



### 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 85.8%
- Input -Transient Blanking Circuit Included
- Minimal Inrush Current Surge
- Full Power Between -25°C and +60°C
- 3 Year Warranty

### PRODUCT 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 CT5.121 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 CT5.121 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 12V                                  | Nominal                                 |
| Adjustment range  | 12 - 15V                                | Factory setting 12.0V                   |
| Output current    | 8.0 – 6.4A<br>6.0 – 4.8A                | Below +60°C ambient<br>At +70°C ambient |
|                   | Derate linearly between +60°C and +70°C |   |
| Input voltage AC  | AC 380-480V                             | -15%/+20%                               |
| Mains frequency   | 50-60Hz                                 | ±6%                                     |
| Input current AC  | 0.64 / 0.56A                            | At 400 / 480Vac                         |
| Power factor      | 0.44 / 0.42                             | At 400 / 480Vac                         |
| AC Inrush current | 4 / 4Apk                                | At 400 / 480Vac                         |
| Efficiency        | 85.4 / 85.8%                            | At 400 / 480Vac                         |
| Losses            | 16.4 / 15.9W                            | At 400 / 480Vac                         |
| Hold-up time      | 43 / 63ms                               | At 400 / 480Vac                         |
| Temperature range | -25°C to +70°C                          |   |
| Size (WxHxD)      | 40x124x117mm                            | Without DIN-rail                        |
| Weight            | 500g / 1.1lb                            |   |

### ORDER NUMBERS

Power Supply **CT5.121**

Mechanical Accessory

ZM1.WALL Wall/panel mount bracket  
ZM12.SIDE Side mount bracket

### MAIN APPROVALS

For details or a complete approval list see section 18.



## INDEX

|  | Page |   | Page |
|--|------|---|------|
| 1. Intended Use .....                    | 3    | 17. Dielectric Strength.....                    | 16   |
| 2. Installation Instructions .....       | 3    | 18. Approvals.....                              | 17   |
| 3. AC-Input.....                         | 5    | 19. Other Fulfilled Standards.....              | 17   |
| 4. DC-Input.....                         | 6    | 20. Physical Dimensions and Weight .....        | 18   |
| 5. Input Inrush Current .....            | 6    | 21. Accessories .....                           | 19   |
| 6. Output .....                          | 7    | 21.1. ZM1.WALL – Wall/Panel Mount Bracket .     | 19   |
| 7. Hold-up Time.....                     | 8    | 21.2. ZM12.SIDE - Side Mount Bracket .....      | 20   |
| 8. Efficiency and Power Losses.....      | 9    | 22. Application Notes.....                      | 21   |
| 9. Functional Diagram.....               | 10   | 22.1. Peak Current Capability .....             | 21   |
| 10. Front Side and User Elements.....    | 10   | 22.2. Charging of Batteries .....               | 22   |
| 11. Connection Terminals .....           | 11   | 22.3. Series Operation .....                    | 23   |
| 12. Lifetime Expectancy .....            | 12   | 22.4. Parallel Use to Increase Output Power.... | 23   |
| 13. MTBF .....                           | 12   | 22.5. Use in a Tightly Sealed Enclosure .....   | 23   |
| 14. EMC.....                             | 13   | 22.6. Mounting Orientations .....               | 24   |
| 15. Environment .....                    | 14   |   |      |
| 16. Safety and Protection Features ..... | 15   |   |      |

The information given in this document is correct to the best of our knowledge and experience at the time of publication. If not expressly agreed otherwise, this information does not represent a warranty in the legal sense of the word. As the state of our knowledge and experience is constantly changing, the information in this data sheet is subject to revision. We therefore kindly ask you to always use the latest issue of this document (available under [www.pulspower.com](http://www.pulspower.com)).

No part of this document may be reproduced or utilized in any form without our prior permission in writing.

## TERMINOLOGY AND ABBREVIATIONS

|  |   |
|--|---|
| <b>PE and <math>\oplus</math> symbol</b> | PE is the abbreviation for <b>Protective Earth</b> and has the same meaning as the symbol $\oplus$ .  |
| <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.   |
| <b>may</b>                               | A key word indicating flexibility of choice with no implied preference.   |
| <b>shall</b>                             | A key word indicating a mandatory requirement.  |
| <b>should</b>                            | A key word indicating flexibility of choice with a strongly preferred implementation.   |

## 1. INTENDED USE

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

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

## 2. INSTALLATION INSTRUCTIONS

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

- Do not use the power supply without proper grounding (Protective Earth). Use the terminal on the input block for earth connection and not one of the screws on the housing.
- Turn power off before working on the device. Protect against inadvertent re-powering.
- Do not modify or repair the unit.
- Do not open the unit as high voltages are present inside.
- Use caution to prevent any foreign objects from entering 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 requirements:**

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

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

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.

Unused screw terminals should be securely tightened.

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

The enclosure of the device provides a degree of protection of IP20.

The isolation of the device is designed to withstand impulse voltages of overvoltage category III according to IEC 60664-1. For corner grounded delta systems, the overvoltage category level is reduced to level II.

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 voltage between the L terminals and the PE terminal must not exceed 500Vac continuously.

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 6000m (19685ft). See additional requirements in this document for use above 2000m (6560ft).

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.

The device is designed, tested and approved for branch circuits up to 32A (IEC) and 30A (UL) without additional protection device. If an external fuse is utilized, do not use circuit breakers smaller than 6A B- or 3A C-Characteristic to avoid a nuisance tripping of the circuit breaker.

The maximum surrounding air temperature is +70°C (+158°F). 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.

#### Installation Instructions for Hazardous Location Areas

The device is suitable for use in Class I Division 2 Groups A, B, C, D locations.

#### WARNING EXPLOSION HAZARDS!

Substitution of components may impair suitability for this environment.

Do not disconnect the device or operate the voltage adjustment unless power has been switched off or the area is known to be non-hazardous.

### 3. AC-INPUT

The device is suitable to be supplied from TN-, TT- and IT mains networks with AC voltage. Grounding of one phase is allowed except for UL508 applications.

|                                 |                                   |             |  |
|---------------------------------|-----------------------------------|-------------|--|
| AC input                        | Nom.                              | AC 380-480V |  |
| AC input range                  | Min.                              | 323-576Vac  | Continuous operation                               |
|                                 | Min.                              | 576-700Vac  | For maximal 1s (occasional)                        |
| Allowed voltage L or N to earth | Max.                              | 500Vac      | Continuous operation, according to IEC 62477-1     |
| Input frequency                 | Nom.                              | 50–60Hz     | ±6%  |
| Turn-on voltage                 | Typ.                              | 270Vac      | Load independent, steady-state value, see Fig. 3-1 |
| Shut-down voltage               | Typ.                              | 185Vac      | At no load   |
|                                 | Typ.                              | 215Vac      | At 12V, 4A   |
|                                 | Typ.                              | 225Vac      | At 12V, 8A   |
| External input protection       | See recommendations in chapter 2. |             |  |

|                   |      | AC 400V | AC 480V |  |
|-------------------|------|---------|---------|--|
| Input current     | Typ. | 0.64A   | 0.56A   | At 12V, 8A, see Fig. 3-3   |
| Power factor      | Typ. | 0.44    | 0.42    | At 12V, 8A, see Fig. 3-4   |
| Start-up delay    | Typ. | 75ms    | 75ms    | See Fig. 3-2   |
| Rise time         | Typ. | 50ms    | 50ms    | At 12V, 8A const. current load, 0mF load capacitance, see Fig. 3-2 |
|                   | Typ. | 85ms    | 85ms    | At 12V, 8A const. current load, 8mF load capacitance, see Fig. 3-2 |
| Turn-on overshoot | Max. | 100mV   | 100mV   | See Fig. 3-2   |

Fig. 3-1 Input voltage range

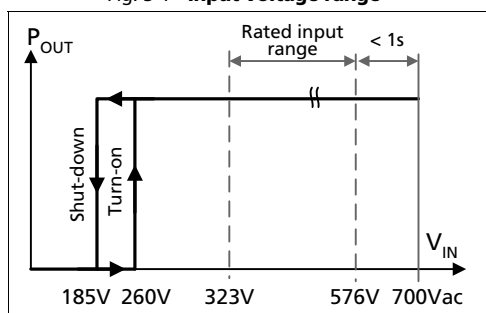


Fig. 3-2 Turn-on behavior, definitions

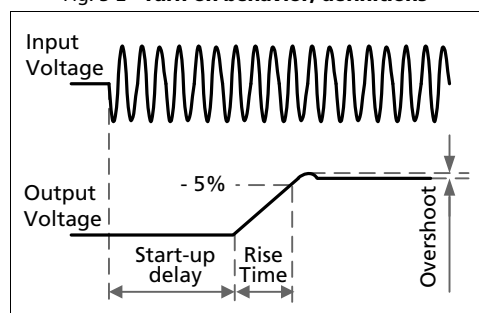


Fig. 3-3 Input current vs. output load at 12V

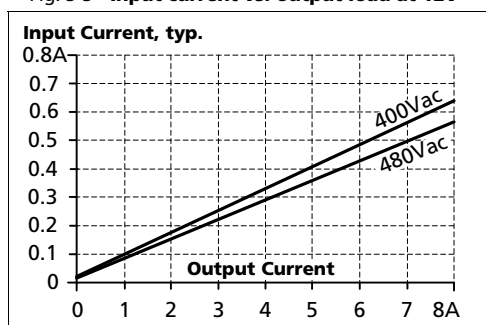
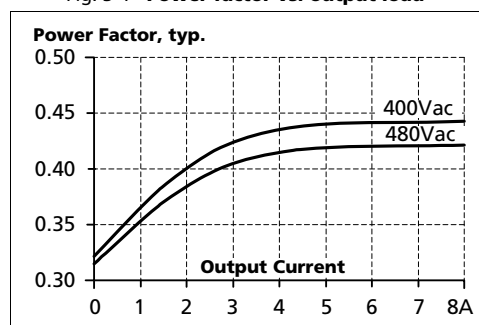


Fig. 3-4 Power factor vs. output load



## 4. DC-INPUT

Do not use the power supply with DC-input voltages.

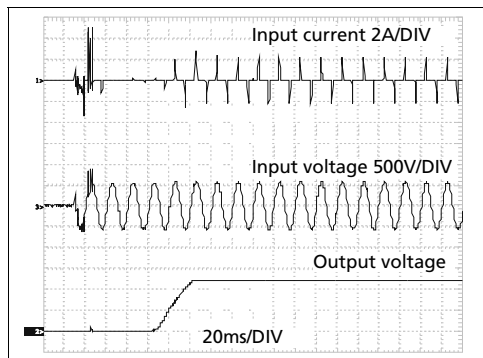
## 5. INPUT INRUSH CURRENT

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> | Temperature independent |
|                | Typ. | 4A <sub>peak</sub>  | 4A <sub>peak</sub>  | Temperature independent |
| Inrush energy  | Max. | 0.5A <sup>2</sup> s | 0.5A <sup>2</sup> s | Temperature independent |

**Fig. 5-1 Typical input inrush current behaviour at nominal load and 25°C ambient**



## 6. OUTPUT

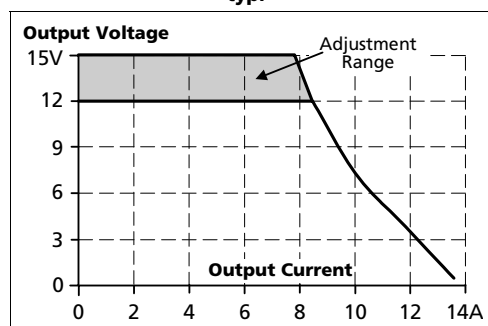
The output provides a SELV/PELV rated voltage, which is galvanically isolated from the input voltage.

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

The output is electronically protected against overload, no-load and short-circuits. In case of a protection event, audible noise may occur.

|                                 |      |  |   |
|---------------------------------|------|--|---|
| Output voltage                  | Nom. | 12V  |   |
| Adjustment range                | Min. | 12-15V   | Guaranteed value  |
|                                 | Max. | 16V  | This is the maximum output voltage which can occur at the clockwise end position of the potentiometer due to tolerances. It is not a guaranteed value which can be achieved.  |
| Factory setting output voltage  | Typ. | 12.0V  | ±0.2% at full load, cold unit   |
| Line regulation                 | Max. | 10mV   | Between 323 and 576Vac input voltage change   |
| Load regulation                 | Max. | 100mV  | Between 0 and 8A in "single use" mode, static value   |
| Ripple and noise voltage        | Max. | 100mVpp  | Bandwidth 20Hz to 20MHz, 50Ohm  |
| Output current                  | Nom. | 8.0A   | At 12V and 60°C ambient temperature   |
|                                 | Nom. | 6.0A   | At 12V and 70°C ambient temperature   |
|                                 | Nom. | 6.4A   | At 15V and 60°C ambient temperature   |
|                                 | Nom. | 4.8A   | At 15V and 70°C ambient temperature   |
|                                 |      | Reduce output current linearly between +60°C and +70°C |   |
| Overload behavior               |      | Continuous current                                     | See Fig. 6-1  |
| Overload/ short-circuit current | Max. | 15A  | Continuous current, see Fig. 6-1  |
| Output capacitance              | Typ. | 5 200µF  | Included inside the power supply  |
| Back-feeding loads              | Max. | 25V  | The unit is resistant and does not show malfunctioning when a load feeds back voltage to the power supply. It does not matter whether the power supply is on or off. The absorbing energy can be calculated according to the built-in large sized output capacitor. |

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



## 7. HOLD-UP TIME

|              |      | AC 400V | AC 480V |                          |
|--------------|------|---------|---------|--------------------------|
| Hold-up Time | Typ. | 43ms    | 63ms    | At 12V, 8A, see Fig. 7-1 |
|              | Typ. | 86ms    | 130ms   | At 12V, 4A, see Fig. 7-1 |
|              | Min  | 35ms    | 53ms    | At 12V, 8A, see Fig. 7-1 |
|              | Min. | 75ms    | 110ms   | At 12V, 4A, see Fig. 7-1 |

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

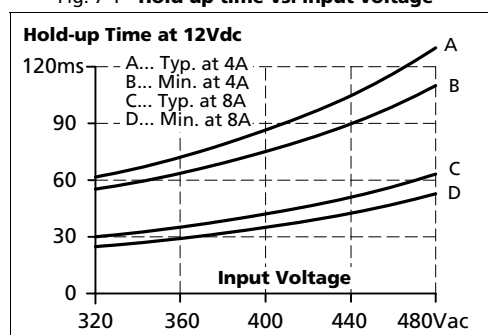
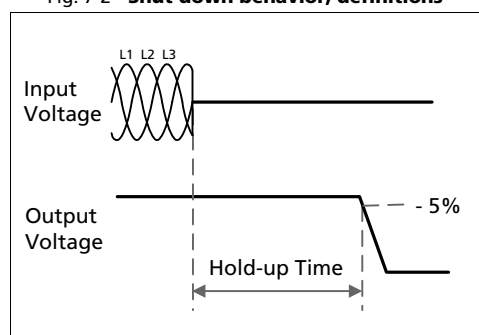


Fig. 7-2 Shut-down behavior, definitions





## 8. EFFICIENCY AND POWER LOSSES

|                       |      | <b>AC 400V</b> | <b>AC 480V</b> |  |
|-----------------------|------|----------------|----------------|--|
| Efficiency            | Typ. | 85.4%          | 85.8%          | At 12V, 8A                                 |
| Average efficiency *) | Typ. | 84.7%          | 84.1%          | 25% at 2A, 25% at 4A, 25% at 6A, 25% at 8A |
| Power losses          | Typ. | 1.5W           | 1.6W           | At 0A                                      |
|                       | Typ. | 8.4W           | 9.1W           | At 12V, 4A                                 |
|                       | Typ. | 16.4W          | 15.9W          | At 12V, 8A                                 |

\*) 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 12V, typ.**

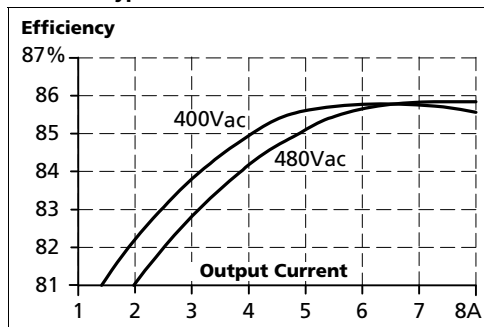


Fig. 8-2 **Losses vs. output current at 12V, typ.**

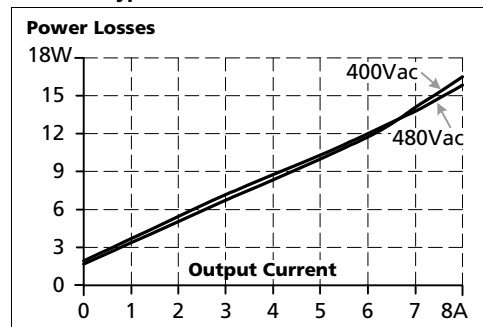


Fig. 8-3 **Efficiency vs. input voltage at 12V, 8A, typ.**

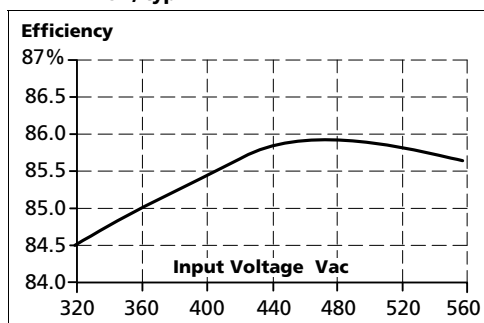
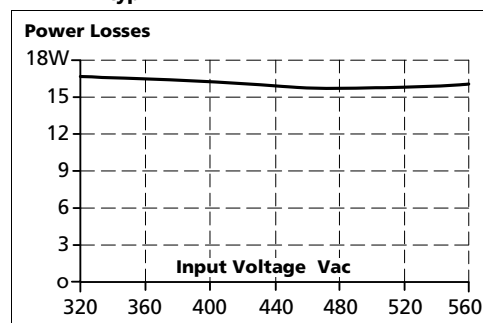
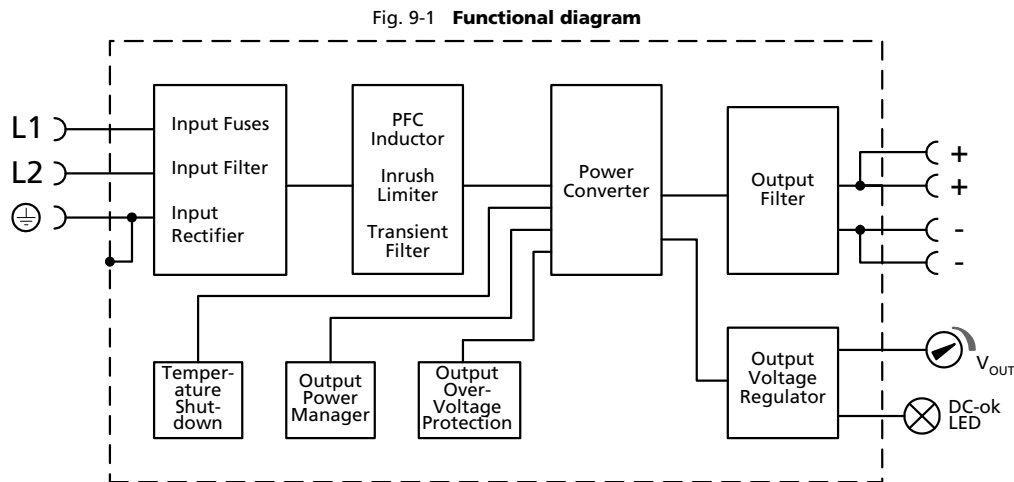


Fig. 8-4 **Losses vs. input voltage at 12V, 8A, typ.**



### 9. FUNCTIONAL DIAGRAM



### 10. FRONT SIDE AND USER ELEMENTS

Fig. 10-1 Front side



#### A Output Terminals

- + Positive output (two identical + poles)
- Negative/ return output (two identical - poles)

#### B Input Terminals

- L1, L2 Line input
- ⊕ PE (Protective Earth) input

#### C Output voltage potentiometer

Open the flap to adjust the output voltage. The factory setting is 12.0V

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

On, when the output voltage is above 10.5V.

## 11. CONNECTION TERMINALS

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

|   | Input                          | Output                         |
|---|--------------------------------|--------------------------------|
| Type                                    | Screw termination              | Screw termination              |
| Solid wire                              | Max. 6mm <sup>2</sup>          | Max. 6mm <sup>2</sup>          |
| Stranded wire                           | Max. 4mm <sup>2</sup>          | Max. 4mm <sup>2</sup>          |
| American Wire Gauge                     | AWG 20-10                      | AWG 20-10                      |
| Max. wire diameter (including ferrules) | 2.8mm                          | 2.8mm                          |
| Recommended tightening torque           | 1Nm, 9lb-in                    | 1Nm, 9lb-in                    |
| Wire stripping length                   | 7mm / 0.28inch                 | 7mm / 0.28inch                 |
| Screwdriver                             | 3.5mm slotted or Phillips No 1 | 3.5mm slotted or Phillips No 1 |

### Daisy chaining:

Daisy chaining (jumping from one power supply output to the next) is allowed as long as the average output current through one terminal pin does not exceed 25A. If the current is higher, use a separate distribution terminal block as shown in Fig. 11-2.

Fig. 11-1 Daisy chaining of outputs

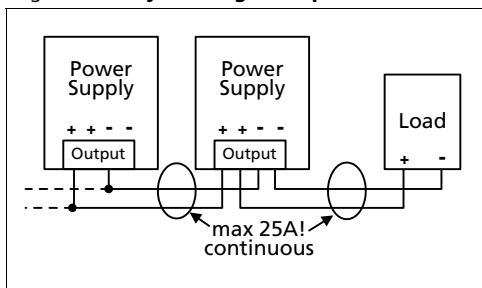
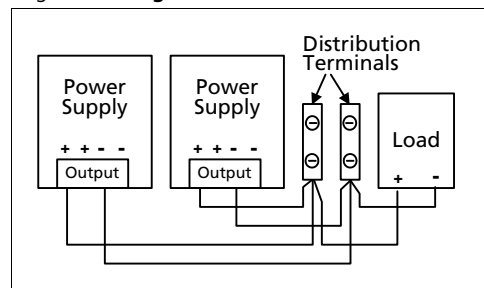


Fig. 11-2 Using distribution terminals



## 12. LIFETIME EXPECTANCY

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

|                     | <b>AC 400V</b> | <b>AC 480V</b> |                     |
|---------------------|----------------|----------------|---------------------|
| Lifetime expectancy | 51 000h        | 55 000h        | At 12V, 8A and 40°C |
|                     | 152 000h       | 147 000h       | At 12V, 4A and 40°C |
|                     | 144 000h       | 156 000h       | At 12V, 8A and 25°C |
|                     | 430 000h       | 416 000h       | At 12V, 4A and 25°C |

## 13. MTBF

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.

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

For these types of units the MTTF (**Mean Time To Failure**) value is the same value as the MTBF value.

|                          | <b>AC 400V</b> | <b>AC 480V</b> |   |
|--------------------------|----------------|----------------|---|
| MTBF SN 29500, IEC 61709 | 982 000h       | 976 000h       | At 12V, 8A and 40°C                     |
|                          | 1 799 000h     | 1 769 000h     | At 12V, 8A and 25°C                     |
| MTBF MIL HDBK 217F       | 484 000h       | 455 000h       | At 12V, 8A and 40°C, Ground Benign GB40 |
|                          | 634 000h       | 599 000h       | At 12V, 8A and 25°C, Ground Benign GB25 |
|                          | 105 000h       | 101 000h       | At 12V, 8A and 40°C, Ground Fixed GF40  |
|                          | 137 000h       | 132 000h       | At 12V, 8A and 25°C, Ground Fixed GF25  |

## 14. EMC

The EMC behavior of the device is designed for applications in industrial environment as well as in residential, commercial and light industry environments. The output is allowed to be grounded or floating.

The device is investigated according to the generic standards EN 61000-6-1, EN 61000-6-2, EN 61000-6-3 and EN 61000-6-4.

### EMC Immunity

|                          |               |                        |              |             |
|--------------------------|---------------|------------------------|--------------|-------------|
| 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 |
|                          |               | L1 → PE, L2 → PE       | 4kV          | Criterion A |
| Surge voltage on output  | EN 61000-4-5  | + → -                  | 500V         | Criterion A |
|                          |               | + / - → PE             | 1kV          | 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 |                        | 5s           | Criterion C |
| Powerful transients      | VDE 0160      | Over entire load range | 1550V, 1.3ms | Criterion A |

### Criteria:

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

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

### EMC Emission

|                                 |   |  |
|---------------------------------|---|--|
| Conducted emission input lines  | EN 55011, EN 55022, FCC Part 15, CISPR 11, CISPR 22 | Class B  |
| Conducted emission output lines | IEC/CISPR 16-1-2, IEC/CISPR 16-2-1                  | Limits for local DC power networks fulfilled               |
| Radiated emission               | EN 55011, EN 55022                                  | Class B  |
| Harmonic input current          | EN 61000-3-2  | Fulfilled for Class A equipment                            |
| Voltage fluctuations, flicker   | EN 61000-3-3  | Fulfilled, tested with constant current loads, non pulsing |

This device complies with FCC Part 15 rules.

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

### Switching Frequency

|                |                 |   |
|----------------|-----------------|---|
| Main converter | 45kHz to 170kHz | Output load and input voltage dependent |
|----------------|-----------------|---|

## 15. ENVIRONMENT

|                         |  |  |
|-------------------------|--|--|
| Operational temperature | -25°C to +70°C (-13°F to 158°F)  | The operational temperature is the ambient or surrounding temperature and is defined as the air temperature 2cm below the device.                          |
| Storage temperature     | -40°C to +85°C (-40°F to 185°F)  | For storage and transportation   |
| Output de-rating        | 2.5W/°C<br>6W/1000m or 5°C/1000m<br>3.6W/-5kPa or 3°C/-5kPa<br>The de-rating is not hardware controlled. The customer has to take care by himself to stay below the de-rated current limits in order not to overload the unit. | Between +60°C and +70°C (140°F to 158°F)<br>For altitudes >2000m (6560ft), see Fig. 15-2<br>For atmospheric pressures <80kPa, see Fig. 15-2                |
| Humidity                | 5 to 95% r.h.  | According to IEC 60068-2-30  |
| Atmospheric pressure    | 110-47kPa  | See Fig. 15-2 for details  |
| Altitude                | Up to 6000m (20 000ft)   | See Fig. 15-2 for details  |
| Over-voltage category   | III<br><br>II  | According to IEC 60664-1 for altitudes up to 2000m<br>According to IEC 60664-1 for altitudes from 2000 to 6000m and atmospheric pressures from 80 to 47kPa |
| Degree of pollution     | 2  | According to IEC 62477-1, not conductive   |
| Vibration sinusoidal    | 2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g<br>2 hours / axis   | According to IEC 60068-2-6   |
| Shock                   | 30g 6ms, 20g 11ms<br>3 bumps / direction, 18 bumps in total<br>Shock and vibration is tested in combination with DIN-Rails according to EN 60715 with a height of 15mm and a thickness of 1.3mm and standard orientation.      | According to IEC 60068-2-27  |
| LABS compatibility      | As a rule, only non-silicon precipitating materials are used. The unit conforms to the LABS criteria and is suitable for use in paint shops.   |  |
| Corrosive gases         | Tested according to ISA-71.04-1985, Severity Level G3 for a service life of minimum 10years in these environments.   |  |
| Audible noise           | Some audible noise may be emitted from the power supply during no load, overload or short circuit.   |  |

Fig. 15-1 Output current vs. ambient temp.

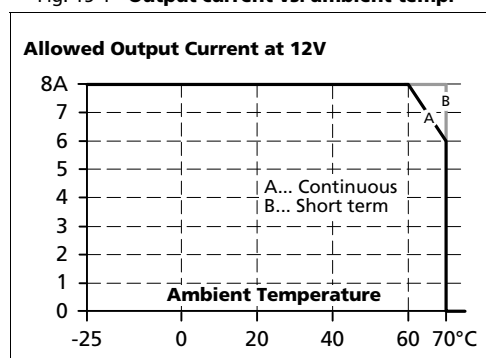
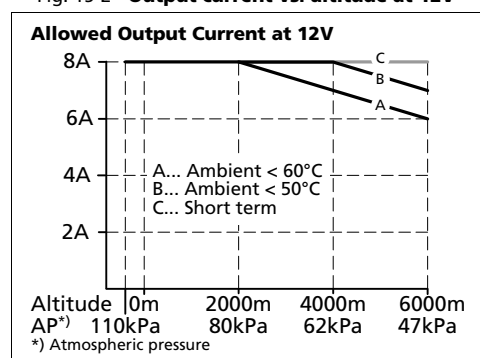


Fig. 15-2 Output current vs. altitude at 12V



## 16. SAFETY AND PROTECTION FEATURES

|                                 |                            |         |   |
|---------------------------------|----------------------------|---------|---|
| Isolation resistance            | Min.                       | 500MOhm | At delivered condition between input and output, measured with 500Vdc   |
|                                 | Min.                       | 500MOhm | At delivered condition between input and PE, measured with 500Vdc   |
|                                 | Min.                       | 500MOhm | At delivered condition between output and PE, measured with 500Vdc  |
|                                 | Min.                       | 500MOhm | At delivered condition between output and DC-OK contacts, measured with 500Vdc  |
| PE resistance                   | Max.                       | 0.1Ohm  | Resistance between PE terminal and the housing in the area of the DIN-rail mounting bracket.  |
| Output over-voltage protection  | Typ.                       | 18Vdc   | In case of an internal defect, a redundant circuit limits the maximum output voltage. The output shuts down and automatically attempts to restart.  |
|                                 | Max.                       | 20Vdc   |   |
| Class of protection             | I                          |         | According to IEC 61140<br>A PE (Protective Earth) connection is required  |
| Degree of protection            | IP 20                      |         | According to EN/IEC 60529   |
| Over-temperature protection     | Included                   |         | Output shuts down with automatic restart. Temperature sensors are installed on critical components inside the unit and turn the unit off in safety critical situations, which can happen e.g. when ambient temperature is too high, ventilation is obstructed or the de-rating requirements are not followed. There is no correlation between the operating temperature and turn-off temperature since this is dependent on input voltage, load and installation methods. |
| Input transient protection      | MOV (Metal Oxide Varistor) |         | For protection values see chapter 14(EMC).  |
| Internal input fuse             | Included                   |         | Not user replaceable slow-blow high-braking capacity fuse   |
| Touch current (leakage current) | Typ.                       | 0.14mA  | At 400Vac, 50Hz, TN-,TT-mains   |
|                                 | Typ.                       | 0.19mA  | At 480Vac, 60Hz, TN-,TT-mains   |
|                                 | Max.                       | 0.18mA  | At 440Vac, 60Hz, TN-,TT-mains   |
|                                 | Max.                       | 0.25mA  | At 528Vac, 50Hz, TN-,TT-mains   |

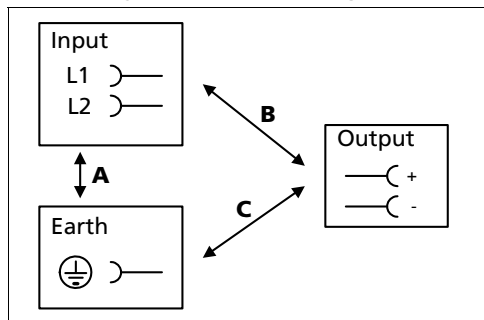
## 17. DIELECTRIC STRENGTH

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

The output is insulated to the input by a double or reinforced insulation.

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

Fig. 17-1 Dielectric strength



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

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



## 18. APPROVALS

EC Declaration of Conformity



The CE mark indicates conformance with the  
- RoHS directive  
- EMC directive and the  
- Low-voltage directive (LVD)

IEC 60950-1  
2<sup>nd</sup> Edition



CB Scheme,  
Information Technology Equipment

UL 508



Listed for use as Industrial Control Equipment;  
U.S.A. (UL 508) and Canada (C22.2 No. 107-1-01);  
E-File: E198865

UL 60950-1  
2<sup>nd</sup> Edition



Recognized for use as Information Technology Equipment,  
Level 5; U.S.A. (UL 60950-1) and Canada (C22.2 No. 60950-1);  
E-File: E137006  
Applicable for altitudes up to 2000m.

Marine



GL (Germanischer Lloyd) classified and  
ABS (American Bureau for Shipping) PDA  
Environmental category: C, EMC2  
Marine and offshore applications

EAC TR Registration



Registration for the Eurasian Customs Union market  
(Russia, Kazakhstan, Belarus)

## 19. OTHER FULFILLED STANDARDS

RoHS Directive



Directive 2011/65/EU of the European Parliament and the  
Council of June 8<sup>th</sup>, 2011 on the restriction of the use of  
certain hazardous substances in electrical and electronic  
equipment.

REACH Directive



Directive 1907/2006/EU of the European Parliament and the  
Council of June 1<sup>st</sup>, 2007 regarding the Registration,  
Evaluation, Authorisation and Restriction of Chemicals  
(REACH)

IEC/EN 61558-2-16  
(Annex BB)

Safety Isolating  
Transformer

Safety Isolating Transformers corresponding to Part 2-6 of the  
IEC/EN 61558

## 20. PHYSICAL DIMENSIONS AND WEIGHT

|                         |   |
|-------------------------|---|
| Width                   | 40mm 1.57"  |
| Height                  | 124mm 4.88"   |
| Depth                   | 117mm 4.61"   |
|                         | The DIN-rail height must be added to the unit depth to calculate the total required installation depth. |
| 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.                      |
| Housing material        | Body: Aluminium alloy<br>Cover: zinc-plated steel   |
| Installation clearances | See chapter 2   |
| Penetration protection  | Small parts like screws, nuts, etc. with a diameter larger than 3.5mm                                   |

Fig. 20-1 **Front view**

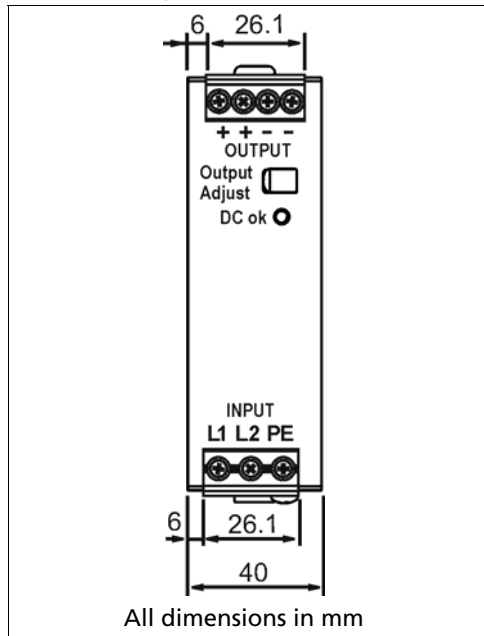
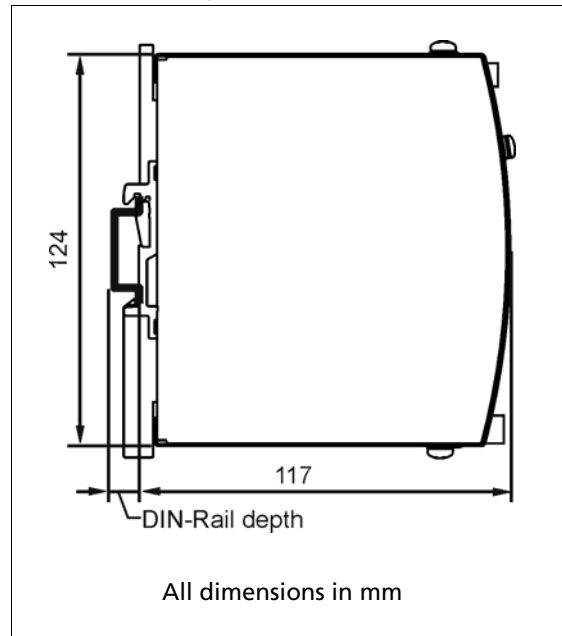


Fig. 20-2 **Side view**



## 21. ACCESSORIES

### 21.1. ZM1.WALL – WALL/PANEL MOUNT BRACKET

These brackets are used to mount the device on a flat surface or panel 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 in the holes of the aluminum brackets.

The order number ZM1.WALL contains two brackets needed for one device.

Fig. 21-1 **ZM1.Wall**



Fig. 21-2 **Hole pattern**

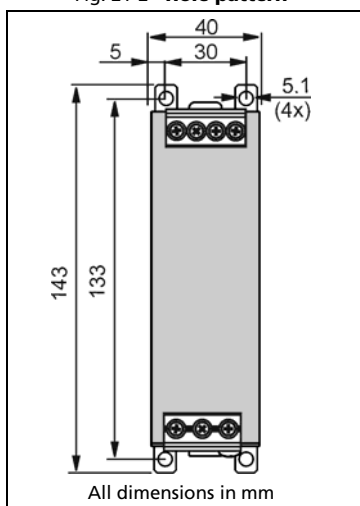


Fig. 21-3 **Side view**

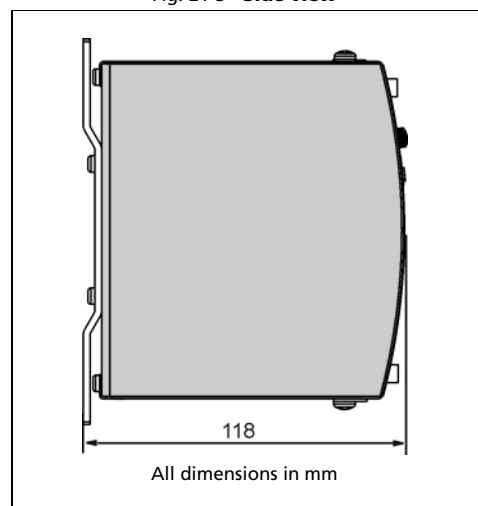


Fig. 21-4 **Isometric view-**

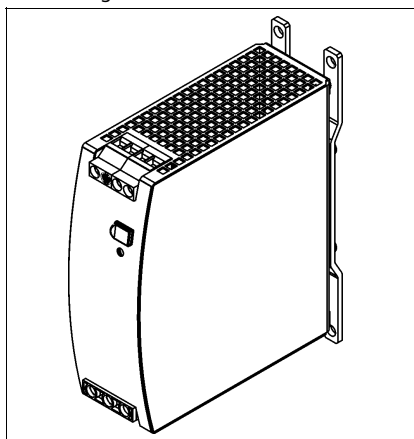


Fig. 21-5 **Isometric view**

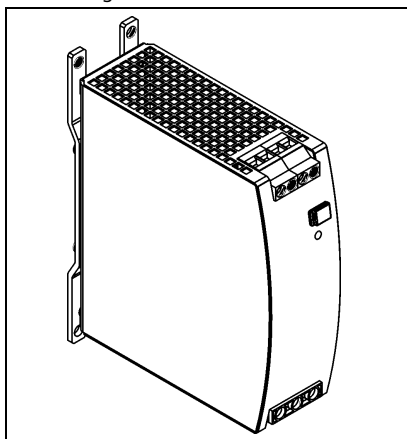
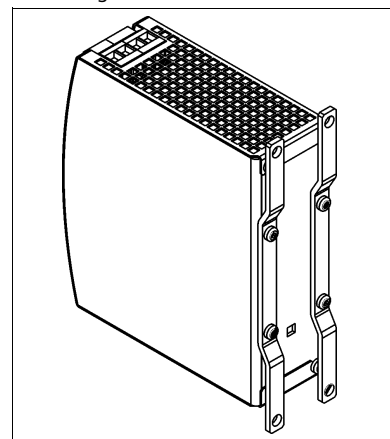


Fig. 21-6 **Isometric view**



## 21.2. ZM12.SIDE - SIDE MOUNT BRACKET

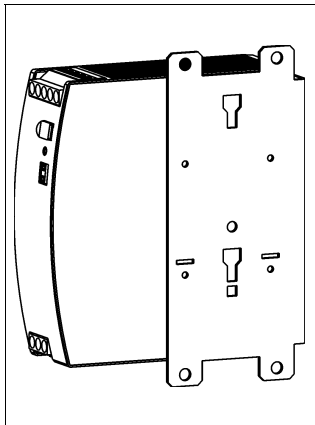
This ZM12.SIDE bracket is used to mount the device sideways with or without utilizing a DIN-rail to save installation depth.

The two aluminum brackets and the black plastic slider of the unit have to be detached, so that the ZM12.SIDE steel bracket can be mounted.

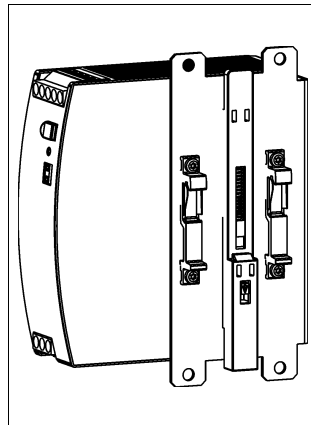
For sideways DIN-rail mounting, the removed aluminum brackets and the black plastic slider need to be mounted on the ZM12.SIDE steel bracket.



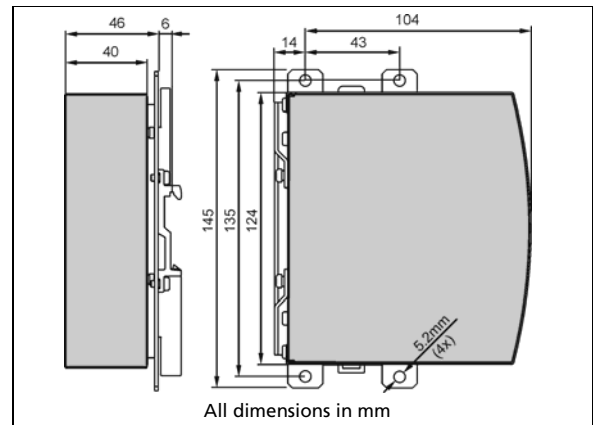
**Fig. 21-7**  
**Side mounting**  
**without DIN-rail brackets**



**Fig. 21-8**  
**Side mounting**  
**with DIN-rail brackets**



**Fig. 21-9**  
**Hole pattern**



## 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 over-current to open in a timely manner. This avoids voltage loss in adjacent circuits.

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

Fig. 22-1 **16A peak current for 50ms, typ.**  
(2x the nominal current)

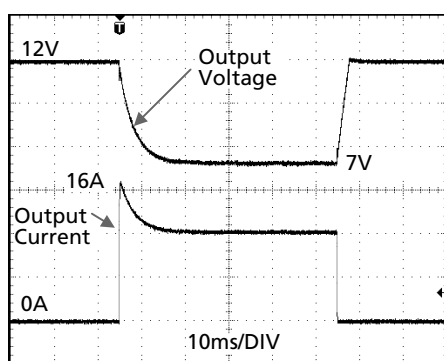
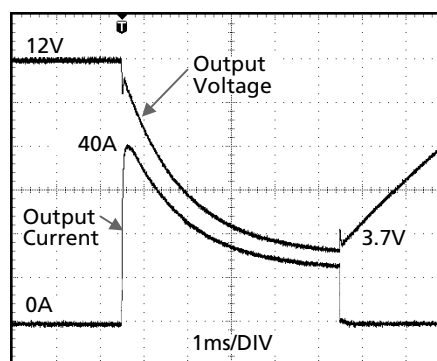


Fig. 22-2 **40A peak current for 5ms, typ.**  
(5x the nominal current)



|                           |      |                  |                                 |
|---------------------------|------|------------------|---------------------------------|
| Peak current voltage dips | Typ. | from 12V to 7V   | At 16A for 50ms, resistive load |
|                           | Typ. | from 12V to 7V   | At 40A for 2ms, resistive load  |
|                           | Typ. | from 12V to 3.7V | At 40A for 5ms, resistive load  |

## 22.2. CHARGING OF BATTERIES

The power supply can be used to charge lead-acid or maintenance free batteries.

### Instructions for charging batteries:

- Ensure that the ambient temperature of the power supply stays below 45°C.
- Set the 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 | 13.9V | 13.75V | 13.6V | 13.4V |
| Battery temperature   | 10°C  | 20°C   | 30°C  | 40°C  |
- Use a 10A circuit breaker or a blocking diode between the power supply and the battery.
- Ensure that the output current of the power supply is below the allowed charging current of the battery.
- The return current to the power supply is typically 5.5mA. This return current can discharge the battery when the power supply is switched off except in case a blocking diode is utilized.

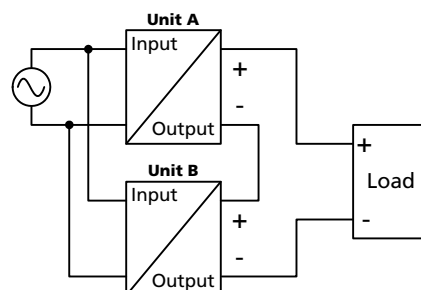
### 22.3. SERIES OPERATION

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

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

Keep an installation clearance of 15mm (left / right) between two power supplies and avoid installing the power supplies on top of each other. Do not use power supplies in series in mounting orientations other than the standard mounting orientation.

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



### 22.4. PARALLEL USE TO INCREASE OUTPUT POWER

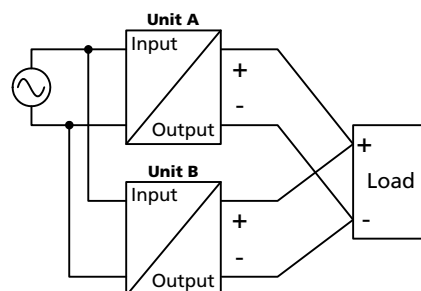
Devices can be paralleled to increase the output power. The output voltage shall be adjusted to the same value ( $\pm 100\text{mV}$ ) with the same load conditions on all devices, or the devices can be left with the factory settings.

The ambient temperature is not allowed to exceed  $+45^{\circ}\text{C}$ .

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

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

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



### 22.5. USE IN A TIGHTLY SEALED ENCLOSURE

When the device 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 device.

In the following test setup, the device is placed in the middle of the box, no other heat producing items are inside the box. The load is placed outside the box.

The temperature sensor inside the box is placed in the middle of the right side of the power supply with a distance of 1cm.

The following measurement results can be used as a reference to estimate the temperature rise inside the enclosure.

|                             | Case A   | Case B   |
|-----------------------------|--|--|
| Enclosure size              | 110x180x165mm<br>Rittal Typ IP66 Box<br>PK 9516 100, plastic | 110x180x165mm<br>Rittal Typ IP66 Box<br>PK 9516 100, plastic |
| Input voltage               | 400Vac   | 400Vac   |
| Load                        | 12V, 6.4A; (=80%)  | 12V, 8A; (=100%)   |
| Temperature inside the box  | 51.1°C   | 56.9°C   |
| Temperature outside the box | 25.2°C   | 25.9°C   |
| Temperature rise            | 25.9K  | 31.0K  |

## 22.6. MOUNTING ORIENTATIONS

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

The listed lifetime and MTBF values from this datasheet apply only for the standard mounting orientation.

The following curves give an indication for allowed output currents for altitudes up to 2000m (6560ft).

Fig. 22-3  
**Mounting Orientation A**  
(Standard orientation)

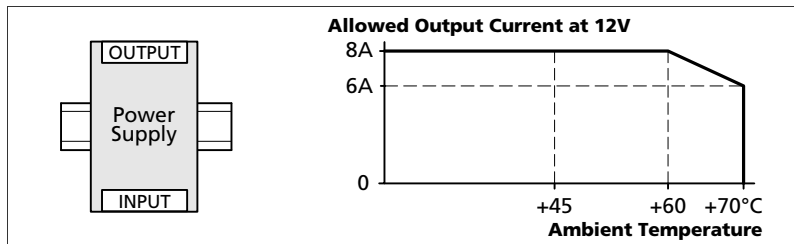


Fig. 22-4  
**Mounting Orientation B**  
(Upside down)

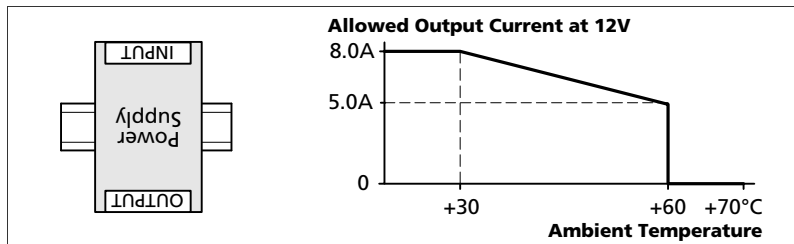


Fig. 22-5  
**Mounting Orientation C**  
(Table-top mounting)

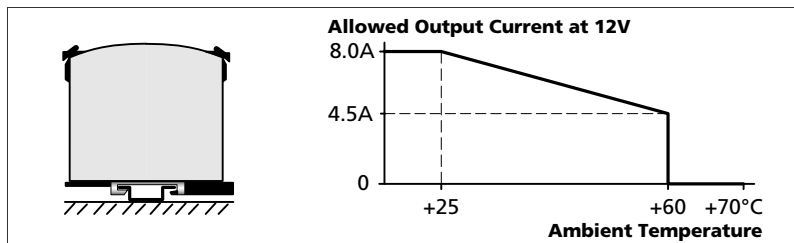


Fig. 22-6  
**Mounting Orientation D**  
(Horizontal cw)

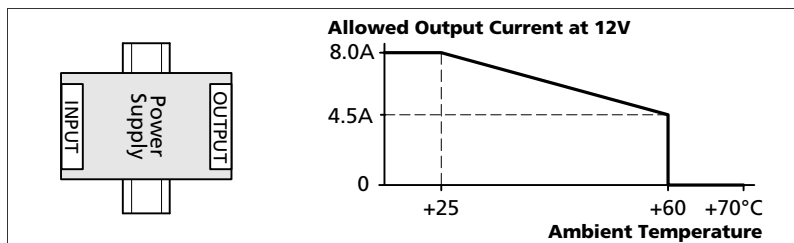


Fig. 22-7  
**Mounting Orientation E**  
(Horizontal ccw)

