

## AC/DC Medical Power Supply

## TPP 150 Series, 150 Watt

- Encased 150 W power supply with screw connection 2.44" x 4.6" package
- Certification according to IEC/EN/ES 60601-1 3rd edition for 2 x MOPP
- Low leakage current <100 µA rated for BF applications
- Risk management process according to ISO 14971 incl. risk management file
- Acceptance criteria for electronic assemblies acc. to IPC-A-610 Level 3
- Active power factor correction >0.95
- Protection class I and II prepared
- Operating up to 5000 m altitude
- 5-year product warranty



The TPP 150 series of 150 Watt AC/DC encased power supplies feature a reinforced double I/O isolation system according to latest medical safety standards (60601-1 3rd edition, 2 x MOPP). The earth leakage current is below 100 µA which makes the units suitable for BF (body floating) applications. The excellent efficiency of up to 92% allows a high power density for the standard 2.44" x 4.6" packaging format. The full load operating temperature range is -25°C to +70°C while it goes up to 80°C with 40% load derating. The EMC characteristic is dedicated for applications in industrial and domestic medical fields. High reliability is provided by the use of industrial quality grade components and an excellent thermal management. It makes the products an ideal solution for medical devices and for demanding safety and space critical applications.

Models				
Order Code	Output Power max.	Output Voltage nom. (adjustable)	Output Current max.	Efficiency typ.
TPP 150-112	150 W	12 VDC (10.8 - 13.2 VDC)	12'500 mA	91 %
TPP 150-115		15 VDC (13.5 - 16.5 VDC)	10'000 mA	92 %
TPP 150-124		24 VDC (21.6 - 26.4 VDC)	6'250 mA	92 %
TPP 150-128		28 VDC (25.2 - 30.8 VDC)	5'360 mA	92 %
TPP 150-136		36 VDC (32.4 - 39.6 VDC)	4'170 mA	92 %
TPP 150-148		48 VDC (43.2 - 52.8 VDC)	3'130 mA	92 %

## Input Specifications

Input Voltage	- AC Range	Operational Range: <b>85 - 264 VAC</b> (Full Range)
	- DC Range	Rated Range: <b>100 - 240 VAC</b> (Full Range) Operational Range: <b>120 - 370 VDC</b> (Designed for, no certification) Polarity: <b>+DC: L / -DC: N</b>
Input Frequency		<b>47 - 63 Hz</b>
Input Current	- Full Load & $V_{in} = 230$ VAC	<b>800 mA max.</b>
	- Full Load & $V_{in} = 115$ VAC	<b>1'700 mA max.</b>
Power Consumption	- At no load	<b>1'000 mW max.</b>
Input Inrush Current	- At 230 VAC	<b>60 A max.</b>
Power Factor	- At 230 VAC	<b>0.95 min.</b> (Active Power Factor Correction)
	- At 115 VAC	<b>0.95 min.</b> (Active Power Factor Correction)
Input Protection		<b>T 3.15 A / 250 VAC</b> (Internal Fuse in L & N)
Recommended Input Fuse		(The need of an external fuse has to be assessed in the final application.)

## Output Specifications

Output Voltage Adjustment		<b>±10%</b> (By trim potentiometer) Output power must not exceed rated power!
Voltage Set Accuracy		<b>±1% max.</b>
Regulation	- Input Variation ( $V_{min} - V_{max}$ )	<b>0.2% max.</b>
	- Load Variation (0 - 100%)	<b>0.5% max.</b>
Ripple and Noise (20 MHz Bandwidth)	12 VDC model:	<b>120 mVp-p typ.</b> (w/ 1 $\mu$ F X7R)
	15 VDC model:	<b>150 mVp-p typ.</b> (w/ 1 $\mu$ F X7R)
	24 VDC model:	<b>220 mVp-p typ.</b> (w/ 1 $\mu$ F X7R)
	28 VDC model:	<b>220 mVp-p typ.</b> (w/ 1 $\mu$ F X7R)
	36 VDC model:	<b>250 mVp-p typ.</b> (w/ 1 $\mu$ F X7R)
	48 VDC model:	<b>250 mVp-p typ.</b> (w/ 0.1 $\mu$ F X7R)
Capacitive Load	12 VDC model:	<b>10'400 <math>\mu</math>F max.</b>
	15 VDC model:	<b>6'600 <math>\mu</math>F max.</b>
	24 VDC model:	<b>2'600 <math>\mu</math>F max.</b>
	28 VDC model:	<b>1'900 <math>\mu</math>F max.</b>
	36 VDC model:	<b>1'150 <math>\mu</math>F max.</b>
	48 VDC model:	<b>650 <math>\mu</math>F max.</b>
Minimum Load		<b>Not required</b>
Temperature Coefficient		<b>±0.02 %/K max.</b>
Hold-up Time	- At 230 VAC	<b>16 ms min.</b>
	- At 115 VAC	<b>16 ms min.</b>
Start-up Time	- At 230 VAC	<b>1'000 ms max.</b>
	- At 115 VAC	<b>1'000 ms max.</b>
Short Circuit Protection		<b>Continuous, Automatic recovery</b>
Output Current Limitation		<b>115 - 150% of <math>I_{out}</math> max.</b>
Overvoltage Protection		<b>115 - 135% of <math>V_{out}</math> nom.</b>
Transient Response	- Response Deviation	<b>3% max.</b> (50% to 75% Load Step)
	- Response Time	<b>500 <math>\mu</math>s typ.</b> (50% to 75% Load Step)

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

## Safety Specifications

Safety Standards	- IT / Multimedia Equipment	EN 62368-1 IEC 62368-1 UL 60950-1 UL 62368-1
	- Medical Equipment	EN 60601-1 IEC 60601-1 ANSI/AAMI ES 60601-1 2 x MOPP (Means Of Patient Protection)
	- Certification Documents	<a href="http://www.tracopower.com/overview/tpp150">www.tracopower.com/overview/tpp150</a>
	Protection Class	Class I & II (Prepared): Reinforced Insulation
Pollution Degree		PD 2
Over Voltage Category		OVC II

## EMC Specifications

EMI Emissions	- Conducted Emissions	EN 60601-1-2 edition 4 (Medical Devices) EN 55011 class B (internal filter) EN 55032 class B (internal filter) FCC Part 15 class B (internal filter) FCC Part 18 class B (internal filter)
	- Radiated Emissions	EN 55011 class A (internal filter) EN 55032 class A (internal filter) FCC Part 15 class A (internal filter) FCC Part 18 class A (internal filter)
	- Harmonic Current Emissions	EN 61000-3-2, class A EN 61000-3-2, class D
	- Voltage Fluctuations & Flicker	EN 61000-3-3
EMS Immunity	- Electrostatic Discharge	EN 55024 (IT Equipment) EN 60601-1-2 edition 4 (Medical Devices) Air: EN 61000-4-2, $\pm 15$ kV, perf. criteria A Contact: EN 61000-4-2, $\pm 8$ kV, perf. criteria A
	- RF Electromagnetic Field	EN 61000-4-3, 20 V/m, perf. criteria A
	- EFT (Burst) / Surge	EN 61000-4-4, $\pm 2$ kV, perf. criteria A L to L: EN 61000-4-5, $\pm 1$ kV, perf. criteria A L to PE: EN 61000-4-5, $\pm 2$ kV, perf. criteria A
	- Conducted RF Disturbances	EN 61000-4-6, 20 Vrms, perf. criteria A
	- PF Magnetic Field	Continuous: EN 61000-4-8, 10 A/m, perf. criteria A
	- Voltage Dips & Interruptions	230 VAC / 50 Hz: EN 61000-4-11 30%, 25 periods, perf. criteria A 60%, 5 periods, perf. criteria A >95%, 0.5 periods, perf. criteria A >95%, 250 periods, perf. criteria B

## General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-25°C to +80°C
	- Storage Temperature	-40°C to +75°C
Power Derating	- High Temperature	See application note: <a href="http://www.tracopower.com/overview/tpp150">www.tracopower.com/overview/tpp150</a>
	- Low Input Voltage	
Cooling System		1.33 %/V below 100 VAC Forced air cooling (with internal fan)
Fan Power Source	- Characteristic	Variable fan speed (temperature regulated)
	- Output Voltage	12 VDC
	- Output Current	500 mA max.
Altitude During Operation		5'000 m max.
Switching Frequency		45 - 75 kHz (PWM QR)
Insulation System		Reinforced Insulation

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

Working Voltage (rated)	250 VAC
Isolation Test Voltage	<ul style="list-style-type: none"> <li>- Input to Output, 60 s</li> <li>- Input to Case or PE, 60 s</li> <li>- Output to Case or PE, 60 s</li> </ul>
	4'000 VAC
	2'000 VAC
	2'000 VAC
Isolation Resistance	- Input to Output, 500 VDC
	100 MΩ min.
Leakage Current (at 264 VAC)	- Touch Current
	100 µA max.
Reliability	- Calculated MTBF
	786'000 h (MIL-HDBK-217F, ground benign)
Environment	- Vibration
	IEC 60068-2-6
	5 g, 3 axis, sine sweep, 10-500 Hz, 1 oct/min
	IEC 60068-2-27
	50 g, 3 axis, half sine, 11 ms
Housing Material	Alu alloy, black anodized coating
Housing Type	Metal Case
Mounting Type	Chassis Mount
Connection Type	Screw Terminal
Weight	273 g
Environmental Compliance	- REACH Declaration
	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a>
	REACH SVHC list compliant
	REACH Annex XVII compliant
	- RoHS Declaration
	<a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a>
	Exemptions: 7a, 7c-I
	(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule). The SCIP number is provided on request.)

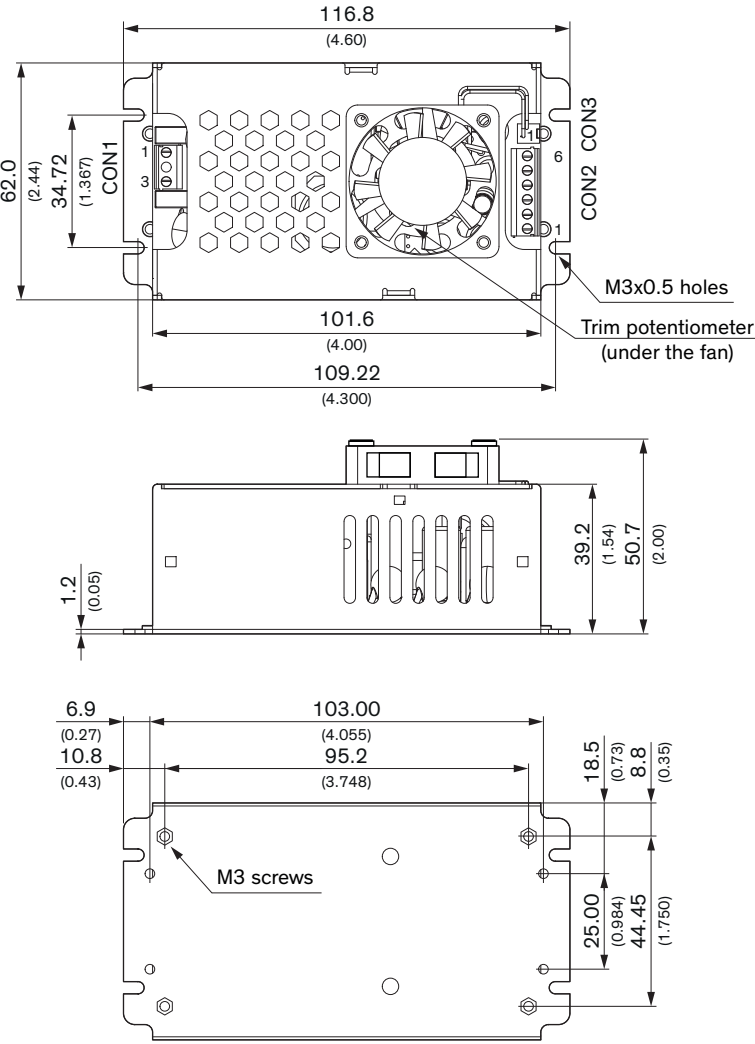
## Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tpp150](http://www.tracopower.com/overview/tpp150)

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**Outline Dimensions**



Max. corner screw penetration: 1.8 (0.07)  
Max. center screw penetration: 2.0 (0.08)

The fan's durability is lower compared to the power supply and has only 2 years warranty.

Dimension in mm (inch)  
Tolerances: x.x ±0.50 (±0.02)  
x.xx ±0.25 (±0.01)

Terminal Block				Molex	
Input (CON1)		Output (CON2)		Fan (CON3)	
Pin	Function	Pin*	Function	Pin	Function
1	Line	1-3	-Vout	1	-Fan
3	Neutral	4-6	+Vout	2	+Fan

\*Terminal rated for 7 A max.  
(at higher current connection has to be split)

**CON1:** Terminal Block  
mates with Screw locked torque MAX 2Kgf.cm/0.2N.m  
Wire dimension range: 26 - 16 AWG

**CON2:** Terminal Block  
mates with Screw locked torque MAX 2Kgf.cm/0.2N.m  
Wire dimension range: 26 - 16 AWG

**CON3:** Molex series  
mates with Molex crimp terminals: 2759  
and Molex housing: 22-01-1022