**Features**
- 3.3 and 5 VDC voltage supply option
- Quadrature output
- Bushing or servo mount
- Non-contacting magnetic technology
- Small size
- CMOS and TTL compatible
- Resolution from 32-256 PPR
- Long life
- High operating speed
- Highly repeatable
- Sealed option
- Magnetic technology

### EMS22Q - Non-Contacting Incremental Encoder

#### Electrical Characteristics
- **Resolution**: 32 to 256 PPR
- **Insulation Resistance (500 VDC)**: 1,000 megohms
- **Supply Voltage**: 5.0 VDC ±10 %, 3.3 VDC ±10 %
- **Supply Current**: 20 mA maximum
- **Output Voltage**
  - Low Output Level: Vss+0.4 V maximum
  - High Output Level: Vdd-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
- **Hysteresis**: 0.7 °
- **Accuracy**
  - Nominal: ±0.7 ° or better
  - Worst Case: ±1.4 °
- **Output Transition Noise**: 0.12 ° RMS max.

#### Environmental Characteristics
- **Operating Temperature Range**: -40 °C to +125 °C (-40 °F to +257 °F)
- **Storage Temperature Range**: -55 °C to +125 °C (-67 °F to +257 °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
  - Wave Soldering: 96.5Sn/3.0Ag/0.5Cu solder with no-clean flux
- **Humidity**: MIL-STD-202, Method 103B, Condition B
- **Wash processes**: Not recommended

#### Pin Configuration

<table>
<thead>
<tr>
<th>Output Type</th>
<th>Pin 1</th>
<th>Pin 2</th>
<th>Pin 3</th>
<th>Pin 4</th>
<th>Pin 5</th>
<th>Pin 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/B Quadrature</td>
<td>A</td>
<td>B</td>
<td>GND</td>
<td>Index</td>
<td>VCC*</td>
<td>CS**</td>
</tr>
</tbody>
</table>

* 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](http://www.P65Warnings.ca.gov)

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

### EMS22Q - Non-Contacting Incremental Encoder

#### Output Type Waveform and Variant Table

**Quadrature Output**

<table>
<thead>
<tr>
<th>PPR</th>
<th>3.3 Vcc</th>
<th>5.0 Vcc</th>
<th>Index 1</th>
<th>Index 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>256</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>256</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>128</td>
<td>X</td>
<td>X</td>
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<tr>
<td>128</td>
<td>X</td>
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<td>64</td>
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<tr>
<td>32</td>
<td>X</td>
<td>X</td>
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<tr>
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<td>X</td>
<td>X</td>
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<td></td>
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<tr>
<td>32</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Minimum edge separation = 20*256/PPR (no missing pulses)

#### Chip Select Hardware Sample

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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

**EMS22Q - Non-Contacting Incremental Encoder**

### Dimensional Drawings

#### Shaft Style D (Bushing T)

![Shaft Style D (Bushing T) diagram]

#### Shaft Style B (Bushing S)

![Shaft Style B (Bushing S) diagram]

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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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EMS22Q - Non-Contacting Incremental Encoder

How To Order

BOURNS EMS22 22 MM NON-CONTACTING INCREMENTAL ENCODER

INDEX CHANNEL
Code | Description
--- | ---
1 | 1 LSB
3 | 3 LSB

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

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)

RESOLUTION
Code | PPR
--- | ---
1 | 32
2 | 64
3 | 128
4 | 256

OUTPUT TYPE
Code | Description
--- | ---
Q | Quadrature

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

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

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)

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

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