

# Medical AC-DC Adapter

## MDS-030AAC Series / MDS-030AAC□



# 030AAC

### Highlights & Features

- MDS-030AAC05, 12, 15, 24 Meet Efficiency Level VI
- MDS-030AAC07 Meet Efficiency Level V
- Safety Approvals to IEC 60601-1 3.1rd ed. & IEC 60950-1
- Compliant with IEC 60601-1-2 4th Ed. Requirements
- Meets Limited Power Source (LPS) requirements
- Low touch current. Suitable for type BF applications
- Detachable AC plug with multiple country options
- IP22 ingress protection rating
- 2 × MOPP isolation
- 500K hours MTBF

### Safety Standards



CB Certified for worldwide use

|                                |  |
|--------------------------------|--|
| <b>Model Number:</b>           | MDS-030AAC□                                      |
| <b>Unit Weight:</b>            | 150 grams  |
| <b>Dimensions (W × L × H):</b> | 53.5 × 88.0 × 27.5 mm<br>2.11 × 3.46 × 1.08 inch |

### General Description

The MDS series of external power supply comes with universal AC input at 85Vac to 264Vac. Other features include low touch current, risk management report available and the electric shock protection comply with 2 × MOPP. The MDS series is certified for EMC standards according to EN 55011 for industrial, scientific and medical (ISM) radio-frequency equipment and EN 55032 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 and IEC-60950-1 CB certification as a Limited Power Source (LPS), and CCC approval. Designs are fully compliant with RoHS Directive 2011/65/EU for environmental protection.

### Model Information

#### Medical AC-DC Adapter

| Model Number | Input Voltage Range | Efficiency Level | Rated Output Voltage | Rated Output Current |
|--------------|---------------------|------------------|----------------------|----------------------|
| MDS-030AAC05 | 85-264Vac           | Level VI         | 5Vdc                 | 3A                   |
| MDS-030AAC07 |                     | Level V          | 7Vdc                 | 3A                   |
| MDS-030AAC12 |                     | Level VI         | 12Vdc                | 2A                   |
| MDS-030AAC15 |                     | Level VI         | 15Vdc                | 2A                   |
| MDS-030AAC24 |                     | Level VI         | 24Vdc                | 1.25A                |

### Model Numbering

| MDS –                      | 030                               | AAC         | □  | □  | □  |
|----------------------------|-----------------------------------|-------------|--|--|--|
| Delta Medical Power Supply | Max wattage in the product series | Family Code | Output Voltage (Single Output)<br><br>- 05 for 5V<br>- 07 for 7V<br>- 12 for 12V<br>- 15 for 15V<br>- 24 for 24V | Revision Code <sup>1</sup><br><br>DC plug type and output cable length<br>A : 2.1 x 5.5 x10mm DC plug<br>B : 2.1 x 5.5 x12mm DC plug<br>Both A & B are 1200mm cable length | Revision Code <sup>2</sup><br><br>Country duck-head type<br>A : China ; B : United States;<br>C : European; D : United Kingdom;<br>E : Australia; G : Korea; H : India,<br>J : Argentina ; K : Brazil;<br>M : South Africa |

\* MDS-030AAC15 BB is not available.

# Medical AC-DC Adapter

## MDS-030AAC Series / MDS-030AAC□

### Specifications

| Model Number | MDS-030AAC05 | MDS-030AAC07 | MDS-030AAC12 | MDS-030AAC15 | MDS-030AAC24 |
|--------------|--------------|--------------|--------------|--------------|--------------|
|--------------|--------------|--------------|--------------|--------------|--------------|

#### Input Ratings / Characteristics

|  |        |  |       |        |       |       |
|--|--------|--|-------|--------|-------|-------|
| Nominal Input Voltage  |        | 100-240Vac   |       |        |       |       |
| Input Voltage Range  |        | 85-264Vac  |       |        |       |       |
| Nominal Input Frequency  |        | 50-60Hz  |       |        |       |       |
| Input Frequency Range  |        | 47-63Hz  |       |        |       |       |
| Input Current (max)  | 115Vac | 0.5A   | 0.6A  | 0.8A   | 0.8A  | 0.8A  |
|  | 230Vac | 0.3A   | 0.4A  | 0.6A   | 0.6A  | 0.6A  |
| Average Efficiency (min)   | 115Vac | 81.4%  | 81.4% | 86.21% | 87.0% | 87.0% |
|  | 230Vac |  |       |        |       |       |
| Standby Power (max)  | 115Vac | 0.1W   | 0.1W  | 0.1W   | 0.1W  | 0.1W  |
|  | 230Vac |  |       |        |       |       |
| Inrush Current (typ.)  |        | 60A @ 115Vac and 100A @ 230Vac                                     |       |        |       |       |
| Touch Current (max)  |        | 0.1mA @ 264Vac NC <sup>1)</sup> , 0.3mA @ 264Vac SFC <sup>2)</sup> |       |        |       |       |
| Output-PE (protective earth) leakage current for Type BF application (max) |        | 0.1mA @ 264Vac NC <sup>1)</sup> , 0.5mA @ 264Vac SFC <sup>2)</sup> |       |        |       |       |

1) NC: Normal condition

2) SFC: Single fault condition

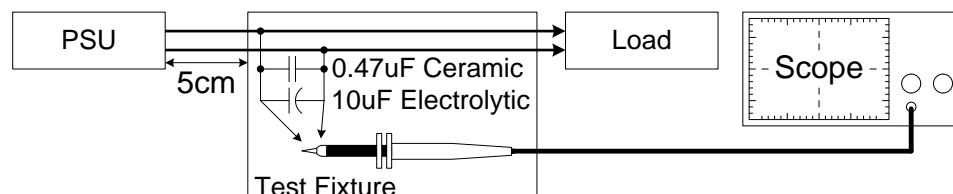
| Model Number | MDS-030AAC05 | MDS-030AAC07 | MDS-030AAC12 | MDS-030AAC15 | MDS-030AAC24 |
|--------------|--------------|--------------|--------------|--------------|--------------|
|--------------|--------------|--------------|--------------|--------------|--------------|

#### Output Ratings / Characteristics

|   |                         |                         |                         |                         |                         |
|---|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Nominal Output Voltage                                | 5Vdc                    | 7Vdc                    | 12Vdc                   | 15Vdc                   | 24Vdc                   |
| Output Total Regulation                               | ±6%                     |                         |                         |                         |                         |
| Output Current  | 3A                      | 3A                      | 2A                      | 2A                      | 1.25A                   |
| Output Power  | 15W                     | 21W                     | 24W                     | 30W                     | 30W                     |
| Line Regulation                                       | ±1%                     |                         |                         |                         |                         |
| Load Regulation                                       | ±5%                     |                         |                         |                         |                         |
| Ripple & Noise (max)                                  | 100mVpk-pk @ Rated load | 100mVpk-pk @ Rated load | 150mVpk-pk @ Rated load | 200mVpk-pk @ Rated load | 200mVpk-pk @ Rated load |
| Start-up Time (max)                                   | 3000ms @ 115Vac         |                         |                         |                         |                         |
| Hold-up Time (min)                                    | 10ms @ 115Vac           |                         |                         |                         |                         |
| Dynamic Response (Overshoot & Undershoot O/P Voltage) | ±10% @ 50-100% load     |                         |                         |                         |                         |
| Capacitive load (max)                                 | 4700uF                  |                         |                         |                         |                         |

\*Periodic and Random Deviation.

#### Ripple & Noise measurement circuit with 20MHz BW



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|--------------|--------------|--------------|--------------|--------------|--------------|
|--------------|--------------|--------------|--------------|--------------|--------------|

### Mechanical

|                        |        |  |
|------------------------|--------|--|
| Case Chassis           |        | PC   |
| Case Cover             |        | PC   |
| Dimensions (W × L × H) |        | 53.5 × 88.0 × 27.5 mm (2.11 × 3.46 × 1.08 in)          |
| Unit Weight            |        | 150 grams (5.3 ounces)                                 |
| Indicator              |        | NA   |
| Cooling System         |        | NA   |
| Terminal               | Input  | Detachable type AC plug                                |
|                        | Output | Barrel type. Dimensions 2.1 × 5.5 × 10 mm (see page 5) |

### Environment

|                             |  |                |
|-----------------------------|--|----------------|
| Surrounding Air Temperature | Operating  | 0°C to +40°C   |
|                             | Storage  | -40°C to +85°C |
| Operating Humidity          | 5 - 95% RH (Non-Condensing)                      |                |
| Operating Altitude          | 5,000 meters (16400 feet)                        |                |
| Shock Test (Non-Operating)  | 50G, 11ms, 3 shocks for each direction           |                |
| Vibration (Non-Operating)   | 5-500Hz, 2.09Grms, 20 minute for each three axis |                |

### Protections

|                              |  |
|------------------------------|--|
| Overvoltage (max)            | 150%, Latch Mode   |
| Overload / Overcurrent (max) | 250% of rated load current, Hiccup Mode, (Non-Latching, Auto-Recovery) |
| Over Temperature             | Hiccup Mode, (Non-Latching, Auto-Recovery)                             |
| Short Circuit                | Hiccup Mode, (Non-Latching, Auto-Recovery)                             |
| Degree of Protection         | IP22   |
| Protection Against Shock     | Class II   |

### Reliability Data

|            |   |
|------------|---|
| MTBF (min) | 500K Hours based on Telecordia SR-332 (at 100Vac, Max. load and 25°C Ambient) |
|------------|---|

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|--------------|--------------|--------------|--------------|--------------|--------------|
|--------------|--------------|--------------|--------------|--------------|--------------|

### Safety Standards / Directives

|                    |  |          |  |  |  |
|--------------------|--|----------|--|--|--|
| Medical Safety     | IEC60601-1 Edition 3.1 (2012), EN60601-1 (2006) + A11 + A1 + A12, CAN/CSA-C22.2 NO. 60601-1:14, ANSI/AAMI ES60601-1:2005/(R)2012<br>UL60601-1 (File No. E356265) |          |  |  |  |
| ITE Safety         | IEC60950-1 (Ed.2,2005), GB4943.1-2011, GB9254-2008, GB17625.1-2003<br>UL60950-1 (File No. E131881), LPS (Limited Power Source)                                   |          |  |  |  |
| CE                 | MDD Directive 93/42/EEC  |          |  |  |  |
| Material and Parts | RoHS Directive 2011/65/EU Compliant  |          |  |  |  |
| Galvanic Isolation | Input to Output  | 4000 Vac |  |  |  |

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

|                                   |               |   |
|-----------------------------------|---------------|---|
| EMC / Emissions                   |               | EN55011/EN55032,FCC Title 47:Class B  |
| Harmonic Current Emissions        | IEC61000-3-2  |   |
| Immunity to                       |               |   |
| Voltage Flicker                   | IEC61000-3-3  |   |
| Electrostatic Discharge           | IEC61000-4-2  | Level 4 Criteria A <sup>1)</sup><br>Air Discharge: 15kV<br>Contact Discharge: 8kV   |
| Radiated Field                    | IEC61000-4-3  | Criteria A <sup>1)</sup><br>80MHz-2700MHz, 10V/m AM modulation<br>385MHz-5785MHz, 28V/m Pulse mode and other modulation   |
| Electrical Fast Transient / Burst | IEC61000-4-4  | Level 3 Criteria A <sup>1)</sup> : 2kV  |
| Surge                             | IEC61000-4-5  | Level 3 Criteria A <sup>1)</sup><br>Differential Mode <sup>3)</sup> : 1kV   |
| Conducted                         | IEC61000-4-6  | Level 2 Criteria A <sup>1)</sup><br>150kHz-80MHz, 3Vrms, 6Vrms at ISM bands and Amateur radio bands   |
| Power Frequency Magnetic Fields   | IEC61000-4-8  | Criteria A <sup>1)</sup><br>Magnetic field strength 30A/m   |
| Voltage Dips                      | IEC61000-4-11 | Criteria A <sup>1)</sup><br>0% U <sub>T</sub> , 0.5 cycle (10ms)<br>, 0°/45°/90°/135°/180°/225°/270°/315°/360°<br><br>Criteria B <sup>2)</sup><br>0% U <sub>T</sub> , 1 cycle (20ms), 0°<br><br>Criteria B <sup>2)</sup><br>70% U <sub>T</sub> , 25 cycle (500ms), 0°<br><br>Criteria B <sup>2)</sup><br>0% U <sub>T</sub> , 250 cycle (5000ms), 0° |

1) Criteria A: Normal performance within the specification limits

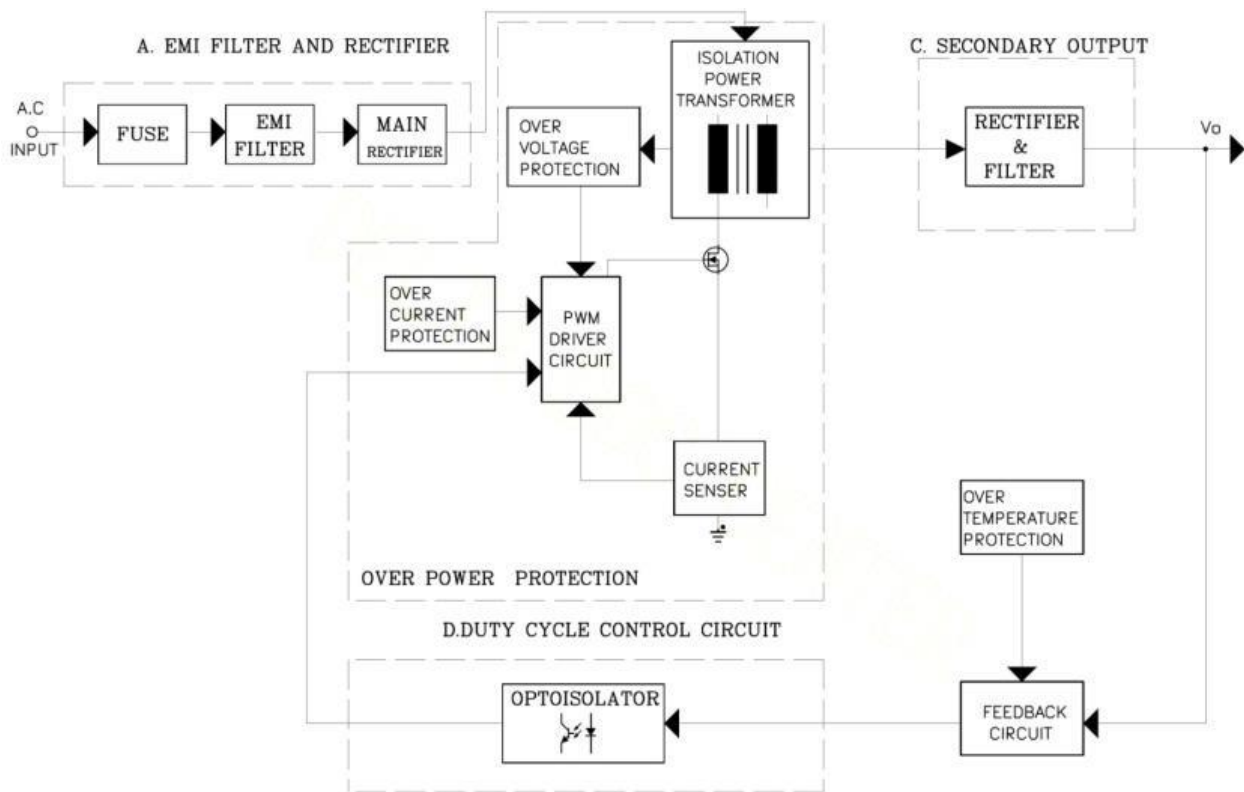
2) Criteria B: Output out of regulation, or shuts down during test. Automatically restore to normal operation after test.

3) Symmetrical: Differential mode (Line to line)

# Medical AC-DC Adapter

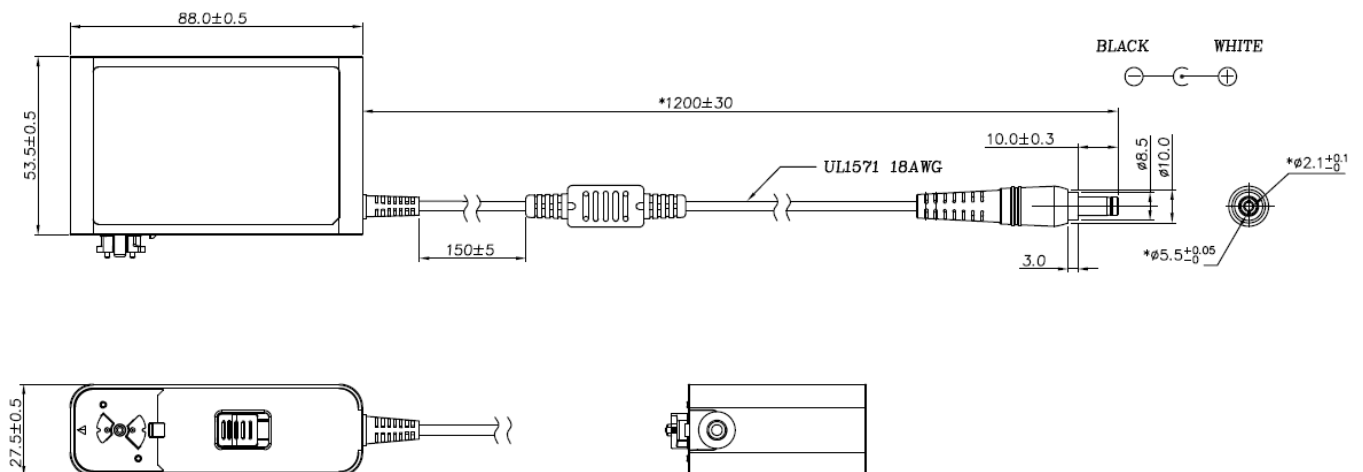
## MDS-030AAC Series / MDS-030AAC□

### Block Diagram



### Dimensions

W × H × H: 53.5 × 88.0 × 27.5 mm



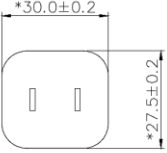
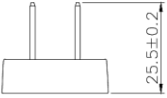

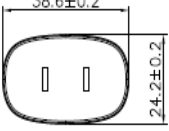
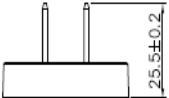
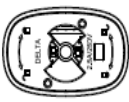
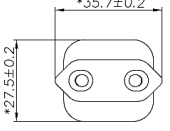
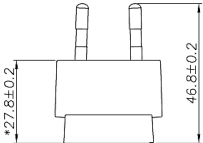
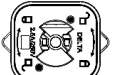

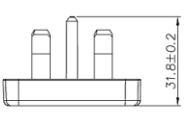
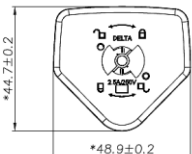
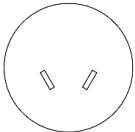
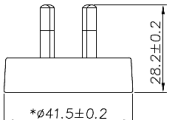

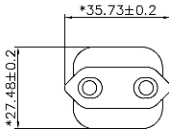
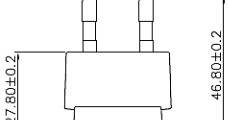


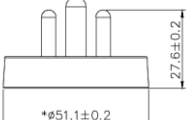
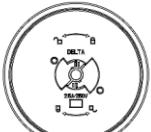
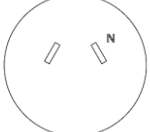


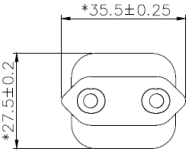
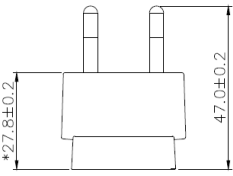

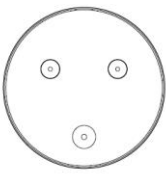
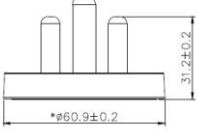
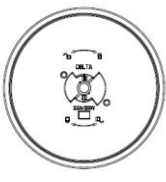
### Note:

The plug's polarity is  $\ominus - \oplus$

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### Duck Head Type:

| CN type   | US/JP type  | EU type   | UK type  |
|---|---|---|--|
|          |          |         |         |
| AU  | KR type   | IN type   | AR type  |
|     |     |    |    |
| BZ type   | SA type   |   |  |
|    |    |   |  |

# Medical AC-DC Adapter

## MDS-030AAC Series / MDS-030AAC□

### Functions

#### Start-up Time

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

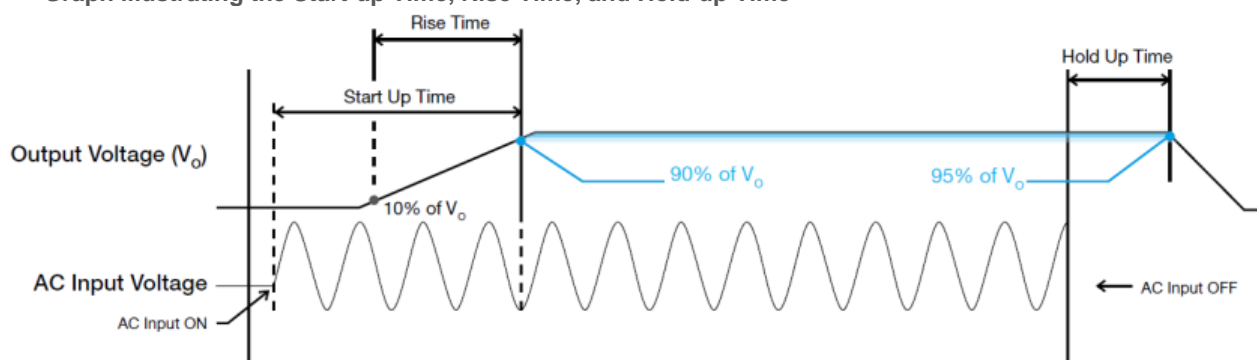
#### Rise Time

The time required for the output voltage ( $V_o$ ) to change from 10% to 90% of its steady state value.

#### Hold-up Time

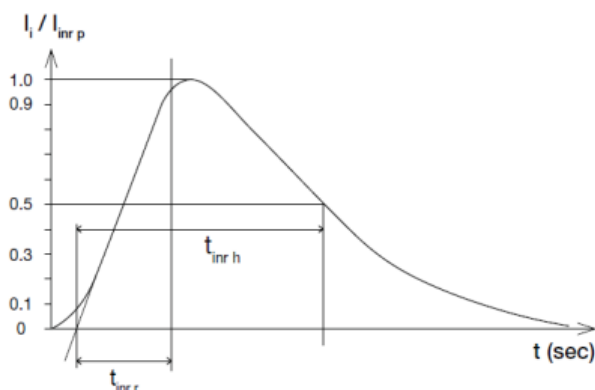
Hold up time is the time when the AC input collapses and output voltage retains regulation for a certain period of time. The time required for the output to reach 95% of its set value, after the input voltage is removed.

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



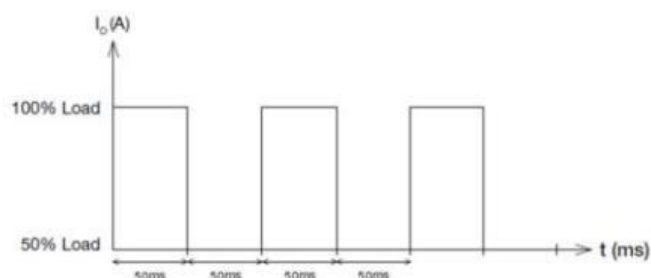
#### Inrush Current

Inrush current is the input current that 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  $\pm 3\%$  of its steady state value, when subjected to a dynamic load change from 50 to 100% of its rated current.

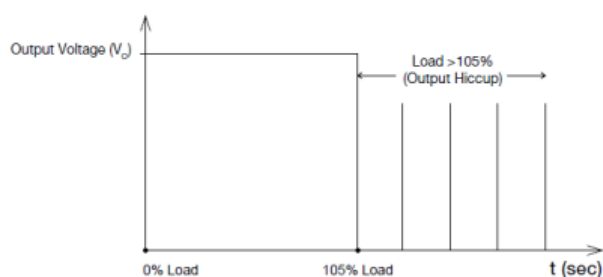


# Medical AC-DC Adapter

## MDS-030AAC Series / MDS-030AAC□

### Overload & Over current Protections

The power supply's Overload (OLP) and Over current (OCP) Protections will be activated when output current is between 110% and 250% of  $I_o$  (Max load). Upon such an 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  $I_o$  is  $<250\%$  but  $>110\%$  for a prolonged 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.

### Short Circuit Protection (Auto-Recovery)

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

### 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."



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.



In addition to a UL Total Certification Program (TCP) approved client laboratory for IEC60950 and IEC60065. Delta also has participated UL Client Test Data Program (CDTP) for IEC 60601.



Meet Level V Efficiency Requirement for MDS-030AAC07



Meet Level VI Efficiency Requirement for MDS-030AAC05, 12, 15, 24



Meets Limited Power Source (LPS) requirement

### 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 [www.DeltaPSU.com](http://www.DeltaPSU.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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**Document Revision Record**

| Date      | Item | Content Revised  | Page Affected | Rev |
|-----------|------|--|---------------|-----|
| 19 Dec 18 | 1    | - Update EMC/Emission from EN55022 to EN55032<br>- Add "Attention" | 4<br>9        | 08  |
| 21 Jun 19 | 1    | -Update to "Vibration (Non-Operating)"                             | 3             | 09  |
| 25 Jun 19 | 1    | - Remove "• 3 years warranty" bullet from Highlight & Features     | 1             | 10  |
|           |      |  |               |     |
|           |      |  |               |     |
|           |      |  |               |     |
|           |      |  |               |     |
|           |      |  |               |     |

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