



Features

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

Additional Information

Click these links for more information:



EM14 – 14 mm Rotary Optical Encoder w/Switch

Electrical Characteristics

| | |
|---|--|
| Electrical Output | 2-bit quadrature code |
| Resolution | 8 to 64 pulses per revolution (PPR) |
| Supply Voltage (VCC) | 5.0 VDC \pm 0.25 VDC |
| Supply Current (ICC) | 26 mA maximum |
| Output Voltage | |
| Low (VCE(sat)), per Channel | 800 mV maximum at I(SINK) = 25 mA |
| High (VO(HI)), per Channel | 4.0 VDC minimum @ VCC = 4.75 VDC |
| Output Current I(SINK), per Channel | 25 mA maximum |
| Rise/Fall Time | 200 ns typical** |
| Power Dissipation | 167 mW maximum |
| Pulse Width (per Channel) | 180 °e typical |
| Phase Angle (Channel A Leads Channel B, Clockwise Rotation) | 90 °e \pm 45 °e |
| Insulation Resistance @ 500 VDC | 1,000 megohms minimum |
| Operating RPM | 120 maximum |
| Switch Power Rating | 12 VDC / 20 mA (600 ohms minimum load) |
| Switch Contact Resistance | 200 ohms maximum |

Environmental Characteristics

| | |
|---|---------------------------------------|
| Operating Temperature Range @ 5.0 VDC | -40 °C to +70 °C (-40 °F to +158 °F) |
| Storage Temperature Range | -55 °C to +125 °C (-67 °F to +257 °F) |
| Vibration | 15 G |
| Shock | 50 G |
| Humidity | MIL-STD-202, Method 103, Condition B |
| Flammability | Conforms to UL 94HB |
| IP Rating | IP 54*** |

Mechanical Characteristics

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

Materials and Finishes

| | |
|--------------------------|--|
| Terminals | Sn plated PC pins |
| 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 5 seconds |
| Wash processes | Not recommended |
| Mounting Hardware | |
| Nut | Black anodized brass, hex (metric)/Nickel-plated brass, hex (SAE) |
| Lockwasher | Nickel-plated spring steel, internal tooth |
| Marking | Manufacturer's symbol, model number, product code, terminal style and date code |
| Standard Packaging | Anti-static plastic tube (25 pcs./tube) |

**See schematic note page 5.

***When device is mounted by normal mounting means.



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

Specifications are subject to change without notice.

Users should verify actual device performance in their specific applications.

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*RoHS Directive 2015/863, Mar 31, 2015 and Annex.

Additional Features

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

EM14 – 14 mm Rotary Optical Encoder w/Switch

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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 | |
|--------------------|-----------------------------|
| Code | Description |
| A | 3/8 " D x 3/8 " L Threaded |
| C | 1/4 " D x 1/4 " L Threaded |
| R | 10 mm D x 9.5 mm L Threaded |

| DETENT OPTION | |
|---------------|---|
| Code | Description |
| 0 | No Detent |
| 1 | 32 Detents (Available for 8 or 32 PPR only) |

| ANTI-ROTATION LUG/BRACKET OPTION | |
|----------------------------------|---|
| Code | Description |
| A | A/R Lug |
| B | Bracket (No hardware/no cable or connector) |
| D | None |

| SHAFT STYLE (See Outline Drawing for Details) | | |
|---|------------------------|----------------------|
| Code | Description | Available w/ Bushing |
| B | 1/4 " Dia. Slotted End | A |
| C | 1/4 " Dia. Flatted End | A |
| E | 1/8 " Dia. Slotted End | C |
| R | 6 mm Dia. Slotted End | R |
| M | 6 mm Dia. Flatted End | R |

| SHAFT LENGTH DESIGNATOR | | |
|-------------------------|--------------|---------------------|
| Code | Length (FMS) | Available w/Bushing |
| 24 | 3/4 " | A, C |
| 28 | 7/8 " | A, C |
| 20 | 20 mm | R |
| 25 | 25 mm | R |

| SWITCH OPTION | |
|---------------|--------------------------|
| Code | Description |
| S | Push Switch (Standard) |
| H | Push Switch (High Force) |
| N | No Switch |

| RESOLUTION (Pulses Per Revolution) | |
|------------------------------------|-------------|
| Code | Description |
| 08 | 8 PPR |
| 16 | 16 PPR |
| 32 | 32 PPR |
| 64 | 64 PPR |

| CABLE/CONNECTOR OPTION | |
|------------------------|---|
| Code | Description |
| 0 | No Cable/Connector |
| 1 | 6 " Cable with Female Connector and stripped/tinned leads |
| 2 | 6 " Cable with Female Connector on both ends |
| 3 | 12 " Cable with Female Connector and stripped/tinned leads |
| 4 | 12 " Cable with Female Connector on both ends |
| 5 | 3 " Cable with Female Connector and stripped/tinned leads |
| 6 | 1.5 " Cable with Female Connector and stripped/tinned leads |
| 7 | 2 " Cable with Female Connector and stripped/tinned leads |
| 8 | 5 " Cable with Female Connector and stripped/tinned leads |

Connector options 1~8 are currently available, but not recommended for new designs. See [Product Obsolescence Memo](#).

For other cable and connector options, please contact the factory.

| TERMINAL CONFIGURATION | |
|------------------------|--------------------------|
| Code | Description |
| L | Axial Multi-Purpose Pin |
| R | Radial Multi-Purpose Pin |

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EM14 – 14 mm Rotary Optical Encoder w/Switch

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Product Dimensions



Shaft / Flat Length Dimensions

"A" Style Bushing - Flatted Shafts



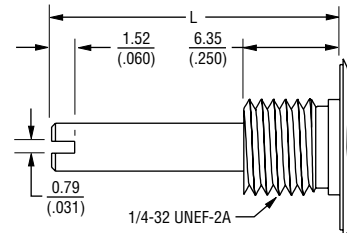
| SHAFT DIA. | BUSHING DIA. | SHAFT LENGTH | |
|-------------|--------------|--------------|-------------|
| | | "L" | "F" |
| 6.35 (.250) | 9.52 (.375) | 19.05 (.750) | 7.94 (.313) |
| | | 22.22 (.875) | 9.52 (.375) |

"R" Style Bushing - Flatted Shafts



| SHAFT DIA. | BUSHING DIA. | SHAFT LENGTH | |
|------------|--------------|--------------|-------------|
| | | "L" | "F" |
| 6.0 (.236) | 10.0 (.394) | 20.0 (.787) | 7.0 (.275) |
| | | 25.0 (.984) | 12.0 (.472) |

"C" Style Bushing - Slotted Shafts



| SHAFT DIA. | BUSHING DIA. | SHAFT LENGTH |
|-------------|--------------|--------------|
| | | "L" |
| 3.17 (.125) | 6.35 (.250) | 19.05 (.750) |
| | | 22.22 (.875) |

"A" Style Bushing - Slotted Shafts



| SHAFT DIA. | BUSHING DIA. | SHAFT LENGTH |
|-------------|--------------|--------------|
| | | "L" |
| 6.35 (.250) | 9.52 (.375) | 19.05 (.750) |
| | | 22.22 (.875) |

"R" Style Bushing - Slotted Shafts



| SHAFT DIA. | BUSHING DIA. | SHAFT LENGTH |
|------------|--------------|--------------|
| | | "L" |
| 6.0 (.236) | 10.0 (.394) | 20.0 (.787) |
| | | 25.0 (.984) |

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

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Cable/Connector Options

Cable Assembly, Connector on One End



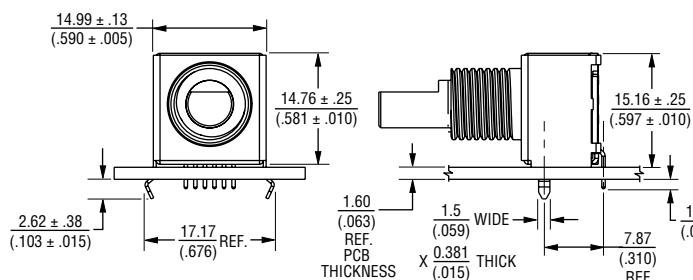
Cable Assembly, Connector on Both Ends



| HDW. NO. | DESCRIPTION | "A" DIM. |
|----------|--|------------------------------|
| H-290-1 | CABLE ASSEMBLY, CONNECTOR ON BOTH ENDS | 152.4 ± 5.0 (6.0 ± .197) |
| H-290-2 | CABLE ASSEMBLY, CONNECTOR ON ONE END | 304.8 ± 5.0 (12.0 ± .197) |
| H-290-3 | CABLE ASSEMBLY, CONNECTOR ON BOTH ENDS | 304.8 ± 5.0 (12.0 ± .197) |
| H-290-4 | CABLE ASSEMBLY, CONNECTOR ON ONE END | 152.4 ± 5.0 (6.0 ± .197) |
| H-290-5 | RIBBON CABLE, 28 AWG, CONNECTOR ON ONE END | 76.2 ± 5.0 (3.0 ± .197) |
| H-290-6 | RIBBON CABLE, 28 AWG, CONNECTOR ON ONE END | 38.1 ± 5.0 (1.5 ± .197) |
| H-290-7 | RIBBON CABLE, 28 AWG, CONNECTOR ON ONE END | 50.8 ± 5.0 (2.0 ± .197) |
| H-290-8 | RIBBON CABLE, 28 AWG, CONNECTOR ON ONE END | 127 ± 5.0 (5.0 ± .197) |

Terminal Configurations

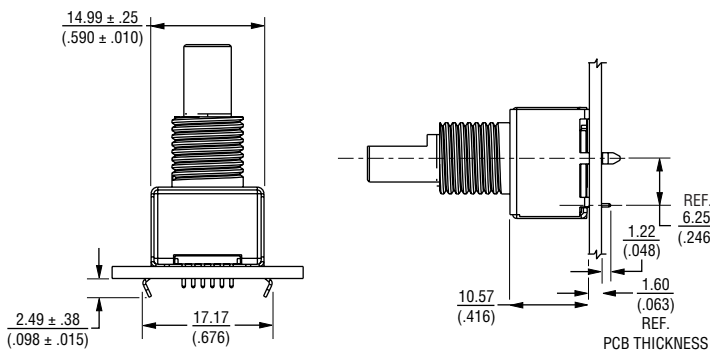
Radial (shown with optional mounting bracket)



Recommended PCB Layout



Axial (shown with optional mounting bracket)



Recommended PCB Layout



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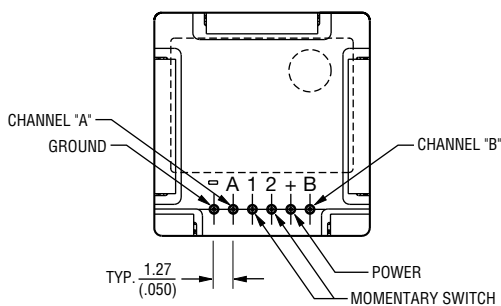


14 mm Optical Encoder Electrical Diagram

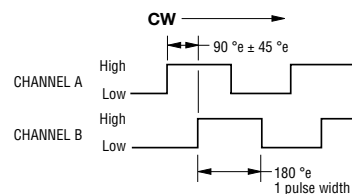


*External pull-up resistors (1K ohms) and filter caps (22 nF) recommended for proper operation. Utilization of a filter circuit will yield a typical rise time of 50 microseconds. See schematic.

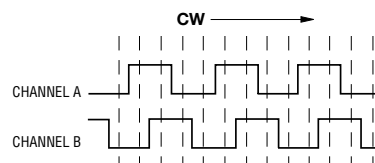
Terminal Diagram



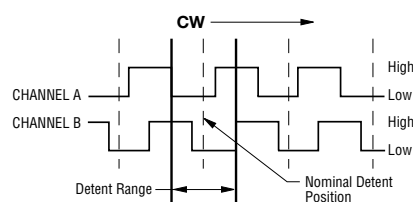
Quadrature Output



32 DETENT / 8 PPR



32 DETENT / 32 PPR



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.



Asia-Pacific: Tel: +886-2 2562-4117 • Email: asiacus@bourns.com

Europe: Tel: +36 88 885 877 • Email: eurocus@bourns.com

The Americas: Tel: +1-951 781-5500 • Email: americus@bourns.com

www.bourns.com

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