

DIMENSION – Q-Series

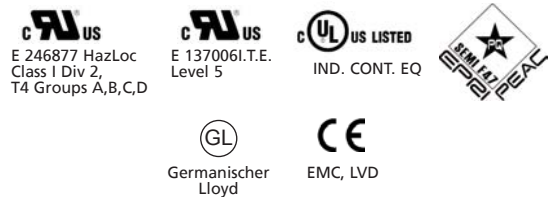


- AC 100-240V Wide-range Input
- Efficiency up to 93%
- Width only 60mm
- 150% Peak Load Capability
- Active Power Factor Correction PFC
- DC Input from 88 to 370Vdc
- Short-term Operation down to 60Vac and up to 300Vac
- Full Power Between -25°C and +60°C
- Minimal Inrush Current
- DC-OK Relay Contact
- Quick-connect Spring Clamp Terminals
- 3 Year Warranty

1. Short-form Data

Output Voltage	DC 24V	
Adjustment Range	24-28V	
Output Current	10A at 24V	continuous
	9A at 28V	continuous
	15A at 24V	for typ. 4 sec
	13.5A at 28V	for typ. 4 sec
Output Power	240W	continuous
	360W	for typ. 4 sec
Output Ripple	< 50mVpp	20MHz BW
Efficiency	92.3 / 93.0%	at 120 / 230Vac
Losses	20.0 / 18.1W	at 120 / 230Vac
Input Voltage	AC 100-240V ±15%	
AC Input Frequency	50-60Hz ±6%	
AC Input Current	2.8-1.2A	at 100-240Vac
Power Factor	0.99-0.92	at 120-230Vac
AC Inrush Current	max. 10A peak	
DC Input Voltage	DC 110-300V -20/+25%	
DC Input Current	2.4-0.9A	at 110-300Vdc
Temperature Range	-25°C to +70°C	operational
Derating	6W/°C	+60 to +70°C
Hold-up Time	typ. 27ms	at 100-240Vac
Dimensions	60x124x117mm	(WxHxD)

2. Approvals



3. Order Numbers

Power Supply	QS10.241 24-28V Power Supply
Accessory	ZM1.WALL (Wall Mounting Bracket), YR2.DIODE (Decoupling Module), SLV20.200 (Buffer Unit)

All parameters are specified at full load, 230Vac and 25°C ambient unless otherwise noted.

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Warning:

Intended Use:

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 aircrafts, trains and nuclear equipment, where malfunctioning of the power supply may cause severe personal injury or threaten a human life.

Risk of electrical shock, fire, personal injury or death:

Do not use the power supply without proper grounding (PE, Protective Earth). 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 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. Do not use the unit in area where moisture or condensation can be expected.

Disclaimer:

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

4. AC-Input

Conditions

AC input	nom.	AC 100-240V $\pm 15\%$			TN-, TT-, IT-Mains
AC input range		85-276Vac			continuous
	min.	60Vac			< 200ms
	max.	300Vac			< 500ms
Input frequency	nom.	50 - 60Hz $\pm 6\%$			
Turn-on voltage	typ.	81Vac			steady state value
Shut-down voltage	typ.	63Vac			steady state value
		AC 100V	AC 120V	AC 230V	
Input current	typ.	2.8A	2.1A	1.2A	at 24V, 10A
Power factor	typ.	0.99	0.98	0.92	at 24V, 10A
Inrush current	max.	10A _{peak}	10A _{peak}	10A _{peak}	-25°C to +70°C
Inrush energy	max.	1A ² s	1A ² s	1A ² s	-25°C to +70°C
Inrush delay	typ.	650ms	520ms	250ms	
Start-up delay	typ.	800ms	650ms	340ms	
Rise time	typ.	8ms	8ms	8ms	24V, 10A, 0mF
Rise time	typ.	15ms	15ms	15ms	24V, 10A, 10mF
Turn-on overshoot	max.	0mV	0mV	0mV	

Fig. 1: Turn-on behavior

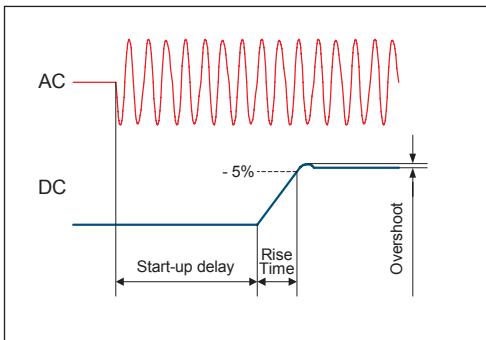


Fig. 2: Input voltage range

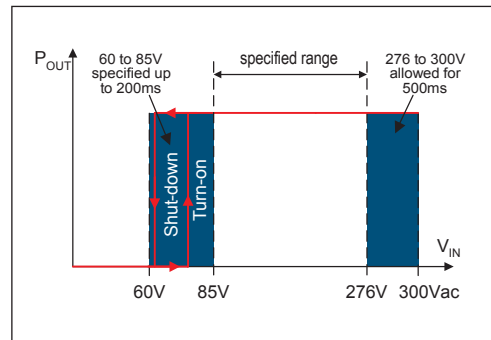


Fig. 3: Input current versus output current

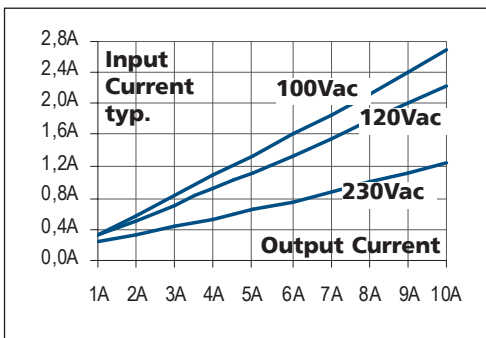


Fig. 4: Power factor versus output current

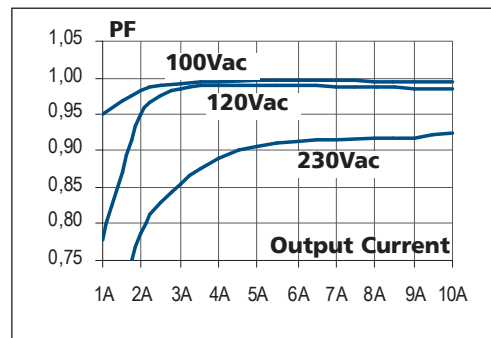
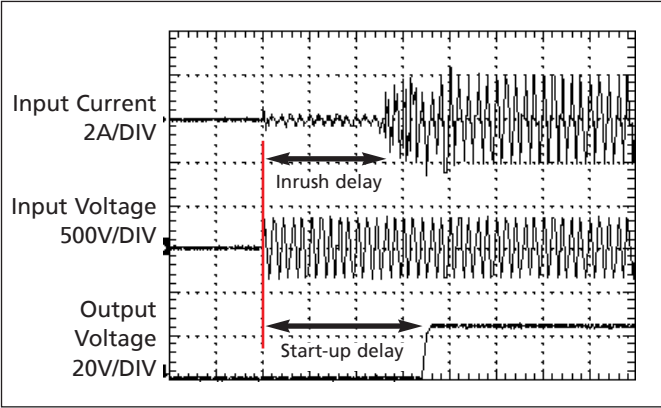


Fig. 5: Input Inrush Current

Typical measurement 230Vac, 24V, 10A, 25°C100ms/DIV



5. Output

Output voltage		DC 24V	
Adjustment range		24-28V	guaranteed
Factory set		24.1V \pm 0.2%	at full load, cold unit
Line regulation	max.	\pm 10mV	Vin min. to Vin max.
Load regulation	max.	\pm 100mV	0A -> 10A -> 0A
Ripple and noise voltage	max.	50mVpp	Bandwidth DC to 20MHz
Output capacitance	nom.	8 360 μ F	Internal included
Return voltage immunity	max.	35Vdc	
Capacitive loads		unlimited	
Inductive loads		unlimited	

The unit is designed to support loads with a higher short-term power requirement without damage or shutdown. The short-term duration is hardware controlled by a output power manager.

Continuous operation:

Output current	nom.	10A	at 24V
Output current	nom.	9A	at 28V
Output power	nom.	240W	24V, continuous
Short-circuit current	min.	8A	
Short-circuit current	max.	12.5A	

Short term power capability (BonusPower®):

Output current	nom.	15A	at 24V
Output current	nom.	13.5A	at 28V
Output power	nom.	360W	24V, short term
Short-circuit current	min.	21A	
Short-circuit current	max.	27A	
Bonus Time	typ.	4s at 15A	Duration until the output voltage starts dipping.

Fig. 6: Output Characteristic
Output voltage versus output current

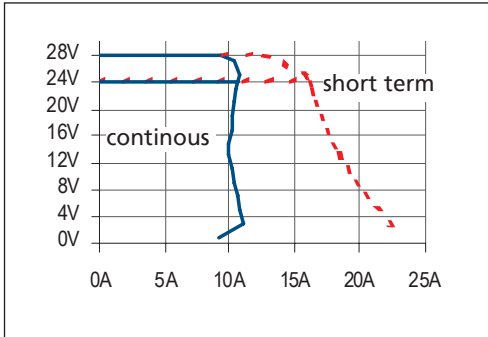


Fig. 7: Bonus Time
versus short term power capability

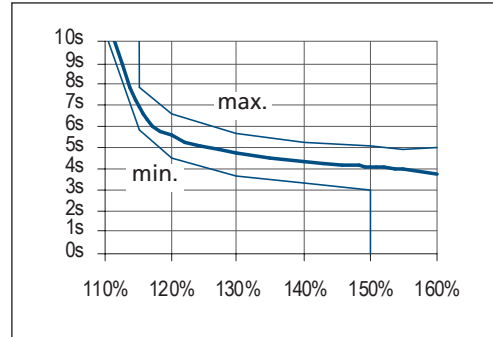


Fig. 8: BonusPower®
is available as soon as power comes on

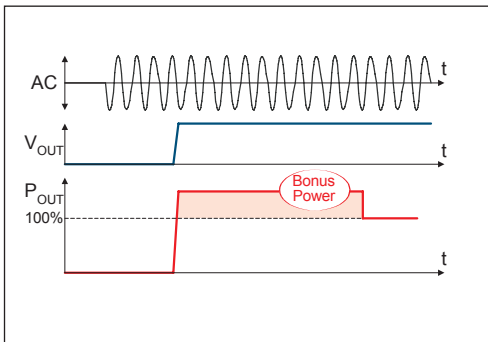
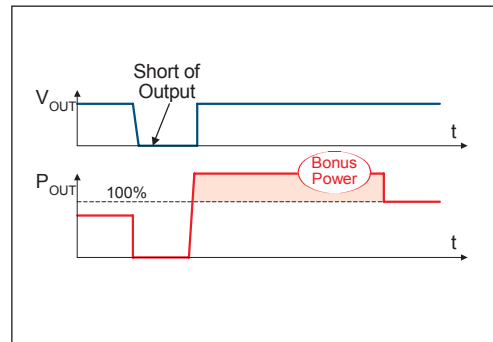


Fig. 9: BonusPower® is available immediately after the end of an output short circuit



6. Repetitive Pulse Loading

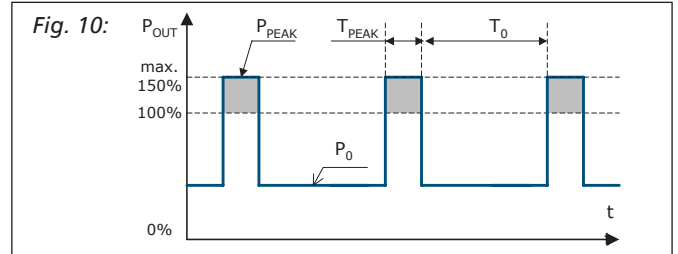
Loads with a pulse current demand can be supported.

Definitions:

P_0	Base load (W)
P_{PEAK}	Pulse load (above 100%)
T_0	Duration between pulses (s)
T_{PEAK}	Pulse duration (s)
Duty cycle	$= T_{PEAK} / (T_{PEAK} + T_0)$

Pulse load compatibility:

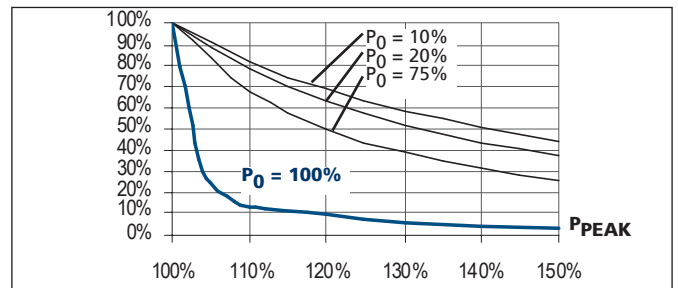
- The pulse power demand must be below 150% of the nominal power.
- The duration of the pulse power must be shorter than the allowed Bonus Time. See graph on the previous page.
- The duty cycle must be below the „Maximum Duty Cycle“ curve.
- The average (R.M.S.) output current must be below the specified continuous output current. If the R.M.S. current is higher, the unit will respond with a thermal shut-down.



Examples for pulse load compatibility:

P_{PEAK}	P_0	T_{PEAK}	T_0
360W	240W	1s	>25s
360W	0W	1s	>1.3s
360W	120W	0.1s	>0.16s
360W	120W	1s	>1.6s
360W	120W	3s	>4.9s

Fig.11: Maximum duty cycle

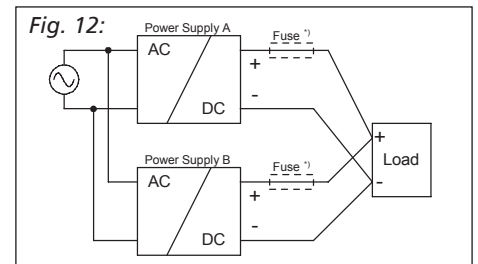


7. Parallel Operation

The power supply can be paralleled to increase the output power or to build redundant systems.

Instructions:

- For parallel operation use power supplies of the same family.
- Use load connection wires of the same gauge and length.
- Set the output voltages of all power supplies to the same value.
- A fuse is only required if more than three units are connected in parallel.
- Check the total PE touch current (earth leakage current)

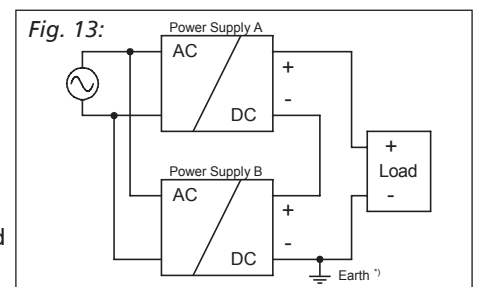


8. Serial Operation

The power supply can be put in series to increase the output voltage.

Instructions:

- It is possible to connect as many units in series as needed, providing the sum of the voltage does not exceed 150Vdc.
- For serial operation use only power supplies of the same type.
- Grounding of the output is required when the sum of the output voltage > 60Vdc.
- Avoid return voltages (e.g. from a decelerating motor or battery) which is applied to the output terminals.
- Check the total PE touch current (earth leakage current)



9. Hold-up Time

Hold-up Time	typ.	26ms	27ms	28ms	at 24V, 10A
Hold-up Time	typ.	51ms	53ms	55ms	at 24V, 5A

Fig. 14: Shut-down behavior

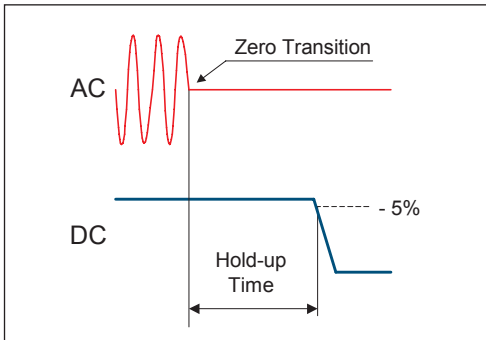
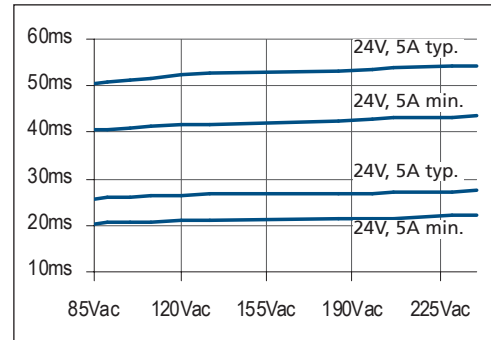


Fig. 15: Hold-up time versus input voltage



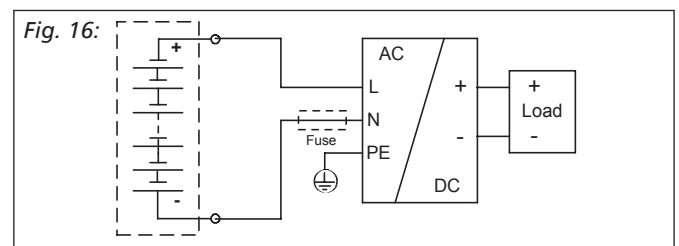
10. DC Input

Beside an AC input voltage, the unit can also be supplied with a DC input voltage.

DC input	nom.	DC 110-300V -20%/+25%	
DC input range	nom.	88-375Vdc	continuous
DC input current	typ.	2.4A at 110Vdc, 0.9A at 300Vdc	24V, 10A
Turn-on voltage	typ.	80Vdc	Steady state
Shut-down voltage	typ.	55Vdc	Steady state

Instructions for DC use:

Use a battery or similar DC source. Connect +pole to L and -pole to N. Connect the ground terminal to a PE wire or to the machine ground. In case the -pole of the battery is not rounded, use an appropriate fuse to protect the N terminal.

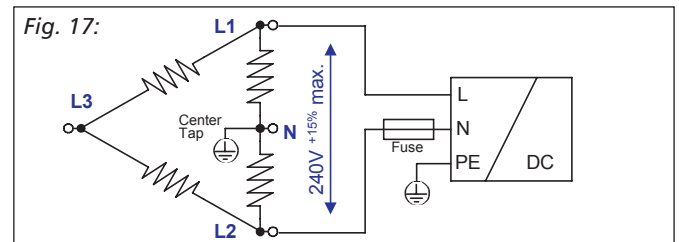


11. Operation on Two Phases

Follow the following instructions for use on two phases:

The supply voltage must be below 240V+15%.

Use a fuse or a circuit breaker to protect the N terminal. Appropriate fuses or circuit breakers are specified in the section „Protection“.



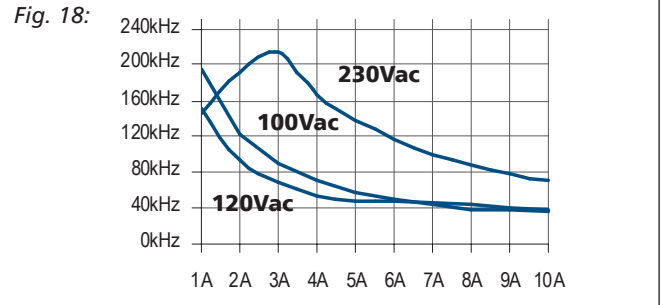
12. Switching Frequency

The power supplies has three converters with three different switching frequencies included. Two frequencies are nearly constant. One depends is input voltage and load dependent.

Switching frequency 1: nearly constant 35kHz

Switching frequency 2: nearly constant 105kHz

Switching frequency 3: input voltage and load dependent see graph on the right side



13. Monitoring Functions

Beside the DC-ok relay contact, the power supply is equipped with a green DC-ok lamp and a red overload lamp.

	DC-ok lamp	Overload lamp	DC-ok contact
Color	green	red	
Normal operating mode	ON	OFF	Closed
BonusPower® operation	ON	OFF	Closed
Overload ($V_{OUT} < 90\%$)	OFF	ON	Open
Short-circuit ($V_{OUT} = 0$)	OFF	ON	Open
Temperature shut-down	OFF	Flashing	Open
No input power	OFF	OFF	Open

14. DC-ok Relay Contact

This feature monitors the output voltage, which is produced by the power supply itself, and is independent of a return voltage from a unit which is connected in parallel.

Contact closes As soon as the output voltage reaches the adjusted value.

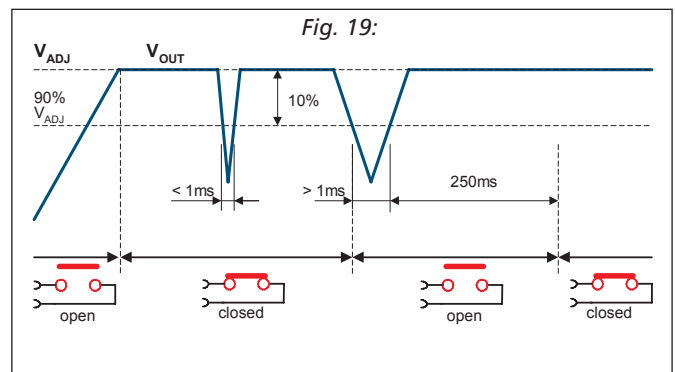
Contact opens As soon as the output voltage dips more than 10%. Short dips will be extended to a length of 250ms. Dips shorter than 1ms will be ignored.

Contact re-closes As soon as the output voltage exceeds 90% of the adjusted voltage

Contact ratings 60Vdc 0.3A, 30Vdc 1A, 30Vac 0.5A, resistive load

Note:

The DC-ok feature requires that the output voltage reach the nominal (=adjusted) level after turn-on in order to function to specification. If this level cannot be achieved, overload lamp will be on and the DC-ok contact will be open. The overload signal will shut off as soon as the adjusted voltage is reached. This is an important condition to consider particularly, if the load is a battery, the power supply is used in parallel or the power supply is used for N+1 redundant systems.



15. Efficiency and Losses

		AC 100V	AC 120V	AC 230V	
Efficiency	typ.	91.2%	92.3%	93.0%	at 24V, 10A
Power losses	typ.	23.1W	20.0W	18.1W	at 24V, 10A
Power losses	typ.	5.6W	5.7W	5.9W	at 24V, 0A

Fig. 20: Efficiency versus output current
24V

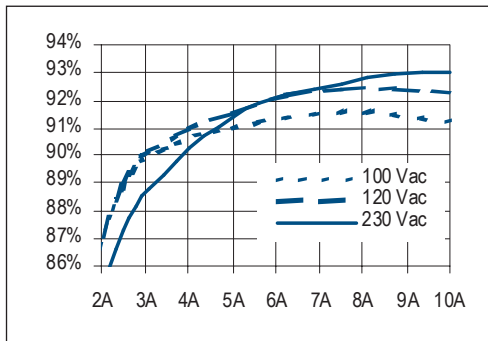


Fig. 21: Losses versus output current
24V

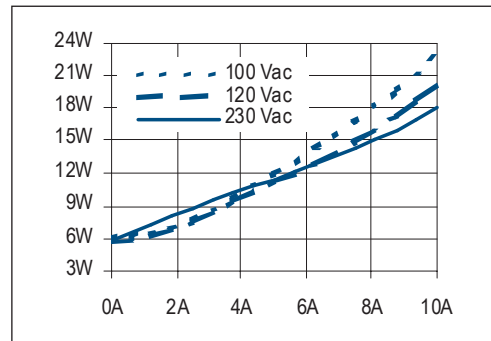


Fig. 22: Efficiency versus input voltage
24V, 10A

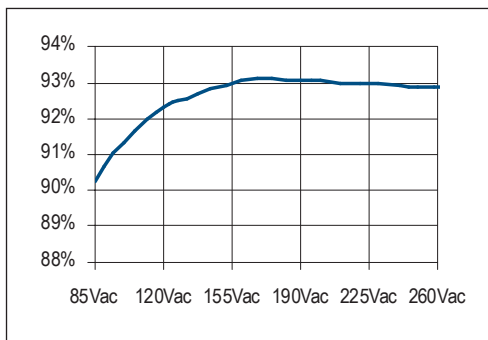
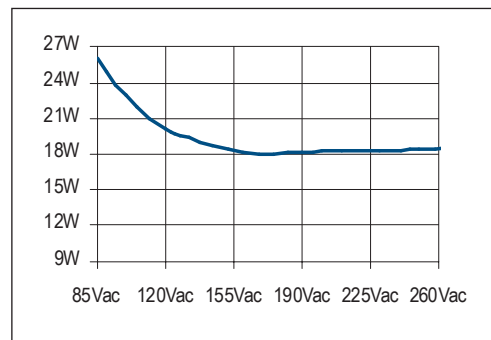


Fig. 23: Losses versus input voltage
24V, 10A



16. Reliability

	AC 100V	AC 120V	AC 230V	
Lifetime expectancy	40 000h	50 000h	57 000h	24V, 10A, 40°C
Lifetime expectancy	93 000h	100 000h	97 000h	24V, 5A, 40°C
Lifetime expectancy	114 000h	141 000h	161 000h	24V, 10A, 25°C

Lifetime expectancy according to the specification of the capacitor's manufacturer

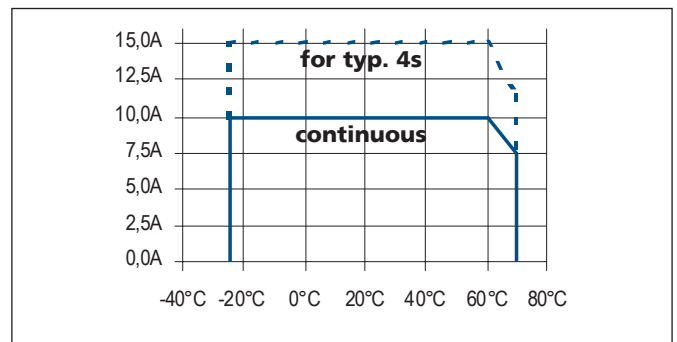
MTBF SN 29500, IEC 61709	478 000h	535 000h	581 000h	24V, 10A, 40°C
MTBF SN 29500, IEC 61709	827 000h	926 000h	1005000h	24V, 10A, 25°C

17. Environment

Operational temperature	-25°C to +70°C	reduce output power > 60°C
Output de-rating	6W/°C	60-70°C
Storage temperature	-40 to +85°C	storage, transport
Humidity	5 to 95% r.H.	no condensation allowed
Vibration sinusoidal	2-17.8Hz ±1.6mm; 17.8-500Hz 2g	IEC 60068-2-6
Vibration random	0.5m ² (s ³)	IEC 60068-2-64
Shock	15g 6ms, 10g 11ms	IEC 60068-2-27

Ambient temperature is defined 2cm below the unit.
The unit does not release any Silicon and can be use in paint shops.

Fig. 24: Allowed output current versus ambient temperature 24V



18. Terminals and Wiring

Type	Bi-stable, quick-connect spring clamp terminals. Shipped in open position.	
Solid wire	0.5-6mm ²	
Stranded wire	0.5-4mm ²	
AWG	20-10AWG	American Wire Gauge
Ferrules	Allowed, but not required	
Wire stripping length	10mm / 0.4inch	
Pull-out force	10AWG:80N, 12AWG:60N, 14AWG:50N, 16AWG:40N (UL486E)	

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 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 power supply without PE (Ground) connection!

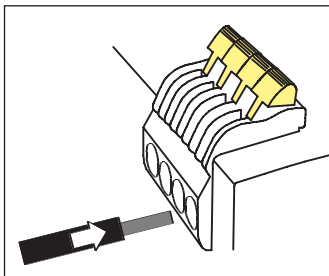


Fig. 25: 1. Insert the wire

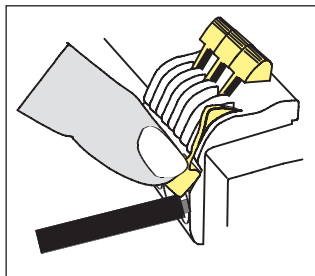


Fig. 26: 2. Snap the lever

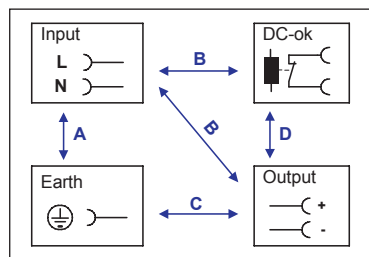
To disconnect wire: same procedure vice versa

19. Protection

Output	Electronically protected. Overload, no-load, short-circuit proof	
Output over-voltage protection	typ. 35Vdcmax. 39Vdc	In case of a defect of the internal regulation feedback loop, a redundant circuitry limits the maximum output voltage. The output shuts-down and makes restart attempts automatically.
Output voltage	< 30Vdc	At clockwise end position of pot
Degree of protection	IP 20	EN/IEC 60529
Class of protection	I	PE (Ground) connection required
Degree of pollution	2	EN 50178, not conductive
Penetration protection	> 3.5mm	e.g. screws, small parts
Over-temperature	yes	Output shut-down with automatic restart
Over-voltage category	III	EN 50178
Input transients	MOV (Metal Oxide Varistor) and active transient filter	
Internal input fuse	T6.3A	Device protection, not accessible
External protection	The unit is tested and approved for branch circuits up to 20A. External protection is only required, if the supplying branch has an ampacity greater than this. The minimum rating of an external circuit breaker or fuse shall be 6A (B-characteristic) or 4A (C-characteristic) to avoid a wrong tripping of the fuse.	

20. Safety

Separation of output	SELV PELV	IEC/EN 60950-1 EN 60204-1, EN 50178, IEC 60364-4-41
Isolation resistance	> 5MΩ	Input to output, 500Vdc
PE resistance	< 0.1Ω	Between housing and ground terminal
Touch current	< 0.32mA < 0.45mA < 0.7mA	AC 100V, 50Hz, TN mains AC 120V, 60Hz, TN mains AC 230V, 50Hz, TN mains
Output reference	The output voltage is floating and has no ohmic connection to ground.	
Grounding of output	Grounding of the output voltage is allowed. We recommend grounding the negative output pole if multiple loads are supplied.	
Dielectric Strength	<p>Fig. 27:</p>	



		A	B	C	D
Type Test	60s	2500Vac	3000Vac	500Vac	500Vac
Factory Test	5s	2500Vac	2500Vac	500Vac	500Vac
Field Test	5s	2000Vac	2000Vac	500Vac	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! Connect L and N together as well as all output poles.

21. 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/EEC and 93/68/EEC and the low-voltage directive (LVD) 73/23/EWG.

EMC Immunity

EN 61000-6-1 and EN 61000-6-2

Electrostatic discharge EN 61000-4-2	Contact discharge	8kV	Crit. A
	Air discharge	15kV	Crit. A
Electromagnetic RF field EN 61000-4-3	80MHz-1GHz	10V/m	Crit. A
Fast transients (Burst) EN 61000-4-4	Input lines	4kV	Crit. A
	Output lines	2kV	Crit. A
Surge voltage on input EN 61000-4-5	L -> N	2kV	Crit. A
	N / L -> PE	4kV	Crit. A
	+ -> -	500V	Crit. A
Surge voltage on output EN 61000-4-5	+ / - -> PE	500V	Crit. A
	0,15-80MHz	10V/m	Crit. A
Conducted disturbance EN 61000-4-6			
Mains voltage dips EN 61000-4-11	0.7x V _{IN}	70Vac, 10ms	Crit. A
	0.4x V _{IN}	40Vac, 100ms	Crit. C
	0.4x V _{IN}	40Vac, 1000ms	Crit. C
Voltage interruptions EN 61000-4-11		0Vac, 5000ms	Crit. C
Voltage sags SEMI F47 0200		96Vac, 1000ms	Crit. A
		84Vac, 500ms	Crit. A
		60Vac, 200ms	Crit. A
Input voltage swells Internal standard		300Vac, 500ms	Crit. A
Powerful transients VDE 0160		750V, 1.3ms	Crit. A

Criterion A Power supply shows normal operation behavior within the defined limits.

Criterion C Temporary loss of function is possible. Power supply might shut-down and restarts by itself.
No damages or hazards for the power supply occur.







EMC Emission

EN 61000-6-3 and EN 61000-6-4

Conducted emission input lines EN 55011, EN 55022, FCC Part 15, CISPR 11, CISPR 22	Class B
Conducted emission output lines EN 55022	Class B, independent of wire length
Radiated emission EN 55011, EN 55022	Class B
Harmonic input current EN 61000-3-2	Fulfilled, active PFC
Voltage fluctuations and 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.

22. Approvals

IEC 60950-1	CB Scheme, Information Technology Equipment	
UL 508	LISTED E 198865 Industrial Control Equipment	
UL 60950-1	RECOGNIZED E 137006 Information Technology Equipment Level 5	
UL 1604 Pending	RECOGNIZED E 246877 Class I Div 2 Hazardous Location	
Hazardous Locations	The unit is suitable for use in Class I Division 2 Groups A, B, C, D locations. Substitution of components may impair suitability for Class I Division 2 environment. Do not disconnect equipment unless power has been switched off. Wiring must be in accordance with Class I, Division 2 wiring methods of the National Electrical Code, NFPA 70, and in accordance with other local or national codes.	
Marine Pending	GL (Germanischer Lloyd) classified and ABS (American Bureau for Shipping) PDA for marine and offshore applications.	
SEMI F47	Power Quality StarRide-through compliance for semiconductor industry.	

23. Fulfilled Standards

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

25. Dimensions

Width	60mm / 2.36"	
Height	124mm / 4.88"	
Depth	117mm / 4.61"	Plus DIN-rail depth
Weight	900g / 1.98lb	
Cooling	Convection cooled, no forced air cooling required	
DIN-Rail	Use DIN-rails according to EN 60715 or EN 50022 with a height of 7.5 or 15mm	

Fig. 28:

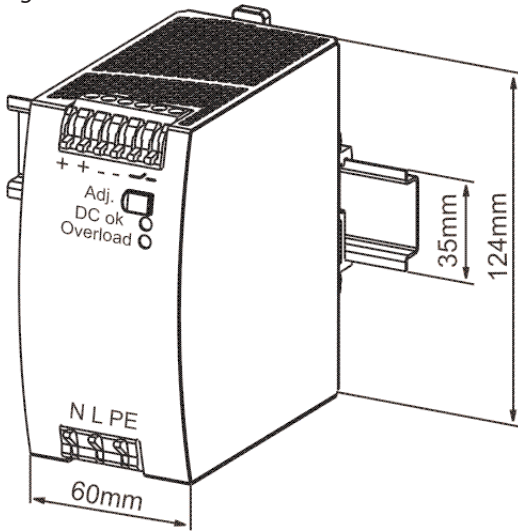


Fig. 29:

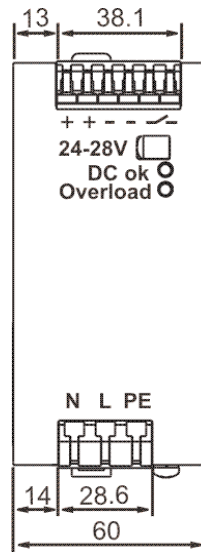
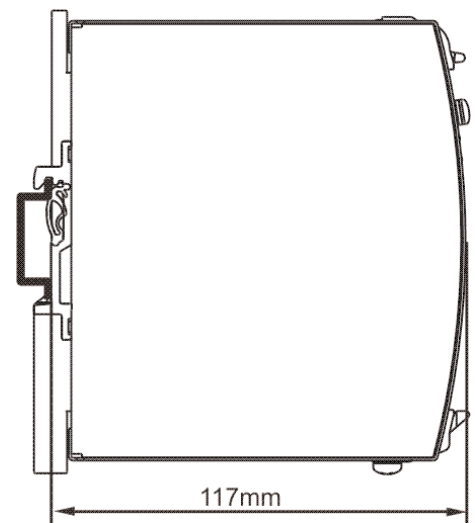


Fig. 30:



25. Mounting Orientation



Output terminal on top and input terminals on the bottom. For other orientations consult factory.

Do not obstruct air flow!

Keep installation clearances when loaded permanent with full power:

25mm on top and on the bottom, 15mm on the left and right side are recommended.