Medical / Industrial AC-DC Power Supply

2,500 W with 5 V/2 A Standby / MEB-2K5A series



Highlights & Features

- Up to 2,500 Watt in 5" x 10.67" x 1.59" package without BUSBAR terminal
- Up to 29.5 W/inch^3 power density
- Full power up to 50°C ambient
- 2 x MOPP Isolation
- Suited for Type BF medical products
- 5 V / 2 A standby output
- Active current sharing
- Conformal coating
- Class B Conducted and Radiated EMI
- IEC60601-1-2 4th Edition Immunity Compliance
- Normal and reversed option for Remote On/Off and Power Good Signal
- PMBus Ver 1.3 supported
- Intelligent fan speed control

Safety Certifications

- IEC 60601-1 CB report
- TUV IEC/EN 60601-1
- ANSI/AAMI ES 60601-1+CAN/CSA 60601-1
- IEC 60950-1 CB report
- IEC 62368-1 CB report
- IEC 60335-1 CB report
- IEC 61558-1/-2-16 CB report
- TUV EN 60335-1
- TUV EN 61558-1/-2-16

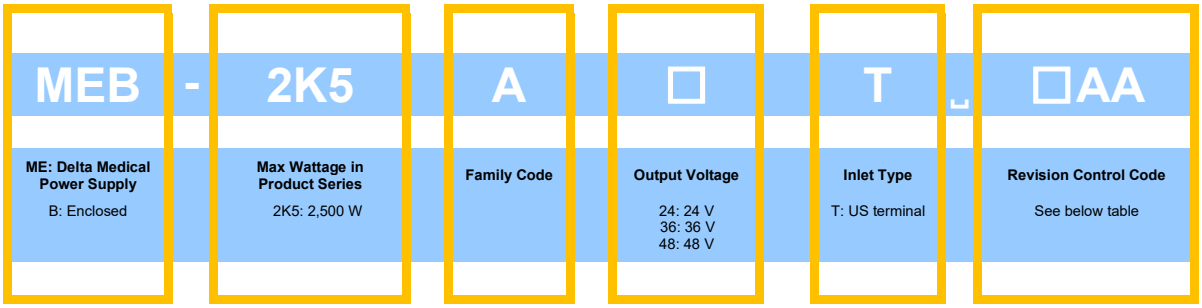
Input				
Input Voltage		85 VAC ~ 264 VAC		
Input Frequency		47 Hz ~ 63 Hz		
Input Current		16 A max		
Inrush Current		<40 A @ 264 Vac		
Power Factor		>0.95 @ rated load		
Efficiency[1)]		Up to 94%[1)]		
Touch Current (Output to PE)		<100 uA normal, <400 uA SFC		
Earth Leakage Current (Input to PE)		<400 uA normal, <700 uA SFC		
Output				
CV mode	Output Voltage	24 V	36 V	48 V
	Output Current	0-104.2 A	0-69.5 A	0-52.1 A
CC mode	Output Voltage	24-28 V	N/A	48-56 V
	Output Current	62.5-108 A (2,500 W max)		26-52.1 A (2,500 W max)
Ripple & Noise		<1% Vrated pk-pk (CV mode)		
Standby Power		5 V / 2 A (No minimum load required)		
Environmental				
MTBF		500 KHrs		
Operation Temperature		-20°C ~70°C[2)]		
Operation Altitude		5,000 m or 54 kPa		

1) Exclude fan power
2) Power de-rating with temperature above 50°C, refer to power de-rating curve for detail

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

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Model Numbering



Model Information (With 5 V / 2 A standby available)

Model Number	Input Voltage[3)]	Output Voltage	Current Output	Output Power
MEB-2K5A24T NAA MEB-2K5A24T RAA	85 Vac	24 Vdc	0-41.67 A	1,000 W
	90-100 Vac		0-56.25 A	1,350 W
	110-132 Vac		0-62.5 A	1,500 W
	180-264 Vac		0-104.2 A	2,500 W
MEB-2K5A36T NAA MEB-2K5A36T RAA	85 Vac	36 Vdc	0-27.78 A	1,000 W
	90-100 Vac		0-37.5 A	1,350 W
	110-132 Vac		0-41.67 A	1,500 W
	180-264 Vac		0-69.5 A	2,500 W
MEB-2K5A48T NAA MEB-2K5A48T RAA	85 Vac	48 Vdc	0-20.83 A	1,000 W
	90-100 Vac		0-28.125 A	1,350 W
	110-132 Vac		0-31.25 A	1,500 W
	180-264 Vac		0-52.1 A	2,500 W

3) Please refer to power de-rating curve for more details.

Revision Control Code

1st CC code		2nd CC code	3rd CC code
☐		A	A
N	Remote On/Off state: default ON	Product Revision	Delta Standard
R	Remote On/Off state: default OFF		

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

Medical / Industrial AC-DC Power Supply
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Specifications

Model Number		MEB-2K5A24T	MEB-2K5A36T	MEB-2K5A48T

Input Ratings / Characteristics

Nominal Input Voltage		100-240 Vac		
Input Voltage Range		85-264 Vac		
Nominal Input Frequency		50-60 Hz		
Input Frequency Range		47-63 Hz		
Input Current (max)		16 A		
Input Surge Voltage (max)		300 Vac for 100 ms		
Full Load Efficiency (typ.)	@ 115 Vac	90.3%	90.5%	91.1%
	@ 230 Vac	92.6%	92.8%	94.0%
Inrush Current (max)		40 A @ 264 Vac, cold/hot start		
No load consumption (max)		0.75 W @ remote off status		
Earth Leakage Current (Input to PE) (max)		0.4 mA @ NC, 0.7 mA @ SFC [4)]		
Touch Current (Output to PE) (max)		0.1 mA @ NC, 0.4 mA @ SFC [4)]		
Power Factor (min)		0.95 @ 115 V / 50 Hz, 230 V / 50 Hz, full load		

4) NC: normal condition, SFC: single fault condition

Output Ratings / Characteristics

Total Regulation	± 3%		
Output Power (max)	2,500 W		
Line Regulation (max)	1%		
Load Regulation (max)	2%		
Ripple & Noise (typ.)	1% pk-pk Vrated @ rated load		
Voltage Trimming Range (CV mode)	24-28 V	36-42 V	48-56 V
Current Trimming Range (CC mode)	62.5-108 A (voltage range 23-28 V with 2,500 W max)	N/A	26-52.1 A (voltage range 45-56 V with 2,500 W max)
Dynamic Response (Overshoot & Undershoot O/P Voltage)	± 10% @ with 50-100% load change		
Start-up Time (typ.)	1200 ms @ 1500 W load, 110 Vac		
Hold-up Time (min)	16 ms @ 2000 W load, 230 Vac		
Capacitive Load (max)	6000 uF		
Rise Time (max)	50 ms		
Remote Sense	Up to 500 mV compensation for voltage drop across external wire connections to load. Short and reverse connection protected.		

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Ripple & Noise Measurement Circuit

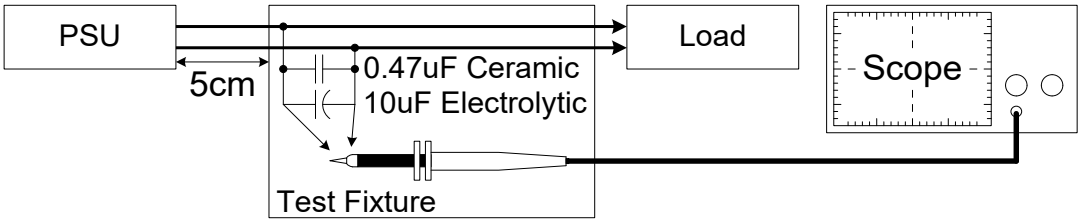


Figure 1. Ripple & Noise Testing Set Up

Standby Power

Nominal Output Voltage of Standby Output (Vrated)	5 V
Nominal Output Current of Standby Output	2 A
Total Regulation of Standby Output	± 4%
Ripple & Noise of Standby Output	100 mV max

Mechanical

Package	Enclosed
Dimensions (W x L x H) [5)]	127 x 271 x 40.5 mm (5 x 10.67 x 1.59 inch)
Unit Weight	1.95 kg (4.30 lb)

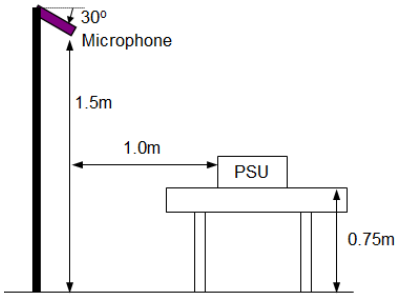
5) Without BUSBAR terminal

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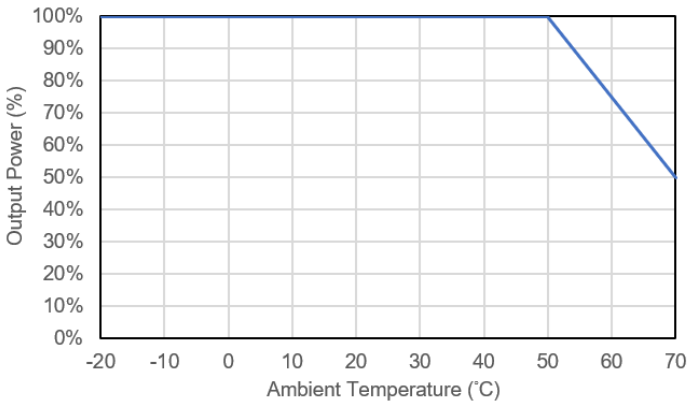
Environment

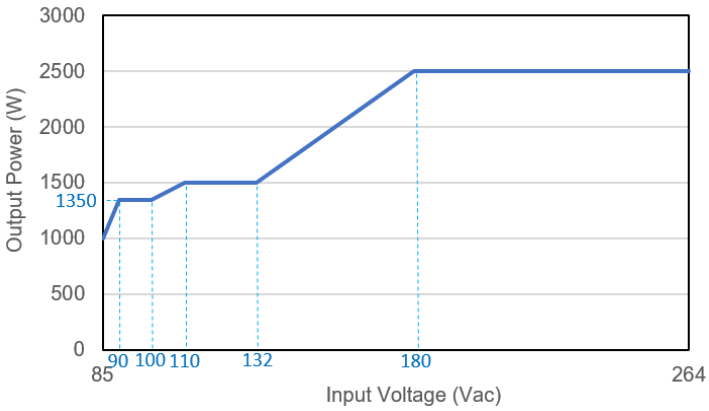
Surrounding Air Temperature	Operating	Absolute Maximum/Minimum Rating. -20°C to +70°C. Linear power derate from 100% load at 50°C, to 50% load at 70°C Note: see power de-rating curves below
	Storage	-40°C to +85°C
Operating Humidity		5-95% RH (Non-Condensing)
Operating Altitude		Up to 5,000 meters (up to 16,400 feet or 106-54 kPa)
Shock Test (Non-Operating)		50G, 11 ms, 3 shocks for each direction
Vibration (Operating)		5-500 Hz, 2.09 Grms, 20 minutes for each three axis
Acoustic Noise [6] (typ.)		45 dB @ 80% load, 25°C
Pollution Degree		3 (for IEC 60335-1)

6) Acoustic Noise test set up according to ISO-7779



Power De-rating Curve





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Medical / Industrial AC-DC Power Supply
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Protections (for both main output and 5 Volt Standby outputs, unless otherwise indicated)

Overvoltage (max)	Main output 145% of rated normal voltage, Latch Mode Standby 125% of rated voltage, Latch Mode
Over load / Over current (max)	Main output 130% of rated current, with Hiccup Mode (Non-Latching, Auto-Recovery) Standby 3.2 A max with Hiccup Mode (Non-Latching, Auto-Recovery)
Over Temperature	Hiccup Mode (Non-Latching, Auto-Recovery)
Short Circuit	Hiccup Mode for Main output and Standby (Non-Latching, Auto-Recovery)

Reliability Data

MTBF (Minimum) at 230 Vac, 2,500 W, 35 °C	500 Khrs based on Telecordia SR-332
Operating Life (Minimum) at 230 Vac, 2,500 W, 25°C	26,280 hrs

Safety Standards / Directives

Medical Safety		IEC 60601-1 CB report TUV IEC/EN 60601-1 ANSI/AAMI ES 60601-1+CAN/CSA 60601-1
ITE Safety		IEC 60950-1 CB report IEC 62368-1 CB report
Home Appliance		IEC 60335-1 CB report IEC 61558-1/-2-16 CB report TUV EN 60335-1 TUV EN 61558-1, EN 61558-2-16
CE		In conformance with EMC Directive 2014/30/EU and Low Voltage Directive 2014/35/EU EN 60601-1: 2006 + A1: 2013 + A2: 2021 & EN 60601-1-2: 2015+ A1:2021
UKCA		In conformance with Electromagnetic Compatibility Regulations 2016 and Medical Devices Regulations 2002 (UK MDR 2002)
Galvanic Isolation	Input to/Output (2XMOPP)	4000 Vac
	Input to/Ground (1XMOPP)	1500 Vac
	Output to/Ground (1XMOPP)	1500 Vac (Type BF application rated)

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EMC

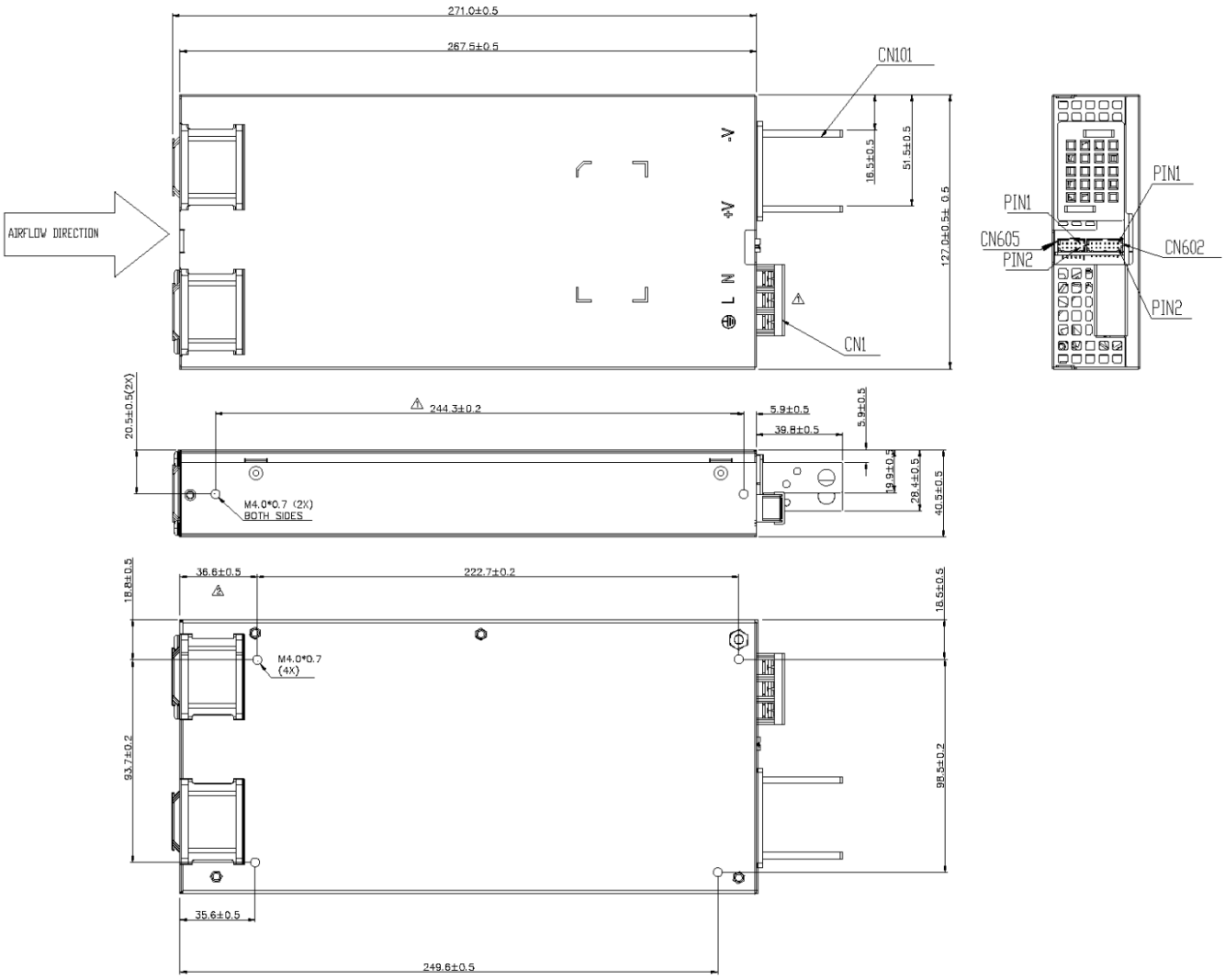
EMC / Emissions		EN55011/ EN55032, FCC Title 47: Class B
Harmonic Current Emissions	IEC61000-3-2	Meet Class A limit
Voltage Flicker	IEC61000-3-3	
Immunity		
Electrostatic Discharge	IEC61000-4-2	Level 4 Criteria A [1)5)] Air Discharge: 15 kV Contact Discharge: 8 kV
Radiated Field	IEC61000-4-3	Criteria A[1)] 80 MHz-2700 MHz, 10 V/m AM modulation Level 2 Criteria A [1)5)] 385 MHz-5785 MHz, 28 V/m Pulse mode and other modulation
Electrical Fast Transient / Burst	IEC61000-4-4	Level 3 Criteria A[1)]: 2 kV
Surge	IEC61000-4-5	Level 3 Criteria A [1)5)] Common Mode [3)]: 2 kV Differential Mode [4)]: 1 kV
Conducted	IEC61000-4-6	Level 2 Criteria A [1)5)] 150 kHz-80 MHz, 3 Vrms, 6 Vrms at ISM bands and Amateur radio bands
Power Frequency Magnetic Fields	IEC61000-4-8	Criteria A [1)5)] Magnetic field strength 30 A/m
Voltage Dips	IEC61000-4-11	30% 10 ms Criteria A [1)] 60% 100 ms Criteria B [2)] 100% 5000 ms Criteria B [2)]
Voltage Dips [5)]	IEC60601-1-2	Criteria A [1)] @ 2,500 W 180 Vac above 0% UT, 0.5 cycle (10 ms) (0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°, 360°) Criteria B [2)], can meet Criteria A with 1,500 W or lower load 0% UT, 1 cycle (20 ms), 0° Criteria B [2)] 70% UT, 25 cycle (500 ms), 0° Criteria B [2)] 0% UT, 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 restored to normal operation after test.
3) Asymmetrical: Common mode (Line to earth)
4) Symmetrical: Differential mode (Line to line)
5) Compliant with IEC60601-1-2 4th Edition

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Dimensions

Mechanical Drawing



Notes:

1. Base plate mounting, M4 thread holes, maximum penetration 3.0 mm (0.118 inch) from outside face of chassis, maximum torque 9-10 kgf.cm (7.82-8.69 lbf.in).
2. Side mounting, M4 thread holes, maximum penetration 3.0 mm (0.118inch) from outside face of chassis, maximum torque 9-10 kgf.cm (7.82-8.69 lbf.in).
3. CN101, M6 screw in two positions, maximum torque 32 kgf.cm (27.81 inch.lbs). M3 screw in two positions, maximum torque 4-5 kgf.cm (3.48-4.35 inch.lbs)
4. CN1, M3.5 screw in three positions, maximum torque 6-7 kgf.cm (5.21-6.08 inch.lbs).
5. VR: clockwise is to increase the output voltage, anti-clockwise is to reduce the output voltage in voltage mode, and to change current in current mode.
6. All dimensions are in millimeters and inches

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Connector Definition and Pin Assignment

Input Connector CN1(ANYTEK: YK50A)	
Pin 1	Earth
Pin 2	Neutral
Pin 3	Line
Output Connector	
CN101	DC RTN
	Vo
Control Connector CN605 (Molex:87833-1051) Mating with Molex: 51110-1051 Terminal:0503948052	
Pin 1	5V bus for I^2C
Pin 2	DC RTN of 5V bus for I^2C
Pin 3	Serial data signal (SDA)
Pin 4	Serial clock signal (SCL)
Pin 5	NC
Pin 6	NC
Pin 7	Address bit 0 (A0)
Pin 8	Address bit 1 (A1)
Pin 9	Address bit 2 (A2)
Pin 10	NC
Control Connector CN602(Molex:87833-7420) Mating with Molex: 51110-1451 Terminal:0503948052	
Pin 1	Remote On_Off/Inhibit +
Pin 2	Remote On_Off/Inhibit -
Pin 3	Power Good-
Pin 4	Power Good+
Pin 5	NC
Pin 6	NC
Pin 7	5V Standby Output +
Pin 8	5V Standby Output +
Pin 9	DC RTN
Pin 10	DC RTN
Pin 11	Remote Sense +
Pin 12	Remote Sense -
Pin 13	Current Share
Pin 14	CC/CV mode switch

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2,500 W with 5 V/2 A Standby / MEB-2K5A series

Functions

Start-up Time

The time required for the output voltage to reach 90% of its final steady state 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 value.

Hold-up Time

Time between the collapse of the AC input voltage, and the output falling to 90% of its steady state value.

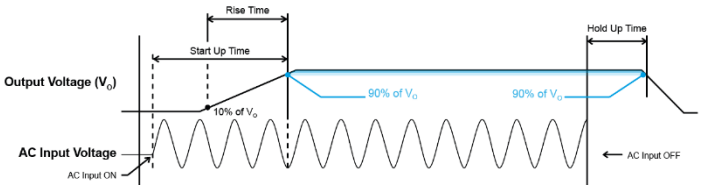


Figure 2. Time Sequence

Dynamic Response (Main Output)

The power supply output voltage will remain within ±10% of its steady state value, when subjected to a dynamic load 50 to 100% of its rated current.

■ **50% to 100% Load**

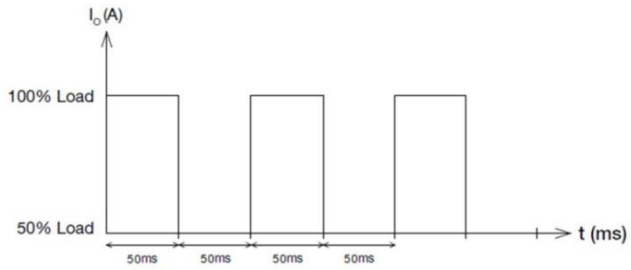


Figure 3. Dynamic Load

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.

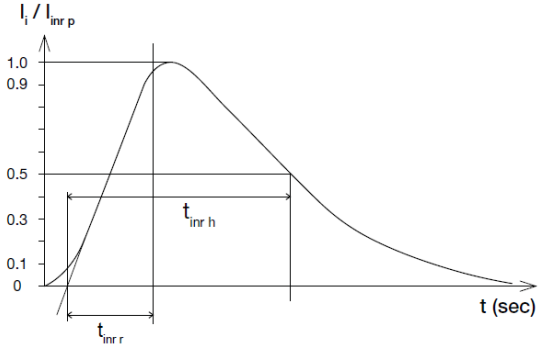


Figure 4. Inrush Current

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

Overload & Over current Protections

The power supply's Overload (OLP) and Overcurrent (OCP) Protections will be activated when output current exceeds 130% of I_O (Max load). In such occurrence, the V_O will start to drop 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.

Please be noted the output current might be clamped in constant current mode and in this case, the protection will be triggered by output undervoltage point. (85% of rated output voltage for 24V; 80% of rated output voltage for 36V; and 82% of rated output voltage for 48V).

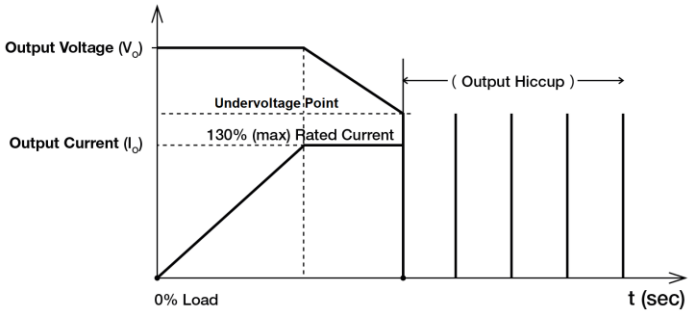


Figure 5. Hiccup at OLP/OCP

Short Circuit Protection

Output OLP/OCP 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.

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 hiccup mode until the surrounding air temperature drops to its normal operating temperature.

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Power Good

Power Good+/- pin is an isolated open collector transistor (80V/50mA rating). A resistor (suggested value 10Kohm, 1/8W) can be added between Power Good- pin and DC RTN, Power Good+ pin can be connected to 5V standby (or, other available pull-up voltage that is no greater than the transistor rating). Value of 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 Signal (Shown in below figure) generated will be high. When AC input is off, Power Good Signal generated will be low. There will be a minimum of 5 milliseconds between the time the Power Good Signal goes to low level, and the time when the output reaches 90% of its rated value.

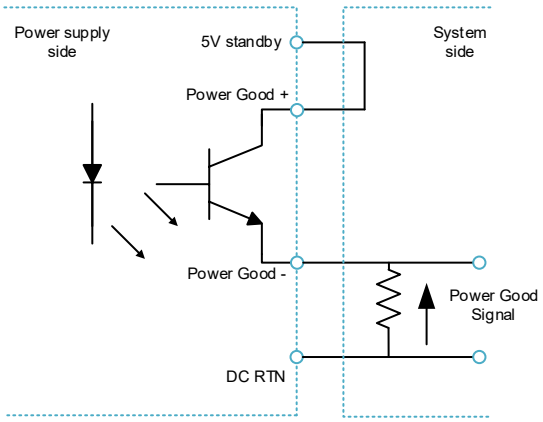


Figure 6. Power Good Connection

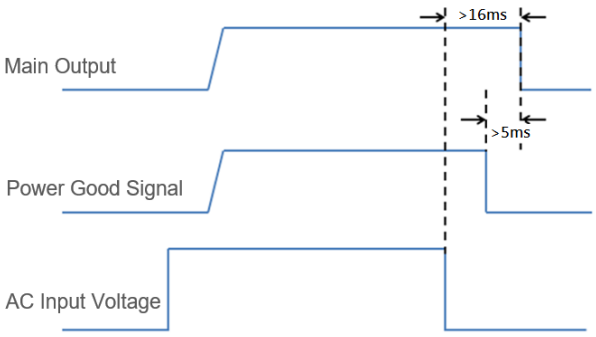


Figure 7. Power Good Time Sequence

Remote On_Off/Inhibit

Remote ON_OFF/INHIBIT uses an isolated diode (6V/50mA rating) located within the power supply. This signal can be used to enable or disable only the main output. When the main output is disabled, the +5V Standby output will continue to operate. System can use a switch to conduct through this diode (suggested pull up resistor to 5V standby with 500 to 1Kohm resistor) to disable the main out. The signal can be floated (no connection to the signal), in order to enable the main output.

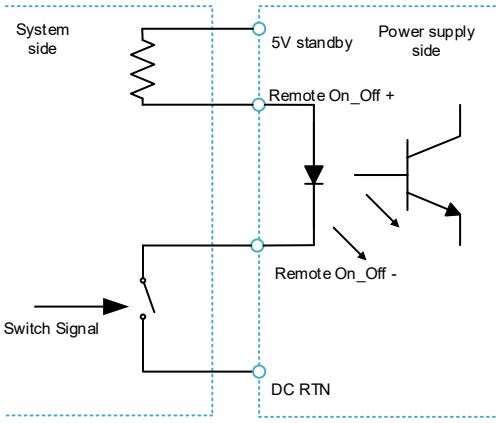


Figure 8. Remote On_Off Connection

Remote Sense

Remote sense feature can be used to compensate for the extra voltage drop on output wires that are connected from the main output terminals, to the load. With wires connected from the remote sense pins, at the same locations as the wires from the main output, the remote sense function can compensate up to 500mV voltage drop. The power supply will not be damaged if the remote sense pins are shorted, or if a reverse/inverted polarity connection is made to the load.

Voltage/Current Adjustment

The power supply provides a potentiometer for user to adjust the output voltage in CV mode or to adjust the output current in CC mode. The output voltage is designed to be able to adjust above the normal rated voltage, when the output is adjusted above nominal value, the output power cannot exceed the nominal maximum power (the maximum output current will be reduced accordingly).

PMBus

The power supply can communicate with the host product, using PMBus version 1.3 protocols. Multiple functions can be realized, such as monitoring the power supply operation status, and editing the power supply operating set-points. See user instruction for detailed control information.

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Current Sharing

The power supply has an active current sharing circuit for the main output; it can realize the output current to be balanced when customer is using up to four power supplies in parallel to achieve higher output power. A one wire current share bus is used to achieve current sharing between units, the current share bus must be connected together among different units (pin 13 of CN602, refer to power supply mechanical drawing and pin assignment). The difference in output voltage can impact the current sharing accuracy, all the units to be paralleled, please use the voltage adjustment function to set the voltage to be ±50 mV of the set value, and the maximum output current set at 80% of rated output current.

The paralleled units can be connected with or without remote sense function, Figure 9 &10 are typical connection of the parallel connections.

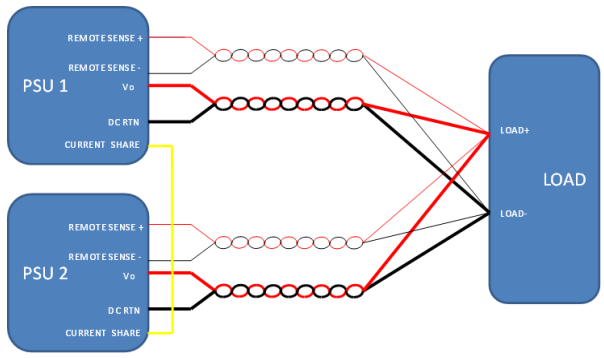


Figure 9. Parallel Connection with Remote Sense

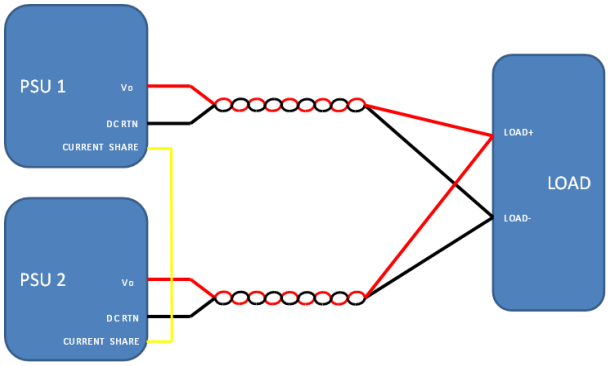


Figure 10. Parallel Connection without Remote Sense

CC/CV mode selection

Pin14 of CN602 can be used to select from constant voltage output mode or constant current output mode, if the pin is left open the output will be default as constant voltage output, if the pin is shorted to ground return, the output will be selected as constant current.

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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 13485:2016 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 IEC60950 and IEC60065. Delta also has participated UL Client Test Data Program (CDTP) for IEC 60601.

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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