

Features

- 3.3 and 5 VDC voltage supply option
- Quadrature, absolute, PWM and direction/step output options
- Bushing or servo mount
- Non-contacting magnetic technology
- Small size
- CMOS and TTL compatible
- Resolution from 32-512 PPR and 1024 states
- Long life
- High operating speed
- Highly repeatable
- Sealed option

EMS22 - Non-Contacting Rotary Magnetic Encoder

Electrical Characteristics

| | |
|--|---|
| Resolution | 32 to 512 PPR and 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 | 0.35 % |
| Accuracy | |
| Nominal | $\pm 0.5^\circ$ or better |
| Worst Case..... | $\pm 1.4^\circ$ |
| Output Transition Noise | 0.12 $^\circ$ RMS max. |

Environmental Characteristics

| | |
|---|---|
| Operating Temperature Range..... | -40°C to $+125^\circ\text{C}$ (-40°F to $+257^\circ\text{F}$) |
| Storage Temperature Range | -55°C to $+125^\circ\text{C}$ (-67°F to $+257^\circ\text{F}$) |
| 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

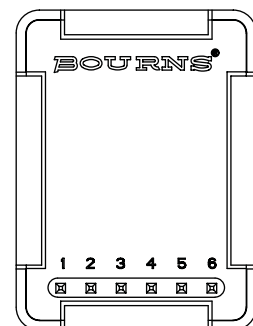
| | |
|-------------------------|--|
| Mechanical Angle..... | 360° Continuous |
| Torque | |
| Starting..... | 43 ± 21 g-cm (0.6 ± 0.3 oz-in.) |
| Running..... | 29 ± 14 g-cm (0.4 ± 0.2 oz-in.) |
| Mounting Torque | 203 N-cm (18 lb.-in.) |
| Shaft End Play..... | 0.30 mm (0.012 ") T.I.R. maximum |
| 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°C (700°F) max. for 3 seconds |
| Wave Soldering | 96.5Sn/3.0Ag/0.5Cu solder with no-clean flux 260°C (500°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 |
|----------------|---------------|-----------|-------|----------------|-------|-------|
| A/B Quadrature | A | B | GND | Index | VCC* | CS** |
| Direction/Step | Pulse | Direction | GND | Index | VCC* | CS** |
| PWM | PWM Signal | GND | GND | GND | VCC* | CS** |
| Absolute | Digital Input | Clock | GND | Digital Output | VCC* | CS** |

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

** Active low chip select pin.



Applications

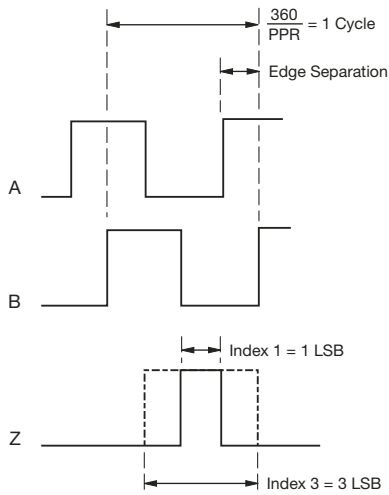
- Material handling equipment
- Brushless DC motor commutation
- Robotics
- Automotive
- Industrial automation
- Petroleum refinery
- Medical
- Office equipment
- Audio and broadcast equipment

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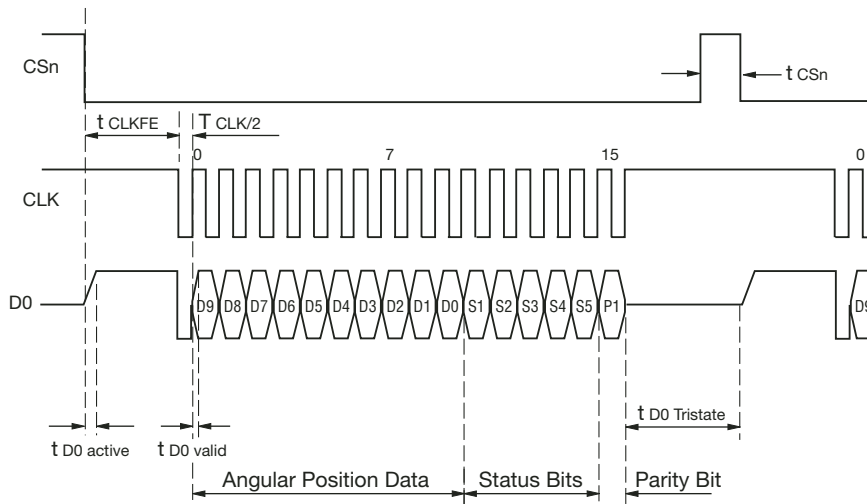
Output Type Waveforms and Variant Tables

Quadrature Output



| PPR | 3.3 Vcc | 5.0 Vcc | Index 1 | Index 3 |
|-----|---------|---------|---------|---------|
| 256 | X | | X | |
| 256 | X | | | X |
| 256 | | X | X | |
| 256 | | X | | X |
| 128 | X | | X | |
| 128 | X | | | X |
| 128 | | X | X | |
| 128 | | X | | X |
| 64 | X | | X | |
| 64 | X | | | X |
| 64 | | X | X | |
| 64 | | X | | X |
| 32 | X | | X | |
| 32 | X | | | X |
| 32 | | X | X | |
| 32 | | X | | X |

Absolute Output



| Data Content | Description |
|--------------|--|
| D9:D0 | Absolute angular position data |
| S1 | End of offset compensation algorithm |
| S2 | Cordic overflow indicating an error in cordic part |
| S3 | Linearity alarm |
| S4 | Increase in magnitude |
| S5 | Decrease in magnitude |
| P1 | Even parity for detecting bits 1-15 transmission error |

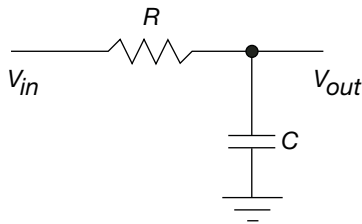
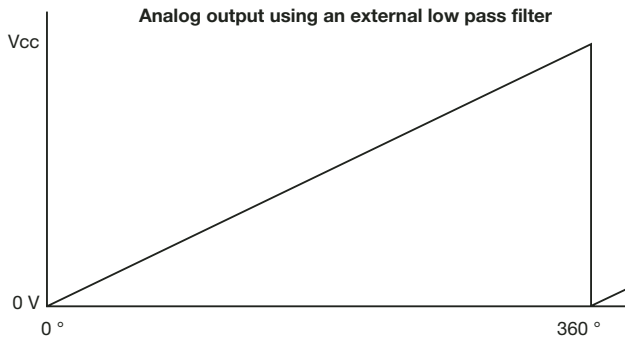
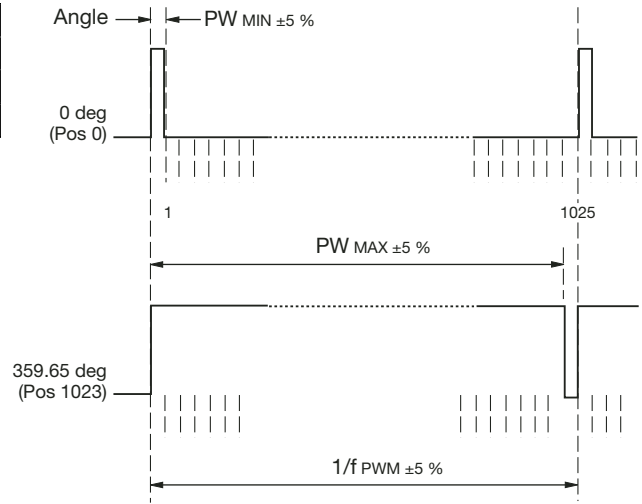
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Output Type Waveforms and Variant Tables (Continued)

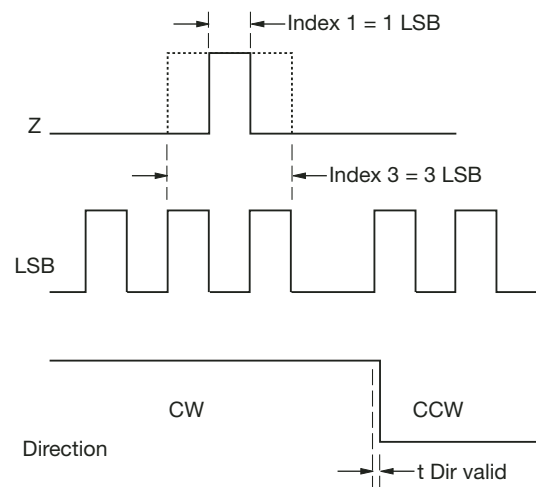
PWM Output

| 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° |



Direction/Step Output

| PPR | 3.3 Vcc | 5.0 Vcc | Index 1 | Index 3 |
|-----|---------|---------|---------|---------|
| 512 | X | | X | |
| 512 | X | | | X |
| 512 | | X | X | |
| 512 | | X | | X |
| 256 | X | | X | |
| 256 | X | | | X |
| 256 | | X | X | |
| 256 | | X | | X |
| 128 | X | | X | |
| 128 | X | | | X |
| 128 | | X | X | |
| 128 | | X | | X |
| 64 | X | | X | |
| 64 | X | | | X |
| 64 | | X | X | |
| 64 | | X | | X |



Specifications are subject to change without notice.
Customers should verify actual device performance in their specific applications

Consult factory for options not shown, including:

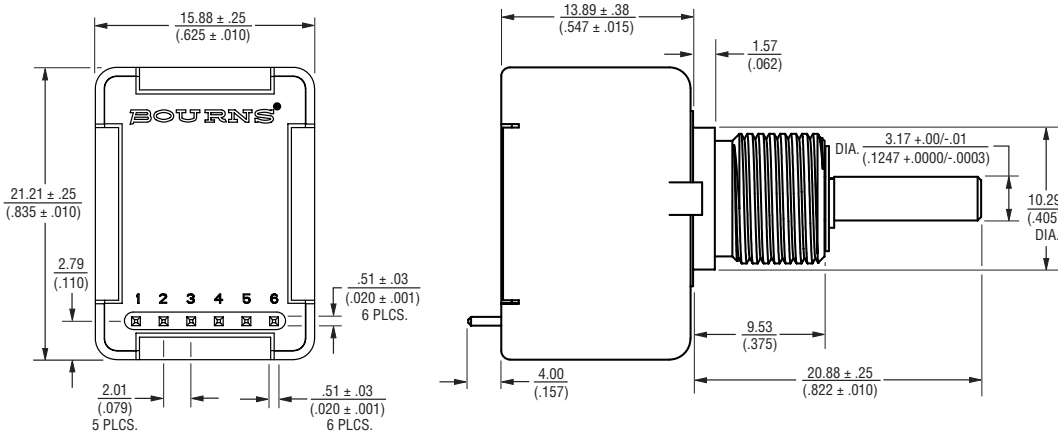
- Wire lead or cable options
- Connectors
- Non-standard resolutions
- Special shaft/bushing sizes and features
- Special performance characteristics
- PCB mounting bracket

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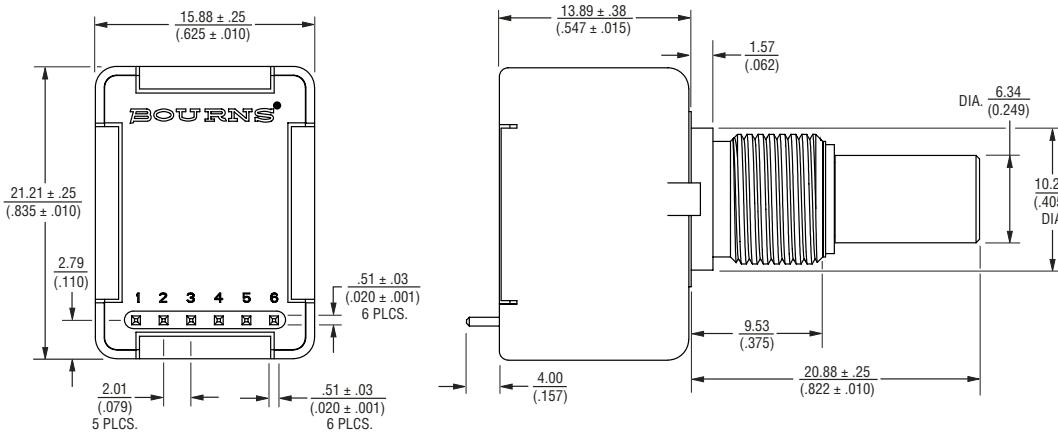
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Dimensional Drawings

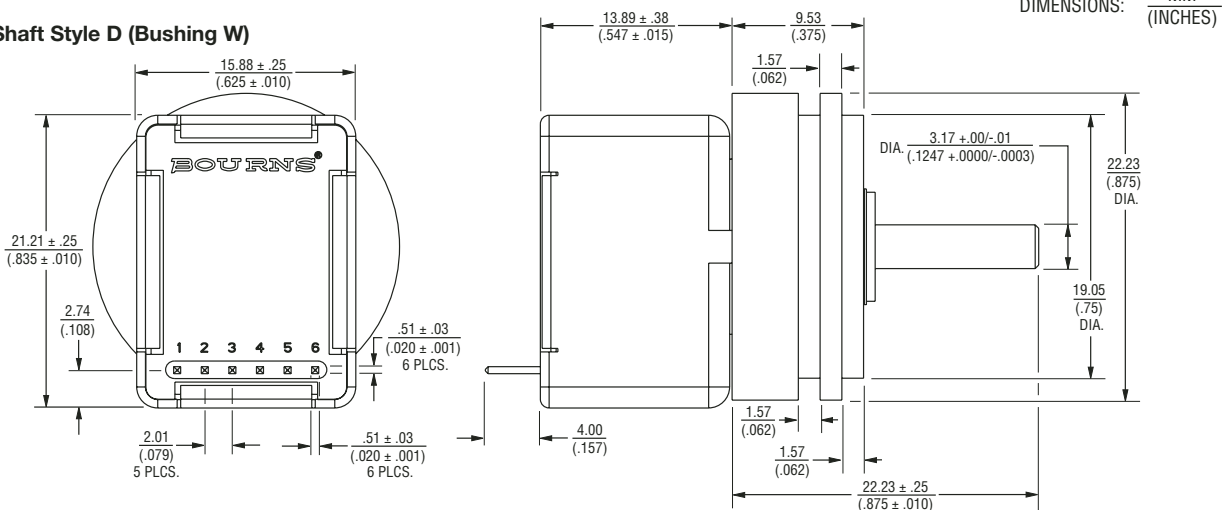
Shaft Style D (Bushing T)



Shaft Style B (Bushing S)



Shaft Style D (Bushing W)



DIMENSIONS: $\frac{\text{MM}}{\text{(INCHES)}}$

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EMS22 - Non-Contacting Rotary Magnetic Encoder

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How To Order

BOURNS EMS22 22 MM NON-CONTACTING ROTARY MAGNETIC ENCODER

E M S 2 2 S 5 1 - B 2 8 - L Q 3

| INDEX CHANNEL | | |
|---------------|-------------|------------------------------------|
| Code | Description | Available With Output Types (Code) |
| 0 | No Index | A, P |
| 1 | 1 Pulse | Q, D |
| 3 | 3 Pulses | Q, D |

| VOLTAGE SUPPLY | |
|----------------|-------------|
| Code | Description |
| 3 | 3.3 VDC |
| 5 | 5 VDC |

| SHAFT STYLE | | |
|-------------|-------------------------|--------------------------------|
| Code | Description | Available With Bushings (Code) |
| B | 1/4 " Dia., Plain End | S |
| C | 1/4 " Dia., Flatted End | S |
| D | 1/8 " Dia., Plain End | T, W |
| R | 6 mm Dia., Slotted End | D |
| M | 6 mm Dia., Flatted End | D |

| SHAFT LENGTH DESIGNATOR* | |
|--------------------------|--|
| Code | Description |
| 16 | 1/2 " Long |
| 20 | 5/8 " Long |
| 28 | 7/8 " Long |
| 25 | 25 mm Long (Available with D Bushing Only) |

| TERMINAL CONFIGURATION** | |
|--------------------------|-----------------------------------|
| Code | Description |
| L | Axial, Multi-Purpose Pin |
| M | Rear Ribbons Cable with Connector |
| W | Rear Ribbons Cable - No Connector |

| RESOLUTION | | |
|------------|---------------|--------------------------|
| Code | PPR/States*** | Avail. with Output Types |
| 1 | 32 | Q |
| 2 | 64 | Q, D |
| 3 | 128 | Q, D |
| 4 | 256 | Q, D |
| 5 | 512 | D |
| 6 | 1024*** | A, P |

| OUTPUT TYPE | |
|-------------|----------------|
| Code | Description |
| Q | Quadrature |
| A | CW Absolute |
| P | CW PWM |
| D | Direction/Step |

| BUSHING DESIGNATOR | |
|--------------------|---|
| Code | Description |
| S | 3/8 " D X 3/8 " L Threaded (Single Ball Bearing) |
| T | 3/8 " D X 3/8 " L Threaded (Dual Ball Bearing) |
| W | Servo Mount 7/8 " D (Dual Ball Bearing) |
| D | 9 mm D X 7.94 mm L Threaded (Single Ball Bearing) |



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* Shaft length measured from mounting surface.
 ** Standard ribbon cable is 10 inches long. Consult factory for other lengths.