

# MDS Medical AC-DC Adapter

## 6Volt, 5Watt / MDS-005AAS06 B



# 005AAS06 B

### Highlights & Features

- Safety Approvals to IEC 60601-1 3rd ed. & IEC 60950-1
- Risk management report available
- Low touch current (<0.1mA Normal & ,0.3mA single fault)
- Over-Voltage/Load/Temperature & Short Circuit protections
- 1 Million Hours MTBF
- Small Size and Low Weight
- 2 x MOPP (means of patient protection)
- 3 years warranty

### Safety Standards



CB Certified for worldwide use

**Model Number:** MDS-005AAS06 B

**Unit Weight:** 100 grams (3.6 ounces)

**Dimensions (W x L x H):** 39.5 x 56.5 x 28.0 mm

### General Description

The MDS series of embedded power supply comes with universal AC input at 90Vac to 264Vac. Other features include low touch current, risk management report available and the electric shock protection comply with 2 x MOPP. The MDS series is certified for EMC standards according to EN 55011 for industrial, scientific and medical (ISM) radio-frequency equipment and EN 55022 for Information Technology Equipment (ITE) radio-frequency equipment. In addition, only recognized Japanese capacitors are used.

The MDS series come with both medical and ITE safety approvals including UL/cUL/CE and CB certification and are fully compliant with RoHS Directive 2011/65/EU for environmental protection.

### Model Information

#### Medical AC-DC Charger

| Model Number | Input Voltage Range | Output Voltage | Output Current |
|--------------|---------------------|----------------|----------------|
| MDS-005AAS06 | 90-264Vac           | 6Vdc           | 0.83A          |

### Model Numbering

|                                                         |   |                                                                                                           |                                          |                                                                             |
|---------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------|------------------------------------------|-----------------------------------------------------------------------------|
| <b>MDS</b><br><small>Delta Medical power Supply</small> | - | <b>005</b><br><small>Max wattage in the product series. Maybe lower at some voltage.<br/>005 → 5W</small> | <b>AAS</b><br><small>Family Code</small> | <b>06</b><br><small>Output Voltage<br/>Single Output:<br/>06 for 6V</small> |
|---------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------|------------------------------------------|-----------------------------------------------------------------------------|

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### Specifications

#### Input Ratings / Characteristics

|                         |                                                                    |
|-------------------------|--------------------------------------------------------------------|
| Nominal Input Voltage   | 100-240Vac                                                         |
| Input Voltage Range     | 90-264Vac                                                          |
| Nominal Input Frequency | 50-60Hz                                                            |
| Input Frequency Range   | 47-63Hz                                                            |
| Input Current (max)     | 0.2A @ 115Vac ; 0.1 A @ 230Vac                                     |
| Efficiency (typ.)       | 73%, Reference Fig.1                                               |
| Standby Power (max)     | 0.3W                                                               |
| Inrush Current (typ.)   | No component damage                                                |
| Touch Current (max)     | 0.1mA @ 264Vac NC <sup>1)</sup> , 0.3mA @ 264Vac SFC <sup>2)</sup> |

1) NC: normal condition

2) SFC: single fault condition

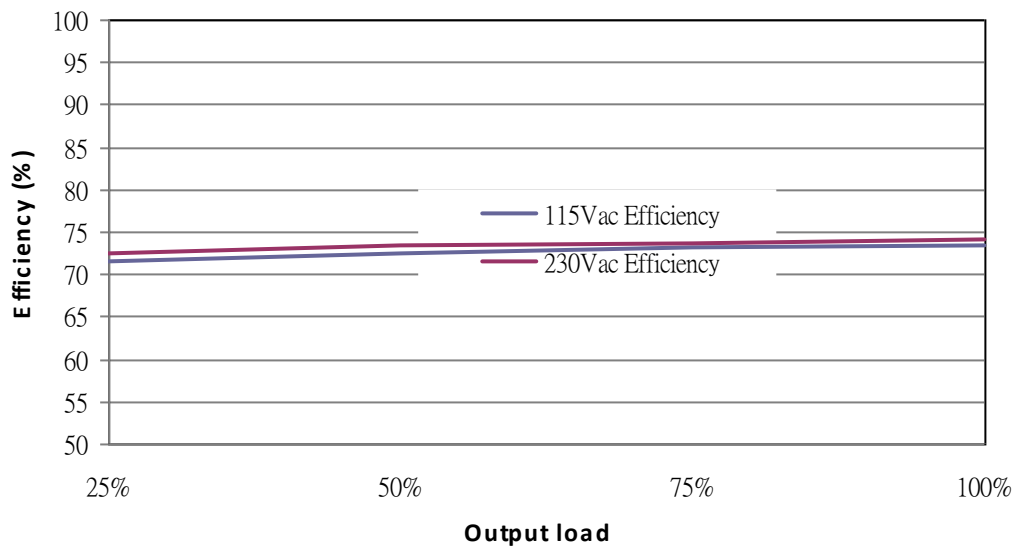


Fig.1 Efficiency versus output load

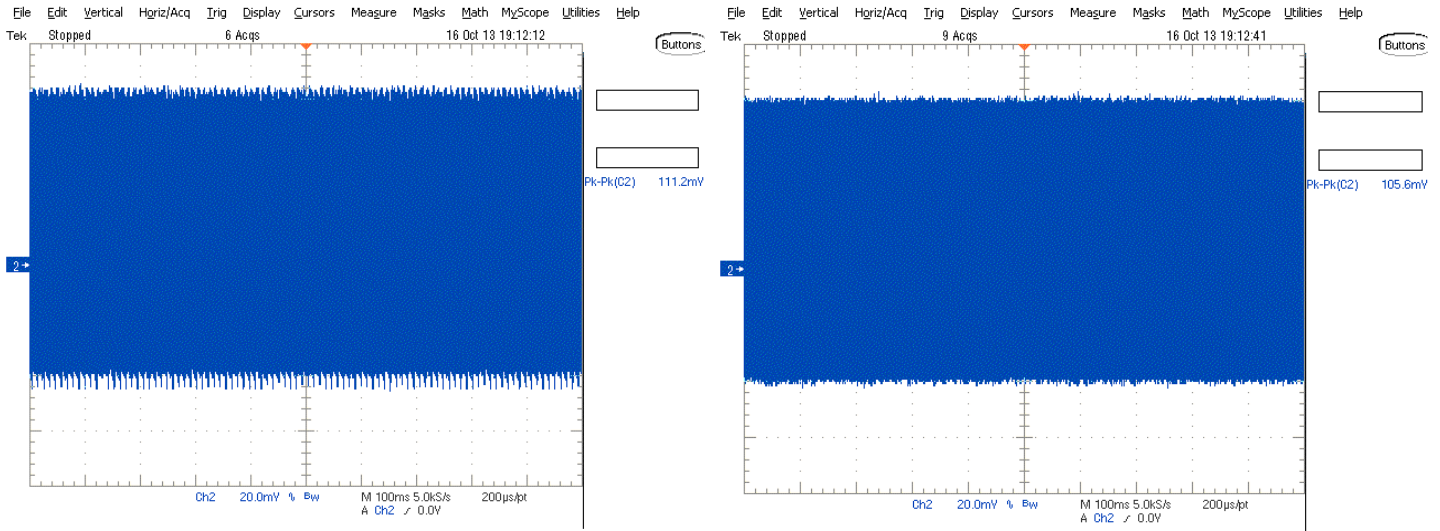
#### Output Ratings / Characteristics

|                                                       |                                                 |
|-------------------------------------------------------|-------------------------------------------------|
| Nominal Output Voltage                                | 6Vdc                                            |
| Output Voltage Tolerance                              | ± 10%                                           |
| Output Current                                        | 0.83A                                           |
| Output Power                                          | 5W                                              |
| Line Regulation (max)                                 | ±5%                                             |
| Load Regulation (max)                                 | ±10%                                            |
| Ripple & Noise (typ.)                                 | 111.2mV pk-pk @ Full load, Reference Fig. 3 & 4 |
| Start-up Time(max)                                    | 3000ms @ 115Vac                                 |
| Hold-up Time(min)                                     | 5ms @ 115Vac                                    |
| Dynamic Response (Overshoot & Undershoot O/P Voltage) | ±10% @ 50-100% load                             |

\*Periodic and Random Deviation

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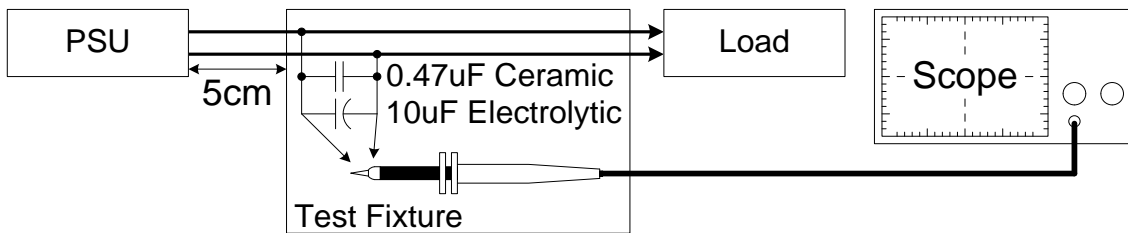


(a) 115V

(b) 230V

Fig. 2 Ripple & Noise example, 20MHz BW

### Ripple & Noise measurement circuit



### Mechanical

|                      |                                                    |
|----------------------|----------------------------------------------------|
| Case Chassis         | PC                                                 |
| Case Cover           | PC                                                 |
| Dimensions(W x Lx H) | 39.5 x 56.5 x 28.0 mm                              |
| Unit Weight          | 100 grams (3.6 ounces)                             |
| Indicator            | NA                                                 |
| Cooling System       | NA                                                 |
| Terminal             | Input: Wall mount - US Type<br>Output: Barrel type |

### Environment

|                             |           |                                                  |
|-----------------------------|-----------|--------------------------------------------------|
| Surrounding Air Temperature | Operating | 0°C to +40°C                                     |
|                             | Storage   | -40°C to +85°C                                   |
| Operating Humidity          |           | 10-95% RH (Non-Condensing)                       |
| Operating Altitude          |           | 3,000 meters                                     |
| Shock Test (Non-Operating)  |           | 50G, 11ms, 3 shocks for each direction           |
| Vibration (Operating)       |           | 5-500Hz, 2.09Grms, 20 minute for each three axis |

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### Protections

|                                |                                                             |
|--------------------------------|-------------------------------------------------------------|
| Over Voltage (max)             | 150% of rated output voltage<br>(Non-latch Mode)            |
| Over Load / Over Current (max) | 130% of rated load current<br>(Non-Latching, Auto-Recovery) |
| Over Temperature               | Hiccup Mode,<br>(Non-Latching, Auto-Recovery)               |
| Short Circuit                  | Hiccup Mode,<br>(Non-Latching, Auto-Recovery)               |
| Degree of Protection           | IP22                                                        |
| Protection Against Shock       | Class II                                                    |

\*PE: Protective Earth

### Reliability Data

|             |                                            |
|-------------|--------------------------------------------|
| MTBF (typ.) | 1 Million hours based on Telecordia SR-332 |
|-------------|--------------------------------------------|

### Safety Standards / Directives

|                    |                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------|
| Medical Safety     | IEC60601-1: (Ed.3,2005), EN60601-1:2006, CAN/CSA-C22.2 No. 60601-1:08, ANSI/AAMI ES60601-1: (Ed.3,2005) |
| ITE Safety         | IEC60950-1 (Ed.2,2005), GB4943.1-2011, GB9254-2008, GB17625.1-2003                                      |
| CE                 | MDD Directive 93/42/EEC                                                                                 |
| Material and Parts | RoHS Directive 2011/65/EU Compliant                                                                     |
| Galvanic Isolation | Input to Output 4000 Vac                                                                                |

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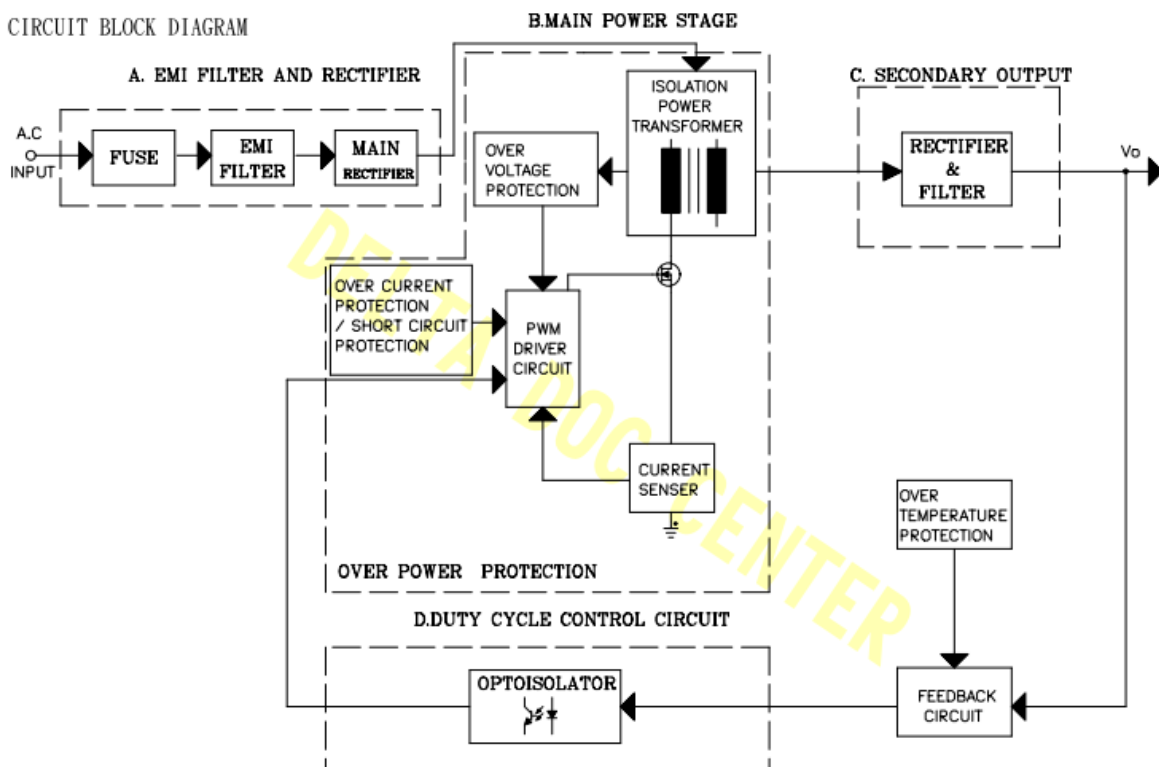
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### EMC

|                                   |               |                                                                                                              |
|-----------------------------------|---------------|--------------------------------------------------------------------------------------------------------------|
| EMC / Emissions                   |               | EN55011, EN55022, FCC Title 47: Class B                                                                      |
| Immunity to                       |               |                                                                                                              |
| Voltage Flicker                   | IEC61000-3-3  | Meet the requirement                                                                                         |
| Electrostatic Discharge           | IEC61000-4-2  | Level 3 Criteria A <sup>1)</sup><br>Air Discharge: 10kV<br>Contact Discharge: 8kV                            |
| Radiated Field                    | IEC61000-4-3  | Level 2 Criteria A <sup>1)</sup><br>80MHz-1GHz, 3V/M with 1kHz tone / 80% modulation                         |
| Electrical Fast Transient / Burst | IEC61000-4-4  | Level 3 Criteria A <sup>1)</sup><br>2kV                                                                      |
| Surge                             | IEC61000-4-5  | Level 3 Criteria A <sup>1)</sup><br>Common Mode <sup>2)</sup> : 2kV<br>Differential Mode <sup>3)</sup> : 1kV |
| Conducted                         | IEC61000-4-6  | Level 2 Criteria A <sup>1)</sup><br>150kHz-80MHz, 3Vrms                                                      |
| Power Frequency Magnetic Fields   | IEC61000-4-8  | Criteria A <sup>1)</sup><br>Magnetic field strength 3A/Meter                                                 |
| Voltage Dips                      | IEC61000-4-11 | 30% 10ms Criteria A ; 60% 100ms and 95% 5000ms<br>Criteria B                                                 |

1) Criteria A: Normal performance within the specification limits  
 2) Asymmetrical: Common mode (Line to earth)  
 3) Symmetrical: Differential mode (Line to line)

### Block Diagram



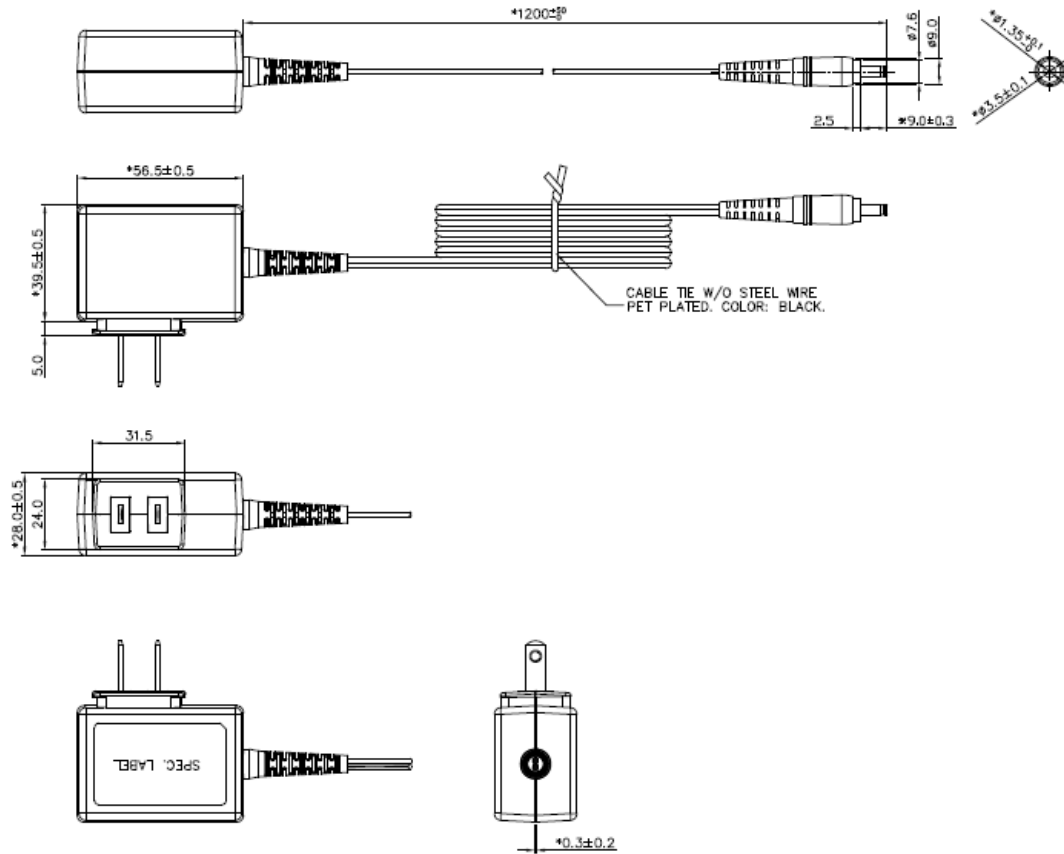
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### Dimensions

W x L x H: 39.5 x 56.5 x 28.0 mm

US type



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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.

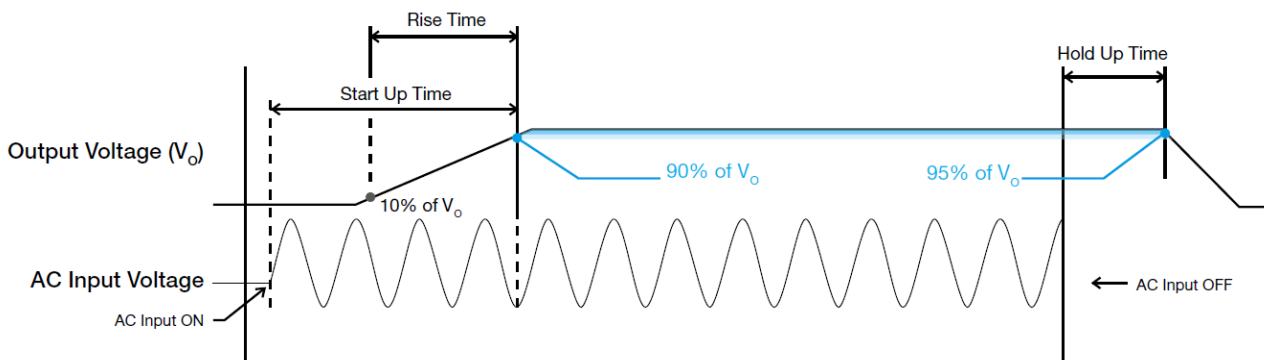
#### Rise Time

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 95% of its set value, after the input voltage is removed.

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

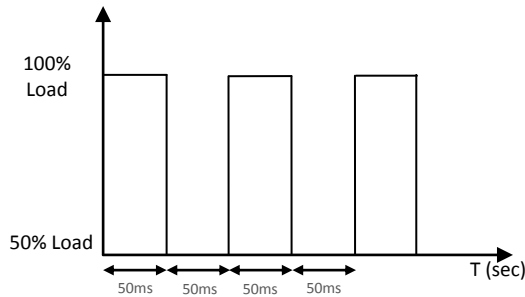


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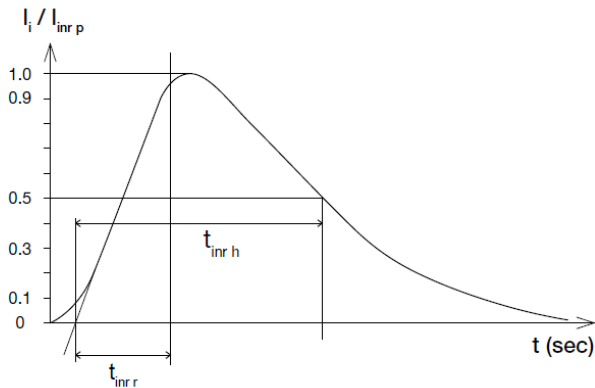
### Dynamic Response

The power supply output voltage will remain within  $\pm 3\%$  of its steady state value, when subjected to a dynamic load 50 to 100% of its rated current.



### 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

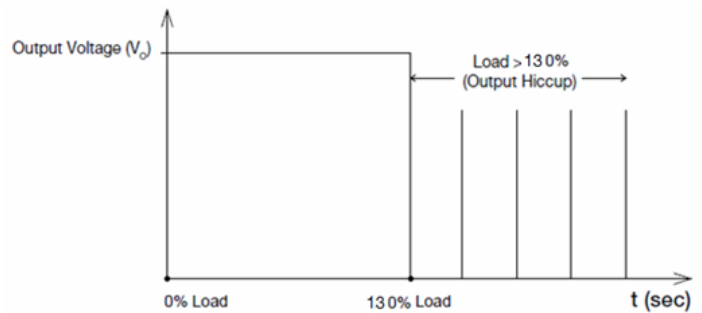
The power supply's overvoltage circuit will be activated when its internal feedback circuit fails. The power supply will shut down before the output reaches the maximum value shown in "Protections" section on page 4. The output will fall to approximately zero volts, but will not latch off. The output will remain at this value, until the cause of the failure is no longer present. The output will then return to its' rated operating voltage. Removal and reapplication of input voltage, in order to restore rated output voltage (after cause of failure is no longer present) , is not required .

### 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 & Over current Protections

The power supply's Overload (OLP) and Over current (OCP) Protections will be activated when output current between 110% and 130%  $I_O$  (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.



Additionally, if the  $I_O$  is  $< 130\%$  but  $> 110\%$  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. The power supply will then go into hiccup mode until the fault is removed; and, the input voltage is removed, then reapplied.

### 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 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 hiccup mode until the input voltage is removed; then, reapplied, and the surrounding air temperature drops to its normal operating temperature.



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### Certificate



All Delta Medical Power products conform to the European directive 2011/65/EU. RoHS is the abbreviation for "Restriction of the use of certain hazardous substances."



Delta has been certified as meeting the requirement of ISO 13485: 2003 and EN ISO 13485:2012 for the design and manufacture of switching power supply and adaptor for medical device.



Delta is approved for the UL Total Certification Program (TCP) approved client laboratory for IEC62368-1. Delta also has participated UL Client Test Data Program (CTDP) for IEC 60601.