PRELIMINARY

CP5.241, CP5.241-C1, CP5.241-S1, CP5.241-S2, CP5.242

DIMENSION **CP-Series**

24V, 5A, 120W, SINGLE PHASE INPUT

POWER SUPPLY

- AC 100-240V Wide-range Input
- Width only 32mm
- Efficiency up to 94.3%
- Excellent Partial Load Efficiency
- 20% Output Power Reserves
- Easy Fuse Breaking – 3 times nominal current for 12ms
- Safe Hiccup^{PLUS} Overload Mode
- Active Power Factor Correction (PFC)
- Minimal Inrush Current Surge
- Full Power Between -25°C and +60°C
- DC-OK Relay Contact
- 3 Year Warranty

GENERAL DESCRIPTION

The Dimension CP-Series are cost optimized power supplies without compromising quality, reliability and performance. The CP-Series is part of the DIMENSION power supply family.

The CP5.241 power supplies come with three connection terminal options: screw, spring-clamp or push-in terminals, which are optimized for automated wiring.

The CP5.241-C1 is equipped with conformal coated pc-boards preferred for the use in harsh environments and the CP4.242 features an enhanced DC input voltage range.

The most outstanding features of these units are the small size, the high efficiency, the electronic inrush current limitation, active PFC and the wide operational temperature range. The devices have a power reserve of 20% included, which may even be used continuously at temperatures up to +45°C. Additionally, they can deliver 3 times the nominal output current for 12ms which helps to trip fuses on faulty output branches.

High immunity to transients and power surges as well as low electromagnetic emission, a DC-OK signal contact for remote monitoring, 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 24V	Nominal
Adjustment range	24 - 28V	Factory setting 24.1V
Output current	6.0 - 5.1A	Below +45°C ambient
	5.0 – 4.3A	At +60°C ambient
	3.8 – 3.2A	At +70°C ambient
	Derate linearly between +45°C and +70°C	
Input voltage AC	AC 100-240V	-15%/+10%
Mains frequency	50-60Hz	±6%
Input current AC	1.09 / 0.6A	At 120 / 230Vac
Power factor	0.98 / 0.91	At 120 / 230Vac
Input voltage DC	DC 110-150V ±20%	For CP5.241 (-xx)
	DC 110-300V ±20%	For CP5.242
Input current DC	1.21 / 0.43A	At 110 / 300Vdc
AC Inrush current	4 / 4A	At 120 / 230Vac
Efficiency	93.6 / 94.3%	At 120 / 230Vac
Losses	8.2 / 7.3W	At 120 / 230Vac
Hold-up time	35 / 35ms	At 120 / 230Vac
Temperature range	-25°C to +70°C	
Size (WxHxD)	32x124x102mm	Without DIN-rail
Weight	440g / 0.97lb	

ORDER NUMBERS

Power Supply **CP5.241**
CP5.241-C1 Conformal coated pc-boards
CP5.241-S1 Spring-clamp terminals
CP5.241-S2 Push-in terminals
CP5.242 Enhanced DC input

Mechanical Accessory
ZM6.WALL Wall/Panel mount bracket

MARKINGS

For details or a complete approval list see chapter 19.

cULus LISTED
Ind. Cont. Eq. planned

CE

IECEx ATEX
planned

cULus LISTED
Class I Div 2, planned

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. 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 6A 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 62477-1
Input frequency	Nom.	50–60Hz	±6%
Turn-on voltage	Typ.	80Vac	Steady-state value, see Fig. 3-1
Shut-down voltage	Typ.	74Vac	Steady-state value, see Fig. 3-1
External input protection	See recommendations in chapter 2.		

		AC 100V	AC 120V	AC 230V	
Input current	Typ.	1.30A	1.09A	0.60A	At 24V, 5A, see Fig. 3-3
Power factor	Typ.	0.99	0.98	0.91	At 24V, 5A, see Fig. 3-4
Crest factor	Typ.	1.7	1.8	2.2	At 24V, 5A, The crest factor is the mathematical ratio of the peak value to RMS value of the input current waveform.
Start-up delay	Typ.	390ms	370ms	370ms	See Fig. 3-2
Rise time	Typ.	50ms	50ms	50ms	At 24V, 5A const. current load, 0mF load capacitance, see Fig. 3-2
	Typ.	90ms	90ms	90ms	At 24V, 5A const. current load, 5mF load capacitance,, see Fig. 3-2
Turn-on overshoot	Max.	200mV	200mV	200mV	See Fig. 3-2

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

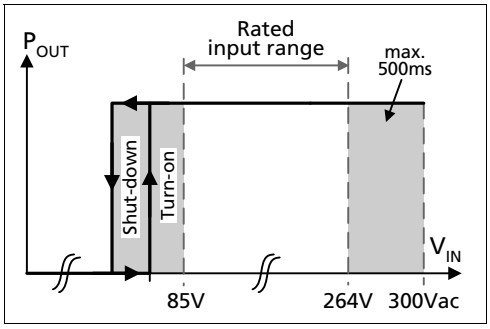


Fig. 3-2 **Turn-on behavior, definitions**

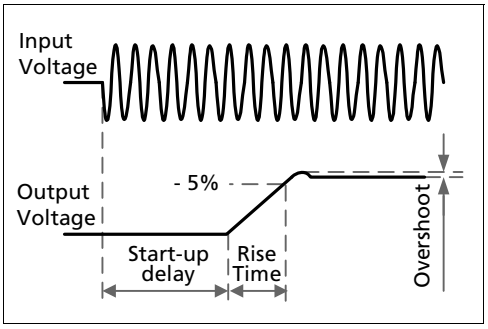


Fig. 3-3 **Input current vs. output current at 24V output voltage**

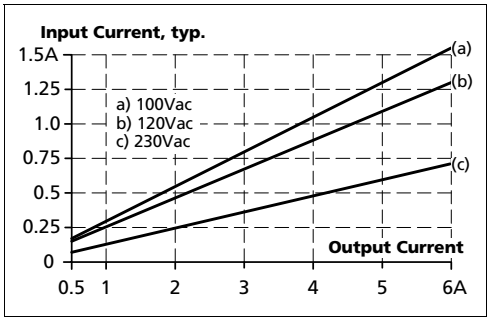
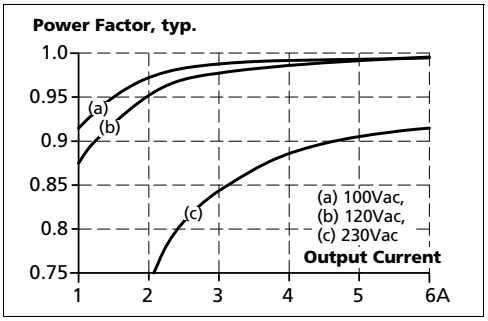


Fig. 3-4 **Power factor vs. output current at 24V output voltage**



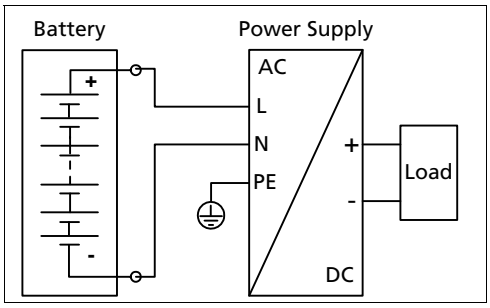
4. DC-INPUT

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 CP5.241, CP5.241-C1, CP5.241-S1, CP5.241-S2
	Nom.	DC 110-300V	±20% For CP5.242
DC input range	Min.	88-180Vdc	Continuous operation For CP5.241, CP5.241-C1, CP5.241-S1, CP5.241-S2
		88-360Vdc	Continuous operation for CP5.242
DC input current	Typ.	1.21A	At 110Vdc, at 24V, 5A
	Typ.	0.43A	At 300Vdc, at 24V, 5A
Allowed Voltage (+) or (-) input to Earth	Max.	360Vdc	Continuous according to IEC 62477-1
Turn-on voltage	Typ.	74Vdc	Steady state value
Shut-down voltage	Typ.	67Vdc	Steady state value

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.	$8A_{peak}$	$7A_{peak}$	$7A_{peak}$	At 40°C, cold start
	Typ.	$5A_{peak}$	$4A_{peak}$	$4A_{peak}$	At 25°C, cold start
	Typ.	$5A_{peak}$	$5A_{peak}$	$6A_{peak}$	At 40°C, cold start
Inrush energy	Max.	$0.4A^2s$	$0.5A^2s$	$1A^2s$	At 40°C, cold start

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

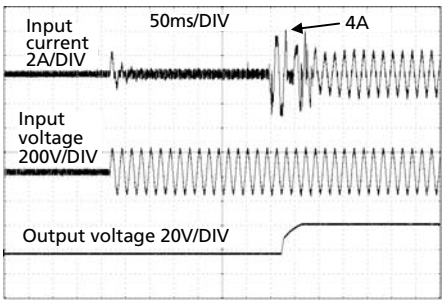
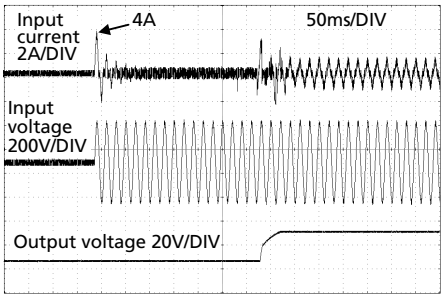


Fig. 5-2 **Typical turn-on behaviour at nominal load, 230Vac input and 25°C ambient**



6. OUTPUT

The output provides a SELV/PELV rated voltage, which is galvanically isolated from the input voltage.

The output 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 > 0.4F are connected to the output, the unit might charge the capacitor in the Hiccup^{PLUS} mode.

Output voltage	Nom.	24V	
Adjustment range	Min.	24-28V	Guaranteed value
	Max.	30.0V	This is the maximum output voltage which can occur at the clockwise end position of the potentiometer due to tolerances. It is not a guaranteed value which can be achieved.
Factory settings	Typ.	24.1V	±0.2%, at full load and cold unit
Line regulation	Max.	10mV	Between 85 and 300Vac
Load regulation	Max.	50mV	Between 0A and 6A, static value, see Fig. 6-1
Ripple and noise voltage	Max.	50mVpp	Load >0.2A, Bandwidth 20Hz to 20MHz, 50Ohm
	Max.	200mVpp	Load <0.2A, Bandwidth 20Hz to 20MHz, 50Ohm
Output current	Nom.	6A[1)]	At 24V and an ambient temperatures below 45°C
	Nom.	5A	At 24V and 60°C ambient temperature
	Nom.	3.8A	At 24V and 70°C ambient temperature
	Nom.	5.1A[1)]	At 28V and an ambient temperatures below 45°C
	Nom.	4.3A	At 28V and 60°C ambient temperature
	Nom.	3.2A	At 28V and 70°C ambient temperature
Fuse breaking current	Typ.	15A	Up to 12ms once every five seconds, see Fig. 6-2.
		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 23.1 for additional measurements.	
Overload protection		Included	Electronically protected against no-load, overload and short circuit. In case of a protection event, audible noise may occur.
Overload behaviour		Continuous current	Output voltage > 13Vdc, see Fig. 6-1
		Hiccup^{PLUS} mode [2)]	Output voltage < 13Vdc, see Fig. 6-1
Overload/ short-circuit current	Max.	7.5A	Continuous current, see Fig. 6-1
	Typ.	9A	Intermitted current peak value for typ. 1s Load impedance 50mOhm, see Fig. 6-3 Discharge current of output capacitors is not included.
	Max.	3.5A	Intermitted current average value (R.M.S.) Load impedance 50mOhm, see Fig. 6-3
Output capacitance	Typ.	2 000µF	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) Hiccup^{PLUS} Mode:
At heavy overloads (when output voltage falls below 13V), the power supply delivers continuous output current for 1s. After this, the output is switched off for approx. 9s 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.

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

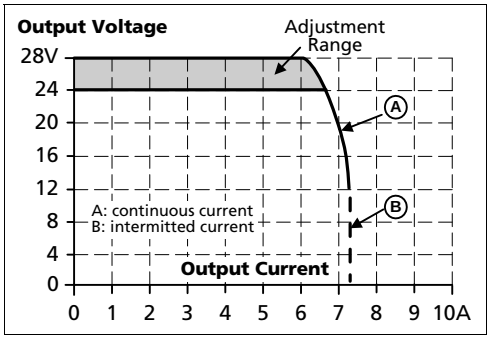


Fig. 6-2 **Dynamic output current capability, typ.**

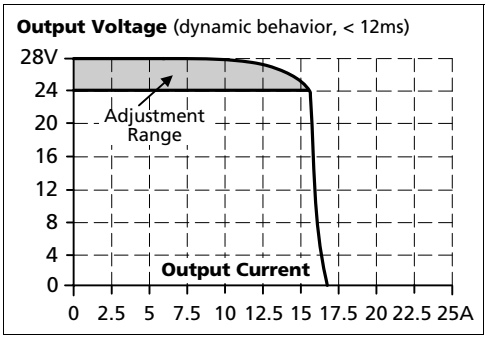
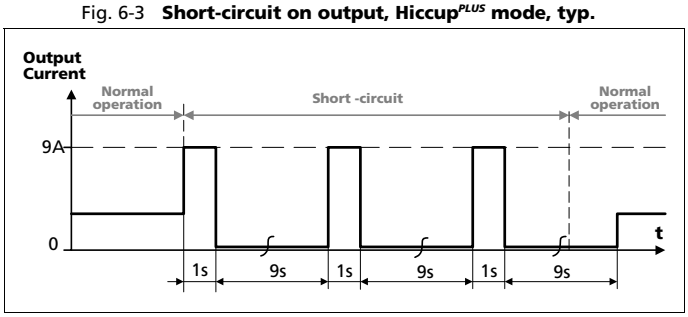


Fig. 6-3 **Short-circuit on output, Hiccup^{PLUS} mode, typ.**



7. HOLD-UP TIME

The hold-up time is the time during which a power supply's output voltage remains within specification following the loss of input power. The hold-up time is output load dependent. At no load, the hold-up time can be up to several seconds. The green DC-ok lamp is also on during this time.

		AC 100V	AC 120V	AC 230V	
Hold-up Time	Typ.	70ms	70ms	70ms	At 24V, 2.5A, see Fig. 7-1
	Min.	55ms	55ms	55ms	At 24V, 2.5A, see Fig. 7-1
	Typ.	35ms	35ms	35ms	At 24V, 5A, see Fig. 7-1
	Min.	27ms	27ms	27ms	At 24V, 5A, see Fig. 7-1

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

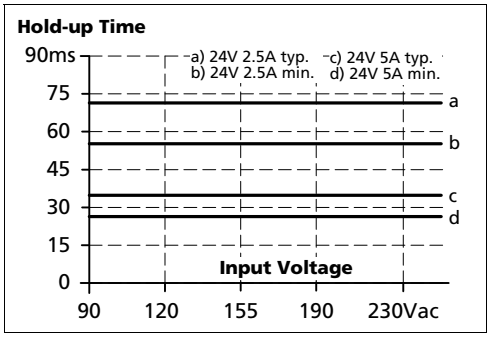
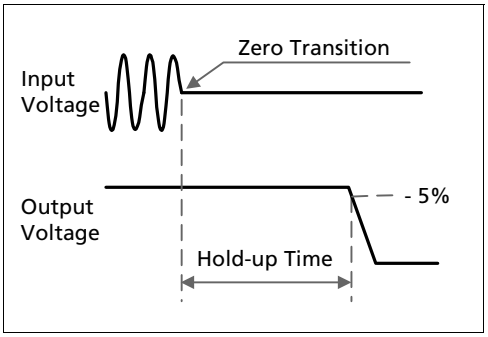


Fig. 7-2 **Shut-down behavior, definitions**

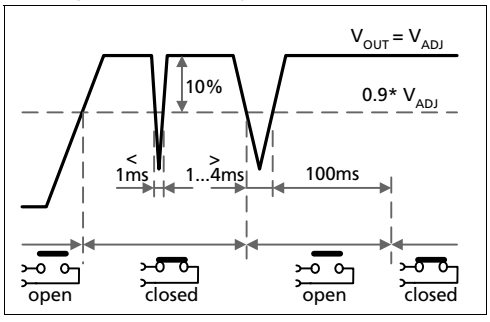


8. DC-OK RELAY CONTACT

This feature monitors the output voltage 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% below the adjusted output voltage. Short dips will be extended to a signal length of 100ms. Dips shorter than 1ms will be ignored.
Switching hysteresis	Typically 0.7V
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 section 18.

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



9. EFFICIENCY AND POWER LOSSES

		AC 100V	AC 120V	AC 230V	
Efficiency	Typ.	92.9%	93.6%	94.3%	At 24V, 5A
	Typ.	92.7%	93.5%	94.5%	At 24V, 6A (Power Boost)
Average efficiency*)	Typ.	91.3%	91.7%	92.0%	25% at 1.25A, 25% at 2.5A, 25% at 3.75A. 25% at 5A
Power losses	Typ.	1.5W	1.5W	1.4W	At 24V, 0A
	Typ.	4.6W	4.4W	4.1W	At 24V, 2.5A
	Typ.	9.2W	8.2W	7.3W	At 24V, 5A
	Typ.	11.3W	9.8W	8.4W	At 24V, 6A (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 at 24V, typ**

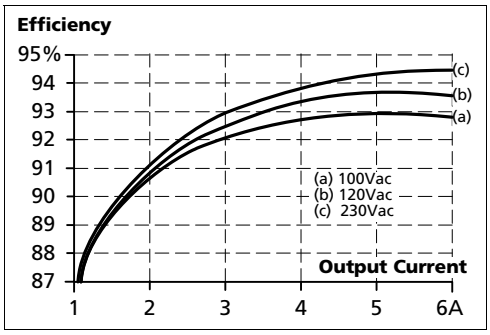


Fig. 9-2 **Losses vs. output current at 24V, typ.**

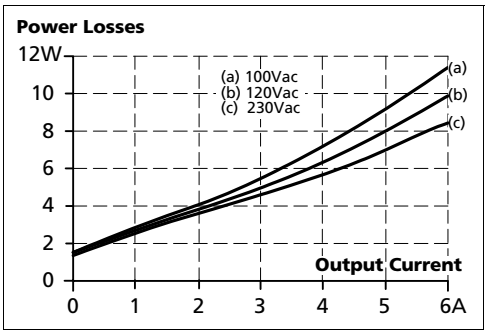


Fig. 9-3 **Efficiency vs. input voltage at 24V, 5A, typ.**

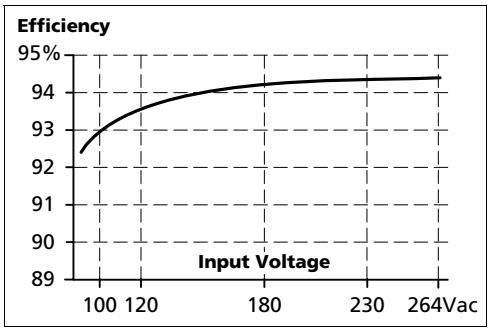
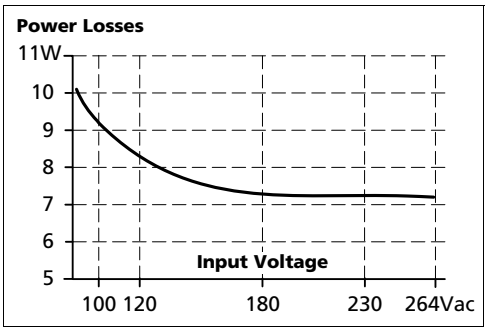


Fig. 9-4 **Losses vs. input voltage at 24V, 5A, typ.**



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	265 000h	270 000h	274 000h	At 24V, 2.5A and 40°C
	748 000h	764 000h	775 000h	At 24V, 2.5A and 25°C
	128 000h	143 000h	166 000h	At 24V, 5A and 40°C
	363 000h	405 000h	469 000h	At 24V, 5A and 25°C
	81 000h	96 000h	119 000h	At 24V, 6A and 40°C
	228 000h	271 000h	336 000h	At 24V, 6A 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.

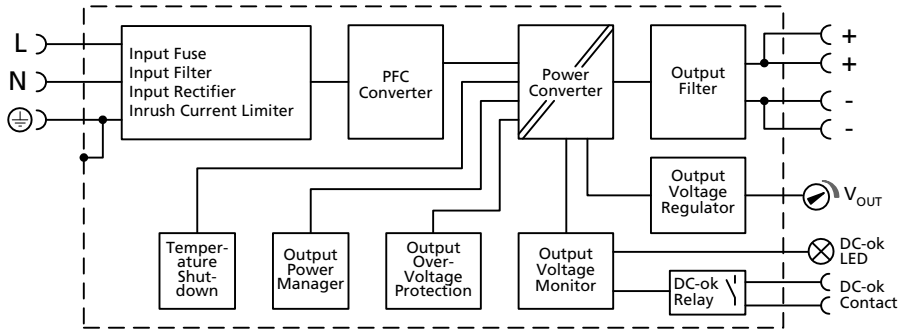
The MTBF figure is a statistical representation of the likelihood of a device to fail. A MTBF figure of e.g. 1 000 000h means that statistically one unit will fail every 100 hours if 10 000 units are installed in the field. However, it can not be determined if the failed unit has been running for 50 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	800 000h	807 000h	867 000h	At 24V, 5A and 40°C
	1 402 000h	1 414 000h	1 510 000h	At 24V, 5A and 25°C
MTBF MIL HDBK 217F	339 000h	343 000h	368 000h	At 24V, 5A and 40°C; Ground Benign GB40
	490 000h	496 000h	529 000h	At 24V, 5A and 25°C; Ground Benign GB25
	81 000h	83 000h	89 000h	At 24V, 5A and 40°C; Ground Fixed GF40
	109 000h	111 000h	119 000h	At 24V, 5A and 25°C; Ground Fixed GF25

12. FUNCTIONAL DIAGRAM

Fig. 12-1 **Functional diagram**



13. TERMINALS AND WIRING

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

CP5.241, CP5.241-C1, CP5.242	**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

CP5.241-S1	**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	-	-	3mm slotted to open the spring

CP5.241-S2	Input	Output	DC-OK-Signal
Type	Push-in termination	Push-in termination	Push-in termination
Solid wire	Max. 2.5mm²	Max. 2.5mm²	Max. 1.5mm²
Stranded wire	Max. 2.5mm²	Max. 2.5mm²	Max. 1.5mm²
Stranded wire with ferrules	Max. 1.5mm²	Max. 1.5mm²	Max. 1.5mm²
American Wire Gauge	AWG 24-12	AWG 24-12	AWG 24-16
Max. wire diameter (including ferrules)	2.3mm	2.3mm	1.6mm
Wire stripping length	10mm / 0.4inch	10mm / 0.4inch	7mm / 0.28inch
Screwdriver	3.0mm slotted to open the spring	3.0mm slotted to open the spring	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 and
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.

Daisy chaining:

Daisy chaining (jumping from one power supply output to the next) is allowed as long as the average output current through one terminal pin does not exceed 25A or 15A for the CP5.241-S2. If the current is higher, use a separate distribution terminal block as shown in Fig. 13-2.

Fig. 13-1 Daisy chaining of outputs

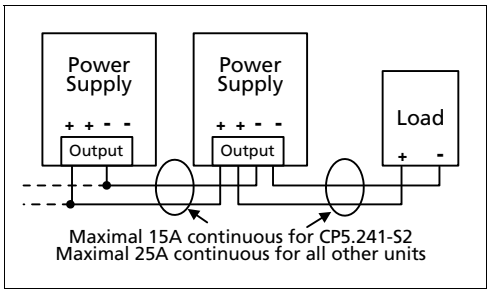
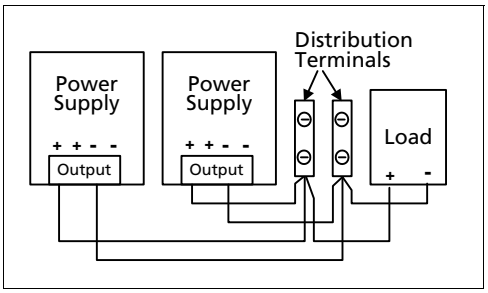


Fig. 13-2 Using distribution terminals



14. FRONT SIDE AND USER ELEMENTS

Fig. 14-1 Front side

CP5.241, CP5.241-C1

CP5.241-S1

CP5.241-S2

CP5.242

A **Input Terminals**

N, L Line input

⏚ PE (Protective Earth) input

B **Output Terminals**

Two identical + poles and two identical - poles

+ Positive output

– Negative (return) output

C **Output Voltage Potentiometer**

D **DC-OK LED** (green)

On, when the output voltage is >90% of the adjusted output voltage

E **DC-OK Relay Contact**

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

15. 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 DC-OK	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 <4A Criterion C >4A 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

Performance 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 55022, FCC Part 15, CISPR 11, CISPR 22	Class B
Conducted emission output lines**)	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	Class A for information only, not mandatory for EN 61000-6-3
Radiated emission	EN 55011, EN 55022	Class B
Harmonic input current (PFC)	EN 61000-3-2	Class A equipment: fulfilled
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	70kHz to 130kHz	Input voltage and output load dependent
Main converter	60kHz to 140kHz	Output load dependent
Auxiliary converter	60kHz	Fixed frequency

16. 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	1.6W/°C 3W/°C 7.5W/1000m or 5°C/1000m 4.2W/-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. 16-2 For atmospheric pressures <80kPa, see Fig. 16-2
	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.	
Humidity	5 to 95% r.h.	According to IEC 60068-2-30 Do not energize while condensation is present.
Atmospheric pressure	110-47kPa	See Fig. 16-2 for details
Altitude	Up to 6000m (20 000ft)	See Fig. 16-2 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 62477-1, not conductive
Vibration sinusoidal	2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g 2 hours / axis	According to IEC 60068-2-6
Shock	30g 6ms, 20g 11ms 3 bumps per direction, 18 bumps in total	According to IEC 60068-2-27
	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.	
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.	

Fig. 16-1 **Output current vs. ambient temp.**

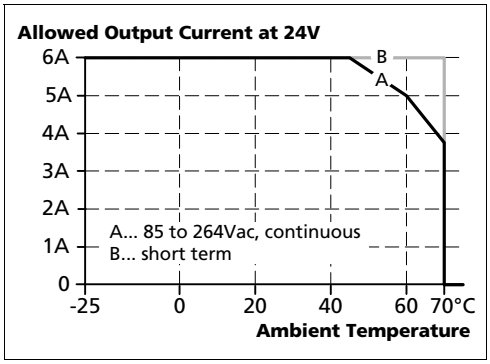
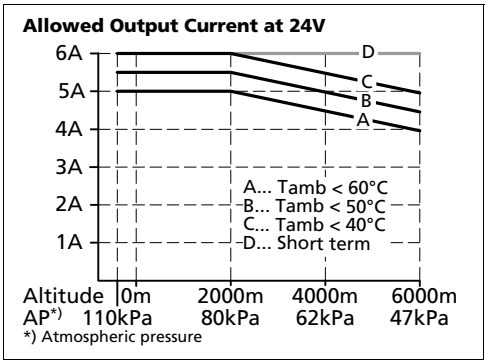


Fig. 16-2 **Output current vs. altitude**



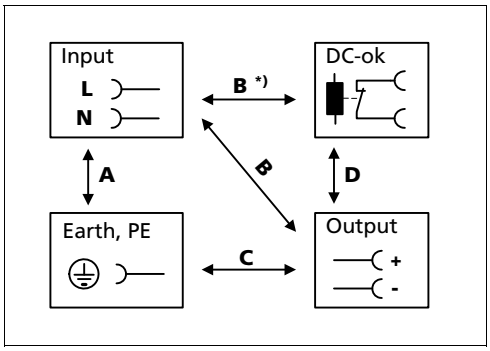
17. SAFETY AND PROTECTION FEATURES

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	Typ. Max.	30.5Vdc 32.0Vdc	In case of an internal power supply defect, a redundant circuit limits the maximum output voltage. The output shuts down and performs three restart attempts. If the failure continues, the output shuts down. Cycle input power to reset.
Class of protection		I	According to IEC 61140 A PE (Protective Earth) connection is required
Degree of protection		IP 20	According to EN/IEC 60529
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 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.
Input transient protection		MOV	Metal Oxide Varistor For protection values see chapter 15 (EMC).
Internal input fuse		Included	Not user replaceable slow-blow high-braking capacity fuse
Touch current (leakage current)	Typ.	0.10mA / 0.27mA	At 100Vac, 50Hz, TN-,TT-mains / IT-mains
	Typ.	0.13mA / 0.38mA	At 120Vac, 60Hz, TN-,TT-mains / IT-mains
	Typ.	0.20mA / 0.60mA	At 230Vac, 50Hz, TN-,TT-mains / IT-mains
	Max.	0.13mA / 0.35mA	At 110Vac, 50Hz, TN-,TT-mains / IT-mains
	Max.	0.17mA / 0.51mA	At 132Vac, 60Hz, TN-,TT-mains / IT-mains
	Max.	0.27mA / 0.81mA	At 264Vac, 50Hz, TN-,TT-mains / IT-mains

18. 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. 18-1 **Dielectric strength**



		A	B	C	D
Type test	60s	2500Vac	3000Vac	1000Vac	500Vac
Routine test	5s	2500Vac	2500Vac	500Vac	500Vac
Field test	5s	2000Vac	2000Vac	500Vac	500Vac
Field test cut-off current settings		> 10mA	> 10mA	> 20mA	> 1mA

We recommend that either the + pole or 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.

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.

19. APPROVALS

EC Declaration of Conformity planned	CE	The CE mark indicates conformance with the - EMC directive, - Low-voltage directive and the - ATEX directive
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, Safety requirements 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 TX 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 planned	EAC	Registration for the Eurasian Customs Union market (Russia, Kazakhstan, Belarus)

20. OTHER FULFILLED STANDARDS

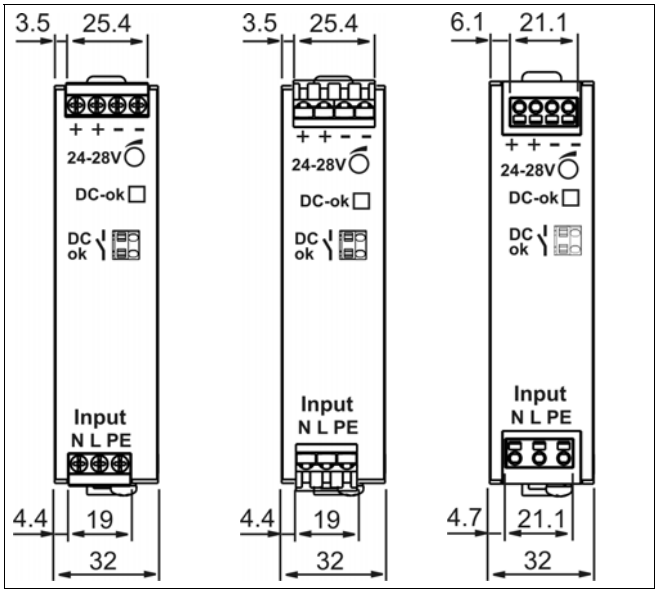
RoHS Directive	RoHS ✓	Directive 2011/65/EU of the European Parliament and the Council of June 8th, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
REACH Directive	REACH ✓	Directive 1907/2006/EU of the European Parliament and the Council of June 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

21. PHYSICAL DIMENSIONS AND WEIGHT

Width	32mm 1.26''
Height	124mm 4.88''
Depth	102mm 4.02'' The DIN-rail height must be added to the unit depth to calculate the total required installation depth.
Weight	440g / 0.97lb
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, nits, etc. with a diameter larger than 3.5mm

Fig. 21-1 **Front view**

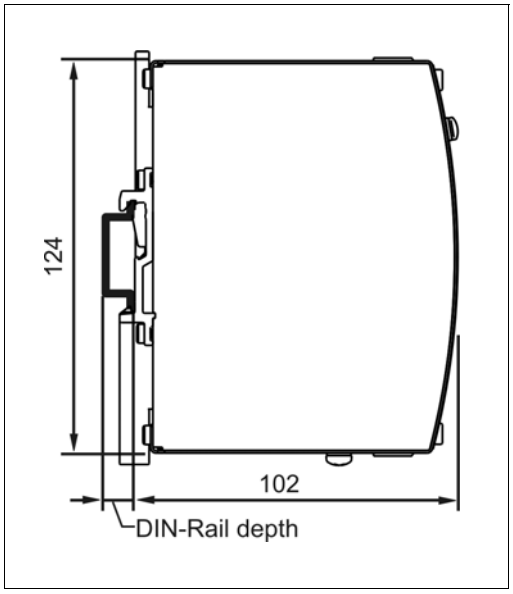
CP5.241, CP5.241-C1, CP5.242



CP5.241-S1

CP5.241-S2

Fig. 21-2 **Side view**



22. ACCESSORIES

22.1. YR2.DIODE - REDUNDANCY MODULE

The YR2.DIODE is equipped with two input channels, which are individually decoupled by utilizing diodes. The YR2.DIODE does not require an additional auxiliary voltage and is self-powered even in case of a short circuit across the output.

The unit is very slender and only requires 32mm width on the DIN-rail.

Further information and wiring configurations can be found in chapter 23.4.

22.2. YR20.242 - REDUNDANCY MODULE

The YR20.242 is equipped with two input channels, which are individually decoupled by utilizing MOSFET technology. Using MOSFETSs instead of diodes reduces the heat generation and the voltage drop between input and output. The YR20.242 does not require an additional auxiliary voltage and is self-powered even in case of a short circuit across the output.

Due to the low power losses, the unit is very slender and only requires 32mm width on the DIN-rail.

The YR20.242 can be used for n+1 and 1+1 redundancy systems.

Further information and wiring configurations can be found in chapter 23.4.

22.3. YR20.246 - REDUNDANCY MODULE WITH AUTOMATED LOAD SHARING

The YR20.246 is equipped with two input channels, which are individually decoupled by utilizing MOSFET technology. Using MOSFETSs instead of diodes reduces the heat generation and the voltage drop between input and output. The YR20.246 does not require an additional auxiliary voltage and is self-powered even in case of a short circuit across the output.

Due to the low power losses, the unit is very slender and only requires 32mm width on the DIN-rail.

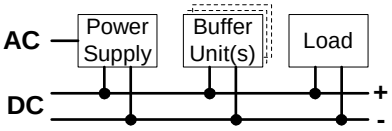
The YR20.246 is optimized for 1+1 redundancy systems.

Compared to the YR20.242, the YR20.246 is featured with an automated load sharing between the connected power supplies. The YR20.246 monitors the function of the redundancy circuitry and provides a signal in case of too high of output current, which could prevent redundancy, if one power supply fails.

Further information and wiring configurations can be found in chapter 23.4.

22.4. UF20.241 BUFFER MODULE

This buffer unit is a supplementary device for DC 24V power supplies. It delivers power to bridge typical mains failures or extends the hold-up time after turn-off of the AC power. In times when the power supply provides sufficient voltages, the buffer unit stores energy in integrated electrolytic capacitors. In case of mains voltage fault, this energy is released again in a regulated process. One buffer module can deliver 20A additional current.



The buffer unit does not require any control wiring. It can be added in parallel to the load circuit at any given point. Buffer units can be added in parallel to increase the output ampacity or the hold-up time.

22.5. ZM6.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.

Fig. 22-1 **Isometric view** (Picture shows the CP5.241)

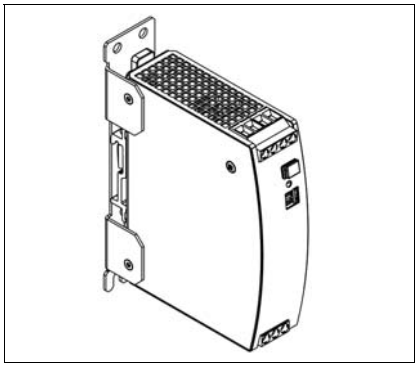


Fig. 22-2 **Isometric view-** (Picture shows the CP5.241)

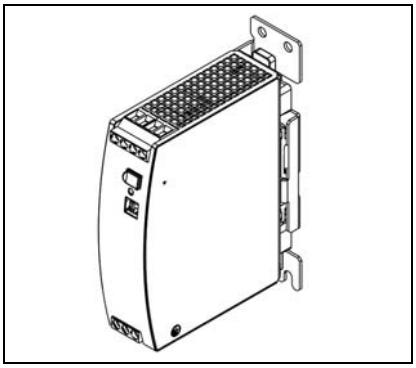


Fig. 22-3 **Isometric view** (Picture shows the CP5.241)

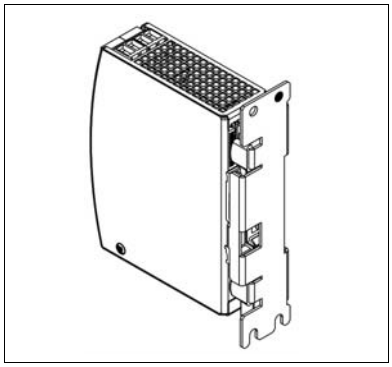


Fig. 22-4 **Wall/panel mounting, front view** (Picture shows the CP5.241)

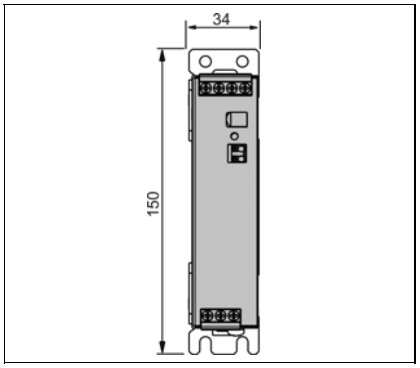


Fig. 22-5 **Hole pattern for wall mounting**

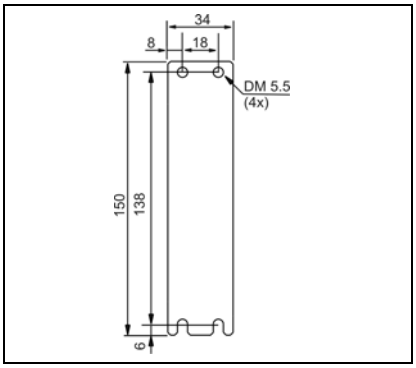
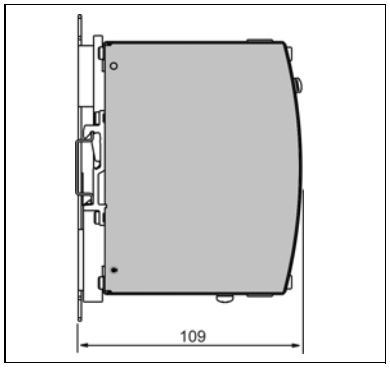


Fig. 22-6 **Wall/panel mounting, side view** (Picture shows the CP5.241)



23. APPLICATION NOTES

23.1. 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 (including the PowerBoost). 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 three examples show typical voltage dips for resistive loads:

Fig. 23-1 **10A peak current for 50ms , typ. (2x the nominal current)**

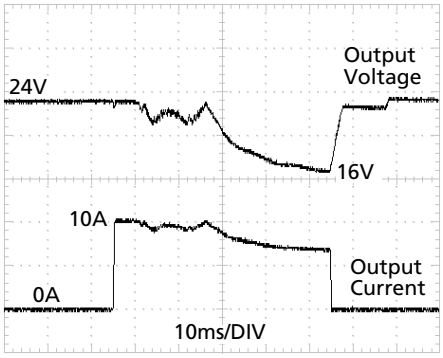


Fig. 23-2 **25A peak current for 5ms , typ. (5x the nominal current)**

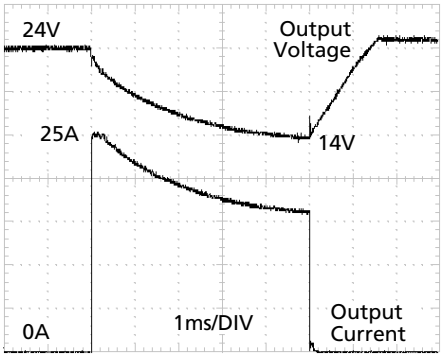
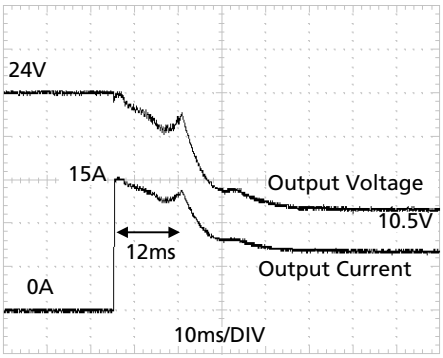


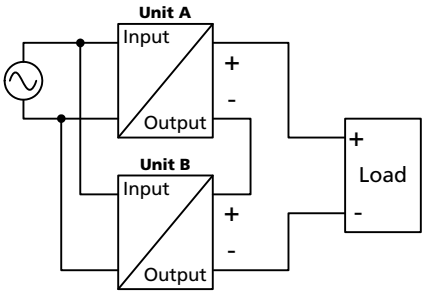
Fig. 23-3 **15A peak current for 12ms , typ. (3x the nominal current)**



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 16V	At 10A for 50ms and resistive load
	Typically from 24V to 16.5V	At 25A for 2ms and resistive load
	Typically from 24V to 14V	At 25A for 5ms and resistive load

23.2. SERIES OPERATION



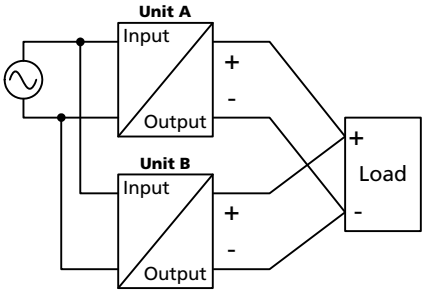
Power supplies of the same type can be connected in series for higher output voltages. It is possible to connect as many units in series as needed, providing the sum of the output voltage does not exceed 150Vdc. Voltages with a potential above 60Vdc must be installed with a protection against touching.

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.

23.3. PARALLEL USE TO INCREASE OUTPUT POWER



Power supplies can be paralleled to increase the output power. The output voltage of all power supplies shall be adjusted to the same value (±100mV) with the same load conditions on all units, or the units can be left with the factory settings. There is no feature included which balances the load current between the power supplies. Usually the power supply with the higher adjusted output voltage draws current until it goes into current limitation. This means no harm to this power supply as long as the ambient temperature stays below 40°C for AC 120-240V mains and below 35°C for AC 100V mains.

If more than three units are connected in parallel, a fuse or circuit breaker with a rating of 10A is required on each output. Alternatively, a diode or redundancy module can also be utilized.

Energize all units at the same time to avoid the overload Hiccup^{PLUS} mode. It also might be necessary to cycle the input power (turn-off for at least five seconds), if the output was in Hiccup^{PLUS} mode due to 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 reduction 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.

23.4. PARALLEL USE FOR REDUNDANCY

Please note that there are variants with built-in redundancy are available in the CP5 series. Check CP5.241-Rx units.

1+1 Redundancy:
Power supplies can be paralleled for redundancy to gain higher system availability. Redundant systems require a certain amount of extra power to support the load in case one power supply unit fails. The simplest way is to put two power supplies in parallel. This is called a 1+1 redundancy. In case one power supply unit fails, the other one is automatically able to support the load current without any interruption. It is essential to use a redundancy module to decouple power supplies from each other. This prevents that the defective unit becomes a load for the other power supplies and the output voltage cannot be maintained any more.

Recommendations for building redundant power systems:

- Use separate input fuses for each power supply.
- Use separate mains systems for each power supply whenever it is possible.
- Monitor the individual power supply units. Therefore, use the DC-OK signal of the power supply.
- It is desirable to set the output voltages of all units to the same value (± 100mV) or leave it at the factory setting.
- Set the power supply into "Parallel use" mode.

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

N+1 Redundancy:
Redundant systems for a higher power demand are usually built in a N+1 method. E.g. four power supplies, each rated for 5A are paralleled to build a 15A redundant system.

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

Keep an installation clearance of 15mm (left / right) between two power supplies and avoid installing the power supplies on top of each other.

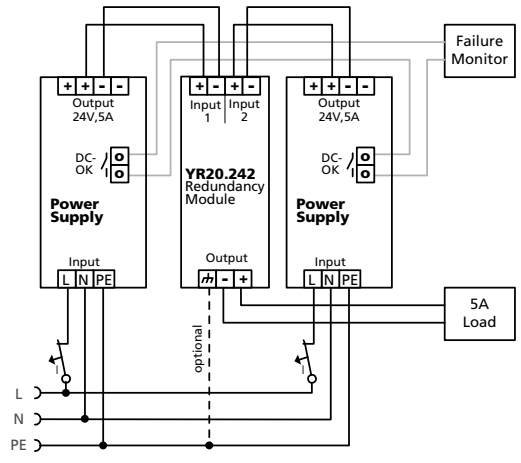
Ensure that the ambient temperature stays below 40°C for AC 120-240V mains and below 35°C for AC 100V mains.

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

Do not use power supplies 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.

Wiring examples for 1+1 and N+1 redundancy:

Fig. 23-4 **1+1 Redundant configuration for 5A load current with a dual redundancy module**



Note: A YR2.DIODE can also be used instead of a YR20.242

Fig. 23-5 **1+1 Redundant configuration with active load share for 5A load current with a dual redundancy module**

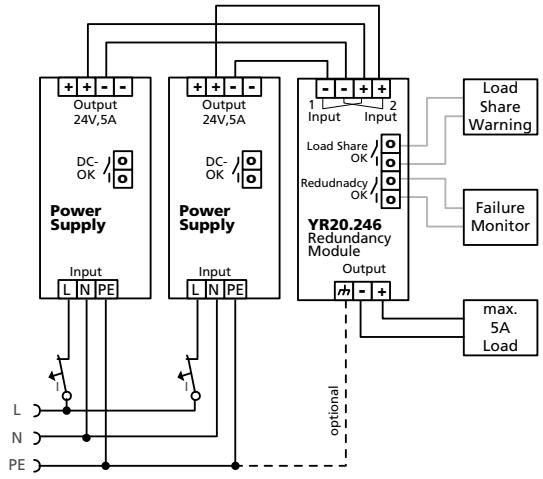
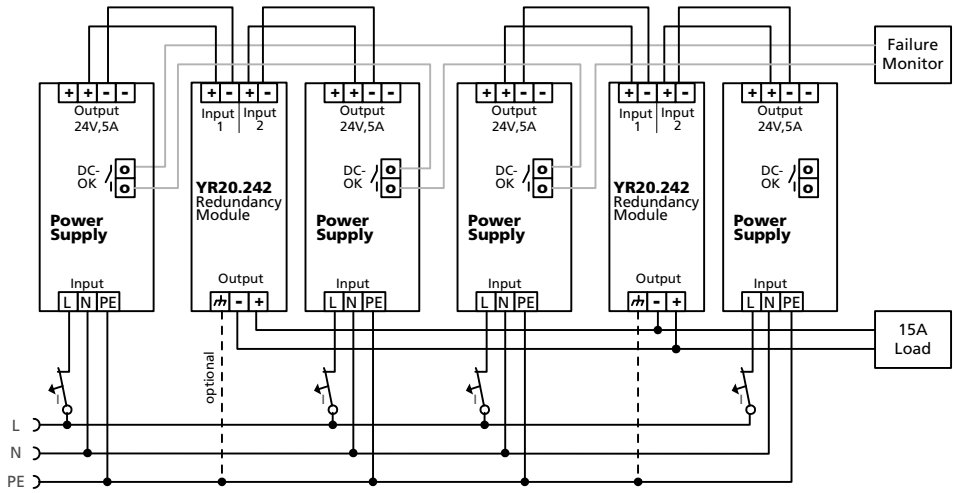


Fig. 23-6 **N+1 Redundant configuration for 15A load current with multiple power supplies and redundancy modules**



Note: A YR2.DIODE can also be used instead of a YR20.242

23.5. CHARGING OF BATTERIES

The power supply can be used to charge lead-acid or maintenance free batteries. Two 12V SLA or VRLA batteries are needed in series connection.

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.

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

b) Use a 10A circuit breaker (or blocking diode) between the power supply and the battery.

c) Ensure that the output current of the power supply is below the allowed charging current of the battery.

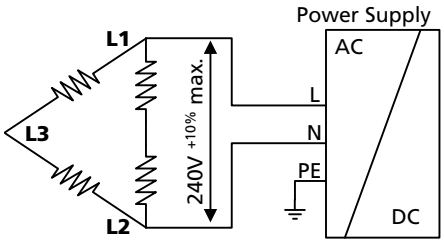
d) Ensure that the ambient temperature of the power supply stays below 40°C for AC 120-240V mains and below 35°C for AC 100V mains.

e) Use only matched batteries when putting 12V types in series.

f) The return current to the power supply (battery discharge current) is typ. 8mA when the power supply is switched off (except in case a blocking diode is utilized).

23.6. 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$^{+10\%}$.



23.7. 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**
Enclosure size	110x180x165mm Rittal Typ IP66 Box PK 9516 100, plastic	110x180x165mm Rittal Typ IP66 Box PK 9516 100, plastic
Input voltage	230Vac	230Vac
Load	24V, 4A; (=**80%**)	24V, 5A; (=**100%**)
Temperature inside the box	38.3°C	39.6°C
Temperature outside the box	26.1°C	25.5°C
Temperature rise	12.2K	14.1K

23.8. 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. 23-7
Mounting Orientation A
(Standard orientation)

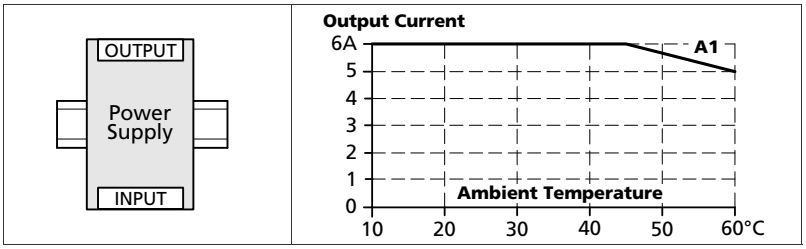


Fig. 23-8
Mounting Orientation B
(Upside down)

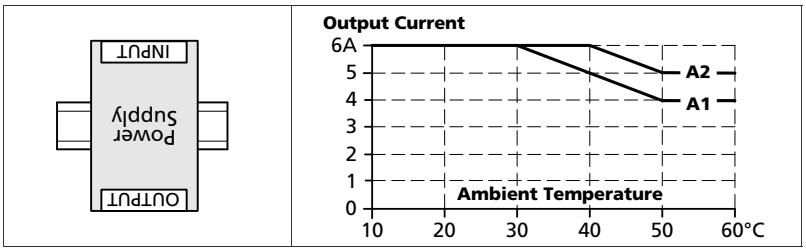


Fig. 23-9
Mounting Orientation C
(Table-top mounting)

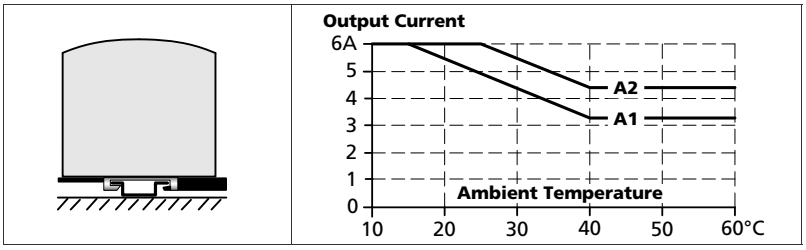


Fig. 23-10
Mounting Orientation D
(Horizontal cw)

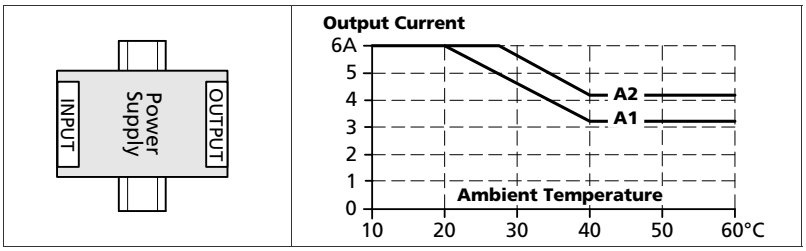


Fig. 23-11
Mounting Orientation E
(Horizontal ccw)