



### POWER SUPPLY

- AC 380-480V Wide-range Input
- Input Fuses Already Included
- Requires only Two Legs of a 3-Phase System
- Width only 40mm
- Efficiency up to 90.4%
- 20% Output Power Reserves
- Input -Transient Blanking Circuit Included
- Minimal Inrush Current Surge
- Full Power Between -25°C and +60°C
- 3 Year Warranty

### GENERAL DESCRIPTION

The Dimension C-Series are cost optimized power supplies without compromising quality, reliability and performance. The C-Series is part of the DIMENSION power supply family. The most outstanding features of CT5.241 are the high efficiency, electronic inrush current limitation, active input transient filter and wide operational temperature range, the small size and other technological design concepts.

The C-Series includes all the essential basic functions. The devices have a power reserve of 20% included, which may even be used continuously at temperatures up to +45°C. The CT5.241 utilizes only 2 legs of a 3-phase system which saves wiring and installation costs. Furthermore, this allows a smaller unit without compromising the size of the terminals. Due to the low power consumption, an unbalancing of the individual phases is not expected.

### SHORT-FORM DATA

|                   |                |                 |
|-------------------|----------------|-----------------|
| Output voltage    | DC 24V         |                 |
| Adjustment range  | 24-28V         |                 |
| Output current    | 5 – 4.3A       | ambient <60°C   |
|                   | 6 – 5.2A       | ambient <45°C   |
| Output power      | 120W           | ambient <60°C   |
|                   | 144W           | ambient <45°C   |
| Output ripple     | < 50mVpp       | 20Hz to 20MHz   |
| Input voltage     | AC 380-480V    | -15%/+20%       |
| Mains frequency   | 50-60Hz        | ±6%             |
| AC Input current  | 0.75 / 0.68A   | at 400 / 480Vac |
| Power factor      | 0.45 / 0.43    | at 400 / 480Vac |
| AC Inrush current | typ. 4A peak   |                 |
| Efficiency        | 90.4 / 90.0%   | at 400 / 480Vac |
| Losses            | 12.7 / 13.3W   | at 400 / 480Vac |
| Temperature range | -25°C to +70°C | operational     |
| Derating          | 3W/°C          | +60 to +70°C    |
| Hold-up time      | typ. 27 / 48ms | at 400 / 480Vac |
| Dimensions        | 40x124x117mm   | WxHxD           |

### ORDER NUMBERS

|              |                |                      |
|--------------|----------------|----------------------|
| Power Supply | <b>CT5.241</b> | 24-28V Standard unit |
| Accessory    | ZM1.WALL       | Wall mount bracket   |
|              | ZM12.SIDE      | Side mount bracket   |
|              | YRM2.DIODE     | Decoupling module    |
|              | UF20.241       | Buffer unit          |

### MARKINGS



Marine, pending





EMC, LVD

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The information presented in this document is believed to be accurate and reliable and may change without notice.

## TERMINOLOGY AND ABBREVIATIONS

|  |   |
|--|---|
| <b>PE and  symbol</b> | PE is the abbreviation for <b>Protective Earth</b> and has the same meaning as the symbol  .   |
| <b>Earth, Ground</b>   | This document uses the term "earth" which is the same as the U.S. term "ground".  |
| <b>T.b.d.</b>  | To be defined, value or description will follow later.  |
| <b>AC 400V</b>   | A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances (usually $\pm 15\%$ ) included.<br>E.g.: DC 12V describes a 12V battery disregarding whether it is full (13.7V) or flat (10V) |
| <b>400Vac</b>  | A figure with the unit (Vac) at the end is a momentary figure without any additional tolerances included.   |
| <b>50Hz vs. 60Hz</b>   | As long as not otherwise stated, AC 380V and AC 400V parameters are valid at 50Hz and AC 480V parameters are valid at 60Hz mains frequency.   |



## 3. AC-INPUT

|                                |      |             |  |
|--------------------------------|------|-------------|--|
| AC input                       | nom. | AC 380-480V | TN, TT, IT-mains networks, grounding of one phase is allowed except for UL508 applications |
| AC input range                 |      | 323-576Vac  | continuous operation, no damage between 0 and 323Vac                                       |
|                                |      | 576-700Vac  | for max. 1 second, occasional (not periodical)   |
| Allowed Voltage Phase to Earth |      | 500Vac      | IEC 62103  |
| Input frequency                | nom. | 50–60Hz     | ±6%  |
| Turn-on voltage                | typ. | 270Vac      | load independent, see Fig. 3-1   |
| Shut-down voltage              | typ. | 185Vac      | at 24V, 0A, see Fig. 3-1   |
|                                | typ. | 220Vac      | at 24V, 2.5A   |
|                                | typ. | 230Vac      | at 24V, 5A   |

|                   |      | <b>AC 400V</b> | <b>AC 480V</b> |                            |
|-------------------|------|----------------|----------------|----------------------------|
| Input current     | typ. | 0.75A          | 0.68A          | at 24V, 5A, see Fig. 3-3   |
| Power factor *)   | typ. | 0.45           | 0.43           | at 24V, 5A, see Fig. 3-1   |
| Start-up delay    | typ. | 75ms           | 75ms           | see Fig. 3-2               |
| Rise time         | typ. | 35ms           | 36ms           | 0mF, 24V, 5A, see Fig. 3-2 |
|                   | typ. | 64ms           | 68ms           | 5mF, 24V, 5A, see Fig. 3-2 |
| Turn-on overshoot | max. | 200mV          | 200mV          | see Fig. 3-2               |

\*) The power factor is the ratio of the true (or real) power to the apparent power in an AC circuit.

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

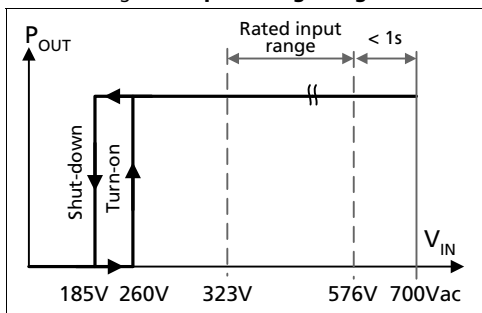


Fig. 3-2 **Turn-on behavior, definitions**

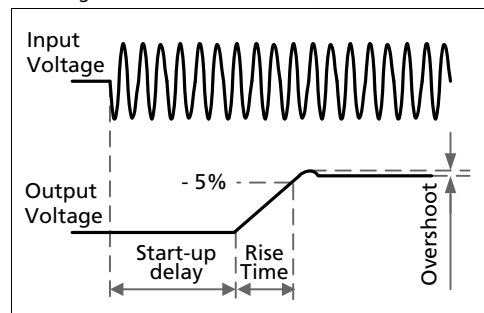


Fig. 3-3 **Input current vs. output load at 24V**

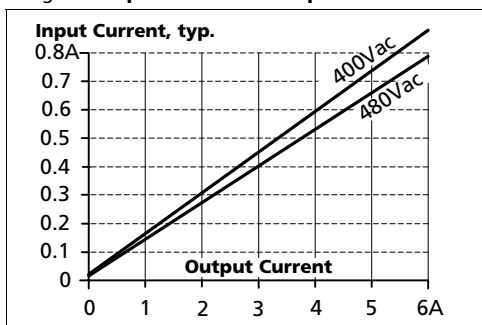
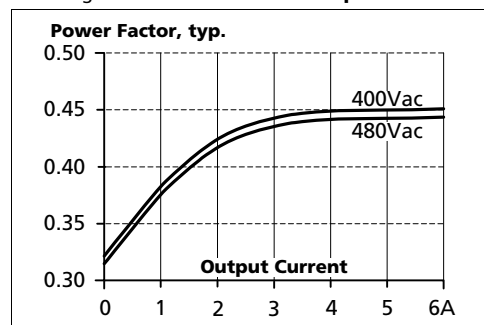


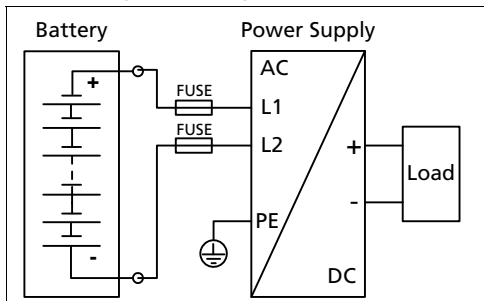
Fig. 3-4 **Power factor vs. output load**



### 4. DC-INPUT

|                               |      |                |                          |
|-------------------------------|------|----------------|--------------------------|
| DC input                      | nom. | <b>DC 600V</b> |                          |
| DC input range                |      | 450-780Vdc     | continuous operation     |
| Allowed Voltage Line to Earth | max. | 820Vdc         | IEC 62103                |
| DC input current              | typ. | 0.3A / 0.17A   | 450Vdc / 780Vdc, 24V, 5A |
| Turn-on voltage               | typ. | 370Vdc         | steady state value       |
| Shut-down voltage             | typ. | 260Vdc         | steady state value       |

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



#### Instructions for DC use:

- Use a battery or similar DC source. For other sources contact PULS
- Connect +pole to L1 and –pole to L2.
- Use appropriate external fuses in the + and – lines which are suitable for the DC-voltage.
- Connect the PE terminal to a earth wire or to the machine ground.
- DC-operation is not included in the UL approval. Additional testing might be necessary.

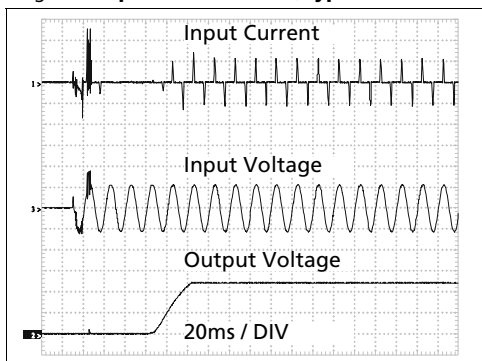
### 5. INPUT INRUSH CURRENT

An active inrush limitation circuit limits the input inrush current after turn-on of the input voltage and after short input voltage interruptions.

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

|                |      | <b>AC 400V</b>      | <b>AC 480V</b>      |                |
|----------------|------|---------------------|---------------------|----------------|
| Inrush current | max. | 10A <sub>peak</sub> | 10A <sub>peak</sub> | -25°C to +70°C |
|                | typ. | 4A <sub>peak</sub>  | 4A <sub>peak</sub>  | -25°C to +70°C |
| Inrush energy  | max. | 0.5A <sup>2</sup> s | 0.5A <sup>2</sup> s | -25°C to +70°C |

Fig. 5-1 **Input inrush current, typical behavior**



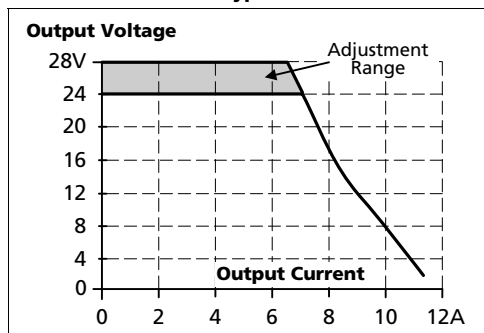
Input: 400Vac  
Output: 24V, 5A  
Ambient: 25°C

Upper curve: Input current 2A / DIV  
Middle curve: Input voltage 500V / DIV  
Lower curve: Output voltage 10V / DIV  
Time basis: 20ms / DIV

### 6. OUTPUT

|                          |      |         |   |
|--------------------------|------|---------|---|
| Output voltage           | nom. | 24V     |   |
| Adjustment range         | min. | 24-28V  | guaranteed  |
|                          | max. | 30V     | at clockwise end position of potentiometer          |
| Factory setting          |      | 24.1V   | ±0.2%, at full load, cold unit                      |
| Line regulation          | max. | 10mV    | 323-576Vac  |
| Load regulation          | max. | 100mV   | static value, 0A → 5A                               |
| Ripple and noise voltage | max. | 50mVpp  | 20Hz to 20MHz, 50Ohm                                |
| Output capacitance       | typ. | 3 800µF |   |
| Output current           | nom. | 6A      | at 24V, ambient < 45°C, see Fig. 6-1                |
|                          | nom. | 5A      | at 24V, ambient < 60°C, see Fig. 6-1                |
|                          | nom. | 5.2A    | at 28V, ambient < 45°C, see Fig. 6-1                |
|                          | nom. | 4.3A    | at 28V, ambient < 60°C, see Fig. 6-1                |
| Output power             | nom. | 144W    | for ambient temperatures < 45°C                     |
|                          | nom. | 120W    | for ambient temperatures < 60°C                     |
| Short-circuit current    | min. | 10A     | continuous current, short circuit impedance 200mOhm |
|                          | max. | 13A     | continuous current, short circuit impedance 200mOhm |

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



#### Peak current capability (up to several milliseconds)

The power supply can deliver a peak current which is higher than the specified short term current. This helps to start current demanding loads or to safely operate subsequent circuit breakers.

The extra current is supplied by the output capacitors inside the power supply. During this event, the capacitors will be discharged and causes a voltage dip on the output. Detailed curves can be found in chapter 23.1.

|                           |      |                   |                                 |
|---------------------------|------|-------------------|---------------------------------|
| Peak current voltage dips | typ. | from 24V to 18.5V | at 10A for 50ms, resistive load |
|                           | typ. | from 24V to 13V   | at 25A for 2ms, resistive load  |
|                           | typ. | from 24V to 7V    | at 25A for 5ms, resistive load  |

## 7. HOLD-UP TIME

|              |      | <b>AC 400V</b> | <b>AC 480V</b> |                            |
|--------------|------|----------------|----------------|----------------------------|
| Hold-up Time | typ. | 27ms           | 48ms           | at 24V, 5A, see Fig. 7-1   |
|              | typ. | 51ms           | 91ms           | at 24V, 2.5A, see Fig. 7-1 |

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

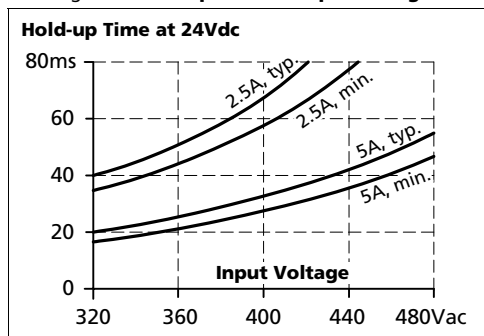
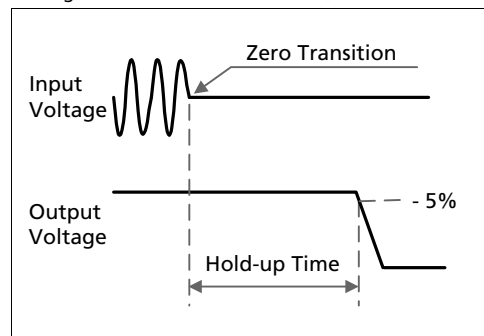


Fig. 7-2 **Shut-down behavior, definitions**



## 8. EFFICIENCY AND POWER LOSSES

|                       |      | <b>AC 400V</b> | <b>AC 480V</b> |   |
|-----------------------|------|----------------|----------------|---|
| Efficiency            | typ. | 90.4%          | 90.0%          | at 24V, 5A  |
| Average efficiency *) | typ. | 88.8%          | 87.9%          | 25% at 1.25A, 25% at 2.5A, 25% at 3.75A.<br>25% at 5A |
| Power losses          | typ. | 1.5W           | 1.6W           | at 0A   |
|                       | typ. | 12.7W          | 13.3W          | at 24V, 5A  |
|                       | typ. | 15.3W          | 15.8W          | at 24V, 6A  |

\*) 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.**

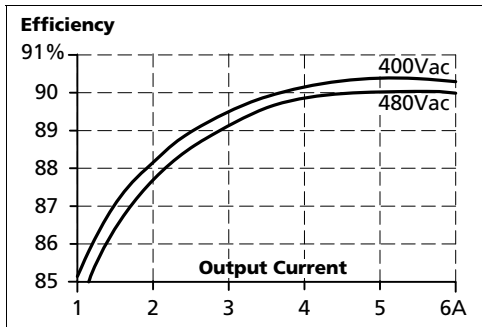


Fig. 8-2 **Losses vs. output current at 24V, typ.**

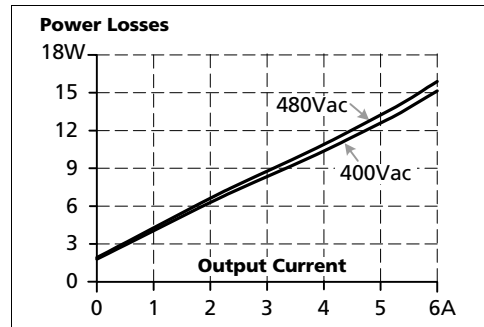


Fig. 8-3 **Efficiency vs. input voltage at 24V, 5A, typ.**

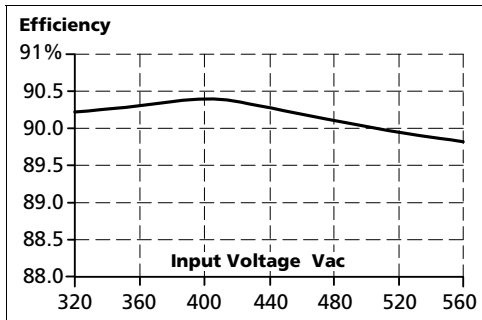
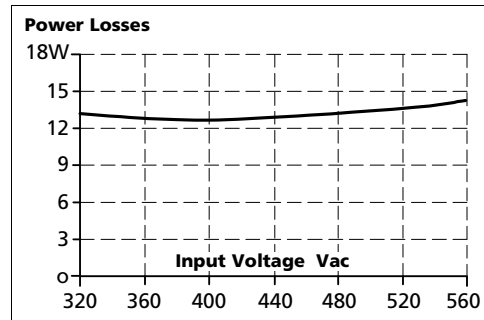
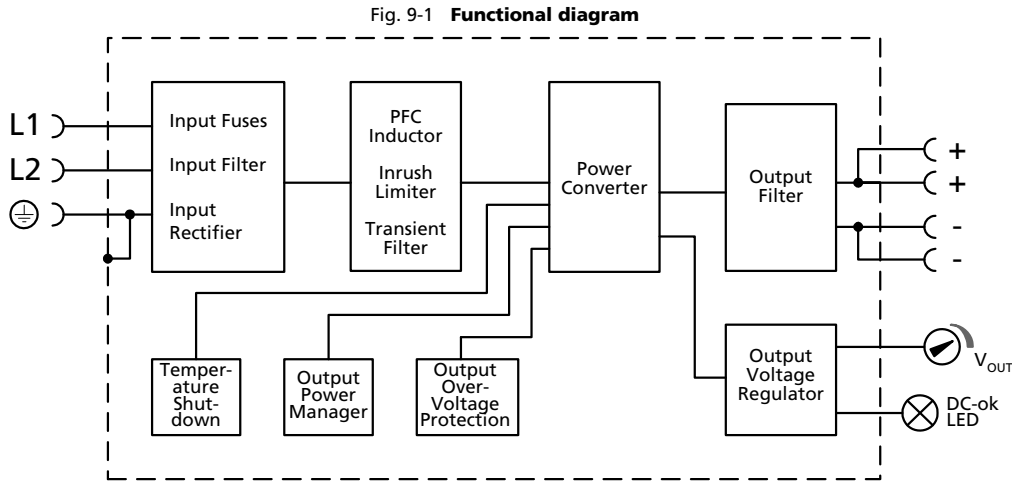


Fig. 8-4 **Losses vs. input voltage at 24V, 5A, typ.**



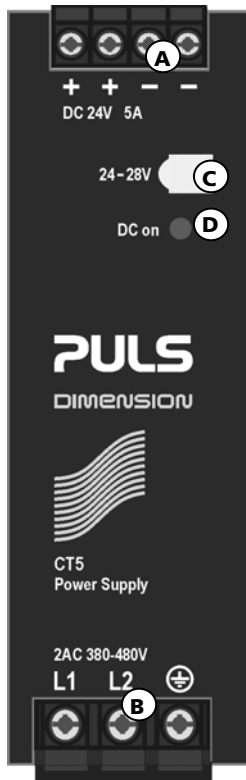


### 9. FUNCTIONAL DIAGRAM



### 10. FRONT SIDE AND USER ELEMENTS

Fig. 10-1 **Front side**



- A** Output Terminals  
Screw terminals, dual terminals per pole  
+ Positive output  
- Negative (return) output
- B** Input Terminals  
Screw terminals  
L1, L2 Phase input  
⊕ PE (Protective Earth) input
- C** Output voltage potentiometer  
Open the flap to set the output voltage. Factory set: 24.1V
- D** DC-OK LED (green)  
On when the voltage on the output terminals is > 21V

### 11. TERMINALS AND WIRING

|                               | <b>Input</b>                       | <b>Output</b>                      |
|-------------------------------|------------------------------------|------------------------------------|
| <b>Type</b>                   | screw terminals                    | screw terminals                    |
| Solid wire                    | 0.5-6mm <sup>2</sup>               | 0.5-6mm <sup>2</sup>               |
| Stranded wire                 | 0.5-4mm <sup>2</sup>               | 0.5-4mm <sup>2</sup>               |
| American Wire Gauge           | 20-10 AWG                          | 20-10 AWG                          |
| Wire stripping length         | 7mm / 0.275inch                    | 7mm / 0.275inch                    |
| Screwdriver                   | 3.5mm slotted or<br>Pozidrive No 2 | 3.5mm slotted or<br>Pozidrive No 2 |
| Recommended tightening torque | 0.8Nm, 7lb.in                      | 0.8Nm, 7lb.in                      |

**Instructions:**

- a) Use appropriate copper cables that are designed for an operating temperature of: 60°C for ambient up to 45°C and 75°C for ambient up to 60°C minimum.
- b) Follow national installation codes and installation regulations!
- c) Ensure that all strands of a stranded wire enter the terminal connection!
- d) Up to two stranded wires with the same cross section are permitted in one connection point (except PE wire).
- e) Do not use the unit without PE connection.
- f) Screws of unused terminal compartments should be securely tightened.
- g) Ferrules are allowed, but not required

### 12. RELIABILITY

|                              | <b>AC 400V</b> | <b>AC 480V</b> |   |
|------------------------------|----------------|----------------|---|
| Lifetime expectancy *)       | 92 000h        | 92 000h        | at 24V, 5A and 40°C                     |
|                              | 186 000h       | 175 000h       | at 24V, 2.5A and 40°C                   |
|                              | 260 000h       | 260 000h       | at 24V, 5A and 25°C                     |
| MTBF **) SN 29500, IEC 61709 | 1 173 000h     | 1 155 000h     | at 24V, 5A and 40°C                     |
|                              | 2 105 000h     | 2 075 000h     | at 24V, 5A and 25°C                     |
| MTBF **) MIL HDBK 217F       | 454 000h       | 446 000h       | at 24V, 5A and 40°C; Ground Benign GB40 |
|                              | 607 000h       | 593 000h       | at 24V, 5A 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 prediction model allows only a calculation of up to 15 years from date of shipment.

\*\*) **MTBF** stands for **Mean Time Between Failure**, 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.

## 13. EMC

The power supply is suitable for applications in industrial environment as well as in residential, commercial and light industry environment without any restrictions. The CE mark indicates conformance with EMC guideline 89/336/EC, 93/68/EC and 2004/108/EC and the low-voltage directive (LVD) 73/23/EC and 2006/95/EC. A detailed EMC report is available on request.

| <b>EMC Immunity</b>      | Generic standards: EN 61000-6-1 and EN 61000-6-2 |                                |              |             |
|--------------------------|--|--------------------------------|--------------|-------------|
| Electrostatic discharge  | EN 61000-4-2                                     | Contact discharge              | 8kV          | Criterion A |
|                          |  | Air discharge                  | 15kV         | 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                    | 4kV          | Criterion A |
|                          |  | Output lines                   | 2kV          | Criterion A |
| Surge voltage on input   | EN 61000-4-5                                     | L1 → L2                        | 2kV          | Criterion A |
| Surge voltage on input   | EN 61000-4-5                                     | L1 → PE, L2 → PE               | 4kV          | Criterion A |
| Surge voltage on output  | EN 61000-4-5                                     | + → -                          | 500V         | Criterion A |
|                          |  | + / - → PE                     | 500V         | Criterion A |
| Conducted disturbance    | EN 61000-4-6                                     | 0.15-80MHz                     | 10V          | Criterion A |
| Mains voltage dips       | EN 61000-4-11                                    | 0% of 380Vac                   | 0Vac, 20ms   | Criterion A |
|                          |  | 0% of 480Vac                   | 0Vac, 20ms   | Criterion A |
| Mains voltage dips       | EN 61000-4-11                                    | 40% of 380Vac                  | 200ms        | Criterion C |
|                          |  | 40% of 480Vac                  | 200ms        | Criterion C |
|                          |  | 70% of 380Vac                  | 500ms        | Criterion A |
|                          |  | 70% of 480Vac                  | 500ms        | Criterion A |
| Voltage interruptions    | EN 61000-4-11                                    |                                | 0Vac, 5000ms | Criterion C |
| Voltage sags             | SEMI F47 0706                                    | 80% of 380Vac, load: 24V, 2.5A | 1000ms       | Criterion A |
|                          |  | 70% of 380Vac, load: 24V, 2.5A | 500ms        | Criterion A |
|                          |  | 50% of 380Vac, load: 24V, 2.5A | 200ms        | Criterion A |
| Voltage sags             | SEMI F47 0706                                    | 80% of 480Vac, load: 24V, 5A   | 1000ms       | Criterion A |
|                          |  | 70% of 480Vac, load: 24V, 5A   | 500ms        | Criterion A |
|                          |  | 50% of 480Vac, load: 24V, 5A   | 200ms        | Criterion A |
| Powerful transients      | VDE 0160   | over entire load range         | 1550V, 1.3ms | Criterion A |

**Criteria:**

- A:** Power supply shows normal operation behavior within the defined limits.
- 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.

| <b>EMC Emission</b>           | Generic standards: EN 61000-6-3 and EN 61000-6-4    |                      |
|-------------------------------|---|----------------------|
| Conducted emission            | EN 55011, EN 55022, FCC Part 15, CISPR 11, CISPR 22 | Class B, input lines |
| Radiated emission             | EN 55011, EN 55022                                  | Class B              |
| Harmonic input current        | EN 61000-3-2  | fulfilled            |
| Voltage fluctuations, flicker | EN 61000-3-3  | fulfilled            |

This device complies with FCC Part 15 rules.

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

**Switching frequency** Variable between 45kHz and 170kHz depending on load and input voltage

## 14. ENVIRONMENT

|                            |   |   |
|----------------------------|---|---|
| Operational temperature *) | -25°C to +70°C (-13°F to 158°F)                             | reduce output power according Fig. 14-1                                     |
| Storage temperature        | -40 to +85°C (-40°F to 185°F)                               | for storage and transportation  |
| Output de-rating           | 1.6W/°C<br>3W/°C  | 45-60°C (113°F to 140°F)<br>60-70°C (140°F to 158°F)                        |
| 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 6000m (0 to 20 000ft)                                  | reduce output power or ambient temperature<br>above 2000m sea level.        |
| Altitude de-rating         | 7.5W/1000m or 5°C/1000m                                     | above 2000m (6500ft), see Fig. 14-2   |
| Over-voltage category      | III<br>II   | IEC 62103, EN 50178, altitudes up to 2000m<br>altitudes from 2000m to 6000m |
| Degree of pollution        | 2   | IEC 62103, EN 50178, not conductive   |

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

\*\*\*) Do not energize while condensation is present

Fig. 14-1 **Output current vs. ambient temp.**

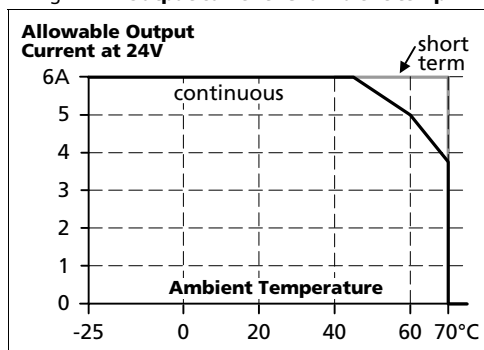
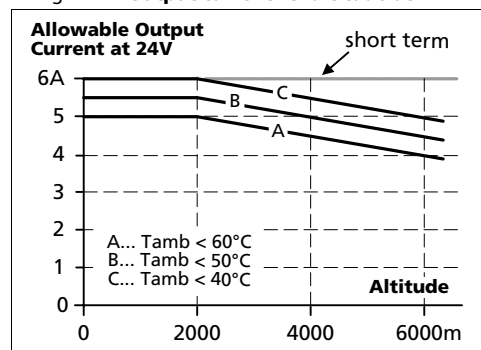


Fig. 14-2 **Output current vs. altitude at 24V**



### 15. PROTECTION FEATURES

|                                |  |   |
|--------------------------------|--|---|
| Output protection              | Electronically protected against overload, no-load and short-circuits *) |   |
| Output over-voltage protection | typ. 30.5Vdc<br>max. 32Vdc   | 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           | IP 20  | EN/IEC 60529  |
| Penetration protection         | > 3.5mm  | e.g. screws, small parts  |
| Over-temperature protection    | yes  | output shut-down with automatic restart   |
| Input transient protection     | MOV (Metal Oxide Varistor) and active transient filter                   |   |
| Internal input fuse            | 2x T3.15A H.B.C.   | not user replaceable  |

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

### 16. SAFETY FEATURES

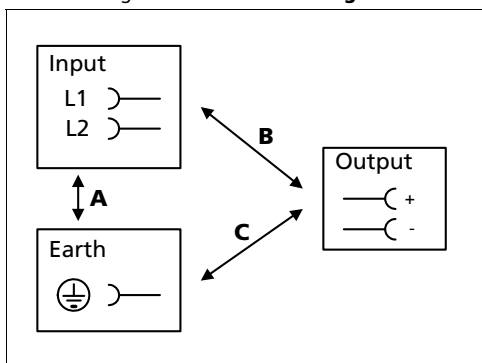
|                                 |  |  |
|---------------------------------|--|--|
| Input / output separation *)    | SELV<br>PELV                                       | IEC/EN 60950-1<br>IEC/EN 60204-1, EN 50178, IEC 62103, IEC 60364-4-41                                |
| Class of protection             | I  | PE (Protective Earth) connection required  |
| Isolation resistance            | > 5MΩ  | input to output, 500Vdc  |
| PE resistance                   | < 0.1Ω   |  |
| Touch current (leakage current) | typ. 0.14mA<br>typ. 0.19mA<br>< 0.18mA<br>< 0.25mA | 400Vac, 50Hz, TN mains<br>480Vac, 60Hz, TN mains<br>440Vac, 50Hz, TN mains<br>528Vac, 60Hz, TN mains |

\*) Double or reinforced insulation

### 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 phase-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



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

To fulfill 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 can not be switched off when unnoticed earth faults occur.

## 18. APPROVALS

|                    |   |   |
|--------------------|---|---|
| IEC 60950-1        |  | CB Scheme,<br>Information Technology Equipment  |
| UL 508             |  | Listed for use as Industrial Control Equipment;<br>U.S.A. (UL 508) and Canada (C22.2 No. 107-1-01);<br>E-File: E198865<br>Mains supply circuit: 3-wire + PE, star |
| UL 60950-1         |  | Recognized for use as Information Technology Equipment;<br>U.S.A. (UL 60950-1) and Canada (C22.2 No. 60950);<br>E-File: E137006, Level 3                          |
| Marine,<br>pending |  | GL (Germanischer Lloyd) classified and<br>ABS (American Bureau for Shipping) PDA<br>Environmental category: C, EMC2<br>Marine and offshore applications           |
| SEMI F47           |  | SEMI F47-0706<br>Ride-through compliance for the semiconductor industry.<br>maximal 24V, 2.5A for 380V and 400V mains and 24V, 5A for 480V mains                  |

## 19. FULFILLED STANDARDS

|                     |   |
|---------------------|---|
| EN 61558-2-17       | Safety of Power Transformers                |
| EN/IEC 60204-1      | Safety of Electrical Equipment of Machines  |
| EN/IEC 61131-2      | Programmable Controllers                    |
| EN 50178, IEC 62103 | Electronic Equipment in Power Installations |

## 20. USED SUBSTANCES

The unit does not release any silicone and is suitable for the use in paint shops.

The unit conforms to the RoHS directive 2002/96/EC

Electrolytic capacitors included in this unit do not use electrolytes such as Quaternary Ammonium Salt Systems.

Plastic housings and other molded plastic materials are free of halogens, wires and cables are not PVC insulated.

The production material within our production does not include following toxic chemicals:

Polychlorized Biphenyl (PCB), Polychlorized Terphenyl (PCT), Pentachlorophenol (PCP), Polychlorinated naphthalene (PCN), Polybrom Biphenyl (PBB), Polybrom Biphenyl-oxyd (PBO), Polybrominated Diphenylether (PBDE), Polychlorinated Diphenylether (PCDE), Polydibromphenyl Oxyd (PBDO), Cadmium, Asbestos, Mercury, Silica

### 21. PHYSICAL DIMENSIONS AND WEIGHT

|                         |  |
|-------------------------|--|
| Weight                  | 500g / 1.1lb   |
| DIN-Rail                | Use 35mm DIN-rails according to EN 60715 or EN 50022 with a height of 7.5 or 15mm. The DIN-rail height must be added to the unit depth (117mm) to calculate the total required installation depth. |
| Installation Clearances | See chapter 2  |

Fig. 21-1 **Front view**

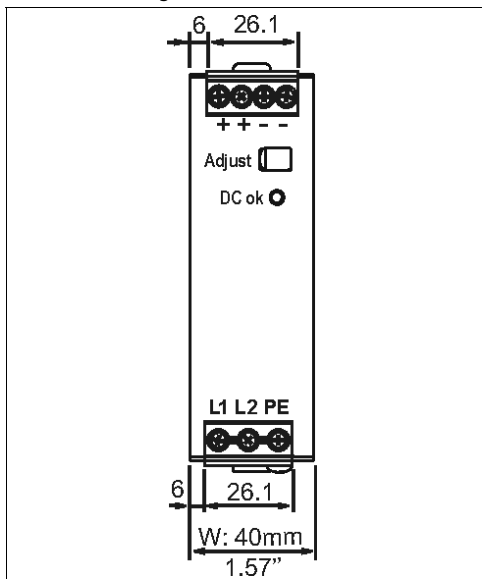
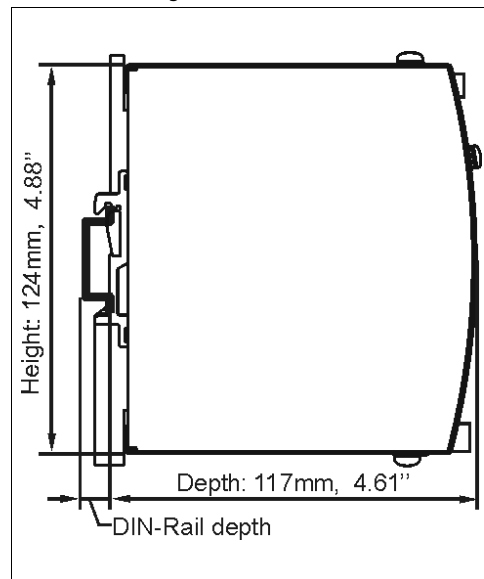


Fig. 21-2 **Side view**

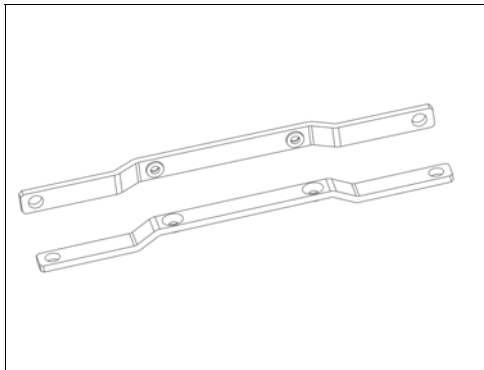


## 22. ACCESSORIES

### ZM1.WALL Wall mounting bracket

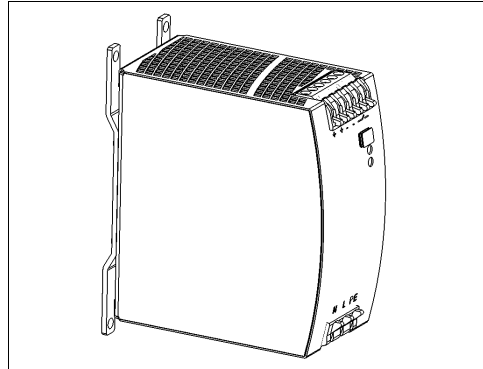
This bracket is used to mount specific Dimension units onto a flat surface without utilizing a DIN-Rail. The two aluminum brackets and the black plastic slider of the unit have to be removed, so that the two steel brackets can be mounted.

Fig. 22-1 ZM1.WALL Wall mounting bracket



\*) Picture of the power supply is for representation only

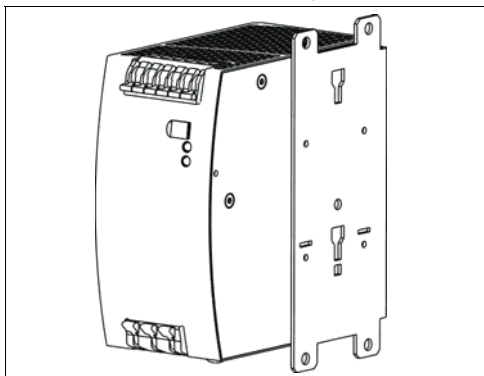
Fig. 22-2 Assembled wall mounting bracket \*)



### ZM12.SIDE Side mounting bracket

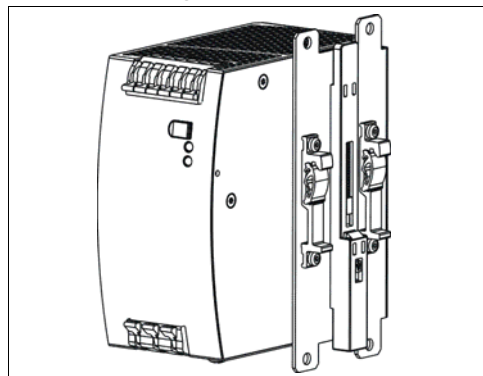
This bracket is used to mount Dimension units sideways with or without utilizing a DIN-Rail. The two aluminum brackets and the black plastic slider of the unit have to be detached, so that the steel brackets can be mounted. For sideways DIN-rail mounting, the removed aluminum brackets and the black plastic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

Fig. 22-3 ZM12.SIDE Side mounting bracket \*)



\*) Picture of the power supply is for representation only

Fig. 22-4 Side mounting with DIN-rail brackets \*)





## 23. APPLICATION NOTES

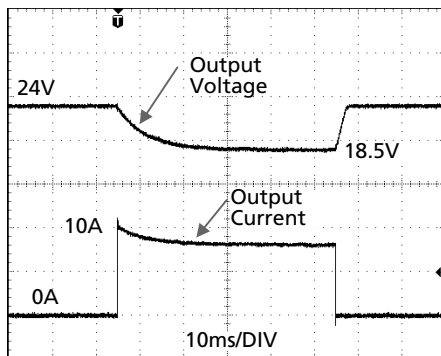
### 23.1. PEAK CURRENT CAPABILITY

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.

Branch circuits are often protected with circuit breakers or fuses. In case of a short or an overload in the branch circuit, the fuse needs a certain amount of over-current to trip or to blow. The peak current capability ensures the safe operation of subsequent circuit breakers.

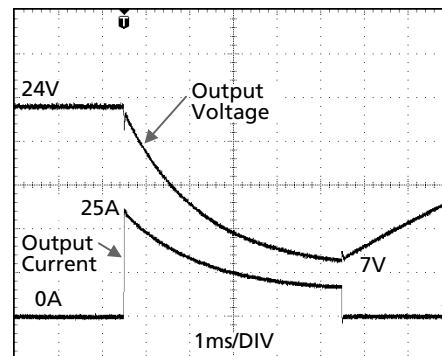
Assuming the input voltage is turned on before such an event, the built-in large sized output capacitors inside the power supply can deliver extra current. Discharging this capacitor causes a voltage dip on the output. The following two examples show typical voltage dips:

Fig. 23-1 Peak load 10A for 50ms, typ.



Peak load 10A (resistive load) for 50ms  
Output voltage dips from 24V to 18.5V.

Fig. 23-2 Peak load 25A for 5ms, typ.



Peak load 25A (resistive load) for 5ms  
Output voltage dips from 24V to 7V.

### 23.2. 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 capacitance which is specified in chapter 6.

### 23.3. CHARGING OF BATTERIES

The power supply can be used to charge lead-acid or maintenance free batteries. (Two 12V batteries in series)

**Instructions for charging batteries:**

- a) Ensure that the ambient temperature of the power supply is below 45°C
- b) Set output voltage (measured at no load and at the battery end of the cable) very precisely to the end-of-charge voltage.

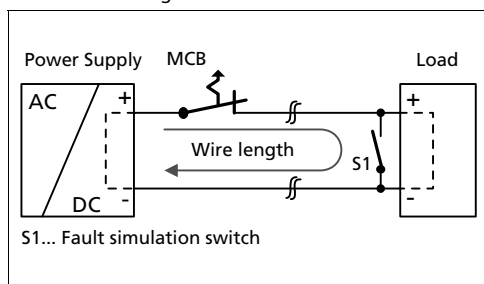
|                       |       |       |        |       |
|-----------------------|-------|-------|--------|-------|
| End-of-charge voltage | 27.8V | 27.5V | 27.15V | 26.8V |
| Battery temperature   | 10°C  | 20°C  | 30°C   | 40°C  |

- c) Use a 10A circuit breaker (or blocking diode) between the power supply and the battery.
- d) Ensure that the output current of the power supply is below the allowed charging current of the battery.
- e) Use only matched batteries when putting 12V types in series.
- f) The return current to the power supply (battery discharge current) is typ. 5.5mA when the power supply is switched off (except in case a blocking diode is utilized).

### 23.4. OUTPUT CIRCUIT BREAKERS

Standard miniature circuit breakers (MCB's or UL1077 circuit breakers) are without doubt, one of the most efficient and economical ways to open circuits on faulty branches. Most of these breakers may also be used on 24V branches. MCB's are designed to protect wires and circuits. If the ampere value and the characteristics of the MCB are adapted to the wire size that is used, the wiring is considered as thermally safe regardless of whether the MCB opens or not. To avoid voltage dips and under-voltage situations in adjacent 24V branches which are supplied by the same source, a fast (magnetic) tripping of the MCB is desired. A quick shutdown within 10ms is necessary corresponding roughly to the ride-through time of PLC's. This requires power supplies with high current reserves and large output capacitors. Furthermore, the impedance of the faulty branch must be sufficiently small in order for the current to actually flow. The best current reserve in the power supply does not help if Ohm's law does not permit current flow. The following table has typical test results showing which B- and C-Characteristic MCBs magnetically trip depending on the wire cross section and wire length.

Fig. 23-3 Test circuit



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

|       | 0.75mm <sup>2</sup> | 1.0mm <sup>2</sup> | 1.5mm <sup>2</sup> | 2.5mm <sup>2</sup> |
|-------|---------------------|--------------------|--------------------|--------------------|
| C-2A  | 17m                 | 19m                | 29m                | 39m                |
| C-3A  | 11m                 | 14m                | 22m                | 33m                |
| C-4A  | 3m                  | 4m                 | 6m                 | 14m                |
| C-6A  | 1m                  | 1m                 | 2m                 | 3m                 |
| C-8A  | -                   | -                  | -                  | -                  |
| B-6A  | 6m                  | 9m                 | 13m                | 17m                |
| B-10A | -                   | -                  | -                  | 1m                 |

\*) Don't forget to consider two times the distance to the load (or cable length) when calculating the total wire length (+ and - wire).

### 23.5. INDUCTIVE AND CAPACITIVE LOADS

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

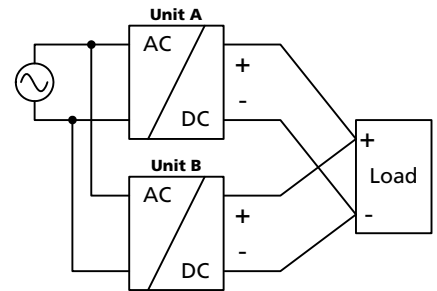
### 23.6. EXTERNAL INPUT PROTECTION

The unit is tested and approved for branch circuits up to 30A (U.S.A.) and 32A (IEC). 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 6A B- or 3A C-Characteristic breaker should be used

### 23.7. PARALLEL USE TO INCREASE OUTPUT POWER

CT5.241 power supplies can be paralleled to increase the output power. This power supply has 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 45°C. The CT5.241 can also be paralleled with power supplies from the DIMENSION CT, QS or QT-series. The output voltages of all power supplies shall be adjusted to the same value ( $\pm 100\text{mV}$ ). A fuse or diode on the output of each unit is only required if more than three units are connected in parallel. If a fuse (or circuit breaker) is used, choose one with approximately 150% of the rated output current of one power supply. 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 the bottom and output terminals on top of the unit) or in any other condition where a derating of the output current is required (e.g. altitude, above 60°C, ...). Pay attention that leakage current, EMI, inrush current, harmonics will increase when using multiple power supplies.



### 23.8. 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. Redundant systems for a higher power demand are usually built in a N+1 method. E.g. five power supplies, each rated for 5A are paralleled to build a 20A redundant system. For N+1 redundancy the same restrictions apply as for increasing the output power, see also section 23.7.

**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 defect unit becomes a load for the other power supplies and the output voltage can not be maintained any more. This can only be avoided by utilizing decoupling diodes which are included in the decoupling module YRM2.DIODE.

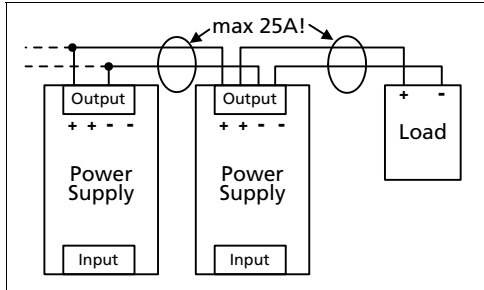
Recommendations for building redundant power systems:

- Use separate input fuses for each power supply.
- Monitor the individual power supply units. A DC-ok lamp and a DC-ok contact is included in the redundancy module YRM2.DIODE. This feature reports a faulty unit.
- 1+1 Redundancy is allowed up to an ambient temperature of 60°C  
N+1 Redundancy is allowed up to an ambient temperature of 45°C
- It is desirable to set the output voltages of all units to the same value ( $\pm 100\text{mV}$ ) or leave it at the factory setting.

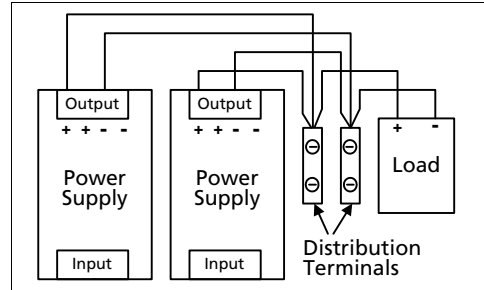
### 23.9. DAISY CHAINING OF OUTPUTS

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. If the current is higher, use a separate distribution terminal block.

**Fig. 23-4 Daisy chaining of outputs**

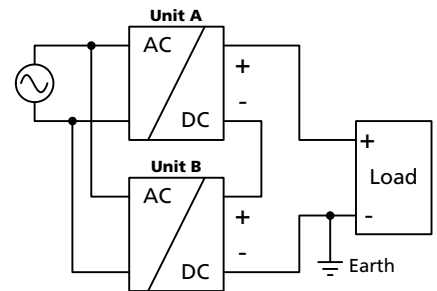


**Fig. 23-5 Using distribution terminals**



### 23.10. 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 not SELV any more and can be dangerous. Such voltages must be installed with a protection against touching. Earthing of the output is required when the sum of the output voltage is above 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. Pay attention that leakage current, EMI, inrush current, harmonics will increase when using multiple power supplies.



### 23.11. 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 9516 100, plastic, 110x180x165mm                             |
| Load:                          | 24V, 4A; (=80%) load is placed outside the box                                      |
| Input:                         | 2x 400Vac   |
| Temperature inside enclosure:  | 46.0°C (in the middle of the right side of the power supply with a distance of 2cm) |
| Temperature outside enclosure: | 25.6°C  |
| Temperature rise:              | 20.4K   |

## 23.12. MOUNTING ORIENTATIONS

Mounting orientations other than input terminals on the bottom and output on the top require a reduction in continuous output power or a limitation in the max. 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. 23-6  
**Mounting Orientation A**  
(Standard orientation)

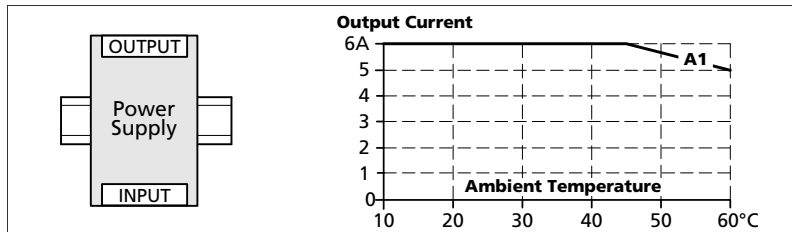


Fig. 23-7  
**Mounting Orientation B**  
(Upside down)

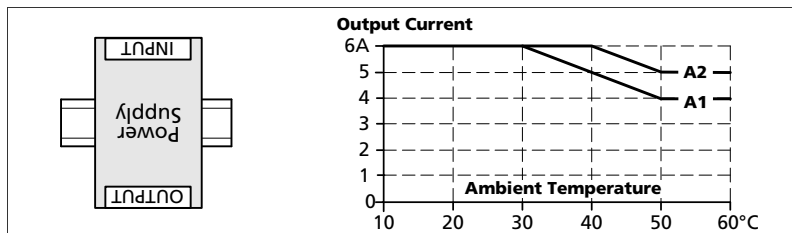


Fig. 23-8  
**Mounting Orientation C**  
(Table-top mounting)

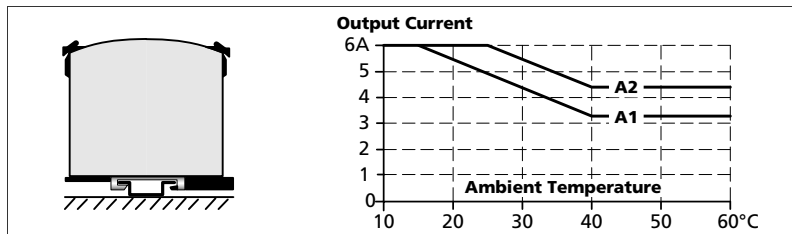


Fig. 23-9  
**Mounting Orientation D**  
(Horizontal cw)

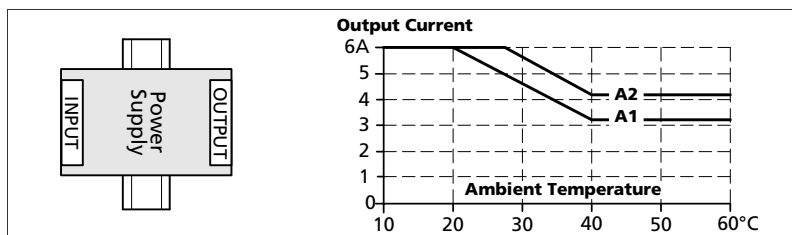


Fig. 23-10  
**Mounting Orientation E**  
(Horizontal ccw)

