Technical Information
EF4810



Product Name
EF4810

Description	
	The EF4810 DIN rail industrial power supply features high power density and high efficiency. The power supply offers overcurrent protection in constant current mode, making it suitable for charging applications. Conformal coating is applied on the PCBAs to protect against dust and pollutants often found in harsh industrial environments. The unit's electromagnetic radiated and conducted emissions are compliant with heavy industrial Class B Emission standard and Immunity standard and comply with environmental protection standards RoHS Directive.

Characteristics	
	Universal AC input voltage range
	Built-in constant current circuit for charging applications
	Full load operating temperature up to 60 °C
	Cold start at -40 °C
	Ultra-slim design
	Long life electrolytic capacitor
	Built-in DC OK relay and LED indicator
	Conformal coating on PCBAs to protect against common dust and pollutants
	Designed for industrial 115 to 230 V applications

Input	
Nominal input voltage	100-240 VAC
Input voltage range	90-264 VAC
Nominal input frequency	50-60 Hz
Input frequency range	47-63 Hz
DC input voltage range*1	127-375 VDC
Input current	4.7 A typ. @ 115 VAC, 2.4 A typ. @ 230 VAC
Efficiency at 100 % load	95.0 % typ. @ 230 VAC
Average efficiency (25 %, 50 %, 75 %, 100 %)	91.5 % typ. @ 115 VAC
No load power consumption	1 W typ. @ 115 VAC & 230 VAC
Max inrush current (cold start)	22 A typ. @ 230 VAC
Power factor at 100 % load	> 0.96 @ 115 VAC & > 0.93 @ 230 VAC
Leakage current	< 1.5 mA @ 240 VAC

*1 Power supply can operate at DC input voltage, please connect +pole to L, -pole to N and PE terminal to an earth wire or to the machine ground.

Output[2]		
Nominal output voltage		48 VDC
Factory set point tolerance		48 VDC ± 1 %
Output voltage adjustment range		48-55 VDC
Output current		0-10.0 A
Output power		480 W max.
Line regulation		± 0.5 % @ 115 VAC & 230 VAC
Load regulation		± 0.5 %
PARD*3 (20 MHz)		150 mVpp typ. @ 0 °C to +70 °C 450 mVpp typ. @ -30 °C to 0 °C
Rise time		30 ms typ. @ 115 VAC & 230 VAC
Start-up time		800 ms typ. @ 115 VAC & 230 VAC
Hold-up time		25 ms typ. @ 115 VAC & 230 VAC (100 % load)
Dynamic response (overshoot & undershoot O/P voltage)		± 10 % @ 115 VAC & 230 VAC input, 10-100 % load (slew rate: 2.5 A/µS, 50 % duty cycle @ 5 Hz & 10 kHz)
Start-up with capacitive loads		5,000 µF max.
Functional	DC OK relay contact	30 V / 1 A The relay contact is normally “ON” (closed) when the output (V_{OUT}) is greater than 90 % typ. of its rated value.

*2 For power will be de-rating from 60 °C to 70 °C, and V_{in} < 100 VAC, see Engineering Data power de-rating information.
*3 PARD 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. PSU needs to burn in around 5 minutes when AMB ≤ 0 °C.

Mechanical Data		
Case cover / chassis		Metal
Dimensions (H x W x D)		123.6 x 56 x 116.8 mm (4.87 x 2.20 x 4.60 inch)
Unit weight		0.88 kg (1.94 lb)
Indicator	Green LED	DC OK
Cooling system		Convection
Terminal	Input	3 pins (rated 300 V / 30 A)
	Output	4 pins (rated 300 V / 30 A)
	DC OK	2 pins (rated 300 V / 6 A)
Wire	Input	AWG 14-12 (current rating can refer to "AWG Wire Table")
	Output	AWG 14-12 (current rating can refer to "AWG Wire Table")
	DC OK	AWG 22-16 (current rating can refer to "AWG Wire Table")
Mounting rail		Standard TS35 DIN Rail in accordance with EN 60715
Noise (1 meter from power supply)		Sound pressure level (SPL) < 25 dBA

Environment		
Surrounding air temperature	Operating	-30 °C to +70 °C (-40°C cold start)
	Storage	-40 °C to +85 °C
Power de-rating	Temperature	> 60 °C de-rate power by 2.5 % / °C
	Input voltage	< 100 VAC de-rate power by 1 % / VAC
Operating humidity		5 to 90 % 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
Vibration	Operating	IEC 60068-2-6, sine wave: 10 Hz to 500 Hz; 4 G peak; 60 min per axis for all X, Y, Z directions
Over voltage category		II (compliance to EN 62477-1 OVC III with 2000 meters altitude)
Pollution degree		2

Protection	
Overvoltage	< 68.0 V, SELV output, latch mode
Overload / overcurrent	105-150 % of rated load current, auto-recovery Continuous current limit Mode[*5] (V_O > 80 %)
Over temperature	Latch mode
Short circuit	Hiccup mode, non-latching (auto-recovery when the fault is removed)
Internal fust at L pin	T10 A / 250 V
Protection against shock	Class I with PE[*6] connection

*5 Constant current limit protection for inductive and capacitive load applications

*6 PE: Primary Earth

Reliability Data		
MTBF	Telcordia SR-332	> 700,000 hrs I/P: 115 VAC & 230 VAC O/P: 100 % load Ta: 25 °C
Expected cap lifetime		10 years (230 VAC, 50 % load @ 50 °C)

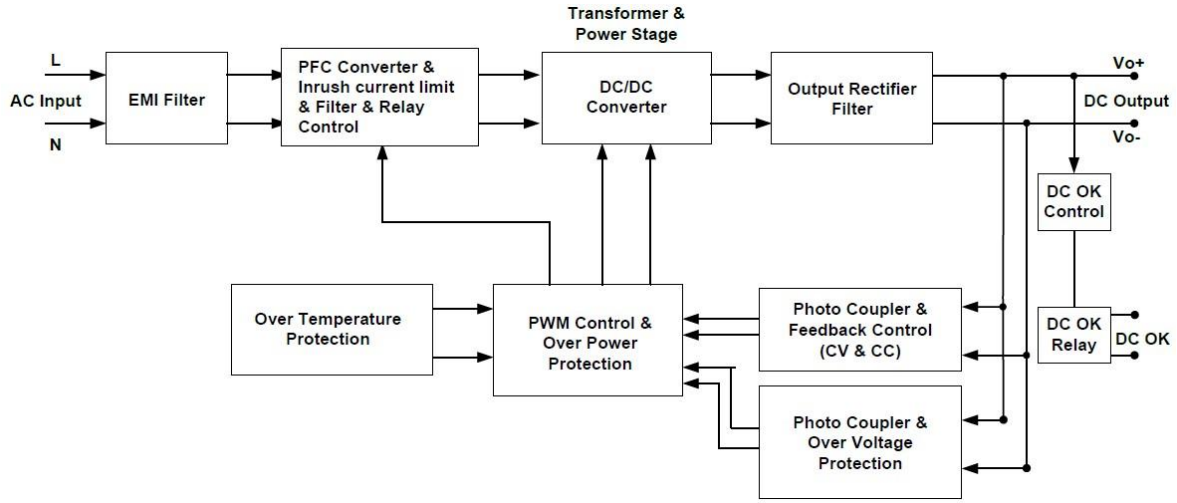
Safety Standards / Directives		
Electrical safety	CB scheme	IEC 62368-1, IEC 60950-1, IEC 61010-1/-2-201
	TUV Bauart	EN 62368-1, EN/BS 61010-1/-2-201
	EAC	TP TC 004/2011
	BSMI	CNS14336-1
	CCC	GB4943.1
CE		In conformance with EMC Directive 2014/30/EU and Low Voltage Directive 2014/35/EU
UKCA		In conformance with Electrical Equipment (Safety) Regulations 2016 and Electromagnetic Compatibility Regulations 2016
Galvanic isolation	Input to output	4.0 kVAC
	Input to ground	2.0 kVAC
	Output to ground	1.5 kVAC
	Output to DC OK	500 VAC

EMC[*7]				
Emissions (CE & RE)		CISPR 32, EN/BS 55032, EN/BS 61000-6-4, AS/NZS CISPR32, EN/BS EN 61204-3, KS C 9832 Compliance to FCC Title 47, EN/BS 61000-6-3: Class B		
Component Power Supply for General Use		EN/BS EN 61204-3		
Immunity		EN 55035, KS C 9835, EN/BS EN 61000-6-2 Compliance to EN/BS EN 61000-6-1		
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	Criteria A[1)] 80 MHz – 1 GHz, 10 V/M, 80 % Modulation (1 kHz) 1.4 GHz – 2 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[1)] 2 kV		
Surge	IEC 61000-4-5	Level 4 Criteria A[1)] Common Mode[4)]: 4 kV Differential Mode[5)]: 2 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	Level 4 Criteria A[1)] 30 A/m		
Voltage Dips and Interruptions	IEC 61000-4-11	0% residual; 1 cycle, Criteria B[2)] 40% residual; 10 cycle, Criteria C[3)] 70% residual; 25 cycle, Criteria C[3)]		
Harmonic Current Emission		IEC/EN/BS EN 61000-3-2, Class A & Class D		
Voltage Fluctuation and Flicker		IEC/EN/BS EN 61000-3-3		
Voltage Sag Immunity SEMI F47 – 0706		80 % of 200 VAC 70 % of 200 VAC 50 % of 200 VAC	160 VAC, 1000 ms 140 VAC, 500 ms 100 VAC, 200 ms	Criteria A[1)] Criteria A[1)] Criteria A[1)]

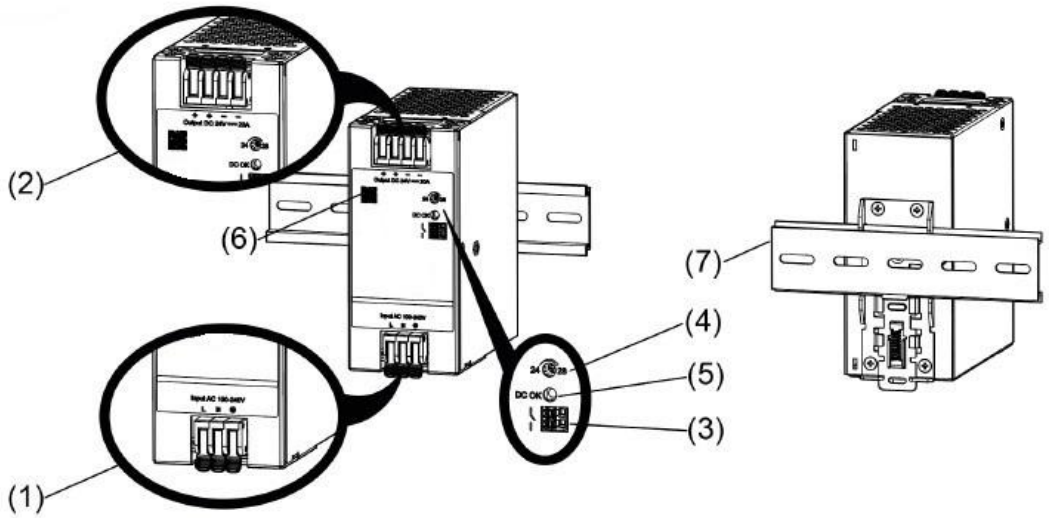
1) Criteria A: Normal performance within the specification limits
2) Criteria B: Temporary degradation or loss of function which is self-recoverable
3) Criteria C: Output out of regulation, shuts down during test (Need to recycle AC power cord to normal operation after test)
4) Asymmetrical: Common mode (Line to earth)
5) Symmetrical: Differential mode (Line to line)

*7 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.

Block Diagram



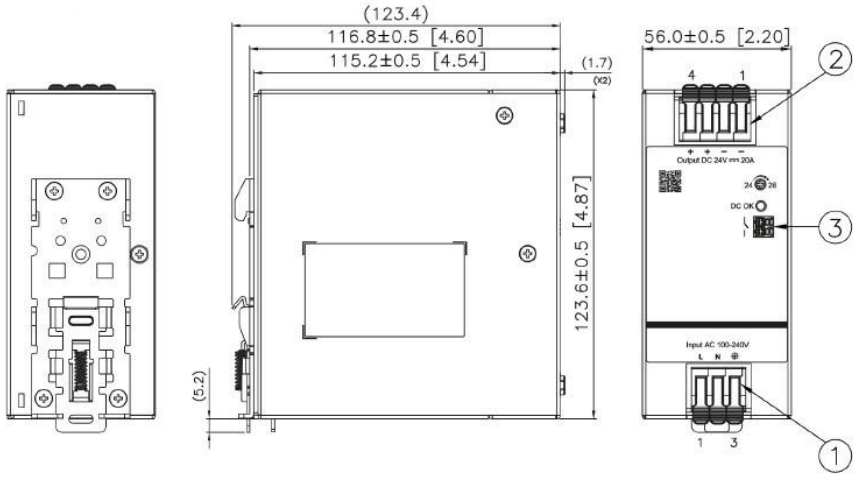
Device Description



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

Dimensions

H x W x D: 123.6 x 56 x 116.8 mm (4.87 x 2.20 x 4.60 inch)



*Unless otherwise specified tolerance of dimension are ± 0.5 mm

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

AWG Wire Table – Current Rating for PVC Wire

6 AWG	52.5 A
8 AWG	37.5 A
10 AWG	29.0 A
12 AWG	22.5 A
14 AWG	16.5 A
16 AWG	12.0 A
18 AWG	9.0 A
20 AWG	6.5 A
22 AWG	5.0 A
24 AWG	3.5 A
26 AWG	2.5 A
28 AWG	2.0 A
30 AWG	1.5 A

Engineering Data

Output Load De-rating VS Surrounding Air Temperature

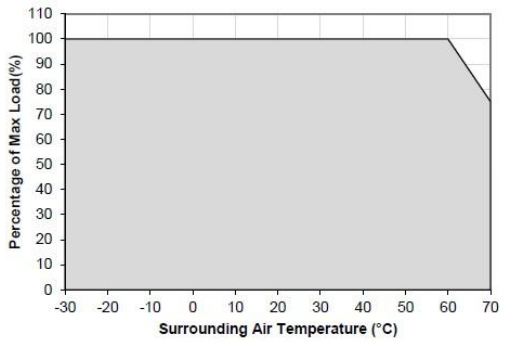


Fig. 1 De-rating for Vertical Mounting Orientation
> 60°C de-rate power by 2.5 % / °C

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 PSU will be bouncing and start up time will not exceed 5 s when ambient temperature at -30 °C.
3. If the output capacity is not reduced when the surrounding air temperature > 60 °C, the device will run into Over Temperature Protection. When activated, power supply will latch off, until the surrounding air temperature is lowered or the load is reduced as far as necessary to keep the device in working condition and require removal/re-application of input AC voltage in order to restart.
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 > 60 °C.
7. If the device has to be mounted in any other orientation, please contact us.

Output Load De-rating VS Input Voltage

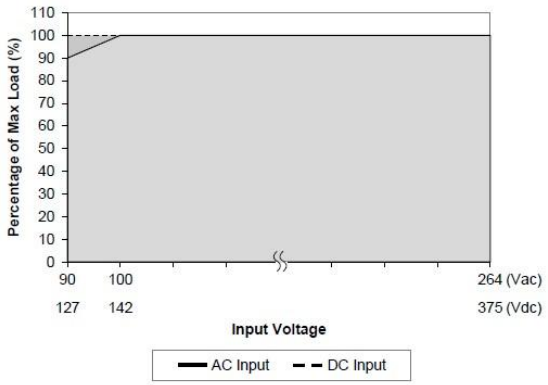


Fig. 2 De-rating for AC & DC Input Voltage
< 100 VAC de-rate power by 1 % / VAC
No de-rate power for DC input

- No output power de-rating for the input voltage from 100 VAC to 264 VAC & 127 VDC to 375 VDC

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

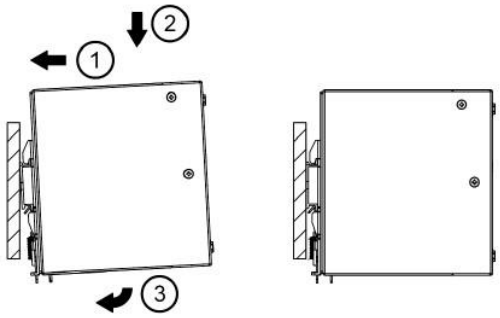


Fig. 3.1 Mounting

Snap on the DIN rail as shown in Fig. 3.1:

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

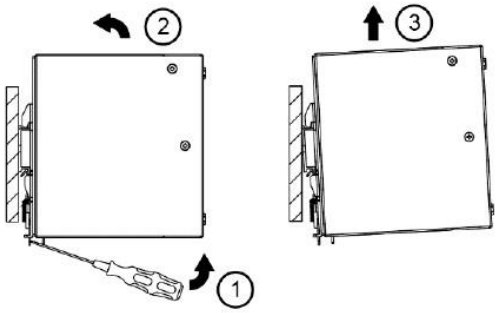
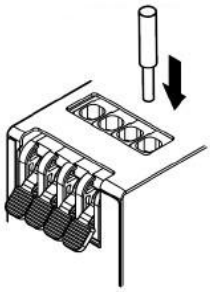


Fig. 3.2 Dismounting

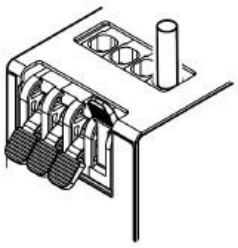
To uninstall, pull or slide down the latch with screw driver as shown in Fig. 3.2. Then slide the power supply unit (PSU) in the opposite direction, release the latch and pull out the power supply unit (PSU) from the rail.

Connecting a Wire to Spring Clamp Terminals

1. Open the lever and insert the wire.



2. Close the lever.

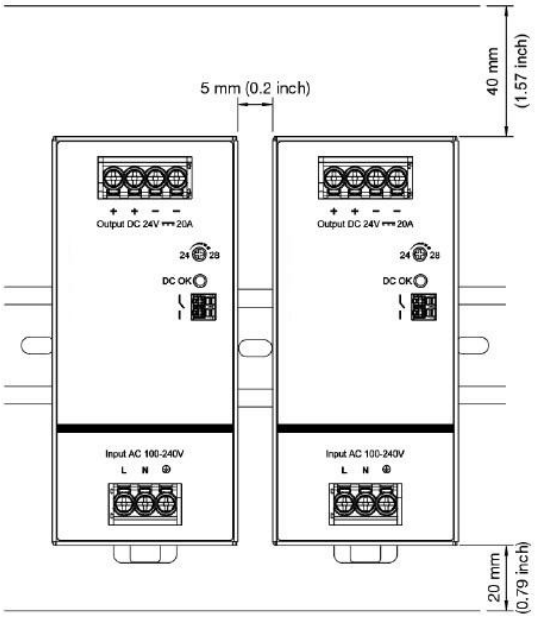


To disconnect the wires, reverse the procedure.

Note: The use of wire end ferrules in combination with spring-loaded terminals is not permitted; there is a risk that this could damage the terminals, and it also results in increased contact resistance.

Safety Instructions

Vertical Mounting



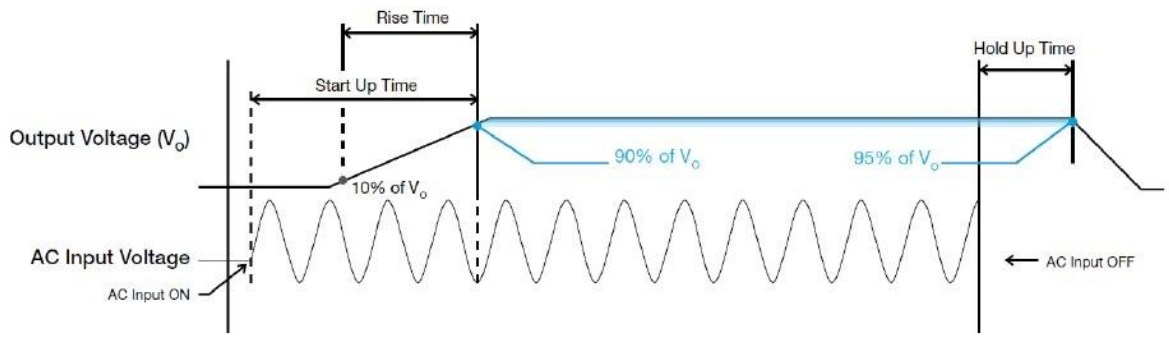
- ALWAYS switch mains of input power OFF before connecting and disconnecting the input voltage to the unit. If mains are not turned OFF, there is risk of explosion / severe damage.
- **To guarantee sufficient convection cooling, keep a distance of 40 mm (1.57 inch) above and 20 mm (0.79 inch) below the device as well as a lateral distance of 5 mm (0.2 inch) to other units and if load less than 50 %, lateral distance can be 0 mm. In case the adjacent device is a heat source, the lateral distance will be 15 mm (0.6 inch) at 230 VAC input.**
- 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.

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

LED Indicator Characteristics		
	DC OK (Green LED)	**DC OK Relay Contact**
Normal operation	ON	Closed
Overload (Hiccup mode)	INTERMITTENT	Open
Output short circuit	INTERMITTENT	Open
Over temperature	OFF	Open

No input power	OFF	Open

Start-up Time, Rise Time, and Hold-up Time



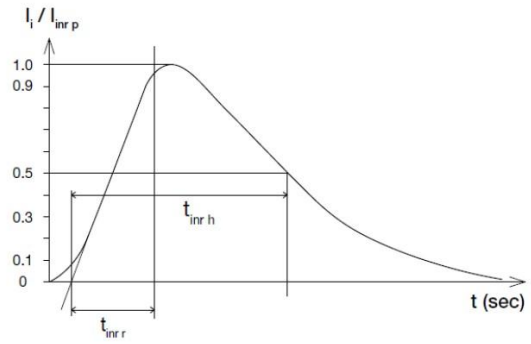
Start-up Time
The time required for the output voltage to reach 90 % of its final steady state set value, after the input voltage is applied.

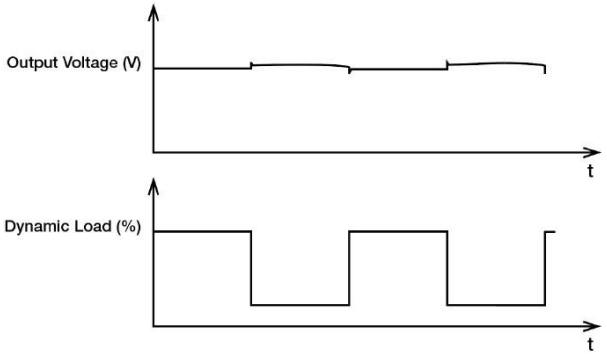
Rise Time
The time required for the output voltage to change from 10 % to 90 % of its final steady state set value.

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.

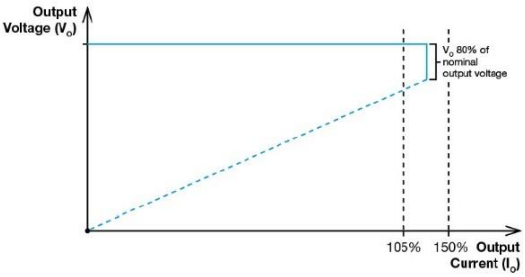
Dynamic Response
The power supply output voltage will remain within ±10 % of its steady state value, when subjected to a dynamic load from 10 % to 100 % of its rated current.





Overload & Overcurrent Protections (Continuous Current)

The power supply offers constant current limit protection for inductive and capacitive load applications when output current range is 105-150 % of I_O (Max load) and output voltage large than 80 %. Upon such an occurrence, the V_O (output voltage) will start to drop. Once the power supply has reached its maximum power limit, the protection will be activated; and the power supply will operate in continuous current. The power supply will recover once the cause of OLP or OCP is removed, and I_O (output current) is back within the specified range.



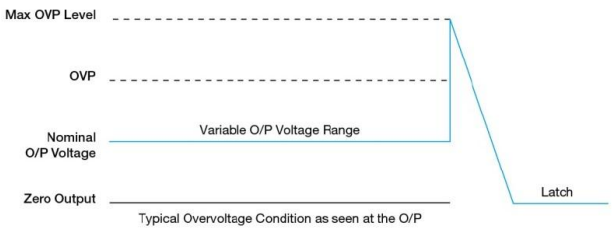
Short Circuit Protection (Auto-Recovery)

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.

Overvoltage Protection (Latch Mode)

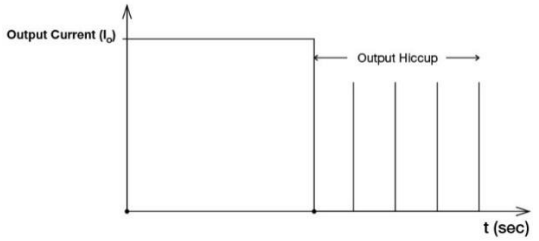
The power supply's overvoltage circuit will be activated when its internal feedback circuit fails. The output voltage shall not exceed its specifications as described in "Protections" section. Power supply will latch off, and require removal/re-application of input AC voltage in order to restart.

The power supply should be latch.



Over Temperature Protection (Latch Mode)

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; or, when the operating temperature is beyond what is recommended in the de-rating graph, the OTP circuit will be activated. When activated, power supply will latch off, until the surrounding air temperature drops to its normal operating temperature or the load is reduced as recommended in the de-rating graph. Removal/re-application of input AC voltage will then be required in order to restart.



Operating Mode

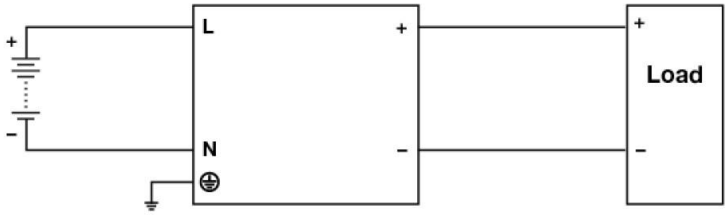


Fig. 4 DC Input Operation Connection Diagram

DC Input Operation

1. Use a battery or similar DC source.
2. Connect +pole to L and -pole to N.
3. Connect the PE terminal to an earth wire or to the machine ground.

Please note:
All parameters are specified at 25 °C ambient and AC input unless otherwise indicated.