

# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□



## DIN Eco

### Highlights & Features

- 3-Phase AC input from 340-575 Vac
- Optional 3ENA models: 600 Vac with conformal coating
- Slim and compact size design
- Wide operating temperature from -40°C to +70°C
- Power good LED indicator
- Surge protection capacity 4 kV / 2 kV
- Compliant with SEMI F47
- IEC/EN/UL 62368-1 and IEC/UL 61010-1 certified

### Safety Standards



CB Certified for worldwide use

<b>Model Number:</b>	DRL-□V960W3EN□
<b>Unit Weight:</b>	2 kg (4.41 lb)
<b>Dimensions (H x W x D):</b>	123.6 x 110 x 142.6 mm (4.87 x 4.33 x 5.61 inch)

### General Description

Delta's DIN Eco Series DIN rail power supply is designed for three-phase AC input and fulfills the essential requirements of many general industrial applications, delivering high quality and reliability. The convection-cooled DIN Eco Series operates at full power from -40°C to +50°C, with power derating up to +70°C. It supports a 150% power boost for up to 0.5 seconds. The product is certified to IEC/EN/UL 62368-1 and IEC/UL 61010-1 safety standards. Its radiated and conducted electromagnetic emissions comply with the EN 61000-6-4 (Emission) standard for heavy industrial environments and the EN 61000-6-2 (Immunity) standard. The product also meets environmental protection requirements in accordance with the RoHS/REACH Directive. In addition, it features surge protection capable of withstanding 4 kV / 2 kV in industrial applications.

### Model Information

#### DIN Eco Series DIN Rail Power Supply

Model Number	Input Voltage Range	Rated Output Voltage	Rated Output Current
DRL-24V960W3EN□	3EN : 340-575 Vac	24 Vdc	40.0 A
DRL-48V960W3EN□	3ENA: 340-600 Vac	48 Vdc	20.0 A

### Model Numbering

DR	L -	□V	960W	3	E	N	□
DIN Rail	Product Series L - DIN Eco	Output Voltage 24 - 24 V 48 - 48 V	Output Power	Three Phase	E: with Slim Design	N: Delta Standard	A: Option Type for 340-600 Vac and Conformal Coating

# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□

### Specifications

Model Number	DRL-24V960W3EN□	DRL-48V960W3EN□
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#### Input Ratings / Characteristics\*<sup>1</sup>

Nominal Input Voltage	3 x 380-500 Vac	
Input Voltage Range	3EN: 3 x 340-575 Vac; 3ENA: 3 x 340~600 Vac Option type (3-Phase with 100% Load) 3EN: 2 x 340-575 Vac; 3ENA: 2 x 340~600 Vac Option type (2-Phase with 80% Load)	
Nominal Input Frequency	50-60 Hz	
Input Frequency Range	47-63 Hz	
Input Current	< 1.8 A @ 3 x 400 Vac, < 1.2 A @ 3 x 500 Vac	
Efficiency at 100% Load	94.5% typ. @ 3 x 400 Vac & 3 x 500 Vac	95% typ. @ 3 x 400 Vac & 3 x 500 Vac
Max Inrush Current (Cold Start)	15 A typ. @ 3 x 400 Vac & 3 x 500 Vac	
Power Factor at 100% Load	> 0.9 typ. @ 3 x 400 Vac & 3 x 500 Vac	
Leakage Current	< 0.5 mA @ 3 x 400 Vac & 3 x 500 Vac	

\*1 All parameters not specially mentioned are measured at 400Vac input and 25°C ambient temperature.

#### Output Ratings / Characteristics\*<sup>2</sup>

Nominal Output Voltage	24 Vdc	48 Vdc
Factory Set Point Tolerance	24 Vdc ± 1%	48 Vdc ± 1%
Output Voltage Adjustment Range	24-28 Vdc	48-55 Vdc
Output Current	0-40.0 A (960 W max)	0-20.0 A (960 W max)
Output Power	960 W max	
Line Regulation	± 0.5%	
Load Regulation	± 1%	
PAR <sup>3</sup> (20 MHz)	180 m Vpp typ. @ 0°C to +70°C 300 m Vpp typ. @ -30°C to 0°C	
Rise Time	15 ms typ. @ nominal input (100% load)	
Start-up Time	700 ms typ. @ nominal input (100% load)	
Hold-up Time	16 ms typ. @ 3 x 400 Vac & 3 x 500 Vac (100% load)	
Dynamic Response (Overshoot & Undershoot O/P Voltage)	± 10% @ 3 x 340-575 Vac input, 10-100% load (Slew Rate: 0.1 A/μS, 50% duty cycle @ 5 Hz & 10 kHz)	
Start-up with Capacitive Loads	10,000 μF Max	8000 μF Max
Functional	DC OK Relay Contact	Rated: 30 V / 1 A, resistive load. Refer to the details in the Function section at DC OK Relay Contacts and LED Indicator Characteristics on page 10.

\*2 All parameters not specially mentioned are measured at 400Vac input and 25°C ambient temperature.

\*3 PAR is measured with an AC coupling mode, 5 cm wires, and in parallel to end terminal with 0.1 μF ceramic capacitor & 47 μF electrolytic capacitor.

# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□

<b>Model Number</b>	DRL-24V960W3EN□	DRL-48V960W3EN□
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### Mechanical

Case Cover / Chassis	Aluminum	
Dimensions (H x W x D)	123.6 x 110 x 142.6 mm (4.87 x 4.33 x 5.61 inch)	
Unit Weight	2 kg (4.41 lb)	
Indicator	Green LED	DC OK
Cooling System	Convection	
Terminal*4	Input	4 Pins (Rated 600 V / 30 A)
	Output	4 Pins (Rated 600 V / 30 A)
	Signal	2 Pins (Rated 300 V / 7 A)
Wire	Input	AWG 18-10
	Output	AWG 12-10
	Signal	AWG 22-18
Mounting Rail	Standard TS35 DIN Rail in accordance with EN 60715	
Noise (1 Meter from power supply)	Sound Pressure Level (SPL) < 25dBA	

\*4 The torque at the screw terminal connector shall not exceed 8.0 Kgf.cm. (7.0 lbf.in).

### Environment

Surrounding Air Temperature *5/6	Operating	-40°C to +70°C (Please refer to page 8 derating curve)
	Storage	-40°C to +85°C
Power De-rating	Temperature	> 50°C de-rate power by 2 % / °C @ 400 Vac
Operating Humidity	5 to 95% RH (Non-Condensing)	
Operating Altitude	0 to 5,000 Meters (16,400 ft.)	
Shock Test	Non-Operating	IEC 60068-2-27, Half Sine Wave: 50 G for duration of 11 ms; 3 times per direction, 9 times in total
Vibration	Non-Operating	IEC 60068-2-64, Random: 5 Hz to 500 Hz (2.09 G); 20 min per axis for all X, Y, Z direction
	Operating	IEC 60068-2-6, Sine Wave: 10 Hz to 500 Hz @ 19.6 m/s <sup>2</sup> (2 G peak); 10 min per cycle, 60 min for X, Y, Z direction
Over Voltage Category	II (Compliance to EN 62477-1 OVC III with 2000 meters altitude)	
Pollution Degree	2	

\*5 When operating at temperatures below -30°C, the PSU may require a few seconds to “bounce” before completing a cold-start power-up.

\*6 For power de-rating from 50°C to 70°C, see power de-rating on page 8.

# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□

Model Number	DRL-24V960W3EN□	DRL-48V960W3EN□
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### Protections

Overvoltage	< 34 V, SELV Output, Auto-recovery Mode	< 68 V, SELV Output, Auto-recovery Mode
Overload / Overcurrent	105 – 180% of rated load current, Auto-recovery (150% Power Boost for 500 ms )	
Over Temperature	Non-Latching (Auto-recovery)	
Short Circuit	Hiccup Mode, Non-Latching (Auto-recovery when the fault is removed)	
Degree of Protection	IP20	
Protection Against Shock	Class I with PE*7 connection	

\*7 PE: Primary Earth

### Reliability Data

MTBF	Telcordia SR-332	> 500,000 hrs. I/P: 3 x 400 Vac & 3 x 500 Vac, O/P: 100% load, Ta: 25°C
Expected Cap Life Time	10 Years	I/P: 3 x 400 Vac & 3 x 500 Vac, O/P: 50% load, Ta: 40°C
Warranty	3 Years	I/P: 3 x 400 Vac & 3 x 500 Vac, O/P: 80% load, Ta: 50°C

### Safety Standards / Directives

Electrical Safety	CB scheme	IEC/EN/BS EN 62368-1, AS/NZS 62368-1; IEC/EN 61010-1/-2-201
	TUV Bauart	IEC/EN 62368-1
	UL/cUL	UL 62368-1, CSA C22.2; UL 61010-1/-2-201, CAN/CSA-C22.2 No. 61010-1-12
	CCC	GB4943.1
	BIS	IS 13252-1 (Part 1)
	BSMI	CNS 15598-1
	EAC	TP TC 004/2011
	KC	KC 62368-1 (upon request)
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. 1091	
SELV	IEC/EN/UL 61010-2-201, IEC/EN 62368-1	
Galvanic Isolation*8	Input to Output	4.0 kVac
	Input to Ground	2.5 kVac
	Output to Ground	0.5 kVac
	DC OK relay contact to Output	0.5 kVac

\*8 For Hi-Pot testing, the Gas tube screw of TM200 must be removed, after testing must be reinstalled the screw.

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Model Number	DRL-24V960W3EN□	DRL-48V960W3EN□
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### EMC<sup>\*9</sup>

Emissions (CE & RE)	CISPR 32, EN/BS EN 55032, AS/NZS CISPR 32, Class B; KS C 9832; CNS15936; EN/EN BS 61000-6-4, EN/BS EN 61204-3; Compliance to FCC Title 47		
Immunity	EN/BS EN 55035; KS C 9835; EN/BS EN 61000-6-2 ; EN/BS EN 61204-3		
Electrostatic Discharge	IEC 61000-4-2	Level 4 Criteria A <sup>1)</sup> Air Discharge: 15k V Contact Discharge: 8 kV	
Radiated Field	IEC 61000-4-3	Criteria A <sup>1)</sup> 80 MHz – 1 GHz, 10 V/M, 80% Modulation (1 kHz) 1.4 GHz – 6 GHz, 3 V/M, 80% Modulation (1 kHz) 2 GHz – 2.7 GHz, 1 V/M, 80% Modulation (1 kHz)	
Electrical Fast Transient / Burst	IEC 61000-4-4	Level 3 Criteria A <sup>1)</sup> 2 kV	
Surge	IEC 61000-4-5	Level 4 Criteria A <sup>1)</sup>	
		Condition	W/O SPD
		Common Mode <sup>3)</sup>	4 kV
		Differential Mode <sup>4)</sup>	2 kV
Conducted Susceptibility	IEC 61000-4-6	Level 3 Criteria A <sup>1)</sup> 150 kHz – 80 MHz, 10 Vrms	
Power Frequency Magnetic Fields	IEC 61000-4-8	Level 4 Criteria A <sup>1)</sup> 30 A/m	
Voltage Dips and Interruptions	IEC 61000-4-11	0% residual; 1 cycle, Criteria A <sup>1)</sup> 40% residual; 10 cycle, Criteria B <sup>1)</sup> 70% residual; 25 cycle, Criteria B <sup>1)</sup>	
Harmonic Current Emission	IEC/EN/BS 61000-3-2, Class A		
Voltage Fluctuation and Flicker	IEC/EN/EN BS 61000-3-3, d <sub>max</sub> ≤ 4%		
Voltage Sag Immunity SEMI F47-0706	80% of 380 Vac	304 Vac, 1,000 ms	Criteria A <sup>1)</sup>
	70% of 380 Vac	266 Vac, 500 ms	Criteria A <sup>1)</sup>
	50% of 380 Vac	190 Vac, 200 ms	Criteria A <sup>1)</sup>

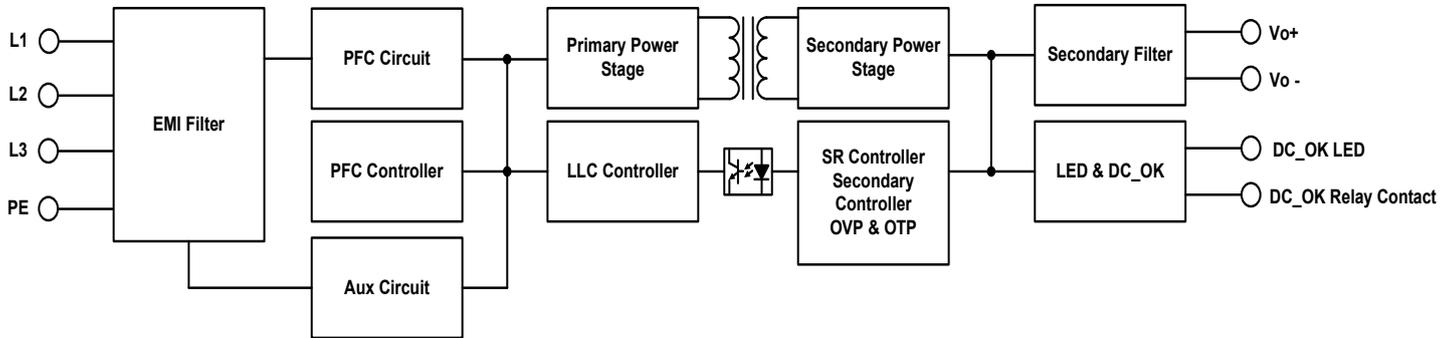
- 1) Criteria A: Normal performance within the specification limits
- 2) Criteria B: Temporary degradation or loss of function which is self-recoverable
- 3) Asymmetrical: Common mode (Line to earth)
- 4) Symmetrical: Differential mode (Line to line)
- 5) Criteria C: Temporary degradation or loss of function which require operator intervention.

\*9 Power supply is considered a component in the end-user's system. Please contact our local sales to get more information about the power supply EMC test setup.

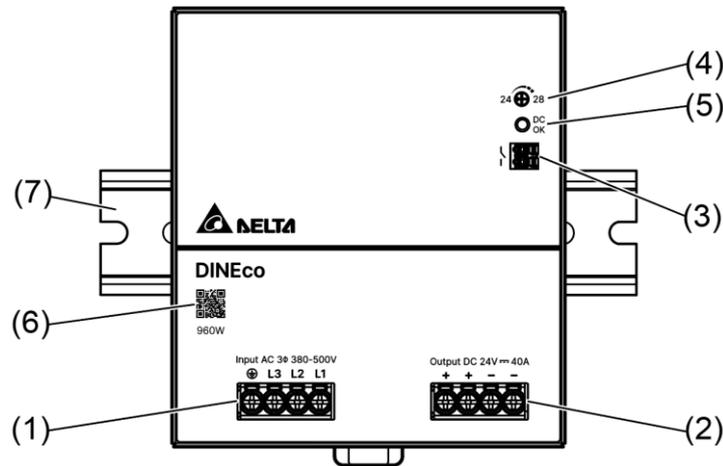
# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□

### Block Diagram



### Device Description



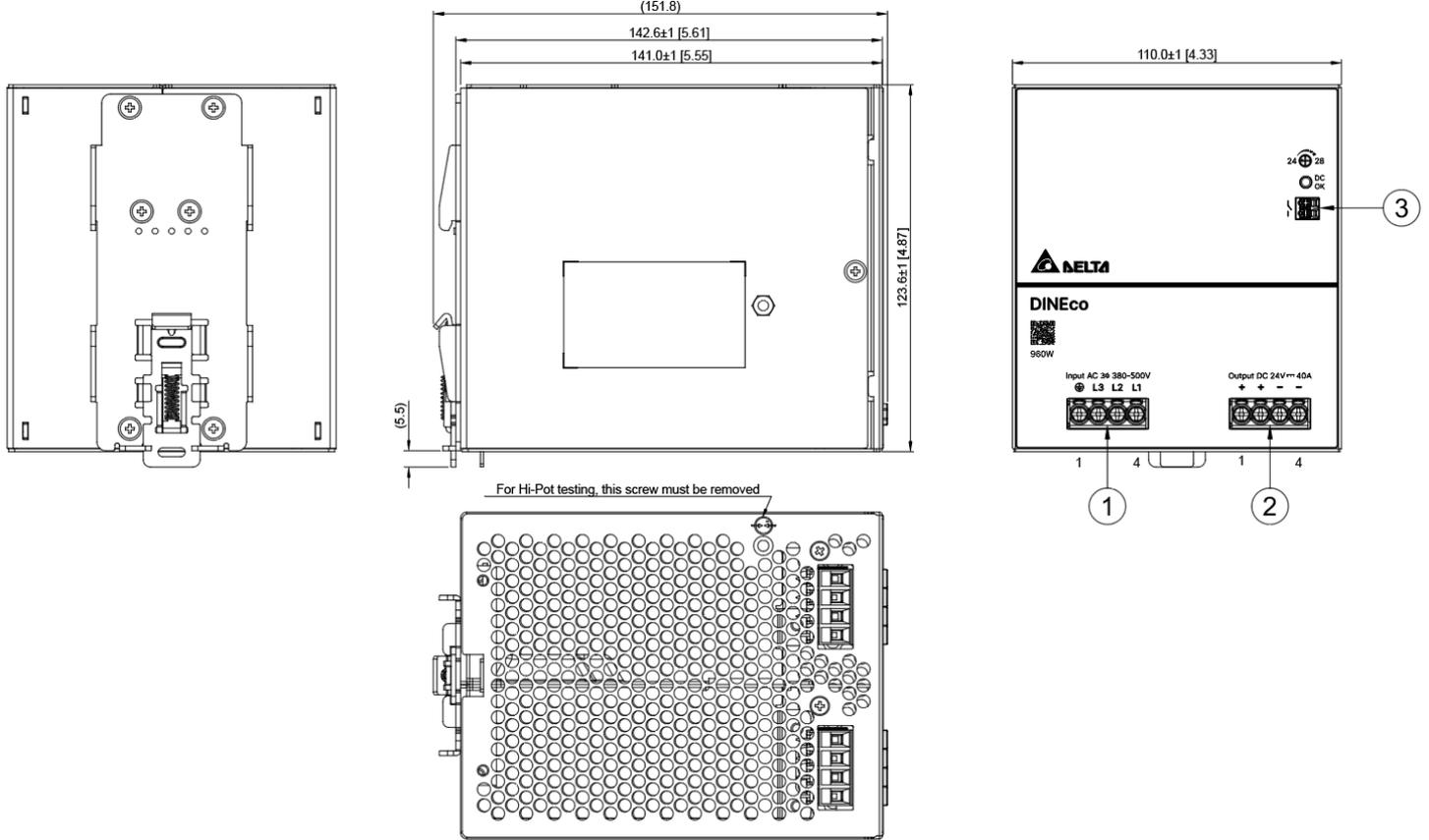
- 1) Input terminal block connector
- 2) Output terminal block connector
- 3) DC OK relay contact
- 4) DC OK LED (Green)
- 5) DC voltage adjustment potentiometer
- 6) QR code for product datasheet link
- 7) Universal mounting rail system

# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□

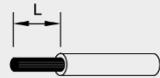
### Dimensions

H x W x D: 123.6 x 110 x 142.6 mm (4.87 x 4.33 x 5.61 inch)



Item	Device Description
1	Input terminal block connector Pin 1: PE Pin 2: L3 Pin 3: L2 Pin 4: L1
2	Output terminal block connector Pin 1 to 2: V(+) Pin 3 to 4: V(-)
3	DC OK relay contact

### Wiring Size:

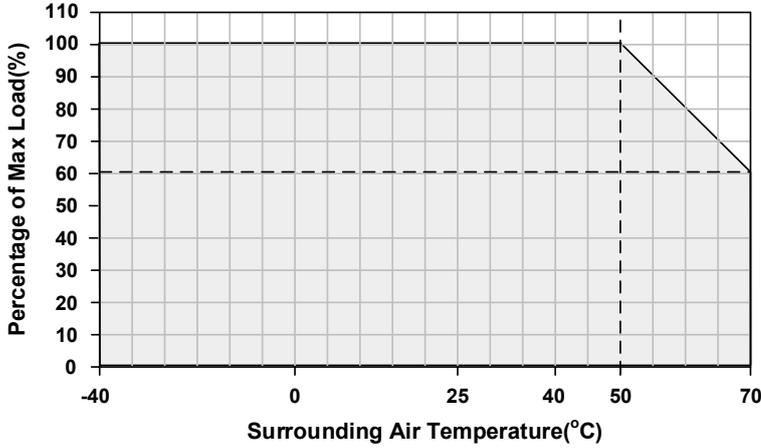
	Stranded / Solid		Torque		Stripping Length (mm) 
	(mm <sup>2</sup> )	(AWG)	(Kgf.cm)	(lbf.in)	
(1) Input	0.82-5.26	18-10	8.0	7.0	8
(2) Output	3.31-5.26	12-10	8.0	7.0	8
(3) Relay Contact	0.32-0.82	22-18	-	-	8

# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□

### Engineering Data

#### Output Load De-rating VS Surrounding Air Temperature



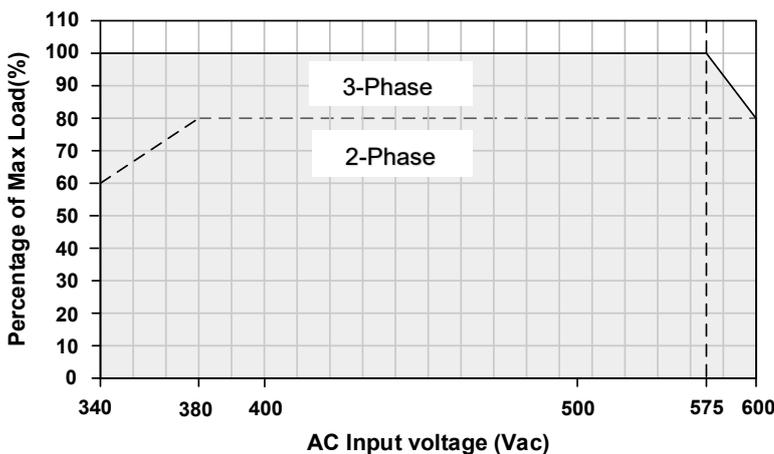
**Fig. 1 De-rating for Vertical Mounting Orientation**  
 > 50°C de-rate power by 2% / °C

Note: When operating at temperatures below -30°C, the PSU may require a few seconds to “bounce” before completing a cold-start power-up.

#### 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. The power supply will have a longer rise time when the ambient temperature range is -30°C to -40°C.
3. If the output capacity is not reduced when the surrounding air temperature exceeds its specification as defined on Page 3 under “Environment”, the device will 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.
4. 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.
5. Depending on the surrounding air temperature and output load delivered by the power supply, the device can be very hot!
6. Need to consider power de-rating if Surrounding Air Temperature is > 50°C.
7. If the device has to be mounted in any other orientation, please leave a message via the [Contact Us](#) form.

#### Output Load De-rating VS AC Input Range



**Fig. 2 De-rating for AC Input**

3-phase: > 575Vac de-rate power by 0.8% / V  
 2-phase: < 380Vac de-rate power by 0.5% / V

1. No output power de-rating for the input voltage from 3 x 340 Vac to 575 Vac.

3-Phase operating curve	—————
2-Phase operating curve	- - - - -

# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□

### Assembly & Installation

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

Each device is delivered ready to install.

#### Mounting

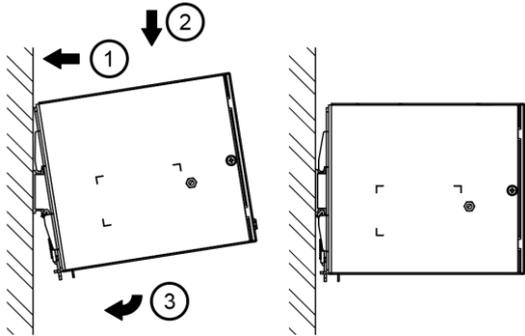


Fig. 3.1 Mounting

1. Tilt the unit upwards and insert it onto the DIN rail. Snap on the DIN rail as shown in Fig. 3.1.
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

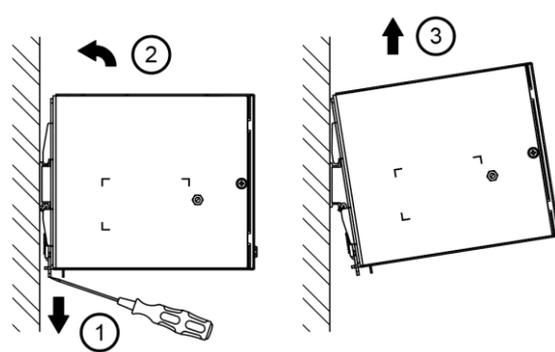


Fig. 3.2 Dismounting

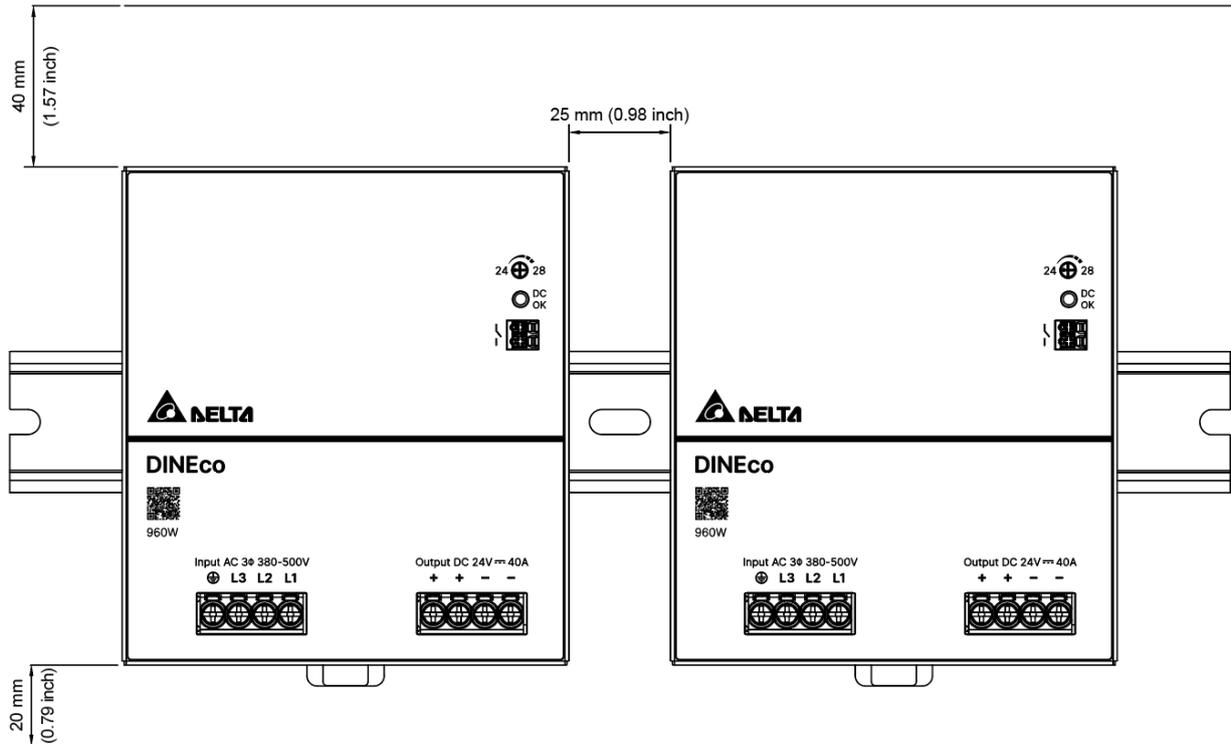
To uninstall, pull or slide down the latch with screw driver as shown in Fig. 3.2. Then slide the power supply unit (PSU) in the opposite direction, release the latch and pull out the power supply unit (PSU) from the rail.

# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□

### Safety Instructions

#### Vertical 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 40 mm (1.57 inch) above and 20 mm (0.79 inch) below. If load is less than 50%, lateral distance can be 0 mm (0 in). In case the adjacent device is a heat source, the lateral distance will be 15 mm (0.59 in) for 80% load or > 25 mm (0.98 in) lateral distance condition for 100% load @ 50°C ambient temperature.
- 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 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.
- For detailed product installation and notice, please refer the user manual.

# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□

### Functions

#### DC OK Relay Contacts and LED Indicator Characteristics

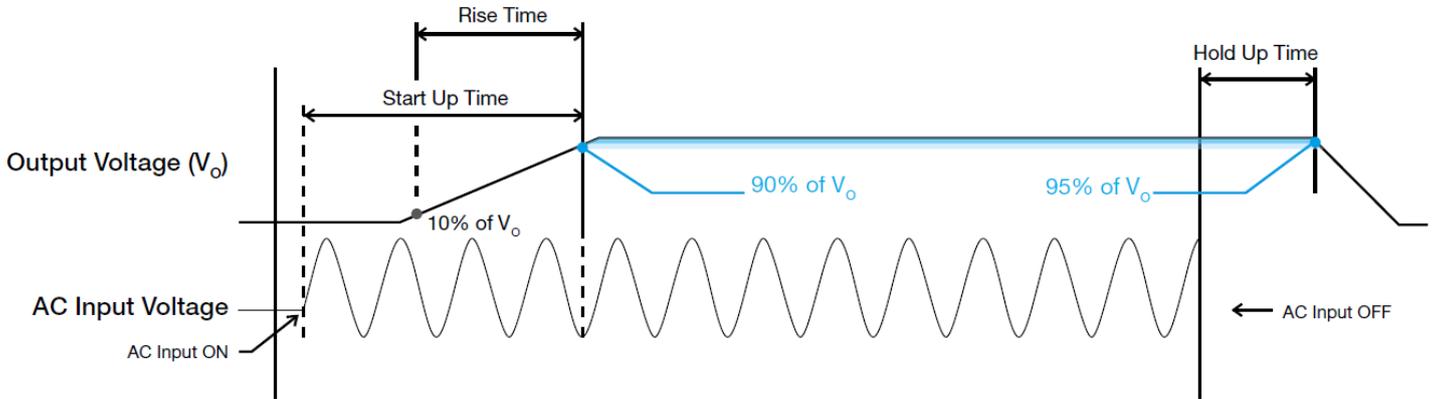
DC OK Relay Contacts Status	Characteristics
Contact closes	The output voltage > 90% of its steady state set value.
Contact opens	The output voltage < 90% of its steady state set value.

Operating Status	DC OK (Green LED)	DC OK Relay Contact
Normal Operation	ON	Closed
Overload (Hiccup Mode)	OFF	Open
Output Short Circuit	OFF	Open
Over Temperature	OFF	Open
No Input Power	OFF	Open

# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□

■ 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

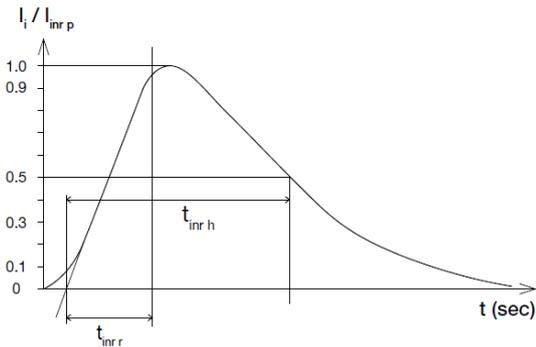
The time required for the output voltage to change from 10% to 90% of its final steady state set value.

### Hold-up Time

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

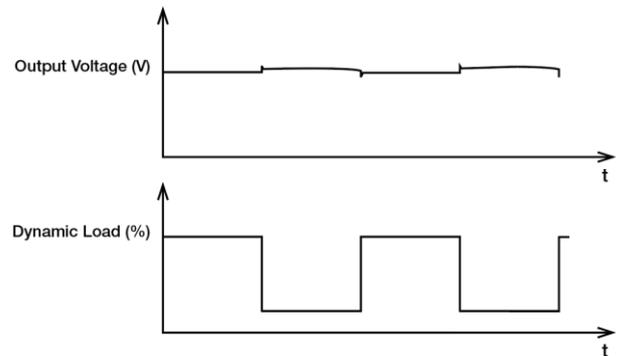
### Inrush Current

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 remain within  $\pm 10\%$  of its steady state value, when subjected to a dynamic load from 10% to 100% of its rated current.

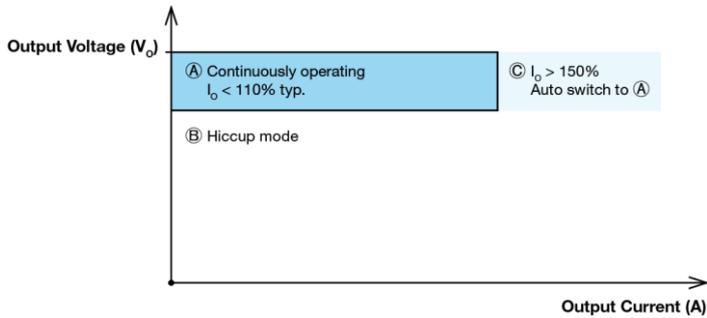


# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□

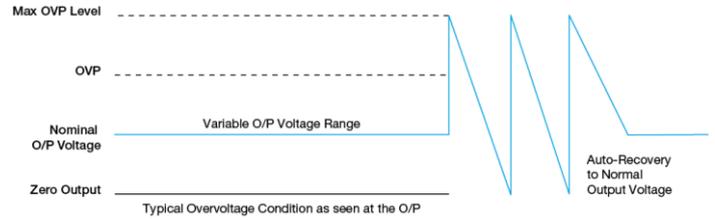
### Overload & Overcurrent Protections (Auto-recovery)

The power supply's Overload (OLP) and Overcurrent (OCP) Protections will be monitored by internal counter when output current ( $I_o$ ) is 105~180% of maximum rated load ( $I_o$  Max). After counter reaches the limit value (typically 500ms), output current will be limited to 150% typ. (refer to ① below) and output voltage ( $V_o$ ) will start to droop. Once  $V_o$  is below approximately 18 Vdc typ., the power supply will start to operate in "Hiccup mode" as described in short circuit protection. The power supply will recover once the fault condition due to OLP or OCP is removed, then  $I_o$  is back within its specified limits.



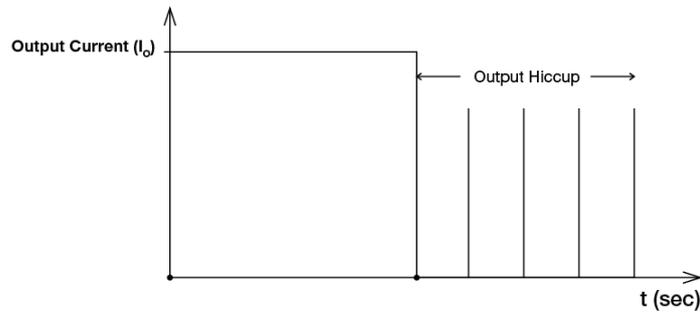
### Overvoltage Protection (Auto-recovery)

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 4 under "Protections".



### Short Circuit Protection (Auto-recovery)

The power supply's output Short Circuit Protection function also provides protection against short circuits. When a short circuit is applied, the output current will operate in "Hiccup mode". The power supply will return to normal operation after the short circuit is removed.



### 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 de-rating graph.

### External Input Protection Device

The unit is protected with internal fuse at L1, L2 and L3 pins, with an internal fuse that cannot be replaced. The power supply has 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 in instruction sheet with 10 A B- or 4 A C- characteristic breaker.

# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□

### Operating Connection

#### 3-Phase AC Input Operation

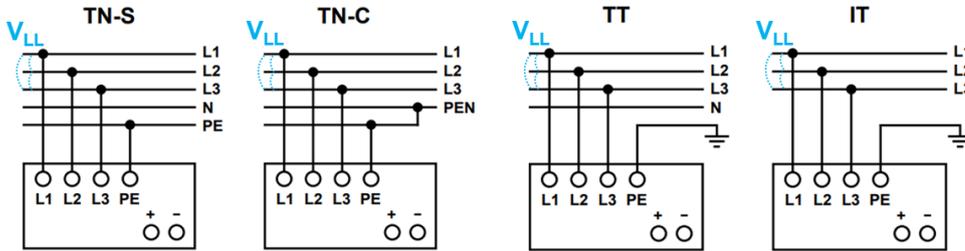


Fig. 4 AC Input Operation Connection Diagram

The power supply is approved for Star or Delta system with L1, L2, L3 and PE connections. The nominal input voltage is 340~575 Vac phase to phase ( $V_{LL}$ ) or equivalent to 340-575 Vac phase to neutral ( $V_{LN}$ ) voltage system.

#### 2-Phase AC Input Operation

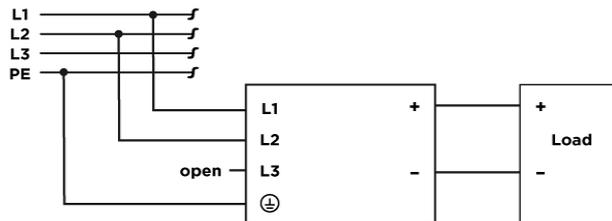


Fig. 5 2-Phase AC Input Operation Connection Diagram

This power supply can also be operated on 2 of 3-phase system, just in case a phase-loss failure from 3-phase system. However, it is not recommended for 3-phase power system, since the 3-phase system can become unbalanced and the lifetime is reduced. Besides, the output power must be reduced according to the derating curves, if it is exceeding of these limits, it may cause a thermal protection.

# DIN Eco Series DIN Rail Power Supply

## 960 W 3-Phase / DRL-□V960W3EN□

### Others

#### 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 [PSU.deltaww.com](http://PSU.deltaww.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.

Delta reserves the right to make changes to the information described in the datasheets without notice.

### Manufacturer and Authorized Representatives Information

#### Manufacturer

##### Thailand

Delta Electronics (Thailand) PCL.  
909 Pattana 1 Rd., Muang, Samutprakarn, 10280 Thailand

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