Medical AC-DC Open Frame Power Supply
200 W 2″x4″ High Density / MDS-200APB☐ AA



MDS-200APB☐ AA

Highlights & Features

- Safety Approvals to IEC 60601-1 & IEC 62368-1
- Compliant with IEC 60601-1-2 4th Ed. Requirements
- Power Good Signal
- 2xMOPP Isolation for Medical Applications
- Up to 120 W~140 W convection, 200 W forced air

Safety Standards

CB Certified for worldwide use

Model Number: MDS-200APB☐ AA
Unit Weight: 200 g (0.441 lb)
Dimensions (L x W x H): 101.9 x 51.1 x 36.6 mm (4.01 x 2.01 x 1.44 inch)

General Description

Delta's MDS-200APB☐ AA internal open frame power supply comes with universal AC input range from 90 Vac to 264 Vac. Other features include low leakage, Type BF Patient Access Leakage Currents, and electric shock protection compliance with 2 x MOPP requirements. The MDS-200APB☐ AA is certified for EMC standards according to EN/BS EN 55011 for industrial, scientific and medical (ISM) radio-frequency equipment; and EN/BS EN 55032 for Industrial Technology Equipment (ITE) radio-frequency equipment.

The MDS-200APB☐ AA comes with both medical and ITE safety approvals, such as UL/CE, and CB certification. Designs are compliant with RoHS Directive for environmental protection.

Model Information

Model Number	Input Voltage	Output Voltage	Convection Current Output	Forced Air Current Output
MDS-200APB12 AA	90-264 Vac	12 Vdc	0-10.83 A	0-16.67 A**
MDS-200APB24 AA		24 Vdc	0-5.83 A	0-8.33 A*
MDS-200APB36 AA		36 Vdc	0-3.33 A	0-5.56 A*

*With 5.5 CFM forced air
**With 8.5 CFM forced air

Model Numbering

MDS	-	200	A	P	B	☐	☐	AA
Delta Medical Power Supply		Max wattage in the product Series. Maybe lower at some voltage. 200 → 200 W	Family Code A~Z	Product Type P: Open Frame	Input Type Code B: 3pin Class I	Output Voltage 12 for 12 V 24 for 24 V 36 for 36 V	Blank	Revision Code

All parameters are specified at 25°C ambient unless otherwise noted.

Medical AC-DC Open Frame Power Supply
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Specifications

Model Number	MDS-200APB12 AA	MDS-200APB24 AA	MDS-200APB36 AA

Input Ratings / Characteristics

Nominal Input Voltage	100-240 Vac		
Input Voltage Range	90-264 Vac		
Nominal Input Frequency	50-60 Hz		
Input Frequency Range	47-63 Hz		
Input Current (max)	2.5 A		
Input Surge Voltage (max)	300 Vac for 100 ms		
Full load Efficiency (typ.)	91% @ 115 Vac/60 Hz 93% @ 230 Vac/50 Hz, Reference Fig. 1	92% @ 115 Vac/60 Hz 93% @ 230 Vac/50 Hz, Reference Fig. 2	91.5% @ 115 Vac/60 Hz 94% @ 230 Vac/50 Hz, Reference Fig. 3
Standby Power (max)	0.5 W @ 115 Vac/60 Hz, 230 Vac/50 Hz		
Inrush Current (max)	60 A @ 230 Vac, cold start		
Input-PE (protective earth) leakage current (max)	0.1 mA @ NC, 0.3 mA @ SFC[1)]		
Output-PE (protective earth) leakage current for Type BF application (max)	0.1 mA @ NC, 0.5 mA @ SFC [1)]		
Power Factor (min)	0.95 @ 115 V/50 Hz, 230 V/50 Hz, full load		

1) NC: normal condition
2) SFC: single fault condition

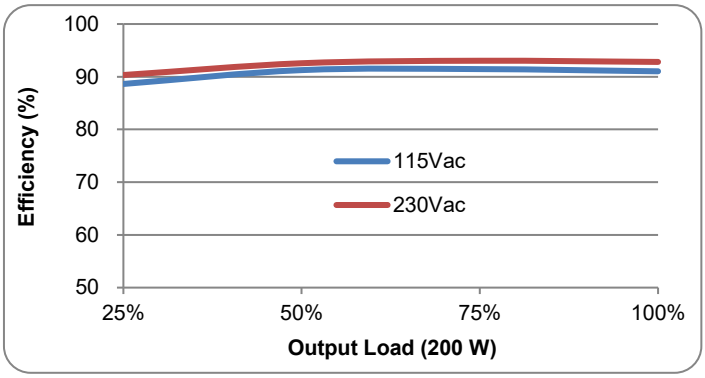

Fig. 1 Efficiency versus output load (MDS-200APB12 AA)

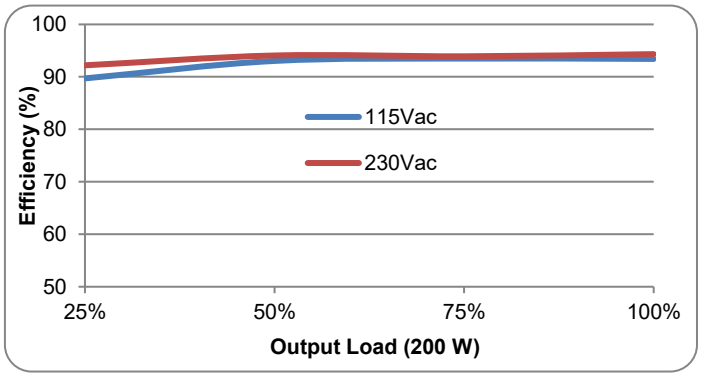

Fig. 2 Efficiency versus output load (MDS-200APB24 AA)

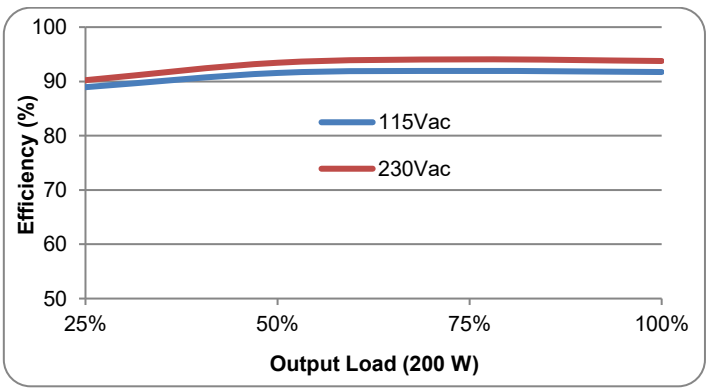

Fig. 3 Efficiency versus output load (MDS-200APB36 AA)

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Medical AC-DC Open Frame Power Supply
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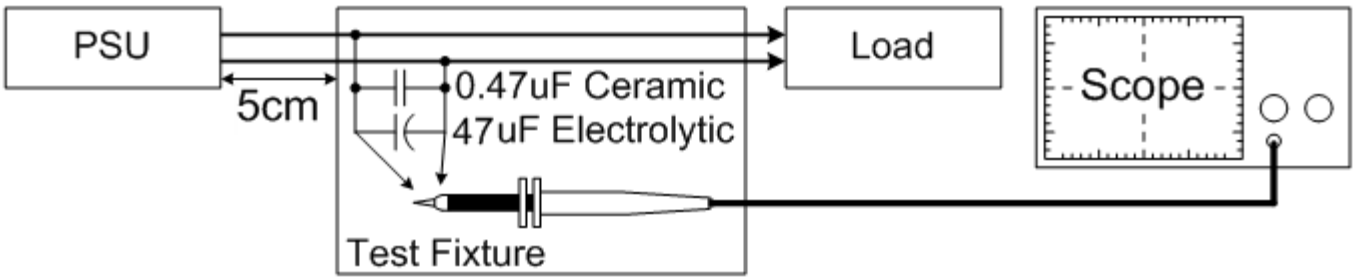
Output Ratings / Characteristics

Model Number	MDS-200APB12 AA	MDS-200APB24 AA	MDS-200APB36 AA
Nominal Output Voltage (Vrated)	12 V	24 V	36 V
Total Regulation (max.)	±3%	±3%	±3%
Output Power	200 W 8.5 CFM air Up to 130 W convection air	200 W 5.5 CFM air Up to 140 W convection air	200 W 5.5 CFM air Up to 120 W convection
Line Regulation (max)	±0.5%		
Load Regulation (max)	±2.5%		
Ripple& Noise (typ.)	1% pk-pkVrated @ Full load		
Start-up Time (max)	2000 ms @ 115 Vac		
Hold-up Time (min)	12 ms @ 115 Vac, tested with 130 W load	12 ms @ 115 Vac, tested with 130 W load	12 ms @ 115 Vac, tested with 120 W load
Dynamic Response (Overshoot & Undershoot O/P Voltage)	±5% @ 50-100% load (Slew Rate: 0.5 A/μS, 50% duty cycle @ 10 Hz & 10 KHz)		
Capacitive load (max)	1000 uF @ 200 W 1500 uF @ 130 W	1000 uF @ 200 W 1500 uF @ 140 W	1000 uF @ 200 W 1500 uF @ 120 W
Rise time (max)	100 ms		

Ripple & Noise measurement circuit



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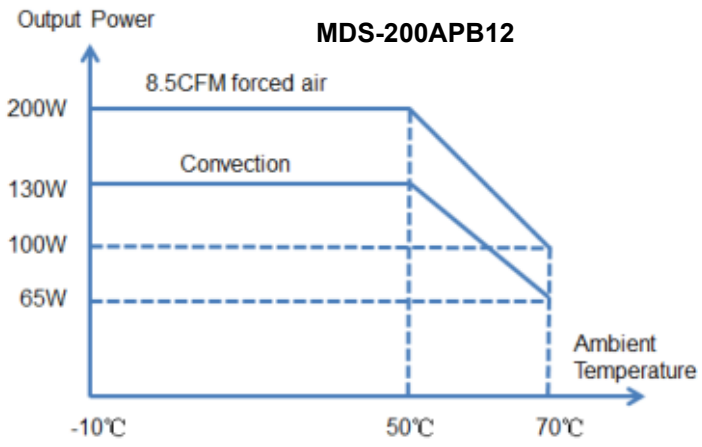
Mechanical

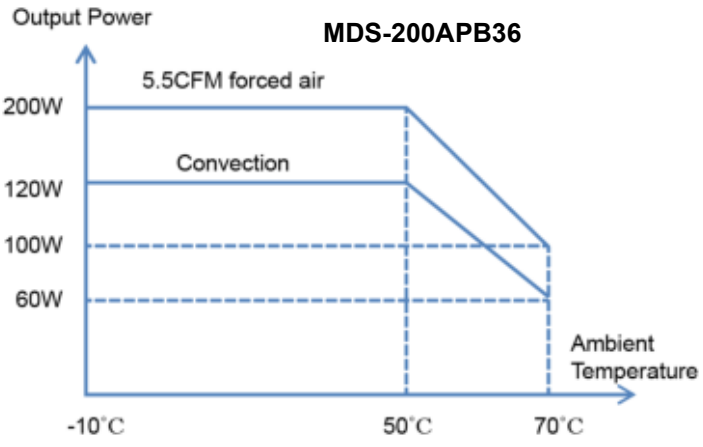
Case Cover	NA
Dimensions (L x W x H)	101.9 x 51.1 x 36.6 mm (4.01 x 2.01 x 1.44 inch)
Unit Weight	200 g (0.441 lb)
Indicator	NA
Cooling System	NA

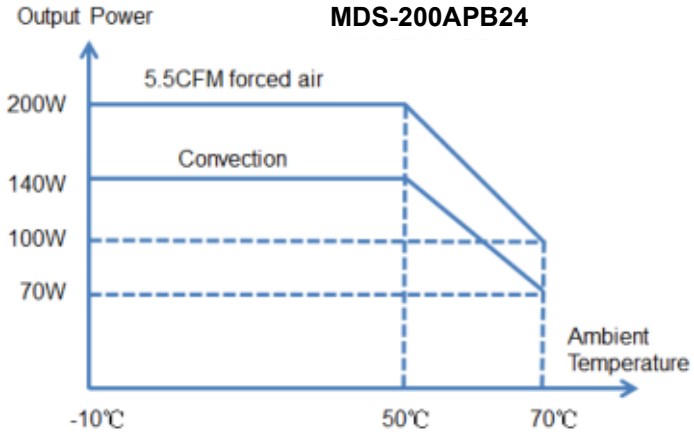
Environment

Surrounding Air Temperature	Operating	Absolute Max -10°C to +70°C, supported power linearly de-rate from 50°C to 50% rated up to 70°C Note: see power de-rating curve
	Storage	-40°C to +85°C
Operating Humidity		5-95% RH (Non-Condensing)
Storage Humidity		5-95% RH (Non-Condensing)
Operating Altitude		Up to 5,000 meters (up to 16402 feet or 106-54 kPa)
Shock Test	Non-Operating	50 G, 11 ms, 3 shocks for each direction
Vibration	Non-Operating	5-500 Hz, 2 Grms, 15 minute for each three axis

Power De-rating curve







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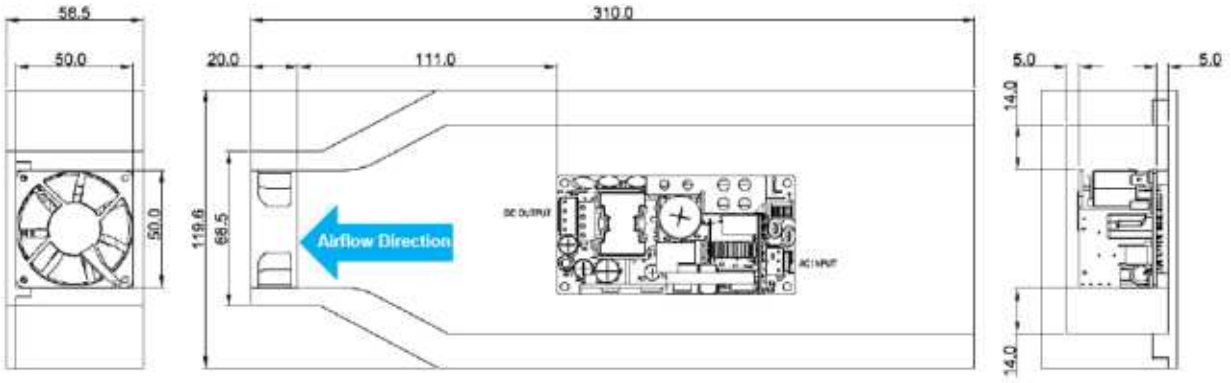
Load De-rating fixture and Test setup. Fan is DELTA Part Number AFB0512HHD



Protections

Overvoltage (max)	125% of rated voltage, Latch Mode
Overload / Overcurrent (typ.)	Main output 160% of rated current Hiccup Mode (Non-Latching, Auto-Recovery)
Over Temperature	Latch Mode
Short Circuit	Hiccup Mode, (Non-Latching, Auto-Recovery)

Reliability

MTBF (Minimum) 115 Vac, 130 W, 35°C, Convection Air Flow (MDS-200APB12 AA) 115 Vac, 140 W, 35°C, Convection Air Flow (MDS-200APB24 AA) 115 Vac, 120 W, 35°C, Convection Air Flow (MDS-200APB36 AA)	800 kHrs based on Telcordia SR-332
Operating life 115 Vac, 130 W, 25°C, Convection Air Flow (MDS-200APB12 AA) 115 Vac, 140 W, 25°C, Convection Air Flow (MDS-200APB24 AA) 115 Vac, 120 W, 25°C, Convection Air Flow (MDS-200APB36 AA)	26,280 Hrs

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Safety Standards / Directives

Medical Safety		IEC 60601-1 CB report EN 60601-1 CAN/CSA-C22.2 No. 60601-1 ANSI/AAMI ES 60601-1
ITE Safety		IEC 60950-1 CB report IEC 62368-1 TUV 60950-1 UL 60950-1+CAN/CSA 60950-1 CCC GB 17625.1; GB 4943.1; GB/T 9254.1[1)]
CE		In conformance with EMC Directive 2014/30/EU and Low Voltage Directive 2014/35/EU EN 60601-1: 2006 + A11: 2011 + A1L 2013 + A12: 2014 & EN 60601-1-2: 2015
UKCA		In conformance with Electrical Equipment (Safety) Regulations 2016 and Electromagnetic Compatibility Regulations 2016, Medical Devices Regulations 2002 (UK MDR 2002)
Galvanic Isolation	Input to Output (2XMOPP) Input to Ground (1XMOPP) Output to Ground (1XMOPP)	4000 Vac 1500 Vac[2)] 1500 Vac (Type BF application rated)

1) 36V only.
2) PSU can support PoE applications with Primary to FG 2500Vac test.

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EMC (Compliant with IEC 60601-1-2 4th Ed. Requirements)

EMC / Emissions		EN/BS EN 55011, EN/BS EN 55032, FCC Title 47: Class B
Harmonic Current Emissions	IEC 61000-3-2	Meet Class D limit
Voltage Flicker	IEC 61000-3-3	
Immunity to		
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-2700 MHz, 10 V/m AM modulation 385 MHz-5785 MHz, 28 V/m Pulse mode and other modulation
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[3)]: 2 kV Differential Mode[4)]: 1 kV
Conducted	IEC 61000-4-6	Level 2 Criteria A[1)] 150 kHz-80 MHz, 3 Vrms, 6 Vrms at ISM bands and Amateur radio bands
Power Frequency Magnetic Fields	IEC 61000-4-8	Criteria A[1)] Magnetic field strength 30 A/m
Voltage Dips	IEC 61000-4-11	Criteria A[1)] 0% U_T, 0.5 cycle (10 ms), 0˚/45˚/90˚/135˚/180˚/225˚/270˚/315˚/360˚ Criteria B[1)] 0% U_T, 1 cycle (20 ms), 0˚ Criteria B[2)] 70% U_T, 25 cycle (500 ms), 0˚ Criteria B[2)] 0% U_T, 250 cycle (5000 ms), 0˚

1) Criteria A: Normal performance within the specification limits
2) Criteria B: Output out of regulation, or shuts down during test. Automatically restore to normal operation after test.
3) Asymmetrical: Common mode (Line to earth)
4) Symmetrical: Differential mode (Line to line)

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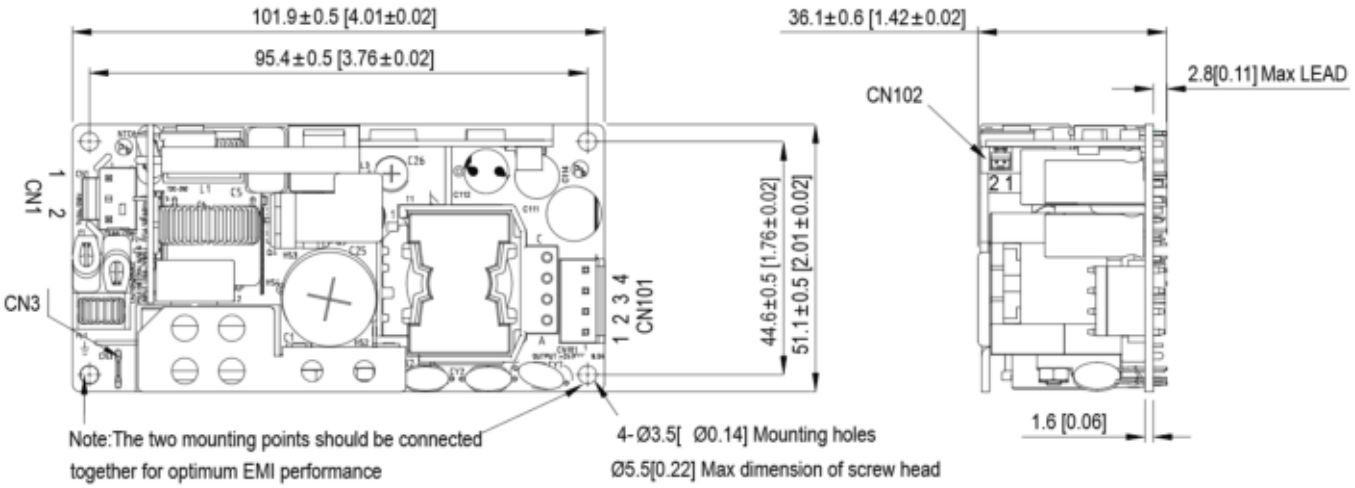
Dimensions

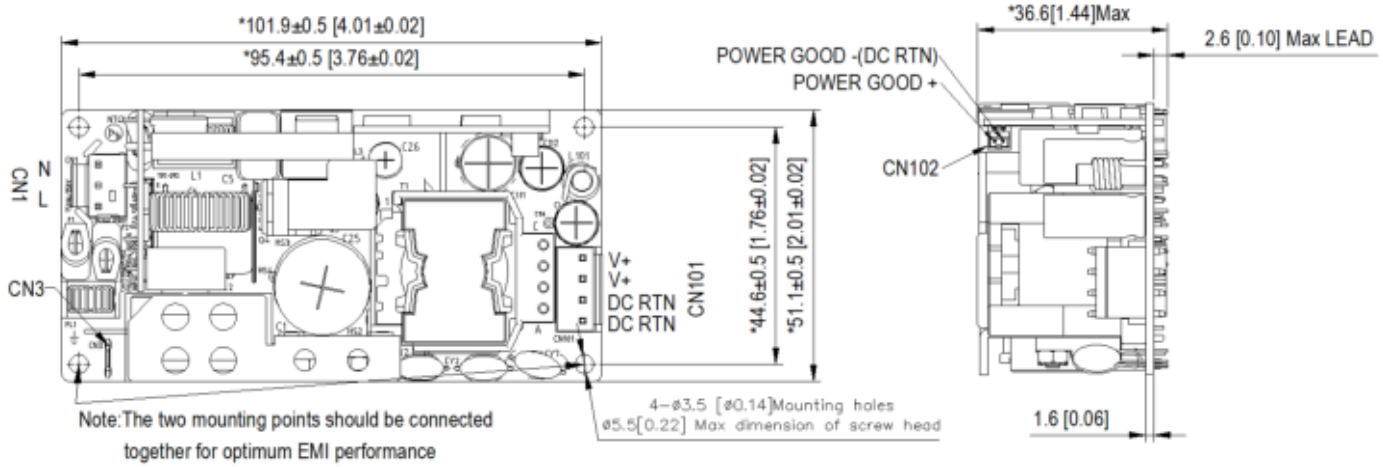
L x W x H: 101.9 x 51.1 x 36.6 mm

Mechanical Drawing (3Pin input type)

MDS-200APB12 AA



MDS-200APB24 AA & MDS-200APB36 AA



Notes

- Dimensions are in mm
- CN1 mates with Molex housing 26-03-4030 and Molex series 6838 crimp terminals. Input Line can also be connected to Neutral, and Input Neutral can be connected to Line.
- CN101 mates with JST housing VHR-4N and JST terminal SVH-41T-P1.1.
- CN102 mates with Molex housing 0874390200 and Molex 874210000 crimp terminals.
- CN3: PINGOOD JP-13T or equivalent mate with KST FDFNYD1-187 or other applicable connectors
- Two mounting points in mechanical drawing need to be connected to system earth case together, Protective bonding conductor from the end product protective earth terminal (if any) can be tied to CN3 for open frame model.

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Functions

Start-up Time

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

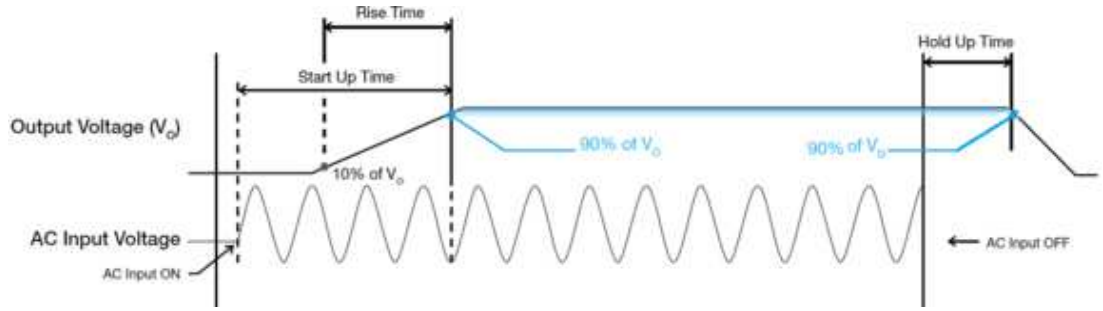
Rise Time

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.

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



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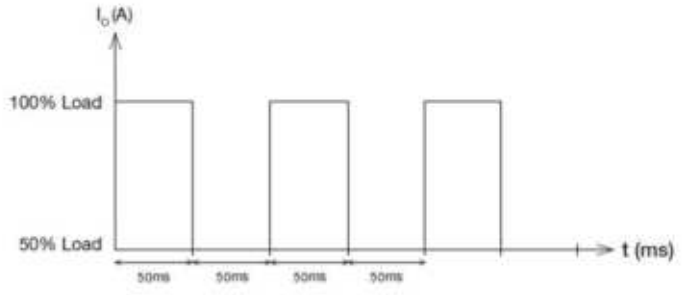
Dynamic Response

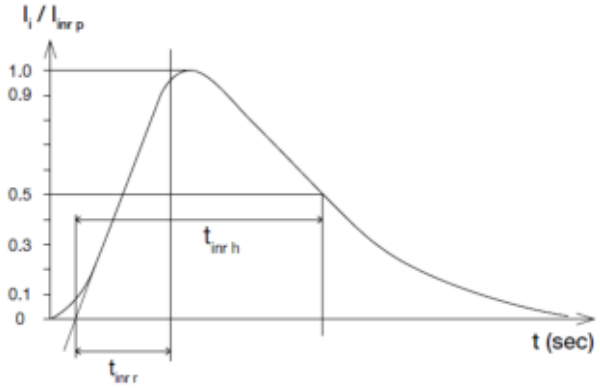
The power supply output voltage will remain within ±5% of its steady state value, when subjected to a dynamic load 50 to 100% of its rated current.

- 50 to 100% Load



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.

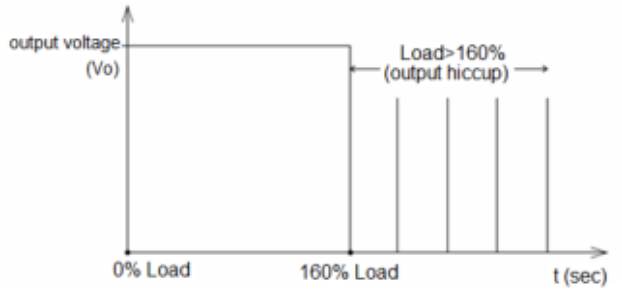


Overvoltage Protection

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 5 under "Protections". Power supply will latch off, and require removal/re-application of input AC voltage in order to restart.

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.



Overload & Overcurrent Protections

The power supply's Overload (OLP) and Overcurrent (OCP) Protections will be activated before output current under 160% of I_O (Max load). Upon such occurrence, V_O will start to drop. Once the power supply has reached its maximum power limit, the protection will be activated and the power supply will go into "Hiccup mode" (Auto-Recovery). The power supply will recover once the fault condition causing the OLP and OCP is removed and I_O is back within the specified limit.

Additionally, if the Iout is <160% but >100% for a prolong period of time (depending on the load), the Over Temperature Protection (OTP) will be activated due to high temperature on critical components. Then, the power supply will be latched off, and require recycling of input voltage to restart it.

Over Temperature Protection

As mentioned above, the power supply also has Over Temperature Protection (OTP). This is activated when the overload condition persists for an extended duration and the output current is below the overload trigger point but >100% load. In the event of a higher operating temperature condition at 100% load, the power supply will run into OTP when the surrounding air temperature is higher than the operating temperature. When activated, the output voltage will go into latch mode until the input voltage is removed; then, reapplied, and the surrounding air temperature drops to its normal operating temperature.

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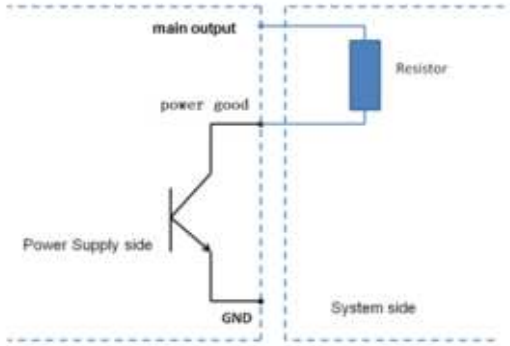
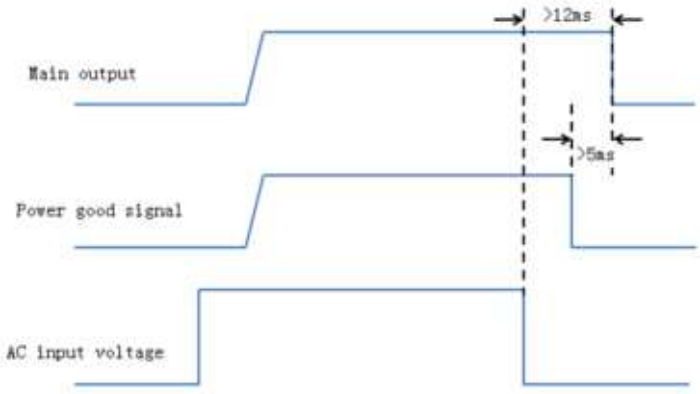
Power Good

Power Good+ pin is an open collector transistor (40V/600 mA rating). A resistor (suggested value 20 Kohm, 1/8 W) can be added between output pin (or, other available pull-up voltage that is no greater than 30 V) and the Power Good+ pin (refer to figure below). Value of pull-up resistor may have to be adjusted, depending on voltage used, and other end-use conditions of the Power Good+ pin connection to the product. When AC input is on, Power Good+ pin will be high. When AC input is off, Power Good+ pin will be low. There will be a minimum of 5 milliseconds (with 120 W convection output power) between the time the power good goes to low level, and the time when the output reaches 90% of its rated value.





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Certificate

Delta has been certified as meeting the requirement of ISO 13485:2016 and EN ISO 13485:2016 for the design and manufacture of switching power supply and adaptor for medical device.

In addition to a UL Total Certification Program (TCP) approved client laboratory for IEC 62368-1. Delta also has participated UL Client Test Data Program (CDTP) for IEC 60601

E356265

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 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.

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