**CS3.241**

**POWER SUPPLY**
- AC 100-240V Wide-range Input
- Width only 32mm
- NEC Class 2 Compliant
- Efficiency up to 89.8%
- Full Power Between -25°C and +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 CS3.241 includes all the essential basic functions but also includes important features of small size, high efficiency, wide temperature range and is NEC Class 2 compliant.

The wide range 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**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage</td>
<td>DC 24V</td>
</tr>
<tr>
<td>Adjustment range</td>
<td>24 - 28V</td>
</tr>
<tr>
<td>Output current</td>
<td>3.3A at 24V</td>
</tr>
<tr>
<td></td>
<td>2.7A at 28V</td>
</tr>
<tr>
<td>Output power</td>
<td>80W</td>
</tr>
<tr>
<td>Output ripple</td>
<td>max. 50mVpp 20Hz to 20MHz</td>
</tr>
<tr>
<td>AC input voltage</td>
<td>AC 100-240V ±10%</td>
</tr>
<tr>
<td>DC input voltage</td>
<td>DC 110-300V -20/+25%</td>
</tr>
<tr>
<td>Mains frequency</td>
<td>50-60Hz ±6%</td>
</tr>
<tr>
<td>AC input current</td>
<td>1.23 / 0.68A at 120 / 230Vac</td>
</tr>
<tr>
<td>DC input current</td>
<td>0.81 / 0.29A at 110 / 300Vdc</td>
</tr>
<tr>
<td>Power factor</td>
<td>0.61 / 0.56 at 120 / 230Vac</td>
</tr>
<tr>
<td>AC Inrush current</td>
<td>23 / 45A peak at 120 / 230Vac</td>
</tr>
<tr>
<td>Efficiency</td>
<td>88.0 / 89.8% at 120 / 230Vac</td>
</tr>
<tr>
<td>Losses</td>
<td>11.1 / 9.1W at 120 / 230Vac</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-25°C to +70°C operational</td>
</tr>
<tr>
<td>Derating *)</td>
<td>1.8W/°C +60 to +70°C</td>
</tr>
<tr>
<td>Hold-up time</td>
<td>29 / 120ms at 120 / 230Vac</td>
</tr>
<tr>
<td>Dimensions</td>
<td>32x124x102mm WxHxD</td>
</tr>
<tr>
<td>Weight</td>
<td>430g / 0.95lb</td>
</tr>
</tbody>
</table>

**ORDER NUMBERS**

<table>
<thead>
<tr>
<th>Component</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply</td>
<td>CS3.241</td>
<td>24-28V Standard unit</td>
</tr>
<tr>
<td>Accessory</td>
<td>ZM1.WALL</td>
<td>Wall mount bracket</td>
</tr>
<tr>
<td></td>
<td>ZM11.SIDE</td>
<td>Side mount bracket</td>
</tr>
<tr>
<td></td>
<td>YRM2.DIODE</td>
<td>Redundancy module</td>
</tr>
</tbody>
</table>

**MARKINGS**

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

Jul. 2015 / Rev. 2.0 DS-CS3.241-EN
All parameters are specified at 24V, 3.3A, 230Vac, 50Hz, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

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TERMINOLOGY, ABBREVIATIONS AND DEFINITIONS

PE and symbol PE is the abbreviation for Protective Earth and has the same meaning as the symbol ➋.
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 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.

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

AC input nom. AC 100-240V ±10%, Wide-range input
Mains network systems TN, TT or IT
AC input range min. 90-264Vac continuous operation
85-90Vac short-term or with reduced output current
264-300Vac max. 500ms
Allowed voltage L or N to earth max. 300Vac continuous, IEC 62103
Input frequency nom. 50–60Hz ±6%
Turn-on voltage typ. 75Vac steady-state value, see Fig. 3-1
Shut-down voltage typ. 58Vac steady-state value, see Fig. 3-1
External input protection See recommendations in chapter 22.3.

### AC 100V
- Input current typ. 1.48A, 1.23A, 0.68A at 24V, 3.3A, see Fig. 3-3
- Power factor*) typ. 0.62, 0.61, 0.56 at 24V, 3.3A, see Fig. 3-4
- Crest factor**) typ. 3.1, 3.2, 4.0 at 24V, 3.3A
- Start-up delay typ. 95ms, 95ms, 95ms see Fig. 3-2
- Rise time typ. 18ms, 29ms, 56ms at 24V, 3.3A const. current load, 0mF load capacitance, see Fig. 3-2
- typ. 35ms, 52ms, 92ms at 24V, 3.3A const. current load, 3.3mF load capacitance

### AC 120V
- Input current typ. 1.48A, 1.23A, 0.68A at 24V, 3.3A, see Fig. 3-3
- Power factor*) typ. 0.62, 0.61, 0.56 at 24V, 3.3A, see Fig. 3-4
- Crest factor**) typ. 3.1, 3.2, 4.0 at 24V, 3.3A
- Start-up delay typ. 95ms, 95ms, 95ms see Fig. 3-2
- Rise time typ. 18ms, 29ms, 56ms at 24V, 3.3A const. current load, 0mF load capacitance, see Fig. 3-2
- typ. 35ms, 52ms, 92ms at 24V, 3.3A const. current load, 3.3mF load capacitance

### AC 230V
- Input current typ. 1.48A, 1.23A, 0.68A at 24V, 3.3A, see Fig. 3-3
- Power factor*) typ. 0.62, 0.61, 0.56 at 24V, 3.3A, see Fig. 3-4
- Crest factor**) typ. 3.1, 3.2, 4.0 at 24V, 3.3A
- Start-up delay typ. 95ms, 95ms, 95ms see Fig. 3-2
- Rise time typ. 18ms, 29ms, 56ms at 24V, 3.3A const. current load, 0mF load capacitance, see Fig. 3-2
- typ. 35ms, 52ms, 92ms at 24V, 3.3A const. current load, 3.3mF load capacitance

Turn-on overshoot max. 400mV, 400mV, 400mV 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 24V
Fig. 3-4 Power factor vs. output load

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All parameters are specified at 24V, 3.3A, 230Vac, 50Hz, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.
4. DC-INPUT

The power supply can be supplied with an AC or DC input voltage.

**Instructions for DC-use:**

a) Use a battery or a similar DC source. A supply from the intermediate DC-bus of a frequency converter is not recommended and can cause a malfunction or damage the unit.
b) Connect +pole to L and –pole to N.
c) Connect the PE terminal to an earth wire or to the machine ground.

<table>
<thead>
<tr>
<th>DC input</th>
<th>nom.</th>
<th>DC 110-300V</th>
<th>-20% / +25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC input range</td>
<td>min.</td>
<td>88-375Vdc</td>
<td>continuous operation, observe reduced output current below 100Vdc, see Fig. 4-2.</td>
</tr>
<tr>
<td>DC input current</td>
<td>typ.</td>
<td>0.81A / 0.29A</td>
<td>at 110Vdc / 300Vdc</td>
</tr>
<tr>
<td>Allowed Voltage L/N to Earth</td>
<td>max.</td>
<td>375Vdc</td>
<td>continuous, IEC 62103</td>
</tr>
<tr>
<td>Turn-on voltage</td>
<td>typ.</td>
<td>103Vdc</td>
<td>steady state value</td>
</tr>
<tr>
<td>Shut-down voltage</td>
<td>typ.</td>
<td>50Vdc</td>
<td>steady state value</td>
</tr>
</tbody>
</table>

---

**Fig. 4-1  Wiring for DC Input**

**Fig. 4-2  Output current vs. input voltage**

All parameters are specified at 24V, 3.3A, 230Vac, 50Hz, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.
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.

<table>
<thead>
<tr>
<th></th>
<th>AC 100V</th>
<th>AC 120V</th>
<th>AC 230V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inrush current</td>
<td>max.</td>
<td>24A peak</td>
<td>28A peak</td>
</tr>
<tr>
<td></td>
<td>typ.</td>
<td>14A peak</td>
<td>16A peak</td>
</tr>
<tr>
<td></td>
<td>typ.</td>
<td>20A peak</td>
<td>23A peak</td>
</tr>
<tr>
<td>Inrush energy</td>
<td>max.</td>
<td>0.4A²s</td>
<td>0.5A²s</td>
</tr>
</tbody>
</table>

Fig. 5-1 Typical input inrush current behavior

Input: 230Vac
Output: 24V, 3.3A
Ambient: 25°C

Upper curve: Input current (20A / DIV)
Medium curve: Input voltage (500V / DIV)
Lower curve: Output voltage (20V / DIV)
Time scale: 40ms / DIV
## 6. Output

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Nominal Value</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage</td>
<td>24V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjustment range</td>
<td>24-28V</td>
<td></td>
<td>30V**¹</td>
<td>at clockwise end position of potentiometer</td>
</tr>
<tr>
<td>Factory settings</td>
<td>24.1V</td>
<td></td>
<td>±0.2% ²</td>
<td>at full load, cold unit,</td>
</tr>
<tr>
<td>Line regulation</td>
<td>50mV</td>
<td></td>
<td>90-300Vac</td>
<td></td>
</tr>
<tr>
<td>Load regulation</td>
<td>100mV</td>
<td></td>
<td>static value, 0A → 3.3A; see Fig. 6-1</td>
<td></td>
</tr>
<tr>
<td>Ripple and noise voltage</td>
<td>50mVpp</td>
<td></td>
<td>20Hz to 20MHz, 50Ohm</td>
<td></td>
</tr>
<tr>
<td>Output current</td>
<td>3.3A</td>
<td></td>
<td></td>
<td>at 24V, ambient temperature &lt;60°C, see Fig. 6-1</td>
</tr>
<tr>
<td></td>
<td>2.5A</td>
<td></td>
<td></td>
<td>at 24V and 70°C ambient temperature</td>
</tr>
<tr>
<td></td>
<td>2.7A</td>
<td></td>
<td></td>
<td>at 28V, ambient temperature &lt;60°C, see Fig. 6-1</td>
</tr>
<tr>
<td></td>
<td>2.1A</td>
<td></td>
<td></td>
<td>at 28V and 70°C ambient temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reduce output current linearly between +60°C and +70°C</td>
</tr>
<tr>
<td>Output power</td>
<td>80W</td>
<td></td>
<td></td>
<td>continuously available</td>
</tr>
<tr>
<td>Overload behavior</td>
<td>continuous</td>
<td></td>
<td></td>
<td>see Fig. 6-1</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>4A**¹</td>
<td></td>
<td></td>
<td>load impedance &lt;250mOhm, see Fig. 6-1</td>
</tr>
<tr>
<td></td>
<td>8A**¹</td>
<td></td>
<td></td>
<td>load impedance &lt;250mOhm, see Fig. 6-1</td>
</tr>
<tr>
<td>Output capacitance</td>
<td>1 450μF</td>
<td></td>
<td></td>
<td>included inside the power supply</td>
</tr>
</tbody>
</table>

*) 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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All parameters are specified at 24V, 3.3A, 230Vac, 50Hz, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.
7. **Hold-up Time**

<table>
<thead>
<tr>
<th></th>
<th>AC 100V</th>
<th>AC 120V</th>
<th>AC 230V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hold-up Time</td>
<td>typ. 38ms</td>
<td>60ms</td>
<td>244ms at 24V, 1.65A, see Fig. 7-1</td>
</tr>
<tr>
<td></td>
<td>min. 29ms</td>
<td>45ms</td>
<td>200ms at 24V, 1.65A, see Fig. 7-1</td>
</tr>
<tr>
<td></td>
<td>typ. 19ms</td>
<td>29ms</td>
<td>120ms at 24V, 3.3A, see Fig. 7-1</td>
</tr>
<tr>
<td></td>
<td>min. 15ms</td>
<td>23ms</td>
<td>95ms at 24V, 3.3A, see Fig. 7-1</td>
</tr>
</tbody>
</table>

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

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

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

All parameters are specified at 24V, 3.3A, 230Vac, 50Hz, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.
8. EFFICIENCY AND POWER LOSSES

<table>
<thead>
<tr>
<th></th>
<th>AC 100V</th>
<th>AC 120V</th>
<th>AC 230V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>86.4%</td>
<td>88.0%</td>
<td>89.8%</td>
</tr>
<tr>
<td>Average efficiency(\textsuperscript{1})</td>
<td>87.4%</td>
<td>88.4%</td>
<td>87.7%</td>
</tr>
<tr>
<td>Power losses</td>
<td>1.0W</td>
<td>1.1W</td>
<td>1.8W</td>
</tr>
<tr>
<td></td>
<td>5.4W</td>
<td>4.9W</td>
<td>5.9W</td>
</tr>
<tr>
<td></td>
<td>12.5W</td>
<td>11.1W</td>
<td>9.1W</td>
</tr>
</tbody>
</table>

\(\textsuperscript{1})\) 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.
9. LIFETIME EXPECTANCY AND MTBF

<table>
<thead>
<tr>
<th>Component</th>
<th>AC 100V</th>
<th>AC 120V</th>
<th>AC 230V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifetime expectancy¹)</td>
<td>98 000h</td>
<td>106 000h</td>
<td>120 000h</td>
</tr>
<tr>
<td></td>
<td>277 000h²)</td>
<td>300 000h³)</td>
<td>338 000h²)</td>
</tr>
<tr>
<td></td>
<td>57 000h</td>
<td>64 000h</td>
<td>77 000h</td>
</tr>
<tr>
<td></td>
<td>160 000h²)</td>
<td>180 000h³)</td>
<td>218 0000h²)</td>
</tr>
<tr>
<td>MTBF²) SN 29500, IEC 61709</td>
<td>1 788 000h</td>
<td>1 901 000h</td>
<td>2 243 000h</td>
</tr>
<tr>
<td></td>
<td>3 131 000h</td>
<td>3 287 000h</td>
<td>3 796 000h</td>
</tr>
<tr>
<td>MTBF²) MIL HDBK 217F</td>
<td>849 000h</td>
<td>854 000h</td>
<td>886 000h</td>
</tr>
<tr>
<td></td>
<td>1 088 000h</td>
<td>1 095 000h</td>
<td>1 153 000h</td>
</tr>
<tr>
<td></td>
<td>195 000h</td>
<td>196 000h</td>
<td>214 000h</td>
</tr>
<tr>
<td></td>
<td>246 000h</td>
<td>246 000h</td>
<td>272 000h</td>
</tr>
</tbody>
</table>

¹) 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.

²) 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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All parameters are specified at 24V, 3.3A, 230Vac, 50Hz, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.
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.

A detailed EMC report is available on request.

EMC Immunity

<table>
<thead>
<tr>
<th>EMC Immunity</th>
<th>According generic standards: EN 61000-6-1 and EN 61000-6-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrostatic discharge</td>
<td>EN 61000-4-2  contact discharge 8kV, Criterion A 15kV, Criterion A</td>
</tr>
<tr>
<td>Electromagnetic RF field</td>
<td>EN 61000-4-3  80MHz-2.7GHz, 10V/m, Criterion A</td>
</tr>
<tr>
<td>Fast transients (Burst)</td>
<td>EN 61000-4-4  input lines 4kV, output lines 2kV, Criterion A</td>
</tr>
<tr>
<td>Surge voltage on input</td>
<td>EN 61000-4-5  L → N 2kV, Criterion A  L → PE, N → PE 4kV, Criterion A</td>
</tr>
<tr>
<td>Surge voltage on output</td>
<td>EN 61000-4-5  + → - 500V, Criterion A  + / - → PE 1kV, Criterion A</td>
</tr>
<tr>
<td>Conducted disturbance</td>
<td>EN 61000-4-6  0.15-80MHz 10V, Criterion A</td>
</tr>
<tr>
<td>Mains voltage dips</td>
<td>EN 61000-4-11  0% of 100Vac 0Vac, 20ms, Criterion B *) 40% of 100Vac 40Vac, 200ms, Criterion C 70% of 100Vac 70Vac, 500ms, Criterion A 0% of 200Vac 0Vac, 20ms, Criterion A 40% of 200Vac 80Vac, 200ms, Criterion A 70% of 200Vac 140Vac, 500ms, Criterion A</td>
</tr>
<tr>
<td>Voltage interruptions</td>
<td>EN 61000-4-11  5000ms, Criterion C</td>
</tr>
<tr>
<td>Powerful transients</td>
<td>VDE 0160  over entire load range 750V, 1.3ms, Criterion A</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.
*) Criterion A is fulfilled below 2.8A output current

EMC Emission

<table>
<thead>
<tr>
<th>EMC Emission</th>
<th>According generic standards: EN 61000-6-3, EN 61000-6-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conducted emission input lines</td>
<td>EN 55011, EN 55022, FCC Part 15, CISPR 11, CISPR 22  Class B</td>
</tr>
<tr>
<td>Conducted emission output lines**</td>
<td>IEC/CISPR 16-1-2, IEC/CISPR 16-2-1 limits for DC power port according EN 61000-6-3 not fulfilled</td>
</tr>
<tr>
<td>Radiated emission</td>
<td>EN 55011, EN 55022  Class B</td>
</tr>
<tr>
<td>Harmonic input current</td>
<td>EN 61000-3-2  fulfilled</td>
</tr>
<tr>
<td>Voltage fluctuations, flicker</td>
<td>EN 61000-3-3  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

50kHz to 450kHz  Main converter, input voltage and load dependent

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All parameters are specified at 24V, 3.3A, 230Vac, 50Hz, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

www.pulspower.com  Phone +49 89 9278 0  Germany
## 14. ENVIRONMENT

**Operational temperature***) -25°C to +70°C (-13°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** 1.8W/°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** 5W/1000m or 5°C/1000m > 2000m (6500ft), see Fig. 14-2  
**Over-voltage 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  
**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  
*****) 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.](image1)  
![Fig. 14-2  Output current vs. altitude](image2)

---

All parameters are specified at 24V, 3.3A, 230Vac, 50Hz, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.
15. PROTECTION FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output protection</strong></td>
<td>Electronically protected against overload, no-load and short-circuits*)</td>
</tr>
<tr>
<td><strong>Output over-voltage protection</strong></td>
<td>typ. 34Vdc max. 39Vdc</td>
</tr>
<tr>
<td><strong>Degree of protection</strong></td>
<td>IP 20 EN/IEC 60529 Caution: For use in a controlled environment according to CSA 22.2 No 107.1-01.</td>
</tr>
<tr>
<td><strong>Penetration protection</strong></td>
<td>&gt; 3.5mm e.g. screws, small parts</td>
</tr>
<tr>
<td><strong>Over-temperature protection</strong></td>
<td>no</td>
</tr>
<tr>
<td><strong>Input transient protection</strong></td>
<td>MOV (Metal Oxide Varistor)</td>
</tr>
<tr>
<td><strong>Internal input fuse</strong></td>
<td>included 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><strong>Input / output separation</strong></td>
<td>SELV IEC/EN 60950-1 PELV IEC/EN 60204-1, EN 50178, IEC 62103, IEC 60364-4-41</td>
</tr>
<tr>
<td><strong>Class of protection</strong></td>
<td>I PE (Protective Earth) connection required</td>
</tr>
<tr>
<td><strong>Isolation resistance</strong></td>
<td>&gt; 5MOhm input to output, 500Vdc</td>
</tr>
<tr>
<td><strong>PE resistance</strong></td>
<td>&lt; 0.1Ohm between housing and PE terminal</td>
</tr>
<tr>
<td><strong>Touch current (leakage current)</strong></td>
<td>typ. 0.16mA / 0.35mA 100Vac, 50Hz, TN-,TT-mains / IT-mains</td>
</tr>
<tr>
<td></td>
<td>typ. 0.24mA / 0.52mA 120Vac, 60Hz, TN-,TT-mains / IT-mains</td>
</tr>
<tr>
<td></td>
<td>typ. 0.41mA / 0.85mA 230Vac, 50Hz, TN-,TT-mains / IT-mains</td>
</tr>
<tr>
<td></td>
<td>max. 0.22mA / 0.43mA 110Vac, 50Hz, TN-,TT-mains / IT-mains</td>
</tr>
<tr>
<td></td>
<td>max. 0.32mA / 0.63mA 132Vac, 60Hz, TN-,TT-mains / IT-mains</td>
</tr>
<tr>
<td></td>
<td>max. 0.57mA / 1.08mA 264Vac, 50Hz, TN-,TT-mains / IT-mains</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.

![Dielectric strength diagram](image)

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Duration</th>
<th>Voltage A</th>
<th>Voltage B</th>
<th>Voltage C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type test</td>
<td>60s</td>
<td>2500Vac</td>
<td>3000Vac</td>
<td>500Vac</td>
</tr>
<tr>
<td>Factory test</td>
<td>5s</td>
<td>2500Vac</td>
<td>2500Vac</td>
<td>500Vac</td>
</tr>
<tr>
<td>Field test</td>
<td>5s</td>
<td>2000Vac</td>
<td>2000Vac</td>
<td>500Vac</td>
</tr>
<tr>
<td>Cut-off current setting</td>
<td>&gt; 10mA</td>
<td>&gt; 10mA</td>
<td>&gt; 10mA</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.
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

IECEE 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.

NEC CLASS 2

Listed as Limited Power Source (LPS) in the UL 60950-1 UL
report. According to NEC (National Electrical Code) Article
725-41 (4).

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

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>32mm</td>
<td>1.26”</td>
</tr>
<tr>
<td>Height</td>
<td>124mm</td>
<td>4.88”</td>
</tr>
<tr>
<td>Depth</td>
<td>102mm</td>
<td>4.02”</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Weight</th>
<th>430g / 0.95lb</th>
</tr>
</thead>
</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

---

![Fig. 20-1 Front view](image1)

![Fig. 20-2 Side view](image2)

---

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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. ZM11.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 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.

---

**Fig. 21-1** Typical 1+1 Redundant configuration for 3.3A load current

![Typical 1+1 Redundant configuration for 3.3A load current](image)
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:

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

<table>
<thead>
<tr>
<th>Output Voltage</th>
<th>Output Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>24V</td>
<td>0A</td>
</tr>
</tbody>
</table>
| 6.6A Peak load (resistive) for 50ms  
Output voltage dips from 24V to 12.5V. |

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

<table>
<thead>
<tr>
<th>Output Voltage</th>
<th>Output Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>24V</td>
<td>0A</td>
</tr>
</tbody>
</table>
| 16.5A Peak load (resistive) for 5ms  
Output voltage dips from 24V to 7V. |

<table>
<thead>
<tr>
<th>Peak current voltage dips</th>
<th>typ.</th>
<th>from 24V to 12.5V</th>
<th>at 6.6A for 50ms, resistive load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>typ.</td>
<td>from 24V to 12.5V</td>
<td>at 16.5A for 2ms, resistive load</td>
</tr>
<tr>
<td></td>
<td>typ.</td>
<td>from 24V to 17V</td>
<td>at 16.5A for 5ms, resistive load</td>
</tr>
</tbody>
</table>

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 10A B- or 6A C-Characteristic breaker should be used.

22.4. **PARALLEL USE TO INCREASE OUTPUT POWER**

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

22.5. **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 22.4.

**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.

22.6. **CHARGING OF BATTERIES**

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

22.10. 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 9516 100, plastic, 110x180x165mm
Input: 230Vac
Load: 24V, 3.3A; (=100%) load is placed outside the box
Temperature inside enclosure: 45.7°C (in the middle of the right side of the power supply with a distance of 2cm)
Temperature outside enclosure: 27.3°C
Temperature rise: 18.4K

Load: 24V, 2.64A; (=80%) load is placed outside the box
Temperature inside enclosure: 41.8°C (in the middle of the right side of the power supply with a distance of 2cm)
Temperature outside enclosure: 26.5°C
Temperature rise: 15.3K

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22.11. 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. 22-3**  
Mounting Orientation A  (Standard orientation)

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

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

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

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