24 V 240 W 2 Phase / DRP-24V240W2BN





Highlights & Features

- Designed for single phase input 180-305 Vac (for L-N) or 2 of 3-Phase system 2 x 180-550 Vac (for L-L) or 254-780 Vdc
- Compact and corrosion resistant aluminium casing
- High Efficiency > 90.0%
- Conforms to harmonic current IEC/EN 61000-3-2, Class A
- Wide operating temperature range from -30°C to +70°C
- Built-in DC OK Contact
- Conformal coating on PCBAs to protect against common dust and chemical pollutants
- Certified according to IEC/EN/UL 62368-1

Safety Standards











CB Certified for worldwide use

Model Number: Unit Weight: Dimensions (L x W x D): 124 x 60 x 117 mm

DRP-24V240W2BN 0.81 kg (1.79 lb) (4.88 x 2.36 x 4.61 inch)

General Description

The CliQ II DIN rail power supply series with a model offering two phase 2 x 180-550 Vac (for L-L) or single phase 180-305 Vac (for L-N) for 24 V/10 A output. The DRP-24V240W2BN has safety approvals for single phase and two phase input according to IEC/EN/UL 60950-1, IEC/EN/UL 62368-1 and UL 508 safety standards. The product features wide AC input voltage for single or two phase range. Such feature can protect the power supply from damage when user accidentally apply two phase input on the single phase power supply. Other advantages include reduced external input protection components and improved installation time since there is only two phase connection. The product performs under wide operating temperature from -30°C to 70°C with 2-Phase of 3-Phase application (for L-L). Conformal coating is applied on the PCBA to protect against common dust and chemical pollutant to withstand harsh industrial environments. Other major safety approvals included.

Model Information

CliQ II DIN Rail Power Supply

| Model Number | Input Voltage Range | Rated Output Voltage | Rated Output Current |
|----------------|--|----------------------|----------------------|
| DRP-24V240W2BN | 2 x 180-550 Vac (2-Phase) 180-305 Vac (Single Phase) 254-780 Vdc | 24 Vdc | 10.0 A |

Model Numbering

| DR | P – | 24V | 240W | 2 | В | N |
|----------|--------------|----------------|--------------|-----------|----------------|--|
| DIN Rail | Power Supply | Output Voltage | Output Power | Two Phase | CliQ II Series | N - Metal Case, without Class I, Div 2 and ATEX |



24 V 240 W 2 Phase / DRP-24V240W2BN

Specifications

Input Ratings / Characteristics

| | | 2 x 200-500 Vac (2-Phase) 200-277 Vac (Single Phase) | | |
|---------------------------------|---------|---|--|--|
| Input Voltage Range | | 2 x 180-550 Vac (2-Phase) 180-305 Vac (Single Phase) | | |
| Nominal Input Frequency | | 50-60 Hz | | |
| Input Frequency Range | | 47-63 Hz | | |
| DC Input Voltage Range* | | 254-780 Vdc | | |
| Input Current | | < 2.00 A @ 2 x 230 Vac, < 1.00 A @ 2 x 400 Vac | | |
| Efficiency at 100% Load | | > 90.0% @ 2 x 400 Vac | | |
| Max Power Dissipation | 0% load | < 8.5 W @ 2 x 200 Vac, < 9.5 W @ 2 x 500 Vac | | |
| 100% load | | < 26.5 W @ 2 x 200 Vac, < 21.5 W @ 2 x 500 Vac | | |
| Max Inrush Current (Cold Start) | | < 50 A @ 2 x 200 Vac & 2 x 500 Vac | | |
| Leakage Current | | < 3.5 mA @ 500 Vac | | |

^{*}Safety approval according to IEC/EN/UL 60950-1 and IEC/EN/UL 62368-1.

Output Ratings / Characteristics**

| Nominal Output Voltage | | 24 Vdc | | |
|--|---------------------|--|--|--|
| Factory Set Point Tolerance | | 24 Vdc ± 2% | | |
| Output Voltage Adjustment Range | | 24-28 Vdc | | |
| Output Current | | 10.0 A (continuously operating at 24 V) 12.0 A (Power Boost for 3 seconds at 24 V, refer to the detail in the Functions section) | | |
| Output Power | | 240 W (continuously operating at 24 V) 288 W (Power Boost for 3 seconds at 24 V, refer to the detail in the Functions section) | | |
| Line Regulation | | < 0.5% (@ 200-550 Vac input, 100% load) | | |
| Load Regulation | | < 1.0% (@ 200-550 Vac input, 0-100% load) | | |
| PARD*** (20 MHz) | | < 150 mVpp @ -10°C and above < 200 mVpp @ below -10°C | | |
| Rise Time | | < 100 ms @ nominal input (100% load) | | |
| Start-up Time | | < 1,000 ms @ nominal input (100% load) | | |
| Hold-up Time | | > 18 ms @ 2 x 230 Vac, > 30 ms @ 2 x 400 Vac (100% load) | | |
| Dynamic Response (Overshoot & Undershoot O/P Voltage) | | ± 5% @ 180-550 Vac input, 0-100% load (Slew Rate: 0.1 A/µs, 50% duty cycle @ 5Hz) | | |
| Start-up with Capacitive Loads | | 10,000 μF Max | | |
| Functional | DC OK Relay Contact | 30 V / 1 A Max The relay is usually closed when the output is normal | | |



^{**}For power de-rating from 50°C to 70°C, see power de-rating on page 3.
***PARD is measured with an AC coupling mode, 5cm wires, and in parallel with 0.1 µF ceramic capacitor & 47 µF electrolytic capacitor.

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Mechanical

| Case Cover / Chassis | | Aluminium | | |
|-----------------------------------|--------|--|--|--|
| Dimensions (L x W x D) | | 124 x 60 x 117 mm (4.88 x 2.36 x 4.61 inch) | | |
| Unit Weight | | 0.81 kg (1.79 lb) | | |
| Indicator Green LED | | DC OK | | |
| Cooling System | | Convection | | |
| Terminal | Input | 3 Pins (Rated 600V/35 A) | | |
| | Output | 4 Pins (Rated 300 V/28 A) | | |
| Wire | Input | AWG 18-8 | | |
| | Output | AWG 16-12* | | |
| Mounting Rail | | Standard TS35 DIN Rail in accordance with EN 60715 | | |
| Noise (1 Meter from power supply) | | Sound Pressure Level (SPL) < 40 dBA | | |

^{*}For AWG 16-12, ensure that all output terminals are connected.

Environment

| Surrounding Air Temperature | Operating | -30°C to +70°C | ; | |
|-----------------------------|---------------------|--|---|--|
| | Storage | -40°C to +85°C | | |
| Power De-rating | Vertical Mounting | > 50°C de-rate power by 2.25% / °C | | |
| | Horizontal Mounting | > 30°C de-rate | power by 2% / °C | |
| | Input Voltage | < 200 Vac de-ra | ate power by 0.5% / Vac | |
| Operating Humidity | | 5 to 95% RH (N | Non-Condensing) | |
| Operating Altitude | | 0 to 2,500 Meters (8,200 ft.) for ITE application 0 to 2,000 Meters (6,560 ft.) for Industrial application | | |
| Shock Test | Non-Operating | IEC 60068-2-27, 30G (300m/S²) for a duration of 18ms, 1 times per direction, 3 times in total | | |
| Vibration Non-Operating | | IEC 60068-2-6, 10 Hz to 500 Hz @ 30 m/S² (3 G peak); 60 min per axis for all X, Y, Z direction | | |
| Bump Test Operating | | IEC 60068-2-29, Half Sine Wave: 10 G for a duration of 17 1,000 times per direction, 6,000 times in total | | |
| Over Voltage Category | | III | According to IEC/EN 62477-1 / EN 60204-1 (clearance and creepage distances) and IEC 62103 (safety part) | |
| Pollution Degree | | 2 | | |

Protections

| 32 V ±10%, SELV Output, Hiccup Mode, Non-Latching (Auto-Recovery) |
|---|
| > 120-180% of rated load current, Constant current, Hiccup Mode (Auto-Recovery) |
| < 80°C Surrounding Air Temperature @ 100% load, Non-Latching (Auto-Recovery) |
| Hiccup Mode, Non-Latching (Auto-Recovery when the fault is removed) |
| T 3.15 A |
| IP20 |
| Class I with PE* connection |
| |

^{*}PE: Primary Earth



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Reliability Data

| MTBF | > 500,000 hrs. as per Telcordia SR-332 l/P: 2 x 200 Vac & 500 Vac, O/P: 100% load, Ta: 25°C |
|------------------------|---|
| Expected Cap Life Time | 10 years (2 x 200 Vac & 500 Vac, 50% load @ 40°C) |

Safety Standards / Directives

| Electrical Equipment of Machines | | EN/BS EN 60204-1 (over voltage category III) | | |
|--|-------------------|--|--|--|
| Electrical Equipment for Use in Electrical Power Installations | | IEC/EN/BS EN 62477-1 / IEC 62103 | | |
| Safety Entry Low Voltage | | SELV (IEC 60950-1) | | |
| Electrical Safety | SIQ Bauart | EN 62368-1 | | |
| | UL/cUL recognized | UL 60950-1 and CSA C22.2 No. 60950-1 (File No. E191395) UL 62368-1 and CSA C22.2 No. 62368-1 (File No. E191395) | | |
| | CB scheme | IEC 60950-1, IEC 62368-1 | | |
| | UKCA | BS EN 62368-1 | | |
| Industrial Control Equipment | UL/cUL listed | UL 508 and CSA C22.2 No. 107.1-01 (File No. E315355) | | |
| | CSA | CSA C22.2 No. 107.1-01 (File No. 181564) | | |
| CE | | In conformance with EMC Directive 2014/30/EU and Low Voltage Directive 2014/35/EU | | |
| UKCA | | In conformance with Electrical Equipment (Safety) Regulations 2016 No. 1011 and | | |
| | | The Electromagnetic Compatibility Regulations 2016 No. 109 | | |
| Galvanic Isolation | Input to Output | 4.0 KVac | | |
| | Input to Ground | 2.0 KVac | | |
| | Output to Ground | 1.5 KVac | | |



24 V 240 W 2 Phase / DRP-24V240W2BN

EMC

| Emissions (CE & RE) | | Generic Standards: CISPR 32, EN/BS EN 55032, CISPR 11, EN/BS EN 55011, FCC Title 47: Class B EN/BS EN 61204-3 | | |
|--|----------------|--|--|--|
| Component Power Supply for General Use | | | | |
| Immunity | | Generic Standards: EN/BS EN 55024, EN/BS EN 61000-6-2 | | |
| Electrostatic Discharge | IEC 61000-4-2 | Level 4 Criteria A ¹⁾ Air Discharge: 15 kV Contact Discharge: 8 kV | | |
| Radiated Field | IEC 61000-4-3 | Level 3 Criteria A ¹⁾ 80 MHz-1 GHz, 10V/M, 80% modulation (1 kHz) 1.4 GHz-2 GHz, 3V/M, 80% modulation (1 KHz) 2 GHz-2.7 GHz, 1V/M, 80% modulation (1 KHz) | | |
| Electrical Fast Transient / Burst | IEC 61000-4-4 | Level 3 Criteria A ¹⁾ 2 kV | | |
| Surge | IEC 61000-4-5 | Level 3 Criteria A ¹⁾ Common Mode ²⁾ : 2 kV Differential Mode ³⁾ : 1 kV | | |
| Conducted | IEC 61000-4-6 | Level 3 Criteria A ¹⁾ 150 kHz-80 MHz, 10 Vrms | | |
| Power Frequency Magnetic Fields | IEC 61000-4-8 | Criteria A ¹⁾ 30 A/Meter | | |
| Voltage Dips and Interruptions | IEC 61000-4-11 | 100% dip; 1 cycle (20 ms); Self Recoverable | | |
| Low Energy Pulse Test (Ring Wave) | IEC 61000-4-12 | Level 3 Criteria A ¹⁾ Common Mode ²⁾ : 2 kV Differential Mode ³⁾ : 1 kV | | |
| Harmonic Current Emission | | IEC/EN/BS EN 61000-3-2, Class A | | |
| Voltage Fluctuation and Flicker | | IEC/EN/BS EN 61000-3-3 | | |

¹⁾ Criteria A: Normal performance within the specification limits

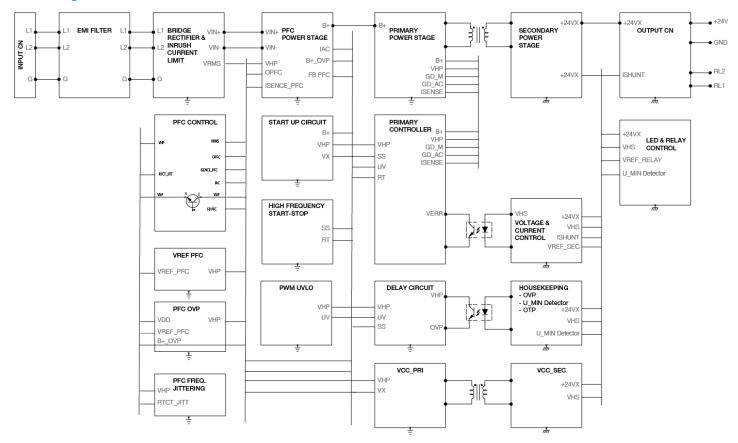


²⁾ Asymmetrical: Common mode (Line to earth)

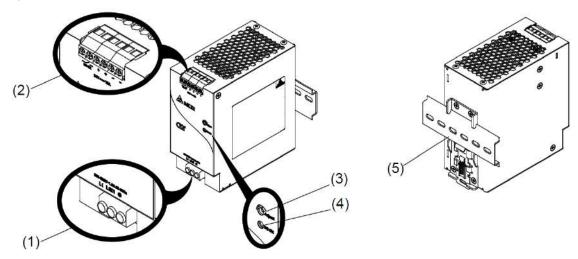
³⁾ Symmetrical: Differential mode (Line to line)

24 V 240 W 2 Phase / DRP-24V240W2BN

Block Diagram



Device Description



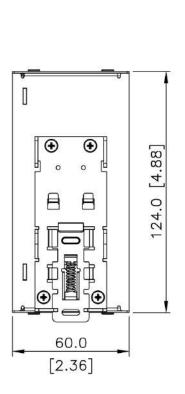
- 1) Input terminal block connector
- 2) Output terminal block connector
- 3) DC Voltage adjustment potentiometer
- 4) DC OK LED (Green)
- 5) Universal mounting rail system

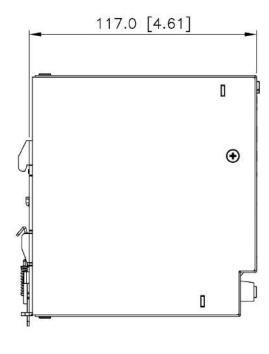


24 V 240 W 2 Phase / DRP-24V240W2BN

Dimensions

L x W x D: 124 x 60 x 117 mm (4.88 x 2.36 x 4.61 inch)







Engineering Data

Output Load De-rating VS Surrounding Air Temperature

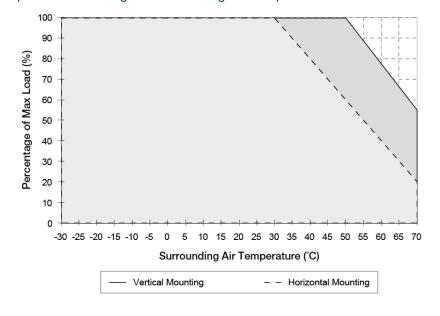


Fig. 1 De-rating for Vertical Mounting Orientation > 50°C de-rate power by 2.25% / °C

De-rating for Horizontal Mounting Orientation > 30°C de-rate power by 2% / °C

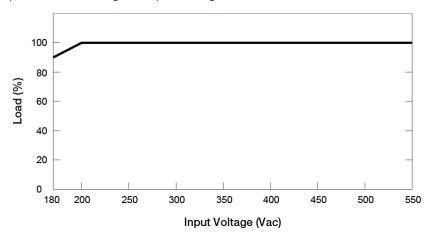
Note

- Power supply components may degrade, or be damaged, when the power supply is continuously used outside the shaded region, refer to the graph shown in Fig. 1.
- 2. If the output capacity is not reduced when the surrounding air temperature exceeds its specification as defined on Page 3 under "Environment", the device may run into Over Temperature Protection. When activated, the output voltage will go into bouncing mode and will recover when the surrounding air temperature is lowered or the load is reduced as far as necessary to keep the device in working condition.
- In order for the device to function in the manner intended, it is also necessary to keep a safety distance as recommended in the safety instructions while the device is in operation.
- 4. Depending on the surrounding air temperature and output load delivered by the power supply, the device can be very hot!
- If the device has to be mounted in any other orientation, please contact info@deltapsu.com for more details.



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Output Load De-rating VS Input Voltage



No output power de-rating for the input voltage range from 200 Vac to 550 Vac

Assembly & Installation

The power supply unit (PSU) can be mounted on 35 mm DIN rails in accordance with EN 60715. For Vertical Mounting, the device should be installed with input terminal block at the bottom. For Horizontal Mounting, the device should be installed with input terminal block on the left side.

Each device is delivered ready to install.

Mounting

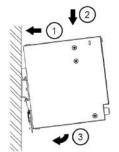
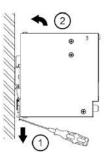


Fig. 2.1 Mounting

Snap on the DIN rail as shown in Fig. 2.1:

- Tilt the unit upwards and insert it onto the DIN rail.
- 2. Push downwards until stopped.
- 3. Press against the bottom front side for locking.
- 4. Shake the unit slightly to ensure that it is secured.

Dismounting



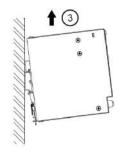


Fig. 2.2 Dismounting

To uninstall, pull or slide down the latch with screw driver as shown in Fig. 2.2. Then slide the power supply unit (PSU) in the opposite direction, release the latch and pull out the power supply unit (PSU) from the rail.

In accordance to EN 60950 / UL 60950 and EN 62368 / UL 62368, flexible cables require ferrules. Use appropriate copper cables designed to sustain operating temperature of:

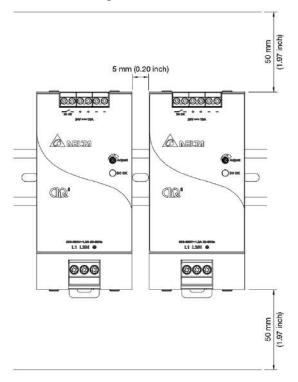
- 1. 60°C, 60°C / 75°C for USA
- 2. At least 75°C for ambient not exceeding 30°C, and 90°C for ambient exceeding 30°C for Canada.



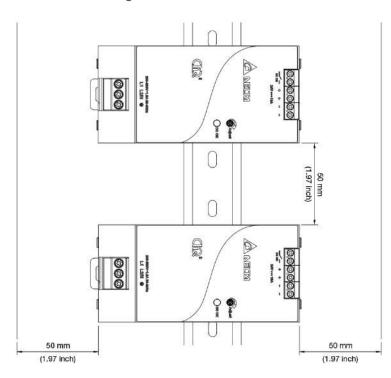
24 V 240 W 2 Phase / DRP-24V240W2BN

Safety Instructions

■ Vertical Mounting



Horizontal Mounting



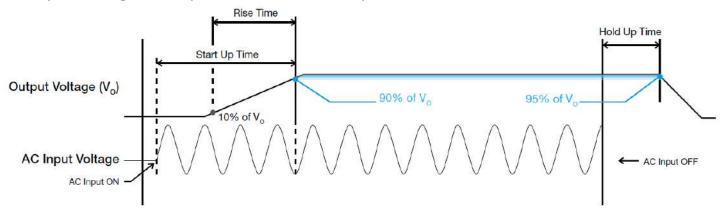
- ALWAYS switch mains of input power OFF before connecting and disconnecting the input voltage to the unit. If mains are not turned OFF, there is risk of explosion / severe damage.
- To guarantee sufficient convection cooling, please refer to the following instructions to ensure sufficient clearance around the device.
 - <u>Vertical Mounting:</u> 50 mm (1.97 inch) above and below the device as well as a lateral distance of 5 mm (0.20 inch) to other units.
 - <u>Horizontal Mounting:</u> 50 mm (1.97 inch) above and below the device as well as a lateral distance of 50 mm (1.97 inch) to other units.
- Note that the enclosure of the device can become very hot depending on the surrounding air temperature and load of the power supply. Risk of burns!
- The main power must be turned off before connecting or disconnecting wires to the terminals.
- DO NOT insert any objects into the unit.
- Hazardous voltages may be present for up to 5 minutes after the input mains voltage is disconnected. Do not touch the unit during this time.
- The power supplies unit should be installed in minimum IP54 rated enclosure.
- The power supplies are built in units and must be installed in a cabinet or room (condensation free environment and indoor location) that is relatively free of conductive contaminants.
- CAUTION: Double pole/neutral fusing.
- CAUTION: "For use in a controlled environment".



24 V 240 W 2 Phase / DRP-24V240W2BN

Functions

■ Graph illustrating the Start-up Time, Rise Time, and Hold-up Time



Start-up Time

The time required for the output voltage to reach 90% of its final steady state set value, after the input voltage is applied.

Rise Time

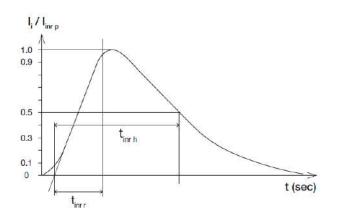
The time required for the output voltage to change from 10% to 90% of its final steady state set value.

Hold-up Time

Time between the collapse of the AC input voltage, and the output falling to 95% of its steady state set value.

Inrush Current

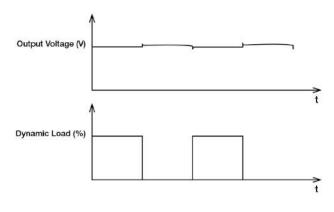
Inrush current is the peak, instantaneous, input current measured and, occurs when the input voltage is first applied. For AC input voltages, the maximum peak value of inrush current will occur during the first half cycle of the applied AC voltage. This peak value decreases exponentially during subsequent cycles of AC voltage.



Dynamic Response

The power supply output voltage will remains within $\pm 5\%$ of its steady state value, when subjected to a dynamic load from 0 to 100% of its rated current.

■ 50% duty cycle / 5 Hz





24 V 240 W 2 Phase / DRP-24V240W2BN

Power Boost

Power Boost is the reserve power available constantly that allows reliable startup to support sudden and short spike of loads with high inrush current typically during turn on to remove the need of more expensive higher rated power supply unit. After the output has reached its steady state set value, the power supply can support surge loads with a higher short-term power demand up to 120% of maximum rated load (Io Max), for a maximum duration of 3 seconds. The Power Boost is also available to repeatedly basis with according to the condition of an average (R.M.S) output power shall not exceed continuous operating condition or refer to duty cycle calculation below.

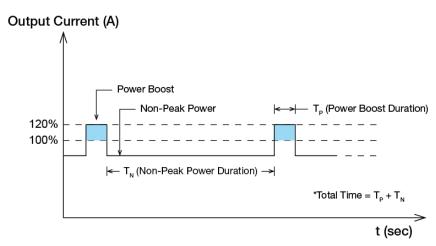


Fig. 3 Duty Cycle Calculation

$$Duty\ cycle\ (\%) = \frac{T_P}{Total\ Time}$$

$$Average\ Output\ Power\ (P_{Avg}) = \frac{(Power\ Boost\ \times T_P) + (Non\text{-}Peak\ Power\ \times T_N)}{Total\ Time}$$

OR

$$Non\text{-}Peak\ Power = \frac{\left(P_{Avg} \times Total\ Time\right) - \left(Power\ Boost\ \times T_P\right)}{T_N}$$

An example of Power Boost and Average Output Power

| Power Boost | Peak Power (W _P) | Power Boost Duration (T _P) | Duty Cycle | Non-Peak Power (W _N) | Non-Peak Power Duration (T _N) | Total Time (T) |
|-------------|---------------------------------|---|------------|-------------------------------------|---|-------------------|
| 120% | 288 | 3 sec | 10% | 235 W | 27 sec | 30 sec |
| 120% | 288 | 3 sec | 15% | 232 W | 17 sec | 20 sec |

It is not recommended to prolong the duration of Power Boost to be longer than the specified duty cycle calculation, this may cause damage to the PSU.

External Input Protection Device

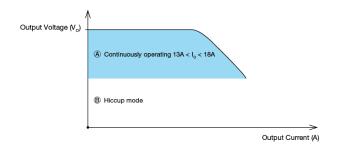
The unit is protected with internal fuse (not replaceable) at L1 and L2/N pins, which have been tested and approved on 20 A (UL) and 16 A (IEC) branch circuits without additional protection device. An external protection device is only required if the supplying branch has an ampacity greater than above. Thus, if an external protective device is necessary, or, utilized, please refer a minimum value of 16 A B- or 8 A C- characteristic breaker.



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Overload & Overcurrent Protections (Auto-Recovery)

The power supply's Overcurrent (OCP) Protection will be activated when output current is > 13 A typ. In such occurrence, the V_O will start to droop and once the output voltage is below 18 Vdc typ., the power supply will go into "Hiccup mode" (Auto-Recovery). The power supply will recover once the fault condition of the OCP is removed and I_O is back within the specifications.

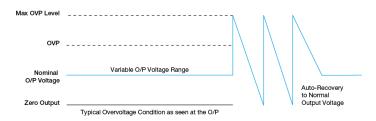


Short Circuit Protection (Auto-Recovery)

The power supply's output OLP/OCP function also provides protection against short circuits. When a short circuit is applied, the output current will operate in "Hiccup mode", as shown in the illustration in the OLP/OCP section on this page. The power supply will return to normal operation after the short circuit is removed.

Overvoltage Protection (Auto-Recovery)

The power supply's overvoltage circuit will be activated when its internal feedback circuit fails. The output voltage shall not exceed its specifications defined on Page 3 under "Protections".



Over Temperature Protection (Auto-Recovery)

As described in load de-rating section, the power supply also has Over Temperature Protection (OTP). In the event of a higher operating temperature at 100% load, the power supply will run into OTP when the operating temperature is beyond what is recommended in the de-rating graph. When activated, the output voltage will go into bouncing mode until the temperature drops to its normal operating temperature as recommended in the derating graph.



24 V 240 W 2 Phase / DRP-24V240W2BN

Operating Mode

■ Redundant Operation

In order to ensure proper redundant operation for the power supply unit (PSU), the output voltage difference between the two units must be kept at 0.45~0.50 V for 24 V supplies. Follow simple steps given below to set them up for the redundant operation:

Step 1.

Measure output voltage of PSU 1 and PSU 2. If PSU 1 is the master unit, then V_0 of PSU 1 must be higher than PSU 2. In order to set the output voltage, individually connect the power supply to 50% of rated load, and set the PSU 1 and PSU 2 output voltage.

Step 2.

Connect the power supply units PSU 1 and PSU 2 to Vin 1 & Vin 2, respectively, of the DRR-20N (or 20A) module shown on the diagram on the right.

Step 3.

Connect the system load from V_{out} . Please note that output voltage V_{out} from DRR module will be = V_{O} (output voltage of power supply) – V_{drop}^* (in DRR module).

 $^*\mbox{V}_{\mbox{\scriptsize drop}}$ will vary from 0.60 V to 0.90 V (Typical 0.65 V) depending on the load current and surrounding air temperature.

PSU 1 PSU 2 DRR-20N or DRR-20N Common Output GND A NELTA A NELT

**The Signal GND in the DRR module is for the built-in LED and DC OK signals. The Output GND terminals from the two PSU's do not need to be connected to the Signal GND terminal.

Fig. 4 Redundant Operation Connection Diagram

■ Parallel Operation

The power supply units (PSUs) can also be used for parallel operation in order to increase the output power. The difference in output voltage between the two units must be kept to within 25 mV of each other. This difference must be verified with the same output load connected independently to each unit.

Parameters such as EMI, inrush current, leakage current, PARD, start up time will be different from those on the datasheet, when two units are connected in parallel. The user will need to verify that any differences will still allow the two power supplies connected in parallel will work properly in their product/application.

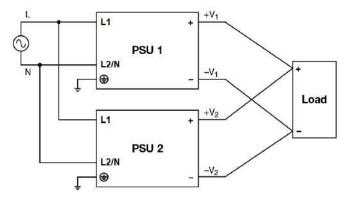


Fig. 5 Parallel Operation Connection Diagram



24 V 240 W 2 Phase / DRP-24V240W2BN

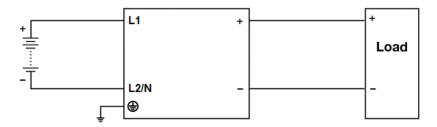


Fig. 5 DC Input Operation Connection Diagram

■ DC Input Operation

Step 1.

Use a battery or similar DC source.

Sten 2

Connect +pole to L1 and -pole to L2/N.

Step 3.

Connect the PE terminal to an earth wire or to the machine ground.



24 V 240 W 2 Phase / DRP-24V240W2BN

Others

Conformal Coating



The Protective Coating Technology

Delta Electronics Group has designed the perfect dipping technique which penetrates everywhere including under device, and prevents leakage. The conformal coating dipping can be applied to PCBAs or circuit board. The coating preserves the performance of precision electronic primarily by preventing ionizable contaminants such as salt from reaching circuit nodes, where the material slumps around sharp edges. This can be a problem especially in highly conversing atmosphere.

PFC - Norm EN 61000-3-2

Line Current Harmonic content



Typically, the input current waveform is not sinusoidal due to the periodical peak charging of the input capacitor. In industrial environment, complying with EN 61000-3-2 is only necessary under special conditions. Complying to this standard can have some technical drawbacks, such as lower efficiency as well as some commercial aspects such as higher purchasing costs. Frequently, the user does not profit from fulfilling this standard, therefore, it is important to know whether it is mandatory to meet this standard for a specific application.

Attention

Delta provides all information in the datasheets on an "AS IS" basis and does not offer any kind of warranty through the information for using the product. In the event of any discrepancy between the information in the catalog and datasheets, the datasheets shall prevail (please refer to **www.DeltaPSU.com** for the latest datasheets information). Delta shall have no liability of indemnification for any claim or action arising from any error for the provided information in the datasheets. Customer shall take its responsibility for evaluation of using the product before placing an order with Delta.

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Manufacturer and Authorized Representatives Information

Manufacturer

<u>Thailand</u>
Delta Electronics (Thailand) PCL.
909 Pattana 1 Rd., Muang, Samutprakarn, 10280 Thailand

<u>Taiwan</u>
Delta Electronics, Inc.
3 Tungyuan Road, Chungli Industrial Zone, Taoyuan County
32063. Taiwan

Authorized Representatives

<u>The Netherlands</u>
Delta Greentech (Netherlands) B.V.
Zandsteen 15, 2132 MZ Hoofddorp, The Netherlands

United Kingdom
Delta Electronics Europe Limited
1 Redwood Court, Peel Park Campus,
East Kilbride, Glasgow, G74 5PF, United Kingdom



Mouser Electronics

Authorized Distributor

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Delta Electronics:

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