



### POWER SUPPLY

- 3AC 380-480V Wide-range Input
- 2 or 3-Phase Operation Possible
- Width only 62mm
- Efficiency up to 92.9% Due to Synchronous Rectifier
- Excellent Partial Load Efficiency
- 20% Output Power Reserves
- Easy Fuse Tripping Due to High Overload Current
- Input -Transient Blanking Circuit Included
- Minimal Inrush Current Surge
- 3 Input Fuses Included
- Current Sharing Feature for Parallel Use
- Full Power Between -25°C and +60°C
- 3 Year Warranty

## 1. 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 CT10.241 are the high efficiency, electronic inrush current limitation, active input transient filter and wide operational temperature range. The small size is achieved by a synchronous rectification and further technological design details.

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. Additionally, the CT10.241 can deliver 3 times the nominal output current for 10ms which helps to trip fuses on faulty output branches.

## 2. SHORT-FORM DATA

Output voltage	DC 24V	
Adjustment range	24-28V	
Output current	10 – 8.6A	ambient <60°C
	12 – 10.3A	ambient <45°C
Output power	240W	ambient <60°C
	288W	ambient <45°C
Output ripple	< 50mVpp	20Hz to 20MHz
Input voltage	AC 380-480V	-15%/+20%
Mains frequency	50-60Hz	±6%
AC Input current	0.7 / 0.6A	At 3x400 / 480Vac
Power factor	0.53 / 0.52	At 3x400 / 480Vac
AC Inrush current	typ. 4A peak	
Efficiency	92.8 / 92.9%	At 3x400 / 480Vac
Losses	18.6 / 18.3W	At 3x400 / 480Vac
Temperature range	-25°C to +70°C	Operational
Derating	6W/°C	+60 to +70°C
Hold-up time	typ. 34 / 54ms	At 3x400 / 480Vac
Dimensions	62x124x117mm	WxHxD

## 3. ORDER NUMBERS

Power Supply	<b>CT10.241</b>	24-28V Standard unit
Accessory	ZM1.WALL	Wall mount bracket
	ZM13.SIDE	Side mount bracket
	YRM2.DIODE	Decoupling module
	UF20.241	Buffer unit

## 4. MARKINGS



Marine, pending

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## INTENDED USE

The power supply shall only be installed and put into operation by qualified personnel.

This power supply is designed for installation in an enclosure and is intended for the general use, such as in industrial control, office, communication, and instrumentation equipment. Do not use this device in aircraft, trains and nuclear equipment, where malfunctioning of the power supply may cause severe personal injury or threaten human life.

## 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. 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.

## DISCLAIMER

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

### 5. AC-INPUT

AC input	nom.	3AC 380-480V	Wide-range input, TN-, TT-, IT-Mains, see Fig. 5-1 Consult factory if one phase is earthed.
AC input range	min.	3x 323-576Vac	Continuous operation Full power for 200ms, no damage between 0 and 200Vac For 2-phase operation see section 26.6
	min.	3x 200-323Vac	
Input frequency	nom.	50–60Hz	±6%
Turn-on voltage	typ.	3x 260Vac	Steady-state value, see Fig. 5-1
Shut-down voltage	typ.	3x 185Vac	Steady-state value, see Fig. 5-1

		<b>3AC 400V</b>	<b>3AC 480V</b>	
Input current	typ.	0.7A	0.6A	At 24V, 10A, all three phases equal voltage See Fig. 5-3
Power factor *)	typ.	0.53	0.52	At 24V, 10A, see Fig. 5-4
Start-up delay	typ.	100ms	100ms	See Fig. 5-2
Rise time	typ.	40ms	40ms	0mF, 24V, 10A, see Fig. 5-2
	typ.	85ms	85ms	10mF, 24V, 10A, see Fig. 5-2
Turn-on overshoot	max.	200mV	200mV	See Fig. 5-2

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

Fig. 5-1 **Input voltage range**

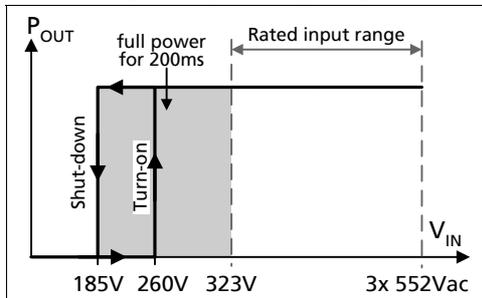


Fig. 5-2 **Turn-on behavior, definitions**

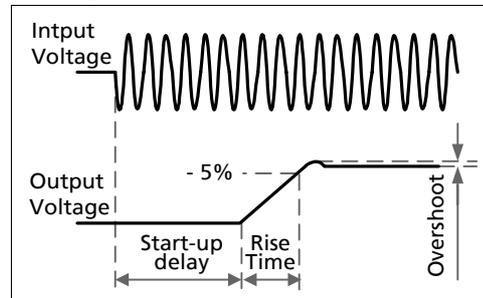


Fig. 5-3 **Input current vs. output load at 24V**

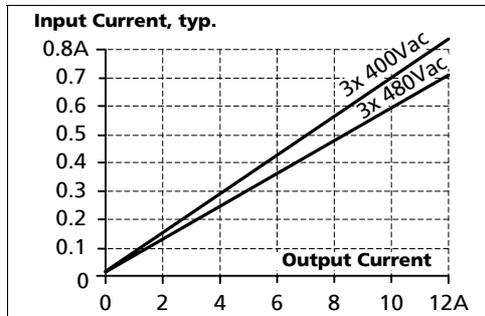
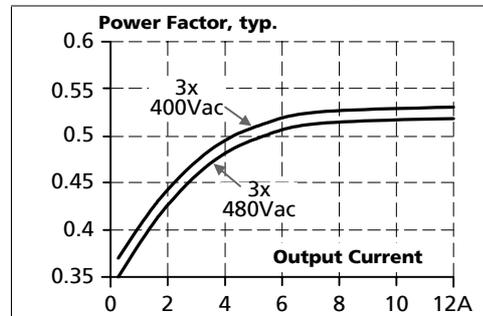


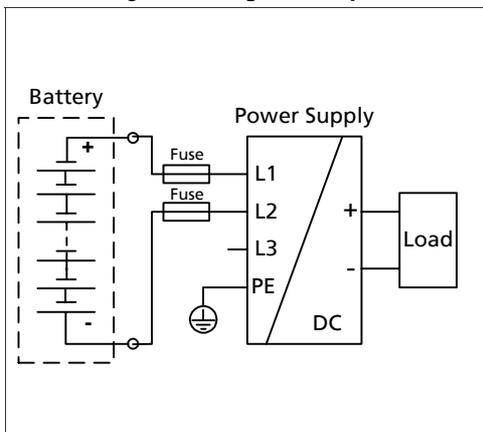
Fig. 5-4 **Power factor vs. output load**



### 6. DC-INPUT

DC input	nom.	DC 600V	
DC input range	min.	450-780Vdc	continuous operation
DC input current	typ.	0.58A / 0.34A	450Vdc / 780Vdc, 24V, 10A
Turn-on voltage	typ.	370Vdc	steady state value
Shut-down voltage	typ.	260Vdc	steady state value

Fig. 6-1 **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.
- Terminal L3 remains unused, terminal screw of L3 must be securely tightened.
- 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.

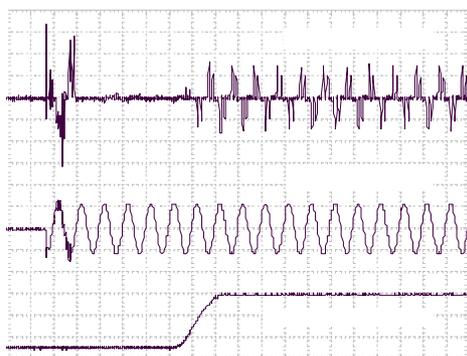
### 7. INPUT INRUSH CURRENT

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>3AC 400V</b>	<b>3AC 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. 7-1 **Input inrush current, typical behavior**



Input: 3x400Vac  
 Output: 24V, 10A  
 Ambient: 25°C  
 Upper curve: Input current 1A / DIV  
 Medium curve: Input voltage 500V / DIV  
 Lower curve: Output voltage 10V / DIV  
 Time basis: 20ms / DIV

### 8. 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	3x 323-576Vac
Load regulation	max.	100mV	in "single use" mode: static value, 0A → 10A → 0A
	typ.	1000mV	in "parallel use" mode: static value, 0A → 10A → 0A, see Fig. 8-2
Ripple and noise voltage	max.	50mVpp	20Hz to 20MHz, 50Ohm
Output capacitance	typ.	6 500µF	
Output current	nom.	12A	at 24V, ambient < 45°C, see Fig. 8-1
	nom.	10A	at 24V, ambient < 60°C, see Fig. 8-1
	nom.	10.3A	at 28V, ambient < 45°C, see Fig. 8-1
	nom.	8.6A	at 28V, ambient < 60°C, see Fig. 8-1
Output power	nom.	288W	ambient < 45°C
	nom.	240W	ambient < 60°C
Short-circuit current	min.	19A	continuous, load impedance 100mOhm, see Fig. 8-1
	max.	23A	continuous, load impedance 100mOhm, see Fig. 8-1
	min.	28A	<20ms, load impedance 100mOhm, see Fig. 8-1
	max.	32A	<20ms, load impedance 100mOhm, see Fig. 8-1 discharge current of output capacitors not included

Fig. 8-1 Output voltage vs. output current, typ.

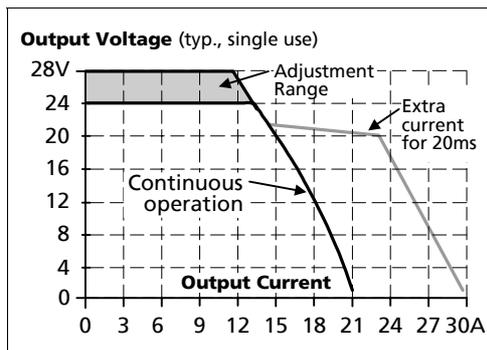
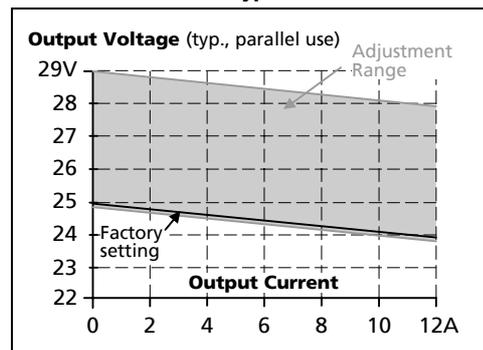


Fig. 8-2 Output voltage in "parallel use mode", typ.



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

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 26.1.

Peak current voltage dips	typ.	from 24V to 6V	at 20A for 50ms, resistive load
	typ.	from 24V to 12V	at 50A for 2ms, resistive load
	typ.	from 24V to 3V	at 50A for 5ms, resistive load

### 9. HOLD-UP TIME

		<b>3AC 400V</b>	<b>3AC 480V</b>	
Hold-up Time	typ.	34ms	54ms	10A, 24V, see Fig. 9-1
	typ.	68ms	108ms	5A, 24V, see Fig. 9-1

Fig. 9-1 **Hold-up time vs. input voltage**

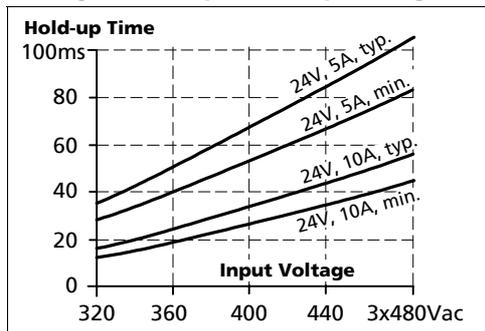
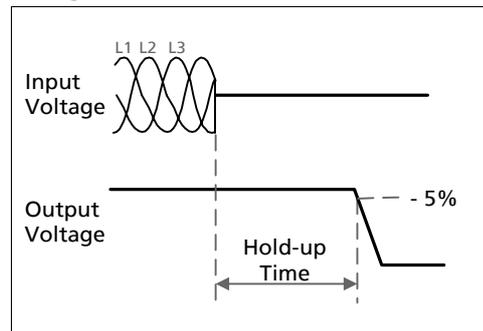


Fig. 9-2 **Shut-down behavior, definitions**



### 10. EFFICIENCY AND POWER LOSSES

		<b>3AC 400V</b>	<b>3AC 480V</b>	
Efficiency	typ.	92.8%	92.9%	10A, 24V, 3-Phase operation
	typ.	92.4%	92.6%	10A, 24V, 2-Phase operation, see chapter 26.6
Average efficiency *)	typ.	92.2%	92.0%	25% at 2.5A, 25% at 5A, 25% at 7.5A. 25% at 10A, 3-Phase operation
Power losses	typ.	2.3W	2.6W	0A, 3-Phase operation
	typ.	18.6W	18.3W	10A, 24V, 3-Phase operation
	typ.	24.0W	23.7W	12A, 24V, 3-Phase operation

\*) 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. 10-1 **Efficiency vs. output current at 24V, 3-Phase Operation**

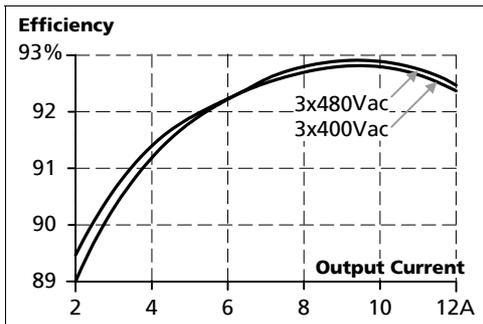


Fig. 10-2 **Losses vs. output current at 24V, 3-Phase Operation**

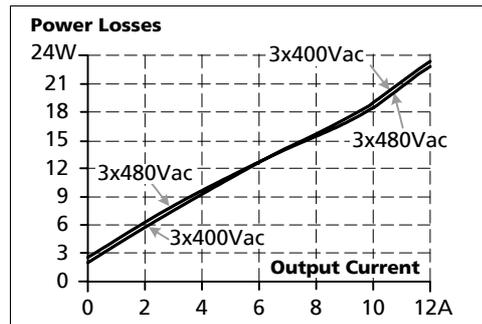


Fig. 10-3 **Efficiency vs. input voltage, 24V, 10A, 3-Phase Operation**

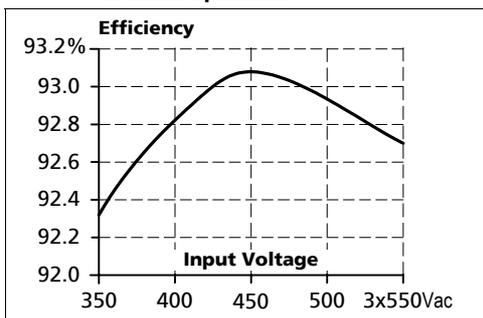
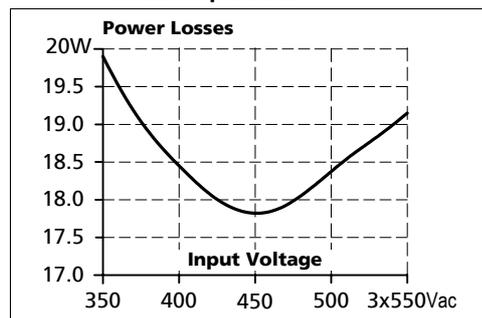
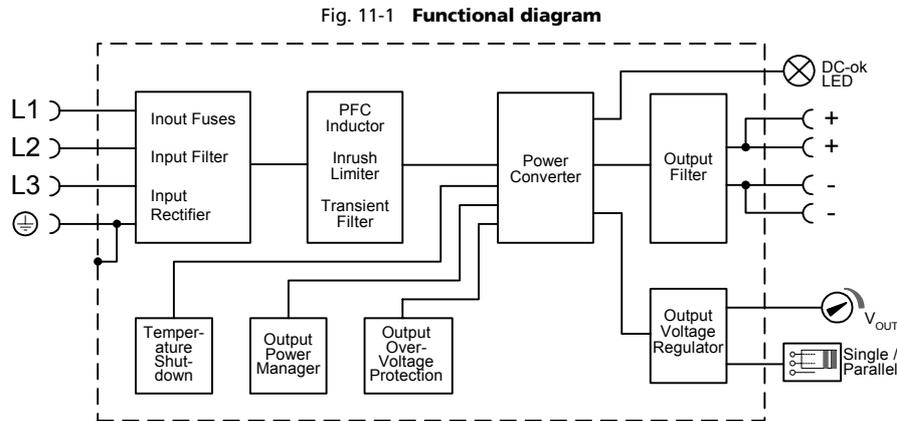


Fig. 10-4 **Losses vs. input voltage, 24V, 10A, 3-Phase Operation**



### 11. FUNCTIONAL DIAGRAM



### 12. FRONT SIDE AND USER ELEMENTS

Fig. 12-1 **Front side**



**A Output Terminals**

- Screw terminals
- Dual terminals per pole
- + Positive output
- Negative (return) output

**B Input Terminals**

- Screw terminals
- L1, L2, L3** Phase input
- ⊕... PE (Protective Earth) input

**C Output voltage potentiometer**

- Open the flap to set the output voltage. Factory set: 24.1V

**D "Parallel Use" "Single Use" selector**

- Set jumper to "Parallel Use" when power supplies are connected in parallel to increase the output power. In order to achieve a sharing of the load current between the individual power supplies, the "parallel use" regulates the output voltage in such a manner that the voltage at no load is approx. 5% higher than at nominal load. See Fig. 8-2.

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

- On when the voltage on the output terminals is > 21V

### 13. TERMINALS AND WIRING

Type	Screw terminals
Solid wire	0.5-6mm <sup>2</sup>
Stranded wire	0.5-4mm <sup>2</sup>
American Wire Gauge	20-10 AWG
Ferrules	allowed, but not required
Wire stripping length	7mm / 0.275inch
Screwdriver	3.5mm slotted or Pozidrive No 2 (only for screw terminals)
Recommended tightening torque	0.8Nm, 7lb.in (only for screw terminals)

**Instructions:**

- 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.
- Follow national installation codes and installation regulations!
- Ensure that all strands of a stranded wire enter the terminal connection!
- Up to two stranded wires with the same cross section are permitted in one connection point (except PE wire).
- Do not use the unit without PE connection.
- Screws of unused terminal compartments should be securely tightened.

### 14. RELIABILITY

3-Phase operation		3AC 400V	3AC 480V	
Lifetime expectancy	min.	54 000h	62 000h	40°C, 24V, 10A
	min.	133 000h	134 000h	40°C, 24V, 5A
	min.	151 000h	176 000h	25°C, 24V, 10A
MTBF SN 29500, IEC 61709		975 000h	985 000h	40°C, 24V, 10A
		1 706 000h	1 723 000h	25°C, 24V, 10A
MTBF MIL HDBK 217F		445 000h	429 000h	40°C, 24V, 10A, Ground Benign GB40
		584 000h	427 000h	25°C, 24V, 10A, Ground Benign GB25
2-Phase operation		2AC 400V	2AC 480V	
Lifetime expectancy	min.	48 000h	58 000h	40°C, 24V, 10A
	min.	134 000h	145 000h	40°C, 24V, 5A
	min.	135 000h	164 000h	25°C, 24V, 10A
MTBF SN 29500, IEC 61709		T.B.D.	T.B.D.	40°C, 24V, 10A
		T.B.D.	T.B.D.	25°C, 24V, 10A
MTBF MIL HDBK 217F		T.B.D.	T.B.D.	40°C, 24V, 10A, Ground Benign GB40
		T.B.D.	T.B.D.	25°C, 24V, 10A, Ground Benign GB25

The **Lifetime expectancy** shown in the table indicates the operating hours (service life) and is determined by the lifetime expectancy of the built-in electrolytic capacitors.

Lifetime expectancy is specified in operational hours. Lifetime expectancy is calculated according to the capacitor's manufacturer specification. The prediction model allows 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.

### 15. EMC

The power supply is suitable for applications in industrial environment as well as in residential, commercial and light industry environment without any restrictions. CE mark is in 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 upon request

<b>EMC Immunity</b>	EN 61000-6-1 EN 61000-6-2		Generic standards	
Electrostatic discharge	EN 61000-4-2	Contact discharge Air discharge	8kV 15kV	Criterion A Criterion A
Electromagnetic RF field	EN 61000-4-3	80MHz-2.7GHz	10V/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	Input lines Output lines	4kV 2kV	Criterion A Criterion A
Surge voltage on input	EN 61000-4-5	L1 → L2, L2 → L3, L1 → L3	2kV	Criterion A
Surge voltage on input	EN 61000-4-5	L1 / L2 / L3 → PE	4kV	Criterion A
Surge voltage on output	EN 61000-4-5	+ → - + / - → PE	500V 500V	Criterion A Criterion A
Conducted disturbance	EN 61000-4-6	0.15-80MHz	10V	Criterion A
Mains voltage dips Dips on all three phases	EN 61000-4-11	0% of 380Vac 0% of 480Vac	0Vac, 20ms 0Vac, 20ms	Criterion A Criterion A
Mains voltage dips Dips on two phases	EN 61000-4-11	40% of 380Vac 40% of 480Vac 70% of 380Vac 70% of 480Vac	200ms 200ms 500ms 500ms	Criterion A Criterion A Criterion A Criterion A
Voltage interruptions	EN 61000-4-11		0Vac, 5000ms	Criterion C
Voltage sags	SEMI F47 0200	Dips on two phases according to section 7.2. (SEMI F47-200)		
		80% of 380Vac 70% of 380Vac 50% of 380Vac	1000ms 500ms 200ms	Criterion A Criterion A 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 might shut-down and restarts by itself. No damage or hazards for the power supply occur.

<b>EMC Emission</b>	EN 61000-6-3 and EN 61000-6-4		Generic standards	
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 Frequencies** Variable between 60kHz - 140kHz

### 16. ENVIRONMENT

Operational temperature	-25°C to +70°C (-13°F to 158°F)	reduce output power according <b>Fig. 16-1</b>
Output de-rating	3.2W/°C 6W/°C	45-60°C (113°F to 140°F) 60-70°C (140°F to 158°F)
Storage temperature	-40 to +85°C (-40°F to 185°F)	storage and transportation
Humidity	5 to 95% r.H.	IEC 60068-2-30 Do not energize while condensation is present
Vibration sinusoidal	2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g 2 hours / axis	IEC 60068-2-6
Shock	30g 6ms, 20g 11ms 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 above 2000m sea level.
Output de-rating (for altitude)	15W/1000m or 5°C/1000m	above 2000m (6500ft), see <b>Fig. 16-2</b>
Over-voltage category	III	EN 50178, IEC 62103, altitudes up to 2000m
	II	Altitudes from 2000m to 6000m
Degree of pollution	2	EN 50178, IEC 62103, not conductive

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

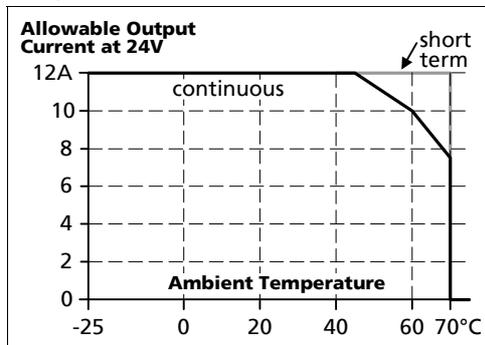
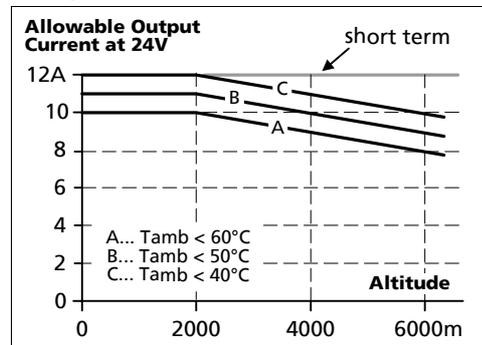


Fig. 16-2 Output current vs. altitude, 24V



The ambient temperature is defined as the air temperature 2cm below the unit.

### 17. PROTECTION FEATURES

Output protection	Electronically protected against overload, no-load and short-circuits	
Output over-voltage protection	typ. 30.5Vdc 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	3x T3.15A H.B.C.	not user replaceable

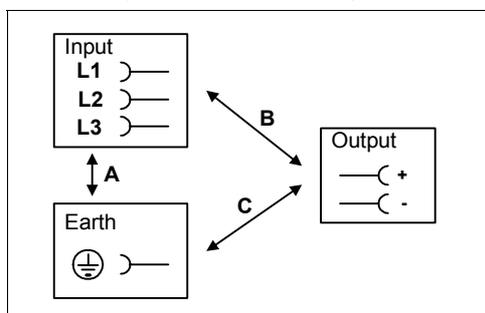
Note: In case of a protection event, audible noise may occur.

### 18. SAFETY

Input / output separation	SELV PELV double or reinforced insulation	IEC/EN 60950-1 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	Between housing and PE terminal
Touch current (leakage current)	typ. 0.17mA typ. 0.24mA < 0.22mA < 0.31mA	3x 400Vac, 50Hz, TN mains 3x 480Vac, 60Hz, TN mains 3x 440Vac, 50Hz, TN mains 3x 528Vac, 60Hz, TN mains

### 19. DIELECTRIC STRENGTH

Fig. 19-1 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

**Type tests and factory tests:**

Conducted by the manufacturer. Do not repeat test in field!

**Rules for field test:**

Use appropriate test equipment which applies the voltage with a slow ramp (up and down)! Connect L1, L2 and L3 together as well as all output poles.

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

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 any more when unnoticed earth faults occur.

### 20. APPROVALS

IEC 60950-1		CB Scheme, Information Technology Equipment
UL 508		LISTED E198865 listed for use in U.S.A. (UL 508) and Canada (C22.2 No. 14-95) Industrial Control Equipment
UL 60950-1		RECOGNIZED E137006 recognized for the use in U.S.A. (UL 60950-1) and Canada (C22.2 No. 60950) Information Technology Equipment, Level 5
Marine, pending		GL (Germanischer Lloyd) classified and ABS (American Bureau for Shipping) PDA for marine and offshore applications. Environmental category: C, EMC2
SEMI F47, pending		SEMI F47-0200 Power Quality Star Ride-through compliance for semiconductor industry. Full SEMI range compliance (Dips on two phase: 304Vac for 1000ms, 266Vac for 500ms and 190Vac for 200ms)

### 21. 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

### 22. USED SUBSTANCES

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

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, Asbest, Mercury, Silicia

### 23. PHYSICAL DIMENSIONS AND WEIGHT

Weight	750g / 1.65lb
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 depth (117mm) to calculate the total required installation depth.
Electronic files with mechanical data can be downloaded at <a href="http://www.pulspower.com">www.pulspower.com</a>	

Fig. 23-1 Front view

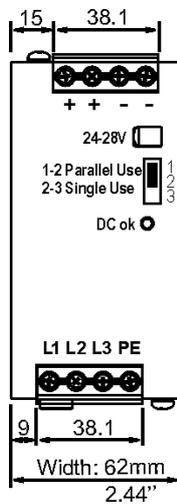
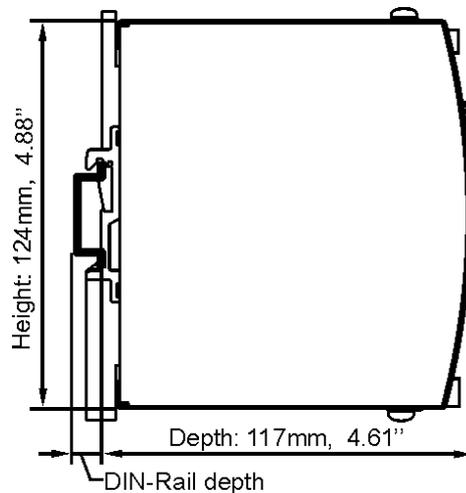


Fig. 23-2 Side view



### 24. INSTALLATION AND OPERATION INSTRUCTIONS

**Mounting Orientation:**

Output terminal must be located on top and input terminal on the bottom. For other orientations see chapter 26.12.

**Cooling:**

Convection cooled, no forced cooling required. Do not cover ventilation grid (e.g. cable conduit) by more than 30%!

**Installation clearances:**

40mm on top, 20mm on the bottom, 5mm on the left and right side are recommended when loaded permanently with full power. In case the adjacent device is a heat source, 15mm clearance are recommended.

**Risk of electrical shock, fire, personal injury or death!**

Do not use the unit without proper earth connection (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 power supply. Protect against inadvertent re-powering.

Make sure the wiring is correct by following all local and national codes.

Do not open, modify or repair the unit.

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.

**Service parts:**

The unit does not contain any service parts. The tripping of an internal fuse is caused by an internal defect. If damage or malfunctioning should occur during operation, immediately turn power off and send unit to factory for inspection!

## 25. 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 slide of the unit have to be removed, so that the two steel brackets can be mounted.

(Note: Picture is for representation only)

Fig. 25-1 ZM1.WALL Wall Mounting Bracket

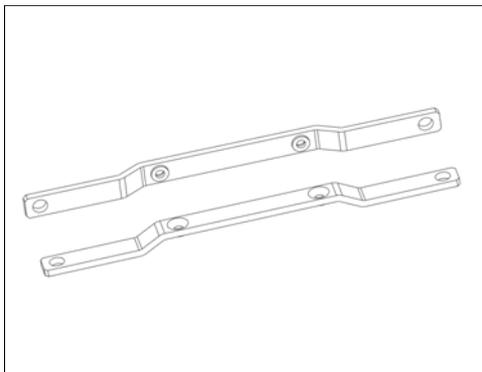
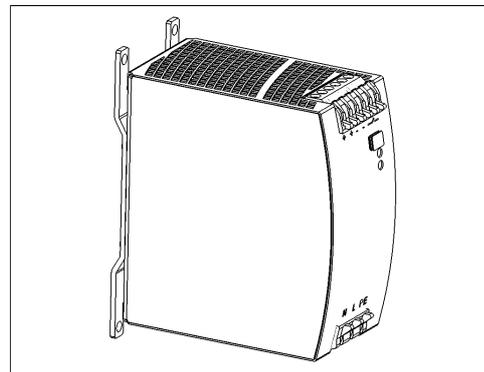


Fig. 25-2 Assembled Wall Mounting Bracket



### ZM13.SIDE Side mounting bracket

This bracket is used to mount Dimension units sideways with or without utilizing a DIN-Rail. The two aluminum brackets and the black plastic slider of the unit 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.

(Note: Picture is for representation only)

Fig. 25-3 ZM13.SIDE Side Mounting Bracket

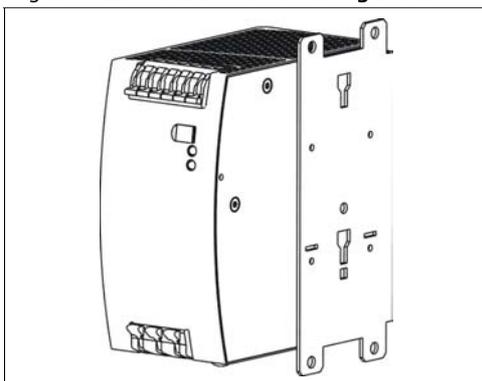
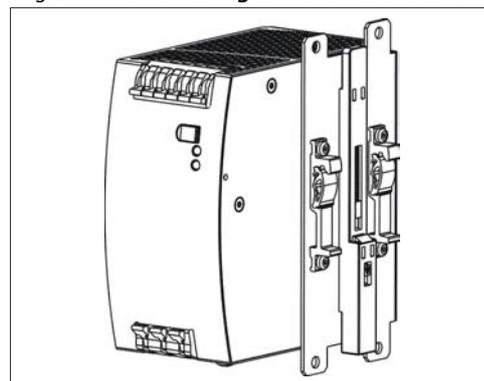


Fig. 25-4 Side Mounting with DIN-rail brackets



## 26. APPLICATION NOTES

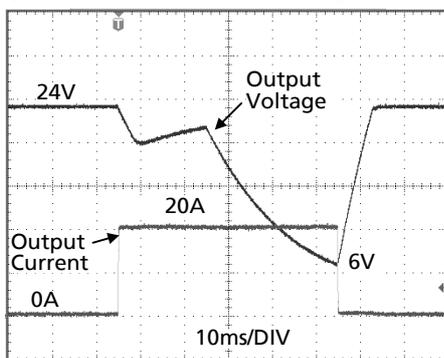
### 26.1. PEAK CURRENT CAPABILITY

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.

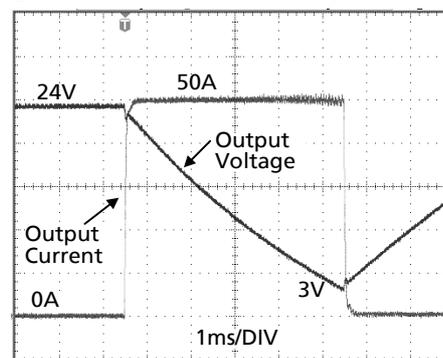
Assuming the input voltage is turned on before such an event, the built-in large sized output capacitors inside the power supply can deliver extra current. Discharging this capacitor causes a voltage dip on the output. The following two examples show typical voltage dips:

Fig. 26-1 **Peak load 20A for 50ms, typ.**



Peak load 20A (resistive) for 50ms  
Output voltage dips from 24V to 6V.

Fig. 26-2 **Peak load 50A for 5ms, typ.**



Peak load 50A (resistive) for 5ms  
Output voltage dips from 24V to 3V.

### 26.2. BACK-FEEDING LOADS

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

This power supply is resistant and does not show malfunctioning when a load feeds back voltage to the power supply. It does not matter, whether the power supply is on or off.

The maximum allowed feed back voltage is 35Vdc. The absorbing energy can be calculated according to the built-in large sized output capacitor which is specified in chapter 8.

### 26.3. 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) Set jumper on the front of the unit into "Parallel Use"
- b) Set output voltage (measured at the battery) 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

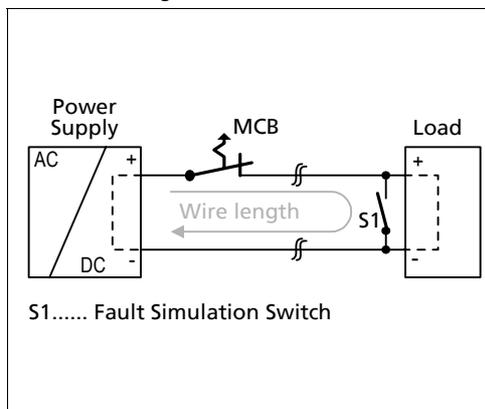
- c) Use a 25A circuit breaker (or blocking diode ) between the power supply and the battery.
- d) Ensure that the output current of the power supply is below the allowed charging current of the battery.
- e) Use only matched batteries when putting 12V types in series.
- f) The return current to the power supply (battery discharge current) is typ. 8mA when the power supply is switched off (except in case a blocking diode is utilized).

### 26.4. 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. 26-3 Test circuit



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

	0.75mm <sup>2</sup>	1mm <sup>2</sup>	1.5mm <sup>2</sup>	2.5mm <sup>2</sup>
<b>C-2A</b>	19m	26m	36m	58m
<b>C-3A</b>	13m	20m	29m	53m
<b>C-4A</b>	8m	12m	19m	30m
<b>C-6A</b>	3m	4m	6m	13m
<b>C-8A</b>	-	1m	1m	2m
<b>C-10A</b>	-	-	-	1m
<b>B-6A</b>	8m	11m	15m	23m
<b>B-10A</b>	3m	6m	8m	9m
<b>B-13A</b>	2m	2m	4m	6m

Please note: Two wires are needed to supply a load (+ and - wire). The distance to the load (cable length) is usually half the total wire length.

### 26.5. EXTERNAL INPUT PROTECTION

The unit is tested and approved for branch circuits up to 30A (U.S.A.) and 32A (IEC). External protection is only required, if the supplying branch has an ampacity greater than this. In some countries local regulations might apply. Check also local codes and local requirements.

If an external fuse is necessary or utilized, a minimum value is required to avoid undesired tripping of the fuse.

	B-Characteristic	C-Characteristic
Ampacity	max. 32A (U.S.A.: 30A)	32A (U.S.A.: 30A)
	min. 6A	3A

### 26.6. 2-PHASE OPERATION

The power supply is specified to operate on three or on two phases. No external phase-loss protection is needed.

#### Instructions for 2-Phase Operation:

- Reduce output power according to curve. Exceeding the limits results in a thermal shut-down.
- Note that the specification for EMC performance, hold-up time, losses and output ripple differ from a three phase operation. Furthermore, 2-Phase Operation is not included in the UL approval. Check suitability of individual applications.

Fig. 26-4 **Wiring diagram 2-phase operation**

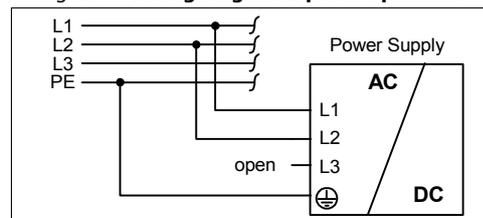


Fig. 26-5 **2-Phase-Operation Allowed output current**

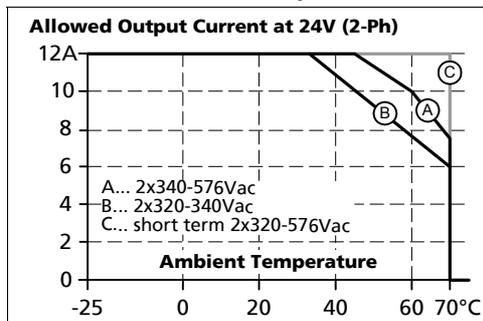


Fig. 26-6 **2-Phase-Operation Hold-up time**

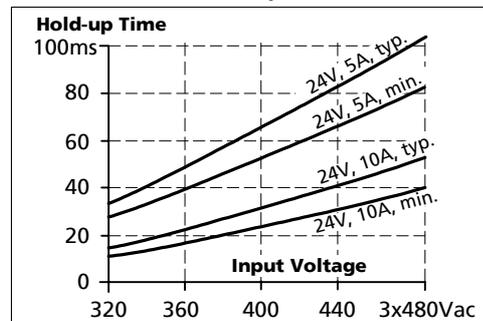


Fig. 26-7 **2-Phase-Operation Efficiency vs. output current at 24V**

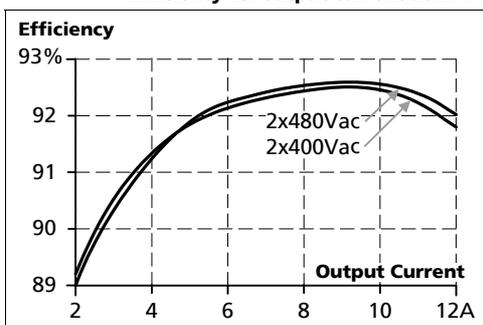
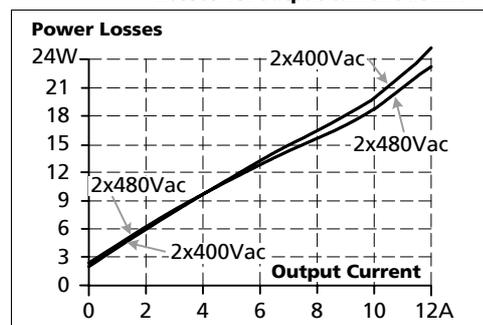


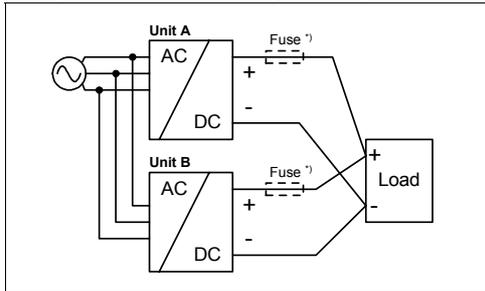
Fig. 26-8 **2-Phase-Operation Losses vs. output current at 24V**



### 26.7. PARALLEL USE TO INCREASE OUTPUT POWER

Power supplies can be paralleled to increase the output power.

Fig. 26-9 Schematic for parallel operation



#### Instructions for parallel use:

- c) Set jumper on the front into "parallel mode"
- d) Use only power supplies from the same series.
- e) Adjust the output voltages of all power supplies at no load to approximately the same value ( $\pm 100\text{mV}$ ).
- f) A fuse (or diode) on the output is only required if more than three units are connected in parallel.
- g) Keep an installation clearance of 15mm (left / right) between two power supplies and avoid installing the power supplies on top of each other.

### 26.8. PARALLEL USE FOR REDUNDANCY

Power supplies can be paralleled for redundancy to gain a 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 10A are paralleled to build a 40A redundant system.

**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:

- a) Use separate input fuses for each power supply.
- b) Set the power supply into "Parallel Use".
- c) 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.
- d) 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.

### 26.9. DAISY CHAINING OF OUTPUTS

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

Fig. 26-10 Daisy chaining of outputs

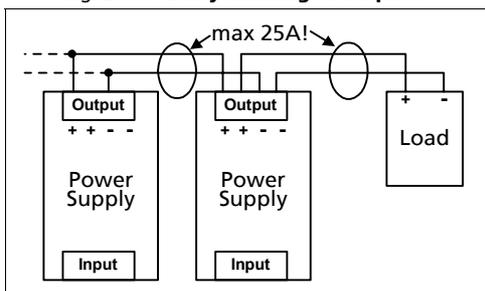
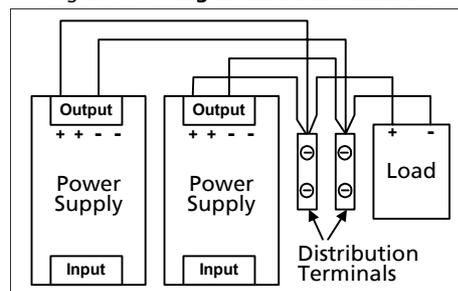


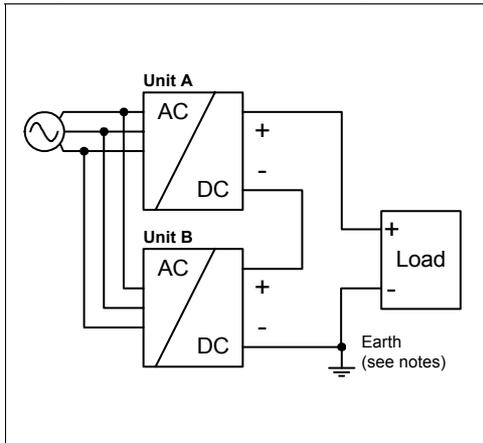
Fig. 26-11 Using distribution terminals



### 26.10. SERIES OPERATION

Power supplies can be connected in series for higher output voltages.

Fig. 26-12 Schematic for series operation



#### Instructions for use in series:

- 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.
- For serial operation use power supplies of the same type.
- Earthing of the output is required when the sum of the output voltage is above 60Vdc.
- Keep an installation clearance of 15mm (left/right) between two power supplies and avoid installing the power supplies on top of each other.

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

### 26.11. 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. The inside temperature defines the ambient temperature for the power supply.

Results from such an installation:

Power supply is placed in the middle of the box, no other heat producer inside the box

Enclosure:	Rittal Typ IP66 Box PK 9519 100, plastic, 180x180x165mm
Load:	24V, 8A; (=80%) load is placed outside the box
Input:	3x 400Vac
Temperature inside enclosure:	48.4°C (in the middle of the right side of the power supply with a distance of 2cm)
Temperature outside enclosure:	24.5°C
Temperature rise:	23.9K

### 26.12. 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 approx. in half the lifetime expectancy of A1).

Fig. 26-13  
**Mounting Orientation A**  
Standard Orientation

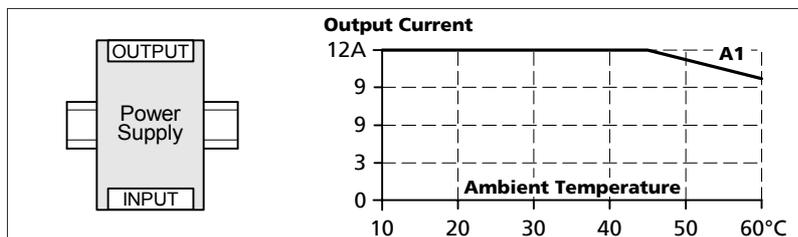


Fig. 26-14  
**Mounting Orientation B**  
(Upside down)

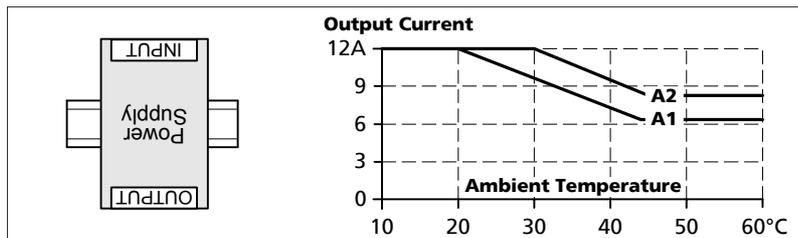


Fig. 26-15  
**Mounting Orientation C**  
(Table-top mounting)

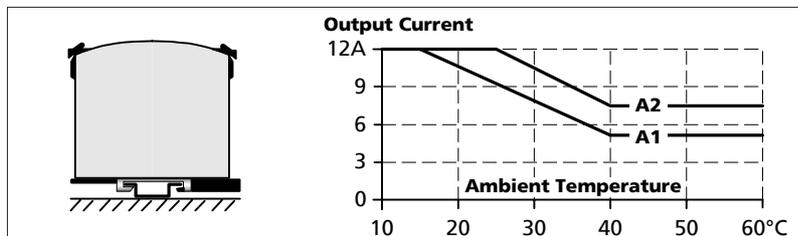


Fig. 26-16  
**Mounting Orientation D**  
(Horizontal cw)

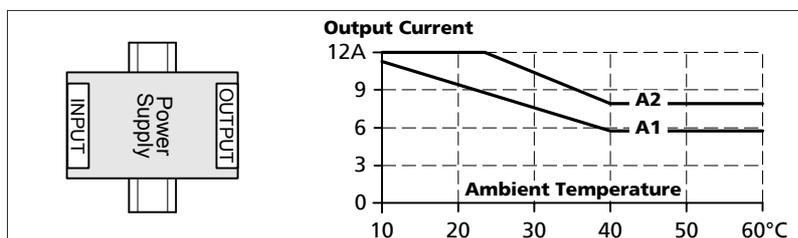


Fig. 26-17  
**Mounting Orientation E**  
(Horizontal ccw)

