Features
- RoHS compliant*
- HCMOS, CMOS and TTL compatible
- Compact package size
- High rotational cycle life
- Standard or high force push switch option
- Optional detent

EM14 - 14 mm Rotary Optical Encoder w/Switch

Electrical Characteristics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Output</td>
<td>2-bit quadrature code</td>
</tr>
<tr>
<td>Resolution</td>
<td>8 to 64 pulses per revolution (PPR)</td>
</tr>
<tr>
<td>Supply Voltage (VCC)</td>
<td>5.0 VDC ± 0.25 VDC</td>
</tr>
<tr>
<td>Supply Current (Icc)</td>
<td>26 mA maximum</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>800 mV maximum at I(Sink) = 25 mA</td>
</tr>
<tr>
<td>Low (VCC(sat)), per Channel</td>
<td>800 mV maximum at I(Sink) = 25 mA</td>
</tr>
<tr>
<td>High (VCC(Hi)), per Channel</td>
<td>4.0 VDC minimum @ VCC = 4.75 VDC</td>
</tr>
<tr>
<td>Output Current I(SINK), per Channel</td>
<td>25 mA maximum</td>
</tr>
<tr>
<td>Rise/Fall Time</td>
<td>200 ns typical</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>167 mW maximum</td>
</tr>
<tr>
<td>Pulse Width (per Channel)</td>
<td>180 °e typical</td>
</tr>
<tr>
<td>Phase Angle (Channel A Leads Channel B, Clockwise Rotation)</td>
<td>90 °e ± 45 °e</td>
</tr>
<tr>
<td>Insulation Resistance @ 500 VDC</td>
<td>1,000 megohms minimum</td>
</tr>
<tr>
<td>Operating RPM</td>
<td>120 maximum</td>
</tr>
<tr>
<td>Switch Power Rating</td>
<td>12 VDC / 20 mA (600 ohms minimum load)</td>
</tr>
<tr>
<td>Switch Contact Resistance</td>
<td>200 ohms maximum</td>
</tr>
</tbody>
</table>

Environmental Characteristics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature Range @ 5.0 VDC</td>
<td>-40 °C to +70 °C (-40 °F to +158 °F)</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>-55 °C to +125 °C (-67 °F to +257 °F)</td>
</tr>
<tr>
<td>Vibration</td>
<td>15 G</td>
</tr>
<tr>
<td>Shock</td>
<td>50 G</td>
</tr>
<tr>
<td>Humidity</td>
<td>MIL-STD-202, Method 103, Condition B</td>
</tr>
<tr>
<td>Flammability</td>
<td>Conforms to UL 94HB</td>
</tr>
<tr>
<td>IP Rating</td>
<td>IP 54**</td>
</tr>
</tbody>
</table>

Mechanical Characteristics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Angle</td>
<td>360 ° Continuous</td>
</tr>
<tr>
<td>Torque</td>
<td>1.06 N-cm (1.5 oz.-in.) maximum</td>
</tr>
<tr>
<td>Detent</td>
<td>1.2 N-cm (1.7 oz.-in.) typical</td>
</tr>
<tr>
<td>Rotational Life</td>
<td>1,000,000 cycles (2,000,000 revolutions)</td>
</tr>
<tr>
<td>Non-detent (@ 30 RPM)</td>
<td>100,000 cycles (200,000 revolutions)</td>
</tr>
<tr>
<td>With detent (@ 30 RPM)</td>
<td>100,000 cycles</td>
</tr>
<tr>
<td>Switch Life</td>
<td>200 ohms maximum</td>
</tr>
<tr>
<td>Switch Actuation Force</td>
<td>250 gm (8.82 oz.) typical</td>
</tr>
<tr>
<td>High Force</td>
<td>850 gm (29.98 oz.) typical</td>
</tr>
<tr>
<td>Switch Travel</td>
<td>0.04 in. typical</td>
</tr>
<tr>
<td>High Force</td>
<td>0.025 in. typical</td>
</tr>
<tr>
<td>Shaft Radial Play</td>
<td>0.005 in. maximum</td>
</tr>
<tr>
<td>Shaft Axial Structural Strength</td>
<td>35 lbs. minimum</td>
</tr>
<tr>
<td>Mounting Torque</td>
<td>2.0 N-m (18 lb.-in.) maximum</td>
</tr>
</tbody>
</table>

Materials and Finishes

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminals</td>
<td>Sn plated PC pins</td>
</tr>
<tr>
<td>Soldering Condition</td>
<td>96.5Sn/3.0Ag/0.5Cu solid wire or no-clean resin cored wire</td>
</tr>
<tr>
<td>Wave Soldering</td>
<td>370 °C (700 °F) max. for 3 seconds</td>
</tr>
<tr>
<td>Shaft Axial Structural Strength</td>
<td>370 °C (700 °F) max. for 3 seconds</td>
</tr>
<tr>
<td>Mounting Hardware</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Nut</td>
<td>Black anodized brass, hex (metric)/Nickel-plated brass, hex (SAE)</td>
</tr>
<tr>
<td>Lockwasher</td>
<td>Nickel-plated spring steel, internal tooth</td>
</tr>
<tr>
<td>Marking</td>
<td>Manufacturer's symbol, model number, product code, terminal style and date code</td>
</tr>
<tr>
<td>Standard Packaging</td>
<td>Anti-static plastic tube (25 pcs./tube)</td>
</tr>
</tbody>
</table>

**When device is mounted by normal mounting means.

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Users should verify actual device performance in their specific applications.
**EM14 - 14 mm Rotary Optical Encoder w/Switch**

### Part Numbering System

| E | M | 1 | 4 | A | 0 | D | - | C | 2 | 4 | - | L | 0 | 3 | 2 | S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**MODEL NO. DESIGNATOR**

- EM14 14 mm Rotary Optical Encoder

**BUSHING DESIGNATOR**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3/8&quot; D x 3/8&quot; L Threaded</td>
</tr>
<tr>
<td>C</td>
<td>1/4&quot; D x 1/4&quot; L Threaded</td>
</tr>
<tr>
<td>R</td>
<td>10 mm D x 9.5 mm L Threaded</td>
</tr>
</tbody>
</table>

**DETENT OPTION**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Detent</td>
</tr>
<tr>
<td>1</td>
<td>32 Detents (Available for 8 or 32 PPR only)</td>
</tr>
</tbody>
</table>

**ANTI-ROTATION LUG/BRACKET OPTION**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A/R Lug</td>
</tr>
<tr>
<td>B</td>
<td>Bracket (No hardware/no cable or connector)</td>
</tr>
<tr>
<td>D</td>
<td>None</td>
</tr>
</tbody>
</table>

**SHAFT STYLE (See Outline Drawing for Details)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Available w/ Bushing</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>1/4&quot; Dia. Slotted End</td>
<td>A</td>
</tr>
<tr>
<td>C</td>
<td>1/4&quot; Dia. Flatted End</td>
<td>A</td>
</tr>
<tr>
<td>E</td>
<td>1/8&quot; Dia. Slotted End</td>
<td>C</td>
</tr>
<tr>
<td>R</td>
<td>6 mm Dia. Slotted End</td>
<td>R</td>
</tr>
<tr>
<td>M</td>
<td>6 mm Dia. Flatted End</td>
<td>R</td>
</tr>
</tbody>
</table>

**SHAFT LENGTH DESIGNATOR**

<table>
<thead>
<tr>
<th>Code</th>
<th>Length (FMS)</th>
<th>Available w/Bushing</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>3/4&quot;</td>
<td>A, C</td>
</tr>
<tr>
<td>28</td>
<td>7/8&quot;</td>
<td>A, C</td>
</tr>
<tr>
<td>20</td>
<td>20 mm</td>
<td>R, U</td>
</tr>
<tr>
<td>25</td>
<td>25 mm</td>
<td>R, U</td>
</tr>
</tbody>
</table>

**TERMINAL CONFIGURATION**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Axial Multi-Purpose Pin</td>
</tr>
<tr>
<td>R</td>
<td>Radial Multi-Purpose Pin</td>
</tr>
</tbody>
</table>

**SPLASHPROOF SHAFT SEAL**

- Recommended for human/machine interface applications (HMI)

**CABLE/CONNECTOR OPTION**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Cable/Connector</td>
</tr>
<tr>
<td>1</td>
<td>6&quot; Cable with Female Connector and stripped/tinned leads</td>
</tr>
<tr>
<td>2</td>
<td>6&quot; Cable with Female Connector on both ends</td>
</tr>
<tr>
<td>3</td>
<td>12&quot; Cable with Female Connector and stripped/tinned leads</td>
</tr>
<tr>
<td>4</td>
<td>12&quot; Cable with Female Connector on both ends</td>
</tr>
<tr>
<td>5</td>
<td>3&quot; Cable with Female Connector and stripped/tinned leads</td>
</tr>
<tr>
<td>6</td>
<td>1.5&quot; Cable with Female Connector and stripped/tinned leads</td>
</tr>
<tr>
<td>7</td>
<td>2&quot; Cable with Female Connector and stripped/tinned leads</td>
</tr>
<tr>
<td>8</td>
<td>5&quot; Cable with Female Connector and stripped/tinned leads</td>
</tr>
</tbody>
</table>

**SPECIFICATIONS**

- The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time.
- Users should verify actual device performance in their specific applications.

**Additional Features**

- Splashproof shaft seal
- Recommended for human/machine interface applications (HMI)
- Cable/connector option
- Optional bracket

**FOR OTHER CABLE AND CONNECTOR OPTIONS, PLEASE CONTACT THE FACTORY.**

Specifications are subject to change without notice.
EM14 - 14 mm Rotary Optical Encoder w/Switch

Product Dimensions

Shaft / Flat Length Dimensions

*"A"* Style Bushing - Flatted Shafts

*"R"* Style Bushing - Flatted Shafts

*"C"* Style Bushing - Slotted Shafts

*"A"* Style Bushing - Slotted Shafts

*"R"* Style Bushing - Slotted Shafts

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EM14 - 14 mm Rotary Optical Encoder w/Switch

Cable/Connector Options

Cable Assembly, Connector on One End

Cable Assembly, Connector on Both Ends

Terminal Configurations

Radial (shown with optional mounting bracket)

Axial (shown with optional mounting bracket)

Recommended PCB Layout

Recommended PCB Layout
EM14 - 14 mm Rotary Optical Encoder w/Switch

Electrical Block Diagram

Quadrature Output

Terminal Diagram

1. Nominal detent position occurs when both Channel A and B are in low states.
2. Channel A leads Channel B in CW direction and lags in CCW direction.

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www.bourns.com

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