PULS
DIMENSION C-Line

CS10.244
24V, 10A, SINGLE PHASE INPUT

POWER SUPPLY
- AC 200-240V Single-Phase Input
- Width only 60mm
- Efficiency up to 91.3%
- Easy Fuse Breaking due to High Overload Peak Current
- 20% Output Power Reserves
- Full Output Power up to +60°C
- 3 Year Warranty

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

The CS10.244 includes all the essential basic functions and the devices have a power reserve of 20%. This extra current 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 unit has an input for 200-240V mains only. This supports regional applications and offers additional cost savings without sacrificing functionality.

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 DC 24V
Adjustment range 24 - 28V
Output current 10A at 24V, amb <60°C
12A at 24V, amb <45°C
8.6A at 24V, amb <60°C
10.3A at 24V, amb <45°C
Output power 240W ambient <60°C
288W ambient <45°C
Output ripple < 50mVpp 20Hz to 20MHz
AC Input voltage AC 200-240V ±10%
Mains frequency 50-60Hz ±6%
AC Input current 2.2A at 230Vac
DC Input voltage - not allowed
Power factor 0.52 at 230Vac
AC Inrush current 48A peak at 230Vac
Efficiency 91.3% at 230Vac
Losses 22.9W at 230Vac
Temperature range 0°C to +70°C operational
Derating *) 6W/°C +60 to +70°C
Hold-up time 45ms at 230Vac
Dimensions 60x124x117mm WxHxD
Weight 700g / 1.54lb

ORDER NUMBERS
Power Supply CS10.244 24-28V Standard unit (AC 200-240V-Version)
Accessory ZM1.WALL Wall mount bracket
ZM13.SIDE Side mount bracket
YRM2.DIODE Redundancy module
YR40.241 Redundancy module

MARKINGS
UL 508
UL 60950-1
Class I Div 2
Marine
EMC, LVD

All parameters are specified at 24V, 10A, 230Vac, 50Hz, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

www.pulpower.com Phone +49 89 9278 0 Germany

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1. **INTENDED USE**

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

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

This device is designed for use in hazardous, non-hazardous, ordinary or unclassified locations.

The power supply does not fulfil the harmonic current standard EN61000-3-2. Do not use this power supply when the following criteria apply:

a) the end-device is used within the European Union and
b) the end-device is connected to a public mains supply with a nominal voltage greater or equal 220Vac and
c) the power supply is:
   - fitted in an end-device with an average input power greater than 75W or
   - fitted in an end-device with a continuous input power greater than 75W or
   - part of a lighting system.

**Exception:**

End-devices for professional applications with an input power > 1000W do not need to fulfill EN 61000-3-2.

**Comments:**

- The average input power must be determined in accordance with EN 61000-3-2.
- Industrial mains supplies with their own transformer are considered to be “non-public”.
- Where individual self-contained items of equipment are installed in a rack or case (e.g. devices connected in parallel), they are regarded as being individually connected to the mains supply. The rack or case need not be tested as a whole. Alternatively it is also permitted to assess the whole rack or case. This is recommended for devices used in professional applications with an input power greater than 1000W.

If PFC according to the Harmonics Standard EN 61000-3-2 is required, please use the CS10.242.
2. INSTALLATION REQUIREMENTS

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. Mount the unit on a DIN-rail so that the input terminals are located on the bottom of the unit. For other mounting orientations see de-rating requirements in this document. See chapter 24.13. This device is designed for convection cooling and does not require an external fan. Do not obstruct airflow and do not cover ventilation grid (e.g. cable conduits) by more than 15%!

Keep the following installation clearances: 40mm on top, 20mm on the bottom, 5mm on the left and right sides are recommended when the device is loaded permanently with more than 50% of the rated power. Increase this clearance to 15mm in case the adjacent device is a heat source (e.g. another power supply).

A disconnecting means shall be provided for the output of the power supplies when used in applications according to CSA C22.2 No 107.1-01.

WARNING Risk of electrical shock, fire, personal injury or death.
- Do not use the power supply without proper grounding (Protective Earth). Use the terminal on the input block for earth connection and not one of the screws on the housing.
- Turn power off before working on the device. Protect against inadvertent re-powering.
- Make sure that 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 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 surfaces may cause burns.

Notes for use in hazardous location areas:
The power supply is suitable for use in Class I Division 2 Groups A, B, C, D locations.

WARNING EXPLOSION HAZARDS!
Substitution of components may impair suitability for this environment. Do not disconnect the unit or operate the voltage adjustment unless power has been switched off or the area is known to be non-hazardous.
3. AC-INPUT

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC input</td>
<td>AC 200-240V ±10%</td>
</tr>
<tr>
<td>Mains network systems</td>
<td>TN, TT or IT</td>
</tr>
<tr>
<td>AC input range</td>
<td>min. 180-264Vac, 264-300Vac, max. 500ms</td>
</tr>
<tr>
<td>Allowed voltage L or N to earth</td>
<td>max. 300Vac, continuous, IEC 62103</td>
</tr>
<tr>
<td>Input frequency</td>
<td>nom. 50–60Hz ±6%</td>
</tr>
<tr>
<td>Turn-on voltage</td>
<td>typ. 155Vac, steady-state value, see Fig. 3-1</td>
</tr>
<tr>
<td>Shut-down voltage</td>
<td>typ. 137Vac, steady-state value, see Fig. 3-1</td>
</tr>
<tr>
<td>Input current</td>
<td>typ. 2.2A at 230Vac, 24V, 10A, see Fig. 3-3</td>
</tr>
<tr>
<td>Power factor*)</td>
<td>typ. 0.52 at 230Vac, 24V, 10A, see Fig. 3-4</td>
</tr>
<tr>
<td>Crest factor**)</td>
<td>typ. 3.2 at 230Vac, 24V, 10A</td>
</tr>
<tr>
<td>Start-up delay</td>
<td>typ. 220ms, see Fig. 3-2</td>
</tr>
<tr>
<td>Rise time</td>
<td>typ. 35ms at 230Vac, 24V, 10A const. current load, 0mF load capacitance, see Fig. 3-2</td>
</tr>
<tr>
<td></td>
<td>typ. 75ms at 230Vac, 24V, 10A const. current load, 10mF load capacitance, see Fig. 3-2</td>
</tr>
<tr>
<td>Turn-on overshoot</td>
<td>max. 100mV, see Fig. 3-2</td>
</tr>
</tbody>
</table>

External input protection: See recommendations in chapter 22.3.

*) 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.

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Fig. 3-1 Input voltage ranges

Fig. 3-2 Turn-on behavior, definitions

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

Fig. 3-4 Power factor vs. output load

All parameters are specified at 24V, 10A, 230Vac, 50Hz, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.
4. DC-INPUT

Do not operate this power supply with DC-input voltage. Use the QS10.241 or CP10.241 unit instead.

5. INPUT INRUSH CURRENT

A NTC inrush limitation circuit limits the input inrush current after turn-on of the input voltage. The charging current into the EMI suppression capacitors is disregarded in the first microseconds after switch-on.

<table>
<thead>
<tr>
<th>Inrush current</th>
<th>max.</th>
<th>59A_{peak}</th>
<th>at 230Vac, +40°C ambient, cold start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inrush energy</td>
<td>typ.</td>
<td>48A_{peak}</td>
<td>at 230Vac, +40°C ambient, cold start</td>
</tr>
<tr>
<td></td>
<td>max.</td>
<td>3A^2 s</td>
<td>at 230Vac, +40°C ambient, cold start</td>
</tr>
</tbody>
</table>

Fig. 5-1  Typical input inrush current behavior

Input: 230Vac
Output: 24V, 10A
Ambient: +40°C

Upper curve: Input current (20A / DIV)
Medium curve: Input voltage (200V / DIV)
Lower curve: Output voltage (10V / DIV)
Time scale: 20ms / DIV

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6. OUTPUT

<table>
<thead>
<tr>
<th>Output voltage</th>
<th>nom. 24V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustment range</td>
<td>min. 24-28V guaranteed</td>
</tr>
<tr>
<td>Factory settings</td>
<td>typ. 24.1V ±0.2%, at full load, cold unit,</td>
</tr>
<tr>
<td>Line regulation</td>
<td>max. 70mV 180-300Vac</td>
</tr>
<tr>
<td>Load regulation</td>
<td>max. 100mV static value, 0A → 10A; see Fig. 6-1</td>
</tr>
<tr>
<td>Ripple and noise voltage</td>
<td>max. 50mVpp 20Hz to 20MHz, 50Ohm</td>
</tr>
<tr>
<td>Output current</td>
<td>nom. 10A at 24V, ambient temperature &lt;60°C, see Fig. 6-1</td>
</tr>
<tr>
<td>nom. 12A*) at 24V, ambient temperature &lt;45°C</td>
<td></td>
</tr>
<tr>
<td>nom. 7.5A at 24V and 70°C ambient temperature</td>
<td></td>
</tr>
<tr>
<td>nom. 8.6A at 28V, ambient temperature &lt;60°C, see Fig. 6-1</td>
<td></td>
</tr>
<tr>
<td>nom. 10.3A*) at 28V, ambient temperature &lt;45°C, see Fig. 6-1</td>
<td></td>
</tr>
<tr>
<td>nom. 6.5A at 28V and 70°C ambient temperature</td>
<td></td>
</tr>
<tr>
<td>Reduce output current linearly between +45°C and +70°C</td>
<td></td>
</tr>
<tr>
<td>Output power</td>
<td>nom. 240W continuously available</td>
</tr>
<tr>
<td>nom. 288W*) Power Boost* *)</td>
<td></td>
</tr>
<tr>
<td>Overload behavior</td>
<td>continuous current see Fig. 6-1</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>min. 14A**) load impedance &lt;100mOhm, see Fig. 6-1</td>
</tr>
<tr>
<td>max. 18A**) load impedance &lt;100mOhm, see Fig. 6-1</td>
<td></td>
</tr>
<tr>
<td>Output capacitance</td>
<td>typ. 7 000μF included inside the power supply</td>
</tr>
</tbody>
</table>

*) Power Boost
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 28.5V.

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

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7. **Hold-up Time**

<table>
<thead>
<tr>
<th>Hold-up Time</th>
<th>typ.</th>
<th>min.</th>
<th>typ.</th>
<th>min.</th>
<th>typ.</th>
<th>min.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>102ms</td>
<td>81ms</td>
<td>45ms</td>
<td>36ms</td>
<td>36ms</td>
<td>27ms</td>
</tr>
<tr>
<td></td>
<td>at 230Vac, 24V, 5A, see Fig. 7-1</td>
<td>at 230Vac, 24V, 5A, see Fig. 7-1</td>
<td>at 230Vac, 24V, 10A, see Fig. 7-1</td>
<td>at 230Vac, 24V, 10A, see Fig. 7-1</td>
<td>at 230Vac, 24V, 12A, see Fig. 7-1</td>
<td>at 230Vac, 24V, 12A, see Fig. 7-1</td>
</tr>
</tbody>
</table>

![Fig. 7-1 Hold-up time vs. input voltage](image1)

![Fig. 7-2 Shut-down behavior, definitions](image2)

**Note:** At no load, the hold-up time can be up to several seconds. The green DC-OK lamp is on during this time.
8. EFFICIENCY AND POWER LOSSES

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>typ. 91.3% at 230Vac, 24V, 10A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>typ. 90.8% at 230Vac, 24V, 12A (Power Boost)</td>
</tr>
<tr>
<td>Average efficiency$^1$</td>
<td>typ. 90.7% 25% at 2.5A, 25% at 5A, 25% at 7.5A, 25% at 10A</td>
</tr>
<tr>
<td>Power losses</td>
<td>typ. 6.9W at 230Vac, 24V, 0A</td>
</tr>
<tr>
<td></td>
<td>typ. 12.0W at 230Vac, 24V, 5A</td>
</tr>
<tr>
<td></td>
<td>typ. 22.9W at 230Vac, 24V, 10A</td>
</tr>
<tr>
<td></td>
<td>typ. 29.2W at 230Vac, 24V, 12A (Power Boost)</td>
</tr>
</tbody>
</table>

$^1$ The average efficiency is an assumption for a typical application where the power supply is loaded with 25% of the nominal load for 25% of the time, 50% of the nominal load for another 25% of the time, 75% of the nominal load for another 25% of the time and with 100% of the nominal load for the rest of the time.

Fig. 8-1  Efficiency vs. output current at 24V, typ.

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

Fig. 8-3  Efficiency vs. input voltage at 24V, 10A, typ.

Fig. 8-4  Losses vs. input voltage at 24V, 10A, typ.
9. LIFETIME EXPECTANCY AND MTBF

<table>
<thead>
<tr>
<th>Lifetime expectancy*</th>
<th>118 000h</th>
<th>at 230Vac, 24V, 5A and 40°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>334 000h*</td>
<td>at 230Vac, 24V, 5A and 25°C</td>
</tr>
<tr>
<td></td>
<td>75 000h</td>
<td>at 230Vac, 24V, 10A and 40°C</td>
</tr>
<tr>
<td></td>
<td>212 000h*</td>
<td>at 230Vac, 24V, 10A and 25°C</td>
</tr>
<tr>
<td></td>
<td>64 000h</td>
<td>at 230Vac, 24V, 12A and 40°C</td>
</tr>
<tr>
<td></td>
<td>181 000h*</td>
<td>at 230Vac, 24V, 12A and 25°C</td>
</tr>
</tbody>
</table>

MTBF**) SN 29500, IEC 61709

<table>
<thead>
<tr>
<th>MTBF**</th>
<th>910 000h</th>
<th>at 230Vac, 24V, 10A and 40°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>774 000h</td>
<td>at 230Vac, 24V, 12A and 40°C</td>
</tr>
<tr>
<td></td>
<td>1 574 000h</td>
<td>at 230Vac, 24V, 10A and 25°C</td>
</tr>
</tbody>
</table>

MTBF**) MIL HDBK 217F

<table>
<thead>
<tr>
<th>MTBF**</th>
<th>530 000h</th>
<th>at 230Vac, 24V, 10A and 40°C; Ground Benign GB40</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>477 000h</td>
<td>at 230Vac, 24V, 12A and 40°C; Ground Benign GB40</td>
</tr>
<tr>
<td></td>
<td>726 000h</td>
<td>at 230Vac, 24V, 10A and 25°C; Ground Benign GB25</td>
</tr>
</tbody>
</table>

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

10. FUNCTIONAL DIAGRAM

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The information above is a faithful representation of the content on the page. The page includes tables and diagrams that provide detailed specifications and functional diagrams for a power supply product, including lifetime expectancy, MTBF values, and a functional diagram that illustrates the internal components and connections. The text explains the meaning of lifetime expectancy and MTBF, emphasizing their importance in assessing device reliability.
# 11. TERMINALS AND WIRING

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Screw terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid wire</td>
<td>0.5-6mm²</td>
</tr>
<tr>
<td>Stranded wire</td>
<td>0.5-4mm²</td>
</tr>
<tr>
<td>American Wire Gauge</td>
<td>AWG20-10</td>
</tr>
<tr>
<td>Max. wire diameter</td>
<td>2.8mm (including ferrules)</td>
</tr>
<tr>
<td>Wire stripping length</td>
<td>7mm / 0.28inch</td>
</tr>
<tr>
<td>Screwdriver</td>
<td>3.5mm slotted or cross-head No 2</td>
</tr>
<tr>
<td>Recommended tightening torque</td>
<td>1Nm, 9lb.in</td>
</tr>
<tr>
<td>Pull-out force</td>
<td>according to UL 486E</td>
</tr>
</tbody>
</table>

**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

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: 24.1V

D DC-OK LED (green)
   On, when the voltage on the output terminals is >21V
# 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

<table>
<thead>
<tr>
<th>Test Category</th>
<th>Standard</th>
<th>Voltage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrostatic discharge</td>
<td>EN 61000-4-2</td>
<td>8kV</td>
<td>Criterion A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15kV</td>
<td>Criterion A</td>
</tr>
<tr>
<td>Electromagnetic RF field</td>
<td>EN 61000-4-3</td>
<td>80MHz-2.7GHz</td>
<td>10V/m</td>
</tr>
<tr>
<td>Fast transients (Burst)</td>
<td>EN 61000-4-4</td>
<td>input lines</td>
<td>4kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>output lines</td>
<td>2kV</td>
</tr>
<tr>
<td>Surge voltage on input</td>
<td>EN 61000-4-5</td>
<td>L → N</td>
<td>2kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L → PE, N → PE</td>
<td>4kV</td>
</tr>
<tr>
<td>Surge voltage on output</td>
<td>EN 61000-4-5</td>
<td>+ → -</td>
<td>500V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ / - → PE</td>
<td>1kV</td>
</tr>
<tr>
<td>Conducted disturbance</td>
<td>EN 61000-4-6</td>
<td>0.15-80MHz</td>
<td>10V</td>
</tr>
<tr>
<td>Mains voltage dips</td>
<td>EN 61000-4-11</td>
<td>0% of 200Vac</td>
<td>0Vac, 20ms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40% of 200Vac</td>
<td>80Vac, 200ms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70% of 200Vac</td>
<td>140Vac, 500ms</td>
</tr>
<tr>
<td>Voltage interruptions</td>
<td>EN 61000-4-11</td>
<td>5000ms</td>
<td>750V, 1.3ms</td>
</tr>
<tr>
<td>Powerful transients</td>
<td>VDE 0160</td>
<td>over entire load range</td>
<td>5000ms</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Test Category</th>
<th>Standard</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conducted emission input lines</td>
<td>EN 55011, EN 55022, FCC Part 15, CISPR 11, CISPR 22</td>
<td>Class B</td>
</tr>
<tr>
<td>Conducted emission output lines**</td>
<td>IEC/CISPR 16-1-2, IEC/CISPR 16-2-1</td>
<td>limits for DC power port according EN 61000-6-3 not fulfilled</td>
</tr>
<tr>
<td>Radiated emission</td>
<td>EN 55011, EN 55022</td>
<td>Class B</td>
</tr>
<tr>
<td>Harmonic input current</td>
<td>EN 61000-3-2</td>
<td>not fulfilled</td>
</tr>
<tr>
<td>Voltage fluctuations, flicker</td>
<td>EN 61000-3-3</td>
<td>fulfilled*</td>
</tr>
</tbody>
</table>

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*) 0°C to +70°C (32°F to 158°F) reduce output power according Fig. 14-1
Storage temperature -40°C to +85°C (-40°F to 185°F) for storage and transportation
Output de-rating 3.2W/°C 45°C to 60°C (113°F to 140°F)
6W/°C 60°C to 70°C (140°F to 158°F)
Humidity**) 5 to 95% r.h. IEC 60068-2-30
Vibration sinusoidal 2-17.8Hz: ±1.6mm; 17.8-500Hz; 2g***) IEC 60068-2-6
Shock 30g 6ms, 20g 11ms***) IEC 60068-2-27
Altitude 0 to 2000m (0 to 6560ft) without any restrictions
2000 to 6000m (6560 to 20000ft) reduce output power or ambient temperature, see Fig. 14-2
Altitude de-rating 15W/1000m or 5°C/1000m > 2000m (6500ft), see Fig. 14-2
Over-voltage category III IEC 62103, EN 50178, overvoltage category II
II altitudes up to 2000m
Degree of pollution 2 IEC 62103, EN 50178, not conductive
LABS compatibility The unit does not release any silicone or other LABS-critical substances and is suitable for use in paint shops.

*) 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

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

Fig. 14-2  Output current vs. altitude
15. PROTECTION FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output protection</td>
<td>Electronically protected against overload, no-load and short-circuits*)</td>
</tr>
<tr>
<td>Output over-voltage protection</td>
<td>typ. 35Vdc</td>
</tr>
<tr>
<td></td>
<td>max. 39Vdc</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP 20</td>
</tr>
<tr>
<td>Penetration protection</td>
<td>&gt; 3.5mm</td>
</tr>
<tr>
<td>Over-temperature protection</td>
<td>yes</td>
</tr>
<tr>
<td>Input transient protection</td>
<td>MOV (Metal Oxide Varistor)</td>
</tr>
<tr>
<td>Internal input fuse</td>
<td>included</td>
</tr>
<tr>
<td></td>
<td>not user replaceable</td>
</tr>
</tbody>
</table>

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

16. SAFETY FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input / output separation*</td>
<td>SELV IEC/EN 60950-1</td>
</tr>
<tr>
<td></td>
<td>PELV IEC/EN 60204-1, EN 50178, IEC 62103, IEC 60364-4-41</td>
</tr>
<tr>
<td>Class of protection</td>
<td>I</td>
</tr>
<tr>
<td>Isolation resistance</td>
<td>&gt; 5MOhm</td>
</tr>
<tr>
<td>PE resistance</td>
<td>&lt; 0.1Ohm</td>
</tr>
<tr>
<td>Touch current (leakage current)</td>
<td>typ. 0.64mA / 1.59mA</td>
</tr>
<tr>
<td></td>
<td>max. 0.85mA / 2.11mA</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Cut-off current setting</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 15mA</td>
<td>&gt; 15mA</td>
<td>&gt; 20mA</td>
<td></td>
</tr>
</tbody>
</table>

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.

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All parameters are specified at 24V, 10A, 230Vac, 50Hz, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.
18. APPROVALS

EC Declaration of Conformity
The CE mark indicates conformance with the
- EMC directive 2004/108/EC and the
- Low-voltage directive (LVD) 2006/95/EC

IEC 60950-1
2nd Edition
CB Scheme,
Information Technology Equipment

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

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

ANSI / ISA 12.12.01-2007
Class I Div 2
Recognized for use in Hazardous Location Class I Div 2 T3
Groups A,B,C,D systems; U.S.A. (ANSI / ISA 12.12.01-2007) and
Canada (C22.2 No. 213-M1987)

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

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

19. ROHS, REACH AND OTHER FULFILLED STANDARDS

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

REACH Directive
Directive 1907/2006/EU of the European Parliament and the
Council of June 1st, 2007 regarding the Registration,
Evaluation, Authorisation and Restriction of Chemicals
(REACH)
20. PHYSICAL DIMENSIONS AND WEIGHT

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>60mm</td>
<td>2.36”</td>
</tr>
<tr>
<td>Height</td>
<td>124mm</td>
<td>4.88”</td>
</tr>
<tr>
<td>Depth</td>
<td>117mm</td>
<td>4.61”</td>
</tr>
</tbody>
</table>

The DIN-rail height must be added to the unit depth to calculate the total required installation depth.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>700g</td>
<td>1.54lb</td>
</tr>
</tbody>
</table>

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

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Fig. 20-1  Front view

Fig. 20-2  Side view

Jul. 2015 / Rev. 2.0 DS-CS10.244-EN
All parameters are specified at 24V, 10A, 230Vac, 50Hz, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.
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.
21.3. REDUNDANCY MODULES

YRM2.DIODE – (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.

YR40.241 – (2x 20A input, 1x 40A output)

The YR40.241 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 YR40.241 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 36mm width on the DIN-rail.
22. APPLICATION NOTES

22.1. PEAK CURRENT CAPABILITY

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

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

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

<table>
<thead>
<tr>
<th>Peak current voltage dips</th>
<th>from 24V to 18.5V</th>
<th>at 20A for 50ms, resistive load</th>
</tr>
</thead>
<tbody>
<tr>
<td>typ.</td>
<td>from 24V to 17V</td>
<td>at 50A for 2ms, resistive load</td>
</tr>
<tr>
<td>typ.</td>
<td>from 24V to 12V</td>
<td>at 50A for 5ms, resistive load</td>
</tr>
</tbody>
</table>

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

Fig. 22-2  Peak load with 5x the nominal current for 5ms, typ.
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 35Vdc. 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 16A B- or 10A 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 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.

\[
\begin{array}{|c|c|c|c|c|}
\hline
& 0.75mm^2 & 1.0mm^2 & 1.5mm^2 & 2.5mm^2 \\
\hline
B-2A & 21m & 26m & 37m & 68m \\
B-3A & 15m & 21m & 30m & 51m \\
B-4A & 10m & 14m & 20m & 38m \\
B-6A & 4m & 6m & 9m & 16m \\
B-8A & 1m & 2m & 4m & 6m \\
B-10A & 1m & 2m & 3m & 4m \\
B-15A & 1m & 2m & 3m & 4m \\
\hline
\end{array}
\]

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

Fig. 22-3 Test circuit

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

\[
\begin{array}{|c|c|c|c|c|}
\hline
\text{Wire length} & 0.75mm^2 & 1.0mm^2 & 1.5mm^2 & 2.5mm^2 \\
\hline
21m & 26m & 37m & 68m \\
15m & 21m & 30m & 51m \\
10m & 14m & 20m & 38m \\
4m & 6m & 9m & 16m \\
1m & 2m & 4m & 6m \\
1m & 2m & 3m & 4m \\
1m & 2m & 3m & 4m \\
\hline
\end{array}
\]
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 QP-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.

- **Enclosure:** Rittal Typ IP66 Box PK 9519 100, plastic, 180x180x165mm
- **Load:** 24V, 8A; (=80%) load is placed outside the box
- **Input:** 230Vac
- **Temperature inside enclosure:** 49.7°C (in the middle of the right side of the power supply with a distance of 2cm)
- **Temperature outside enclosure:** 23.0°C
- **Temperature rise:** 26.7K
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)