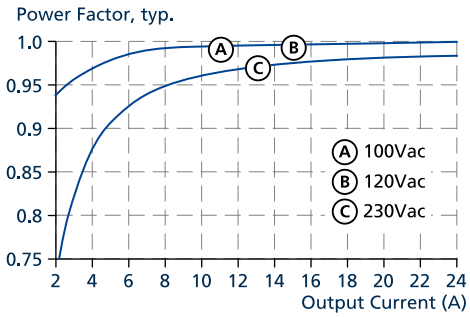


Fig. 3-4: Power factor vs. output current at 24V output voltage

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4. DC Input

DC input	nom.	DC 110-150 V	±20 %
DC input range		88-180 Vdc	
DC input current	typ.	2.35 A	at 110 Vdc, 24 V, 10 A
Allowed voltage (+) or (–) input to earth	max.	360 Vdc	continuous, according to IEC 60664-1
Turn-on voltage	typ.	80 Vdc	steady-state value
Shut-down voltage	typ.	70 Vdc	steady-state value
	typ.	55 Vdc	dynamic value for max. 250 ms

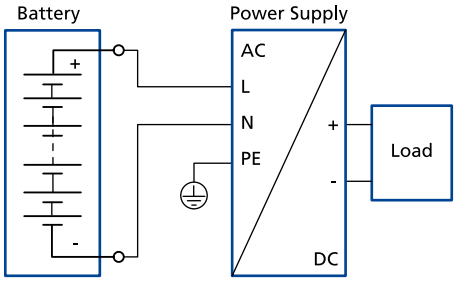


Fig. 4-1: Wiring for DC Input

The device is suitable to be supplied from a DC input voltage.

Instructions for DC use:

a) Use a battery or a similar DC source.

⚠ WARNING

A supply from the intermediate DC-bus of a frequency converter is not recommended and can cause a malfunction or damage the unit.

b) Connect (+) pole to L and (–) pole to N.

c) Connect the PE terminal to an earth wire or to the machine ground.

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5. Input Inrush Current

An active inrush limitation circuit (NTCs, which are bypassed by a relay contact) limits the input inrush current after turn-on of the input voltage.

The charging current into EMI suppression capacitors is disregarded in the first microseconds after switch-on.

		AC 100 V	AC 120 V	AC 230 V	
Inrush current I_{peak}	max.	11 A	7 A	11 A	at +40°C, cold start
	typ.	9 A	6 A	6 A	at +25°C, cold start
	typ.	9 A	6 A	9 A	at +40°C, cold start
Inrush energy I^2t	max.	0.1 A^2s	0.1 A^2s	0.4 A^2s	at +40°C, cold start

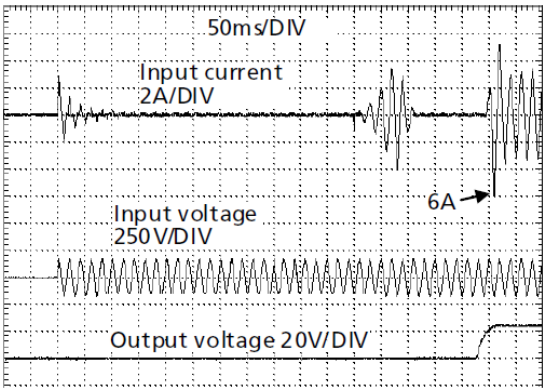


Fig. 5-1: Typical turn-on behaviour at nominal load and 25°C ambient

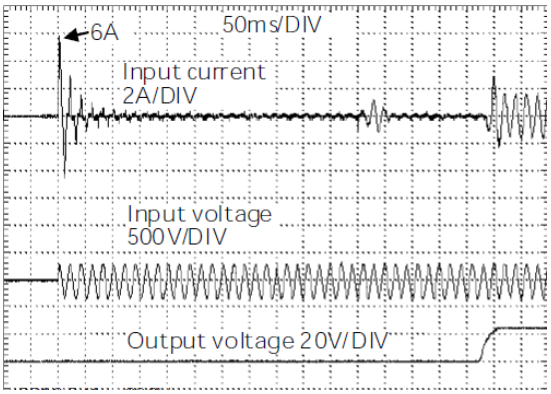


Fig. 5-2: Typical turn-on behaviour at nominal load, 230Vac input and 25°C ambient

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6. Output

The output provides a SELV/PELV/ES1 rated voltage, which is galvanically isolated from the input voltage. The output of the devices includes a decoupling MOSFET for building 1+1 or N+1 redundant power supply systems.

The device is designed to supply any kind of loads, including capacitive and inductive loads. If extreme large capacitors, such as EDLCs (electric double layer capacitors or "UltraCaps") with a capacitance larger than 1.5 F are connected to the output, the unit might charge the capacitor in the Hiccup^{PLUS} mode.

The device is featured with a "soft output regulation characteristic" in order to achieve current share between multiple devices when they are connected in parallel. The "soft output regulation characteristic" regulates the output voltage in such a manner that the voltage at no load is approx. 4 % higher than at nominal load.

Output voltage	nom.	DC 24 V	23.8-25.2 V
Adjustment range		See chapter 25.2	
Factory settings	typ.	24.1 V	±0.2 %, at 10 A, cold unit (results to typ. 23.9 V$^{\pm 0.2\%}$ at 12 A and typ. 25.1 V$^{\pm 0.2\%}$ at no load)
Line regulation	max.	10 mV	between 85 Vac and 300 Vac
Load regulation	max.	1000 mV	between 0 A and 10A, static value, see Fig. 6-1
Ripple and noise voltage	max.	50 mVpp	Bandwidth 20 Hz to 20 MHz, 50 Ohm
Output current	nom.	10 A	at 24 V and up to +60 °C ambient temperatures, see Fig. 17-1
	nom.	7.5 A	at 24 V and +70 °C ambient temperature, see Fig. 17-1
	Derate linearly between +60 °C and +70 °C. See chapter 17		
PowerBoost[1)]	nom.	12 A	at 24 V and up to +45 °C ambient temperature, see Fig. 17-1
	PowerBoost decreases linearly to nominal power between +45 °C and +60 °C. See chapter 17		
Fuse breaking current[2)]	typ.	30 A	Up to 12 ms once every five seconds, see Fig. 6-2.
Overload behavior	Continuous current		for output voltage above 13 Vdc, see Fig. 6-1
	Intermittent current[3)]		for output voltage below 13 Vdc, see Fig. 6-1
Overload/ short-circuit current	max.	15.5 A	continuous current, see Fig. 6-1
	typ.	14 A	intermitted current peak value for typ. 2 s load impedance 10 mOhm, see Fig. 6-3 Discharge current of output capacitors is not included.
	max.	5 A	intermitted current average value (R.M.S.) load impedance 10 mOhm, see Fig. 6-3
Output capacitance	typ.	4 400 µF	included inside the power supply
Back-feeding loads	max.	35 V	The unit is resistant and does not show malfunctioning when a load feeds back voltage to the power supply. It does not matter whether the power supply is on or off. The absorbing energy can be calculated according to the built-in large sized output capacitor.

1) **PowerBoost**
This power/current is continuously allowed up to an ambient temperature of +45 °C.
Above +45 °C, do not use this power/current longer than a duty cycle of 10 % and/or not longer than 1 minute every 10 minutes.

2) The fuse breaking current is an enhanced transient current which helps to start heavy loads or to trip fuses on faulty output branches. The output voltage stays above 20 V.

3) At heavy overloads (when output voltage falls below 13 V), the power supply delivers continuous output current for 2 s. After this, the output is switched off for approx. 18 s before a new start attempt is automatically performed. This cycle is repeated as long as the overload exists. If the overload has been cleared, the device will operate normally. See Fig. 6-3.

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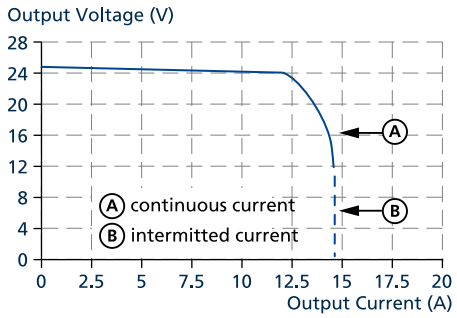


Fig. 6-1: Output voltage vs. output current, typ.

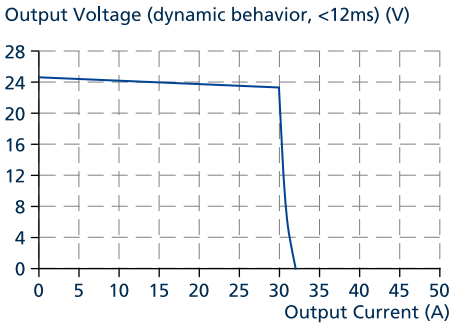


Fig. 6-2: Dynamic overcurrent capability, typ.

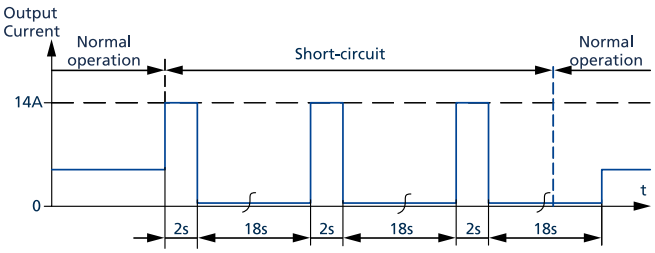


Fig. 6-3: Short-circuit on output, Hiccup^{PLUS} mode, typ.

7. Hold-up Time

		AC 100 V	AC 120 V	AC 230 V	
Hold-up time	typ.	73 ms	73 ms	73 ms	at 24 V, 5 A, see Fig. 7-1
	min.	55 ms	55 ms	55 ms	at 24 V, 5 A, see Fig. 7-1
	typ.	37 ms	37 ms	37 ms	at 24 V, 10 A, see Fig. 7-1
	min.	28 ms	28 ms	28 ms	at 24 V, 10 A, see Fig. 7-1

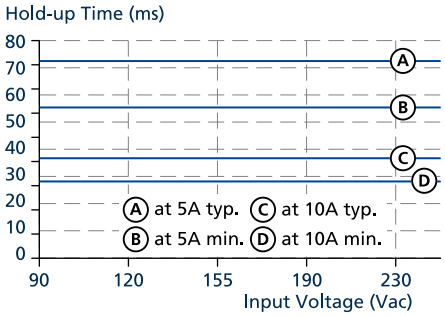


Fig. 7-1: Hold-up time vs. input voltage

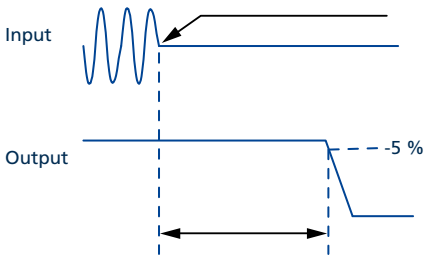


Fig. 7-2: Shut-down behaviour, definitions

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8. DC-OK Relay Contact

This feature monitors the output voltage on the output terminals of a running power supply.

Contact closes	As soon as the output voltage reaches typ. 90 % of the adjusted output voltage level.
Contact opens	As soon as the output voltage dips more than 10 % + switching hysteresis (1 V) below the adjusted output voltage. Short dips will be extended to a signal length of 100 ms. Dips shorter than 1 ms will be ignored.
Switching hysteresis	typ. 1 V
Contact ratings	Maximal 60Vdc 0.3A, 30Vdc 1A, 30Vac 0.5A, resistive load Minimal permissible load: 1mA at 5Vdc
Isolation voltage	See dielectric strength table in chapter 20.

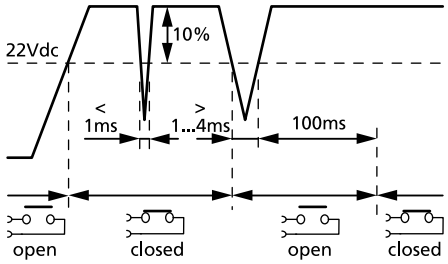


Fig. 8-1: DC-ok relay contact behavior

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9. Efficiency and Power Losses

		AC 100 V	AC 120 V	AC 230 V	
Efficiency	typ.	92.2 %	93 %	94.7 %	at 24 V, 10 A
	typ.	91.9 %	92.8 %	94.6 %	at 24 V, 12 A (PowerBoost)
Average efficiency*)	typ.	91.8 %	92.4 %	93.9 %	25 % at 2.5 A, 25 % at 5 A, 25 % at 7.5 A, 25 % at 10 A
Power losses	typ.	4 W	3.7 W	2.9 W	at 24 V, 0 A
	typ.	11.3 W	10.7 W	8.6 W	at 24 V, 5 A
	typ.	20.3 W	18.1 W	13.4 W	at 24 V, 10 A
	typ.	25.4 W	22.3 W	16.4 W	at 24 V, 12 A (PowerBoost)

*) The average efficiency is an assumption for a typical application where the power supply is loaded with 25 % of the nominal load for 25 % of the time, 50 % of the nominal load for another 25 % of the time, 75 % of the nominal load for another 25 % of the time and with 100 % of the nominal load for the rest of the time.

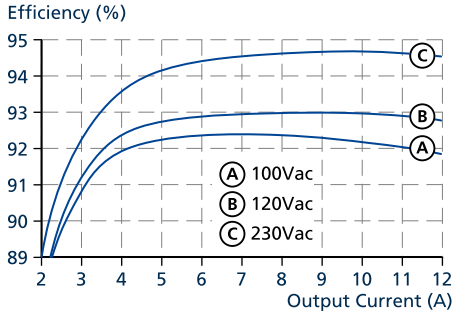


Fig. 9-1: Efficiency vs. output current at 24 V, typ.

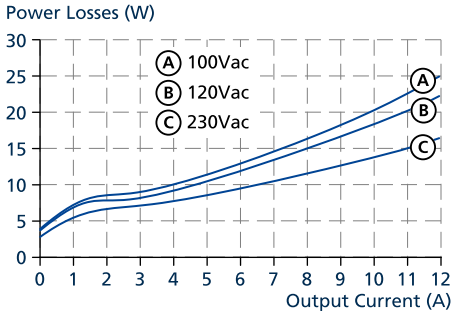


Fig. 9-2: Losses vs. output current at 24 V, typ.

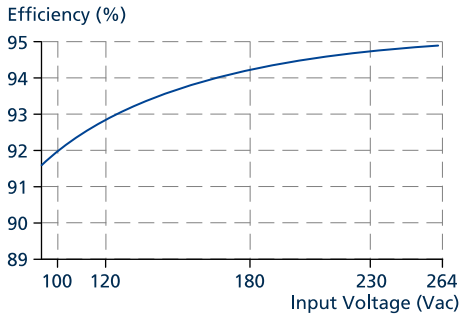


Fig. 9-3: Efficiency vs. input voltage at 24 V, 10 A, typ.

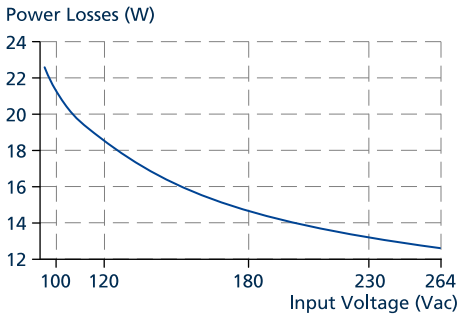


Fig. 9-4: Losses vs. input voltage at 24 V, 10 A, typ.

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

10. Lifetime Expectancy

The Lifetime expectancy shown in the table indicates the minimum operating hours (service lifetime) and is determined by the lifetime expectancy of the built-in electrolytic capacitors. Lifetime expectancy is specified in operational hours and is calculated according to the capacitor's manufacturer specification. The manufacturer of the electrolytic capacitors only guarantees a maximum lifetime of up to 15 years (131 400 h). Any number exceeding this value is a calculated theoretical lifetime, which can be used to compare devices.

	AC 100 V	AC 120 V	AC 230 V	
Lifetime expectancy	143 000 h	153 000 h	188 000 h	at 24 V, 5 A and +40 °C
	405 000 h	434 000 h	531 000 h	at 24 V, 5 A and +25 °C
	66 000 h	78 000 h	109 000 h	at 24 V, 10 A and +40 °C
	188 000 h	220 000 h	307 000 h	at 24 V, 10 A and +25 °C
	37 000 h	47 000 h	71 000 h	at 24 V, 12 A and +40 °C
	105 000 h	132 000 h	200 000 h	at 24 V, 12 A and +25 °C

11. MTBF

MTBF stands for **M**ean **T**ime **B**etween **F**ailures, which is calculated according to statistical device failures, and indicates reliability of a device. It is the statistical representation of the likelihood of a unit to fail and does not necessarily represent the lifetime of a product.

An MTBF figure of e.g. 1 000 000 h means that statistically one unit out of 10 000 installed units will fail every 100 h. However, it can not be determined if the failed unit has been running for 50 000 h or only for 100 h.

For these types of units the MTTF (**M**ean **T**ime **T**o **F**ailures) value is the same value as the MTBF value.

	AC 100 V	AC 120 V	AC 230 V	
MTBF SN 29500, IEC 61709	535 000 h	556 000 h	641 000 h	At 24 V, 10 A and +40 °C
	972 000 h	1 006 000 h	1 138 000 h	At 24 V, 10 A and +25 °C
MTBF MIL HDBK 217F	205 000 h	208 000 h	232 000 h	At 24 V, 10 A and +40 °C; Ground Benign GB40
	279 000 h	283 000 h	318 000 h	At 24 V, 10 A and +25 °C; Ground Benign GB25
	45 000 h	46 000 h	53 000 h	At 24 V, 10 A and +40 °C; Ground Fixed GF40
	58 000 h	59 000 h	63 000 h	At 24 V, 10 A and +25 °C; Ground Fixed GF25

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

12. Functional Diagram

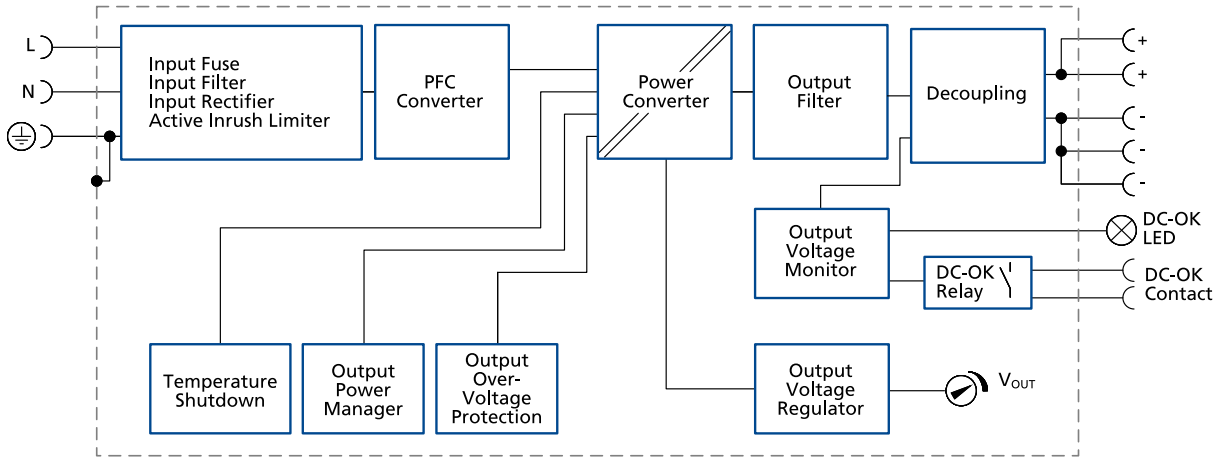


Fig. 12-1: Functional diagram CP10.241-R1

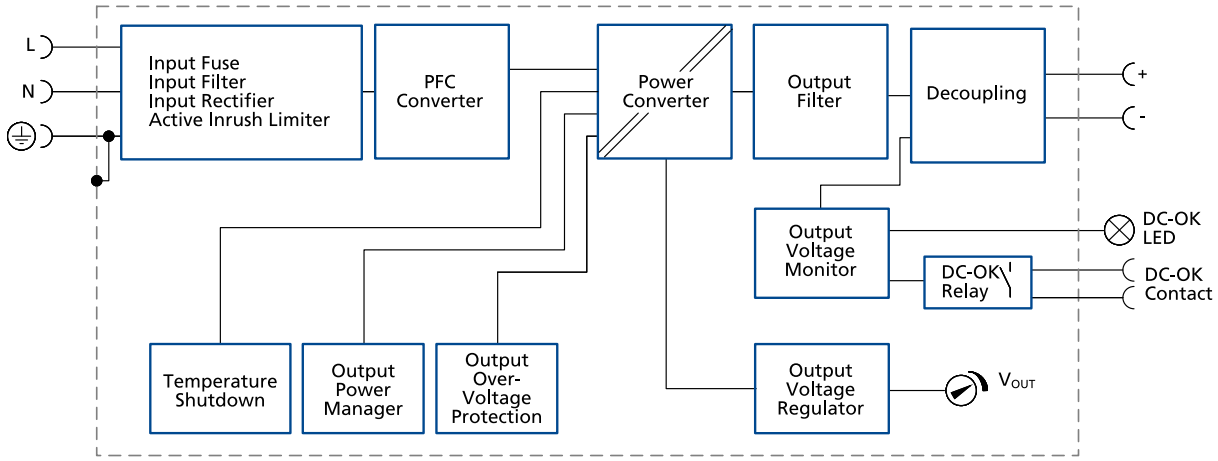


Fig. 12-2: Functional diagram CP10.241-R2, CP10.241-R2-C1

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

13. Terminals And Wiring

The terminals are IP20 Finger safe constructed and suitable for field- and factory wiring.

CP10.241-R1	Input	Output	DC-OK-Signal
Type	Quick-connect spring-clamp terminals	Quick-connect spring-clamp terminals	Push-in terminals
Solid wire Stranded wire American Wire Gauge	max. 6 mm² max. 4 mm² AWG 20-10	max. 6 mm² max. 4 mm² AWG 20-10	max. 1.5 mm² max. 1.5 mm² AWG 24-16
Max. wire diameter (including ferrules)	2.8 mm	2.8 mm	1.6 mm
Wire stripping length	10 mm	10 mm	8 mm
Screwdriver			3 mm slotted to open the spring

CP10.241-R2, CP10.241-R2-C1	Input	Output	DC-OK-Signal
Type	Plug connector with screw terminals	Plug connector with screw terminals	Plug connector with screw terminals
Solid wire Stranded wire American Wire Gauge	max. 4 mm² max. 2.5 mm² AWG 20-12	max. 4 mm² max. 2.5 mm² AWG 20-12	max. 1.5 mm² max. 1.5 mm² AWG 26-16
Max. wire diameter (including ferrules)	2.4 mm	2.4 mm	1.8 mm
Recommende tightening torque	max. 0.5 Nm	max. 0.5 Nm	max. 0.8 Nm
Wire stripping length	7 mm	7 mm	6 mm
Screwdriver	3.5 mm slotted or cross-head No 2	3.5 mm slotted or cross-head No 2	3 mm slotted
	Do not unplug the connectors more often than 20 times in total	Do not unplug the connectors more often than 20 times in total	Do not unplug the connectors more often than 20 times in total

Instructions for Wirings:

a) Use appropriate copper cables that are designed for minimum operating temperatures of:
   +60°C for ambient up to +45°C and
   +75°C for ambient up to +60°C minimum
   90°C for ambient up to +70°C minimum.
b) Follow national installation codes and installation regulations!
c) Ensure that all strands of a stranded wire enter the terminal connection!
d) Unused terminal compartments should be securely tightened.
e) Ferrules are recommended.

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

14. Replacing units while the system is running

This feature is available only for the units, which are equipped with **hot-swappable plug connectors**.

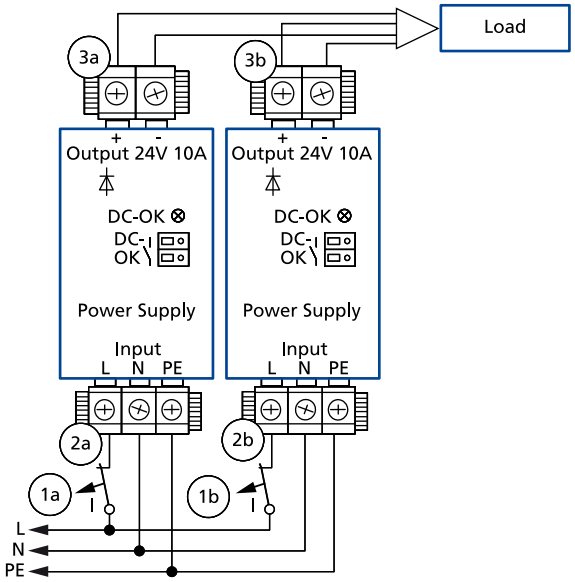


Fig. 14-1: Replacing the power supply while the system is running

Instructions:

a) Switch-off circuit breaker (1a).
b) Remove plug (2a).
c) Remove plug (3a). The plug prevents the cables from shorting.
d) Change power supply.
e) Put the plug (3a) back in.
f) Put the plug (2a) back in.
g) Turn-on the circuit breaker (1a).
h) The circuit is redundant again.

To replace the right power supply, repeat the process above using (1b), (2b) and (3b).

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15. Front Side And User Elements

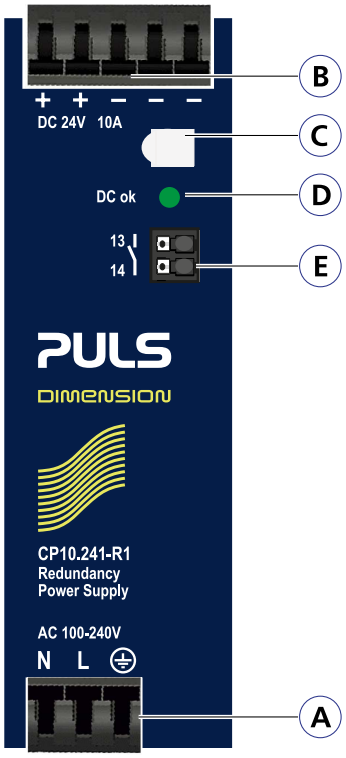


Fig. 15-1: Front side CP10.241-R1

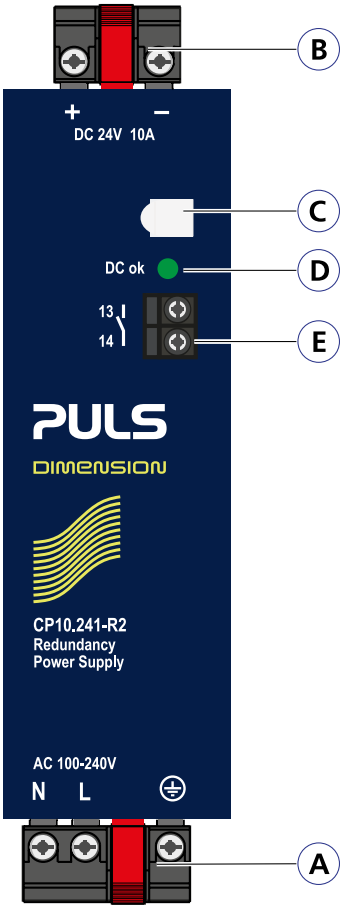


Fig. 15-2: Front side
CP10.241-R2, CP10.241-R2-C1

A **Input Terminals**
- **N, L** Line input
- ⏚ PE (Protective Earth) input

B **Output Terminals**
- **(+)** Positive output
- **(–)** Negative output (return)

C **Output Voltage Potentiometer**
See chapter 25.2

D **DC-OK LED** (green)
On, when the output voltage is above 22 V.

E **DC-OK Relay Contact**
The DC-OK relay contact is synchronized with the DC-OK LED. See chapter 8 for details.

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

16. EMC

The EMC behavior of the device is designed for applications in industrial environment as well as in residential, commercial and light industry environments.

EMC Immunity	According to generic standards: EN IEC 61000-6-1 and EN IEC 61000-6-2			
Electrostatic discharge	EN 61000-4-2	Contact discharge	8 kV	Criterion A
		Air discharge	15 kV	Criterion A
Electromagnetic RF field	EN 61000-4-3	80 MHz - 2.7 GHz	20 V/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	Input lines	4 kV	Criterion A
		Output lines	2 kV	Criterion A
		DC-OK signal (coupling clamp)	2 kV	Criterion A
Surge voltage on input	EN 61000-4-5	L → N	2 kV	Criterion A
		L → PE, N → PE	4 kV	Criterion A
Surge voltage on output	EN 61000-4-5	(+) → (–)	1 kV	Criterion A
		(+) / (–) → PE	2 kV	Criterion A
Surge voltage on DC-OK	EN 61000-4-5	DC-OK signal → PE	1 kV	Criterion A
Conducted disturbance	EN 61000-4-6	0.15 - 80 MHz	20 V	Criterion A
Mains voltage dips	EN 61000-4-11	0 % of 100 Vac	0Vac, 20ms	Criterion A
		40 % of 100 Vac	40Vac, 200ms	Criterion C
		70 % of 100 Vac	70Vac, 500ms	Criterion A
		0 % of 200 Vac	0Vac, 20ms	Criterion A
		40 % of 200 Vac	80Vac, 200ms	Criterion A
		70 % of 200 Vac	140Vac, 500ms	Criterion A
Voltage interruptions	EN 61000-4-11	0 % of 200 Vac (=0 V)	5000 ms	Criterion C
Voltage sags	SEMI F47	Dips on the input voltage according to SEMI F47 standard		
		80 % of 120 Vac (96 Vac)	1000 ms	Criterion A
		70 % of 120 Vac (84 Vac)	500 ms	Criterion A
		50 % of 120 Vac (60 Vac)	200 ms	Criterion A
Powerful transients	VDE 0160	Over entire load range	750V, 0.3ms	Criterion A

Performance criterions:

A: The device shows normal operation behavior within the defined limits.

C: Temporary loss of function is possible. The device may shut-down and restarts by itself. No damage or hazards for the device will occur.

EMC Emission	According to generic standards: EN IEC 61000-6-3, EN IEC 61000-6-4 and EN IEC 61000-6-8	
Conducted emission input lines	EN 55011, EN 55015, EN 55032, FCC Part 15, CISPR 11, CISPR 32	Class B
Conducted emission output lines	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	Limits for DC power ports according to EN 61000-6-3 are fulfilled
Radiated emission	EN 55011, EN 55032	Class B
Harmonic input current (PFC)	EN 61000-3-2	Class A fulfilled between 0 A and 12 A load Class C fulfilled between 6 A and 12 A load
Voltage fluctuations, flicker	EN 61000-3-3	Fulfilled

This device complies with FCC Part 15 rules.
Operation is subjected to following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Switching Frequencies		
PFC converter	100 kHz	Fixed frequency
Main converter	84-140	Output load dependent
Auxiliary converter	60 kHz	Fixed frequency

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

17. Environment

Operational temperature	-25 °C to +70 °C	The operational temperature is the same as the ambient or surrounding temperature. It is defined as the air temperature 2 cm below the device.
Storage temperature	-40 °C to +85 °C	for storage and transportation
Output derating	0.25 A/K	between +60 °C and +70 °C
	0.63 A / 1000 m or 5 K / 1000 m	for altitudes >2000 m, see Fig. 17-2
	0.38 A / - 5 kPa or 3 K / -5 kPa	for atmospheric pressures <80 kPA, see Fig. 17-2
	The derating is not hardware controlled. The user has to take care by himself to stay below the derated current limits in order not to overload the unit.	
Humidity	5 to 95 % r.h.	according to IEC 60068-2-30 Do not energize while condensation is present.
Atmospheric pressure	110-47 kPa	see Fig. 17-2 for details
Altitude	up to 5000 m	see Fig. 17-2 for details
Over-voltage category	III	according to IEC 60664-1 for altitudes <2000 m
	II	according to IEC 60664-1 for altitudes >2000 m and 5000 m and atmospheric pressures from 80 - 47 kPa
Degree of pollution	2	according to IEC 60664-1, not conductive
Vibration sinusoidal	2-17.8 Hz: ±1.6 mm; 17.8-500 Hz: 2 g 2 hours / axis	according to IEC 60068-2-6
Shock	30 g 6 ms, 20 g 11 ms 3 bumps per direction, 18 bumps in total Shock and vibration is tested in combination with DIN rails EN 60715 with a height of 15 mm and a thickness of 1.3 mm and standard orientation.	according to IEC 60068-2-27
Audible noise	Some audible noise may be emitted from the power supply during no load, overload or short circuit.	

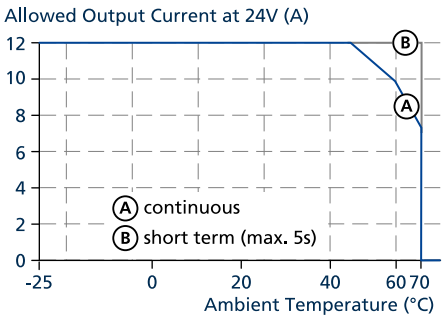


Fig. 17-1: Output current vs. ambient temp.
(I_{nom} = 10A; I_{out} with PowerBoost = 12A)

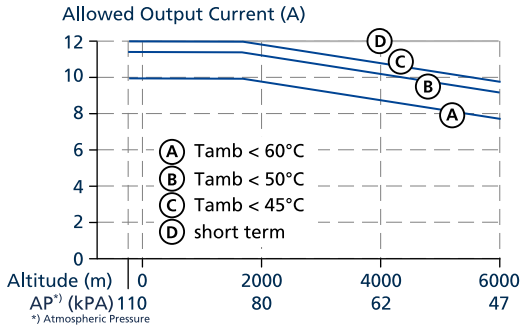


Fig. 17-2: Output current vs. altitude

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

18. Protection Features

Output over-voltage protection	typ. 30.5 Vdc max. 32 Vdc	The output shuts down and automatically attempts to restart for three times. If after the third time the restart still fails, the output is switched off permanently until the line input is disconnected for a second.
Degree of protection	IP20	EN/IEC 60529
Penetration protection	>4 mm	E.g. screws, small parts
Over-temperature protection	included	Output shut-down with automatic restart. Temperature sensors are installed on critical components inside the unit and turn the unit off in safety critical situations, which can happen e.g. when ambient temperature is too high, ventilation is obstructed or the derating requirements are not followed. There is no correlation between the operating temperature and turn-off temperature since this is dependent on input voltage, load and installation methods.
Input transient protection	MOV (Metal Oxide Varistor)	For protection values see chapter (EMC).
Internal input fuse	included	Not user replaceable slow-blow high-braking capacity fuse

19. Safety Features

Class of protection	I	according to IEC 61140
Isolation resistance	>500 MOhm	at delivered condition between input and output, measured with 500 Vdc
	>500 MOhm	at delivered condition between input and PE, measured with 500 Vdc
	>500 MOhm	at delivered condition between output and PE, measured with 500 Vdc
	>500 MOhm	at delivered condition between output and DC-OK contacts, measured with 500 Vdc
PE resistance	<0.1 Ohm	Resistance between PE terminal and the housing in the area of the DIN rail mounting bracket.
Touch current (leakage current)	typ. 0.14 mA / 0.36 mA	at 100 Vac, 50 Hz, TN-, TT-mains / IT-mains
	typ. 0.2 mA / 0.5 mA	at 120 Vac, 60 Hz, TN-, TT-mains / IT-mains
	typ. 0.33 mA / 0.86 mA	at 230 Vac, 50 Hz, TN-, TT-mains / IT-mains
	max. 0.18 mA / 0.43 mA	at 110 Vac, 50 Hz, TN-, TT-mains / IT-mains
	max. 0.26 mA / 0.61 mA	at 132 Vac, 60 Hz, TN-, TT-mains / IT-mains
	max. 0.44 mA / 1.05 mA	at 264 Vac, 50 Hz, TN-, TT-mains / IT-mains

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

20. Dielectric Strength

The output voltage is floating and has no ohmic connection to the ground.

Type and routine tests are conducted by the manufacturer. Field tests may be conducted in the field using the appropriate test equipment which applies the voltage with a slow ramp (2 s up and 2 s down). Connect all input-terminals together as well as all output poles before conducting the test. When testing, set the cut-off current settings to the value in the table below.

It is recommend that either the (+) pole, the (–) pole shall be connected to the protective earth system. This helps to avoid situations in which a load starts unexpectedly or can not be switched off when unnoticed earth faults occur.

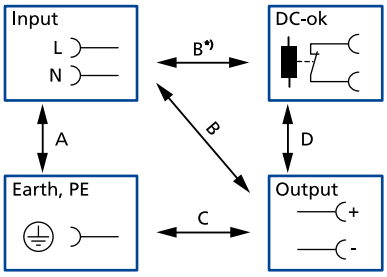


Fig. 20-1: Dielectric strength

		A	B	C	D
Type test	60 s	2500 Vac	4000 Vac	1000 Vac	500 Vac
Factory test	5 s	2500 Vac	2500 Vac	500 Vac	500 Vac
Field test	5 s	2000 Vac	2000 Vac	500 Vac	500 Vac
Field test cut-off current settings		>10 mA	>10 mA	>20 mA	>1 mA

B*) When testing input to DC-OK ensure that the max. voltage between DC-OK and the output is not exceeded (column D). We recommend connecting DC-OK pins and the output pins together when performing the test.

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

21. Approved, Fulfilled or Tested Standards

IEC 60950	CB Report	CB Scheme Certificate IEC 60950-1 - General safety requirements for Information Technology Equipment (ITE)
IEC 62368	CB Report	CB Scheme Certificate IEC 62368-1 - Audio / video, information and communication technology equipment - Safety requirements Output safety level: ES1
IEC 61010	CB Report	CB Scheme Certificate IEC 61010-2-201 - Electrical Equipment for Measurement, Control and Laboratory Use - Particular requirements for control equipment
UL 61010	c UL US LISTED	UL Certificate Listed equipment for category NMTR - UL 61010-2-201 - Electrical equipment for measurement, control and laboratory use - Particular requirements for control equipment Applicable for US and Canada E-File: E198865
Class I Div 2	c UL US LISTED	UL Certificate Listed equipment for category NRAD - Industrial control equipment for use in haradous locations Applicable for US and Canada E-File: E327416 Temperature code: T4 Groups: A, B, C and D
ATEX	Ex	Agency Certificate (Bureau Veritas) EN 60079-0 Explosive atmospheres - General requirements EN 60079-7, EN 60079-15 Equipment protection by type of protection "e" and “n” Certificate: EPS 15 ATEX 1 101 X Temperature Code: T4 Type of Protection: ec nC
IECEx	IECEx	IECEx Certificate IEC 60079-0 Explosive atmospheres - General requirements IEC 60079-7, IEC 60079-15 Equipment protection by type of protection "e" and “n” Certificate: IECEx EPS 15.0079X Temperature Code: T4 Type of Protection: ec nC
IEC 61558-2-16 (Annex BB)	Safety Isolating Transformer	Test Certificate IEC 61558-2-16 - Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1100 V. Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units.
Semi F47	SEMI F47	Test Report Voltage Sag Immunity for Semiconductor Processing Equipment
IEC 60068-2-60	Corrosion IEC 60068-2-60 Method 4 ✓	Manufacturer's Declaration (Online Document) Environmental Tests, Flowing Mixed Gas Corrosion Test Test: Ke - Method 4 H2S: 10ppb NO2: 200ppb Cl2: 10ppb SO2: 200ppb Test Duration: 3 weeks, which simulates a service life of at least 10 years.

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

ISA-71.04-1985	Corrosion G3-ISA-71.04 ✓	Manufacturer's Declaration (Online Document) Airborne Contaminants Corrosion Test Severity Level: G3 Harsh H2S: 100ppb NOx: 1250ppb Cl2: 20ppb SO2: 300ppb Test Duration: 3 weeks, which simulates a service life of at least 10 years
VDMA 24364	LABS VDMA 24364-C1-L/W	Paint Wetting Impairment Substances Test (or LABS-Test) Tested for Zone 2 and Test Class C1 according to VDMA 24364-C1-L/W for solvents and water-based paints

22. Regulatory Product Compliance

EU Declaration of Conformity	CE	The CE mark indicates conformance with the European – EMC directive – Low-voltage directive (LVD) – RoHS directive – ATEX directive
WEEE Regulation		Manufacturer's Declaration EU Directive on Waste Electrical and Electronic Equipment Registered in Germany as business to business (B2B) products. EU Directive 2012/19/EU WEEE-Reg.-Nr. DE 55837529
REACH Regulation	REACH ✓	Manufacturer's Declaration EU Regulation regarding the Registration, Evaluation, Authorisation and Restriction of Chemicals EU Regulation 1907 / 2006
RoHS-China	25	Manufacturer's Statement Administrative Measures for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products 25 years
KC	KC	KC Registration Korean - Registration of Broadcasting and Communication Equipment KOSHA - Korea Occupational Safety and Health Agency Registration No. R-R-PUG-CP10_241-R1
CCC	CCC	CCC Certificate China Compulsory Certification (CNCA-C23-01:2019) Certificate for devices made in Suzhou/China (PULS Electronics): 2021122303114443 Certificate for devices made in Chomutov/Czech Republic (PULS investi#ní): 2021122303114444 CCC-Ex

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

23. Physical Dimensions And Weight

Width	39 mm
Height	124 mm
Depth	117 mm The DIN rail depth must be added to the unit depth to calculate the total required installation depth.
Weight	600 g
DIN rail	Use 35 mm DIN rails according to EN 60715 or EN 50022 with a height of 7.5 or 15 mm.
Housing material	Body: Aluminium alloy Cover: Zinc-plated steel
Installation clearances	See chapter 2.
Penetration protection	Small parts like screws, nuts, etc. with a diameter larger than 4 mm

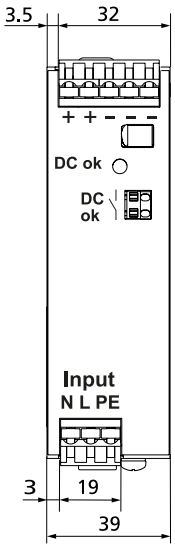


Fig. 23-1: Front view CP10.241-R1

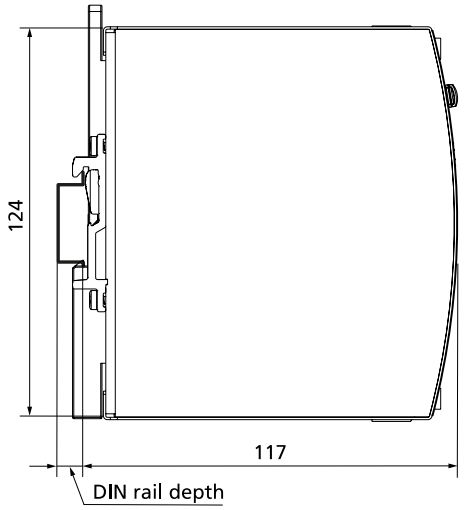


Fig. 23-2: Side view CP10.241-R1

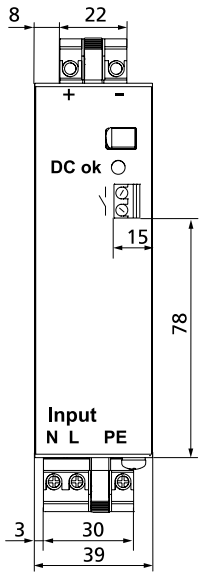


Fig. 23-3: Front view CP10.241-R2, CP10.241-R2-C1

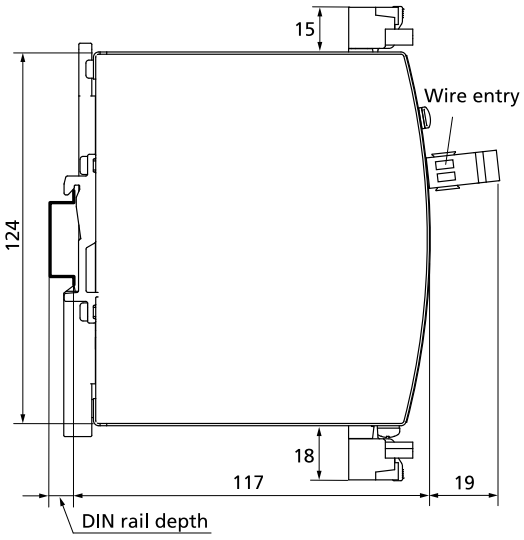


Fig. 23-4: Side view CP10.241-R2, CP10.241-R2-C1

All dimensions in mm unless otherwise noted.

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

24. Accessories

24.1. ZM10.Wall - Wall / Panel Mounting Bracket

This bracket is used to mount the devices on a wall / panel without utilizing the DIN rail. The bracket can be mounted without detaching the DIN rail brackets from the power supply.

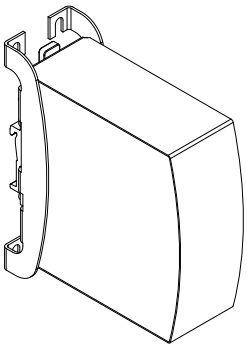


Fig. 24-1: Isometric view

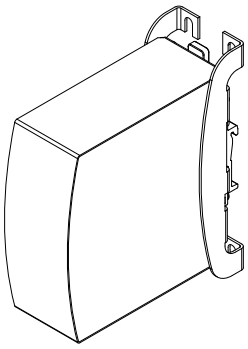


Fig. 24-2: Isometric view

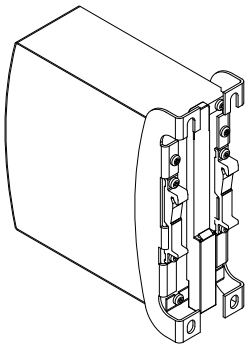


Fig. 24-3: Isometric view

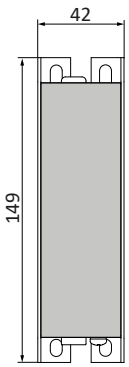


Fig. 24-4: Wall / panel mounting, front view

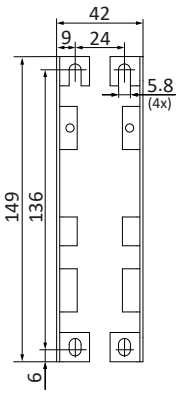


Fig. 24-5: Hole pattern for wall mounting

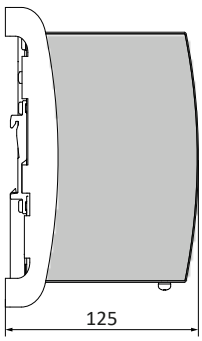


Fig. 24-6: Wall / panel mounting, side view

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

24.2. ZM12.Side - Side Mounting Bracket

This bracket is used to mount the power supply sideways with or without utilizing a DIN rail. The two aluminum brackets and the black plastic slider of the unit have to be detached, so that the steel brackets can be mounted. For sideway DIN rail mounting, the removed aluminum brackets and the black plastic slider need to be mounted on the steel bracket.

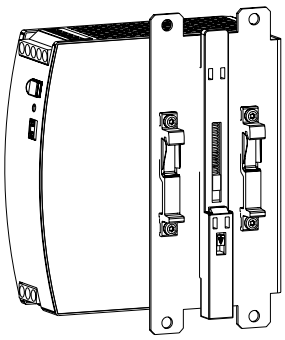


Fig. 24-7: Side mounting with DIN rail brackets

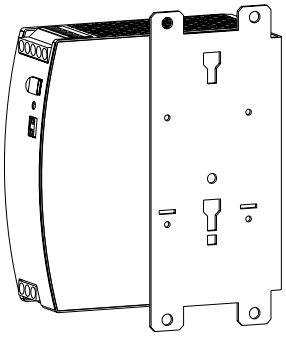


Fig. 24-8: Side mounting without DIN rail brackets

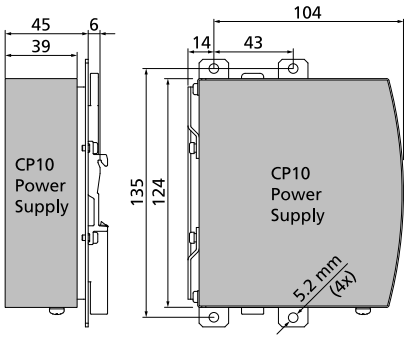


Fig. 24-9: Mounting dimensions side mounting bracket

All dimensions in mm unless otherwise noted.

25. Application Notes

25.1. Peak Current Capability

The device can deliver peak currents (up to several milliseconds) which are higher than the specified short term currents.

This helps to start current demanding loads. Solenoids, contactors and pneumatic modules often have a steady state coil and a pick-up coil. The inrush current demand of the pick-up coil is several times higher than the steady-state current and usually exceeds the nominal output current. The same situation applies when starting a capacitive load.

The peak current capability also ensures the safe operation of subsequent circuit breakers of load circuits. The load branches are often individually protected with circuit breakers or fuses. In case of a short or an overload in one branch circuit, the fuse or circuit breaker need a certain amount of over-current to open in a timely manner. This avoids voltage loss in adjacent circuits.

The extra current (peak current) is supplied by the power converter and the built-in large sized output capacitors of the power supply. The capacitors get discharged during such an event, which causes a voltage dip on the output. The following examples show typical voltage dips for resistive loads:

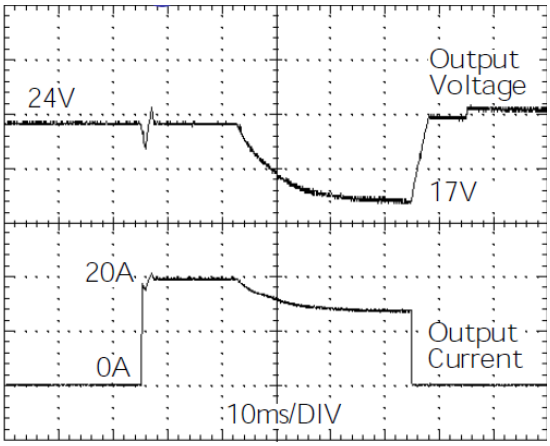


Fig. 25-1: 20 A peak current for
50 ms , typ. (2x the nominal current)

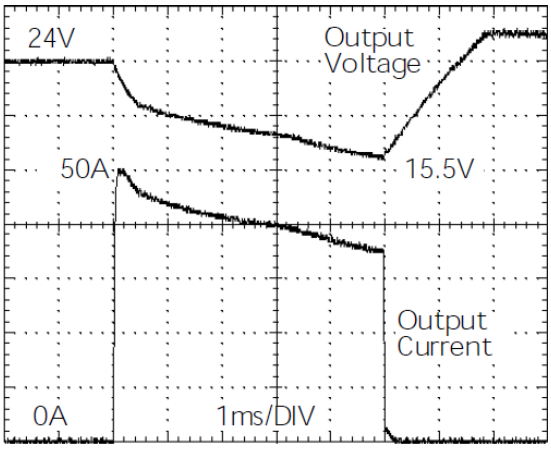


Fig. 25-2: 50 A peak current for
5 ms , typ. (5x the nominal current)

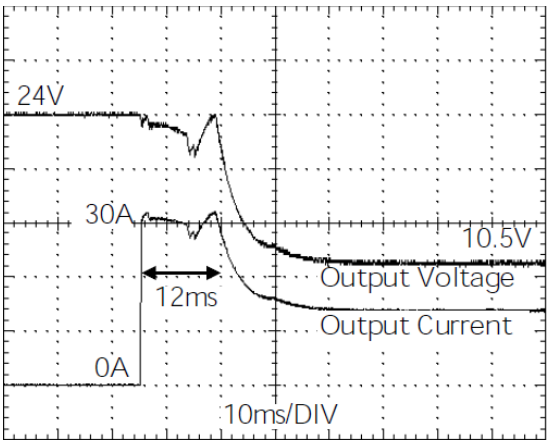


Fig. 25-3: 30 A peak current for
12 ms , typ. (3x the nominal current)

Please note: The DC-OK relay triggers when the voltage dips more than 10 % for longer than 1 ms.

Peak current voltage dips	typ.	From 24 V to 17 V	at 20 A for 50 ms, resistive load
	typ.	From 24 V to 19 V	at 50 A for 2 ms, resistive load
	typ.	From 24 V to 15.5 V	at 50 A for 5 ms, resistive load

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25.2. Adjusting the output voltage

A voltage adjustment potentiometer can be found behind the flap on the front of the unit (see chapter). However, it is not recommended to change the output voltage since load sharing between power supplies connected in parallel can only be achieved by a precise setting of the output voltages. The factory settings allow precise load sharing and only qualified personnel should change the adjustment potentiometer.

Lower end of the specified adjustment range			
Output voltage	nom.	24 V	Due to the soft output voltage regulation characteristic (parallel mode feature) a setting to 24 V results to an output voltage of 23.8 $V^{\pm 0.2\%}$ at 12 A and 25.0 $V^{\pm 0.2\%}$ at no load. See Fig. 25-4.
Output current	min.	12 A	at +45 °C
	min.	10 A	at +60 °C
	min.	7.5 A	at +70 °C
		Reduce output current linearly between +45 °C and +70 °C	
Upper end of the specified adjustment range			
Output voltage	nom.	27 V	Due to the soft output voltage regulation characteristic (parallel mode feature) a setting to 27 V results to an output voltage of 26.7 $V^{\pm 0.2\%}$ at 10.6 A and 28.2 $V^{\pm 0.2\%}$ at no load. See Fig. 25-4.
Output current	min.	10.6 A	at +45 °C
	min.	8.9 A	at +60 °C
	min.	6.7 A	at +70 °C
		Reduce output current linearly between +45 °C and +70 °C	

The maximum output voltage which can occur at the clockwise end position of the potentiometer due to tolerances is 30 V. It is not a guaranteed value which can be achieved.

Current values between 24 V and 27 V can be interpolated.

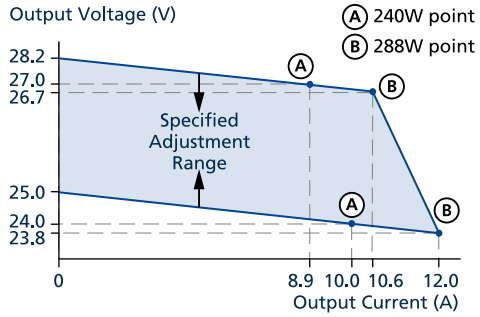


Fig. 25-4: Adjustment range of the output voltage

The output voltage shall only be changed when absolutely necessary, e.g. for battery charging as described in the next chapter.

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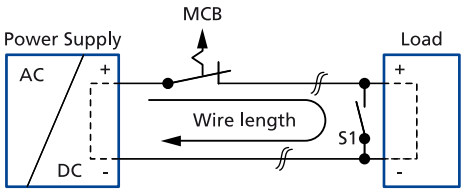
All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

25.3. Output Circuit Breakers

Standard miniature circuit breakers (MCB's or UL 1077 circuit breakers) are commonly used for AC-supply systems and may also be used on 24 V branches.

MCB's are designed to protect wires and circuits. If the ampere value and the characteristics of the MCB are adapted to the wire size that is used, the wiring is considered as thermally safe regardless of whether the MCB opens or not.

To avoid voltage dips and under-voltage situations in adjacent 24 V branches which are supplied by the same source, a fast (magnetic) tripping of the MCB is desired. A quick shutdown within 10 ms is necessary corresponding roughly to the ride-through time of PLC's. This requires power supplies with high current reserves and large output capacitors. Furthermore, the impedance of the faulty branch must be sufficiently small in order for the current to actually flow. The best current reserve in the power supply does not help if Ohm's law does not permit current flow. The following table has typical test results showing which B- and C-Characteristic MCBs magnetically trip depending on the wire cross section and wire length.



S1... Fault simulation switch

Fig. 25-5: Test circuit

Maximum wire length [1] for a fast (magnetic) tripping:

	0.75 mm²	1.0 mm²	1.5 mm²	2.5 mm²
C-2A	30 m	37 m	54 m	84 m
C-3A	25 m	30 m	46 m	69 m
C-4A	9 m	15 m	25 m	34 m
C-6A	3 m	3 m	4 m	7 m
C-8A	-	-	-	-
B-6A	12 m	15 m	21 m	34 m
B-10A	3 m	3 m	4 m	9 m
B-13A	2 m	2 m	3 m	6 m

1) Don't forget to consider twice the distance to the load (or cable length) when calculating the total wire length (+ and – wire).

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

25.4. Parallel Use to Increase Output Power

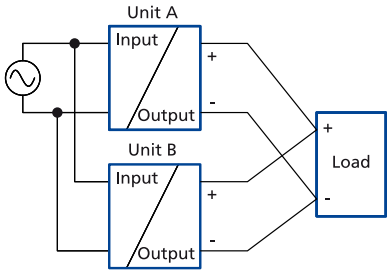
Power supplies can be paralleled to increase the output power. For redundancy applications one extra power supply is always needed for sufficient output current in case one unit fails.

The unit is permanently set to “parallel use” mode in order to achieve load sharing between devices connected in parallel. The “Parallel use” mode regulates the output voltage in such a manner that the voltage at no load is approx. 4% higher than at nominal load. See also chapter 6.

Energize all devices at the same time. It also might be necessary to cycle the input power (turn-off for at least five seconds), if the output was in overload or short circuits and the required output current is higher than the current of one unit.

Keep an installation clearance of 15mm (left / right) between two devices and avoid installing devices on top of each other. Do not use devices in parallel in mounting orientations other than the standard mounting orientation or in any other condition where a reduction of the output current is required (e.g. altitude).

Pay attention that leakage current, EMI, inrush current will increase when using multiple devices.



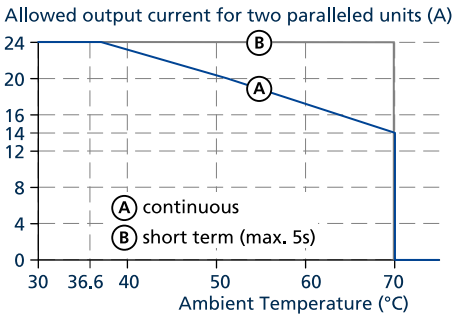


Fig. 25-6: Output current vs. ambient temp. for two paralleled units

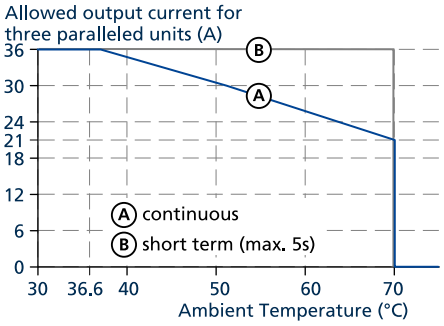


Fig. 25-7: Output current vs. ambient temp. for three paralleled units

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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

25.5. Parallel Use for Redundancy

Power supplies can be paralleled for redundancy to gain higher system availability. The unit is already equipped with a MOSFET as decoupling device on the output to avoid, that a faulty unit becomes a load for the other devices and the output voltage cannot be maintained anymore.

Recommendations for building redundant power systems:

a) Use separate input fuses for each power supply.
b) Monitor the individual power supply units by utilizing the built-in DC-OK relay contacts on each power supply.

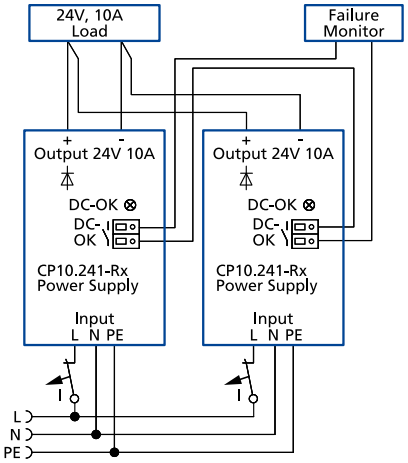


Fig. 25-8: Wiring diagram, 1+1
Redundancy for 10A output current

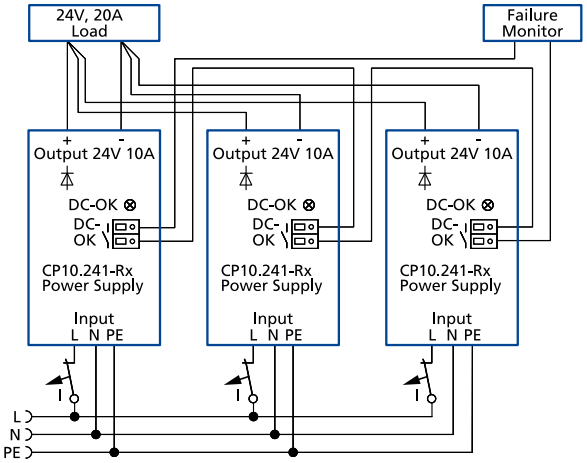


Fig. 25-9: Wiring diagram, N+1
Redundancy for 20A output current

Observe the temperature derating requirements of Fig. 25-6 and Fig. 25-7 for N+1 redundancy applications.

Note: Use separate mains systems for each power supply whenever it is possible.

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25.6. Series Operation

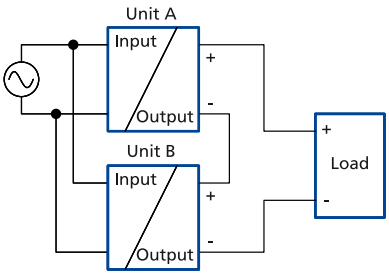
Power supplies of the same type can be connected in series for higher output voltages. It is possible to connect as many units in series as needed, providing the sum of the output voltage does not exceed 150 Vdc. Voltages with a potential above 60 Vdc are not SELV any more and can be dangerous. Such voltages must be installed with a protection against touching.

Earthing of the output is required when the sum of the output voltage is above 60 Vdc.

Avoid return voltage (e.g. from a decelerating motor or battery) which is applied to the output terminals.

Keep an installation clearance 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 mounting orientations other than the standard mounting orientation (terminals on the bottom of the unit).

Pay attention that leakage current, EMI, inrush current, harmonics will increase when using multiple power supplies.



25.7. Charging of Batteries

This redundancy power supply is ideal for charging batteries due to the decoupling circuit built in to the output stage which does not require a fuse or diode between the power supply and the battery.

It can be used to charge sealed lead acid (SLA) or valve regulated lead acid (VRLA) lead batteries when following these instructions:

Instructions for charging batteries:

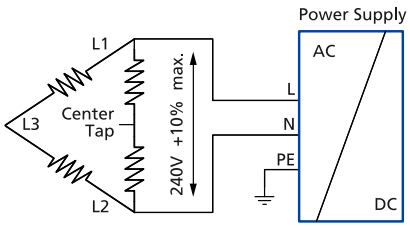
a) Set output voltage (measured at no load and at the battery end of the cable) very precisely to the end-of-charge voltage.
b) Ensure that the output current of the power supply is below the allowed charging current of the battery.
c) Use only matched batteries when putting 12V types in series.
d) The return current to the power supply (battery discharge current) is typ. 3mA when the power supply is switched off (except in case a blocking diode is utilized).

End-of-charge voltage	27.8V	27.5V	27.15V	26.8V
Battery temperature	10°C	20°C	30°C	40°C

25.8. Two Phases Operation

The power supply can also be operated on two phases of a three-phase-system. Such a phase-to-phase connection is allowed as long as the supplying voltage is below 240V$^{+10\%}$.

The maximum allowed voltage between a Phase and the PE must be below 300Vac.



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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

25.9. Use in a Tightly Sealed Enclosure

When the power supply is installed in a tightly sealed enclosure, the temperature inside the enclosure will be higher than outside. In such situations, the inside temperature defines the ambient temperature for the power supply.

The following measurement results can be used as a reference to estimate the temperature rise inside the enclosure. For this measurement the power supply is placed in the middle of the box, no other heat producing items are inside the box. The temperature sensor inside the box is placed in the middle of the right side of the power supply with a distance of 1cm to the power supply's side wall.

	Case A	**Case B**	**Case C**	**Case D**
Enclosure size	**110** x 180 x 165mm Rittal Typ IP66Box PK 9516 100 plastic	**110** x 180 x 165mm Rittal Typ IP66Box PK 9516 100 plastic	**180**x180x165mm Rittal Typ IP66Box PK 9519 100 plastic	**180**x180x165mm Rittal Typ IP66Box PK 9519 100 plastic
Input voltage	230 Vac	230 Vac	230 Vac	230 Vac
Load	24 V, 8 A; (=**80**%)	24 V, 10 A; (=**100**%)	24 V, 8 A; (=**80**%)	24 V, 10 A; (=**100**%)
Temperature inside the box	45.4 °C	49 °C	42 °C	44.4 °C
Temperature outside the box	25 °C	25°C	25 °C	25 °C
Temperature rise	20.4 K	24 K	17 K	19.4 K

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25.10. Mounting Orientations

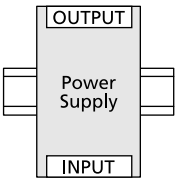
Mounting orientations other than input terminals on the bottom and output on the top require a reduction in continuous output power or a limitation in the maximum allowed ambient temperature.

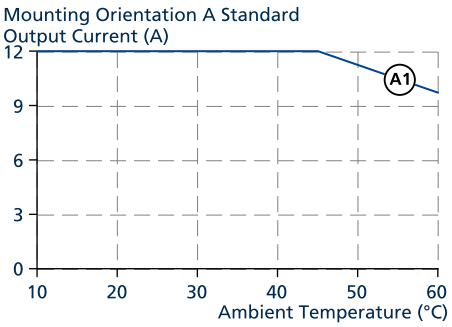
The amount of reduction influences the lifetime expectancy of the power supply. Therefore, two different derating curves for continuous operation can be found below:

Curve A1 Recommended output current.

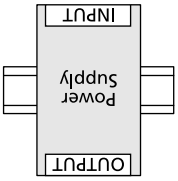
Curve A2 Max. allowed output current (results in approximately half the lifetime expectancy of A1).

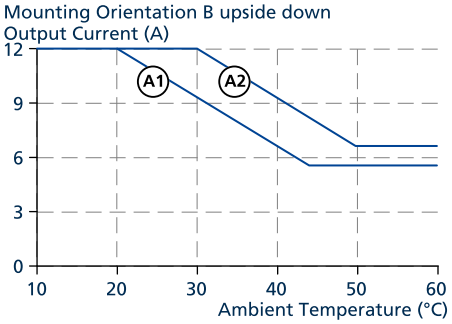
A
Standard orientation



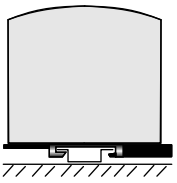


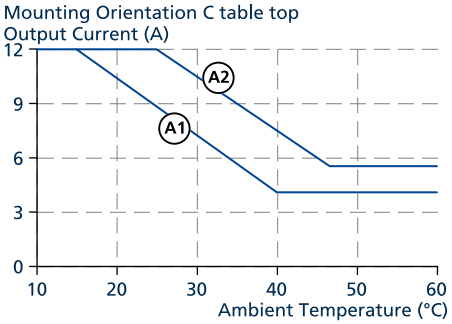
B
Upside down



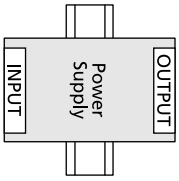


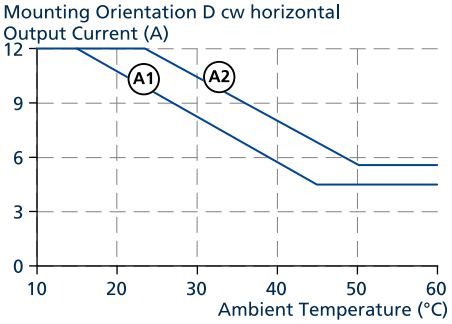
C
Table-top mounting





D
Horizontal cw

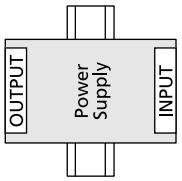


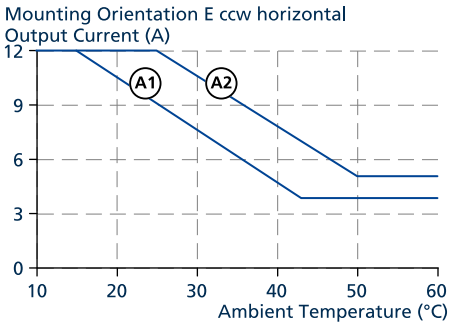


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All parameters are specified at 24V, 10A, 230Vac, +25°C ambient and after a 5 minutes run-in time unless otherwise noted.

E
Horizontal ccw





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