CS10.481

48V, 5A, 240W SINGLE PHASE INPUT



POWER SUPPLY

- AC 100-120 / 200-240V auto-select input
- Width only 60mm
- Efficiency up to 91.6%
- Easy fuse breaking due to high overload peak current
- 20% output power reserves (PowerBoost)
- Full power between -25°C and +60°C
- Minimal inrush current surge
- 3 year warranty

PRODUCT DESCRIPTION

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

The CS10.481 includes all the essential basic functions. The devices also offer PowerBoost: Power reserves of 20%, which may even be used continuously at temperatures up to +45°C.

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

The Auto-select input makes worldwide installation and usage very simple. Defects or system failures caused by wrongly set switches cannot occur.

High immunity to transients and power surges as well as low electromagnetic emission and a large international approval package for a variety of applications makes this unit suitable for nearly every situation.

SHORT-FORM DATA

Output voltage Adjustment range	DC 48V 48 - 52V	
Output current	5.0 – 4.6A 3.8 – 3.5A Derate linearly between +60°C and +70°C	up to +60°C ambient at +70°C ambient
PowerBoost	6.0A Linear decrease to nominal power between +45°C and +60°C	up to +45°C ambient
Output ripple	< 100mVpp	20Hz to 20MHz
AC Input voltage	AC 100-120V / 200-240V	±10% Auto-select input
Mains frequency	50-60Hz	±6%
AC Input current	3.73 / 2.23A	at 120 / 230Vac
DC Input voltage	-	not allowed
Power factor	0.59 / 0.51	at 120 / 230Vac
AC Inrush current	3 / 3A$_{peak}$	at 120 / 230Vac
Efficiency	91.0 / 91.6%	at 120 / 230Vac
Losses	23.7 / 22.0W	at 120 / 230Vac
Temperature range	-25°C to +70°C	operational
Hold-up time	46 / 47ms	at 120 / 230Vac
Dimensions	60x124x117mm	WxHxD
Weight	700g	

ORDER NUMBERS

Power Supply	**CS10.481**	48-52V Standard unit
Accessory	ZM1.WALL	Wall mount bracket
	ZM13.SIDE	Side mount bracket
	YRM2.DIODE	Redundancy module
	YR40.482	Redundancy module

MAIN APPROVALS

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

UL 508 UL 60950-1 Marine

Marine

INDEX

	Page
1. Intended Use	3
2. Installation Insructions	3
3. AC-Input	5
4. DC-Input	7
5. Input Inrush Current	7
6. Output	8
7. Hold-up Time	9
8. Efficiency and Power Losses	10
9. Lifetime Expectancy and MTBF	11
10. Functional Diagram	11
11. Terminals and Wiring	12
12. Front Side and User Elements	13
13. EMC	14
14. Environment	15
15. Protection Features	16
16. Safety Features	16
17. Dielectric Strength	17
18. Approved, Fulfilled or Tested Standards	18
19. Regulatory Product Compliance	19
20. Physical Dimensions and Weight	20
21. Accessories	21
21.1. ZM1.WALL - Wall Mounting Bracket	21
21.2. ZM13.SIDE - Side Mounting Bracket	21
21.3. YRM2.DIODE - Redundancy Modules	22
21.4. YR40.482 - Redundancy Modules	22
22. Application Notes	23
22.1. Peak Current Capability	23
22.2. Back-feeding Loads	24
22.3. External Input Protection	24
22.4. Output Circuit Breakers	24
22.5. Parallel Use to Increase Output Power	25
22.6. Parallel Use for Redundancy	25
22.7. Series Operation	25
22.8. Inductive and Capacitive Loads	25
22.9. Charging of Batteries	25
22.10. Operation on Two Phases	26
22.11. Use in a Tightly Sealed Enclosure	26
22.12. Mounting Orientations	27

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TERMINOLOGY, ABREVIATIONS AND DEFINITIONS

PE and ⏚ symbol	PE is the abbreviation for **P**rotective **E**arth and has the same meaning as the symbol ⏚.
Earth, Ground	This document uses the term "earth" which is the same as the U.S. term "ground".
t.b.d.	To be defined, value or description will follow later.
AC 230V	A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances (usually ±15%) included. E.g.: DC 12V describes a 12V battery disregarding whether it is full (13.7V) or flat (10V)
230Vac	A figure with the unit (Vac) at the end is a momentary figure without any additional tolerances included.
50Hz vs. 60Hz	As long as not otherwise stated, AC 100V and AC 230V parameters are valid at 50Hz mains frequency. AC 120V parameters are valid for 60Hz mains frequency.
may	A key word indicating flexibility of choice with no implied preference.
shall	A key word indicating a mandatory requirement.
should	A key word indicating flexibility of choice with a strongly preferred implementation.

1. INTENDED USE

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

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

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

Without additional measures to reduce the harmonic input current (PFC), the power supply is not suited to be connected to the public mains system in residential, commercial and light-industrial environments. No additional measures are necessary for use in industrial environments. Exceptions for various countries outside the European Union exist and can be determined locally.

2. INSTALLATION INSRUCTIONS

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

- Turn power off before working on the device and protect against inadvertent re-powering.
- Do not open, modify or repair the device.
- Use caution to prevent any foreign objects from entering into the housing.
- Do not use in wet locations or in areas where moisture or condensation can be expected.
- Do not touch during power-on, and immediately after power-off. Hot surface may cause burns.

Obey the following installation instructions:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The device is designed, tested and approved for branch circuits up to 20A without additional protection device. If an external fuse is utilized, do not use circuit breakers smaller than 10A B- or 6A C-Characteristic to avoid a nuisance tripping of the circuit breaker.

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

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

3. AC-INPUT

AC input	nom.	AC 100-120V / 200-240V ±10%	Auto-select input
Mains network systems		TN, TT or IT	
AC input range		90-132Vac /	lower input voltage range
		180-264Vac	upper input voltage range
		85-90Vac	short-term or with reduced output current, see Fig. 3-5
		264-300Vac	max. 500ms
		no harm to the power supply with input voltages between 132 and 180Vac	
Allowed voltage L or N to earth	max.	300Vac	continuous, IEC 62103
Input frequency	nom.	50–60Hz	±6%
Turn-on voltage	typ.	80Vac	steady-state value, see Fig. 3-1
Shut-down voltage	typ.	75Vac	steady-state value, see Fig. 3-1
External input protection	See recommendations in chapter 22.3.		

		AC 100V	**AC 120V**	**AC 230V**	
Input current	typ.	4.34A	3.73A	2.23A	at 48V, 5A, see Fig. 3-3
Power factor*)	typ.	0.61	0.59	0.51	at 48V, 5A, see Fig. 3-4
Crest factor**)	typ.	2.6	2.8	3.3	at 48V, 5A
Start-up delay	typ.	700ms	800ms	850ms	see Fig. 3-2
Rise time	typ.	51ms	51ms	51ms	at 48V, 5A const. current load, 0mF load capacitance, see Fig. 3-2
	typ.	96ms	96ms	96ms	at 48V, 5A const. current load, 5mF load capacitance,, see Fig. 3-2
Turn-on overshoot	max.	100mV	100mV	100mV	see Fig. 3-2

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

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

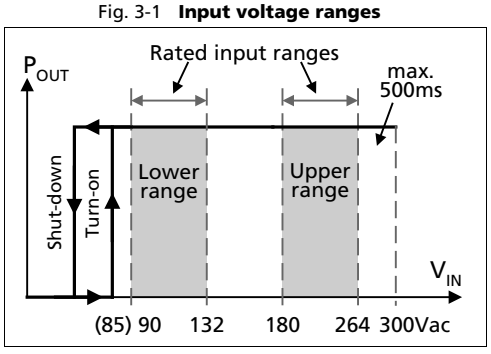


Fig. 3-2 **Turn-on behavior, definitions**

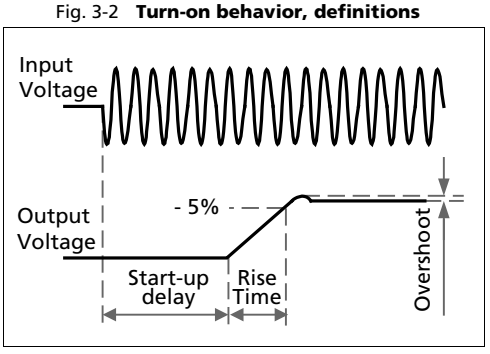


Fig. 3-3 **Input current vs. output load at 48V**

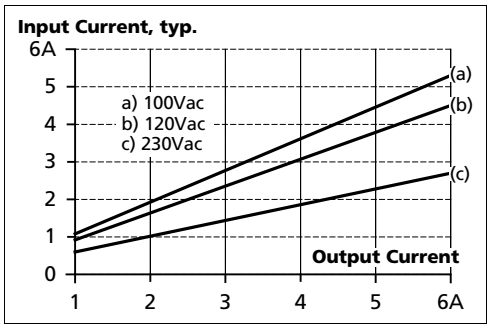


Fig. 3-4 **Power factor vs. output load**

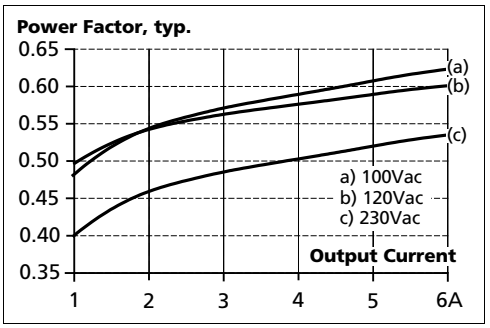
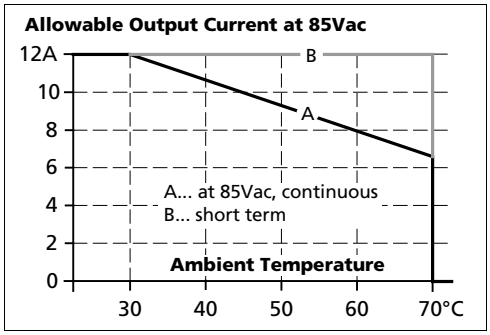


Fig. 3-5 **Input voltage derating**



4. DC-INPUT

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

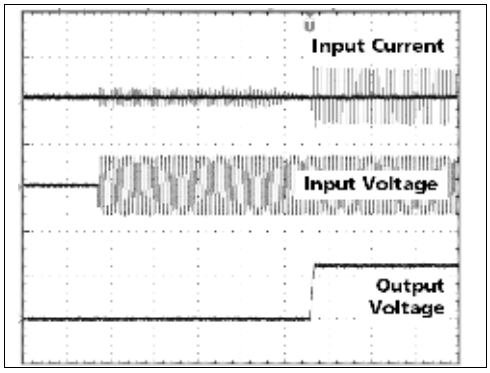
5. INPUT INRUSH CURRENT

After turn-on of the input voltage, an active inrush limitation circuit limits the input inrush current. Virtually no input inrush current is generated.

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

		AC 100V	AC 120V	AC 230V	
Inrush current	max.	$10A_{peak}$	$10A_{peak}$	$10A_{peak}$	temperature independent
	typ.	$3A_{peak}$	$3A_{peak}$	$3A_{peak}$	temperature independent
Inrush energy	max.	$1A^2s$	$1A^2s$	$1A^2s$	temperature independent

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



Input: 230Vac
Output: 48V, 5A
Ambient: 25°C

Upper curve: Input current (10A / DIV)
Medium curve: Input voltage (500V / DIV)
Lower curve: Output voltage (40V / DIV)
Time scale: 100ms / DIV

6. OUTPUT

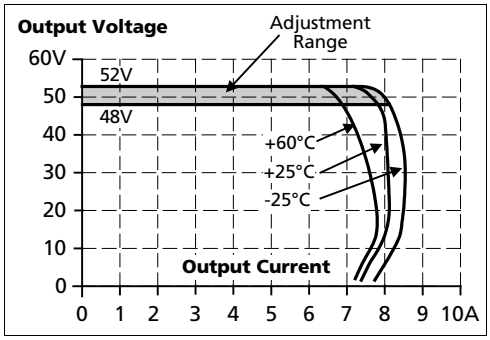
Output voltage	nom.	48V	
Adjustment range		48-52V	guaranteed
	max.	56V***)	at clockwise end position of potentiometer
Factory settings	typ.	48.0V	±0.2%, at full load, cold unit,
Line regulation	max.	70mV	90-132 / 180-300Vac
Load regulation	max.	100mV	static value, 0A → 5A; see Fig. 6-1
Ripple and noise voltage	max.	100mVpp	20Hz to 20MHz, 50Ohm
Output current	nom.	5A	at 48V and up to +60°C ambient temperature, see Fig. 6-1
	nom.	3.75A	at 48V and +70°C ambient temperature
	nom.	4.6A	at 52V and up to +60°C ambient temperature , see Fig. 6-1
	nom.	3.45A	at 52V and +70°C ambient temperature
	Derate linearly between +60°C and +70°C, see chapter 14		
PowerBoost*)	nom.	6A	at 48V and up to +45°C ambient temperature
	nom.	5.5A	at 52V and up to +45°C ambient temperature, see Fig. 6-1
	PowerBoost decreases linearly to nominal power between +45°C and +60°C, see chapter 14		
Overload behavior		continuous current	see Fig. 6-1
Short-circuit current	min.	7A**)	load impedance <100mOhm, see Fig. 6-1
	max.	9A**)	load impedance <100mOhm, see Fig. 6-1
Output capacitance	typ.	3 100µF	included inside the power supply

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

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

***) This is the maximum output voltage which can occur at the clockwise end position of the potentiometer due to tolerances. It is not a guaranteed value which can be achieved. The typical value is about 54.2V.

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



7. HOLD-UP TIME

		AC 100V	AC 120V	AC 230V	
Hold-up Time	typ.	62ms	107ms	103ms	at 48V, 2.5A, see Fig. 7-1
	min.	50ms	86ms	83ms	at 48V, 2.5A, see Fig. 7-1
	typ.	23ms	46ms	47ms	at 48V, 5A, see Fig. 7-1
	min.	19ms	37ms	38ms	at 48V, 5A, see Fig. 7-1
	typ.	17ms	35ms	37ms	at 48V, 6A, see Fig. 7-1
	min.	14ms	28ms	30ms	at 48V, 6A, see Fig. 7-1

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

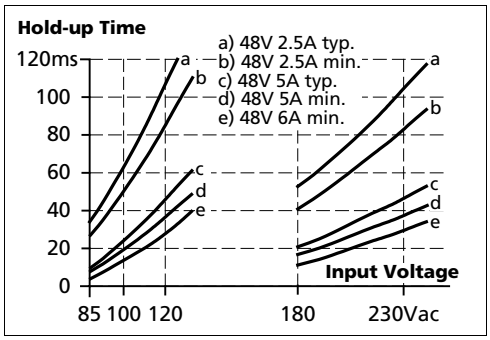
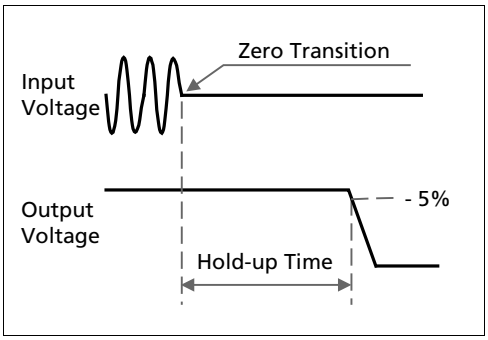


Fig. 7-2 **Shut-down behavior, definitions**



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

8. EFFICIENCY AND POWER LOSSES

		AC 100V	AC 120V	AC 230V	
Efficiency	typ.	90.7%	91.0%	91.6%	at 48V, 5A
	typ.	90.0%	90.7%	91.2%	at 48V, 6A (PowerBoost)
Average efficiency*)	typ.	90.5%	90.2%	91.0%	25% at 1.25A, 25% at 2.5A, 25% at 3.75A. 25% at 5A
Power losses	typ.	5.8W	8.4W	7.5W	at 48V, 0A
	typ.	12.0W	12.3W	11.3W	at 48V, 2.5A
	typ.	24.6W	23.7W	22.0W	at 48V, 5A
	typ.	32.0W	29.5W	27.8W	at 48V, 6A (PowerBoost)

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

Fig. 8-1 **Efficiency vs. output current at 48V, typ**

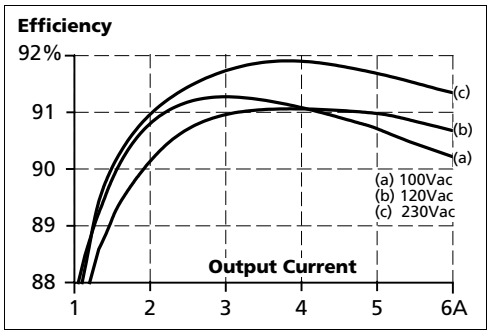


Fig. 8-2 **Losses vs. output current at 48V, typ.**

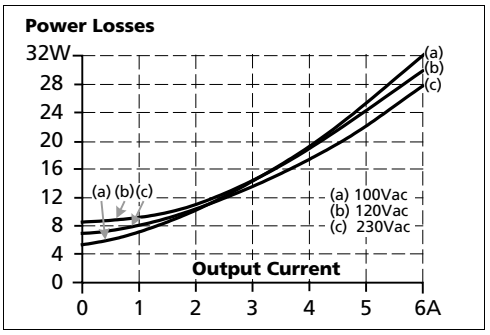


Fig. 8-3 **Efficiency vs. input voltage at 48V, 5A, typ.**

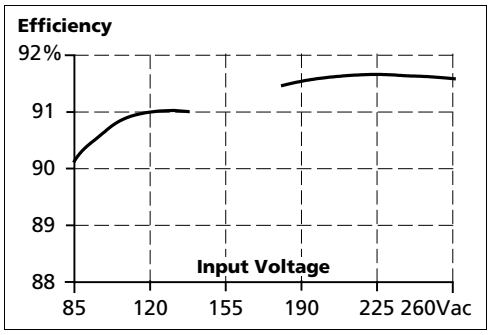
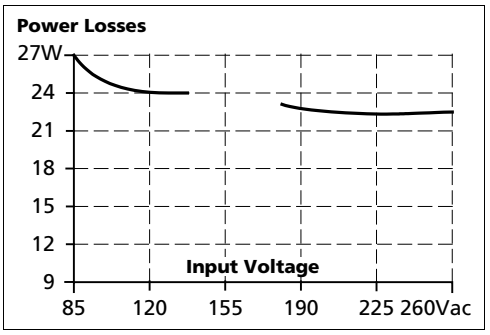


Fig. 8-4 **Losses vs. input voltage at 48V, 5A, typ.**



9. LIFETIME EXPECTANCY AND MTBF

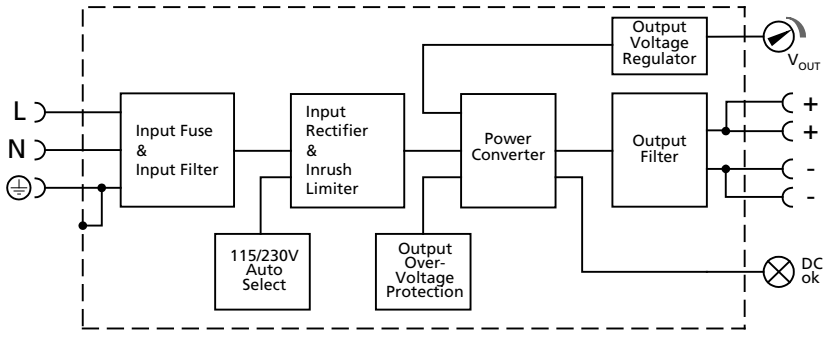
	AC 100V	AC 120V	AC 230V	
Lifetime expectancy*)	97 000h	106 000h	122 000h	at 48V, 2.5A and +40°C
	275 000h*)	299 000h*)	346 000h*)	at 48V, 2.5A and +25°C
	45 000h	60 000h	96 000h	at 48V, 5A and +40°C
	128 000h	171 000h*)	272 000h*)	at 48V, 5A and +25°C
	33 000h	42 000h	63 000h	at 48V, 6A and +40°C
	93 000h	119 000h	179 000h*)	at 48V, 6A and +25°C
MTBF**) SN 29500, IEC 61709	627 000h	653 000h	830 000h	at 48V, 5A and +40°C
	536 000h	558 000h	709 000h	at 48V, 6A and +40°C
	1 060 000h	1 104 000h	1 403 000h	at 48V, 5A and +25°C
MTBF**) MIL HDBK 217F	459 000h	450 000h	475 000h	at 48V, 5A and +40°C; Ground Benign GB40
	413 000h	406 000h	426 000h	at 48V, 6A and +40°C; Ground Benign GB40
	655 000h	642 000h	659 000h	at 48V, 5A and +25°C; Ground Bening GB25

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

) **MTBF stands for **M**ean **T**ime **B**etween **F**ailures, which is calculated according to statistical device failures, and indicates reliability of a device. It is the statistical representation of the likelihood of a unit to fail and does not necessarily represent the life of a product.
The MTBF figure is a statistical representation of the likelihood of a device to fail. A MTBF figure of e.g. 1 000 000h means that statistically one unit will fail every 100 hours if 10 000 units are installed in the field. However, it can not be determined if the failed unit has been running for 50 000h or only for 100h.

10. FUNCTIONAL DIAGRAM

Fig. 10-1 **Functional diagram**



11. TERMINALS AND WIRING

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

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

Instructions:

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

12. FRONT SIDE AND USER ELEMENTS

Fig. 12-1 **Front side**



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

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

C **Output voltage potentiometer**
Open the flap to adjust the output voltage. Factory set: 48.0V

D **DC-OK LED** (green)
On, when the voltage on the output terminals is >42V

13. EMC

The power supply is suitable for applications in industrial environment as well as in residential, commercial and light industry environment. Restrictions apply on public mains (PFC), see chapter 1 for more information.

A detailed EMC report is available on request.

EMC Immunity	According generic standards: EN 61000-6-1 and EN 61000-6-2			
Electrostatic discharge	EN 61000-4-2	contact discharge air discharge	8kV 15kV	Criterion A Criterion A
Electromagnetic RF field	EN 61000-4-3	80MHz-2.7GHz	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	L → N L → PE, N → PE	2kV 4kV	Criterion A Criterion A
Surge voltage on output	EN 61000-4-5	+ → - + / - → PE	500V 1kV	Criterion A Criterion A
Conducted disturbance	EN 61000-4-6	0.15-80MHz	10V	Criterion A
Mains voltage dips	EN 61000-4-11	0% of 100Vac 40% of 100Vac 70% of 100Vac 0% of 200Vac 40% of 200Vac 70% of 200Vac	0Vac, 20ms 40Vac, 200ms 70Vac, 500ms 0Vac, 20ms 80Vac, 200ms 140Vac, 500ms	Criterion A Criterion C Criterion C Criterion A Criterion C Criterion C
Voltage interruptions	EN 61000-4-11		5000ms	Criterion C
Powerful transients	VDE 0160	over entire load range	750V, 1.3ms	Criterion A

Criterions:

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

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

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

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

14. ENVIRONMENT

Operational temperature*)	-25°C to +70°C	reduce output power according Fig. 14-1
Storage temperature	-40°C to +85°C	for storage and transportation
Output derating	6W/K	between +60°C and +70°C
Humidity**)	5 to 95% r.h.	IEC 60068-2-30
Vibration sinusoidal	2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g***) 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 2000m	without any restrictions
	2000 to 6000m	reduce output power or ambient temperature, see Fig. 14-2 IEC 62103, EN 50178, overvoltage category II
Altitude derating	15W/1000m or 5K/1000m	for altitudes > 2000m, see Fig. 14-2
Overvoltage category	III	IEC 62103, EN 50178, altitudes up to 2000m
	II	altitudes from 2000m to 6000m
Degree of pollution	2	IEC 62103, EN 50178, not conductive

*) Operational temperature is the same as the ambient or surrounding temperature and is defined as the air temperature 2cm below the unit.
**) Do not energize while condensation is present
***) Tested in combination with DIN rails according to EN 60715 with a height of 15mm and a thickness of 1.3mm and standard orientation.

Fig. 14-1 **Output current vs. ambient temp. (Inom 5A; Iout with PowerBoost = 6A)**

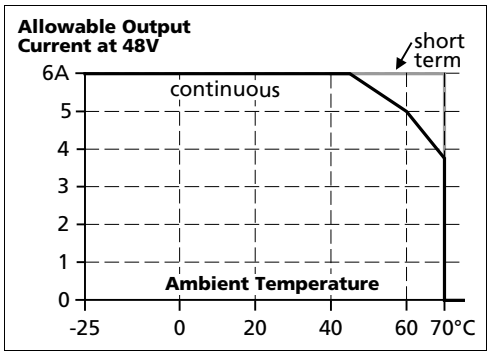
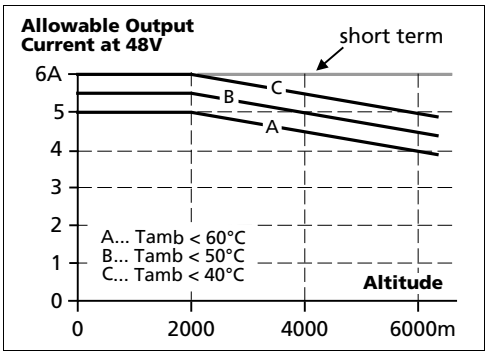


Fig. 14-2 **Output current vs. altitude**



15. PROTECTION FEATURES

Output protection	Electronically protected against overload, no-load and short-circuits*)	
Output overvoltage protection	typ. 56Vdc max. 60Vdc	In case of an internal power supply defect, a redundant circuit limits the maximum output voltage. The output shuts down and automatically attempts to restart.
Degree of protection	IP20	EN/IEC 60529 Caution: For use in a controlled environment according to CSA 22.2 No 107.1-01.
Penetration protection	> 3.5mm	e.g. screws, small parts
Overtemperature protection	yes	Output shut-down with automatic restart
Input transient protection	MOV (Metal Oxide Varistor)	
Internal input fuse	included	not user replaceable

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

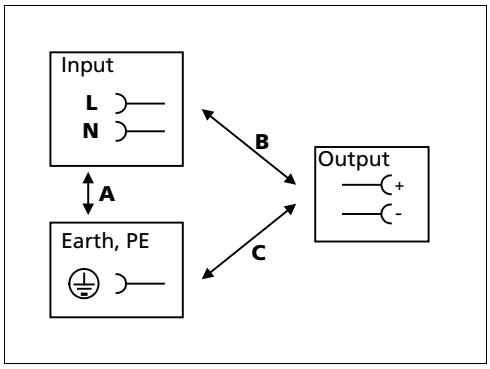
16. SAFETY FEATURES

Input / output separation*)	SELV	IEC/EN 60950-1
	PELV	IEC/EN 60204-1, EN 50178, IEC 62103, IEC 60364-4-41
	double or reinforced insulation	
Class of protection	I	PE (Protective Earth) connection required
Isolation resistance	> 5MOhm	input to output, 500Vdc
PE resistance	< 0.1Ohm	between housing and PE terminal
Touch current (leakage current)	typ. 0.36mA / 0.91mA	100Vac, 50Hz, TN-,TT-mains / IT-mains
	typ. 0.50mA / 1.25mA	120Vac, 60Hz, TN-,TT-mains / IT-mains
	typ. 0.64mA / 1.59mA	230Vac, 50Hz, TN-,TT-mains / IT-mains
	max. 0.45mA / 1.13mA	110Vac, 50Hz, TN-,TT-mains / IT-mains
	max. 0.62mA / 1.55mA	132Vac, 60Hz, TN-,TT-mains / IT-mains
	max. 0.85mA / 2.11mA	264Vac, 50Hz, TN-,TT-mains / IT-mains

17. DIELECTRIC STRENGTH

The output voltage is floating and has no ohmic connection to the ground. Type and factory tests are conducted by the manufacturer. Field tests may be conducted in the field using the appropriate test equipment which applies the voltage with a slow ramp (2s up and 2s down). Connect all input-terminals together as well as all output poles before conducting the test. When testing, set the cut-off current settings to the value in the table below.

Fig. 17-1 **Dielectric strength**



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

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

18. APPROVED, FULFILLED OR TESTED STANDARDS

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

19. REGULATORY PRODUCT COMPLIANCE

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

20. PHYSICAL DIMENSIONS AND WEIGHT

Width	60mm
Height	124mm
Depth	117mm The DIN rail depth must be added to the unit depth to calculate the total required installation depth.
Weight	700g
DIN rail	Use 35mm DIN rails according to EN 60715 or EN 50022 with a height of 7.5 or 15mm.
Housing material	Body: Aluminium alloy Cover: Zinc-plated steel
Installation clearances	See chapter 2

Fig. 20-1 **Front view**

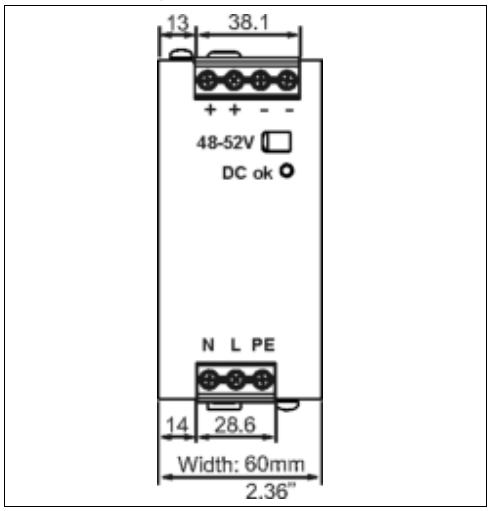
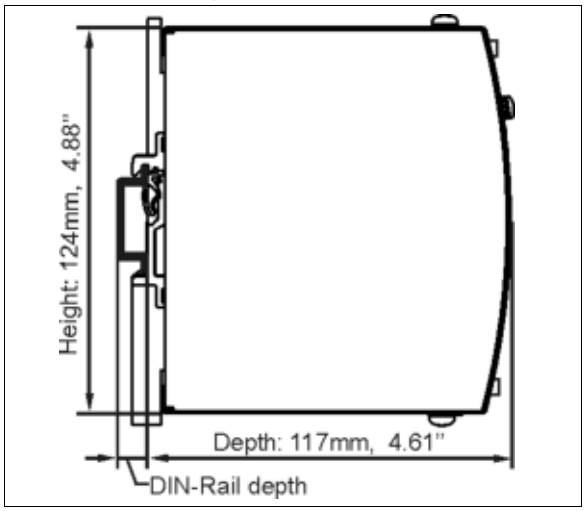


Fig. 20-2 **Side view**

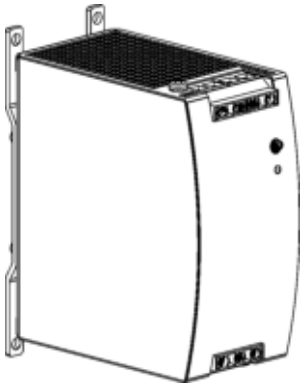


21. ACCESSORIES

21.1. ZM1.WALL - WALL MOUNTING BRACKET

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

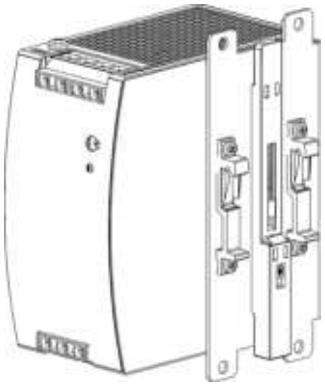




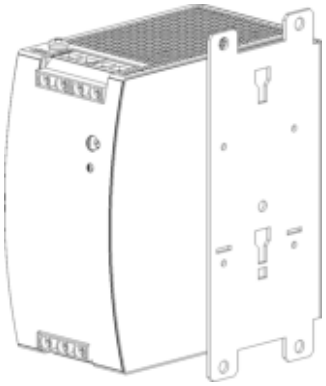
21.2. ZM13.SIDE - SIDE MOUNTING BRACKET

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

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



Side mounting with DIN rail brackets



Side mounting without DIN rail brackets

21.3. YRM2.DIODE - REDUNDANCY MODULES

(2x 10A Inputs, 1x 20A output)



The YRM2.DIODE is a dual redundancy module, which can be used to build 1+1 and N+1 redundant systems. It is equipped with two input channels, which are individually decoupled by utilizing diodes.

The YRM2.DIODE does not require an additional auxiliary voltage and is self-powered even in case of a short circuit across the output.

The YRM2.DIODE has a monitoring circuit included and is the perfect solution when the power supply has no DC-OK function. Two LEDs and two relay contacts signal when one of the two DC-input voltages is not in range due to a non-functioning or disconnected power supply.

Due to the compact design, the unit is very slender and only requires 32mm width on the DIN rail.

21.4. YR40.482 - REDUNDANCY MODULES

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

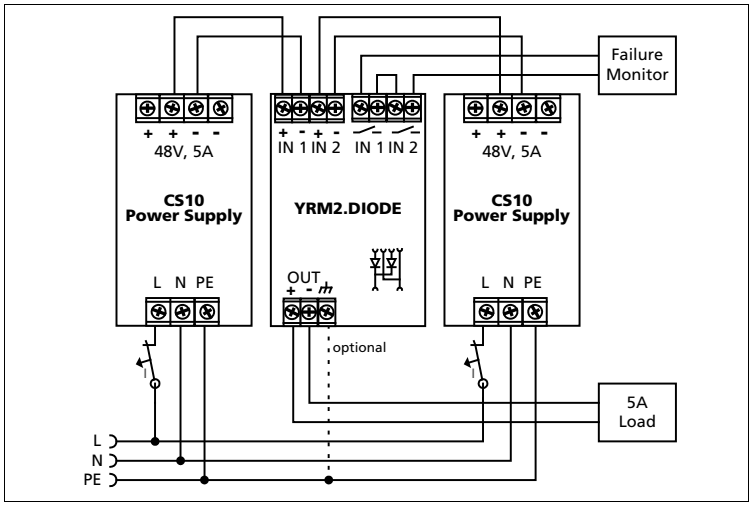


The YR40.482 is a dual redundancy module, which can be used to build redundant systems. It is equipped with two input channels, which are individually decoupled by utilizing MOSFET technology.

Using MOSFET instead of diodes reduces the heat generation and the voltage drop between input and output. The YR40.482 does not require an additional auxiliary voltage and is self-powered even in case of a short circuit across the output.

Due to the low power losses, the unit is very slender and only requires 46mm width on the DIN rail.

Fig. 21-1 **Typical 1+1 Redundant configuration for 48V, 5A load current**



22. APPLICATION NOTES

22.1. PEAK CURRENT CAPABILITY

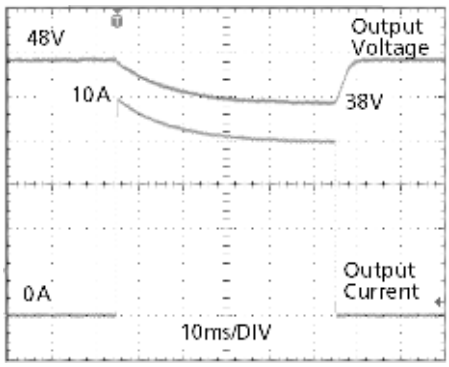
The unit can deliver peak currents (up to several milliseconds) which are higher than the specified short term currents.

This helps to start current demanding loads. Solenoids, contactors and pneumatic modules often have a steady state coil and a pick-up coil. The inrush current demand of the pick-up coil is several times higher than the steady-state current and usually exceeds the nominal output current (including the PowerBoost). The same situation applies when starting a capacitive load.

The peak current capability also ensures the safe operation of subsequent circuit breakers of load circuits. The load branches are often individually protected with circuit breakers or fuses. In case of a short or an overload in one branch circuit, the fuse or circuit breaker need a certain amount of overcurrent to open in a timely manner. This avoids voltage loss in adjacent circuits.

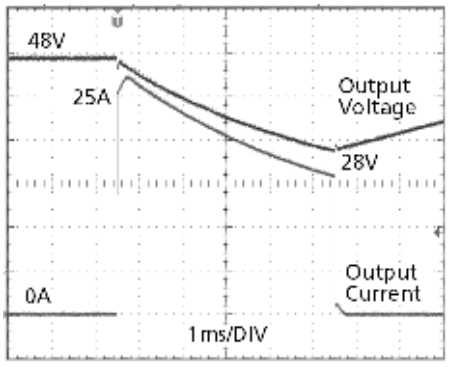
The extra current (peak current) is supplied by the power converter and the built-in large sized output capacitors of the power supply. The capacitors get discharged during such an event, which causes a voltage dip on the output. The following two examples show typical voltage dips:

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



10A Peak load (resistive) for 50ms
Output voltage dips from 48V to 38V.

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



25A Peak load (resistive) for 5ms
Output voltage dips from 48V to 28V.

Peak current voltage dips	typ.	from 48V to 38V	at 10A for 50ms, resistive load
	typ.	from 48V to 35V	at 25A for 2ms, resistive load
	typ.	from 48V to 28V	at 25A for 5ms, resistive load

22.2. BACK-FEEDING LOADS

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

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

The maximum allowed feed-back-voltage is 63Vdc. The absorbing energy can be calculated according to the built-in large sized output capacitor which is specified in chapter 6.

22.3. EXTERNAL INPUT PROTECTION

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

If an external fuse is necessary or utilized, minimum requirements need to be considered to avoid nuisance tripping of the circuit breaker. A minimum value of 10A B- or 6A C-Characteristic breaker should be used.

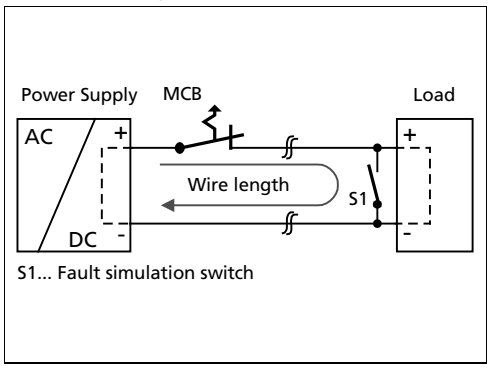
22.4. OUTPUT CIRCUIT BREAKERS

Standard miniature circuit breakers (MCB's or UL 1077 circuit breakers) are commonly used for AC-supply systems and may also be used on 48V 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 48V branches which are supplied by the same source, a fast (magnetic) tripping of the MCB is desired. A quick shutdown within 10ms is necessary corresponding roughly to the ride-through time of PLC's. This requires power supplies with high current reserves and large output capacitors. Furthermore, the impedance of the faulty branch must be sufficiently small in order for the current to actually flow. The best current reserve in the power supply does not help if Ohm's law does not permit current flow. The following table has typical test results showing which B- and C-Characteristic MCBs magnetically trip depending on the wire cross chapter and wire length.

Fig. 22-3 **Test circuit**



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

	0.75mm²	1.0mm²	1.5mm²	2.5mm²
C-2A	59m	78m	108m	157m
C-3A	36m	48m	64m	105m
C-4A	21m	27m	38m	58m
C-6A	10m	13m	19m	28m
C-8A	4m	6m	10m	14m
C-10A	3m	4m	7m	10m
B-6A	22m	30m	42m	62m
B-10A	11m	15m	25m	26m
B-13A	7m	10m	14m	18m

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

22.5. PARALLEL USE TO INCREASE OUTPUT POWER

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

22.6. PARALLEL USE FOR REDUNDANCY

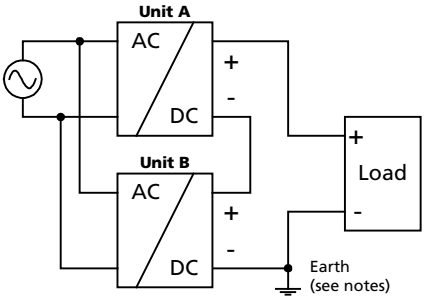
Power supplies can be paralleled for redundancy to gain higher system availability. Redundant systems require a certain amount of extra power to support the load in case one power supply unit fails. The simplest way is to put two power supplies in parallel. This is called a 1+1 redundancy. In case one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

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

Recommendations for building redundant power systems:

a) Use separate input fuses for each power supply.
b) Monitor the individual power supply units.
   Therefore, use the DC-OK relay contact of the YRM2.DIODE.
c) It is desirable to set the output voltages of all units to the same value (± 100mV) or leave it at the factory setting.

22.7. SERIES OPERATION



Power supplies of the same type can be connected in series for higher output voltages. It is possible to connect as many units in series as needed, providing the sum of the output voltage does not exceed 150Vdc. Voltages with a potential above 60Vdc are no longer SELV and can be dangerous. Such voltages must be installed with a protection against touching.

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

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

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

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

22.8. INDUCTIVE AND CAPACITIVE LOADS

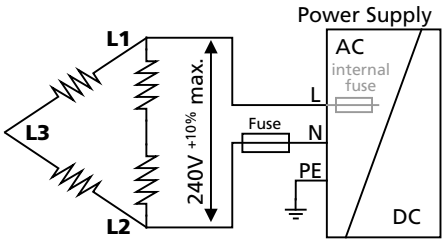
The unit is designed to supply any kind of loads, including capacitive and inductive loads.

22.9. CHARGING OF BATTERIES

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

22.10. OPERATION ON TWO PHASES

The power supply can also be used on two-phases of a three-phase-system. A phase-to-phase connection is allowed as long as the supplying voltage is below 240V$^{+10\%}$.



22.11. USE IN A TIGHTLY SEALED ENCLOSURE

When the power supply is installed in a tightly sealed enclosure, the temperature inside the enclosure will be higher than outside. In such situations, the inside temperature defines the ambient temperature for the power supply.

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

The power supply is placed in the middle of the box, no other heat producing items are inside the box

Enclosure:	Rittal Typ IP66 Box PK 9519 100, plastic, 180x180x165mm
Load:	48V, 4A; (=80%) load is placed outside the box
Input:	230Vac
Temperature inside enclosure:	48.9°C (in the middle of the right side of the power supply with a distance of 2cm)
Temperature outside enclosure:	23.2°C
Temperature rise:	25.7K

22.12. MOUNTING ORIENTATIONS

Mounting orientations other than the input terminals on the bottom require a reduction in continuous output power or a limitation in the maximum allowed ambient temperature. The amount of reduction influences the lifetime expectancy of the power supply. Therefore, two different derating curves for continuous operation can be found below:

Curve A1 Recommended output current.
Curve A2 Max allowed output current (results in approximately half the lifetime expectancy of A1).

Fig. 22-4
Mounting Orientation A
(Standard orientation)

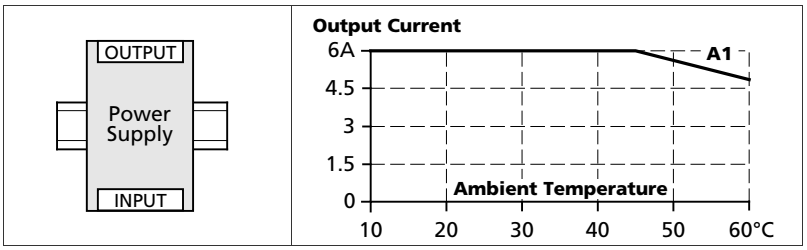


Fig. 22-5
Mounting Orientation B
(Upside down)

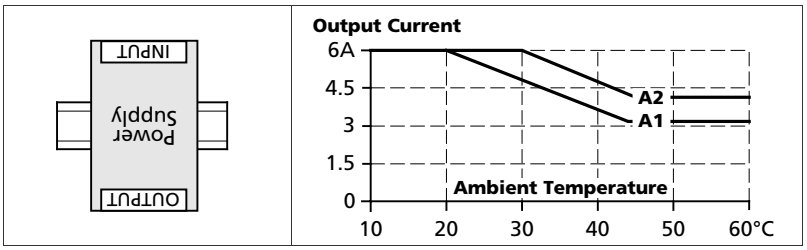


Fig. 22-6
Mounting Orientation C
(Table-top mounting)

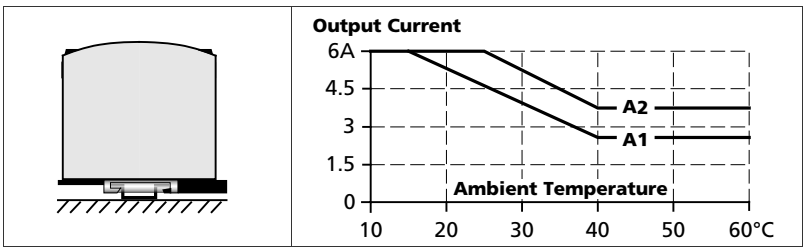


Fig. 22-7
Mounting Orientation D
(Horizontal cw)

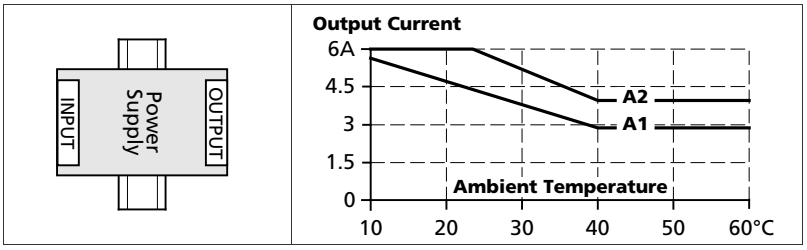


Fig. 22-8
Mounting Orientation E
(Horizontal ccw)

