# CS10.243

24V, 10A, 240W SINGLE PHASE INPUT



## POWER SUPPLY

- AC 100-120V single-phase input
- Width only 60mm
- Efficiency up to 91.3%
- Easy fuse breaking due to high overload peak current
- 20% output power reserves (PowerBoost)
- Full output power up to +60°C
- 3 year warranty

## PRODUCT DESCRIPTION

The DIMENSION CS-Series units are cost optimized power supplies without compromising quality, reliability and performance. The CS-Series is part of the DIMENSION power supply family, existing alongside the high featured Q-Series.

The CS10.243 includes all the essential basic functions. The devices also offer PowerBoost: Power reserves of 20%, which may even be used continuously at temperatures up to +45°C.

The most important features are the small size, high efficiency and the wide temperature range.

The unit has an input for 100-120V mains only. This supports regional applications and offers additional cost savings without sacrificing functionality.

High immunity to transients and power surges as well as low electromagnetic emission 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 | |
| Adjustment range | 24 - 28V | |
| Output current | 10.0 – 8.6A | up to +60°C ambient |
| | 7.5 – 6.4A | at +70°C ambient |
| | Derate linearly between +60°C and +70°C | |
| PowerBoost | 12.0A | up to +45°C ambient |
| | Linear decrease to nominal power between +45°C and +60°C | |
| Output ripple | < 50mVpp | 20Hz to 20MHz |
| AC Input voltage | AC 100-120V | ±10% |
| Mains frequency | 50-60Hz | ±6% |
| AC Input current | 3.84A | at 120Vac |
| DC Input voltage | - | not allowed |
| Power factor | 0.57 | at 120Vac |
| AC Inrush current | $85A_{peak}$ | at 120Vac |
| Efficiency | 91.3% | at 120Vac |
| Power losses | 22.9W | at 120Vac |
| Temperature range | 0°C to +70°C | operational |
| Hold-up time | 46ms | at 120Vac |
| Dimensions | 60x124x117mm | WxHxD |
| Weight | 700g | |

## ORDER NUMBERS

| | | |
|---|---|---|
| Power Supply | **CS10.243** | 24-28V Standard unit (AC 100-120V-Version) |
| Accessory | ZM1.WALL | Wall mount bracket |
| | ZM13.SIDE | Side mount bracket |
| | YR40.241 | Redundancy module |

## MAIN APPROVALS

For details and the complete approval list, see chapter 18.

UL 508

UL 60950-1

Marine



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# TERMINOLOGY, ABREVIATIONS AND DEFINITIONS

| | |
|---|---|
| **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 120V** | A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances included.<br>E.g.: DC 12V describes a 12V battery disregarding whether it is full (13.7V) or flat (10V) |
| **120Vac** | 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 100V parameters are valid at 50Hz mains frequency and AC 120V parameters are valid for 60Hz 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. |



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# 1. INTENDED USE

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

Do not use this device in equipment, where malfunctioning may cause severe personal injury or threaten human life without additional appropriate safety devices, that are suited for the end-application.

If this device is used in a manner outside of its specification, the protection provided by the device may be impaired.

# 2. INSTALLATION INSTRUCTIONS

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

- Turn power off before working on the device and protect against inadvertent re-powering.
- Do not open, modify or repair the device.
- Use caution to prevent any foreign objects from entering into 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 surface may cause burns.

**Obey the following installation instructions:**

This device may only be installed and put into operation by qualified personnel.

This device does not contain serviceable parts. The tripping of an internal fuse is caused by an internal defect.

If damage or malfunction should occur during installation or operation, immediately turn power off and send unit to the factory for inspection.

Install device in an enclosure providing protection against electrical, mechanical and fire hazards.

Install the device onto a DIN rail according to EN 60715 with the input terminals on the bottom of the device. Other mounting orientations require a reduction in output current.

Make sure that the wiring is correct by following all local and national codes. Use appropriate copper cables that are designed for a minimum operating temperature of 60°C for ambient temperatures up to +45°C, 75°C for ambient temperatures up to +60°C and 90°C for ambient temperatures up to +70°C.

Ensure that all strands of a stranded wire enter the terminal connection. Use ferrules for wires on the input terminals. Unused screw terminals should be securely tightened.

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

The enclosure of the device provides a degree of protection of IP20.The housing does not provide protection against spilled liquids.

The device is designed for overvoltage category II zones. Below 2000m altitude the device is tested for impulse withstand voltages up to 4kV, which corresponds to OVC III according to IEC 60664-1.

The device is designed as "Class of Protection I" equipment according to IEC 61140. Do not use without a proper PE (Protective Earth) connection.

The device is suitable to be supplied from TN, TT and IT mains networks. The continuous voltage between the input terminals and the PE potential must not exceed 300Vac.

A disconnecting means shall be provided for the input of the device.

The device is designed for convection cooling and does not require an external fan. Do not obstruct airflow and do not cover ventilation grid!

The device is designed for altitudes up to 5000m. Above 2000m a reduction in output current is required.

Keep the following minimum installation clearances: 40mm on top, 20mm on the bottom, 5mm left and right side. Increase the 5mm to 15mm in case the adjacent device is a heat source. When the device is permanently loaded with less than 50%, the 5mm can be reduced to zero.



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The device is designed, tested and approved for branch circuits up to 20A without additional protection device. If an external fuse is utilized, do not use circuit breakers smaller than 16A B- or 10A C-Characteristic to avoid a nuisance tripping of the circuit breaker.

The maximum surrounding air temperature is +70°C. The operational temperature is the same as the ambient or surrounding air temperature and is defined 2cm below the device.

The device is designed to operate in areas between 5% and 95% relative humidity.



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# 3. AC-INPUT

| | | | |
|---|---|---|---|
| AC input | nom. | AC 100-120V | ±10% |
| Mains network systems | | TN, TT or IT | |
| AC input range | | 90-132Vac | |
| | | 85-90Vac<br>132-150Vac | short-term or with reduced output current<br>max. 500ms |
| Allowed voltage L or N to earth | max. | 300Vac | continuous, IEC 62103 |
| Input frequency | nom. | 50–60Hz | ±6% |
| Turn-on voltage | typ. | 82Vac | steady-state value, see Fig. 3-1 |
| Shut-down voltage | typ. | 78Vac | steady-state value, see Fig. 3-1 |
| External input protection | See recommendations in chapter 22.3. | | |

| | | **AC 100V** | **AC 120V** | |
|---|---|---|---|---|
| Input current | typ. | 4.32A | 3.71A | at 24V, 10A, see Fig. 3-3 |
| Power factor*) | typ. | 0.61 | 0.59 | at 24V, 10A, see Fig. 3-4 |
| Crest factor**) | typ. | 2.6 | 2.8 | at 24V, 10A |
| Start-up delay | typ. | 250ms | 215ms | see Fig. 3-2 |
| Rise time | typ. | 35ms | 35ms | at 24V, 10A const. current load, 0mF load capacitance, see Fig. 3-2 |
| | typ. | 75ms | 75ms | at 24V, 10A const. current load, 10mF load capacitance,, see Fig. 3-2 |
| Turn-on overshoot | max. | 100mV | 100mV | see Fig. 3-2 |

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

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

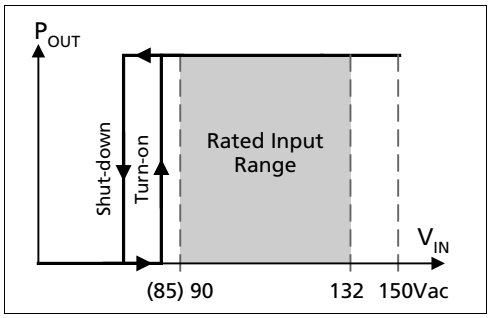
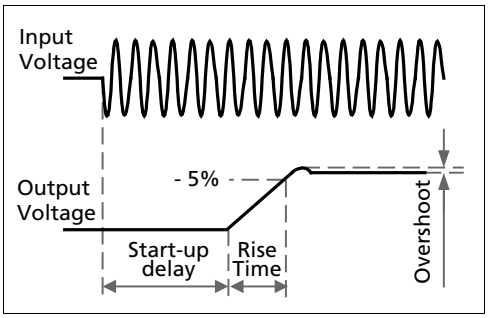



Fig. 3-2 **Turn-on behavior, definitions**






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

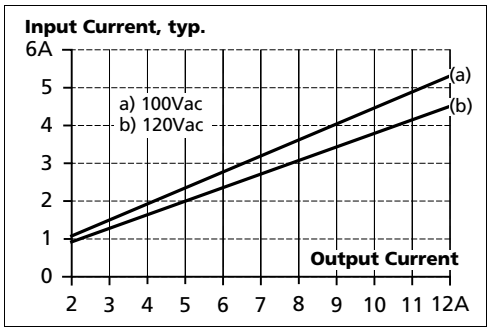



Fig. 3-4 **Power factor vs. output load**

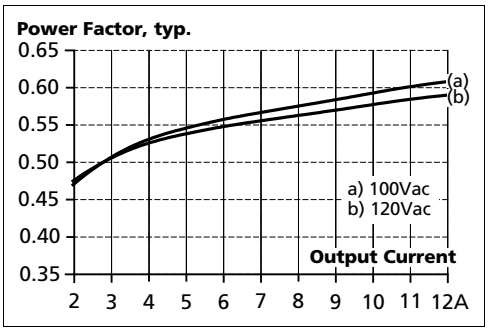
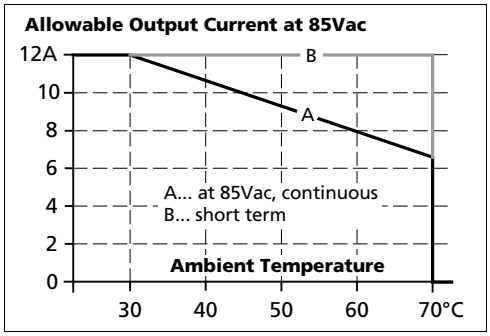



Fig. 3-5 **Input voltage derating**






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## 4. DC-INPUT

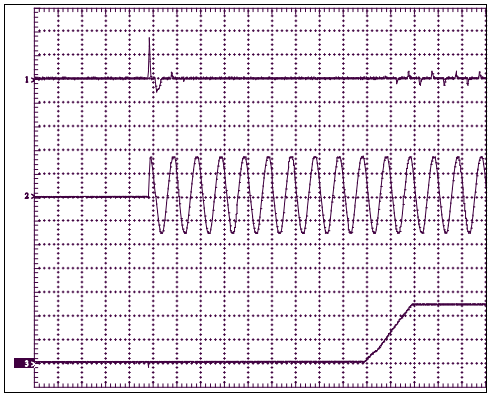
Do not operate this power supply with DC-input voltage. Use the CP10.241 or CP10.242 units instead.

## 5. INPUT INRUSH CURRENT

A NTC inrush limitation circuit limits the input inrush current after turn-on of the input voltage.
The charging current into the EMI suppression capacitors is disregarded in the first microseconds after switch-on.

| | | AC 100V | AC 120V | |
|---|---|---|---|---|
| Inrush current | max. | $90A_{peak}$ | $108A_{peak}$ | at +40°C ambient, cold start |
| | typ. | $71A_{peak}$ | $85A_{peak}$ | at +40°C ambient, cold start |
| Inrush energy | max. | $6A^2s$ | $8.5A^2s$ | at +40°C ambient, cold start |

Fig. 5-1 **Typical input inrush current behavior**



Input: 120Vac
Output: 24V, 10A
Ambient: +40°C

Upper curve: Input current (50A / DIV)
Medium curve: Input voltage (100V / DIV)
Lower curve: Output voltage (10V / DIV)
Time scale: 20ms / DIV



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# 6. OUTPUT

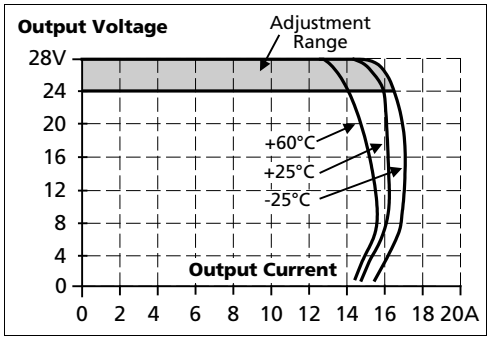
| | | | |
|---|---|---|---|
| Output voltage | nom. | 24V | |
| Adjustment range | | 24-28V | guaranteed |
| | max. | 30V***) | at clockwise end position of potentiometer |
| Factory settings | typ. | 24.1V | ±0.2%, at full load, cold unit, |
| Line regulation | max. | 70mV | 90-132Vac |
| Load regulation | max. | 100mV | static value, 0A → 10A; see Fig. 6-1 |
| Ripple and noise voltage | max. | 50mVpp | 20Hz to 20MHz, 50Ohm |
| Output current | nom. | 10A | at 24V and up to +60°C ambient temperature, see Fig. 6-1 |
| | nom. | 7.5A | at 24V and +70°C ambient temperature |
| | nom. | 8.6A | at 28V and up to +60°C ambient temperature, see Fig. 6-1 |
| | nom. | 6.5A | at 28V and +70°C ambient temperature |
| | Derate linearly between +60°C and +70°C, see chapter 14 | | |
| PowerBoost*) | nom. | 12A | at 24V and up to +45°C ambient temperature |
| | nom. | 10.3A | at 28V and up to +45°C ambient temperature, see Fig. 6-1 |
| | PowerBoost decreases linearly to nominal power between +45°C and +60°C, see chapter 14 | | |
| Overload behavior | | continuous current | see Fig. 6-1 |
| Short-circuit current | min. | 14A**) | load impedance <100mOhm, see Fig. 6-1 |
| | max. | 18A**) | load impedance <100mOhm, see Fig. 6-1 |
| Output capacitance | typ. | 7 000µF | included inside the power supply |

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

**) Discharge current of output capacitors is not included.

***) 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. The typical value is about 28.5V.

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






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# 7. HOLD-UP TIME

| | | AC 100V | AC 120V | |
|---|---|---|---|---|
| Hold-up Time | typ. | 62ms | 107ms | at 24V, 5A, see Fig. 7-1 |
| | min. | 50ms | 86ms | at 24V, 5A, see Fig. 7-1 |
| | typ. | 23ms | 46ms | at 24V, 10A, see Fig. 7-1 |
| | min. | 19ms | 37ms | at 24V, 10A, see Fig. 7-1 |
| | typ. | 17ms | 35ms | at 24V, 12A, see Fig. 7-1 |
| | min. | 14ms | 28ms | at 24V, 12A, see Fig. 7-1 |

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

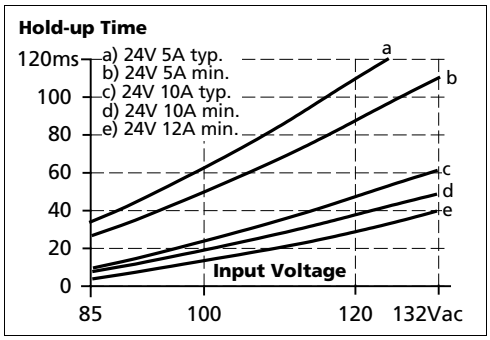
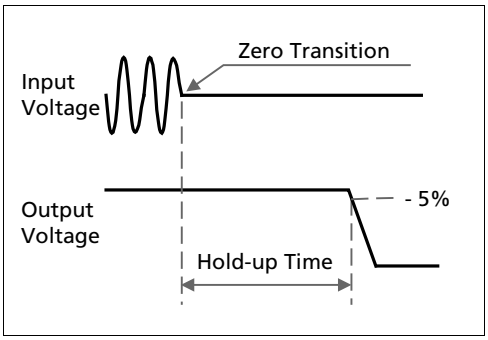



Fig. 7-2 **Shut-down behavior, definitions**




Note: At no load, the hold-up time can be up to several seconds. The green DC-OK LED is on during this time.



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# 8. EFFICIENCY AND POWER LOSSES

| | | AC 100V | AC 120V | |
|---|---|---|---|---|
| Efficiency | typ. | 91.0% | 91.3% | at 24V, 10A |
| | typ. | 90.3% | 90.9% | at 24V, 12A (PowerBoost) |
| Average efficiency*) | typ. | 90.6% | 90.6% | 25% at 2.5A, 25% at 5A, 25% at 7.5A. 25% at 10A |
| Power losses | typ. | 6.6W | 7.2W | at 24V, 0A |
| | typ. | 11.5W | 11.5W | at 24V, 5A |
| | typ. | 23.7W | 22.9W | at 24V, 10A |
| | typ. | 30.9W | 28.8W | at 24V, 12A (PowerBoost) |

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

Fig. 8-1 **Efficiency vs. output current at 24V, typ**

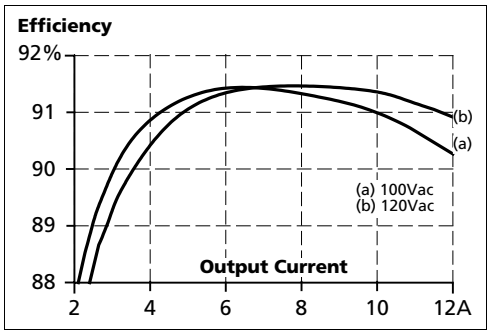



Fig. 8-2 **Losses vs. output current at 24V, typ.**

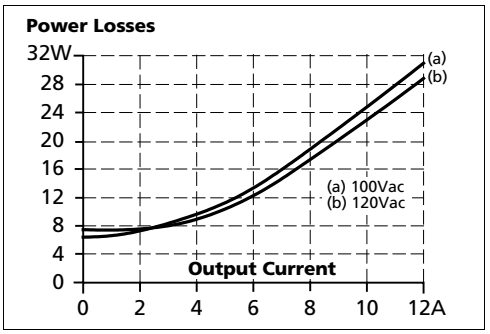



Fig. 8-3 **Efficiency vs. input voltage at 24V, 10A, typ.**

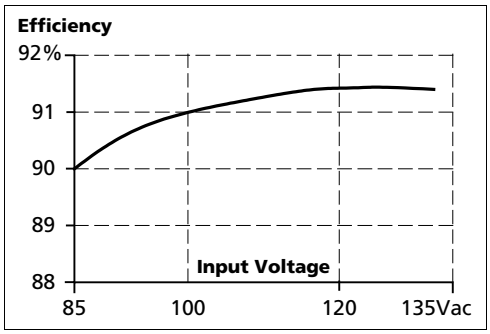
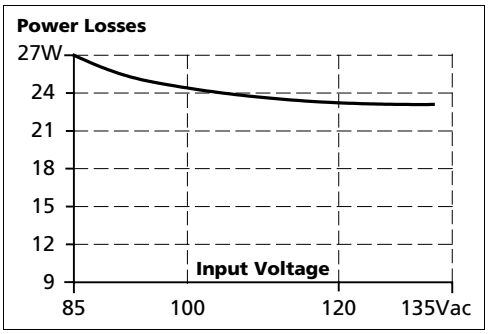



Fig. 8-4 **Losses vs. input voltage at 24V, 10A, typ.**






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## 9. LIFETIME EXPECTANCY AND MTBF

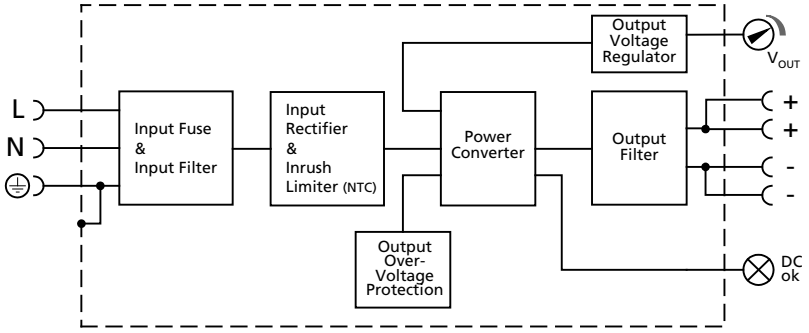
| | AC 100V | AC 120V | |
|---|---|---|---|
| Lifetime expectancy*) | 93 000h | 99 000h | at 24V, 5A and +40°C |
| | 264 000h*) | 281 000h*) | at 24V, 5A and +25°C |
| | 38 000h | 50 000h | at 24V, 10A and +40°C |
| | 108 000h | 141 000h*) | at 24V, 10A and +25°C |
| | 27 000h | 34 000h | at 24V, 12A and +40°C |
| | 76 000h | 96 000h | at 24V, 12A and +25°C |
| MTBF**) SN 29500, IEC 61709 | 690 000h | 710 000h | at 24V, 10A and +40°C |
| | 587 000h | 604 000h | at 24V, 12A and +40°C |
| | 1 193 000h | 1 228 000h | at 24V, 10A and +25°C |
| MTBF**) MIL HDBK 217F | 500 000h | 505 000h | at 24V, 10A and +40°C; Ground Benign GB40 |
| | 450 000h | 455 000h | at 24V, 12A and +40°C; Ground Benign GB40 |
| | 685 000h | 692 000h | at 24V, 10A and +25°C; Ground Benign GB25 |

*) 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.

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

## 10. FUNCTIONAL DIAGRAM

Fig. 10-1 **Functional diagram**






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# 11. TERMINALS AND WIRING

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

| **Type** | Screw terminals |
|---|---|
| Solid wire | 0.5-6mm² |
| Stranded wire | 0.5-4mm² |
| American Wire Gauge | AWG20-10 |
| Max. wire diameter | 2.8mm (including ferrules) |
| Wire stripping length | 7mm |
| Screwdriver | 3.5mm slotted or cross-head No 2 |
| Recommended tightening torque | 1Nm |
| Pull-out force | according to UL 486E |

**Instructions:**

a) Use appropriate copper cables that are designed for minimum operating temperatures of:
60°C for ambient up to 45°C and
75°C for ambient up to 60°C minimum
90°C for ambient up to 70°C minimum.
b) Follow national installation codes and installation regulations!
c) Ensure that all strands of a stranded wire enter the terminal connection!
d) Do not use the unit without PE connection.
e) Unused terminal compartments should be securely tightened.
f) Ferrules are allowed.



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# 12. FRONT SIDE AND USER ELEMENTS

Fig. 12-1 **Front side**




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

**B** **Output Terminals** (screw terminals, two pins per pole)
**+** Positive output
**–** Negative (return) output

**C** **Output voltage potentiometer**
Open the flap to adjust the output voltage. Factory set: 24.1V

**D** **DC-OK LED** (green)
On, when the voltage on the output terminals is >21V



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# 13. EMC

The power supply is suitable for applications in industrial environment as well as in residential, commercial and light industry environment.

| **EMC Immunity** | According generic standards: EN 61000-6-1 and EN 61000-6-2 | | | |
|---|---|---|---|---|
| Electrostatic discharge | EN 61000-4-2 | contact discharge<br>air discharge | 8kV<br>15kV | Criterion A<br>Criterion A |
| Electromagnetic RF field | EN 61000-4-3 | 80MHz-2.7GHz | 10V/m | Criterion A |
| Fast transients (Burst) | EN 61000-4-4 | input lines<br>output lines | 4kV<br>2kV | Criterion A<br>Criterion A |
| Surge voltage on input | EN 61000-4-5 | L → N<br>L → PE, N → PE | 2kV<br>4kV | Criterion A<br>Criterion A |
| Surge voltage on output | EN 61000-4-5 | + → -<br>+ / - → PE | 500V<br>1kV | Criterion A<br>Criterion A |
| Conducted disturbance | EN 61000-4-6 | 0.15-80MHz | 10V | Criterion A |
| Mains voltage dips | EN 61000-4-11 | 0% of 100Vac<br>40% of 100Vac<br>70% of 100Vac | 0Vac, 20ms<br>40Vac, 200ms<br>70Vac, 500ms | Criterion A<br>Criterion C<br>Criterion C |
| Voltage interruptions | EN 61000-4-11 | | 5000ms | Criterion C |
| Powerful transients | VDE 0160 | over entire load range | 375V, 1.3ms | Criterion A |

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

| **EMC Emission** | According generic standards: EN 61000-6-3, EN 61000-6-4 | |
|---|---|---|
| Conducted emission input lines | EN 55011, EN 55032, FCC Part 15, CISPR 11, CISPR 32 | Class B |
| Conducted emission output lines**) | IEC/CISPR 16-1-2, IEC/CISPR 16-2-1 | limits for DC power port according EN 61000-6-3 not fulfilled |
| Radiated emission | EN 55011, EN 55032 | Class B |
| Harmonic input current | EN 61000-3-2 | not applicable (< 220Vac) |
| Voltage fluctuations, flicker | EN 61000-3-3 | fulfilled*) |

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

*) tested with constant current loads, non pulsing
**) for information only, not mandatory for EN 61000-6-3

| **Switching frequency** | 85kHz to 110kHz | Main converter, input voltage dependent |
|---|---|---|



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## 14. ENVIRONMENT

| | | |
|---|---|---|
| Operational temperature*) | 0°C to +70°C | reduce output power according Fig. 14-1 |
| Storage temperature | -40°C to +85°C | for storage and transportation |
| Output derating | 6W/K | Between +60°C and +70°C |
| Humidity**) | 5 to 95% r.h. | IEC 60068-2-30 |
| Vibration sinusoidal | 2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g***)<br>2 hours / axis***) | IEC 60068-2-6 |
| Shock | 30g 6ms, 20g 11ms***)<br>3 bumps / direction, 18 bumps in total | IEC 60068-2-27 |
| Altitude | 0 to 2000m | without any restrictions |
| | 2000 to 6000m | reduce output power or ambient temperature, see Fig. 14-2<br>IEC 62103, EN 50178, overvoltage category II |
| Altitude derating | 15W/1000m or 5K/1000m | for altitudes > 2000m, see Fig. 14-2 |
| Overvoltage category | III | IEC 62103, EN 50178, altitudes up to 2000m |
| | II | altitudes from 2000m to 6000m |
| Degree of pollution | 2 | IEC 62103, EN 50178, not conductive |

*) Operational temperature is the same as the ambient or surrounding temperature and is defined as the air temperature 2cm below the unit.

**) Do not energize while condensation is present

***) 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. 14-1 **Output current vs. ambient temp. (Inom 10A; Iout with PowerBoost = 12A)**

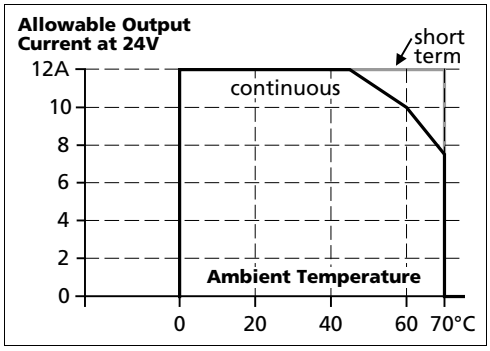
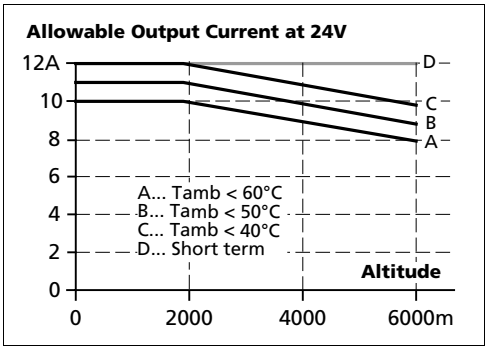



Fig. 14-2 **Output current vs. altitude**






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## 15. PROTECTION FEATURES

| | | |
|---|---|---|
| Output protection | Electronically protected against overload, no-load and short-circuits*) | |
| Output overvoltage protection | typ. 35Vdc<br>max. 39Vdc | In case of an internal power supply defect, a redundant circuit limits the maximum output voltage. The output shuts down and automatically attempts to restart. |
| Degree of protection | IP20 | EN/IEC 60529<br>Caution: For use in a controlled environment according to CSA 22.2 No 107.1-01. |
| Penetration protection | > 3.5mm | e.g. screws, small parts |
| Overtemperature protection | yes | Output shut-down with automatic restart |
| Input transient protection | MOV (Metal Oxide Varistor) | |
| Internal input fuse | included | not user replaceable |

*) In case of a protection event, audible noise may occur.

## 16. SAFETY FEATURES

| | | |
|---|---|---|
| Input / output separation*) | SELV | IEC/EN 60950-1 |
| | PELV | IEC/EN 60204-1, EN 50178, IEC 62103, IEC 60364-4-41 |
| | double or reinforced insulation | |
| Class of protection | I | PE (Protective Earth) connection required |
| Isolation resistance | > 5MOhm | input to output, 500Vdc |
| PE resistance | < 0.1Ohm | between housing and PE terminal |
| Touch current (leakage current) | typ. 0.36mA / 0.91mA | 100Vac, 50Hz, TN-,TT-mains / IT-mains |
| | typ. 0.50mA / 1.25mA | 120Vac, 60Hz, TN-,TT-mains / IT-mains |
| | max. 0.45mA / 1.13mA | 110Vac, 50Hz, TN-,TT-mains / IT-mains |
| | max. 0.62mA / 1.55mA | 132Vac, 60Hz, TN-,TT-mains / IT-mains |

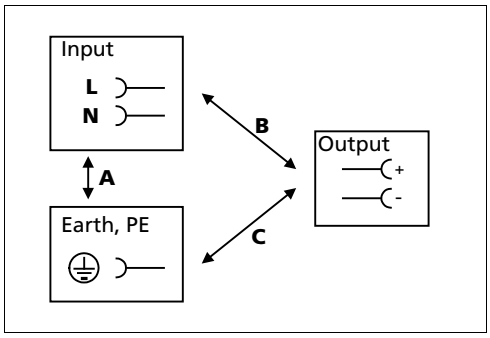


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# 17. DIELECTRIC STRENGTH

The output voltage is floating and has no ohmic connection to the ground. Type and factory 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. 17-1 **Dielectric strength**




| | | A | B | C |
|---|---|---|---|---|
| Type test | 60s | 2500Vac | 3000Vac | 500Vac |
| Factory test | 5s | 2500Vac | 2500Vac | 500Vac |
| Field test | 5s | 2000Vac | 2000Vac | 500Vac |
| Cut-off current setting | | > 15mA | > 15mA | > 20mA |

To fulfil the PELV requirements according to EN60204-1 § 6.4.1, we recommend that either the + pole, the – pole or any other part of the output circuit shall be connected to the protective earth system. This helps to avoid situations in which a load starts unexpectedly or cannot be switched off when unnoticed earth faults occur.



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## 18. APPROVED, FULFILLED OR TESTED STANDARDS

| | | |
|---|---|---|
| UL 508 | c UL us LISTED | UL Certificate<br>Listed equipment for category NMTR - Industrial Control Equipment<br>Applicable for US and Canada<br>E-File: E198865 |
| IEC 61010-2-201 | Safety ✓ | Manufacturer's Declaration<br>Electrical Equipment for Measurement, Control and Laboratory Use - Particular requirements for control equipment |
| IEC 60950-1 | CB Report | CB Scheme Certificate<br>General safety requirements for Information Technology Equipment (ITE) |
| UL 60950-1 | c RU® us | UL Certificate<br>Recognized component for category QQGQ - Information Technology Equipment (ITE)<br>Applicable for US and Canada<br>E-File: E137006 |
| Marine (DNV) | DNV<br>DNV.COM/AF | DNV Certificate<br>DNV Type approved product<br>Certificate: TAA00001ST |
| Marine (ABS) | ABS | ABS Design Assessment Certificate<br>ABS (American Bureau of Shipment) assessed product<br>Certificate: 22-2231447-PDA |
| ISA-71.04 G3 | Corrosion<br>G3-ISA-71.04 ✓ | Manufacturer's Declaration (Online Document)<br>Airborne Contaminants Corrosion Test<br>Severity Level: G3 Harsh<br>H2S: 100ppb<br>NOx: 1250ppb<br>Cl2: 20ppb<br>SO2: 300ppb<br>Test Duration: 3 weeks, which simulates a service life of 10 years. |
| VDMA 24364 | LABS<br>VDMA 24364-C1-L/W | Paint Wetting Impairment Substances Test (or LABS-Test)<br>Tested for Zone 2 and test class C1 according to VDMA 24364-C1-L/W for solvents and water-based paints |



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## 19. REGULATORY PRODUCT COMPLIANCE

| | | |
|---|---|---|
| EU Declaration of Conformity | CE | The CE mark indicates conformance with the<br>- EMC directive<br>- Low-voltage directive<br>- RoHS directive |
| REACH Regulation (EU) | REACH ✓ | Manufacturer's Declaration<br>EU regulation regarding the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) fulfilled.<br>EU Regulation (EC) 1907/2006. |
| WEEE Regulation |  | Manufacturer's Declaration<br>EU Regulation on Waste Electrical and Electronic Equipment<br>Registered as business to business (B2B) products.<br>EU Regulation 2012/19/EU |



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## 20. PHYSICAL DIMENSIONS AND WEIGHT

| | |
|---|---|
| Width | 60mm |
| Height | 124mm |
| Depth | 117mm<br>The DIN rail depth must be added to the unit depth to calculate the total required installation depth. |
| Weight | 700g |
| 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<br>Cover: Zinc-plated steel |
| Installation clearances | See chapter 2 |

Fig. 20-1 **Front view**

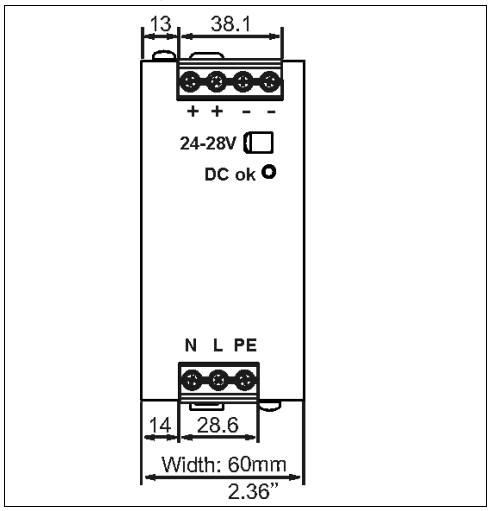
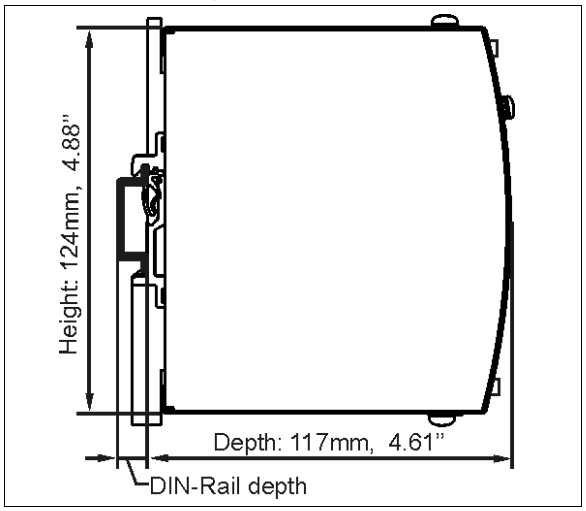



Fig. 20-2 **Side view**



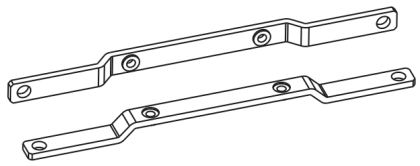


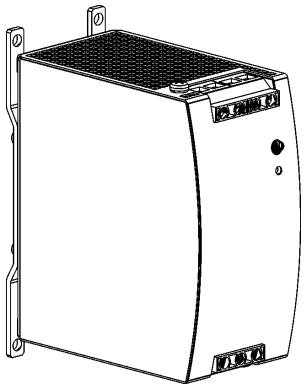

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# 21. ACCESSORIES

## 21.1. ZM1.WALL - WALL MOUNTING BRACKET

This bracket is used to mount the power supply onto a flat surface without utilizing a DIN rail.

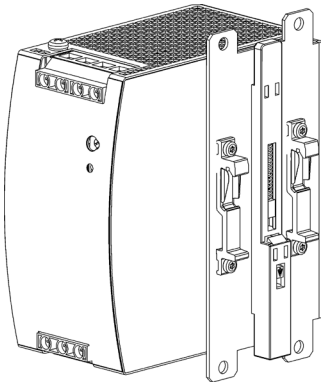




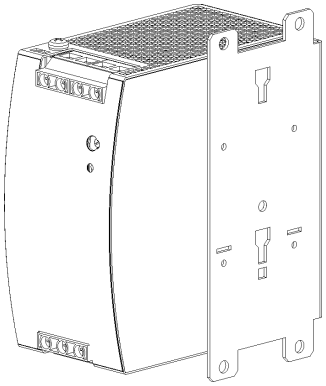
## 21.2. ZM13.SIDE - SIDE MOUNTING BRACKET

This bracket is used to mount Dimension units sideways with or without utilizing a DIN rail. The two aluminum brackets and the black plastic slider of the unit must be detached so that the steel brackets can be installed.

For sideway DIN rail mounting, the removed aluminum brackets and the black plastic slider need to be mounted on the steel bracket.



Side mounting with DIN rail brackets



Side mounting without DIN rail brackets



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## 21.3. YR40.241 - REDUNDANCY MODULES

(2x 20A input, 1x 40A output)

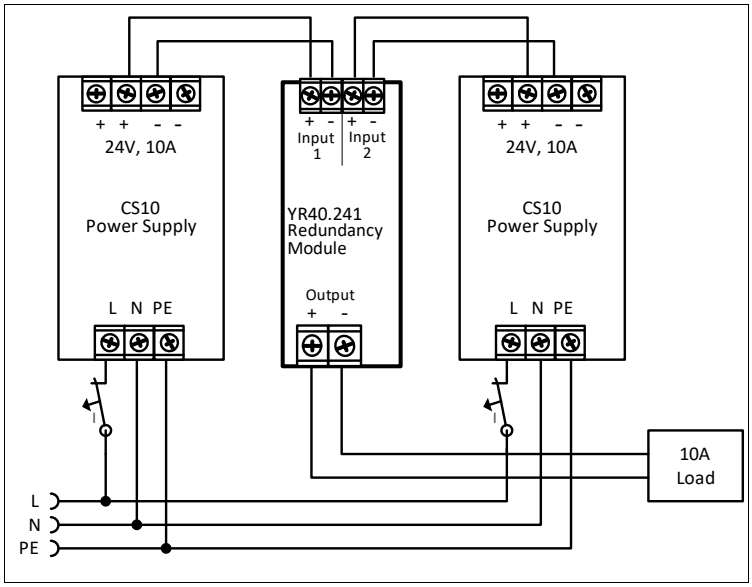


The YR40.241 is a dual redundancy module, which can be used to build redundant systems. It is equipped with two input channels, which are individually decoupled by utilizing MOSFET technology.

Using MOSFET instead of diodes reduces the heat generation and the voltage drop between input and output. The YR40.241 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 36mm width on the DIN rail.

Fig. 21-1 **Typical 1+1 Redundant configuration for 10A load current**






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# 22. APPLICATION NOTES

## 22.1. PEAK CURRENT CAPABILITY

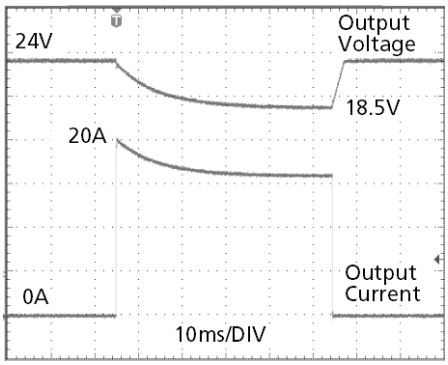
The unit can deliver peak currents (up to several milliseconds) which are higher than the specified short term currents.

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 overcurrent to open in a timely manner. This avoids voltage loss in adjacent circuits.

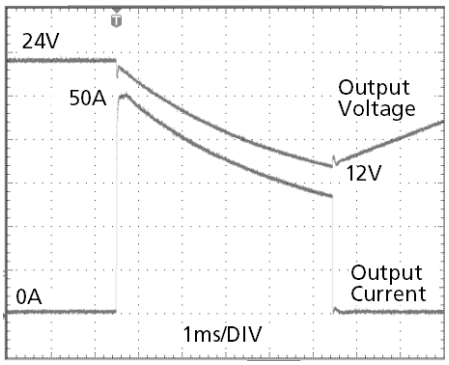
The extra current (peak current) is supplied by the power converter and the built-in large sized output capacitors of the power supply. The capacitors get discharged during such an event, which causes a voltage dip on the output. The following two examples show typical voltage dips:

Fig. 22-1 **Peak load with 2x the nominal current for 50ms, typ.**




20A Peak load (resistive) for 50ms
Output voltage dips from 24V to 18.5V.

Fig. 22-2 **Peak load with 5x the nominal current for 5ms, typ.**




50A Peak load (resistive) for 5ms
Output voltage dips from 24V to 12V.

| | | | |
|---|---|---|---|
| Peak current voltage dips | typ. | from 24V to 18.5V | at 20A for 50ms, resistive load |
| | typ. | from 24V to 17V | at 50A for 2ms, resistive load |
| | typ. | from 24V to 12V | at 50A for 5ms, resistive load |



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## 22.2. BACK-FEEDING LOADS

Loads such as decelerating motors and inductors can feed voltage back to the power supply. This feature is also called return voltage immunity or resistance against Back- E.M.F. (Electro Magnetic Force).

This power supply 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 maximum allowed feed-back-voltage is 35Vdc. The absorbing energy can be calculated according to the built-in large sized output capacitor which is specified in chapter 6.

## 22.3. EXTERNAL INPUT PROTECTION

The unit is tested and approved for branch circuits up to 20A. An external protection is only required if the supplying branch has an ampacity greater than this. Check also local codes and local requirements. In some countries local regulations might apply.

If an external fuse is necessary or utilized, minimum requirements need to be considered to avoid nuisance tripping of the circuit breaker. A minimum value of 16A B- or 10A C-Characteristic breaker should be used.

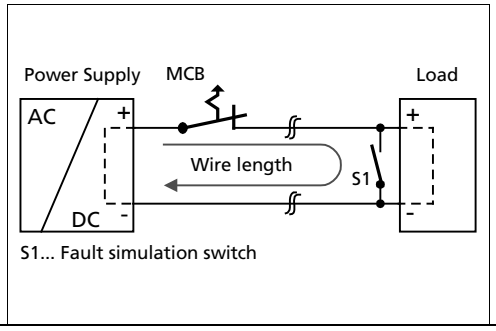
## 22.4. OUTPUT CIRCUIT BREAKERS

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 chapter and wire length.

Fig. 22-3 **Test circuit**




S1... Fault simulation switch

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

| | 0.75mm² | 1.0mm² | 1.5mm² | 2.5mm² |
|---|---|---|---|---|
| **C-2A** | 21m | 26m | 37m | 68m |
| **C-3A** | 15m | 21m | 30m | 51m |
| **C-4A** | 10m | 14m | 20m | 38m |
| **C-6A** | 4m | 6m | 9m | 16m |
| **C-8A** | 1m | 2m | 4m | 6m |
| **C-10A** | 1m | 2m | 3m | 4m |
| **B-6A** | 13m | 18m | 26m | 42m |
| **B-10A** | 10m | 5m | 9m | 11m |

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



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## 22.5. PARALLEL USE TO INCREASE OUTPUT POWER

The power supply shall not be used in parallel to increase the output current.

## 22.6. PARALLEL USE FOR REDUNDANCY

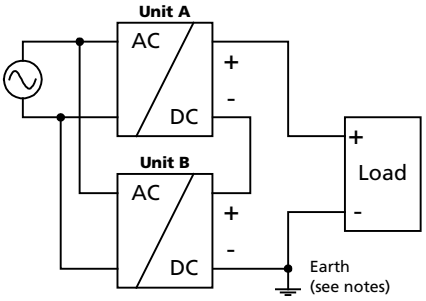
Power supplies can be paralleled for redundancy to gain higher system availability. Redundant systems require a certain amount of extra power to support the load in case one power supply unit fails. The simplest way is to put two power supplies in parallel. This is called a 1+1 redundancy. In case one power supply unit fails, the other one is automatically able to support the load current without any interruption, see also chapter 22.5.

**Please note:** This simple way to build a redundant system does not cover failures such as an internal short circuit in the secondary side of the power supply. In such a case, the defective unit becomes a load for the other power supplies and the output voltage can no longer be maintained. This can be avoided by utilizing redundancy modules, which have decoupling devices (diodes or MOSFETs) included. Further information and wiring configurations can be found in chapter 21.3.

Recommendations for building redundant power systems:

a) Use separate input fuses for each power supply.
b) It is desirable to set the output voltages of all units to the same value (± 100mV) or leave it at the factory setting.

## 22.7. 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 are no longer SELV and can be dangerous. Such voltages must be installed with a protection against touching.

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

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.

## 22.8. INDUCTIVE AND CAPACITIVE LOADS

The unit is designed to supply any kind of loads, including capacitive and inductive loads.

## 22.9. CHARGING OF BATTERIES

The power supply shall not be used to charge batteries. Choose power supplies of the QP-Series or CP-Series for charging batteries.



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## 22.10. 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

| | |
|---|---|
| Enclosure: | Rittal Typ IP66 Box PK 9519 100, plastic, 180x180x165mm |
| Load: | 24V, 8A; (=80%) load is placed outside the box |
| Input: | 120Vac |
| Temperature inside enclosure: | 48.9°C (in the middle of the right side of the power supply with a distance of 2cm) |
| Temperature outside enclosure: | 23.3°C |
| Temperature rise: | 25.6K |



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## 22.11. MOUNTING ORIENTATIONS

Mounting orientations other than the input 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. 22-4
**Mounting Orientation A**
(Standard orientation)

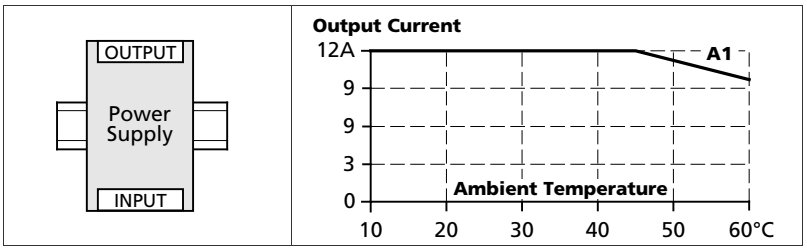



Fig. 22-5
**Mounting Orientation B**
(Upside down)

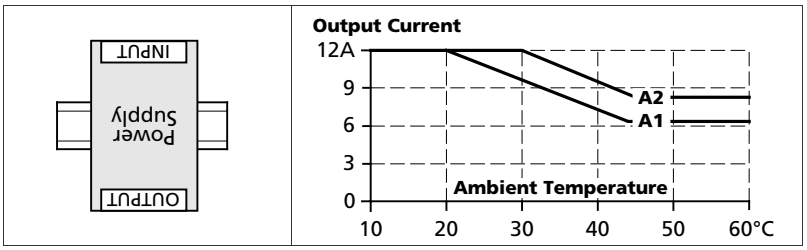



Fig. 22-6
**Mounting Orientation C**
(Table-top mounting)

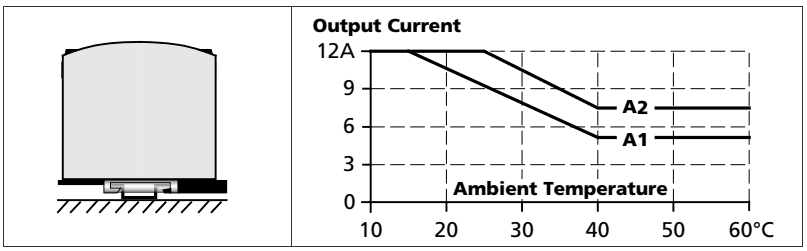



Fig. 22-7
**Mounting Orientation D**
(Horizontal cw)

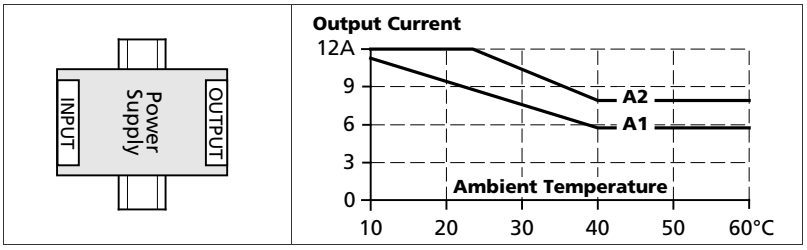
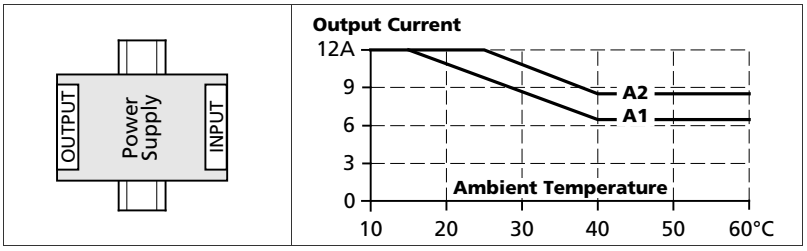



Fig. 22-8
**Mounting Orientation E**
(Horizontal ccw)






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