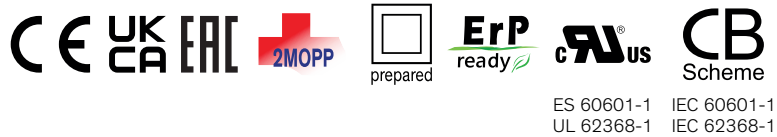


- Enclosed power supply with screw terminal connection
- Certification according to IEC/EN/ES 60601-1 edition 3.2 for 2 x MOPP
- Low leakage current <75 µA rated for BF applications
- Risk management process according to ISO 14971 incl. risk management file
- Acceptance criteria for electronic assemblies 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



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 edition 3.2, 2 x MOPP). The 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 2.38" x 3.53" 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.

### Input Specifications

Input Voltage	- AC Range	Operational Range: <b>85 - 264 VAC</b> (Full Range) Rated Range: <b>100 - 240 VAC</b> (Full Range)
	- DC Range	Operational Range: <b>120 - 370 VDC</b> (Designed for, no certification) Polarity: <b>+DC: L / -DC: N</b>
Input Frequency		Operational Range: <b>47 - 440 Hz</b> Certified: <b>50/60 Hz</b>
Power Consumption	- No load & Vin = 230 VAC - No load & Vin = 115 VAC	<b>150 mW max.</b> (Ready to meet ErP directive) <b>150 mW max.</b>
Input Current	- Full load & Vin = 230 VAC - Full load & Vin = 115 VAC	<b>950 mA max.</b> <b>1'650 mA max.</b>
Input Inrush Current	- At 230 VAC - At 115 VAC	<b>60 A max.</b> <b>35 A max.</b>
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> (Vout 1 only) (By trim potentiometer) Output power must not exceed rated power!
Voltage Set Accuracy		<b>±1% max.</b> (Output 1) <b>±2% max.</b> (Output 2 and 3)
Regulation	- Input Variation (Vmin - Vmax)  - Load Variation (0 - 100%)  - Cross Regulation (25% / 100% asym. load)	single output models: <b>0.2% max.</b> dual output models: <b>0.2% max.</b> triple output models: <b>0.2% max.</b> single output models: <b>0.7% max.</b> (5 VDC model) <b>0.5% max.</b> (other output models) dual output models: <b>0.5% max.</b> (Output 1) <b>1.5% max.</b> (Output 2) triple output models: <b>0.5% max.</b> (Output 1) <b>1.5% max.</b> (Output 2) <b>0.7% max.</b> (Output 3) dual output models: <b>1.5% max.</b> triple output models: <b>1.5% max.</b>
Ripple and Noise (20 MHz Bandwidth)	- single output  - dual output  - triple output	5 VDC model: <b>75 mVp-p typ.</b> (w/ 10 µF X7R) 12 VDC model: <b>75 mVp-p typ.</b> (w/ 10 µF X7R) 15 VDC model: <b>75 mVp-p typ.</b> (w/ 10 µF X7R) 24 VDC model: <b>75 mVp-p typ.</b> (w/ 1 µF X7R) 12 / 5 VDC model: <b>120 / 100 mVp-p typ.</b> (w/ 10 µF X7R) 15 / 5 VDC model: <b>150 / 100 mVp-p typ.</b> (w/ 10 µF X7R) 24 / 5 VDC model: <b>240 / 100 mVp-p typ.</b> (w/ 10 µF X7R) 12 / 5 / -12 VDC model: <b>120 / 100 / 120 mVp-p typ.</b> (w/ 10 µF X7R) 15 / 5 / -15 VDC model: <b>150 / 100 / 150 mVp-p typ.</b> (w/ 10 µF X7R) 24 / 5 / 12 VDC model: <b>240 / 100 / 120 mVp-p typ.</b> (w/ 10 µF X7R)
Capacitive Load	- single output  - dual output  - triple output	5 VDC model: <b>20'000 µF max.</b> 12 VDC model: <b>4'520 µF max.</b> 15 VDC model: <b>2'900 µF max.</b> 24 VDC model: <b>1'130 µF max.</b> 12 / 5 VDC model: <b>2'500 / 3'000 µF max.</b> 15 / 5 VDC model: <b>1'200 / 3'000 µF max.</b> 24 / 5 VDC model: <b>625 / 3'000 µF max.</b> 12 / 5 / -12 VDC model: <b>2'500 / 3'000 / 500 µF max.</b> 15 / 5 / -15 VDC model: <b>1'200 / 3'000 / 500 µF max.</b> 24 / 5 / 12 VDC model: <b>625 / 3'000 / 500 µF max.</b>

All specifications valid at 230 VAC, resistive full load and +25°C after warm-up time, unless otherwise stated.

Minimum Load		Not required (0.5 W for Vout1 and Vout2 if Vout3 = Full Load)
Temperature Coefficient		±0.02 %/K max.
Hold-up Time	- At 115 VAC	16 ms min.
Start-up Time	- At 230 VAC	1'000 ms max.
Short Circuit Protection		Continuous, Automatic recovery
Output Current Limitation		120 - 160% of Iout max. (Pout 1 + Pout 2) 145% typ. of Iout max. (Pout 1 + Pout 2)
Overvoltage Protection		125 - 140% of Vout nom. (only Output 1)
Transient Response	- Response Deviation - Response Time	3% max. (50% to 75% Load Step) 600 µs typ. (50% to 75% Load Step) (Only Output 1)

## Safety Specifications

Standards	- IT / Multimedia Equipment  - Medical Equipment  - Certification Documents	EN 62368-1 IEC 62368-1 UL 62368-1 EN 60601-1 IEC 60601-1 ANSI/AAMI ES 60601-1 2 x MOPP (Means Of Patient Protection) <a href="http://www.tracopower.com/tpp65-safety-cert">www.tracopower.com/tpp65-safety-cert</a>
Protection Class		Class I & II (Prepared): Reinforced Insulation See application note: <a href="http://www.tracopower.com/info/protection-class.pdf">www.tracopower.com/info/protection-class.pdf</a>
Energy Source	- Output, acc. to 62368-1	ES1
Power Source	- Output, acc. to 62368-1	PS3
Pollution Degree		PD 2
Over Voltage Category		OVC II

## EMC Specifications

EMI (Emissions)	- Conducted Emissions  - Radiated Emissions  - Harmonic Current Emissions - Voltage Fluctuations & Flicker	EN 60601-1-2 edition 4 (Medical Devices) EN 55011 class A (internal filter) EN 55011 class B (internal filter) EN 55032 class A (internal filter) EN 55032 class B (internal filter) FCC 47 Part 18 class A (internal filter) FCC 47 Part 18 class B (internal filter) EN 55011 class A (internal filter) EN 55011 class B (internal filter) EN 55032 class A (internal filter) EN 55032 class B (internal filter) FCC 47 Part 18 class A (internal filter) FCC 47 Part 18 class B (internal filter) EN 61000-3-2, class A EN 61000-3-3
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All specifications valid at 230 VAC, resistive full load and +25°C after warm-up time, unless otherwise stated.

EMS (Immunity)	<ul style="list-style-type: none"> <li>- Electrostatic Discharge</li> <li>- RF Electromagnetic Field</li> <li>- EFT (Burst) / Surge</li> <li>- Conducted RF Disturbances</li> <li>- PF Magnetic Field</li> <li>- Voltage Dips &amp; Interruptions</li> </ul>	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 EN 61000-4-3, 20 V/m, perf. criteria A EN 61000-4-4, $\pm 2$ kV, perf. criteria A L to L: EN 61000-4-5, $\pm 1$ kV, perf. criteria A EN 61000-4-6, 20 Vrms, perf. criteria A Continuous: EN 61000-4-8, 30 A/m, perf. criteria A 230 VAC / 50 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 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
EMC / Environmental	- Certification Documents	<a href="http://www.tracopower.com/tpp65-emc-cert">www.tracopower.com/tpp65-emc-cert</a>

### General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	<ul style="list-style-type: none"> <li>- Operating Temperature</li> <li>- Storage Temperature</li> </ul>	-40°C to +85°C -40°C to +85°C
Power Derating	<ul style="list-style-type: none"> <li>- High Temperature</li> <li>- Low Input Voltage</li> </ul>	Depending on model 4.0 %/V below 90 VAC See application note: <a href="http://www.tracopower.com/tpp65-cc">www.tracopower.com/tpp65-cc</a>
Cooling System		Natural convection (20 LFM)
Altitude During Operation		5'000 m max.
Regulator Topology		Flyback Converter
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
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 2'500 VAC 2'500 VAC
Creepage	- Input to Output	8 mm min.
Clearance	- Input to Output	8 mm min.
Isolation Resistance	- Input to Output, 500 VDC	100 M $\Omega$ min.
Leakage Current (at 264 VAC)	- Touch Current	75 $\mu$ A max.
Reliability	- Calculated MTBF	1'500'000 h (for single output models) 1'000'000 h (for multi output models) (MIL-HDBK-217F, ground benign)
Environment	<ul style="list-style-type: none"> <li>- Vibration</li> <li>- Mechanical Shock</li> </ul>	IEC 60068-2-6 5 g, 3 axis, sine sweep, 5-500 Hz, 1 oct/min IEC 60068-2-27 50 g, 3 axis, half sine, 11 ms
Housing Material		Aluminum
Housing Type		Metal Case
Mounting Type		Chassis Mount
Connection Type		Screw Terminal
Weight	<ul style="list-style-type: none"> <li>- single output</li> <li>- dual output</li> <li>- triple output</li> </ul>	172 g 221 g 221 g

All specifications valid at 230 VAC, resistive full load and +25°C after warm-up time, unless otherwise stated.

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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> <b>Exemptions: 7(a), 7(c)-I</b> (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule))
	- SCIP Reference Number	<b>b3f3b644-bdd9-4fcd-8836-8805a668dc5e</b>

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### Additional Information

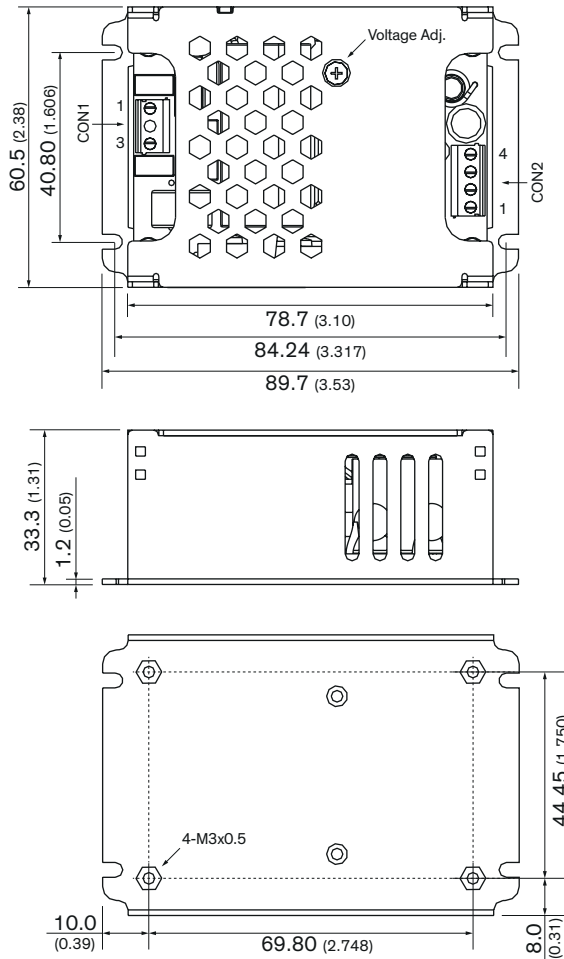
Supporting Documents	<a href="http://www.tracopower.com/overview/tpp65">www.tracopower.com/overview/tpp65</a>
Frequently Asked Questions	<a href="http://www.tracopower.com/glossary-faq">www.tracopower.com/glossary-faq</a>
Glossary	<a href="http://www.tracopower.com/info/glossary.pdf">www.tracopower.com/info/glossary.pdf</a>
Service Portal	<a href="http://www.tracoserviceportal.com">www.tracoserviceportal.com</a>

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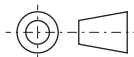
All specifications valid at 230 VAC, resistive full load and +25°C after warm-up time, unless otherwise stated.

### Outline Dimensions

#### Single Output Models



Max. corner screw penetration: 2.3 (0.09)  
 Max. center screw penetration: 2.0 (0.08)



All dimensions in mm (inch)  
 Tolerance:  $x.x \pm 0.5$  ( $x.xx \pm 0.02$ )  
 $x.xx \pm 0.25$  ( $x.xxx \pm 0.010$ )

Mounting screw locked torque:  
 max. 0.41 Nm / 4.2 kgfcm

#### Screw Terminal

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

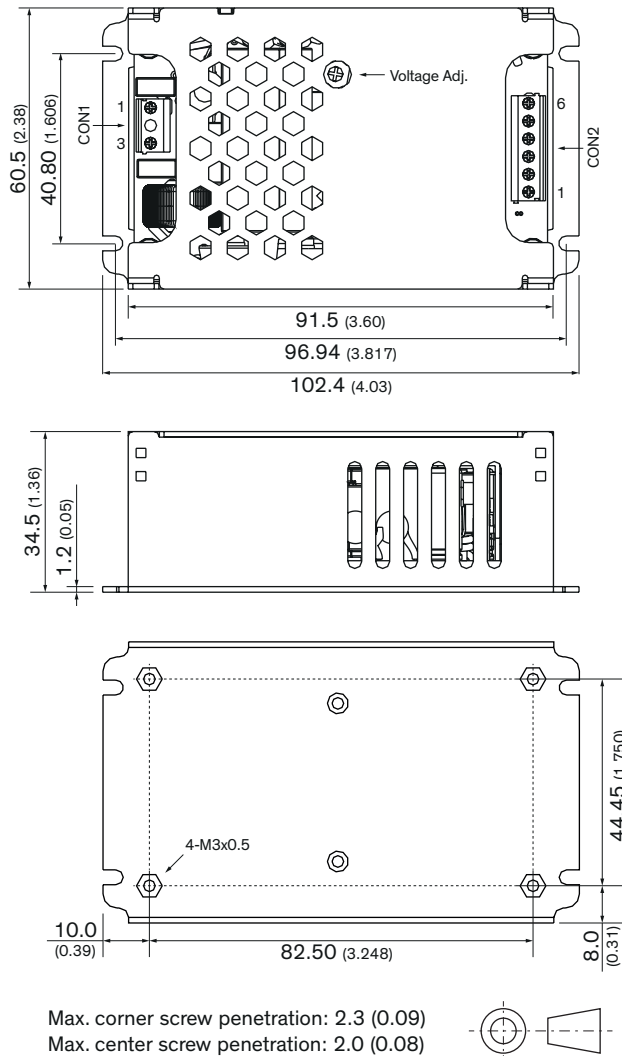
\* Terminal rated for 10 A max.  
 (at higher current connection has to be split)

**CON1:** Terminal Block  
 Max. screw locked torque 2 kgfcm / 0.2 Nm  
 Wire dimension: AWG 16 max.

**CON2:** Terminal Block  
 Max. screw locked torque 2 kgfcm / 0.2 Nm  
 Wire dimension: 16 AWG max.

Note: The size of the wires has to be assessed in the final application.

### Multi Output Models



Max. corner screw penetration: 2.3 (0.09)  
 Max. center screw penetration: 2.0 (0.08)

All dimensions in mm (inch)  
 Tolerance: x.x ±0.5 (x.xx ±0.02)  
 x.xx ±0.25 (x.xxx ±0.010)

Mounting screw locked torque:  
 max. 0.41 Nm / 4.2 kgfcm

### Screw Terminal

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

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

\*\* Not connected on dual output models

**CON1:** Terminal Block  
 Max. screw locked torque 2 kgfcm / 0.2 Nm  
 Wire dimension: AWG 16 max.

**CON2:** Terminal Block  
 Max. screw locked torque 2 kgfcm / 0.2 Nm  
 Wire dimension: AWG 16 max.

Note: The size of the wires has to be assessed in the final application.