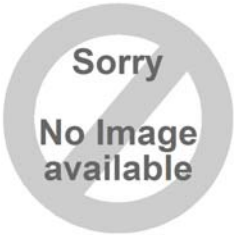
PRELIMINARY

PULS

CP10.241-R1, CP10.241-R2, CP10.241-R3,CP10.242-R2

DIMENSION CP-Series

24V, 10A, 240W, SINGLE PHASE



REDUNDANCY POWER SUPPLY

- AC 100-240V Wide-range Input
- Width only 39mm
- Built-in Decoupling Mosfet for 1+1 and n+1 Redundancy
- Efficiency up to 94.7%
- 20% Output Power Reserves
- Safe Hiccup*PLUS* Overload Mode
- Easy Fuse Breaking – 3 times nominal current for 12ms
- Active Power Factor Correction (PFC)
- Minimal Inrush Current Surge
- Full Power Between -25°C and +60°C
- DC-OK Relay Contact
- Current Sharing Feature Included
- 3 Year Warranty

GENERAL DESCRIPTION

The Dimension CP-Series are cost optimized power supplies without compromising quality, reliability and performance. The most outstanding features of the CP10.241–R1/-R2/-R3 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.

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.

CP10.242-R2 version feature an enhanced DC input voltage range.

With high immunity to transients and power surges, low electromagnetic emission, a DC-OK signal contact for remote monitoring, and a large international approval package, makes this unit suitable for nearly every application.

SHORT-FORM DATA

Output voltage	DC 24V	0%/+6%
Adjustment range	-	
Output current	12A	Below +45°C ambient
	10A	At +60°C ambient
	7.5A	At +70°C ambient
	Derate linearly between +45°C and +70°C	
AC Input voltage	AC 100-240V	-15%/+10%
Mains frequency	50-60Hz	±6%
AC Input current	2.17 / 1.14A	At 120 / 230Vac
Power factor	0.99 / 0.97	At 120 / 230Vac
Input voltage DC	DC 110-150V$^{\pm 20\%}$	For CP10.241-Rx
	DC 110-300V$^{\pm 20\%}$	For CP10.242-R2
Input current DC	2.35A / 0.84A	At 110 / 300Vdc
AC Inrush current	6 / 9Apk	At 120 / 230Vac
Efficiency	93.0 / 94.7%	At 120 / 230Vac
Losses	18.1 / 13.4W	At 120 / 230Vac
Hold-up time	37 / 37ms	At 120 / 230Vac
Temperature range	-25°C to +70°C	
Size (w x h x d)	39x124x117mm	Without DIN-rail and plug connectors
Weight	600g / 1.32lb	

ORDER NUMBERS

Power Supplies

CP10.241-R1	With quick-connect spring-clamp terminals
CP10.241-R2	With hot swappable plug connectors (preferred item)
CP10.241-R3	With screw terminals
CP10.242-R2	Enhanced DC-Input

Mechanical Accessory

ZM4.WALL	Wall/panel mount bracket
ZM12.SIDE	Side mount bracket

MARKINGS

For details or a complete approval list see section 20.

CE

INDEX

TERMINOLOGY AND ABREVIATIONS

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 230V A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances (usually ±15%) included.
E.g.: DC 12V describes a 12V battery disregarding whether it is full (13.7V) or flat (10V)

230Vac A figure with the unit (Vac) at the end is a momentary figure without any additional tolerances included.

50Hz vs. 60Hz As long as not otherwise stated, AC 230V parameters are valid at 50Hz mains frequency.

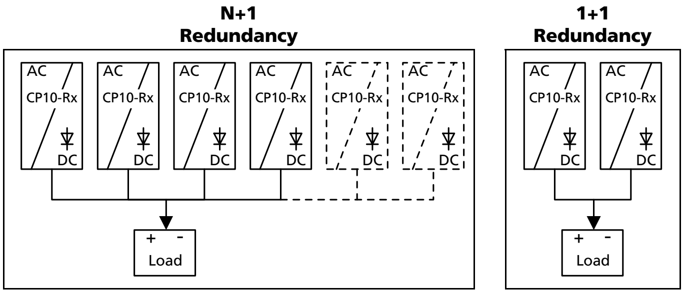
may A key word indicating flexibility of choice with no implied preference.

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. The two power supply outputs should be isolated from each other by utilizing diodes or other switching arrangements. E.g. two 10A power supplies are needed to achieve a 10A redundant system.

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. All power supply outputs should be isolated from each other by utilizing diodes or other switching arrangements.



E.g.: To achieve a 40A redundant system, five 10A power supplies are needed in a N+1 redundant system.

1. INTENDED USE

This device is designed for installation in an enclosure and is intended for the general professional use such as in industrial control, office, communication, and instrumentation equipment.

Do not use this power supply in equipment, where malfunction may cause severe personal injury or threaten human life.

2. INSTALLATION REQUIREMENTS

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

- Do not use the power supply without proper grounding (Protective Earth). Use the terminal on the input block for earth connection and not one of the screws on the housing.
- Turn power off before working on the device. Protect against inadvertent re-powering.
- Make sure that the wiring is correct by following all local and national codes.
- Do not modify or repair the unit.
- Do not open the unit as high voltages are present inside.
- 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.

Obey the following installation requirements:

- This device may only be installed and put into operation by qualified personnel.
- Install the device in an enclosure providing protection against electrical, mechanical and fire hazards.
- The device is designed for use in pollution degree 2 areas in controlled environments.
- The enclosure of the device provides a degree of protection of IP20 according to IEC 60529.
- Mount the unit on a DIN-rail so that the input terminals are located on the bottom of the unit. For other mounting orientations see de-rating requirements in this document.
- The device is designed for convection cooling and does not require an external fan. Do not obstruct airflow and do not cover ventilation grid (e.g. cable conduits) by more than 15%!
- Keep the following installation clearances: 40mm on top, 20mm on the bottom, 5mm on the left and right sides are recommended when the device is loaded permanently with more than 50% of the rated power. Increase this clearance to 15mm in case the adjacent device is a heat source (Example: another power supply).
- 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. Check also local codes and local requirements. In some countries local regulations might apply.
- 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.
- The device is designed, tested and approved for branch circuits up to up to 30A (UL) or 32A (IEC) without additional protection device. If an external fuse is utilized, do not use circuit breakers smaller than 10A B- or C-Characteristic to avoid a nuisance tripping of the circuit breaker.
- A disconnecting means shall be provided for the input of the power supply.

3. AC-INPUT

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

AC input	Nom.	AC 100-240V	
AC input range	Min.	85-264Vac	Continuous operation
	Min.	264-300Vac	For maximal 500ms (occasional)
Allowed voltage L or N to earth	Max.	300Vac	Continuous, according to IEC 60664-1
Input frequency	Nom.	50–60Hz	±6%
Turn-on voltage	Typ.	80Vac	Steady-state value, see Fig. 3-1
Shut-down voltage	Typ.	70Vac	Steady-state value, see Fig. 3-1
	Typ.	55Vac	Dynamic value (max. 250ms)
External input protection	See recommendations in chapter 2.		

		AC 100V	AC 120V	AC 230V	
Input current	Typ.	2.63A	2.17A	1.14A	At 10A, see Fig. 3-3
Power factor	Typ.	0.99	0.99	0.97	At 10A, see Fig. 3-4
Crest factor	Typ.	1.5	1.5	1.65	At 10A, The crest factor is the mathematical ratio of the peak value to RMS value of the input current waveform.
Start-up delay	Typ.	300ms	290ms	240ms	See Fig. 3-2
Rise time	Typ.	30ms	30ms	30ms	At 10A const. current load, 0mF load capacitance, see Fig. 3-2
	Typ.	75ms	75ms	75ms	At 10A const. current load, 20mF load capacitance,, see Fig. 3-2
Turn-on overshoot	Max.	200mV	200mV	200mV	See Fig. 3-2

Fig. 3-1 **Input voltage range**

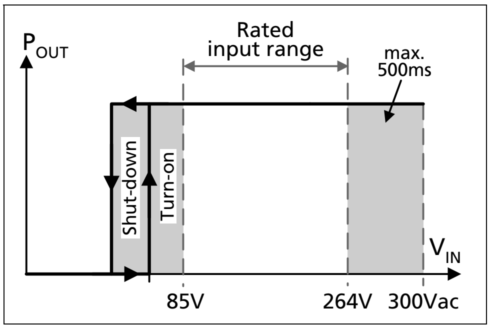


Fig. 3-2 **Turn-on behavior, definitions**

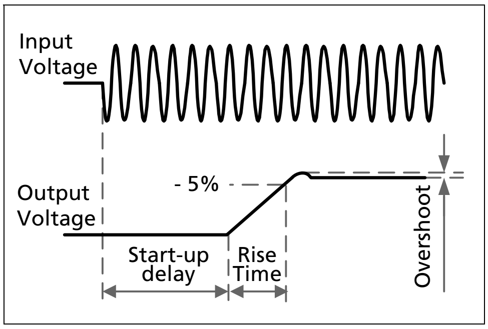


Fig. 3-3 **Input current vs. output current**

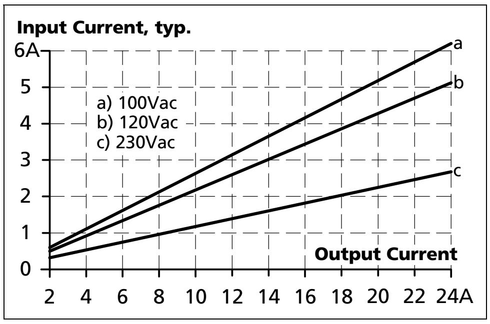
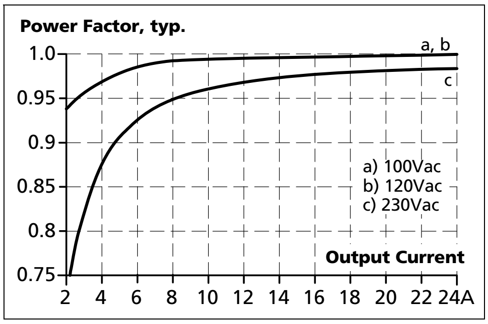


Fig. 3-4 **Power factor vs. output current**



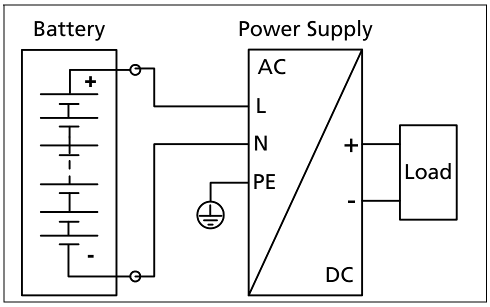
4. DC-INPUT

The device is suitable to be supplied from a DC input voltage. Use a battery or a similar DC source. A supply from the intermediate DC-bus of a frequency converter is not recommended and can cause a malfunction or damage the unit.

Connect +pole to L, –pole to N and the PE terminal to an earth wire or to the machine ground.

DC input	Nom.	DC 110-150V	±20% for CP10.241-Rx
	Nom.	DC 110-300V	±20% for CP10.242-R2
DC input range	Min.	88-180Vdc	Continuous operation for CP10.241-Rx
		88-360Vdc	Continuous operation for CP10.242-R2
DC input current	Typ.	2.35A	At 110Vdc and 10A load current
	Typ.	0.84A	At 300Vdc and 10A load current
Allowed Voltage (+) or (-) input to Earth	Max.	360Vdc	Continuous according to IEC 60664-1
Turn-on voltage	Typ.	80Vdc	Steady state value
Shut-down voltage	Typ.	70Vdc	Steady state value
	Typ.	55Vdc	Dynamic value (max. 250ms)

Fig. 4-1 **Wiring for DC Input**



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 100V	AC 120V	AC 230V	
Inrush current	Max.	11A_{peak}	7A_{peak}	11A_{peak}	At 40°C, cold start
	Typ.	9A_{peak}	6A_{peak}	6A_{peak}	At 25°C, cold start
	Typ.	9A_{peak}	6A_{peak}	9A_{peak}	At 40°C, cold start
Inrush energy	Max.	0.1A²s	0.1A²s	0.4A²s	At 40°C, cold start

Fig. 5-1 **Typical turn-on behaviour at nominal load, 120Vac input and 25°C ambient**

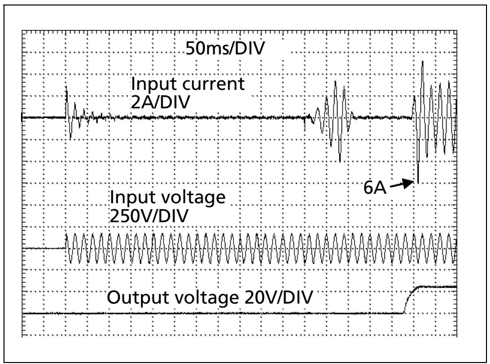
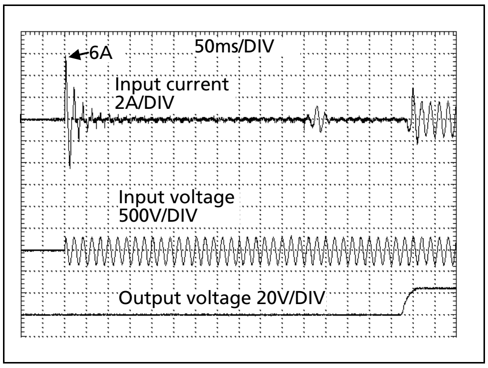


Fig. 5-2 **Typical turn-on behaviour at nominal load, 230Vac input and 25°C ambient**



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 1.5F 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 24V	23.8 - 25.2V
Adjustment range		See chapter 24.2	
Factory settings	typ.	24.1V	±0.2%, at 10A, cold unit (results to typ. 23.9V$^{\pm0.2\%}$ at 12A and typ. 25.1V$^{\pm0.2\%}$ at no load)
Line regulation	Max.	10mV	85-300Vac
Load regulation	Typ.	1000mV	Static value, 0A → 10A; see Fig. 6-1
Ripple and noise voltage	Max.	50mVpp	20Hz to 20MHz, 50Ohm
Output current	Nom.	12A[1]	Below 45°C ambient temperature, see Fig. 17-1
	Nom.	10A	At 60°C ambient temperature, see Fig. 17-1
	Nom.	7.5A	At 70°C ambient temperature, see Fig. 17-1
Fuse breaking current[2]	Typ.	30A	Up to 12ms once every five seconds, see Fig. 6-3.
Overload protection		Included	Electronically protected against overload, no-load and short-circuits. In case of a protection event, audible noise may occur.
Overload behaviour		Continuous current	Output voltage >13Vdc, see Fig. 6-1
		Intermitted current[3]	Output voltage <13Vdc, see Fig. 6-1
Overload/ short-circuit current	Max.	15.5A	Continuous current, see Fig. 6-1
	Typ.	14A	Intermitted current peak value for typ. 2s Load impedance 10mOhm, see Fig. 6-2. Discharge current of output capacitors is not included.
	Max.	5A	Intermitted current average value (R.M.S.) Load impedance 10mOhm, see Fig. 6-2.
Output capacitance	Typ.	4 400µF	Included inside the power supply
Back-feeding loads	Max.	35V	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) This current is also available for temperatures up to +70°C with a duty cycle of 10% and/ or not longer than 1 minute every 10 minutes.

2) The fuse braking 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 20V. See chapter 24.1 for additional measurements.

3) At heavy overloads (when output voltage falls below 13V), the power supply delivers continuous output current for 2s. After this, the output is switched off for approx. 18s 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. 6-2.

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

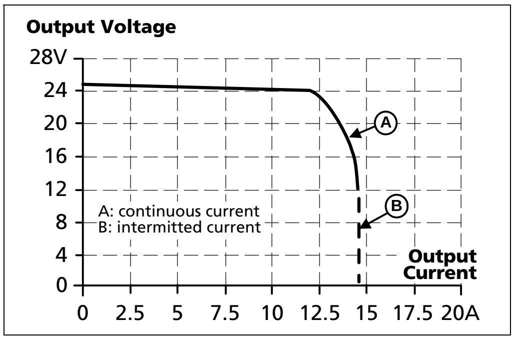


Fig. 6-2 **Short-circuit on output, Hiccup^PLUS mode, typ.**

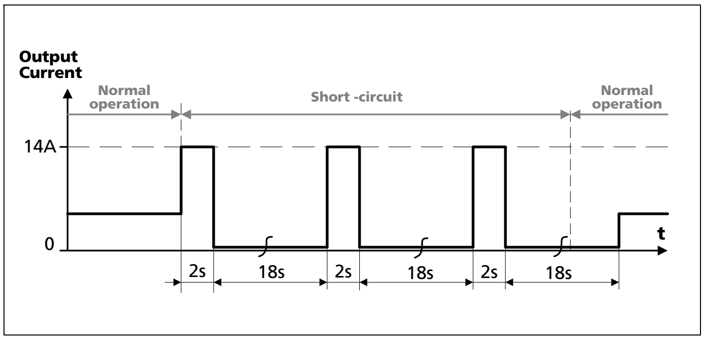
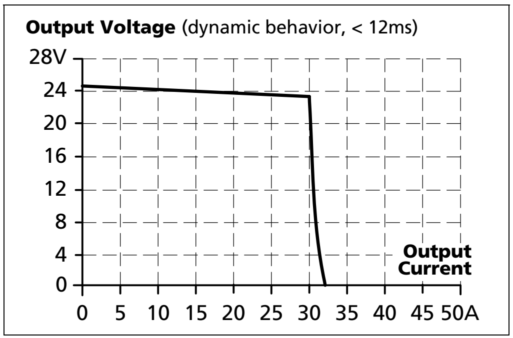


Fig. 6-3 **Dynamic overcurrent capability, typ.**



7. HOLD-UP TIME

		AC 100V	AC 120V	AC 230V	
Hold-up Time	Typ.	73ms	73ms	73ms	At 5A, see Fig. 7-1
	Min.	55ms	55ms	55ms	At 5A, see Fig. 7-1
	Typ.	37ms	37ms	37ms	At 10A, see Fig. 7-1
	Min.	28ms	28ms	28ms	At 10A, see Fig. 7-1

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

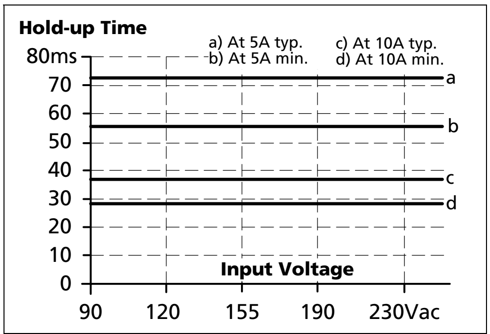
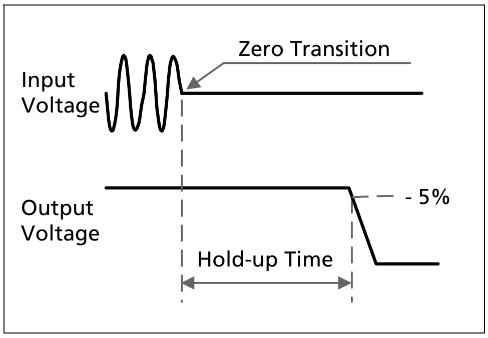


Fig. 7-2 **Shut-down behavior, definitions**

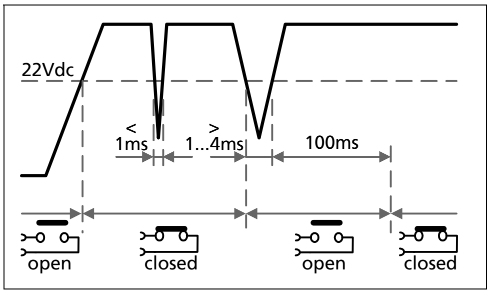


8. DC-OK RELAY CONTACT

This feature monitors the output voltage of the power supply in front of the decoupling device (see also chapter 12).

Contact closes	As soon as the output voltage reaches typically 22Vdc.
Contact opens	As soon as the output voltage dips below 22Vdc. Short dips will be extended to a signal length of 100ms. Dips shorter than 1ms will be ignored.
Switching hysteresis	1V
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 19.

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



9. EFFICIENCY AND POWER LOSSES

		AC 100V	AC 120V	AC 230V	
Efficiency	Typ.	92.2%	93.0%	94.7%	At 10A
	Typ.	91.9%	92.8%	94.6%	At 12A (Power Boost)
Average efficiency*)	Typ.	91.8%	92.4%	93.9%	At 25% at 2.5A, 25% at 5A, 25% at 7.5A. 25% at 10A
Power losses	Typ.	4W	3.7W	2.9W	At 0A
	Typ.	11.3W	10.7W	8.6W	At 5A
	Typ.	20.3W	18.1W	13.4W	At 10A
	Typ.	25.4W	22.3W	16.4W	At 12A (Power Boost)

*) 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, typ**

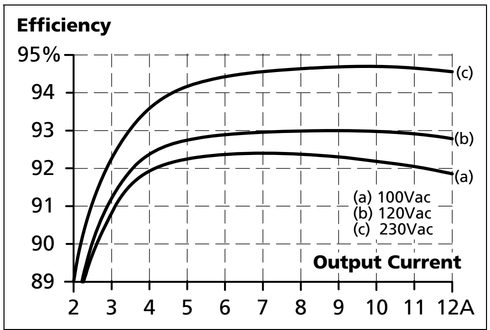


Fig. 9-2 **Losses vs. output current, typ.**

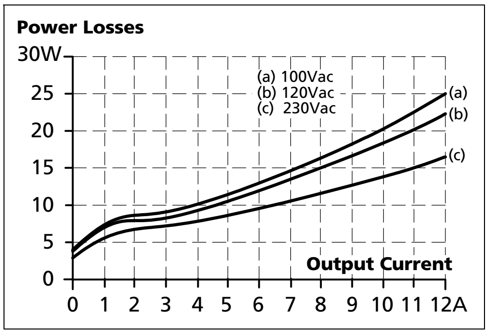


Fig. 9-3 **Efficiency vs. input voltage at 10A, typ.**

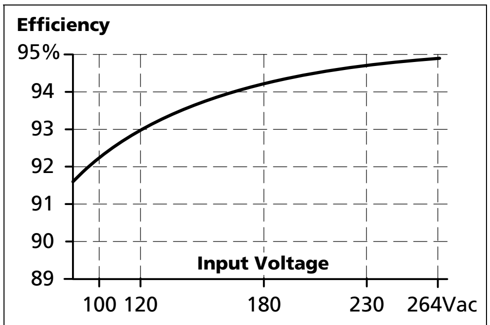
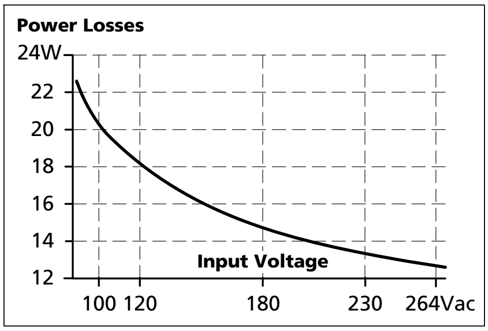


Fig. 9-4 **Losses vs. input voltage at 10A, typ.**



10. LIFETIME EXPECTANCY

The Lifetime expectancy shown in the table indicates the minimum operating hours (service life) 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 life of up to 15 years (131 400h). Any number exceeding this value is a calculated theoretical lifetime which can be used to compare devices.

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

11. MTBF

MTBF stands for **M**ean **T**ime **B**etween **F**ailure, 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 life of a product.

The MTBF figure is a statistical representation of the likelihood of a device to fail. A MTBF figure of e.g. 1 000 000h means that statistically one unit will fail every 100 hours if 10 000 units are installed in the field. However, it can not be determined if the failed unit has been running for 50 000h or only for 100h.

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

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

12. FUNCTIONAL DIAGRAM

Fig. 12-1 **Functional diagram CP10.241-R1 and CP10.241-R3**

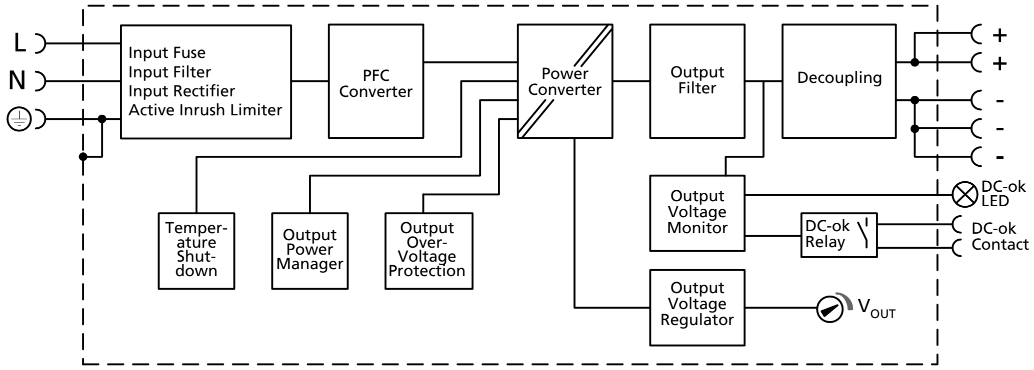
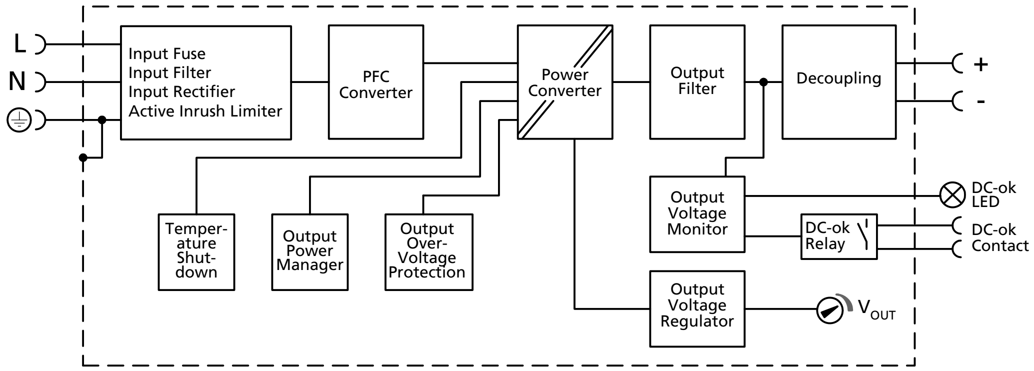


Fig. 12-2 **Functional diagram CP10.241-R2, CP10.242-R2**



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 termination	Quick-connect spring-clamp termination	Push-in termination
Solid wire	Max. 6mm²	Max. 6mm²	Max. 1.5mm²
Stranded wire	Max. 4mm²	Max. 4mm²	Max. 1.5mm²
American Wire Gauge	AWG 20-10	AWG 20-10	AWG 24-16
Max. wire diameter (including ferrules)	2.8mm	2.8mm	1.6mm
Wire stripping length	10mm / 0.4inch	10mm / 0.4inch	7mm / 0.28inch
Screwdriver			3 mm slotted to open the spring

CP10.241-R2, CP10.242-R2	**Input**	**Output**	**DC-OK-Signal**
Type	Plug connector with screw termination	Plug connector with screw termination	Plug connector with screw termination
Solid wire	Max. 4mm²	Max. 4mm²	Max. 1.5mm²
Stranded wire	Max. 2.5mm²	Max. 2.5mm²	Max. 1.5mm²
American Wire Gauge	AWG 20-12	AWG 20-12	AWG 26-14
Max. wire diameter (including ferrules)	2.4mm	2.4mm	1.8mm
Recommended tightening torque	Max. 0.5Nm, 4.5lb-in	Max. 0.5Nm, 4.5lb-in	Max. 0.8Nm, 7lb-in
Wire stripping length	7mm / 0.28inch	7mm / 0.28inch	6mm / 0.24inch
Screwdriver	3.5mm slotted or cross-head No 2	3.5mm slotted or cross-head No 2	3.5mm 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

CP10.241-R3	**Input**	**Output**	**DC-OK-Signal**
Type	Screw termination	Screw termination	Push-in termination
Solid wire	Max. 6mm²	Max. 6mm²	Max. 1.5mm²
Stranded wire	Max. 4mm²	Max. 4mm²	Max. 1.5mm²
American Wire Gauge	AWG 20-10	AWG 20-10	AWG 24-16
Max. wire diameter (including ferrules)	2.8mm	2.8mm	1.6mm
Recommended tightening torque	Max. 1Nm, 9lb-in	Max. 1Nm, 9lb-in	-
Wire stripping length	7mm / 0.28inch	7mm / 0.28inch	7mm / 0.28inch
Screwdriver	3.5mm slotted or cross-head No 2	3.5mm slotted or cross-head No 2	3mm slotted to open the spring

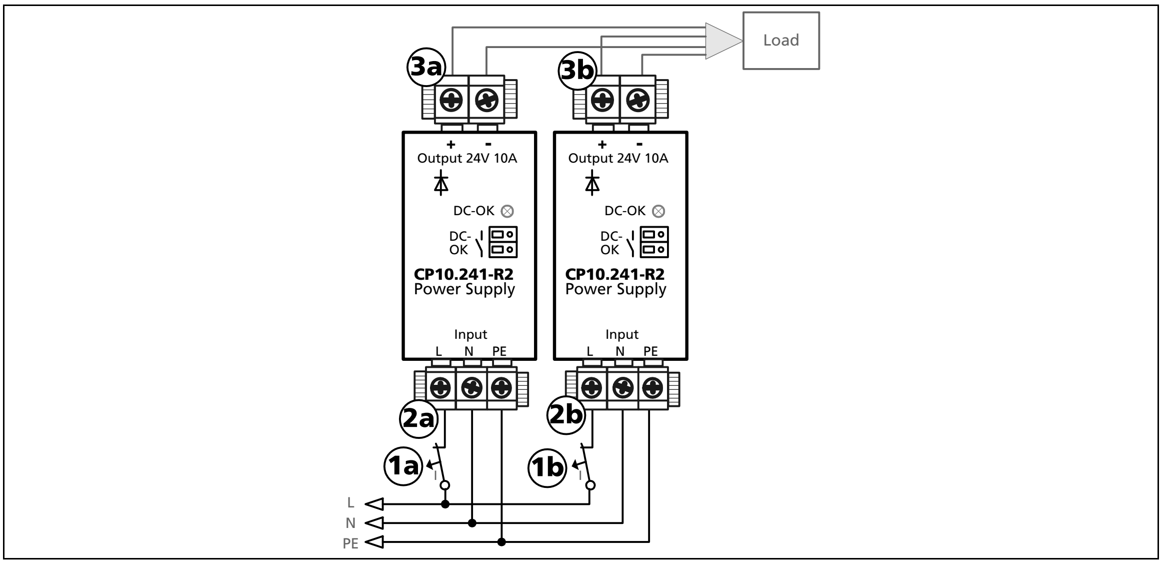
Instructions for wiring:

a) Use appropriate copper cables that are designed for minimum operating temperatures of: 60°C for ambient up to 45°C, 75°C for ambient up to 60°C and 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 allowed and recommended.

14. REPLACING UNITS WHILE THE SYSTEM IS RUNNING

This feature is available only for the CP10.241-R2 and CP10.242-R2 units, which are equipped with hot-swappable plug connectors.

Fig. 14-1 **Replacing the power supply or redundancy module while the system is running**



Replacement instructions (Example for left power supply):

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

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

15. FRONT SIDE AND USER ELEMENTS

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

Fig. 15-2 **Front side CP10.241-R2 CP10.242-R2**

Fig. 15-3 **Front side CP10.241-R3**

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

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

C **Output voltage potentiometer**
See chapter 24.2.

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

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

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 the generic standards EN 61000-6-1 and EN 61000-6-2			
Electrostatic discharge	EN 61000-4-2	Contact discharge Air discharge	8kV 15kV	Criterion A Criterion A
Electromagnetic RF field	EN 61000-4-3	80MHz-2.7GHz	20V/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	Input lines Output lines DC-OK signal (coupling clamp)	4kV 2kV 2kV	Criterion A Criterion A Criterion A
Surge voltage on input	EN 61000-4-5	L → N L → PE, N → PE	2kV 4kV	Criterion A Criterion A
Surge voltage on output	EN 61000-4-5	+ → - + / - → PE	1kV 2kV	Criterion A Criterion A
Surge voltage on Signals	EN 61000-4-5	DC-OK signal → PE	1kV	Criterion A
Conducted disturbance	EN 61000-4-6	0.15-80MHz	20V	Criterion A
Mains voltage dips	EN 61000-4-11	0% of 100Vac 40% of 100Vac 70% of 100Vac 0% of 200Vac 40% of 200Vac 70% of 200Vac	0Vac, 20ms 40Vac, 200ms 70Vac, 500ms 0Vac, 20ms 80Vac, 200ms 140Vac, 500ms	Criterion A Criterion C Criterion A Criterion A Criterion A Criterion A
Voltage interruptions	EN 61000-4-11	0% of 200Vac (=0V)	5000ms	Criterion C
Voltage sags	SEMI F47 0706	Dips on the input voltage according to SEMI F47 standard		
		80% of 120Vac (96Vac) 70% of 120Vac (84Vac) 50% of 120Vac (60Vac)	1000ms 500ms 200ms	Criterion A Criterion A Criterion A
Powerful transients	VDE 0160	Over entire load range	750V, 0.3ms	Criterion A

Criterions:
A: Power supply shows normal operation behavior within the defined limits.
C: Temporary loss of function is possible. Device may shut-down and restarts by itself. No damage or hazards for the power supply will occur.

EMC Emission	According to the generic standards EN 61000-6-3 and EN 61000-6-4	
Conducted emission input lines	EN 55011, EN 55015, EN 55022, FCC Part 15, CISPR 11, CISPR 22	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 55022	Class B
Harmonic input current	EN 61000-3-2	Class A fulfilled between 0A and 12A load Class C fulfilled between 6A and 12A load
Voltage fluctuations, flicker	EN 61000-3-3	Fulfilled, tested with constant current loads, non pulsing

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

17. ENVIRONMENT

Operational temperature	-25°C to +70°C (-13°F to 158°F)	Operational temperature is the same as the ambient or surrounding temperature and is defined as the air temperature 2cm below the unit.
Storage temperature	-40°C to +85°C (-40°F to 185°F)	For storage and transportation
Output de-rating 1)	0.13A/°C 0.25A/°C 0.63A/1000m or 5°C/1000m 0.38A/-5kPa or 3°C/-5kPa	Between +45°C and +60°C (113°F to 140°F) Between +60°C and +70°C (140°F to 158°F) For altitudes >2000m (6560ft), see Fig. 17-2 For atmospheric pressures <80kPa, see Fig. 17-2
Humidity	5 to 95% r.h.	According to IEC 60068-2-30 Do not energize while condensation is present.
Atmospheric pressure	110-47kPa	See see Fig. 17-2 for details
Altitude	Up to 6000m (20 000ft)	See see Fig. 17-2 for details
Over-voltage category	III II	According to IEC 60664-1 for altitudes up to 2000m According to IEC 60664-1, for altitudes between 2000 and 6000m and atmospheric pressures from 80-47kPa.
Degree of pollution	2	According to IEC 60664-1, not conductive
Vibration sinusoidal	2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g 2 hours / axis	According to IEC 60068-2-6
Shock 2)	30g 6ms, 20g 11ms 3 bumps per direction, 18 bumps in total	According to IEC 60068-2-27
LABS compatibility	As a rule, only non-silicon precipitating materials are used. The unit conforms to the LABS criteria and is suitable for use in paint shops.	
Corrosive gases	Tested according to ISA-71.04-1985, Severity Level G3 and IEC 60068-2-60 Test Ke Method 4 for a service life of minimum 10years in these environments.	
Audible noise	Some audible noise may be emitted from the power supply during no load, overload or short circuit.	

1) The de-rating is not hardware controlled. The customer has to take this into consideration to stay below the de-rated current limits in order not to overload the unit.

2) Shock and vibration is tested in combination with DIN-Rails according to EN 60715 with a height of 15mm and a thickness of 1.3mm and standard orientation.

Fig. 17-1 **Output current vs. ambient temp.**

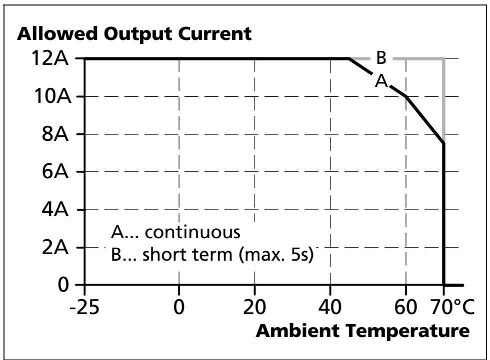
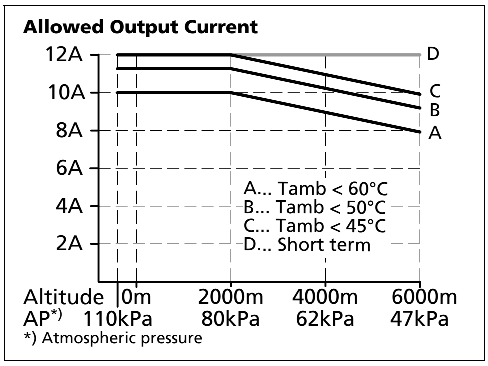


Fig. 17-2 **Output current vs. altitude**



18. SAFETY AND PROTECTION FEATURES

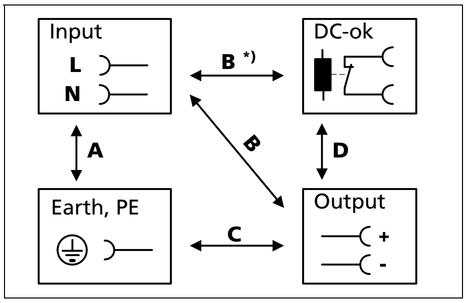
Isolation resistance	Min.	500MOhm	At delivered condition between input and output, measured with 500Vdc
	Min.	500MOhm	At delivered condition between input and PE, measured with 500Vdc
	Min.	500MOhm	At delivered condition between output and PE, measured with 500Vdc
	Min.	500MOhm	At delivered condition between output and DC-OK contacts, measured with 500Vdc
PE resistance	Max.	0.1Ohm	Resistance between PE terminal and the housing in the area of the DIN-rail mounting bracket.
Output over-voltage protection[1)]	Typ.	30.5Vdc	
	Max.	32Vdc	
Class of protection		I	According to IEC 61140
Degree of protection		IP 20	According to EN/IEC 60529
Over-temperature protection[2)]		Included	Output shut-down with automatic restart.
Input transient protection		MOV	(Metal Oxide Varistor) For protection values see chapter 16 (EMC).
Internal input fuse		Included	Not user replaceable slow-blow high-braking capacity fuse
Touch current (leakage current)	Typ.	0.14mA / 0.36mA	At 100Vac, 50Hz, TN-,TT-mains / IT-mains
	Typ.	0.20mA / 0.50mA	At 120Vac, 60Hz, TN-,TT-mains / IT-mains
	Typ.	0.33mA / 0.86mA	At 230Vac, 50Hz, TN-,TT-mains / IT-mains
	Max.	0.18mA / 0.43mA	At 110Vac, 50Hz, TN-,TT-mains / IT-mains
	Max.	0.26mA / 0.61mA	At 132Vac, 60Hz, TN-,TT-mains / IT-mains
	Max.	0.44mA / 1.05mA	At 264Vac, 50Hz, TN-,TT-mains / IT-mains

1) In case of an internal defect, a redundant circuit limits the maximum output voltage. The output shuts down and automatically attempts to restart.
2) 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 de-rating 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.

19. 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 (2s up and 2s 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.

Fig. 19-1 **Dielectric strength**



		A	B	C	D
Type test	60s	2500Vac	4000Vac	1000Vac	500Vac
Routine test	5s	2500Vac	2500Vac	500Vac	500Vac
Field test	5s	2000Vac	2000Vac	500Vac	500Vac
Cut-off current setting for field test		> 10mA	> 10mA	> 20mA	> 1mA

It is recommend that either the + pole, the – pole or any other part of the output circuit shall be connected to the earth/ground system. This helps to avoid situations in which a load starts unexpectedly or can not be switched off when unnoticed earth faults occur.

B*) When testing input to DC-OK ensure that the maximal 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.

20. APPROVALS

EC Declaration of Conformity	CE	The CE mark indicates conformance with the - EMC directive, - Low-voltage directive and the - ATEX directive (planned)
IEC 60950-1 2nd Edition planned	IECEE CB SCHEME	CB Scheme for I.T.E. Information Technology Equipment
IEC 62368-1 2nd Edition planned	IECEE CB SCHEME	CB Scheme for I.C.T. Information and Communication Technology
IEC 61010-2-201 2nd Edition planned	IECEE CB SCHEME	CB Scheme for electrical equipment for measurement, control, and laboratory use - Part 2-201: Particular requirements for control equipment
ANSI/UL 61010-2-201 (former UL 508) planned	c UL US LISTED Ind. Cont. Eq.	Listed as Open Type Device for use in Control Equipment UL Category NMTR, NMTR7 E-File: E198865
ANSI/ISA 12.12.01 Class I Div 2 planned	c UL US LISTED Process Cont. Eq.	Listed for use in Hazardous Location Class I Div 2
EN 60079-0, EN 60079-7 ATEX planned	Ex II 3G Ex ec nC II T4 Gc	Approval for use in hazardous locations Zone 2 Category 3G. Number of ATEX certificate: T.B.D.
IEC 60079-0, IEC 60079-7 planned	IECEx	Suitable for use in Class 1 Zone 2 Groups IIa, IIb and IIc locations. Number of IECEx certificate: T.B.D.
EAC TR Registration (only for CP10.241-R1 and CP10.241-R3)	EAC	Registration for the Eurasian Customs Union market (Russia, Kazakhstan, Belarus)

21. OTHER FULFILLED STANDARDS

RoHS Directive	RoHS ✔	Directive 2011/65/EU of the European Parliament and the Council of June 8th, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
REACH Directive	REACH ✔	Directive 1907/2006/EU of the European Parliament and the Council of June 1st, 2007 regarding the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
IEC/EN 61558-2-16 (Annex BB)	Safety Isolating Transformer	Safety Isolating Transformers corresponding to Part 2-6 of the IEC/EN 61558

22. PHYSICAL DIMENSIONS AND WEIGHT

Width	39mm 1.54''
Height	124mm 4.88'' (without plug-connectors)
Depth	117mm 4.61'' (without plug-connector) The DIN-rail height must be added to the unit depth to calculate the total required installation depth.
Weight	600g / 1.32lb
DIN-Rail	Use 35mm DIN-rails according to EN 60715 or EN 50022 with a height of 7.5 or 15mm.
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 4mm

Fig. 22-1 **Front view**

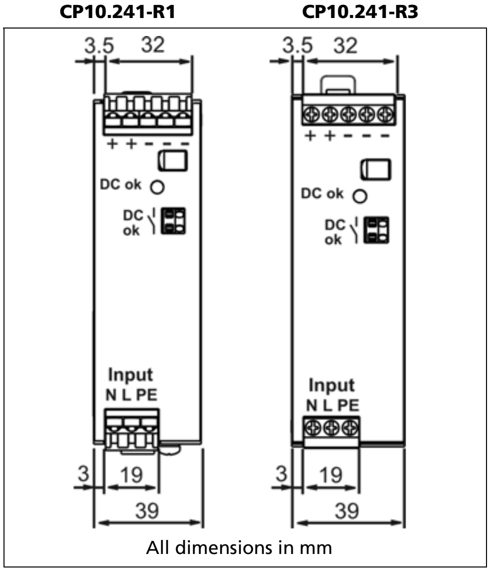


Fig. 22-2 **Side view CP10.241-R1 and CP10.241-R3**

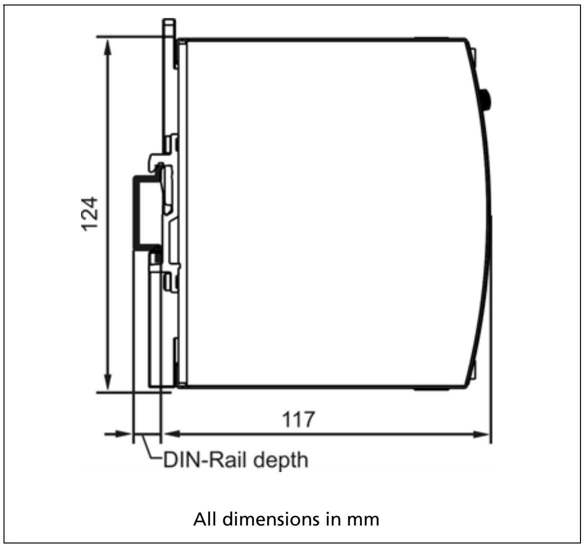


Fig. 22-3 **Front view CP10.241-R2**

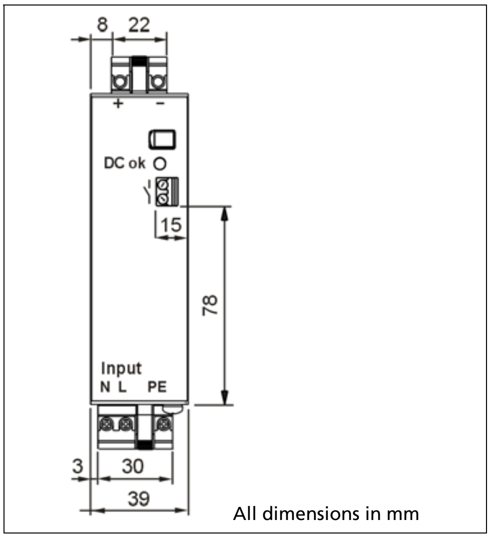
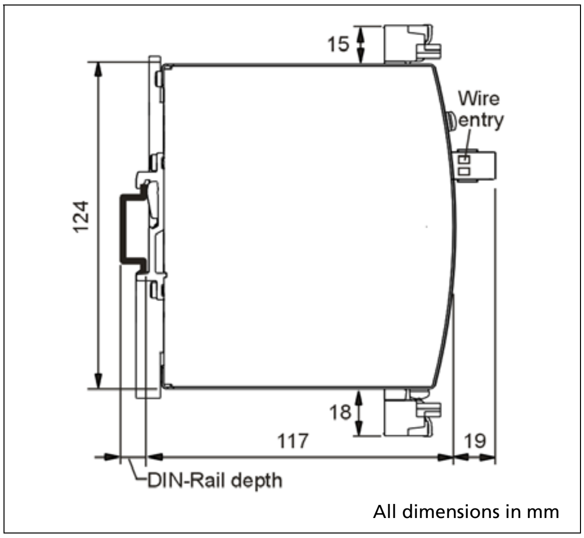


Fig. 22-4 **Side view CP10.241-R2**



23. ACCESSORIES

23.1. ZM4.WALL – WALL/PANEL MOUNT BRACKET

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

Fig. 23-1 **Isometric view**
(Picture shows the CP10.241-R3)

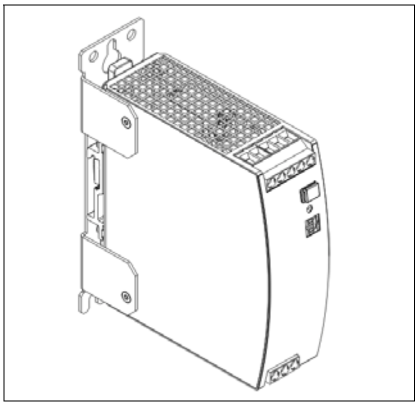


Fig. 23-2 **Isometric view-**
(Picture shows the CP10.241-R3)

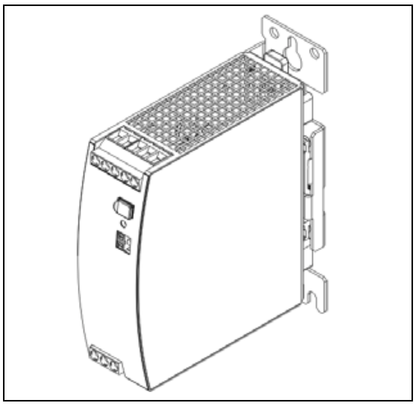


Fig. 23-3 **Isometric view**
(Picture shows the CP10.241-R3)

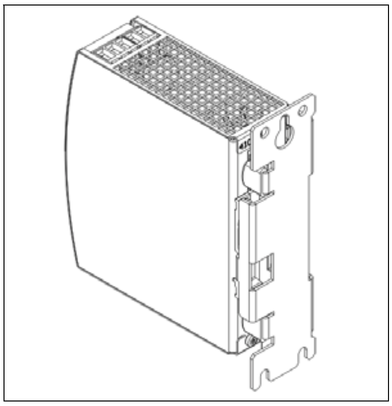


Fig. 23-4 **Wall/panel mounting, front view**
(Picture shows the CP10.241-R3)

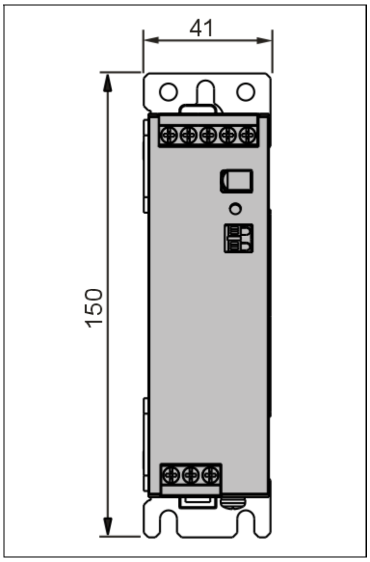


Fig. 23-5 **Hole pattern for wall mounting**

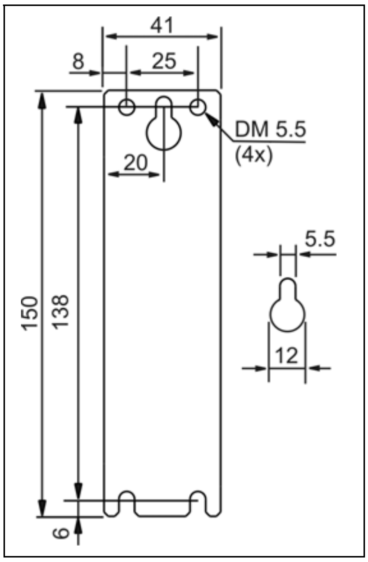
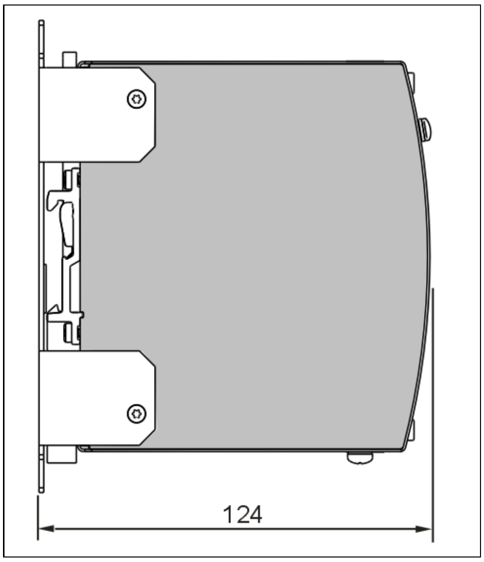


Fig. 23-6 **Wall/panel mounting, side view**
(Picture shows the CP10.241-R3)



23.2. 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. 23-7
Side mounting without DIN-rail brackets
(Picture shows the CP10.241-R3)

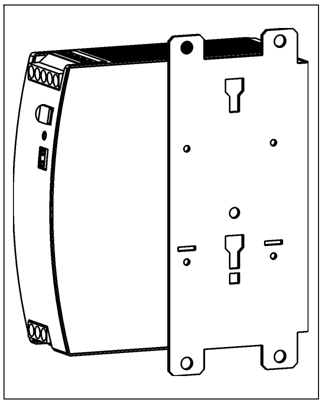


Fig. 23-8
Side mounting with DIN-rail brackets
(Picture shows the CP10.241-R3)

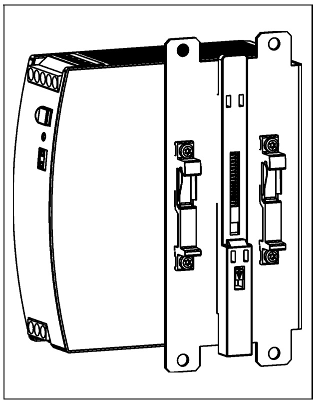
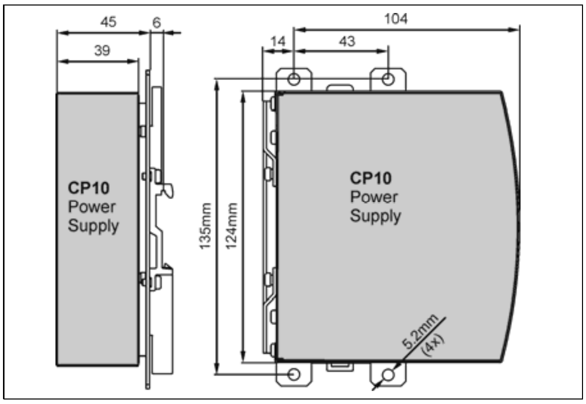


Fig. 23-9
Mounting Dimensions
Side mounting bracket



24. APPLICATION NOTES

24.1. PEAK CURRENT CAPABILITY

The unit 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 two examples show typical voltage dips for a resistive load:

Fig. 24-1 **20A peak current for 50ms , typ. (2x the nominal current)**

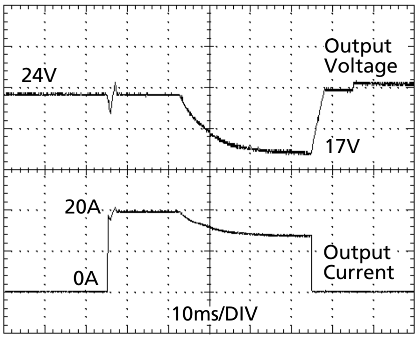


Fig. 24-2 **50A peak current for 5ms , typ. (5x the nominal current)**

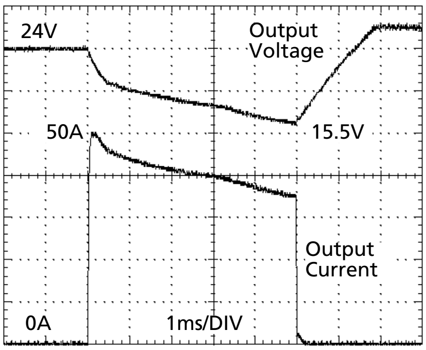
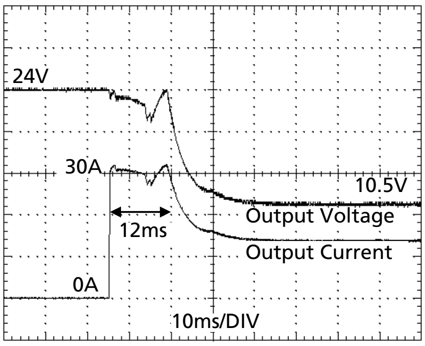


Fig. 24-3 **30A peak current for 12ms , typ. (3x the nominal current)**



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

Peak current voltage dips	Typically from 24V to 17V	At 20A for 50ms, resistive load
	Typically from 24V to 19V	At 50A for 2ms, resistive load
	Typically from 24V to 15.5V	At 50A for 5ms, resistive load

24.2. Adjusting the Output Voltage

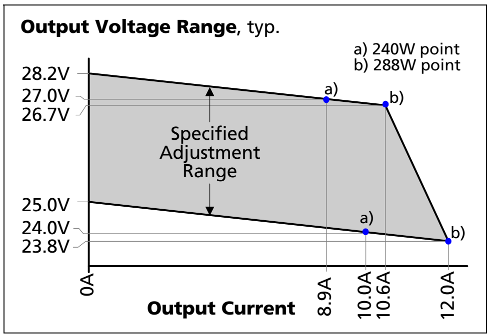
A voltage adjustment potentiometer can be found behind the flap on the front of the unit. However, it is not recommended to change the output voltage since load sharing between power supplies connected in parallel can only be achieved by a precise setting of the output voltages. The factory settings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

Lower end of the specified adjustment range			
Output voltage	Nom.	24.0V	Due to the soft output voltage regulation characteristic (parallel mode feature) a setting to 24.0V results to an output voltage of $23.8V^{\pm0.2\%}$ at 12A and $25.0V^{\pm0.2\%}$ at no load. See Fig. 24-4.
Output current	Min.	12A	At 45°C
	Min.	10A	At 60°C
	Min.	7.55A	At 70°C
		Reduce output current linearly between +45°C and +70°C.	
Upper end of the specified adjustment range			
Output voltage	Nom.	27.0V	Due to the soft output voltage regulation characteristic (parallel mode feature) a setting to 27.0V results to an output voltage of $26.7V^{\pm0.2\%}$ at 10.6A and $28.2V^{\pm0.2\%}$ at no load. See Fig. 24-4.
Output current	Min.	10.6A	At 45°C
	Min.	8.9A	At 60°C
	Min.	6.7A	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 30V. It is not a guaranteed value which can be achieved.

Current values between 24 and 27V can be interpolated.

Fig. 24-4 **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.

24.3. 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:

a) Set output voltage (measured at disconnected battery) very precisely to the end-of-charge voltage. Use the potentiometer, which is hidden behind the flap on the front of the unit. See chapter 24.2.

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

b) Ensure that the ambient temperature of the power supply stays below 40°C.

c) Use only matched batteries when connecting 12V types in series.

d) The return current to the power supply (battery discharge current) is typically 3mA when the power supply is switched off.

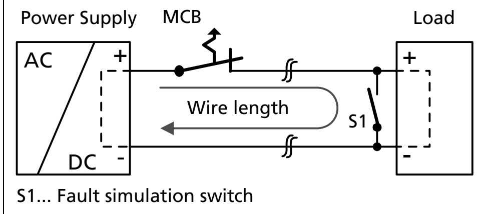
24.4. Output Circuit Breakers

Standard miniature circuit breakers (MCB's or UL 1077 circuit breakers) are commonly used for AC-supply systems and may also be used on 24V 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 24V branches which are supplied by the same source, a fast (magnetic) tripping of the MCB is desired. A quick shutdown within 10ms 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.

Fig. 24-5 **Test circuit**

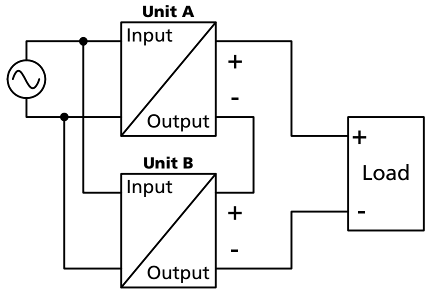


Maximal wire length*) for a fast (magnetic) tripping:

	0.75mm²	**1.0mm²**	**1.5mm²**	**2.5mm²**
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

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

24.5. SERIES OPERATION



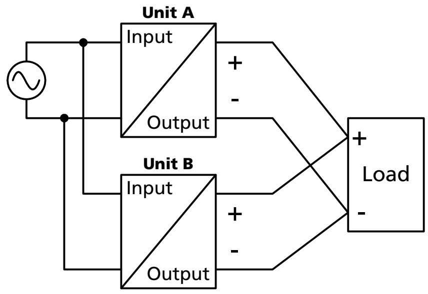
Power supplies of the same type can be connected in series for higher output voltages. It is possible to connect as many units in series as needed, providing the sum of the output voltage does not exceed 150Vdc. Voltages with a potential above 60Vdc must be installed with a protection against touching.

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

Keep an installation clearance of 15mm (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 (input terminals on bottom of the unit).

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

24.6. 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 power supplies 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 units 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 power supplies and avoid installing the power supplies on top of each other.

Do not use power supplies in parallel in mounting orientations other than the standard mounting orientation (input terminals on bottom of the unit) or in any other condition where a derating of the output current is required (e.g. altitude).

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

Do not load paralleled power supplies with higher currents as shown in the following diagrams:

Fig. 24-6 **Output current vs. ambient temp. for two paralleled units**

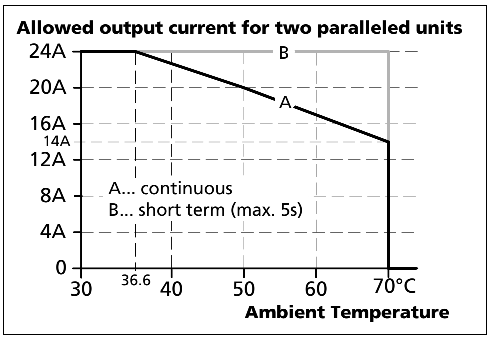
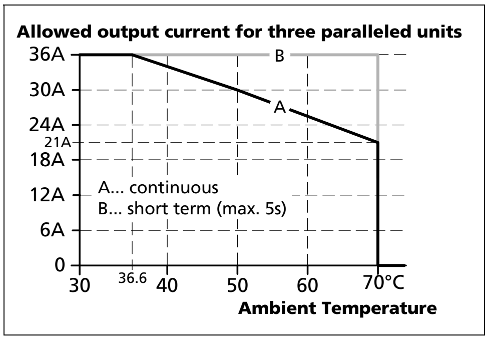


Fig. 24-7 **Output current vs. ambient temp. for three paralleled units**



24.7. PARALLEL USE FOR REDUNDANCY

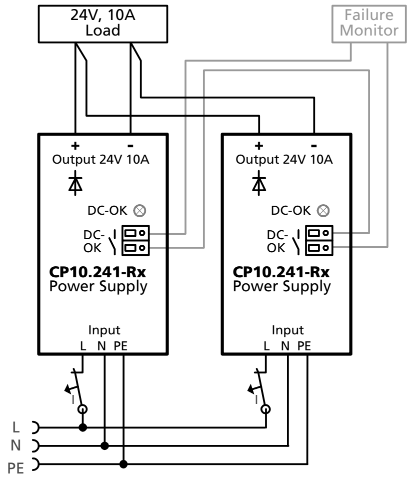
Power supplies can be paralleled for redundancy to gain higher system availability. The unit is already equipped with a MOSFET as decoupling device on the output to avoid, that a faulty unit becomes a load for the other power supplies and the output voltage cannot be maintained any more.

Recommendations for building redundant power systems:

a) Use separate input fuses for each power supply.

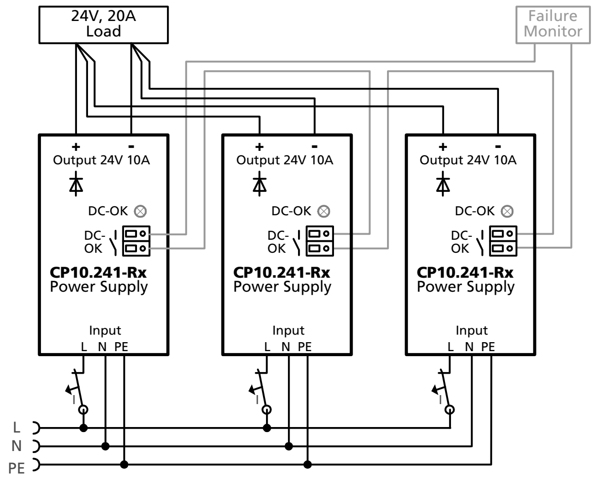
b) Monitor the individual power supply units by utilizing the built-in DC-OK relay contacts on each power supply.

Fig. 24-8 **Wiring diagram, 1+1 Redundancy for 10A output current**



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

Fig. 24-9 **Wiring diagram, N+1 Redundancy for 20A output current**

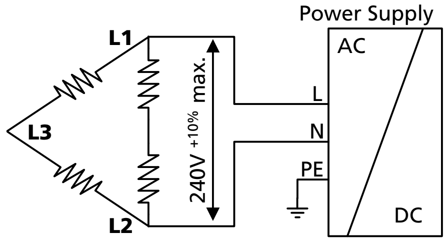


Observe the temperature derating requirements of Fig. 24-6 and Fig. 24-7 for n+1 redundancy applications.
Note: Use separate mains systems for each power supply whenever it is possible.

24.8. 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 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.



24.9. 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.

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.

	Case A	**Case B**	**Case C**	**Case D**
Enclosure size	**110**x180x165mm Rittal Typ IP66 Box PK 9516 100, plastic	**110**x180x165mm Rittal Typ IP66 Box PK 9516 100, plastic	**180**x180x165mm Rittal Typ IP66 Box PK 9519 100, plastic	**180**x180x165mm Rittal Typ IP66 Box PK 9519 100, plastic
Input voltage	230Vac	230Vac	230Vac	230Vac
Load	24V, 8A; (=**80%**)	24V, 10A; (=**100%**)	24V, 8A; (=**80%**)	24V, 10A; (=**100%**)
Temperature inside the box	45.4°C	49.0°C	42.0°C	44.4°C
Temperature outside the box	25.0°C	25.0°C	25.0°C	25.0°C
Temperature rise	20.4K	24.0K	17.0K	19.4K

24.10. MOUNTING ORIENTATIONS

Mounting orientations other than all terminals on the bottom 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).

Fig. 24-10
Mounting Orientation A
(Standard orientation)

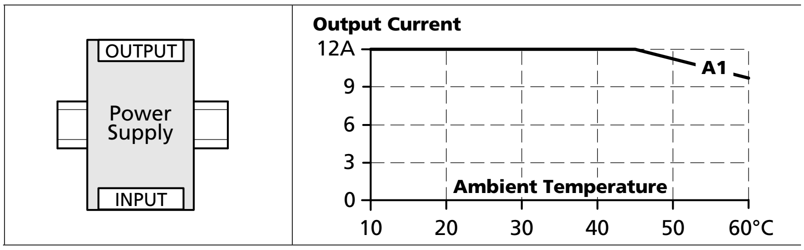


Fig. 24-11
Mounting Orientation B
(Upside down)

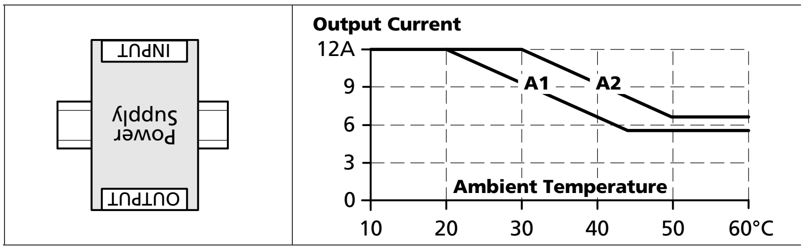


Fig. 24-12
Mounting Orientation C
(Table-top mounting)

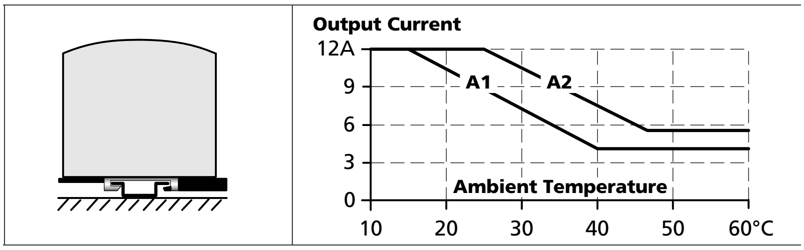


Fig. 24-13
Mounting Orientation D
(Horizontal cw)

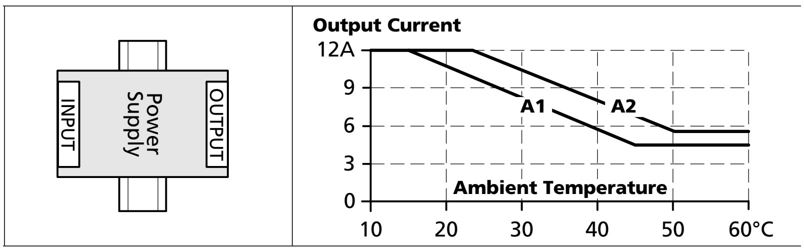


Fig. 24-14
Mounting Orientation E
(Horizontal ccw)