

# 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 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)  - 05 for 5V - 07 for 7V - 12 for 12V - 15 for 15V - 24 for 24V	Revision Code <sup>1</sup>  DC plug type and output cable length A : 2.1 x 5.5 x10mm DC plug B : 2.1 x 5.5 x12mm DC plug Both A & B are 1200mm cable length	Revision Code <sup>2</sup>  Country duck-head type A : China ; B : United States; C : European; D : United Kingdom; E : Australia; G : Korea; H : India, J : Argentina ; K : Brazil; 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
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#### 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

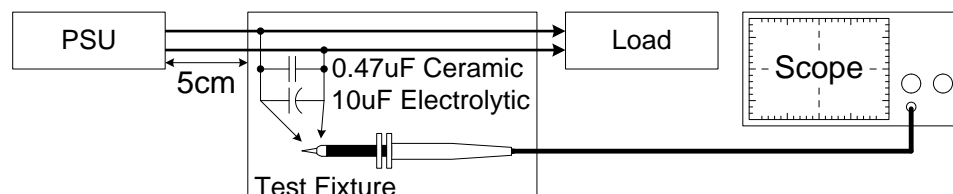
Model Number	MDS-030AAC05	MDS-030AAC07	MDS-030AAC12	MDS-030AAC15	MDS-030AAC24
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#### Output Ratings / Characteristics

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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Model Number	MDS-030AAC05	MDS-030AAC07	MDS-030AAC12	MDS-030AAC15	MDS-030AAC24
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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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Model Number	MDS-030AAC05	MDS-030AAC07	MDS-030AAC12	MDS-030AAC15	MDS-030AAC24
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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 UL60601-1 (File No. E356265)				
ITE Safety	IEC60950-1 (Ed.2,2005), GB4943.1-2011, GB9254-2008, GB17625.1-2003 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> Air Discharge: 15kV Contact Discharge: 8kV
Radiated Field	IEC61000-4-3	Criteria A <sup>1)</sup> 80MHz-2700MHz, 10V/m AM modulation 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> Differential Mode <sup>3)</sup> : 1kV
Conducted	IEC61000-4-6	Level 2 Criteria A <sup>1)</sup> 150kHz-80MHz, 3Vrms, 6Vrms at ISM bands and Amateur radio bands
Power Frequency Magnetic Fields	IEC61000-4-8	Criteria A <sup>1)</sup> Magnetic field strength 30A/m
Voltage Dips	IEC61000-4-11	Criteria A <sup>1)</sup> 0% U <sub>T</sub> , 0.5 cycle (10ms) , 0°/45°/90°/135°/180°/225°/270°/315°/360°  Criteria B <sup>2)</sup> 0% U <sub>T</sub> , 1 cycle (20ms), 0°  Criteria B <sup>2)</sup> 70% U <sub>T</sub> , 25 cycle (500ms), 0°  Criteria B <sup>2)</sup> 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)

The diagram illustrates a power electronic system with the following components and connections:

- A. EMI FILTER AND RECTIFIER:** This section processes the **A.C INPUT** through a **FUSE**, an **EMI FILTER**, and a **MAIN RECTIFIER**.
- B. PROTECTION AND ISOLATION:** This central section contains:
  - OVER VOLTAGE PROTECTION:** Receives input from the main rectifier and the isolation transformer.
  - ISOLATION POWER TRANSFORMER:** Provides isolation and step-down voltage.
  - OVER CURRENT PROTECTION:** Receives input from the current sensor and provides output to the PWM driver circuit.
  - PWM DRIVER CIRCUIT:** Receives inputs from the over current protection and the duty cycle control circuit.
  - CURRENT SENSER:** Monitors the output current and provides feedback to the over current protection.
- C. SECONDARY OUTPUT:** The output of the isolation transformer passes through a **RECTIFIER & FILTER** to produce the final output **Vo**.
- D. DUTY CYCLE CONTROL CIRCUIT:** This section includes:
  - OPTOISOLATOR:** Provides isolation for the control signal.
  - FEEDBACK CIRCUIT:** Receives input from the output **Vo** and provides feedback to the PWM driver circuit.

Connections show the flow of power from input to output, with feedback loops for current and voltage regulation, and protection mechanisms for over-voltage, over-current, and over-temperature.

Technical drawing of the cable assembly showing top, side, and detail views with dimensions.

**Top View Dimensions:**

- Overall width:  $88.0 \pm 0.5$
- Overall height:  $53.5 \pm 0.5$
- Cable length:  $*1200 \pm 30$
- Distance from panel to first connector:  $150 \pm 5$
- Distance from first connector to second connector:  $10.0 \pm 0.3$
- Distance from second connector to third connector:  $3.0$

**Side View Dimensions:**

- Overall height:  $27.5 \pm 0.5$

**Detail View Dimensions:**

- Outer diameter of cable jacket:  $\phi 10.0$
- Inner diameter of cable jacket:  $\phi 8.5$
- Outer diameter of shield:  $*\phi 5.5^{+0.05}_{-0}$
- Outer diameter of center conductor:  $*\phi 2.1^{+0.1}_{-0}$

**Other Labels:**

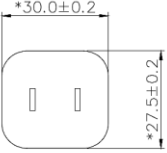
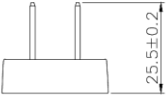

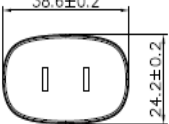
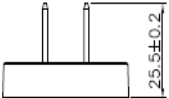
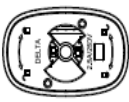
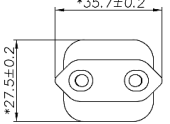
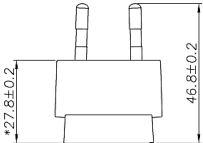
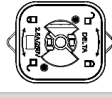

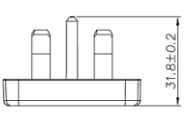
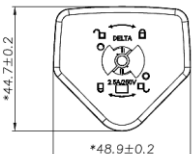
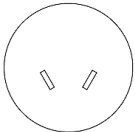
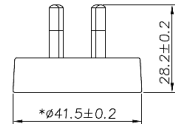

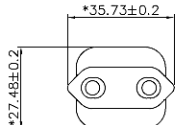
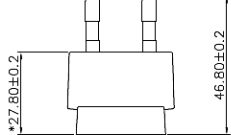
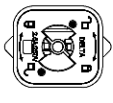

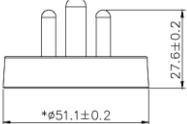
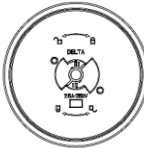
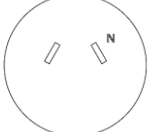
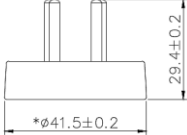

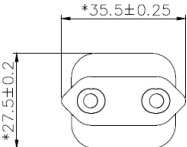
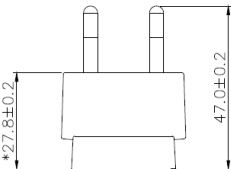
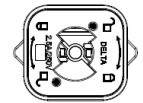
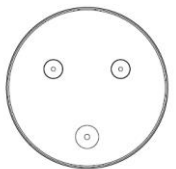
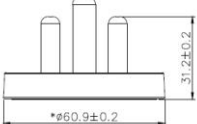
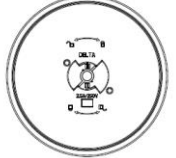
- UL1571 18AWG
- BLACK (with ground symbol)
- WHITE (with positive symbol)

5 All parameters are specified at 25°C ambient unless otherwise indicated.  
www.DeltaPSU.com (July 2019, Rev.10)

# Medical AC-DC Adapter

## MDS-030AAC Series / MDS-030AAC□

### 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.

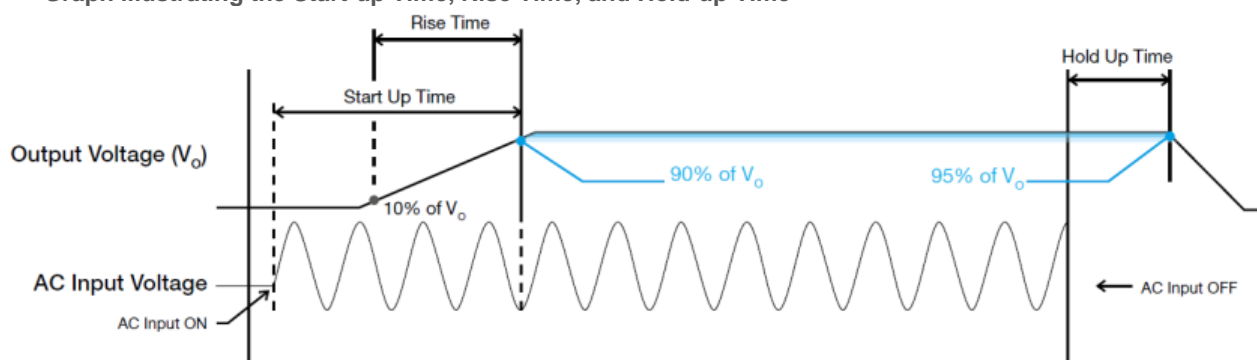
#### Rise Time

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

#### Hold-up Time

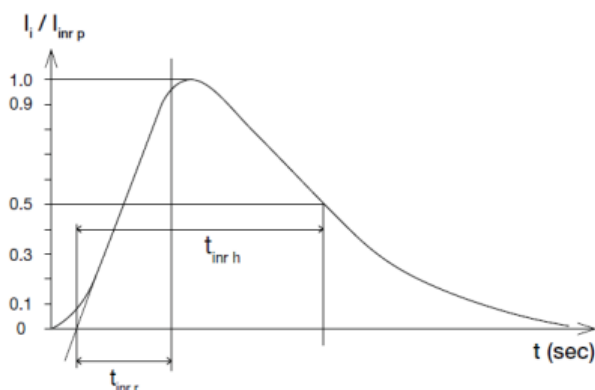
Hold up time is the time when the AC input collapses and output voltage retains regulation for a certain period of time. The time required for the output to reach 95% of its set value, after the input voltage is removed.

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



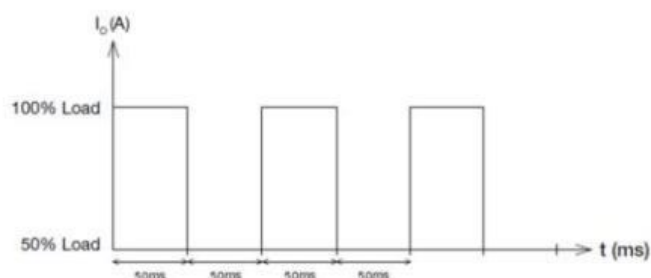
#### Inrush Current

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.

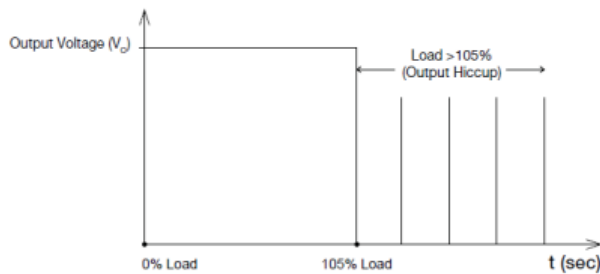


# Medical AC-DC Adapter

## 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.



# Medical AC-DC Adapter

## MDS-030AAC Series / MDS-030AAC□

### 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.

**Medical AC-DC Adapter**

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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 - Add "Attention"	4 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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