



electronic powersolutions

# TR160M SERIES 160 WATT MEDICAL SWITCH ADAPTER

## Features

- Universal Input Range 80~264Vac
- High Efficiency up to 93%
- Class I (TR160MA), Class II (TR160MB)
- No Load Input Power Consumption < 150mW
- Approval IEC/EN/UL 60601-1 2 MOPP
- Approval IEC/EN 60601-1-11 (TR160MB)
- Approval IP22 (TR160MB)
- Approval EN55011 and CISPR/FCC Class B
- Meets IEC/EN 60335-1
- Operating Altitude 5000m
- Continuous Short Circuit Protection
- Over Voltage Protection
- Meets CoC Tier 2 and DOE Level VI



MODEL NUMBER	OUTPUT VOLTAGE	OUTPUT CURRENT	RIPPLE & NOISE NOTE1	VOLTAGE ACCURACY NOTE2	LINE REGULATION NOTE3	LOAD REGULATION NOTE4	%EFF. (Typ.) NOTE5
TR160MA120	12 V	12.5 A	120 mV	±2%	±1%	±3%	91%
TR160MA240	24 V	6.66 A	200 mV	±2%	±1%	±2%	92%
TR160MA360	36 V	4.44 A	200 mV	±2%	±1%	±2%	92%
TR160MA480	48 V	3.33 A	200 mV	±2%	±1%	±2%	93%
TR160MB120	12 V	12.5 A	120 mV	±2%	±1%	±3%	91%
TR160MB240	24 V	6.66 A	200 mV	±2%	±1%	±2%	92%
TR160MB360	36 V	4.44 A	200 mV	±2%	±1%	±2%	92%
TR160MB480	48 V	3.33 A	200 mV	±2%	±1%	±2%	93%

Note:

1. Add a 0.1uF ceramic capacitor and a 10uF E.L. capacitor to output for ripple & noise measuring @20MHz BW.
2. Voltage accuracy is set at 60% full load.
3. Line regulation is measured from 100V<sub>ac</sub> to 240V<sub>ac</sub> with full load.
4. Load regulation measured from 60% to 100% full load and from 60% to 20% full load (60%±40% full load).
5. Typical efficiency at 230V<sub>ac</sub> and 75% full load at 25°C.

## PART NUMBER

Series		Output Voltage	DC Plug Type	Cable Type	Cable Length
TR160M	X	XXX	-XX	E	XX
160W Medical Adapter	A : Class I B : Class II	120 : 12V 240 : 24V 360 : 36V 480 : 48V	See Page 6	E : UL2464 with OVP	12V : 950mm with DIN Power Plug 24V : 1220mm with DC Jack 36V : 1800mm with DC Jack 48V : 1800mm with DC Jack

Part Number Example:

**TR160MA120-1446E471**, 150W, Class I, 12V<sub>dc</sub> Output, DIN Power Plug Type, Cable Length 950mm

**TR160MB240-02E12**, 160W, Class II, 24V<sub>dc</sub> Output, DC Jack Type, Cable Length 1220mm



## TECHNICAL SPECIFICATIONS

(All specifications are typical at nominal input, full load at 25°C unless otherwise noted.)

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Input Voltage		All	80		264	V <sub>ac</sub>
Operating Temperature	See Derating Curve	All	-20		70	°C
Storage Temperature		All	-40		85	°C
Input/Output Isolation Voltage	1 minute	All			4400	V <sub>ac</sub>
Operating Altitude		All			5000	m

### INPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Operating Voltage Range		All	100		240	V <sub>ac</sub>
Input Frequency Range		All	47		63	Hz
Maximum Input Current	100% Load, V <sub>in</sub> =100V <sub>ac</sub>	All			2.0	A
Leakage Current (Earth)		TR160MA			300	uA
Leakage Current (Touch)		All			90	uA
Under Voltage Protection		All	60	66	70	V <sub>ac</sub>
Power Factor	230V <sub>ac</sub> /50Hz at Full load	All	0.9			
Inrush Current	V <sub>in</sub> =240V <sub>ac</sub> , Cold start at 25°C	All			120	A

### OUTPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Output Voltage Set Point	V <sub>in</sub> =115V <sub>ac</sub> and 230V <sub>ac</sub> , I <sub>o</sub> =60% Full load T <sub>c</sub> =25°C	TR160MA/B120	11.76	12	12.24	V <sub>dc</sub>
		TR160MA/B240	23.52	24	24.48	
		TR160MA/B360	35.28	36	36.72	
		TR160MA/B480	47.04	48	48.96	
Operating Output Current Range	V <sub>in</sub> =115V <sub>ac</sub> and 230V <sub>ac</sub> , T <sub>c</sub> =25°C	TR160MA/B120	0		12.5	A
		TR160MA/B240	0		6.66	
		TR160MA/B360	0		4.44	
		TR160MA/B480	0		3.33	
Holdup Time	V <sub>in</sub> =115V <sub>ac</sub>	All		25		ms
Output Voltage Regulation						
Load Regulation	60%±40% Full load change	TR160MA/B120			±3.0	%
		TR160MA/B240			±2.0	
		TR160MA/B360			±2.0	
		TR160MA/B480			±2.0	
Line Regulation	V <sub>in</sub> =High line to low line, full load	All			±1.0	%
Over Voltage Protection	Latch off (AC recycle to reset)	TR160MA/B120		13.2		V <sub>dc</sub>
		TR160MA/B240		28.6		
		TR160MA/B360		41.8		
		TR160MA/B480		55.6		
Over Current Protection	Auto recovery	All	110		130	%
Short Circuit Protection	Auto recovery	All				
Output Ripple and Noise	1. Add a 0.1uF ceramic capacitor and a 10uF aluminum electrolytic capacitor to output 2. Oscilloscope is 20MHz band width 3. Ambient temperature=25°C	TR160MA/B120			120	mV
		TR160MA/B240			200	
		TR160MA/B360			200	
		TR160MA/B480			200	



# TR160M Series

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Load Capacitance	1. $V_{in}=115V_{ac}$ and $230V_{ac}$ 2. Output is max. load 3. Ambient temperature= $25^{\circ}C$	TR160MA/B120			12250	uF
		TR160MA/B240			6600	
		TR160MA/B360			4330	
		TR160MA/B480			3240	
Efficiency	1. $V_{in}=230V_{ac}$ 2. Output is 75% full load 3. Ambient temperature= $25^{\circ}C$	TR160MA/B120		91%		%
		TR160MA/B240		92%		
		TR160MA/B360		92%		
		TR160MA/B480		93%		

## ISOLATION CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Input to Output	1 minute (without dielectric breakdown)	All			4400	$V_{ac}$
Input to Earth (Ground)	1 minute (without dielectric breakdown)	TR160MA			1800	$V_{ac}$
Output to Earth (Ground)	1 minute (without dielectric breakdown)	TR160MA			1800	$V_{ac}$
Isolation Resistance	Input to output	All	100			M $\Omega$

## FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Switching Frequency		All		115		kHz

## GENERAL SPECIFICATIONS

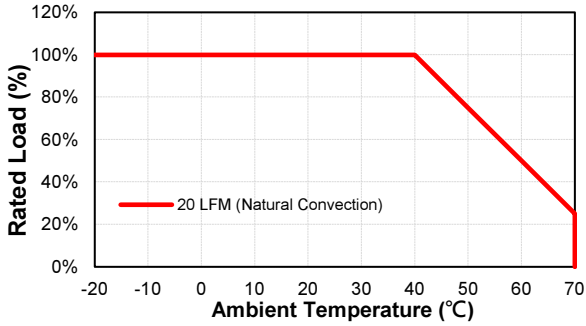
PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
MTBF	$I_o=100\%$ ; $T_a=25^{\circ}C$ per MIL-HDBK-217F	All	370			k hours
Humidity	Non-condensing	All			93	% RH
Shock	MIL-STD-810F Table 516.5, TABLE 516.5-1 10ms, each axis 3 times( $\pm X$ , $\pm Y$ , $\pm Z$ axis)	All		75		g
Vibration	MIL-STD-810F Table 514.5C-VIII, 15~2000Hz, X · Y · Z axis, 1 hour(each axis),. total 3 hours.	All		4		g
Weight		All		575		grams
Dimension		All	5.906x2.756x1.497 inches (150.00x70.00x38.00 mm)			
<b>Safety</b>	Class I (TR160MA), Class II (TR160MB) IEC 60601-1:2005 (Third Edition) + CORR. 1:2006 + CORR. 2:2007 + A1:2012 EN 60601-1:2006;A11+A1+A12 ANSI/AAMI ES60601-1 (2005/(R)2012 + A1:2012, C1:2009/(R)2012 + A2:2010/(R)2012) IEN/EN 60601-1-11-2015 for TR160MB (Home Health Care)					Ed 3.1
<b>EMC Emission</b>	EN55011:2009+A1:2010, EN61000-3-2:2014, EN6100-3-3:2013, FCC CFR47 Part 15					
Conducted Disturbance	EN55011:2009+A1:2010, FCC CFR47 Part 15					Class B
Radiated Disturbance	EN55011:2009+A1:2010, FCC CFR47 Part 15					Class B
Harmonic Current Emissions	EN 61000-3-2:2014					Class A
Voltage Fluctuations & Flicker	EN 61000-3-3:2013					Criterion A
<b>EMC Immunity</b>	EN60601-1-2:2015, IEC61000-4-2, 3, 4, 5, 6, 8, 11					Ed 4.0
Electrostatic Discharge (ESD)	IEC 61000-4-2:2008 Air Discharge: $\pm 15kV$ Contact Discharge: $\pm 8kV$					Criterion A
Radio-Frequency, Continuous Radiated Disturbance	IEC 61000-4-3:2006+A1:2007+A2:2010					Criterion A
Electrical Fast Transient (EFT)	IEC 61000-4-4:2012, $\pm 2kV$					Criterion A
Surge	IEC 61000-4-5:2014+A1:2017, L-N: $\pm 1kV$ , L-E (Ground): $\pm 1kV$ , $\pm 2kV$					Criterion A
Conducted Disturbances, Induced by RF Fields	IEC 61000-4-6:2013+COR1:2015					Criterion A
Power Frequency Magnetic Field	IEC 61000-4-8:2009					Criterion A
Voltage Dips	IEC 61000-4-11:2004+A1:2017, Dips:30% reduction, Dips: >95% reduction					Criterion A
Voltage Interruptions	IEC 61000-4-11:2004+A1:2017, >95% reduction					Criterion B
Application Note Link						<a href="#">TR160M Series App Notes</a>



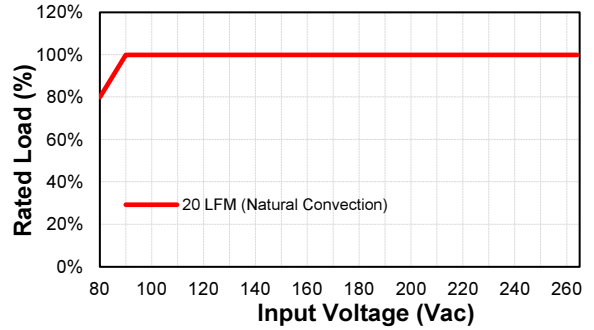
## CHARACTERISTIC CURVE

### Power Derating Curve

TR160M Derating Curve

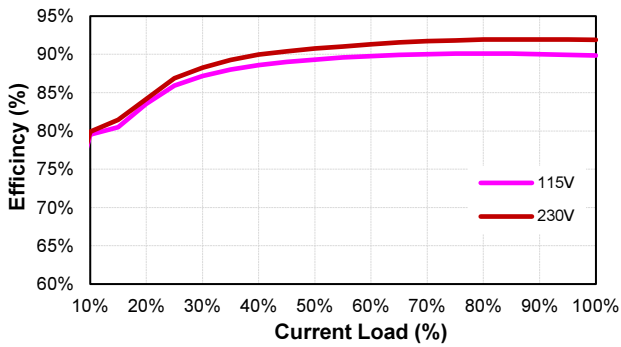


TR160M Input Voltage Derating Curve

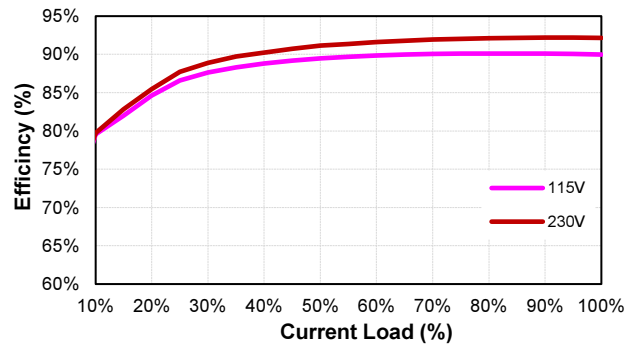


### Performance Data

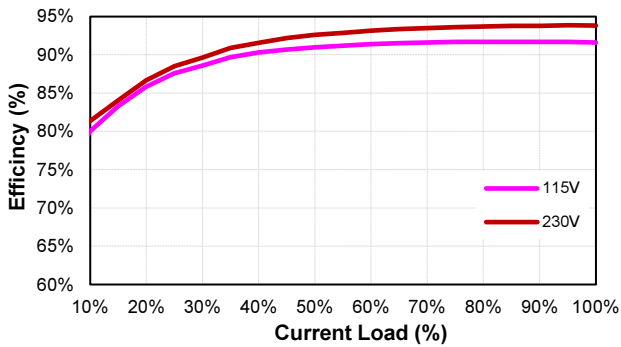
TR160M120 (Eff Vs Io)



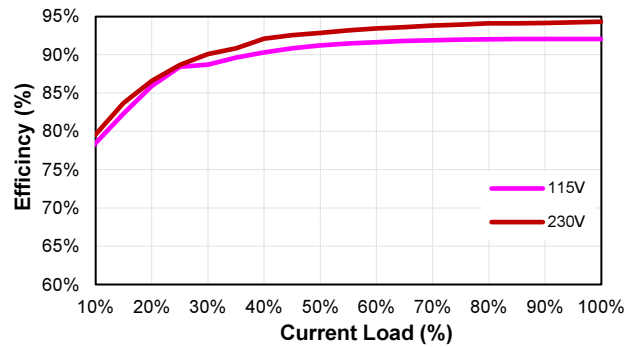
TR160M240 (Eff Vs Io)



TR160M360 (Eff Vs Io)



TR160M480 (Eff Vs Io)

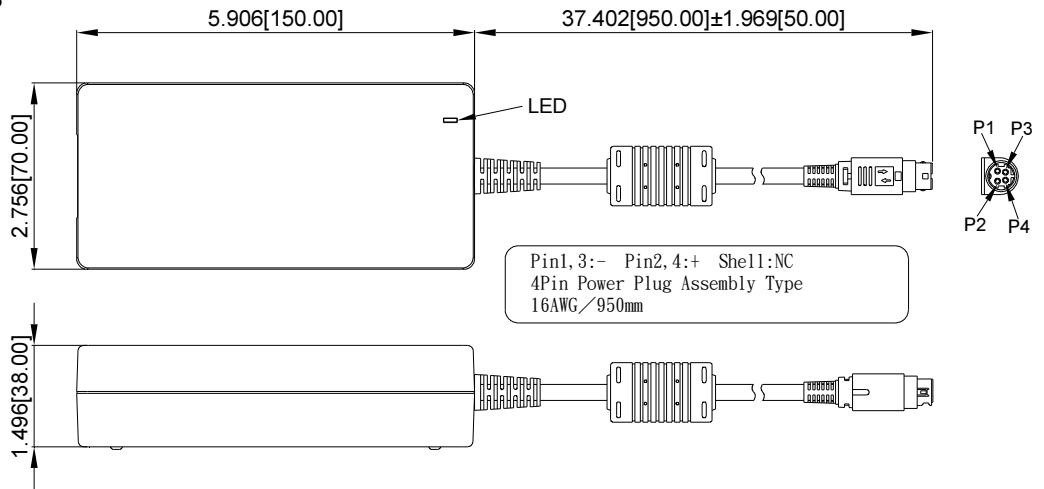
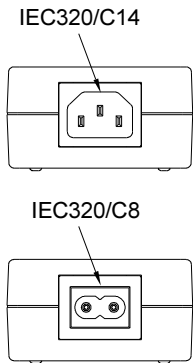




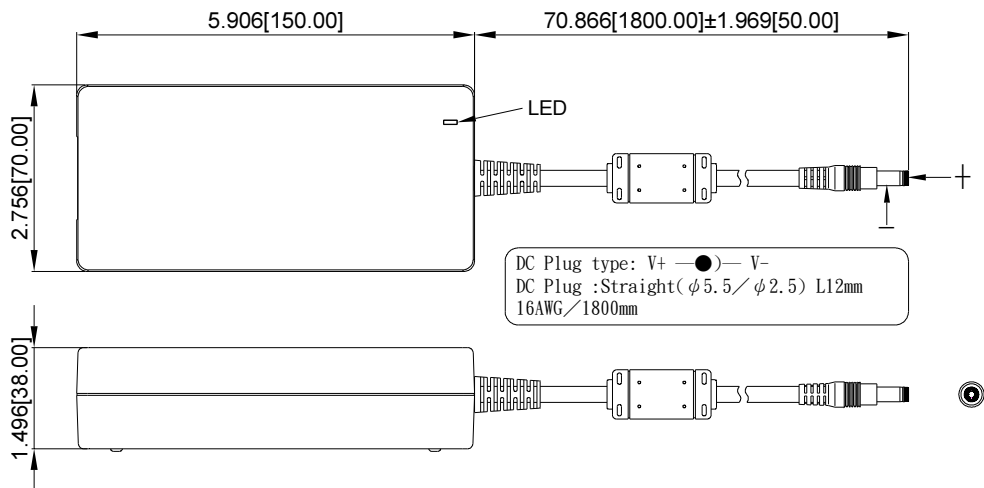
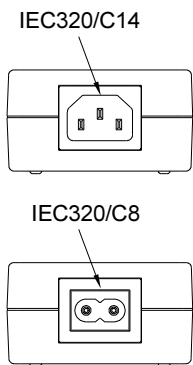
## MECHANICAL SPECIFICATION

All Dimensions are in inches[mm]  
Tolerance:Inches:X.XXX±0.02  
Millimeters:X.XX±0.5  
UNIT:inches[mm]

### Din Power Plug



### DC Jack

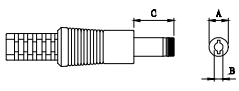
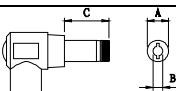
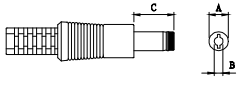
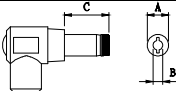
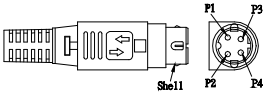
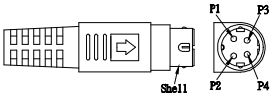


\* For Output Voltage 12Vdc model, it must select Din Power Plug Molded Type or equivalent

\* For Output Voltage 24Vdc to 48Vdc models, it's able to select Din Power Plug Molded Type, DC Jack or equivalent.



## STANDARD OUTPUT DC PLUG

DC Plug Type	Cable Number -XXXXX	A	B	C	Cable Type	Cable Length	Cable AWG
		OD (mm)	ID (mm)	L (mm)			
 <p>Straight/Inner+Outer- + ● -</p>	11E13	Φ5.5	Φ2.1	12	UL2464	1800mm with Ferrite Core	16AWG for 36V, 48V
	12E13	Φ5.5	Φ2.5	12			
	23E13	Φ5.5	Φ2.1	9.5			
	26E13	Φ5.5	Φ2.5	9.5			
 <p>Right Angle/Inner+Outer- + ● -</p>	01E13	Φ5.5	Φ2.1	12			
	02E13	Φ5.5	Φ2.5	12			
	21E13	Φ5.5	Φ2.5	9.5			
	24E13	Φ5.5	Φ2.1	9.5			
 <p>Straight/Inner+Outer- + ● -</p>	11E12	Φ5.5	Φ2.1	12	UL2464	1220mm with Ferrite Core	16AWG for Vo: 24V
	12E12	Φ5.5	Φ2.5	12			
	23E12	Φ5.5	Φ2.1	9.5			
	26E12	Φ5.5	Φ2.5	9.5			
 <p>Right Angle/Inner+Outer- + ● -</p>	01E12	Φ5.5	Φ2.1	12			
	02E12	Φ5.5	Φ2.5	12			
	21E12	Φ5.5	Φ2.5	9.5			
	24E12	Φ5.5	Φ2.1	9.5			
Din Plug Type	Cable Number -XXXXX	Pin Assignment		Cable Type	Cable Length	Cable AWG	
		PIN No.	Polarity				
KYCON KPPX-4P equivalent with Lock (Din Power Plug Assembly Type) 	1446E471	P1	-	UL2464	950mm with Ferrite Core	16AWG for Vo: 12V	
		P2	+				
		P3	-				
		P4	+				
		Shell	No Connection				
KYCON KPPX-4P equivalent without Lock (Din Power Plug Molded Type) 	1538E471	P1	+				
		P2	+				
		P3	-				
		P4	-				
		Shell	No Connection				