P-DUKE POWER

MAH450 Series

3 X 5 Inch AC-DC POWER SUPPLIES
Up to 450 Watts

5 YEARS WARRANTY

RoHS COMPLIANT

REACH COMPLIANT

+85°C / -40°C AMBIENT TEMP.

Medical | Automation | Datacom

IPC | Industry | Measurement

Telecom | Automobile | Boat

Charger | PV | Railway

2 x MOPP | 4000 VAC Reinforced Insulation | ADJ. Output Voltage | Internal EN55032 Class B Filter | LOW Leakage Current | LOW Standby Power | Operating Altitude 5000 meter | POWER GOOD | Protection Class I Class II | REMOTE ON OFF | OCP | OTP | OVP | SCP

PART NUMBER STRUCTURE

M	A	H	450	U	S	12	□	-	F2
Application	**Package Code**	**Dimension Code**	**Output Power (W)**	**Input Voltage (VAC)**	**Output Quantity**	**Output Voltage (VDC)**	**Protection Type**		**Options**
Medical Application	**A:**Open type **E:**Enclosed type			**U:** Universal 85 ~ 264VAC	**S:**Single	**12:**12V **15:**15V **24:**24V **28:**28V **36:**36V **48:**48V **53:**53V	**□:** CLASS I **B:** CLASS II		**□:** Fan connector with fixed fan speed control. **Y:** Fan connector with variable fan speed control. For M**E**H450 only: Fixed fan speed **F1:** Fan 1, fan on the top **F2:** Fan 2, fan on the side Variable fan speed **Y1:** Fan 1, fan on the top **Y2:** Fan 2, fan on the side

TECHNICAL SPECIFICATION All specifications are typical at 230VAC input, full load and 25℃ unless otherwise noted

Model Number	Input Range	Output Voltage	Output Current @ 230VAC				Input Power @No Load	Efficiency	Maximum Capacitor Load
			Natural Convection	Conduction Cooling	Forced Air Cooling				
					21 CFM External Fan	Internal Fan			
	VAC	VDC	A	A	A	A	W	%	μF
MAH450US12(-Y)	85 ~ 264	12	20.8	23.3	37.5	---	0.3	91	31250
MEH450US12(-Y)	85 ~ 264	12	20.8	23.3	37.5	---	0.3	91	31250
MEH450US12-F1(Y1)	85 ~ 264	12	---	---	---	37.5	0.5	91	31250
MEH450US12-F2(Y2)	85 ~ 264	12	---	---	---	37.5	0.5	91	31250
MAH450US15(-Y)	85 ~ 264	15	16.6	18.6	30.0	---	0.5	92	20000
MEH450US15(-Y)	85 ~ 264	15	16.6	18.6	30.0	---	0.5	92	20000
MEH450US15-F1(Y1)	85 ~ 264	15	---	---	---	30.0	0.8	92	20000
MEH450US15-F2(Y2)	85 ~ 264	15	---	---	---	30.0	0.8	92	20000
MAH450US24(-Y)	85 ~ 264	24	13.3	14.55	18.75	---	0.5	93	7820
MEH450US24(-Y)	85 ~ 264	24	13.3	14.55	18.75	---	0.5	93	7820
MEH450US24-F1(Y1)	85 ~ 264	24	---	---	---	18.75	0.8	93	7820
MEH450US24-F2(Y2)	85 ~ 264	24	---	---	---	18.75	0.8	93	7820
MAH450US28(-Y)	85 ~ 264	28	11.4	12.5	16.1	---	0.5	93	5750
MEH450US28(-Y)	85 ~ 264	28	11.4	12.5	16.1	---	0.5	93	5750
MEH450US28-F1(Y1)	85 ~ 264	28	---	---	---	16.1	0.8	93	5750
MEH450US28-F2(Y2)	85 ~ 264	28	---	---	---	16.1	0.8	93	5750
MAH450US36(-Y)	85 ~ 264	36	8.9	9.72	12.5	---	0.5	93	3500
MEH450US36(-Y)	85 ~ 264	36	8.9	9.72	12.5	---	0.5	93	3500
MEH450US36-F1(Y1)	85 ~ 264	36	---	---	---	12.5	0.8	93	3500
MEH450US36-F2(Y2)	85 ~ 264	36	---	---	---	12.5	0.8	93	3500
MAH450US48(-Y)	85 ~ 264	48	6.65	7.3	9.4	---	0.5	94	1960
MEH450US48(-Y)	85 ~ 264	48	6.65	7.3	9.4	---	0.5	94	1960
MEH450US48-F1(Y1)	85 ~ 264	48	---	---	---	9.4	0.8	94	1960
MEH450US48-F2(Y2)	85 ~ 264	48	---	---	---	9.4	0.8	94	1960
MAH450US53(-Y)	85 ~ 264	53	6.05	6.6	8.55	---	0.5	94	1600
MEH450US53(-Y)	85 ~ 264	53	6.05	6.6	8.55	---	0.5	94	1600
MEH450US53-F1(Y1)	85 ~ 264	53	---	---	---	8.55	0.8	94	1600
MEH450US53-F2(Y2)	85 ~ 264	53	---	---	---	8.55	0.8	94	1600

INPUT SPECIFICATIONS

Parameter	Conditions			Min.	Typ.	Max.	Unit
Operating input voltage range	AC input DC input			85 120		264 370	VAC VDC
Input frequency	AC input			47		63	Hz
Input current	100VAC and Full Load 240VAC and Full Load					5.8 2.4	A
No load input power	230VAC	MAH(-Y), MEH(-Y)	12Vout others		0.3 0.5		Watts
		MEH –F☐(Y☐)	12Vout others		0.5 0.8		
Leakage current	264VAC					100	μA
Power Factor				0.95			
Start up time						2000	ms
Rise time					30		ms
Hold up time	115VAC and Full Load				14		ms
Input inrush current	230VAC					100	A
Input protection	Internal fuse				T6.3A/250VAC		
Main output remote control	Positive Logic Referenced to “-Control” *Standby power always present		Main power ON Main power OFF		Open or 3 ~ 12 VDC Short or 0 ~ 1.2VDC		
			Input current of Control	-0.5		1	mA

OUTPUT SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit
Output power	Forced air cooling	All			450	Watts
	Conduction cooling @ 230VAC	12Vout,15Vout			280	
		others			350	
	Natural convection @ 230VAC	12Vout,15Vout			250	
		others			320	
	* Please refer to the derating curve for detailed rating.					
Initial set voltage accuracy	230VAC and Full Load		-1.0		+1.0	%
Line regulation	Low Line to High Line at Full Load		-0.2		+0.2	%
Load regulation	No Load to Full Load		-0.5		+0.5	%
	10% Load to 90% Load		-0.4		+0.4	
Voltage adjustability	Maximum output deviation is inclusive of remote sense		-8		+8	%
Minimum load				0		%
Ripple and noise	Measured by 20MHz bandwidth					mVp-p
	With a 1μF/25V 1206 X7R MLCC	12Vout		250		
		15Vout		300		
	With a 1μF/50V 1206 X7R MLCC	24Vout		240		
		28Vout		280		
		36Vout		360		
		48Vout		480		
	With a 0.1μF/100V 1206 X7R MLCC	53Vout		530		
Temperature coefficient			-0.02		+0.02	%/℃
Transient response	Load step from 50 ~ 75% change at 2.5A/μs	Peak deviation		3		% Vout
		Recovery time		600		μs
Over voltage protection	% of Vout(nom); Latch mode		110		135	%
Over load protection	% of maximum Iout rated; Hiccup mode		115		155	%
Short circuit protection	Protection level 1 (nominal)		Continuous, automatics recovery			
	Protection level 2 (instantaneous high current)		Latch			
Standby power supply	Always present when AC supplied		5V / 2000mA			
Fan power supply	Fixed fan speed function		12V / 500mA			
Main output Power Good signal	Referenced to “GND”	Power good	Low			
		Power off	Open collector			

GENERAL SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit
Isolation voltage	1 minute (2MOPP insulation)	Input to Output	4000			VAC
		Input (Output) to F.G.	2500			
Isolation resistance	500VDC		0.1			GΩ
Switching frequency	230VAC, Full load	15Vout		75		kHz
		Other		65		
Safety approvals	IEC/ EN/ ANSI/AAMI ES 60601-1		UL:E360199			
	IEC/ EN/ UL 62368-1		UL:E193009			
			CB:UL(Demko)			
Weight		MAH(-Y)	462g(16.29oz)			
		MEH(-Y)	504g(17.77oz)			
		MEH –F1(Y1)	524g(18.48oz)			
		MEH –F2(Y2)	552g(19.47oz)			
MTBF	MIL-HDBK-217F Ta=25℃, Full load		4.093 x 10^5 hrs			

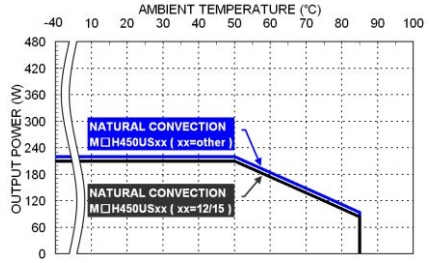
ENVIRONMENTAL SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating ambient temperature	With derating	MAH(-Y), MEH(-Y)	-40		+85	℃
		MEH –F☐(Y☐)	-40		+80	
Storage temperature range		MAH, MEH	-40		+85	℃
		MEH –F☐(Y☐)	-40		+80	
Over temperature protection	Internal thermistor ; Latch mode		110		125	℃
Operating altitude	With derating				5000	m
Shock			IEC60068-2-27			
Vibration			IEC60068-2-6			
Relative humidity	Non-condensing		5% to 95% RH			

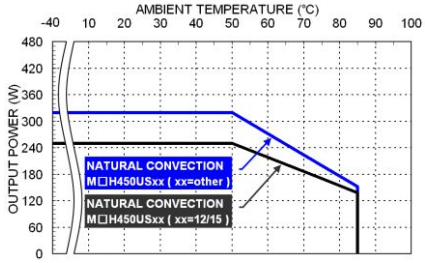
EMC SPECIFICATIONS

Parameter	Conditions		Level
EMI	EN55011, EN55032, EN60601-1-2 and FCC Part 18 / 15 For optimum EMI performance, the power supply should be mounted to a metal plate grounded to all 4 mounting holes of the power supply. To comply with safety standards, this plate must be properly grounded to protective earth.		Conducted Class B Radiated Class A
Harmonic currents	EN61000-3-2	Full Load	Class A and D
Voltage flicker	EN61000-3-3		
EMS	EN55035 and EN60601-1-2		
ESD	EN61000-4-2		Perf. Criteria A
Radiated immunity	EN61000-4-3	3 V/m	Perf. Criteria A
Fast transient	EN61000-4-4	± 2kV	Perf. Criteria A
Surge	EN61000-4-5	DM ± 1kV and CM ± 2kV	Perf. Criteria A
Conducted immunity	EN61000-4-6	20 Vr.m.s	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8	30 A/m	Perf. Criteria A
Dip and interruptions	EN61000-4-11		

CHARACTERISTIC CURVE



Derating Curve vs. Ambient Temperature
Vin=115VAC and Natural convection



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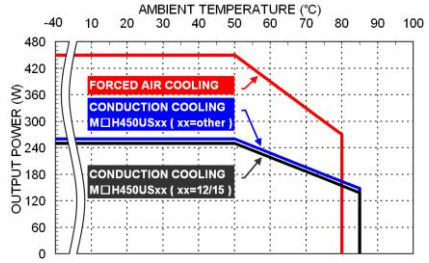
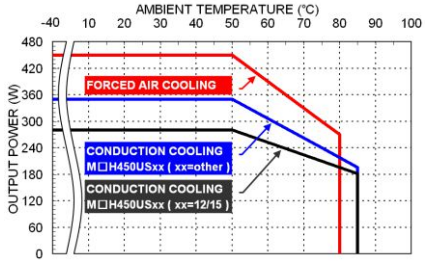
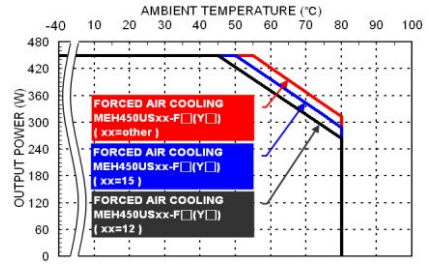
Vin=230VAC and Natural convection



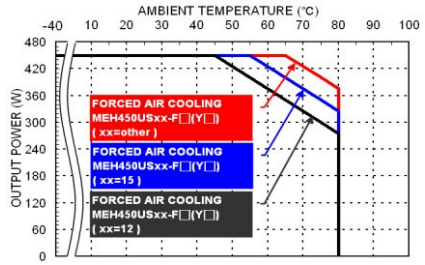
Derating Curve vs. Ambient Temperature
Vin=115VAC and Conduction cooling tested by 43x24.8x0.12cm plate
Forced air cooling with 21CFM (External Fan)



Derating Curve vs. Ambient Temperature
Vin=230VAC and Conduction cooling tested by 43x24.8x0.12cm plate
Forced air cooling with 21CFM (External Fan)

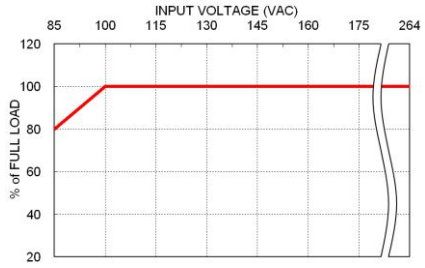


Derating Curve vs. Ambient Temperature
Vin=115VAC and Forced air cooling (Internal Fan)

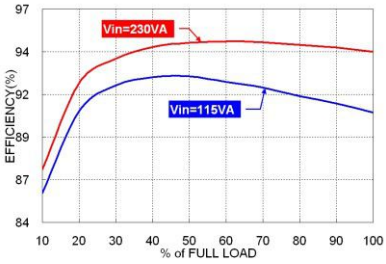


Derating Curve vs. Ambient Temperature
Vin=230VAC and Forced air cooling (Internal Fan)

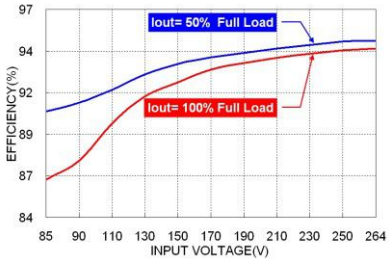
CHARACTERISTIC CURVE (CONTINUED)



Derating Curve vs. Input Voltage
M□H450



Efficiency vs. Output Load
M□H450US24 with Forced air cooling



Efficiency vs. Input Voltage
M□H450US24 with Forced air cooling

OUTPUT SENSING

Output sensing function can be applied via connecting wires on CON3. Initially, Pin 7 and Pin 8 are shorted by a jumpper set as default, shown as Fig. 1.

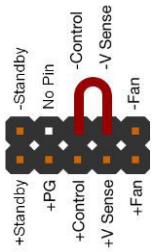
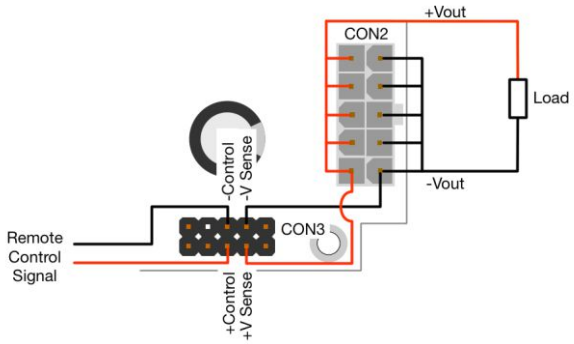
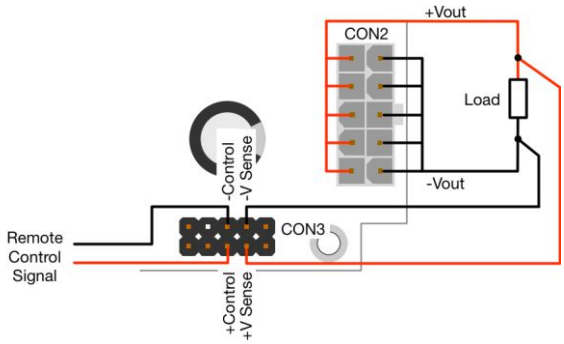


Fig. 1 Default connection

But if remote control function is to be used, the jumpper on Pin 7 and Pin 8 should be removed. Since sense pins sould not be left open for module stability, please follow the connections as below (Fig. 2).



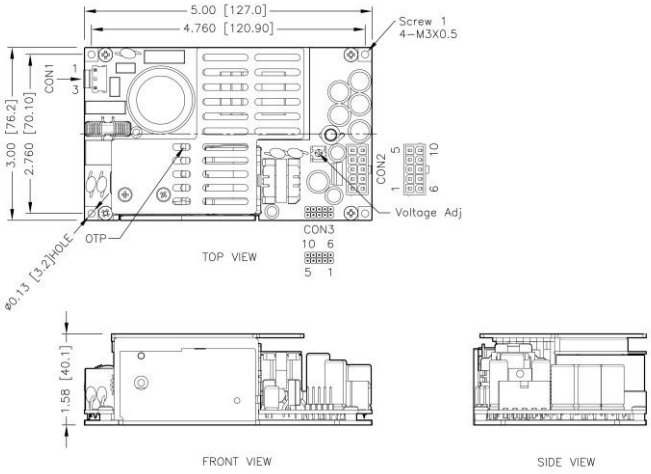


(a) Sense pins connect to corresponding polarity of Vout pin (b) Sense pins connect to corresponding polarity terminal of load.

Fig. 2 Recommended output sensing connections

MECHANICAL DRAWING

MAH450USXX **(-Y)**



*Either one of four screw holes can be considered as PE connection for CLASS I application.

1. All dimensions in inch [mm]
2. Tolerance : x.xx±0.02 [x.x±0.5]
   x.xxx±0.01 [x.xx±0.25]
3. Screw 1 locked torque : MAX 5.2Kgf-cm/0.51N.m

CONNECTORS CONNECTIONS

CON1 – Input Connector

Pin 1	Line
Pin 3	Neutral

Mates with
Molex housing : **09-50-8031**
Molex crimp terminals : **2478,6838,45570**

CON2 – Output Connector

Pin 1,2,3,4,5	+Vout
Pin 6,7,8,9,10	-Vout

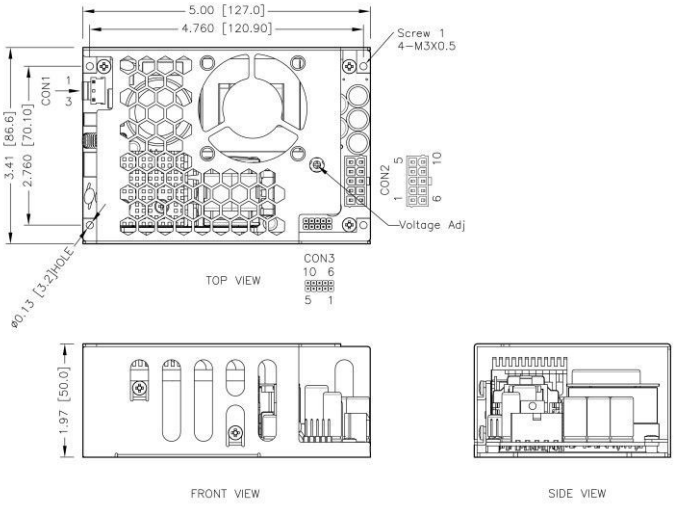
Mates with
Molex housing : **39-01-2105**
Molex crimp terminals : **5556,45750**

CON3 – Aux Connector

Pin 1	+Fan	Pin 6	-Fan (GND)
Pin 2	+V Sense	Pin 7	-V Sense
Pin 3	+Control	Pin 8	-Control (GND)
Pin 4	+PG	Pin 9	No Pin
Pin 5	+Standby	Pin10	-Standby (GND)

Mates with
Molex housing : **90143-0008**
Molex crimp terminals : **90119**

MEH450USXX **(-Y)**



*Either one of four screw holes can be considered as PE connection for CLASS I application.

1. All dimensions in inch [mm]
2. Tolerance : x.xx±0.02 [x.x±0.5]
   x.xxx±0.01 [x.xx±0.25]
3. Screw 1 locked torque : MAX 5.2Kgf-cm/0.51N.m

CONNECTORS CONNECTIONS

CON1 – Input Connector

Pin 1	Line
Pin 3	Neutral

Mates with
Molex housing : **09-50-8031**
Molex crimp terminals : **2478,6838,45570**

CON2 – Output Connector

Pin 1,2,3,4,5	+Vout
Pin 6,7,8,9,10	-Vout

Mates with
Molex housing : **39-01-2105**
Molex crimp terminals : **5556,45750**

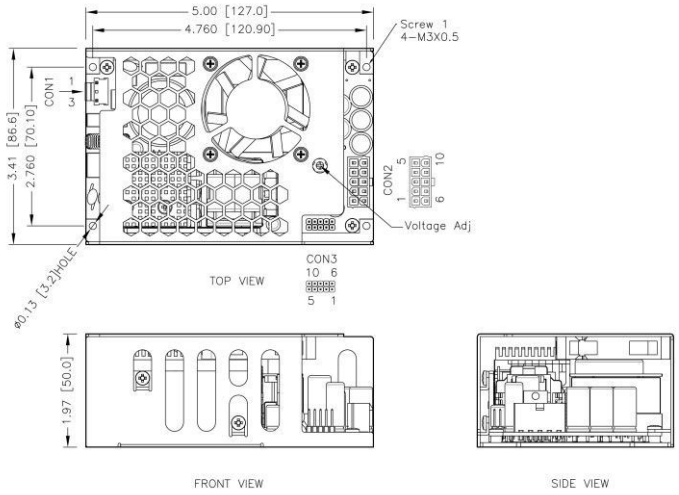
CON3 – Aux Connector

Pin 1	+Fan	Pin 6	-Fan (GND)
Pin 2	+V Sense	Pin 7	-V Sense
Pin 3	+Control	Pin 8	-Control (GND)
Pin 4	+PG	Pin 9	No Pin
Pin 5	+Standby	Pin10	-Standby (GND)

Mates with
Molex housing : **90143-0008**
Molex crimp terminals : **90119**

MECHANICAL DRAWING (CONTINUED)

MEH450USXX**–F1 (Y1)** FAN dimension: 50x50x10mm Air flow: 11.4 CFM
The fan's life is shorter than power supply and has only 2 years warranty.



*Either one of four screw holes can be considered as PE connection for CLASS I application.

1. All dimensions in inch [mm]
2. Tolerance : x.xx±0.02 [x.x±0.5]
   x.xxx±0.01 [x.xx±0.25]
3. Screw 1 locked torque : MAX 5.2Kgf-cm/0.51N.m

CONNECTORS CONNECTIONS

CON1 – Input Connector

Pin 1	Line
Pin 3	Neutral

Mates with
Molex housing : **09-50-8031**
Molex crimp terminals : **2478,6838,45570**

CON2 – Output Connector

Pin 1,2,3,4,5	+Vout
Pin 6,7,8,9,10	-Vout

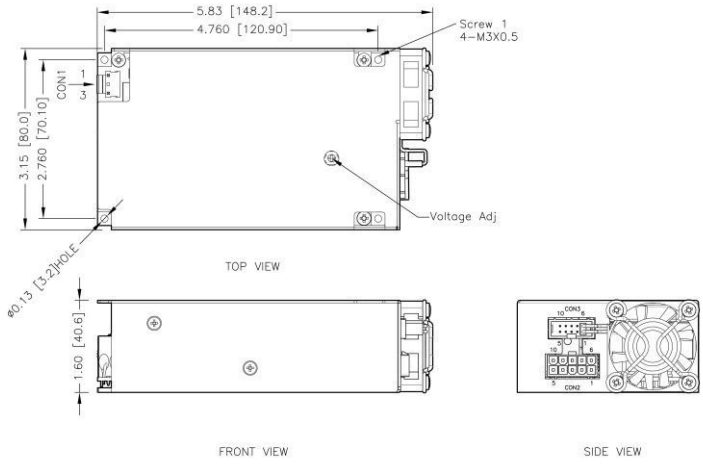
Mates with
Molex housing : **39-01-2105**
Molex crimp terminals : **5556,45750**

CON3 – Aux Connector

Pin 1	+Fan	Pin 6	-Fan (GND)
Pin 2	+V Sense	Pin 7	-V Sense
Pin 3	+Control	Pin 8	-Control (GND)
Pin 4	+PG	Pin 9	No Pin
Pin 5	+Standby	Pin10	-Standby (GND)

Mates with
Molex housing : **90143-0008**
Molex crimp terminals : **90119**

MEH450USXX**–F2 (Y2)** FAN dimension: 40x40x10mm Air flow: 9.5 CFM
The fan's life is shorter than power supply and has only 2 years warranty.



*Either one of four screw holes can be considered as PE connection for CLASS I application.

1. All dimensions in inch [mm]
2. Tolerance : x.xx±0.02 [x.x±0.5]
   x.xxx±0.01 [x.xx±0.25]
3. Screw 1 locked torque : MAX 5.2Kgf-cm/0.51N.m

CONNECTORS CONNECTIONS

CON1 – Input Connector

Pin 1	Line
Pin 3	Neutral

Mates with
Molex housing : **09-50-8031**
Molex crimp terminals : **2478,6838,45570**

CON2 – Output Connector

Pin 1,2,3,4,5	-Vout
Pin 6,7,8,9,10	+Vout

Mates with
Molex housing : **39-01-2105**
Molex crimp terminals : **5556,45750**

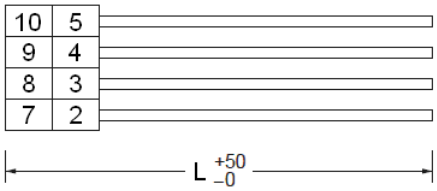
CON3 – Aux Connector

Pin 1	+Fan	Pin 6	-Fan (GND)
Pin 2	+V Sense	Pin 7	-V Sense
Pin 3	+Control	Pin 8	-Control (GND)
Pin 4	+PG	Pin 9	No Pin
Pin 5	+Standby	Pin10	-Standby (GND)

Mates with
Molex housing : **90143-0008**
Molex crimp terminals : **90119**

OPTIONAL PARTS

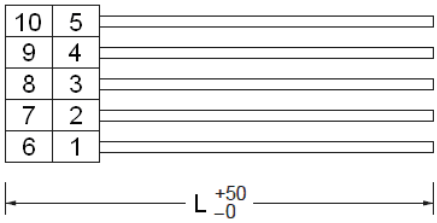
7N-0265-F :



CON3 housing			
Pin 2	+V Sense	gray	26AWG
Pin 3	+Control	orange	26AWG
Pin 4	+PG	blue	26AWG
Pin 5	+Standby	red	22AWG
Pin 7	-V Sense	green	26AWG
Pin 8	-Control (GND)	brown	26AWG
Pin 9	No wire	---	---
Pin10	-Standby (GND)	black	22AWG

Length (**L**) : 500mm typical

7N-0266-F :



CON3 housing			
Pin 1	+Fan	yellow	26AWG
Pin 2	+V Sense	gray	26AWG
Pin 3	+Control	orange	26AWG
Pin 4	+PG	blue	26AWG
Pin 5	+Standby	red	22AWG
Pin 6	-Fan (GND)	brown	26AWG
Pin 7	-V Sense	green	26AWG
Pin 8	-Control (GND)	brown	26AWG
Pin 9	No wire	---	---
Pin10	-Standby (GND)	black	22AWG

Length (**L**) : 500mm typical

P-DUKE

P-DUKE Technology Co., Ltd.

Tel +886-4-2359-0668
Fax +886-4-2359-1337
Email sales@pduke.com
Web www.pduke.com
Add No. 36, 22nd Rd., Taichung Industrial Park, Taichung, Taiwan, R.O.C.