

- Enclosed power supply with screw terminal connection
- Certification according to IEC/EN/ES 60601-1 3rd edition for 2 x MOPP
- Low leakage current <75 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
- EMC compliance to IEC 60601-1-2 ed. 4
- Protection class I and II
- Operating up to 5000 m altitude
- Ready to meet ErP directive, <0.15 W no load power consumption
- 5 year product warranty



ES 60601-1 IEC 60601-1

The TPP 65 Series of 65 Watt AC/DC 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 75 μA what 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 3.0" packaging format. The full load operating temperature range is -40°C to +60°C while it goes up to 85°C with 50% load derating (for single output models). The EMC characteristic is dedicated for applications in industrial and domestic fields.

High reliability is provided by 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	Output 1		Output 2		Output 3		Efficiency typ.
		Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	
TPP 65-105	50 W	5 VDC	10'000 mA					90 %
TPP 65-112		12 VDC	5'420 mA					93 %
TPP 65-115		15 VDC	4'340 mA					94 %
TPP 65-124		24 VDC	2'710 mA					94 %
TPP 65-221	65 W	+12 VDC	5'420 mA	+5 VDC	8'000 mA			90 %
TPP 65-231		+15 VDC	4'340 mA	+5 VDC	8'000 mA			91 %
TPP 65-251		+24 VDC	2'710 mA	+5 VDC	8'000 mA			89 %
TPP 65-321M2		+12 VDC	5'420 mA	+5 VDC	8'000 mA	-12 VDC	600 mA	89 %
TPP 65-331M3		+15 VDC	4'340 mA	+5 VDC	8'000 mA	-15 VDC	600 mA	90 %
TPP 65-3512		+24 VDC	2'710 mA	+5 VDC	8'000 mA	+12 VDC	600 mA	89 %

Note - Total Power must not exceed 65 W.  
 - Other output models are available on request.  
 - Multi output models have a common ground.

### Input Specifications

Input Voltage	- AC Range	85 - 264 VAC (Full Range)
	- DC Range	120 - 370 VDC (designed for, no certification)
Input Frequency		47 - 63 Hz
Input Current	- Full Load & Vin = 230 VAC	950 mA max.
	- Full Load & Vin = 115 VAC	1650 mA max.
Power Consumption	- at no Load	150 mW max. (Ready to meet ErP directive)
Input Inrush Current	- at 230 VAC	60 A max.
Input Protection		T 3.15 A / 250 VAC (Internal Fuse in L & N)

### Output Specifications

Output Voltage Adjustment		$\pm 10\%$ (by trim potentiometer) (only Output 1) Output power must not exceed rated power!
Voltage Set Accuracy		$\pm 1\%$ max. (Output 1)
		$\pm 2\%$ max. (Output 2 and 3)
Regulation	- Input Variation (Vmin - Vmax)	single output models: <b>0.2% max.</b>
		dual output models: <b>0.2% max.</b>
		triple output models: <b>0.2% max.</b>
	- Load Variation (0 - 100%)	single output models: <b>0.5% max.</b>
		dual output models: <b>0.5% max. (Output 1)</b> <b>1.5% max. (Output 2)</b>
		triple output models: <b>0.5% max. (Output 1)</b> <b>1.5% max. (Output 2)</b> <b>0.7% max. (Output 3)</b>
- Cross Regulation (25% / 100% asym. load)	dual output models: <b>1.5% max.</b>	
	triple output models: <b>1.5% max.</b>	
Ripple and Noise (20 MHz Bandwidth)	- single output	5 VDC model: <b>75 mVp-p typ.</b> (with 10 $\mu$ F X7R)
		12 VDC model: <b>75 mVp-p typ.</b> (with 10 $\mu$ F X7R)
		15 VDC model: <b>75 mVp-p typ.</b> (with 10 $\mu$ F X7R)
		24 VDC model: <b>75 mVp-p typ.</b> (with 1 $\mu$ F X7R)
	- dual output	12 / 5 VDC model: <b>120 / 100 mVp-p typ.</b> (with 10 $\mu$ F X7R)
		15 / 5 VDC model: <b>150 / 100 mVp-p typ.</b> (with 10 $\mu$ F X7R)
		24 / 5 VDC model: <b>240 / 100 mVp-p typ.</b> (with 10 $\mu$ F X7R)
	- triple output	12 / 5 / -12 VDC model: <b>120 / 100 / 120 mVp-p typ.</b> (with 10 $\mu$ F X7R)
		15 / 5 / -15 VDC model: <b>150 / 100 / 150 mVp-p typ.</b> (with 10 $\mu$ F X7R)
24 / 5 / 12 VDC model: <b>240 / 100 / 120 mVp-p typ.</b> (with 10 $\mu$ F X7R)		
Capacitive Load	- single output	5 VDC model: <b>20'000 <math>\mu</math>F max.</b>
		12 VDC model: <b>4'520 <math>\mu</math>F max.</b>
		15 VDC model: <b>2'900 <math>\mu</math>F max.</b>
		24 VDC model: <b>1'130 <math>\mu</math>F max.</b>
	- dual output	12 / 5 VDC model: <b>2'500 / 3'000 <math>\mu</math>F max.</b>
		15 / 5 VDC model: <b>1'200 / 3'000 <math>\mu</math>F max.</b>
		24 / 5 VDC model: <b>625 / 3'000 <math>\mu</math>F max.</b>
	- triple output	12 / 5 / -12 VDC model: <b>2'500 / 3'000 / 500 <math>\mu</math>F max.</b>
		15 / 5 / -15 VDC model: <b>1'200 / 3'000 / 500 <math>\mu</math>F max.</b>
24 / 5 / 12 VDC model: <b>625 / 3'000 / 500 <math>\mu</math>F max.</b>		
Minimum Load		<b>not required</b> 0.5 W for Vout1 and Vout2 if Vout3 = Full Load
Temperature Coefficient		<b><math>\pm 0.02\%</math> /K</b>
Hold-up Time	- at 115 VAC	<b>16 ms min.</b>
Start-up Time	- at 230 VAC	<b>1'000 ms max.</b>
Output Current Limitation		<b>120 - 160% of Iout max.</b>
Short Circuit Protection		<b>Continuous, automatic recovery</b>
Overvoltage Protection		<b>125 - 140% of Vout nom.</b> (only Output 1)
Transient Response	- Response Deviation	<b>3% max.</b> (50% to 75% Load Step) (Output 1)
	- Response Time	<b>600 <math>\mu</math>s typ.</b> (50% to 75% Load Step) (Output 1)

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

### Safety Specifications

Safety Standards	- Medical Equipment	EN 60601-1 IEC 60601-1 ANSI/AAMI ES 60601-1 2 x MOPP (Means Of Patient Protection) <a href="http://www.tracopower.com/overview/tp65">www.tracopower.com/overview/tp65</a>
	- Certification Documents	
Protection Class		Class I Prepared: Connection to PE Class II Prepared: Reinforced Insulation
Pollution Degree		PD 2: Office or Laboratory Environments
Over Voltage Category		OVC II

### EMC Specifications

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

### General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-40°C to +85°C
	- Storage Temperature	-40°C to +85°C
Power Derating	- High Temperature	see application note <a href="http://www.tracopower.com/overview/tp65">www.tracopower.com/overview/tp65</a>
	- Low Input Voltage	4 %/V below 90V
Cooling system		Natural convection (no internal fan, 20 LFM)
Altitude during Operation		5000 m max.
Switching Frequency		50 - 140 kHz (PWM) (Output 1) 750 kHz typ. (PWM) (Output 2) 510 kHz typ. (PWM) (Output 3)
Insulation System		Reinforced Insulation
Working Voltage (rated)		258 VAC

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

Isolation Test Voltage	- Input to Output, 60 s	5'657 VDC
	- Input to Case or PE, 60 s	3'535 VDC
	- Output to Case or PE, 60 s	3'535 VDC
Isolation Resistance	- Input to Output, 500 VDC	100 MOhm min.
Leakage Current (at 264 VAC)	- Touch Current	75 $\mu$ A max.
Creepage		8 mm min.
Clearance		8 mm min.
Reliability	- Calculated MTBF	1'500'000 h (acc. to MIL-HDBK-217F 1'500'000 h for single output models 1'000'000 h for multi output models)
	- Vibration	IEC 60068-2-6
	- Mechanical Shock	IEC 60068-2-27
Housing Material		Aluminium
Connection Type		Screw Terminal
Weight	- single output	172 g
	- dual output	221 g
	- triple output	221 g
Environmental Compliance	- Reach	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a>
	- RoHS	<a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a>

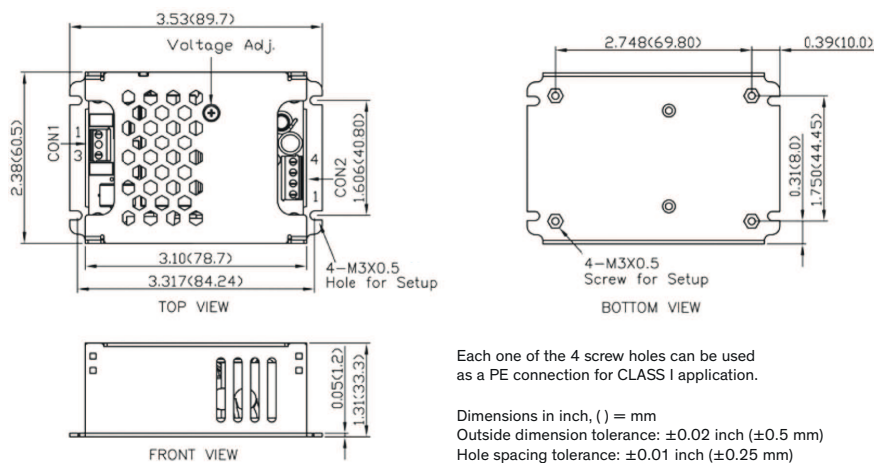
### Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tpp65](http://www.tracopower.com/overview/tpp65)

### Outline Dimensions

#### Single Output Models



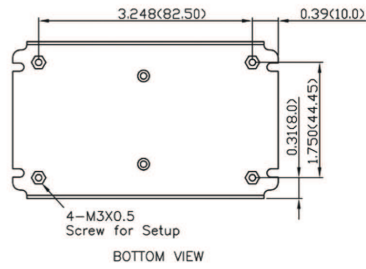
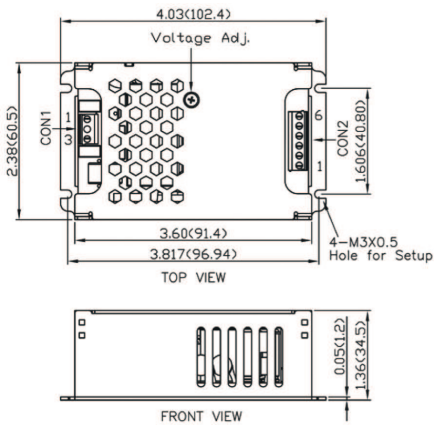
#### Screw Terminal

Input (CON1)		Output (CON2)	
Pin	Function	Pin*	Function
1	Line	1,2	-Vout
3	Neutral	3,4	+Vout

\*Terminal rated for 10 A max.  
 (at higher current connection has to be split)

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

### Multi Output Models



Each one of the 4 screw holes can be used as a PE connection for CLASS I application.

Dimensions in inch, ( ) = mm  
Outside dimension tolerance:  $\pm 0.02$  inch ( $\pm 0.5$  mm)  
Hole spacing tolerance:  $\pm 0.01$  inch ( $\pm 0.25$  mm)

### Screw Terminal

Input (CON1)		Output (CON2)		
Pin	Function	Pin*	Dual	Triple
1	Line	1	NC	Vout 3
3	Neutral	2,3	COM	COM
		4,5	Vout 2	Vout 2
		6	Vout 1	Vout 1

\*Terminal rated for 10 A max.  
(at higher current connection has to be split)