

CliQ II DIN Rail Power Supply

24V 120W 3 Phase / DRP024V120W3B□



Highlights & Features

- Worldwide AC input range without power de-rating
3 x 320Vac – 600Vac (3-Phase) or 2 x 360Vac – 600Vac (2-Phase)
- Compact, rugged design for ease of handling and installation
- 150% Power Boost (steady state peak load) for 5 seconds
- With Conformal Coating on PCBA (DRP024V120W3BN)
- Class I, Div 2 Hazardous Locations (DRP024V120W3BA)
- Overvoltage / Overcurrent / Over Temperature Protections
- IP20 Compliant

Safety Standards



CB Certified for worldwide use

Model Number: DRP024V120W3B□
Unit Weight: 0.66 kg
Dimensions (L x W x D): 121 x 50 x 117.3 mm

General Description

The CliQ II 3-phase DIN Rail power supply series offers output voltage of 24V. These products are encased in rugged yet lightweight full aluminium body that can withstand shock and vibration according to IEC 60068-2 standard. The series of 3-phase products operates over a wide temperature range of -25°C to +75°C and wide input range for 3 -phase from 320Vac to 600Vac or 2-phase from 360Vac to 600Vac, with no power de-rating throughout the entire range. Another great feature is the conformal coating on the PCBA which allows selected models to be certified to ATEX and Class I, Div 2 for use in hazardous locations. The design conforms to harmonic current emission IEC/EN 61000-3-2 standard.

Model Information

CliQ II DIN Rail Power Supply

| Model Number | Input Voltage Range | Output Voltage | Output Current |
|----------------|---|----------------|----------------|
| DRP024V120W3B□ | 3 x 320-600Vac (3-Phase) or 2 x 360-600Vac (2-Phase) | 24Vdc | 5.00A |

Model Numbering

| DR | P | 24V | 120W | 3 | B | □ |
|----------|--------------|----------------|--------------|-------------|----------------|---|
| DIN Rail | Power Supply | Output Voltage | Output Power | Three Phase | CliQ II Series | A - Metal Case, with Class I, Div 2 N - Metal Case, without Class I, Div 2 |

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Specifications

Input Ratings / Characteristics

| | |
|--------------------------|--|
| Nominal Input Voltage | 3 x 400-500Vac |
| Input Voltage Range* | 3 x 320-600Vac (3-Phase) or 2 x 360-600Vac (2-Phase) |
| Nominal Input Frequency | 50-60Hz |
| Input Frequency Range | 47-63Hz |
| Nominal DC Input Voltage | 500Vdc |
| DC Input Voltage Range** | 450-800Vdc |
| Input Current | < 0.50A @ 3 x 400Vac, < 0.40A @ 3 x 500Vac |
| Efficiency at 100% Load | > 88.0% @ 3 x 400Vac & 3 x 500Vac |
| Max Inrush Current | < 30A @ 3 x 400Vac & 3 x 500Vac |
| Power Factor | Conform to EN 61000-3-2 |
| Leakage Current | < 3.5mA @ 500Vac |

*Input voltage above 575Vac to 600Vac is not included in the safety approval. Additional testing might be necessary.

**Fulfills tested conditions

Output Ratings / Characteristics

| | |
|---|--|
| Nominal Output Voltage | 24Vdc |
| Output Voltage Tolerance | ± 2% (initial set point tolerance from factory) |
| Output Voltage Adjustment Range | 24-28Vdc |
| Output Current | 5.00A (continuously operating at 24V) 7.50A (Power Boost for 5 seconds at 24V, refer to the details in the Functions section) |
| Output Power | 120W (continuously operating) 180W (Power Boost for 5 seconds, refer to the details in the Functions section) |
| Line Regulation | < 0.5% typ. (@ 320-600Vac input, 100% load) |
| Load Regulation | < 1% typ. (@ 320-600Vac input, 0-100% load) |
| PARD (20MHz) | < 50mVpp |
| Rise Time | < 100ms @ nominal input (100% load) |
| Start-up Time | < 1,000ms @ nominal input (100% load) |
| Hold-up Time | > 20ms @ 3 x 400Vac, > 40ms @ 3 x 500Vac (100% load) |
| Dynamic Response (Overshoot & Undershoot O/P Voltage) | ± 5% @ 0-100% load |
| Start-up with Capacitive Loads | 10,000µF Max |

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Mechanical

| | | |
|-----------------------------------|--|-------------------------|
| Case Cover / Chassis | Aluminium | |
| Dimensions (L x W x D) | 121 x 50 x 117.3 mm | |
| Unit Weight | 0.66 kg | |
| Indicator | Green LED (DC OK) | |
| Cooling System | Convection | |
| Terminal | Input | 4 Pins (Rated 600V/35A) |
| | Output | 4 Pins (Rated 300V/28A) |
| Wire | AWG 18-12 | |
| Mounting Rail | Standard TS35 DIN Rail in accordance with EN 60715 | |
| Noise (1 Meter from power supply) | Sound Pressure Level (SPL) < 40dBA | |

Environment

| | | |
|-----------------------------|---------------------|---|
| Surrounding Air Temperature | Operating | -25°C to +75°C |
| | Storage | -25°C to +85°C |
| Power De-rating | Vertical Mounting | > 50°C de -rate power by 2.5% / °C , > 70°C de -rate power by 5% / °C |
| | Horizontal Mounting | > 40°C de -rate power by 2.5% / °C , > 60°C de -rate power by 5% / °C |
| Operating Humidity | | < 95% RH (Non-Condensing) |
| Operating Altitude | | 2,500 Meters for ITE application (@ 50°C) 2,000 Meters for Industrial application (@ 50°C) |
| Shock Test (Non-Operating) | | IEC 60068-2-27, 30G (300m/S ²) for a duration of 18ms, 1 times per direction, 2 times in total |
| Vibration (Non-Operating) | | IEC 60068-2-6, 10Hz to 500Hz @ 30m/S ² (3G peak); 60 min per axis for all X, Y, Z direction |
| Pollution Degree | | 2 |

Protections

| | |
|--------------------------|--|
| Overvoltage | < 32V, ±10%, SELV Output, Hicc-up Mode, Non-Latching (Auto-Recovery) |
| Overload / Overcurrent | > 150% of rated load current, Hicc-up Mode, Non-Latching (Auto-Recovery) |
| Over Temperature | < 80°C Surrounding Air Temperature @ 100% load, Non-Latching (Auto-Recovery) |
| Short Circuit | Hicc-up Mode, Non-Latching (Auto-Recovery when the fault is removed) |
| Protection Against Shock | Class I with PE* connection |

*PE: Primary Earth

Reliability Data

| | |
|------------------------|---|
| MTBF | > 500,000 hrs. as per Telcordia SR-332 |
| Expected Cap Life Time | 10 years (400Vac & 500Vac, 50% load @ 40°C) |

CliQ II DIN Rail Power Supply

24V 120W 3 Phase / DRP024V120W3B□

Safety Standards / Directives

| | |
|---|--|
| Electrical Equipment in Power Installations | EN 50178 / IEC 62103 |
| Electrical Safety | SIQ to EN 60950-1, UL/cUL recognized to UL 60950-1 and CSA C22.2 No. 60950-1, CB scheme to IEC 60950-1 |
| Industrial Control Equipment | UL/cUL listed to UL 508 and CSA C22.2 No. 107.1-01, CSA to CSA C22.2 No. 107.1-01 (File No. 181564) |
| Hazardous Location / ATEX | Pending |
| ⊕ II 3G ATEX 94/9/EC; IECEx Test Report | Certificate No. Pending For IEC 60079-0, IEC 60079-15 |
| CE | In conformance with EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC |
| Material and Parts | RoHS Directive 2011/65/EU Compliant |
| Galvanic Isolation | Input to Output 4.0KVac |
| | Input to Ground 1.5KVac |
| | Output to Ground 1.5KVac |

EMC

| | | |
|--|---|--|
| EMC / Emissions | CISPR 22, EN 55022, CISPR 11, EN 55011, FCC Title 47: Class B | |
| Component Power Supply for General Use | EN 61204-3 | |
| Immunity to | EN 55024, EN 61000-6-2 | |
| Electrostatic Discharge | IEC 61000-4-2 | Level 4 Criteria A ¹⁾ Air Discharge: 15kV Contact Discharge: 8kV |
| Radiated Field | IEC 61000-4-3 | Level 3 Criteria A ¹⁾ 80MHz-1GHz, 10V/M, 80% modulation (1kHz) |
| Electrical Fast Transient / Burst | IEC 61000-4-4 | Level 3 Criteria A ¹⁾ 2kV |
| Surge | IEC 61000-4-5 | Level 3 Criteria A ¹⁾ Common Mode ²⁾ : 2kV Differential Mode ³⁾ : 1kV |
| Conducted | IEC 61000-4-6 | Level 3 Criteria A ¹⁾ 150kHz-80MHz, 10Vrms |
| Power Frequency Magnetic Fields | IEC 61000-4-8 | Criteria A ¹⁾ 10A/Meter |
| Voltage Dips | IEC 61000-4-11 | 100% dip; 1 cycle (20ms); Self Recoverable |
| Low Energy Pulse Test (Ring Wave) | IEC 61000-4-12 | Level 3 Criteria A ¹⁾ Common Mode ²⁾ : 2kV Differential Mode ³⁾ : 1kV |
| Harmonic Current Emission | IEC/EN 61000-3-2, Class A | |
| Voltage Fluctuation and Flicker | IEC/EN 61000-3-3 | |

1) Criteria A: Normal performance within the specification limits

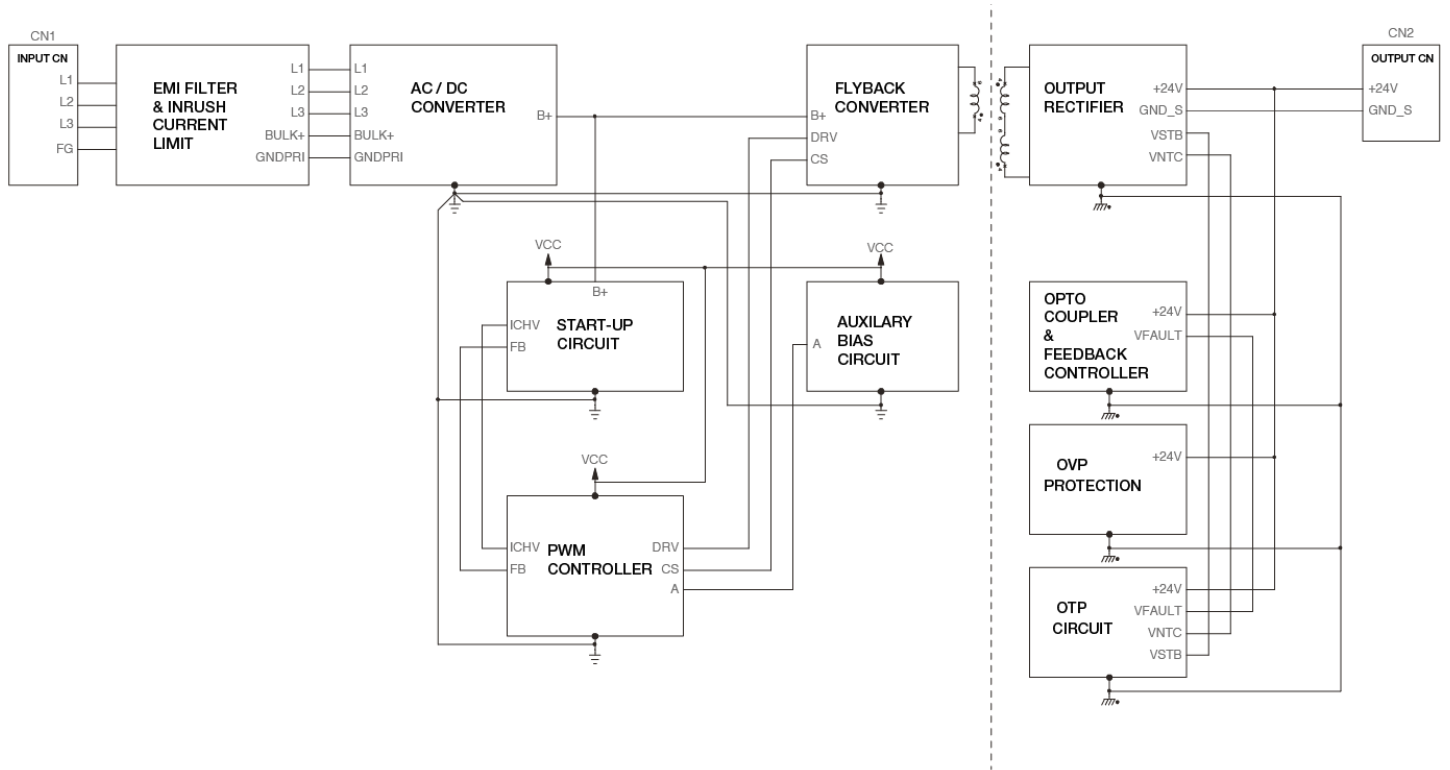
2) Asymmetrical: Common mode (Line to earth)

3) Symmetrical: Differential mode (Line to line)

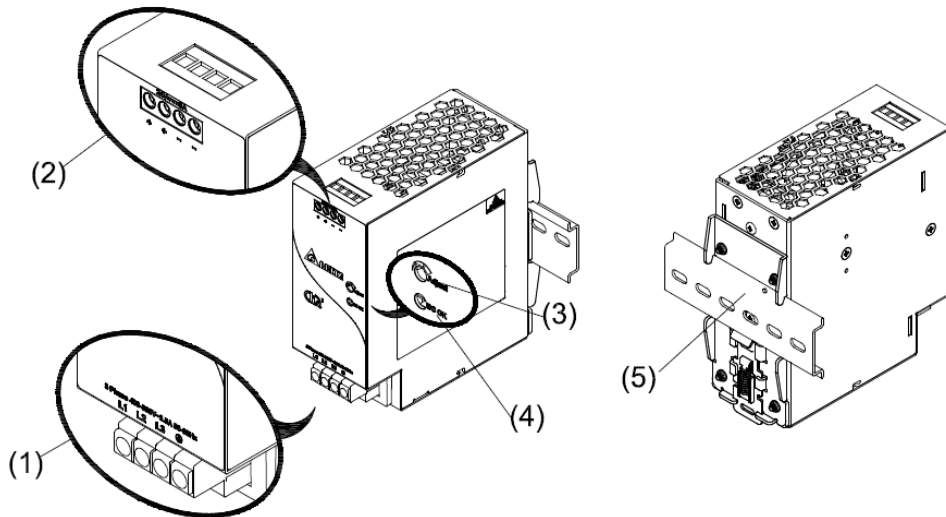
CliQ II DIN Rail Power Supply

24V 120W 3 Phase / DRP024V120W3B

Block Diagram



Device Description



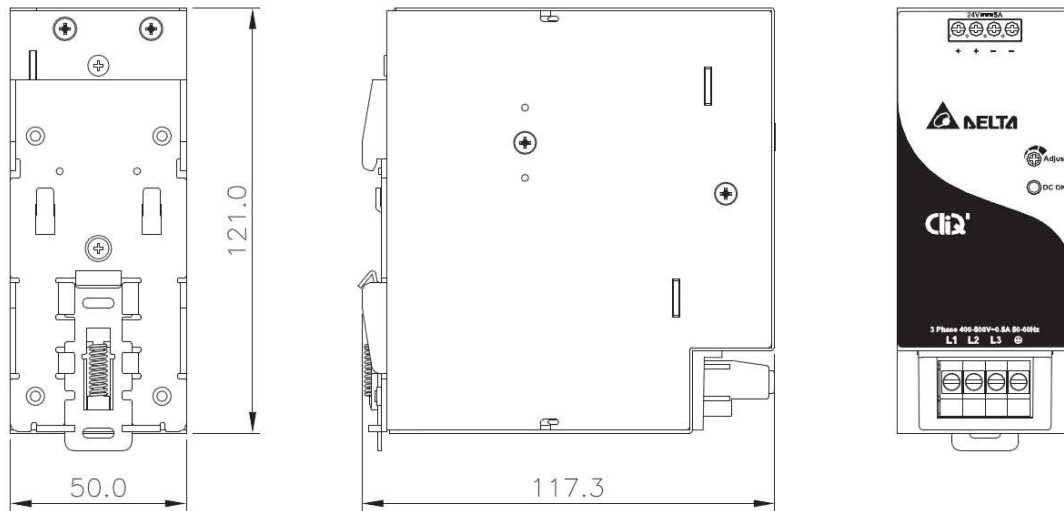
- 1) Input terminal block connector
- 2) Output terminal block connector
- 3) DC Voltage adjustment potentiometer
- 4) DC OK control LED (Green)
- 5) Universal mounting rail system

CliQ II DIN Rail Power Supply

24V 120W 3 Phase / DRP024V120W3B□

Dimensions

L x W x D: 121 x 50 x 117.3 mm



Engineering Data

De-rating

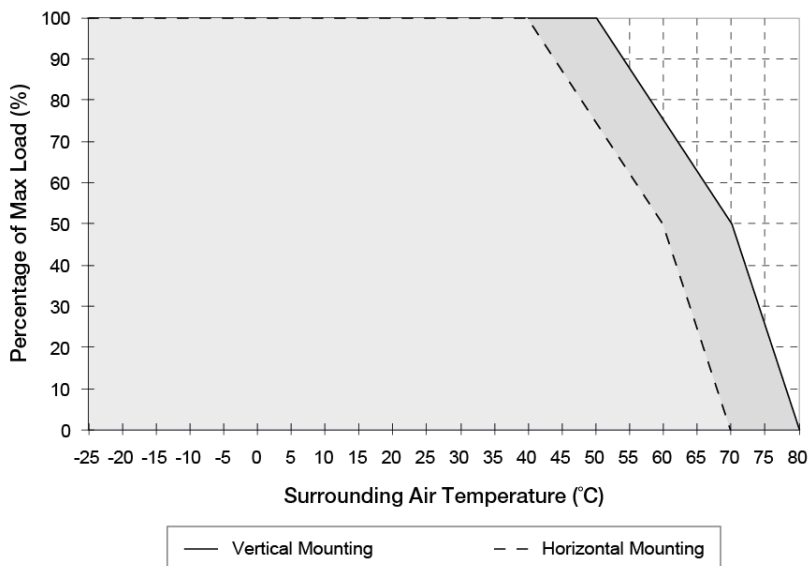


Fig. 1 De-rating for Vertical Mounting Orientation

> 50°C de-rate power by 2.5% / °C,
 > 70°C de-rate power by 5% / °C

De-rating for Horizontal Mounting Orientation

> 40°C de-rate power by 2.5% / °C,
 > 60°C de-rate power by 5% / °C

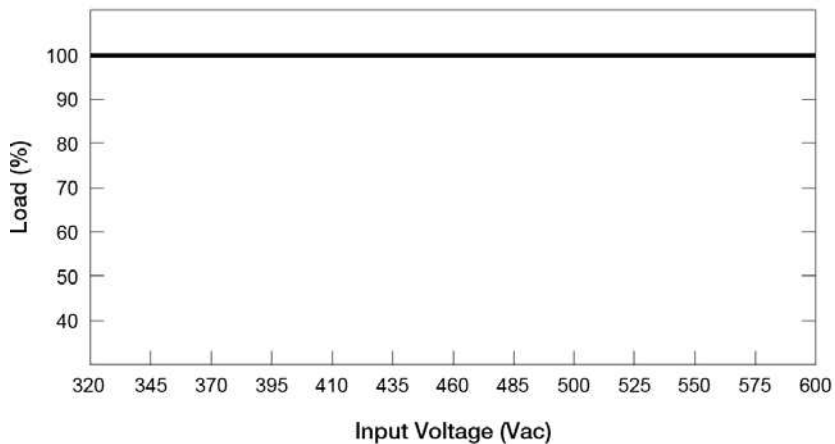
Note

1. 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 > 50°C (Vertical) or > 40°C (Horizontal), 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.
3. In order for the device to function in the manner intended, it is also necessary to keep a safety distance of 5mm with adjacent units 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!
5. If the device has to be mounted in any other orientation, please do not hesitate to contact info@deltapsu.com for more details.

CliQ II DIN Rail Power Supply

24V 120W 3 Phase / DRP024V120W3B□

Output De-rating VS. Input Voltage



■ No output power de-rating across the entire input voltage range 3 x 320-600Vac (3-Phase) or 2 x 360-600Vac (2-Phase)

Assembly & Installation

The power supply unit (PSU) can be mounted on 35mm 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

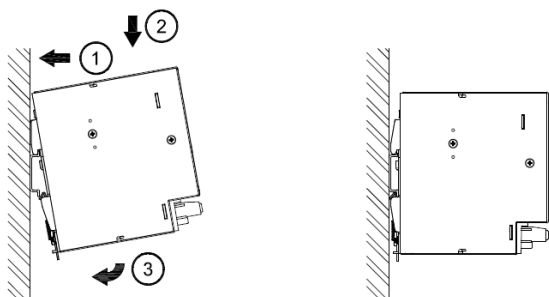


Fig. 2.1 Mounting

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

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

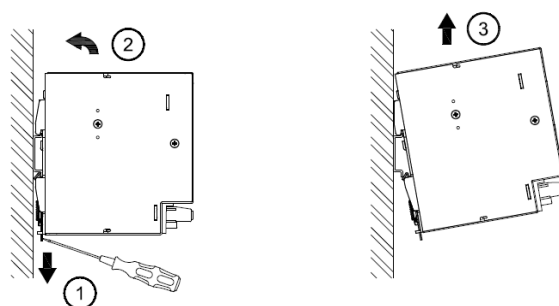


Fig. 2.2 Dismounting

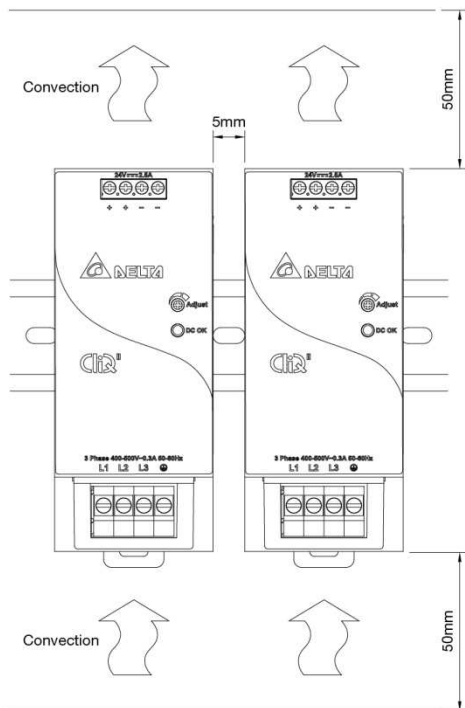
To uninstall, pull or slide down the latch with screw driver as shown in Fig. 2.2. Then slide the power supply unit (PSU) in the opposite direction, release the latch and pull out the power supply unit (PSU) from the rail.

CliQ II DIN Rail Power Supply

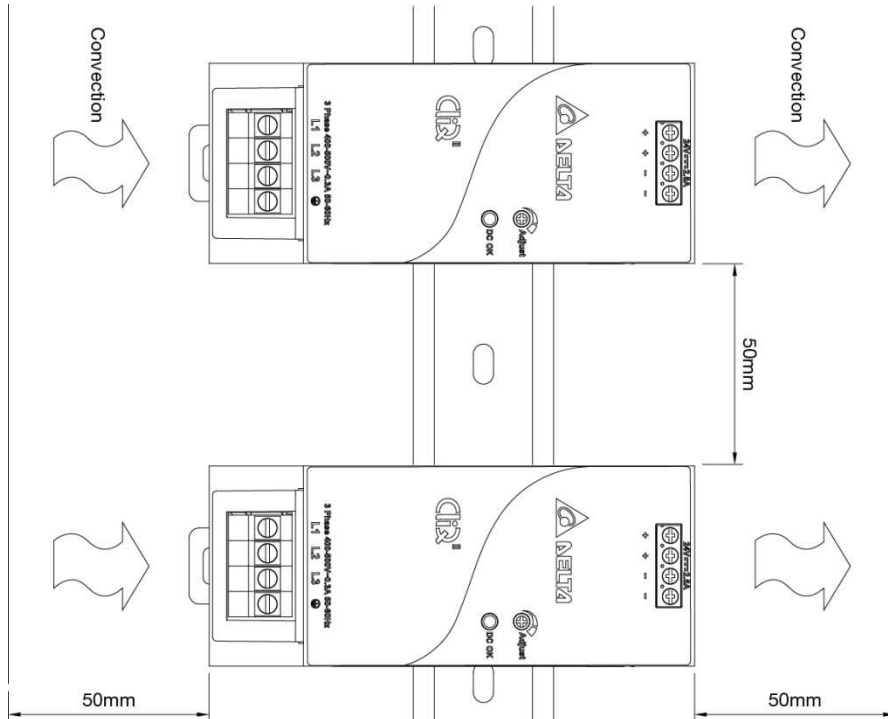
24V 120W 3 Phase / DRP024V120W3B □

Safety Instructions

■ Vertical Mounting



■ Horizontal Mounting



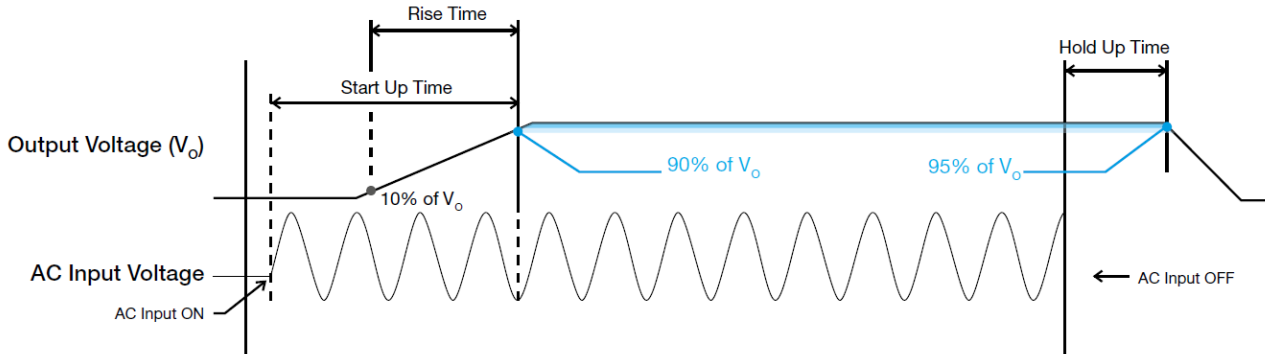
- ALWAYS switch mains of input power OFF before connecting and disconnecting the input voltage to the unit. If mains are not turned OFF, there is risk of explosion / severe damage.
- **To guarantee sufficient convection cooling, keep a distance of 50mm above and below the device as well as a lateral distance of 5mm (for Vertical Mounting) or 50mm (for Horizontal Mounting) 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!
- Only plug in and unplug connectors when power is turned off!
- 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.

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24V 120W 3 Phase / DRP024V120W3B□

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 set value, after the input voltage is applied.

Rise Time

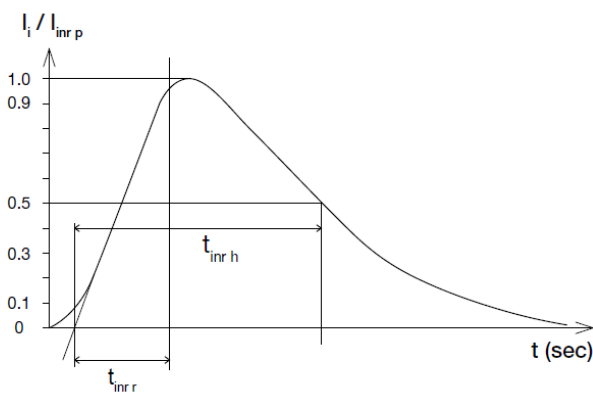
The time required for the output voltage to change from 10% to 90% of its set value.

Hold-up Time

Hold up time is the time when the AC input collapses and output voltage retains regulation for a certain period of time. The time required for the output to reach 90% of its set value, after the input voltage is removed.

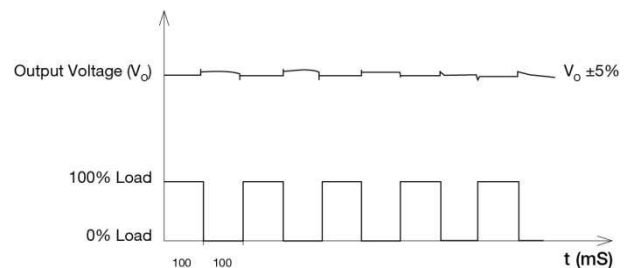
Inrush Current

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 remain within $\pm 5\%$ of its steady state value, when subjected to a dynamic load from 0 to 100% of its rated current.

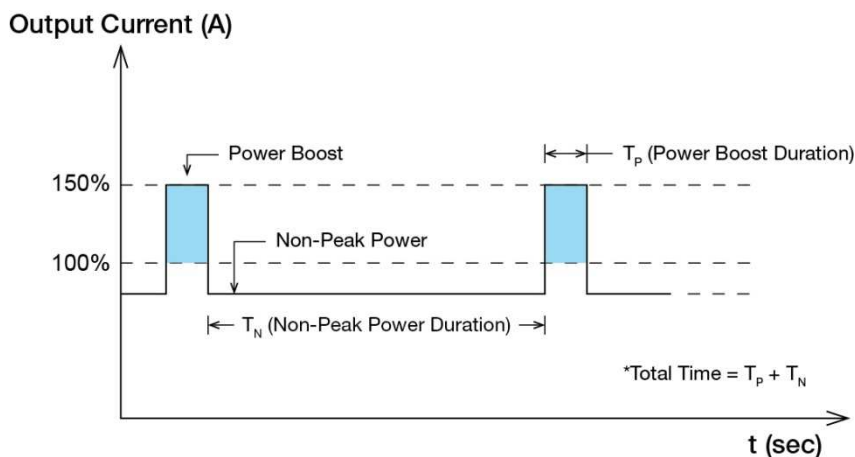


CliQ II DIN Rail Power Supply

24V 120W 3 Phase / DRP024V120W3B □

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 150% of maximum rated load (I_o Max), for a maximum duration of 5 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.



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

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

OR

$$Non-Peak\ Power = \frac{(P_{Avg} \times Total\ Time) - (Power\ Boost \times T_p)}{T_n}$$

■ 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) |
|-------------|------------------------------|--|------------|----------------------------------|---|----------------|
| 150% | 180 | 5 sec | 10% | 113W | 45 sec | 50 sec |
| 150% | 180 | 5 sec | 35% | 88W | 9.3 sec | 14.3 sec |
| 120% | 144 | 10 sec | 20% | 114W | 40 sec | 50 sec |
| 120% | 144 | 10 sec | 35% | 107W | 18.5 sec | 28.5 sec |

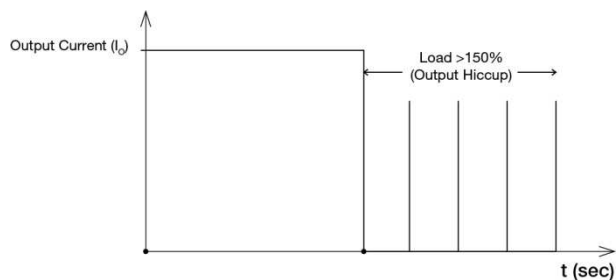
It is not recommended to prolong the duration of Power Boost to be longer than the specified duty cycle calculation, this may cause damage to the PSU.

CliQ II DIN Rail Power Supply

24V 120W 3 Phase / DRP024V120W3B□

Overload & Overcurrent Protections

The power supply's Overload (OLP) and Overcurrent (OCP) Protections will be activated when output current exceeds 150% of I_O (Max load). In such occurrence, the V_O will start to droop and once the power supply has reached its maximum power limit, the protection is activated and the power supply will go into "Hiccup mode" (Auto-Recovery). The power supply will recover once the fault condition of the OLP and OCP is removed and I_O is back within the specifications.



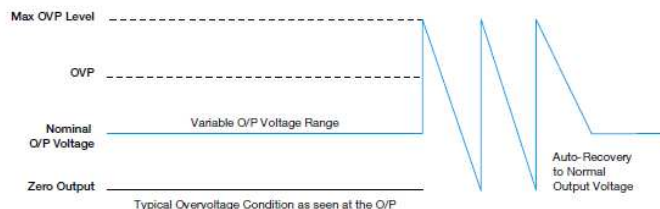
It is not recommended to prolong the duration of I_O when it is <150% but >100%, since it may cause damage to the PSU.

Short Circuit Protection

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

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

As mentioned above, 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 de-rating graph.

CliQ II DIN Rail Power Supply

24V 120W 3 Phase / DRP024V120W3B□

Operating Mode

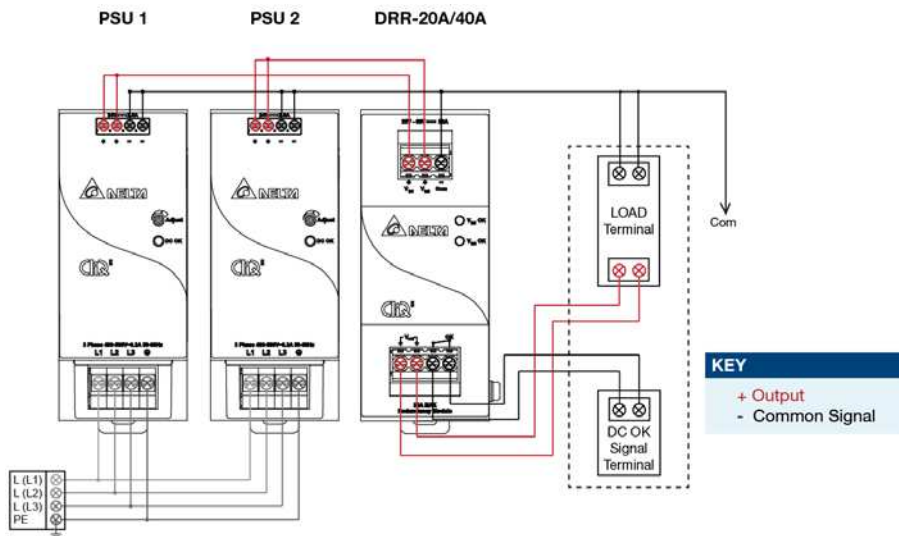


Fig. 3 Redundancy / Parallel Operation Connection Diagram

Parallel Operation

These DRR modules can also be used for Parallel function in order to increase the output power by N+1 (e.g. 2.5A + 2.5A = 5A or 2.5A + 2.5A + 2.5A = 7.5A) or current sharing, and thus increasing the power supply and system reliability. Though the DRP024V120W3B□ is not designed for current sharing, a good current sharing between two power supplies can be achieved by following simple steps as below (Refer to Fig. 3 for the Connection Diagram).

Step 1.

Set output load condition for both supplies at 50% and measure the output voltages.

Step 2.

Adjust output voltages to the same level or within $\pm 25\text{mV}$ difference.

Step 3.

Connect PSU 1 and PSU 2 with the DRR-20A module and measure at $V_{in 1}$ & $V_{in 2}$ to verify the voltage difference. Ensure the voltages are within $\pm 25\text{mV}$.

Step 4.

Output voltage from DRR module V_{out} will be = V_O (output voltage of power supply) - V_{drop}^* (in DRR module).

* V_{drop} will vary from 0.60V to 0.90V (Typical 0.65V) depending on the load current and surrounding air temperature.

Redundancy Operation

In order to ensure proper redundancy operation for the power supply unit (PSU), ensure that the output voltage difference between the two units is kept at 0.45~0.50V for 24V supplies. Follow simple steps given below to verify:

Step 1.

Measure output voltage of PSU 1 and PSU 2. If PSU 1 is the master unit, then V_O of PSU 1 must be higher than PSU 2.

In order to set the output voltage, connect the power supply to 50% load and set the PSU 1 and PSU 2 output voltage.

Step 2.

Connect the right DRR module, 20A as per the system requirement to the power supply units PSU 1 and PSU 2 at $V_{in 1}$ & $V_{in 2}$ respectively.

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).

CliQ II DIN Rail Power Supply

24V 120W 3 Phase / DRP024V120W3B□

Others

Delta RoHS Compliant

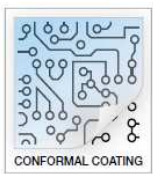


Restriction of the usage of hazardous substances

The European directive 2011/65/EU limits the maximum impurity level of homogeneous materials such as lead, mercury, cadmium, chrome, polybrominated flame retardants PBB and PBDE for the use in electrical and electronic equipment. RoHS is the abbreviation for "Restriction of the use of certain hazardous substances in electrical and electronic equipment".

This product conforms to this standard.

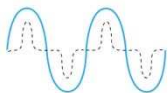
Conformal Coating



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 PCBs 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.