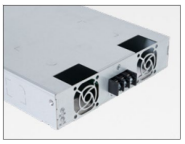
TECHNICAL DATASHEET

Medical/Industrial AC-DC Configurable Power Supply

Up to 3000 Watt / MEG-3K0A Series



Inlet Type Option



T



E



C

Highlights & Features

- Up to 3000W in 7” x 10” x 1.59” Package
- Up to 27W/inch^3 Power Density
- Full Power up to 50°C Ambient
- 9 Slots Modules Configurable
- 2xMOPP Isolation for Medical Application
- Output selectable from 2V to 60V
- Current sharing
- Class B Conducted and Radiated EMI
- IEC 60601-1-2 4th edition immunity compliance
- Normal and Reversed Option for Global Remote On/Off & Air Flow Direction without power de-rating
- Analog and Digital Voltage Trimming
- PMBus Ver 1.3 Supported
- Intelligent Fan Speed Control
- Optional RS485/RS232/USB Communication Adapters
- PC GUI for easy parameter setting and monitoring

Safety Certifications

- IEC 60601-1 2nd edition
- IEC 60601-1 3rd edition + A1 CB report
- CSA 60601-1 ANSI/AAMI 60601-1
- TUV 60601-1
- IEC 62368-1 CB report
- UL 62368-1 CAN/CSA 62368-1
- TUV 62368-1
- SEMI F47 supported

Input			
Input Voltage	90VAC ~ 264VAC		
Input Frequency	47Hz ~ 63Hz		
Input Current	<20A		
Inrush Current	<40A		
Power Factor	>0.95 @ rated load		
Efficiency	Up to 93% 1)		
Patient Leakage Current	<100uA normal, <500uA SFC		
Earth Leakage Current	<400uA normal, <1mA SFC		
Output Module			
Output Number	Single Output		Dual Output
Consuming Slots	Single Slot	Triple Slot	Single Slot
Output Voltage	2V ~ 60V	8V ~ 60V	3.3V ~ 30V
Output Power	300W Max	1200W Max	240W Max
Ripple & Noise	<1% Vrated pk-pk or 100mV, which is larger		
Standby Power	5V / 2A (No minimum load required)		
Environmental			
MTBF	500KHrs		
Operation Temperature	-20°C ~ 70°C 2)		
Operation Altitude	5000m or 50kPa		

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.

Medical/Industrial AC-DC Configurable Power Supply

Up to 3000 Watt / MEG-3K0A Series

Model Numbering

MEG	-	3K0	A	9	X	_	Y-Y-Y-Y	_	zzzzz
ME: Delta Medical Power Supply G: Configurable		**Max Wattage in Product Series** 3K0: 3,000W	**Family Code** A series	**Slot Number** 9: 9 Slots	**Inlet Type** T: US Terminal E: EU Terminal C: C22		**Output Configurations** See below		**PSU Configuration** See below

Model Information:

Model Number	Output Slots	Input Voltage	Maximum Power
MEG-3K0A9	9	100-120Vac	Input Current Limit to 20A
		200-240Vac	3000W

Output Configurations:

Y-Y-Y-Y
Output Configurations See below

For single output **module**, output module code combined with a voltage code and a current code.

For dual output module, output module code is combined with two voltage code.

Please check Table 1 for all available combinations.

For example:

J1: 12V, 25A, single slot, single output module.

O2: 24V, 50A, triple slot, single output module.

OJ: Dual output module, one 24V/4A output, one 12V/5A output.

Split the modules with a “-”.

If any slot to be left empty, use code “NU”.

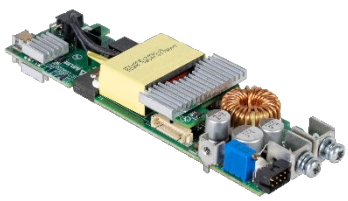
Medical/Industrial AC-DC Configurable Power Supply

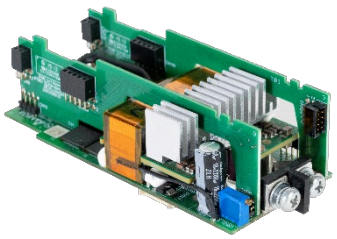
Up to 3000 Watt / MEG-3K0A Series

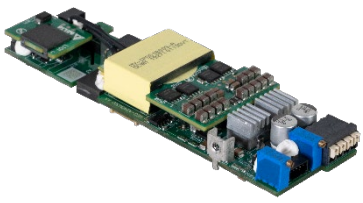
Output Modules:

Table 1. Output Modules

Voltage Code		Current Code					
		Single Slot Module		Triple Slot Module		Single Slot Dual Output Module	
		1		2			
Code	Voltage	Current	Power	Current	Power	V1 or V2 Current	V1 or V2 Power
A	2.0V	45.0A	90W	-		-	-
B	2.4V	45.0A	108W	-		-	-
C	3.0V	45.0A	135W	-		-	-
D	3.3V	45.0A	149W	-		5.0A	16.5W
E	5.0V	45.0A	225W	-		5.0A	25W
F	5.5V	45.0A	248W	-		5.0A	27.5W
G	6.0V	42.0A	252W	-		5.0A	30W
H	8.0V	25.0A	200W	100.0A	800W	5.0A	40W
I	10.0V	25.0A	250W	100.0A	1000W	5.0A	50W
J	12.0V	25.0A	300W	100.0A	1200W	5.0A	60W
K	14.0V	21.4A	300W	85.7A	1200W	5.0A	70W
L	15.0V	20.0A	300W	73.3A	1100W	5.0A	75W
M	18.0V	16.7A	300W	61.1A	1100W	5.0A	90W
N	20.0V	15.0A	300W	53.0A	1060W	5.0A	100W
O	24.0V	12.5A	300W	50.0A	1200W	4.0A	96W
P	28.0V	10.7A	300W	42.8A	1200W	4.0A	112W
Q	30.0V	10.0A	300W	33.3A	1000W	4.0A	120W
R	32.0V	9.4A	300W	34.4A	1100W	-	-
S	36.0V	8.3A	300W	33.3A	1200W	-	-
T	42.0V	7.1A	300W	28.6A	1200W	-	-
U	48.0V	6.3A	300W	25.0A	1200W	-	-
V	54.0V	5.5A	300W	22.2A	1200W	-	-
W	60.0V	5.0A	300W	20.0A	1200W	-	-







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

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Up to 3000 Watt / MEG-3K0A Series

PSU Configurations:

Use following definition for PSU configurations

Z	Z	Z	ZZ
Parallel Code See Table 2	**Control Code** 0: Normal Logic & Normal Fan Direction 1: Reversed Logic & Normal Fan Direction	**Communication Code** 0: Default PMBus 1: RS232 adapter 2. USB adapter 3: RS485 adapter	**CC code** Use AA for default

Parallel Code:

Parallel feature is available for the same output modules. Select parallel code, Delta will parallel the outputs before shipping to customer. Parallel feature is designed for singe slot modules and only two modules can be paralleled. Triple slot modules and dual output module cannot support this option.

Table 2 Parallel Code

Code	1	2	3	4	5	6	7	8	9
0	No Parallel								
A									
B									
C									
D									
E									
F									
G									
H									
I									
J									
K									
L									
M									
N									
O									

Examples:

MEG-3K0A9T O1-O1-O1-O1-O1-O1-O1-O1-O1 A00AA

9 slots, US terminal type input, nine 24V modules, slot 1/slot 2 in parallel

Medical/Industrial AC-DC Configurable Power Supply

Up to 3000 Watt / MEG-3K0A Series

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)	20A
Input Surge Voltage (max)	300Vac for 100ms
Full load Efficiency (typ.)	90% @ 115Vac/60Hz 93% @ 230Vac/50Hz
Inrush Current (max)	40A @ 230Vac, cold start
Power Factor (min)	>0.95 @ 115V/50Hz, 230V/50Hz, full load

Output Ratings / Characteristics

Total Regulation	±3%
Output Power	Up to 300W per single slot module, 1200W per triple slot module
Output Voltage Trimming range	±10% of module rated output voltage
Line Regulation (max)	±0.5%
Load Regulation (max)	±1%
Ripple & Noise (typ.)	1% pk-pk Vrated or 100mV, which is greater
Start-up Time (max)	3000ms @ 115Vac
Hold-up Time (min)	12ms @ rated load, with nominal input range 20ms @ 1500W load, with nominal input range Half rated load @200Vac/240Vac for SEMI F47
Dynamic Response (Overshoot & Undershoot O/P Voltage)	±5% @ with 50-100% load change ±6% @ with 50-100% load change for H2/I2/J2
Capacitive load (max)	Single Slot Single Output Module：1500uF on each load Triple Slot Single Output Module：2800uF on each load Single Slot Dual Output Module：1000uF on each load
Rise time (max)	100ms
Remote Sense	Up to 500mV compensation for voltage drop across external wire connections to load. Short and reverse connection protected.
Inhibit	Default ON, see detail in description
Power Good	Open collector signal when output is in regulation. See application note for detail

Global Control

AC Fail	Open collector signal. Pulled low when AC input is removed.
Global Inhibit	Default ON, see detail in description
PMBus	PMBus Ver 1.3 through I^2C

Standby Ratings / Characteristics

Nominal Output Voltage of standby output	5V
Nominal Output Current of standby output	2.0A
Total Regulation of standby output	±3%
Ripple & Noise of standby output	100mV max (Refer to Fig. 1)

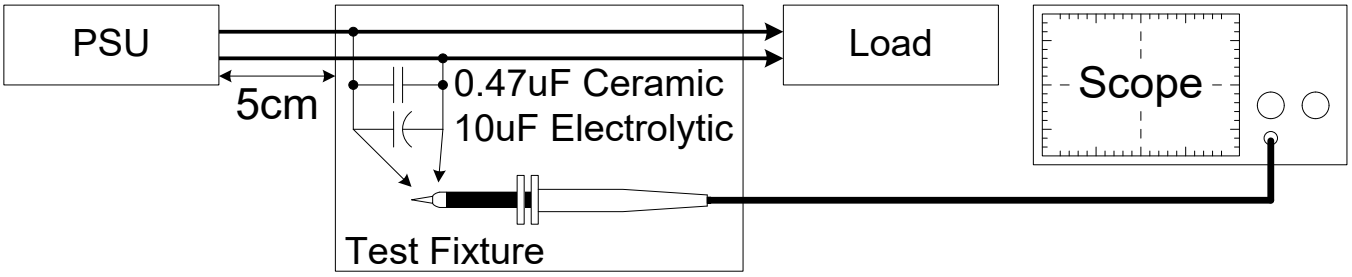


Figure 1. Ripple & Noise Measurement Circuit

Mechanical

Case Material	SGCC
Dimensions (W x L x H)	181.0x254.0x40.5mm 7.13x10.0x1.59inch
Unit Weight	2.5KG

Environment

Surrounding Air Temperature	Operating	Absolute Maximum/Minimum Rating. -20°C to +70°C. Refer to detailed linearly power de-rating curves on page 17&18.
	Storage	-40°C to +85°C
Operating Humidity		5-90% RH (Non-Condensing)
Operating Altitude		Up to 5,000 meters (up to 16,400 feet or 106-54kPa)
Non-Operating Altitude		Up to 5,575 meters (up to 18,290 feet or 106-50kPa)
Shock Test	Non-Operating	50G, 11ms, 3 shocks for each direction
Vibration	Non-Operating	5-500Hz, 2Grms, 20 minute for each three axis

Protections

Overvoltage	Latch off. Reset by recycling AC or through I^2C		
	Min	Min	Min
	110%	110%	110%
Overload / Overcurrent	Hiccup Mode (Non-Latching, Auto-Recovery)		
	Min	Min	Min
	110%	110%	110%
	The OCP value can be programed from default 115% down to 0 through I^2C for single slot modules and dual output modules.		
Over Temperature	Latch off		
Short Circuit	Hiccup Mode (Non-Latching, Auto-Recovery)		

Reliability Data

MTBF (Minimum) at 180Vac, 35°C	>500kHrs based on Telecordia SR-332
Operating life (Minimum) at 180Vac, 25°C	3 Years

Safety Standards / Directives

Medical Safety		IEC 60601-1 2nd edition IEC 60601-1 3rd edition + A1 CB report CSA 60601-1 ANSI/AAMI 60601-1 TUV EN60601-1
ITE Safety		IEC 62368-1 CB report UL 62368-1 CAN/CSA 62368-1 TUV EN62368-1
CE		MDD Directive 93/42/EEC
Galvanic Isolation	Input to Output (2xMOPP) Input to Ground (1xMOPP) Output to Ground	4000Vac 1500Vac 500Vac (Type B application rated)

EMC

EMC / Emissions		EN55011/EN55032, FCC Title 47:Class B
Harmonic Current Emissions	IEC61000-3-2	Meet Class A limit
Immunity to		
Voltage Flicker	IEC61000-3-3	
Electrostatic Discharge	IEC61000-4-2	Level 4 Criteria A[1)5)] Air Discharge: 15kV Contact Discharge: 8kV
Radiated Field	IEC61000-4-3 IEC60601-1-2	Level 3 Criteria A[1)] 80MHz-1000MHz, 10V/m AM modulation Criteria A[1)5)] 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[1)]:2kV
Surge	IEC61000-4-5	Level 3 Criteria A[1)5)] Common Mode[3)]: 2kV Differential Mode[4)]: 1kV
Conducted	IEC61000-4-6	Level 2 Criteria A[1)5)] 150kHz-80MHz, 3Vrms, 6Vrms at ISM bands and Amateur radio bands
Power Frequency Magnetic Fields	IEC61000-4-8	Criteria A[1)5)] Magnetic field strength 30A/m
Voltage Dips	IEC61000-4-11	30% 10ms Criteria A[1)] 60% 100ms Criteria B[2)] 100% 5000ms Criteria B[2)]
Voltage Dips[5)]		Criteria A[1)] @ rated full load 0% U_T, 0.5 cycle(10ms) (0°,45°,90°,135°,180°,225°,270°,315°,360°) Criteria B[2)], can meet Criteria A with 1500W or lower load 0% U_T,1 cycle (20ms), 0° Criteria B[2)] 70% U_T,25 cycle (500ms), 0° Criteria B[2)] 0% U_T,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 restored to normal operation after test.
3) Asymmetrical: Common mode (Line to earth)
4) Symmetrical: Differential mode (Line to line)
5) Compliant with IEC-60601-1-2 4th edition requirements.

Medical/Industrial AC-DC Configurable Power Supply

Up to 3000 Watt / MEG-3K0A Series

MEG Series Mechanical Outlines

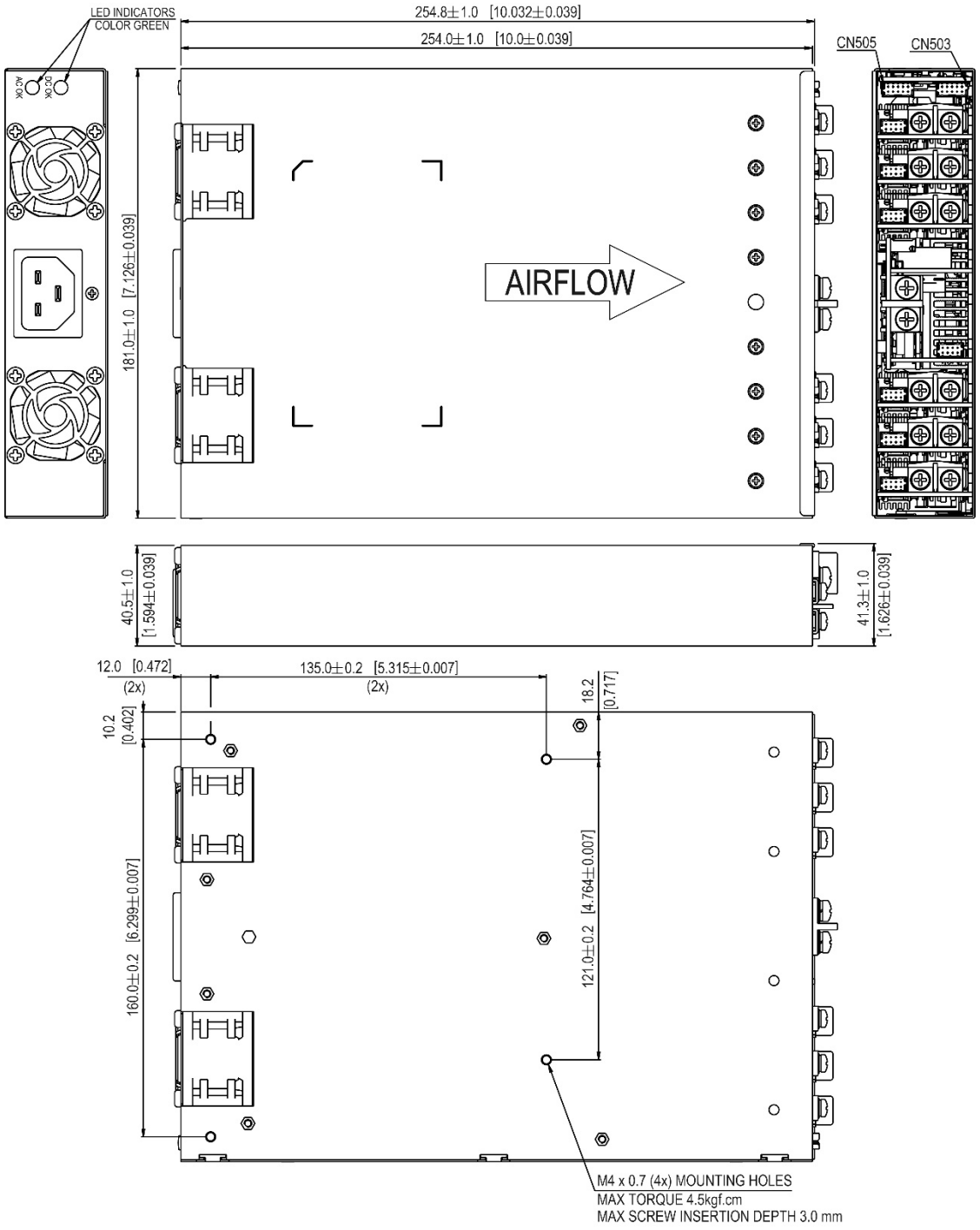


Figure 2. Dimensional drawing MEG-3K0A

Note:

1. Output Module Connectors: All single O/P modules are M4 x 8 mm screws, tighten between 7.0 to 10.0 kgf.cm (6.08 to 8.68 lbf.in); Dual O/P module is PUSH IN conductor connector; Wire Strip Length: 0.315” - 0.354” (8.0 - 9.0 mm).
2. Case Material: SGCC (conductive).
3. Customer Mounting: Screw M4-type mounting holes; Max. Penetration is 3.0 mm (0.118”); Max. Torque: 4.5 kgf.cm (3.91 lbf.in)
4. Adjustable VR clockwise is to increase the output voltage.
5. All dimensions are in millimeters and inches.

Medical/Industrial AC-DC Configurable Power Supply

Up to 3000 Watt / MEG-3K0A Series

AC Inlet Type Option

"C" "E" "T"

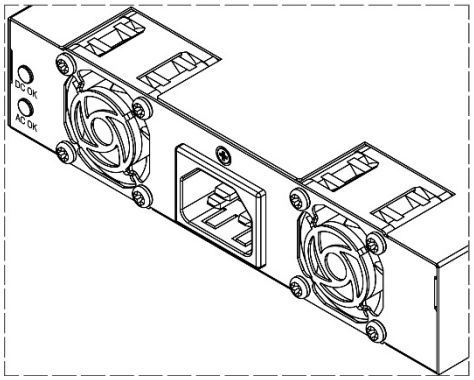


Figure 3. IEC320-C22

CONDUCTOR SIZE: 12－14 AWG

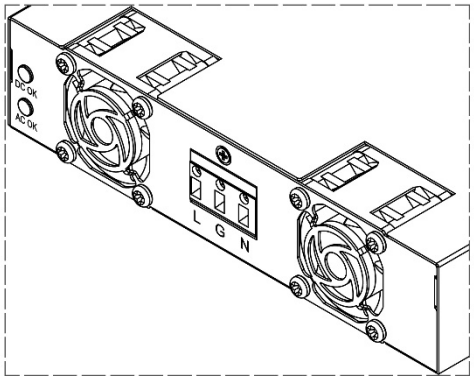


Figure 4. European Terminal Block

CONDUCTOR SIZE: 12－14 AWG
TIGHTENING TORQUE:2.76 kgf.cm

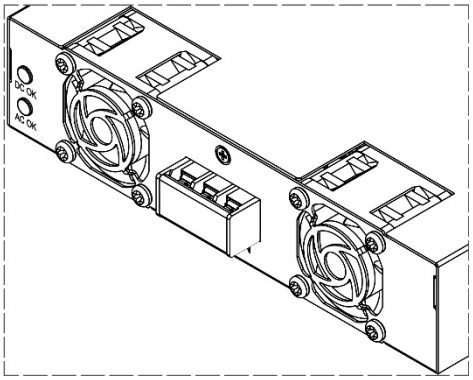


Figure 5. American Barrier Strip

CONDUCTOR SIZE: 12－14 AWG
TIGHTENING TORQUE:8.0 kgf.cm

LED Indicator

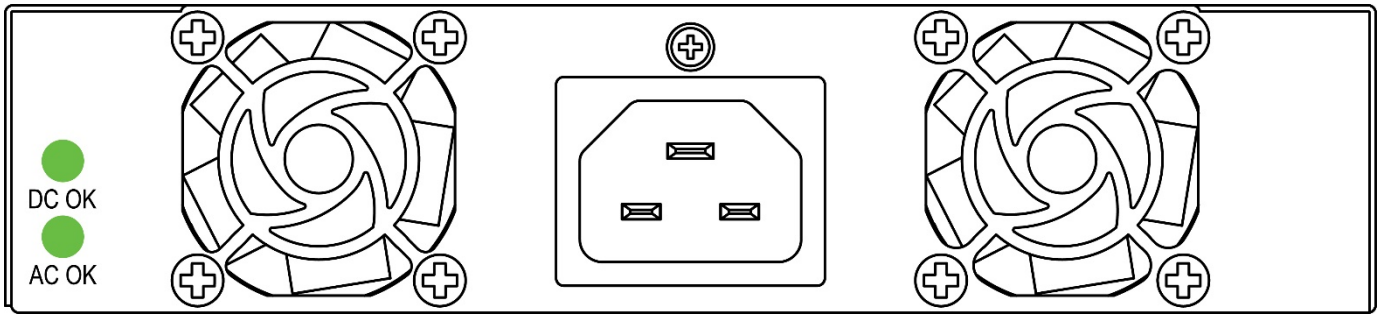


Figure 6. LED Indicator

Two (green/off) LEDs are placed on the case fan panel with status conditions below:

DC OK LED indicator

DC OK Led indicator will be on when all the modules are working normally, and will be off if one or more modules is shut down

AC OK LED indicator

AC OK Led indicator will be on when AC input is above the normal working voltage for the power supply and indicates the AC input status is ready for DC-DC modules to function. This indicator will be off if the AC input falls below normal working voltage for the power supply to maintain performance.

Connector Definitions – Frame

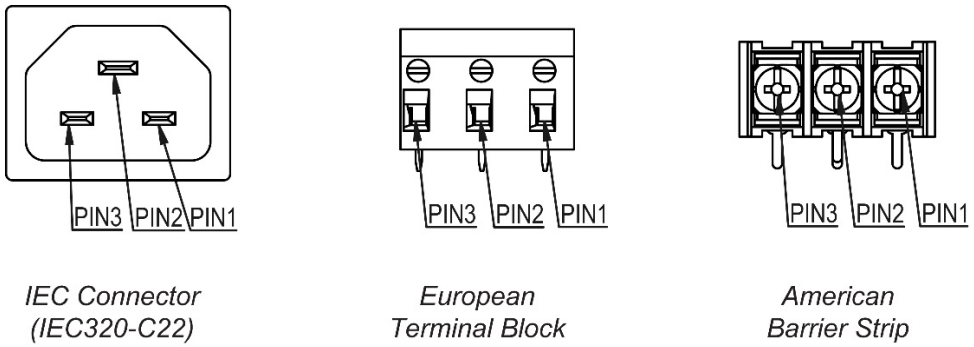


Figure 7. AC Input Connector

Pin	Function
PIN 1	AC Neutral
PIN 2	Chassis(Earth) Ground
PIN 3	AC Line (Phase)

Table 3. AC Input Connector - pin assignment

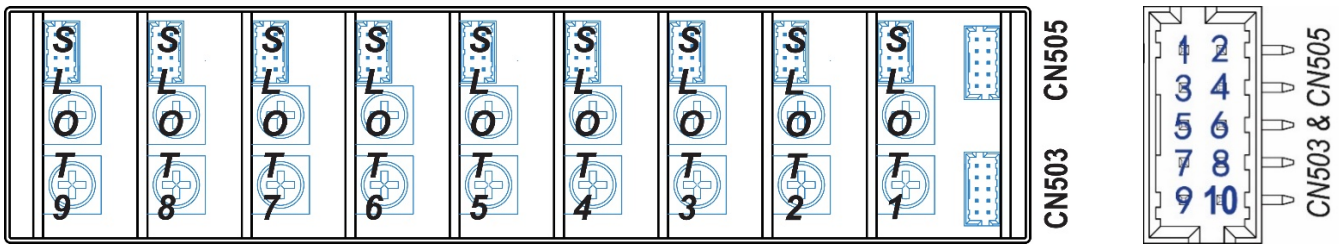


Figure 8. Global Control Signals and Communications Connector

CN503 & CN505(Molex:87833-1031) Mating With Molex:51110-1051 or equivalent Terminal: 0503948052			
Global control signals CN503		Communication signals CN505	
Pin	Function	Pin	Function
1	AC Fail - “Collector”	1	SMBALERT’
2	AC Fail - “Emitter”	2	Address Bit 2 (A2)
3	5V_Standby +	3	Address Bit 1 (A1)
4	5V_Standby +	4	Address Bit 0 (A0)
5	5V_Standby Return	5	Reserve/No Connection
6	5V_Standby Return	6	Reserve/No Connection
7	Global Remote On_Off/Inhibit +	7	PMBus Clock (SCL)
8	Global Remote On_Off/Inhibit -	8	PMBus Data (SDA)
9	Reserve/No Connection	9	5V Communication Bus Return
10	Reserve/No Connection	10	5V Communication Bus +

Table 4. Global Control Signals and Communications Connector (CN503 & CN505) – Pin

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Connector Definitions – Single Slot Single Output Module

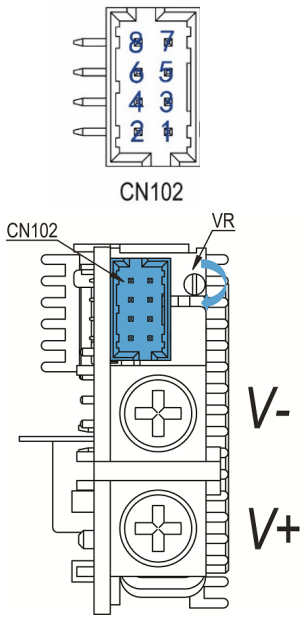


Figure 9. -x1 Module Connector

Pin	Function
V+	Output
V-	Output Return
Wire range: 8-20 AWG Screw torque: 7.0 to 10.0 kgf.cm (6.08 to 8.68 lbf.in) Screws are suitable for slotted and Phillips head screwdrivers.	

Table 5. DC output port - pin assignment

Control Connector CN102 (Molex: 87833-0851) Mating With Molex: 51110-0851 or equivalent , Terminal: 0503948052	
Pin	**Function**
1	Remote On_Off/Inhibit +
2	Remote On_Off/Inhibit -
3	Remote Sense +
4	Remote Sense -
5	Power Good- “Collector”
6	Power Good- “Emitter”
7	Current Share
8	Reserve/No Connection

Table 6. Control Signals Connector - pin assignment

Connector Definitions – Triple Slot Single Output Module

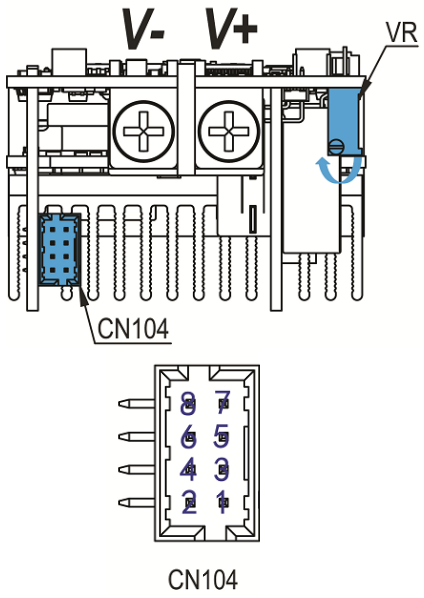


Figure 10. -x2 Module Connector

Pin	Function
V+	Output
V-	Output Return
Wire range: 2-16 AWG Screw torque: 15.0 to 20.0 kgf.cm (13.02 to 17.36 lbf.in) Screws are suitable for slotted and Phillips head screwdrivers.	

Table 7. DC output port - pin assignment

Control Connector CN104 (Molex: 87833-0851) Mating With Molex: 51110-0851 or equivalent Terminal: 0503948052	
Pin	**Function**
1	Remote On_Off/Inhibit +
2	Remote On_Off/Inhibit -
3	Remote Sense +
4	Remote Sense -
5	Power Good- “Collector”
6	Power Good- “Emitter”
7	Current Share
8	Reserve/No Connection

Table 8. Control Signals Connector - pin assignment

Medical/Industrial AC-DC Configurable Power Supply

Up to 3000 Watt / MEG-3K0A Series

Connector Definitions – Single Slot Dual Output Module

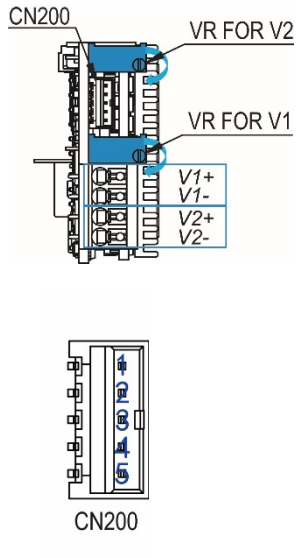


Figure 11. -x3 Module Connector

Pin	Function
V1+	V1 Output
V1-	V1 Output Return
V2+	V2 Output
V2-	V2 Output Return
Wire range: 28-16 AWG	

Table 9. DC output port - pin assignment

Control Connector CN200 (Molex: 87438-0563) Mating With Molex: 87439-0500 Terminal: 874210102	
Pin	**Function**
1	Remote Inhibit 2 +
2	Remote Inhibit 2 -
3	NC
4	Remote Inhibit 1 +
5	Remote Inhibit 1 -

Table 10. Control Signals Connector - pin assignment

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.

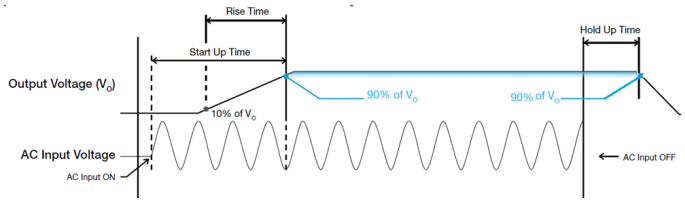


Figure 12. Time Sequence

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.

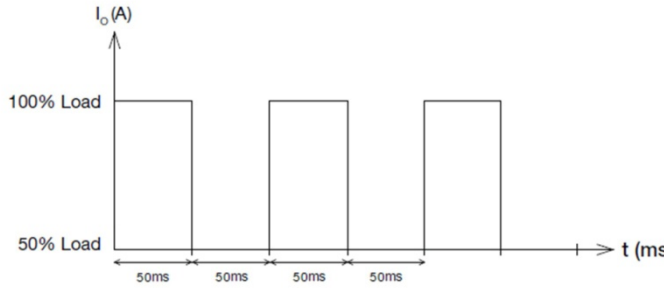


Figure 13. Dynamic from 50% load to 100% Load

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

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.

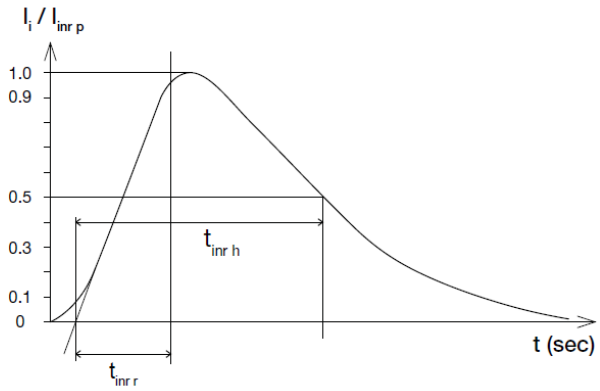


Figure 14. Inrush Current

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

Overload & Overcurrent Protections

Each output will enter auto-recovery mode when the output current reaches over current protection set point. The set point is default 120% of rated output current. 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. The time interval between each auto re-start during protection is 4s typical.

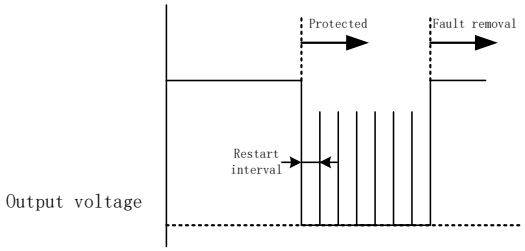


Figure 15. Auto-Recovery

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.

Over Temperature Protection

Each output module and PFC module sense each module operation temperature. Any output module temperature is higher than the over temperature protection set point, all the modules will be shut down latched.

An AC recycle is required to reset the power supply to normal operation.

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. If the remote sense pins are shorted, or if a reverse/inverted polarity connection is made, the output module will be turned off.

Remote On_Off/Inhibit

The remote control 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. Every module has its own remote on/on control signal pin, and can work independently from each other. Below is a suggested connection, system can use a switch to conduct through this diode (suggested pull up resistor to 5V standby with 1Kohm resistor) to disable the main out. The signal can be floated (no connection to the signal), in order to enable the main output.

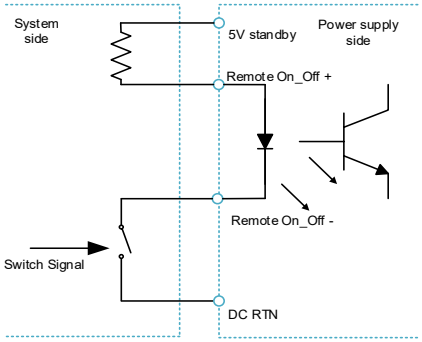


Figure 16. Remote On_Off connection

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Global Remote On_Off/Inhibit

The global inhibit function will turn on/off all the output modules. The control logic is selectable on demand. In normal logic, the module is default on with the control logic described in Figure 17. The module outputs will be turned off if the diode is conducted and modules will be on if diode is left floated of open.

Power Good Signal

Power Good+/- pin on every module's control connector 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 DC output is presented, Power Good Signal (Shown in below figure) generated will be high. When DC output 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.

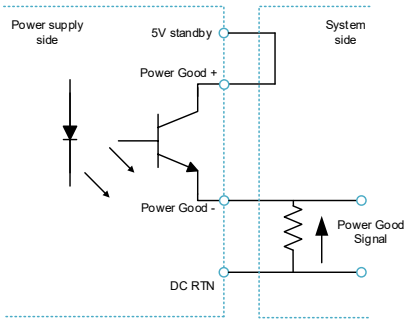


Figure 17. Power good signal connection

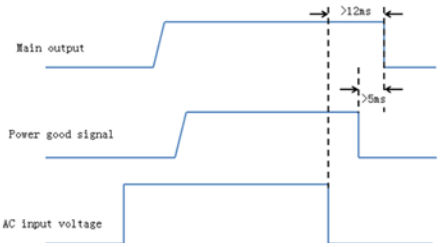


Figure 18. Power good signal sequence

AC Fail

AC fail indicate the AC input information. AC Failed pin is an open collector type output (80V/50mA rating). AC fail signal connection can refer to power good signal. When AC input is on, AC Fail pin will be high. When AC input is removed, AC Fail pin will be pulled low.

Global Communication

The power supply can be fully monitored and controlled through PMBus protocol, or any other protocol supported by adapter board, such as RS485 or RS232 Bus. Once an output module is installed in the power supply, the module and slot location will be recognized automatically. The power supply address can be assigned externally, up to 8 power supplies can be configured to the same bus. Use the command defined in "Delta PMBus Communication" document to monitor and control the power supply. Communication adapters available as below part number:

Communication Adapter	
MEP-PMBUSB	I^2C to USB
MEP-PMB485	I^2C to RS485
MEP-PMB232	I^2C to RS232

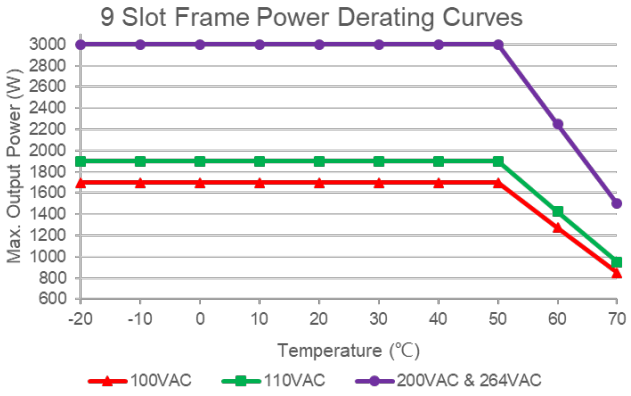
PC GUI

A PC GUI is provided to help the user to easily monitor and control the power supply. Use provided cable to connect the power supply to PC serial port or USB port with Delta PMBus to USB adapter and run GUI in PC. Refer to PC GUI user manual for detailed operation instruction.

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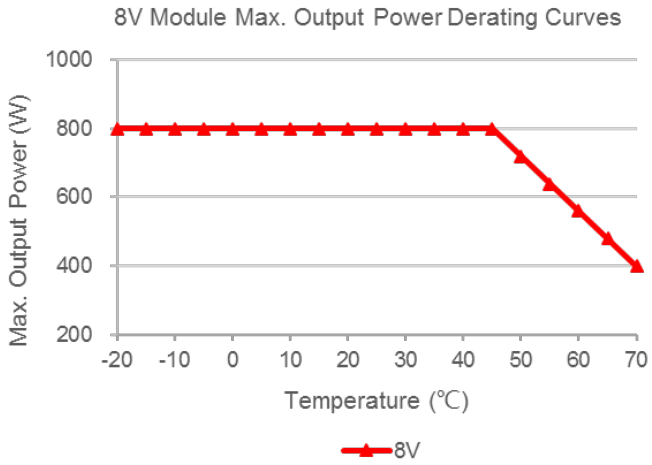
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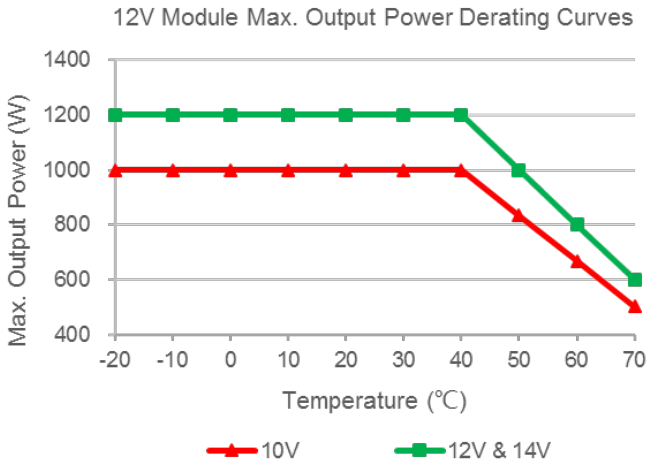
Power Derating – MEG-3K0A Series

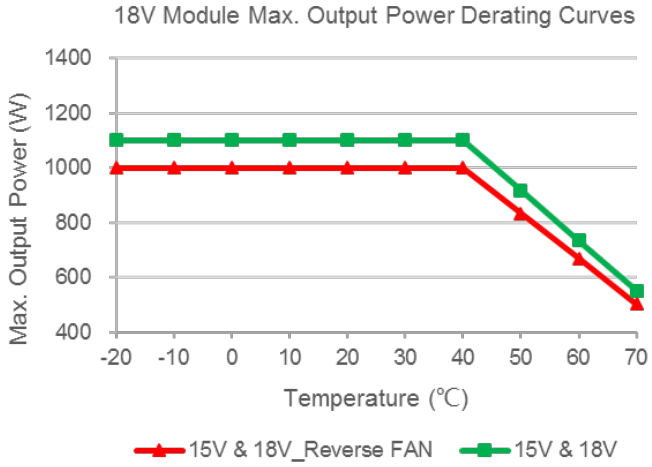


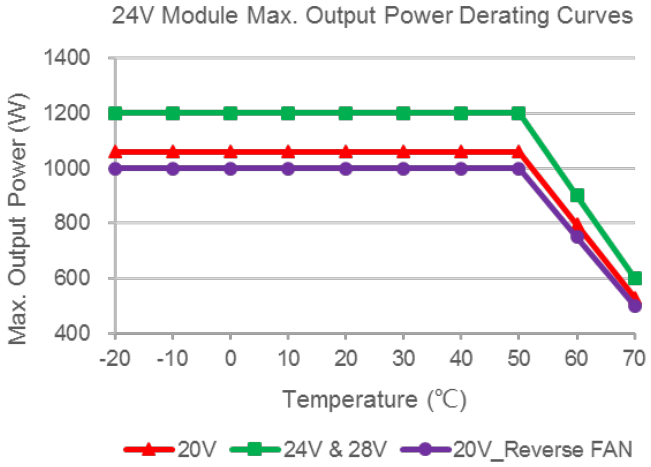
Power Derating – Triple Slot Modules

No air flow direction power derating unless specifically identified.



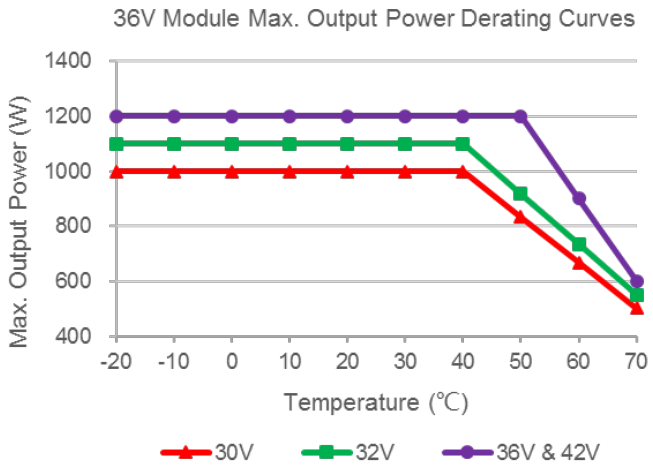


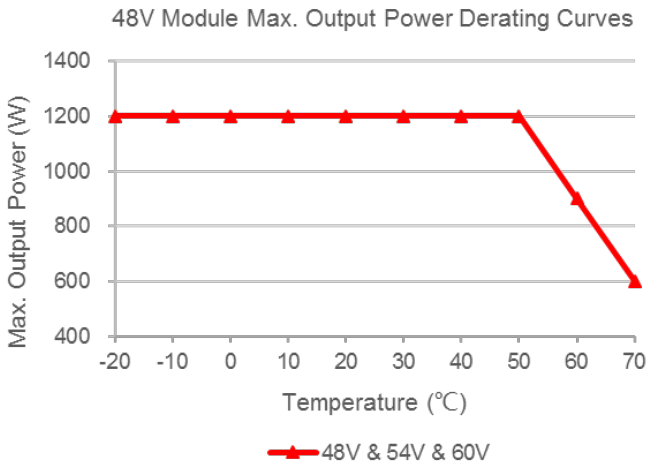




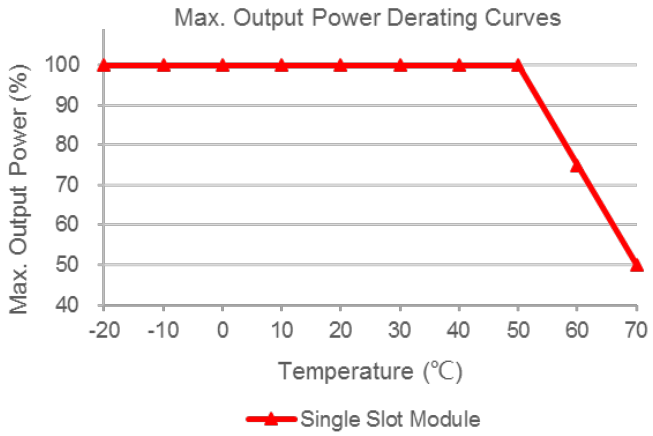
Medical/Industrial AC-DC Configurable Power Supply

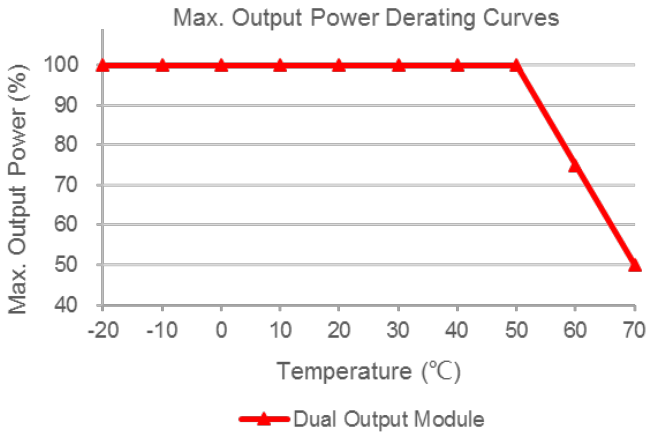
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Power Derating – Single Slot Modules & Dual Output Modules





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Certificate

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.

In addition to a UL Total Certification Program (TCP) approved client laboratory for IEC 60950 and IEC 60065. Delta also has participated UL Client Test Data Program (CDTP) for IEC 60601

Attention

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