



Features

- 3.3 and 5 VDC voltage supply option
- PWM Absolute Position
- Bushing or servo mount
- Non-contacting magnetic technology
- Small size
- CMOS and TTL compatible
- Resolution: 1024 states
- Long life
- High operating speed
- Highly repeatable
- Sealed option
- Magnetic technology

EMS22P - Non-Contacting PWM Encoder

Electrical Characteristics

| | |
|---|---|
| Resolution | 1024 states |
| Insulation Resistance (500 VDC) | 1,000 megohms |
| Electrical Travel | Continuous |
| Supply Voltage | 5.0 VDC $\pm 10\%$, 3.3 VDC $\pm 10\%$ |
| Supply Current | 20 mA maximum |
| Output Voltage | |
| Low Output Level | V _{ss} +0.4 V maximum |
| High Output Level | V _{dd} -0.5 V minimum |
| Output Current | |
| With 4.5 VDC Supply Voltage | 4 mA maximum |
| With 3.0 VDC Supply Voltage | 2 mA maximum |
| Rise/Fall Time (Incremental Output) | 500 ns maximum |
| Shaft RPM (Ball Bearing) | 10,000 rpm maximum |
| Linearity | 0.5 % |
| Accuracy | |
| Nominal | $\pm 0.7^\circ$ or better |
| Worst Case | $\pm 1.4^\circ$ |
| Output Transition Noise | 0.12 $^\circ$ RMS max. |

Environmental Characteristics

| | |
|--|---|
| Operating Temperature Range | -40 $^\circ$ C to +125 $^\circ$ C (-40 $^\circ$ F to +257 $^\circ$ F) |
| Storage Temperature Range | -55 $^\circ$ C to +125 $^\circ$ C (-67 $^\circ$ F to +257 $^\circ$ F) |
| Humidity | MIL-STD-202, Method 103B, Condition B |
| Vibration | 15 G |
| Shock | 50 G |
| Rotational Life | |
| S Bushing (@1,000 rpm) | 100,000,000 revolutions |
| T & W Bushings (@1,000 rpm with 250 g side load) | 50,000,000 revolutions |
| IP Rating | IP 65 |

Mechanical Characteristics

| | |
|-------------------------|--|
| Mechanical Angle | 360 $^\circ$ Continuous |
| Torque | |
| Starting | 43 ± 21 g-cm (0.6 ± 0.3 oz-in.) |
| Running | 29 ± 14 g-cm (0.4 ± 0.2 oz-in.) |
| Mounting Torque | 203 N-cm (18 lb.-in.) |
| Shaft End Play | 0.30 mm (0.012 ") T.I.R. maximum |
| Shaft Radial Play | 0.12 mm (0.005 ") T.I.R. maximum |
| Weight | 11 gms. (0.4 oz.) |
| Terminals | Axial, radial or ribbon cable |
| Soldering Condition | |
| Manual Soldering | 96.5Sn/3.0Ag/0.5Cu solid wire or no-clean rosin cored wire 370 $^\circ$ C (700 $^\circ$ F) max. for 3 seconds |
| Wave Soldering | 96.5Sn/3.0Ag/0.5Cu solder with no-clean flux 260 $^\circ$ C (500 $^\circ$ F) max. for 10 seconds |
| Wash processes | Not recommended |
| Marking | Manufacturer's trademark, name, part number, and date code. |
| Hardware | One lockwasher and one mounting nut supplied with each encoder, except on servo mount versions. |

Pin Configuration

| Output Type | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 |
|-------------|------------|-------|-------|-------|-------|-------|
| PWM | PWM Signal | GND | GND | GND | VCC* | CS** |

* Can be 5 or 3.3 VDC depending on the version.

** Active low chip select pin; if not used connect pin 6 to GND.



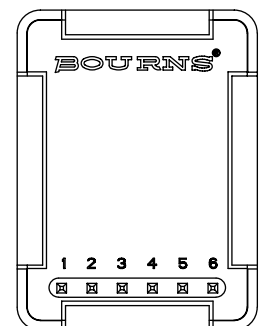
WARNING Cancer and Reproductive Harm - www.P65Warnings.ca.gov

*RoHS Directive 2002/95/EC Jan. 27, 2003 including annex and RoHS Recast 2011/65/EU June 8, 2011.

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Users should verify actual device performance in their specific applications.

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Applications

- Material handling equipment
- Brushless DC motor commutation
- Robotics
- Automotive
- Industrial automation
- Petroleum refinery
- Medical (low/medium risk)*
- Office equipment
- Audio and broadcast equipment

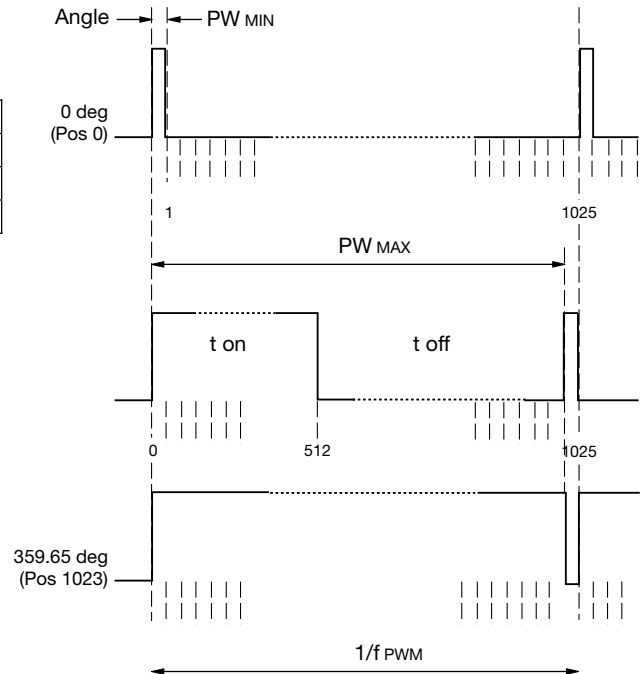
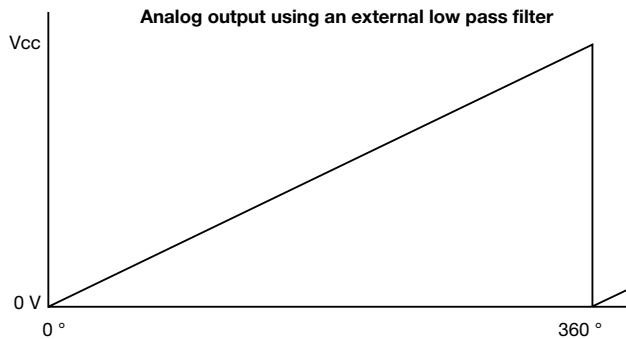
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Output Type Waveform and Variant Table

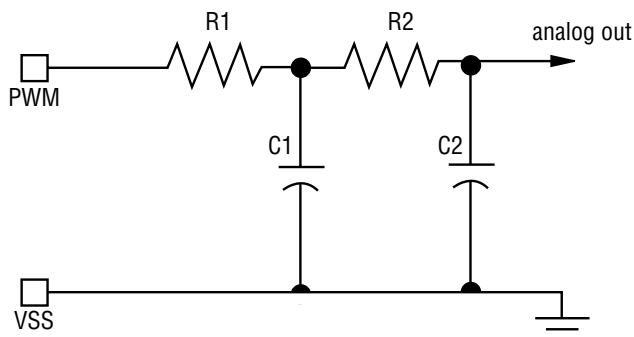
PWM Output

| Parameter | Symbol | Type | Unit | Note |
|----------------|--------|--------|---------|-----------------------------|
| PWM frequency | fPWM | 0.9756 | KHz | Signal period: 1025 μ s |
| MIN pulse with | PWMIN | 1 | μ s | Position 0 Angle 0° |
| MAX pulse with | PWMAX | 1024 | μ s | Position 1023 Angle 359.65° |



$$\text{Position} = t_{on} * 1025 / (t_{on} + t_{off}) - 1$$

Recommended Filter



Simple Passive 2nd Order Low Pass Filter

$$R1, R2 \geq 4.7K \text{ Ohms} \quad C1, C2 \geq 1 \mu F / 6 V$$

R1 should be $\geq 4.7K$ ohms to avoid loading of the PWM output. Larger values of R_x and C_x will provide better filtering and less ripple, but will also slow down the response time.

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Consult factory for options not shown, including:

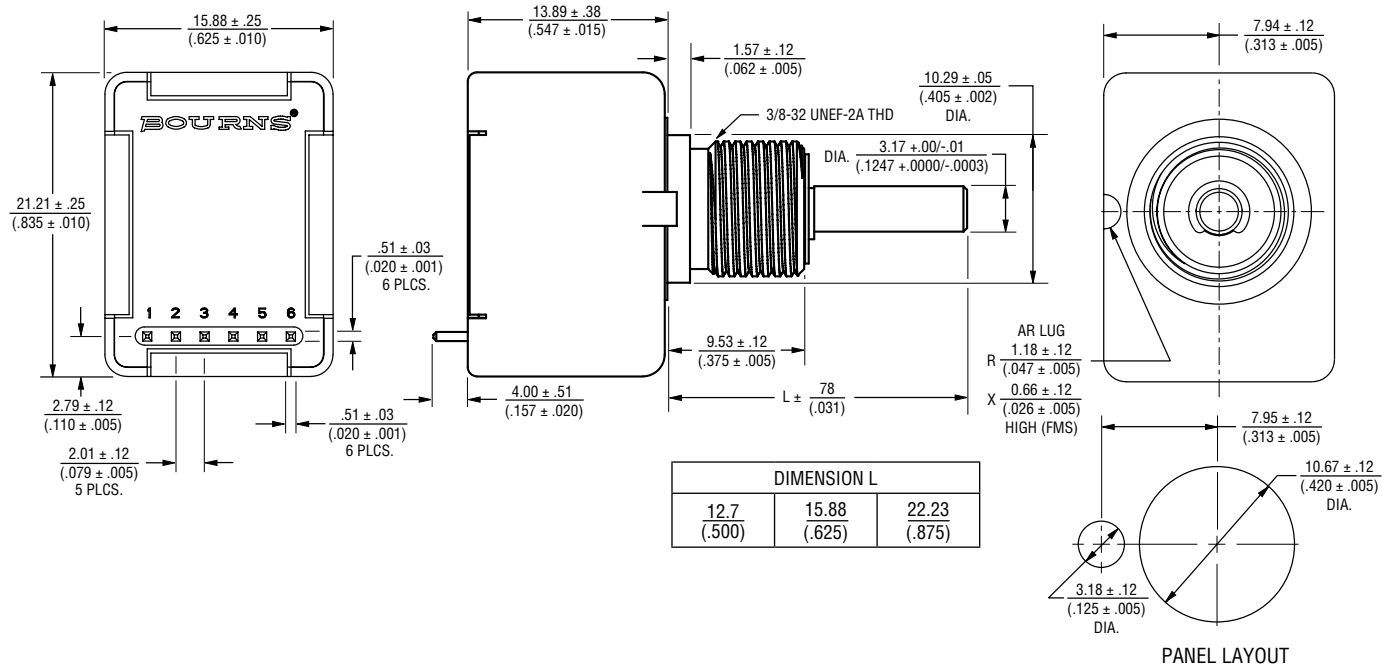
- Wire lead or cable options
- Connectors
- Non-standard resolutions
- Special shaft/bushing sizes and features
- Special performance characteristics
- PCB mounting bracket

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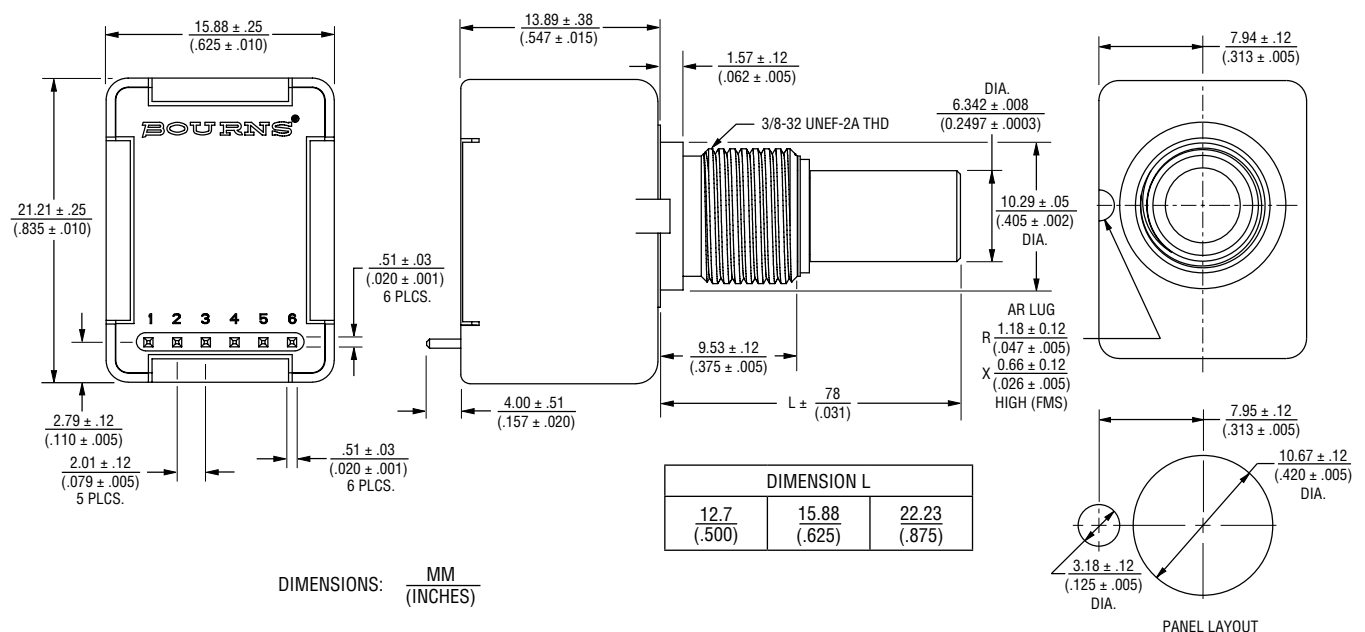
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Product Dimensions

Shaft Style D (Bushing T)



Shaft Style B (Bushing S)



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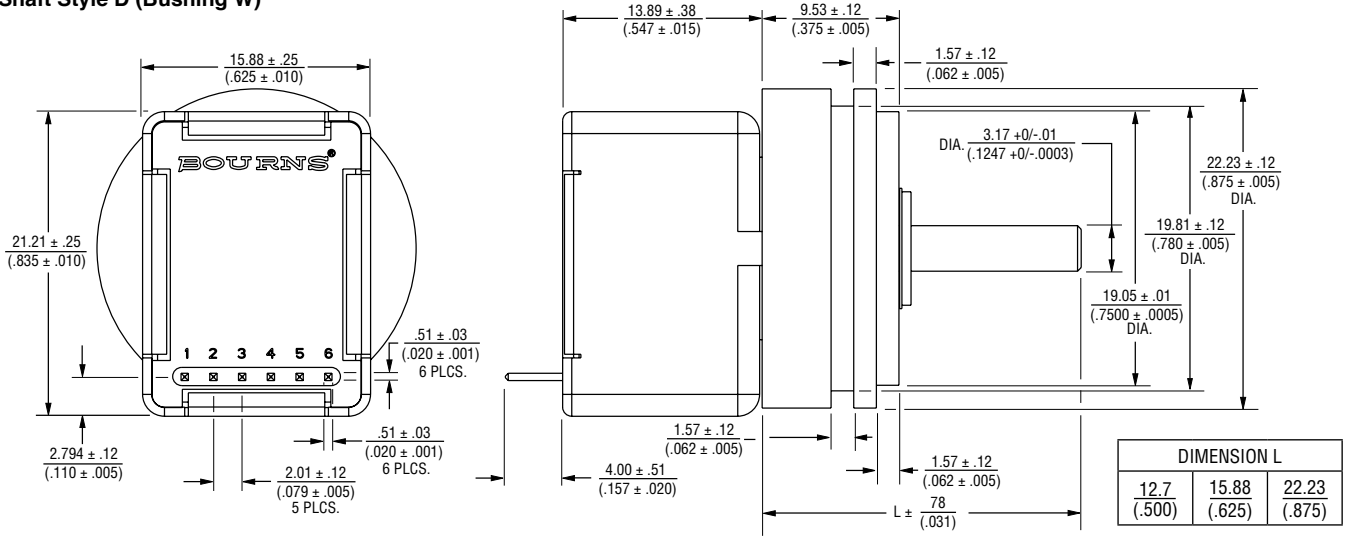
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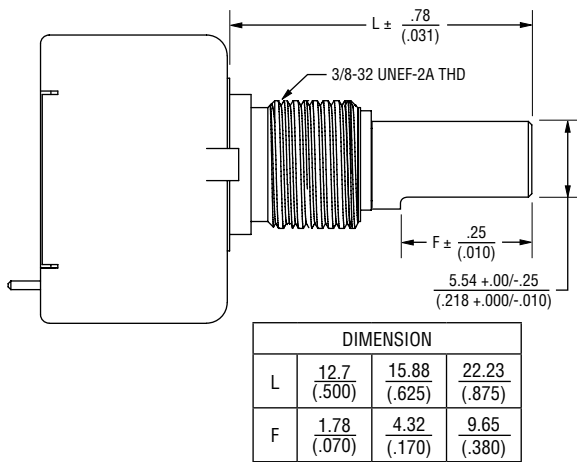
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Product Dimensions (Continued)

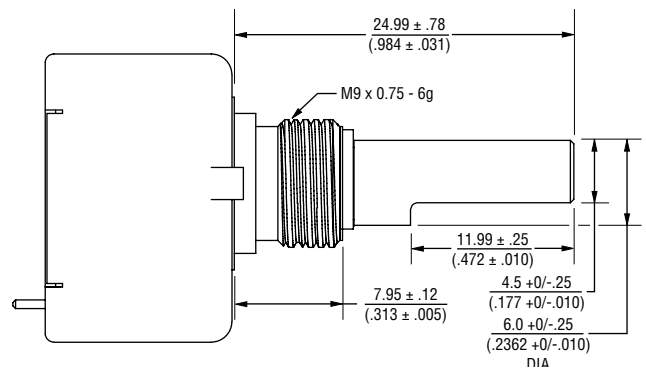
Shaft Style D (Bushing W)



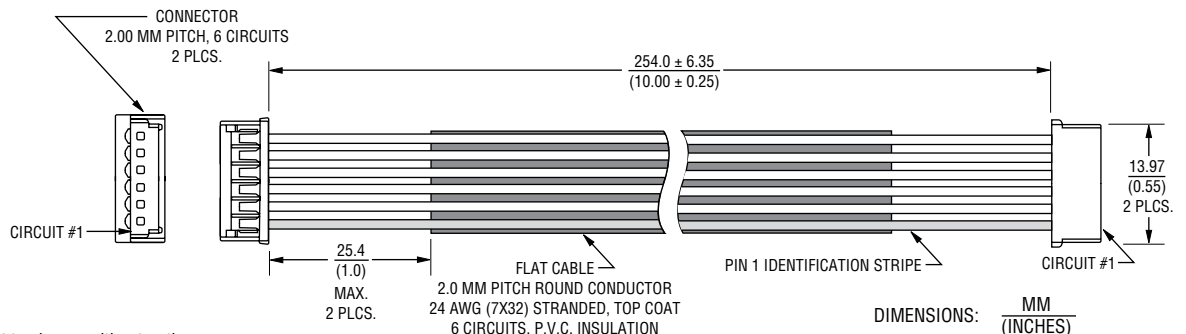
Shaft Style C (Bushing S)



Shaft Style M (Bushing D)



Cable Assembly



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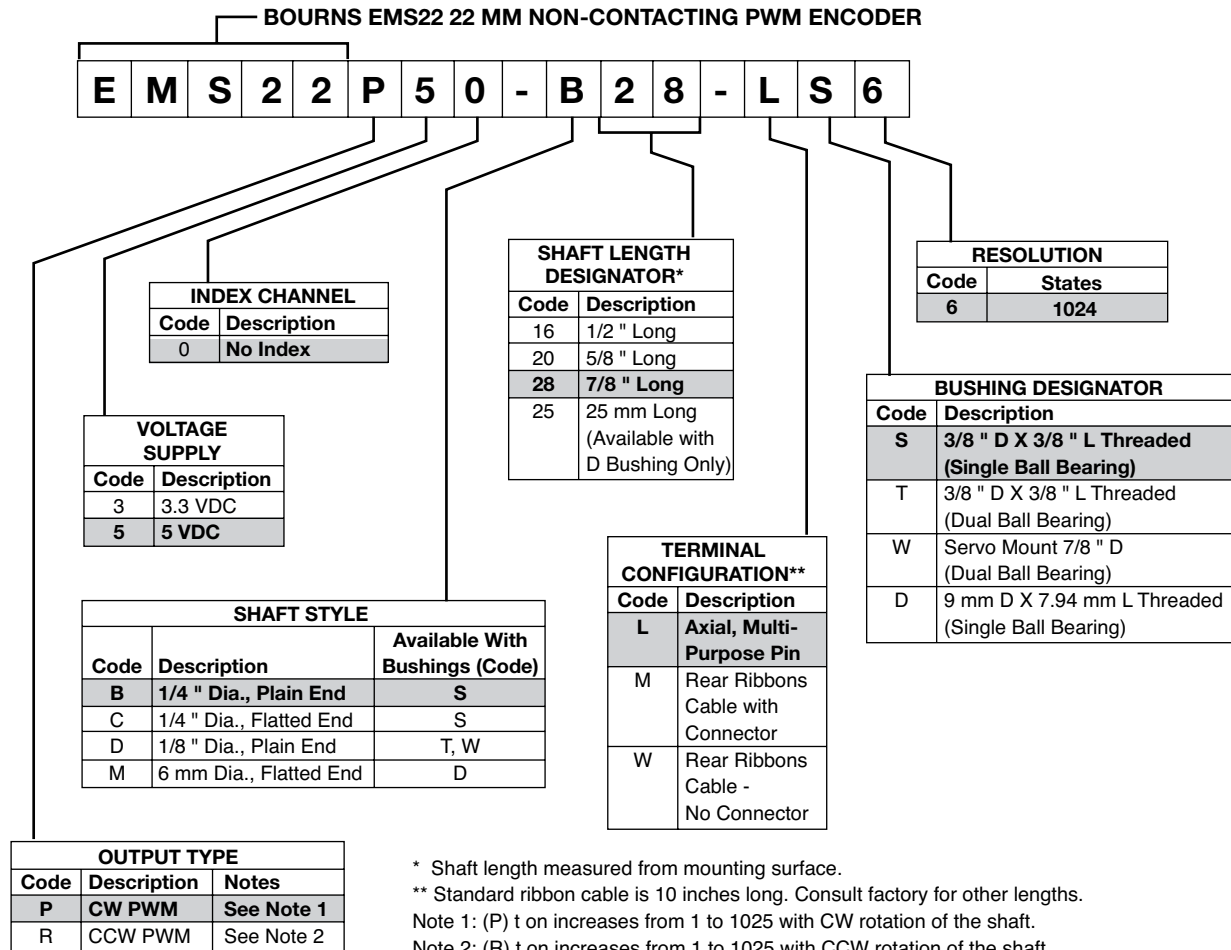
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How To Order



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