



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.

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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/BRAKET 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 |

Specifications are subject to change without notice.

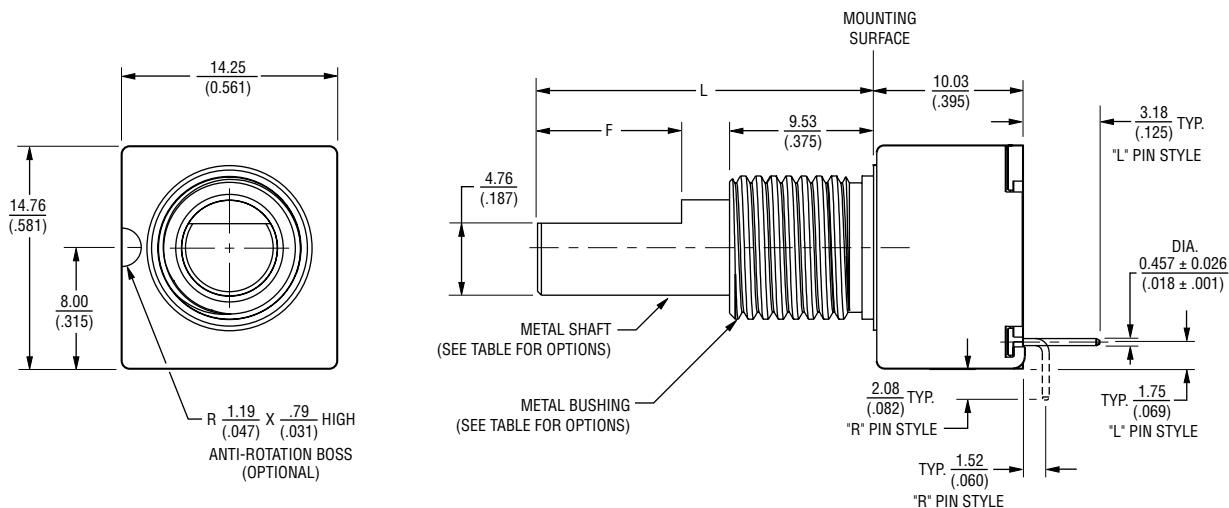
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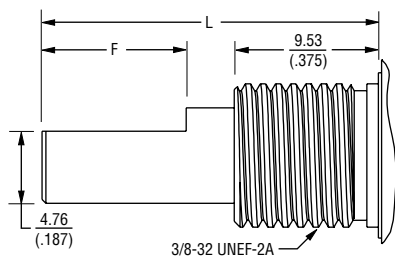
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Product Dimensions



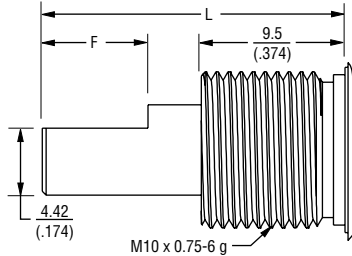
Shaft / Flat Length Dimensions

"A" Style Bushing - Flatted Shafts



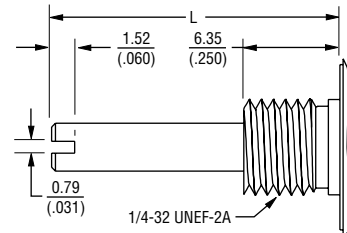
| SHAFT DIA. | BUSHING DIA. | SHAFT LENGTH "L" | FLAT LENGTH "F" |
|----------------|----------------|------------------|-----------------|
| 6.35 (.250) | 9.52 (.375) | 19.05 (.750) | 7.94 (.313) |
| | | 22.22 (.875) | 9.52 (.375) |

"R" Style Bushing - Flatted Shafts



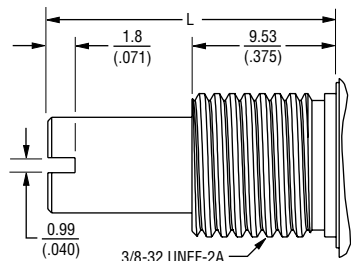
| SHAFT DIA. | BUSHING DIA. | SHAFT LENGTH "L" | FLAT LENGTH "F" |
|---------------|----------------|------------------|-----------------|
| 6.0 (.236) | 10.0 (.394) | 20.0 (.787) | 7.0 (.275) |
| | | 25.0 (.984) | 12.0 (.472) |

"C" Style Bushing - Slotted Shafts



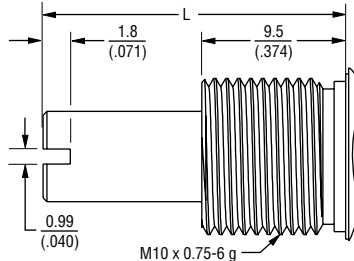
| SHAFT DIA. | BUSHING DIA. | SHAFT LENGTH "L" |
|----------------|----------------|------------------|
| 3.17 (.125) | 6.35 (.250) | 19.05 (.750) |
| | | 22.22 (.875) |

"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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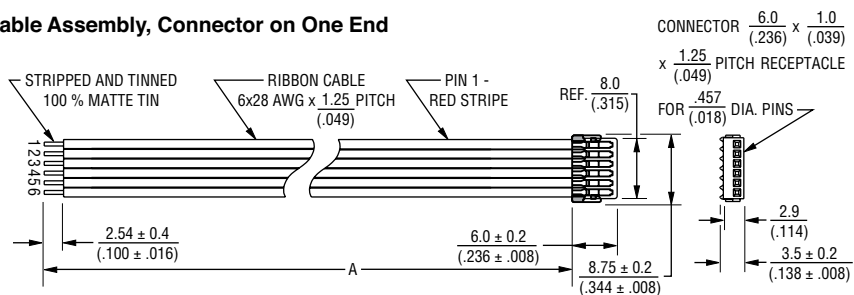
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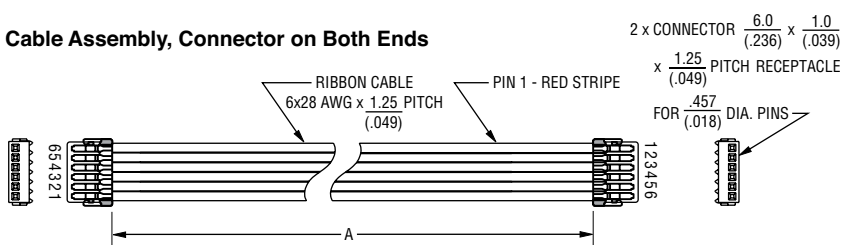
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Cable/Connector Options

Cable Assembly, Connector on One End



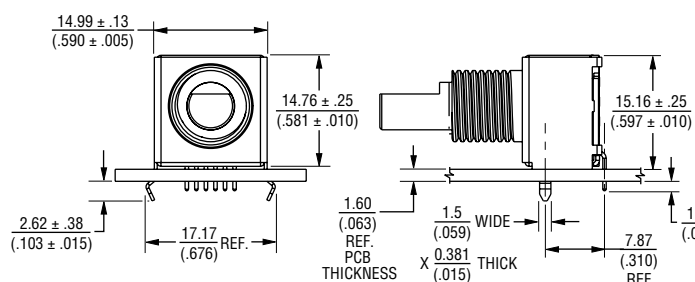
Cable Assembly, Connector on Both Ends



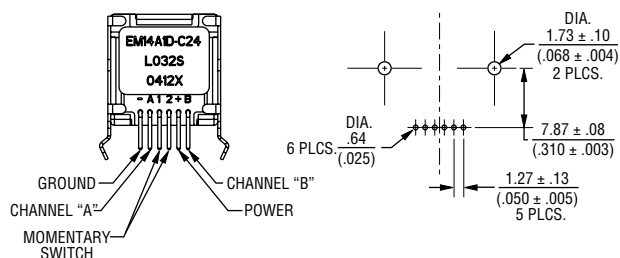
| HDW. NO. | DESCRIPTION | "A" DIM. |
|----------|--|------------------------------|
| H-290-1 | CABLE ASSEMBLY, CONNECTOR ON BOTH ENDS | 152.4 ± 5.0 (6.0 ± .197) |
| H-290-2 | CABLE ASSEMBLY, CONNECTOR ON ONE END | 304.8 ± 5.0 (12.0 ± .197) |
| H-290-3 | CABLE ASSEMBLY, CONNECTOR ON BOTH ENDS | 304.8 ± 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

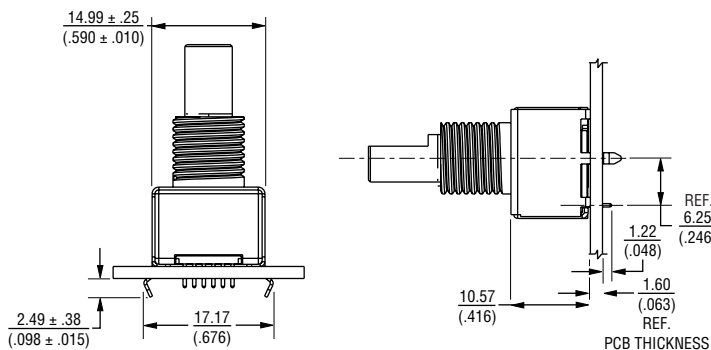
Radial (shown with optional mounting bracket)



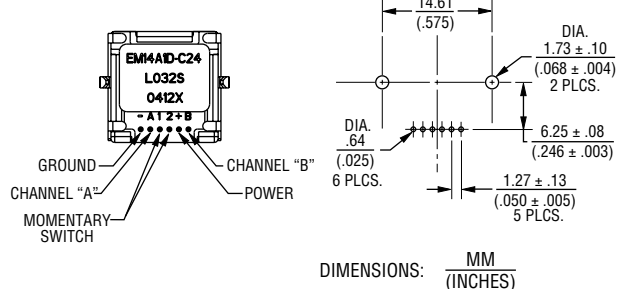
Recommended PCB Layout



Axial (shown with optional mounting bracket)



Recommended PCB Layout



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

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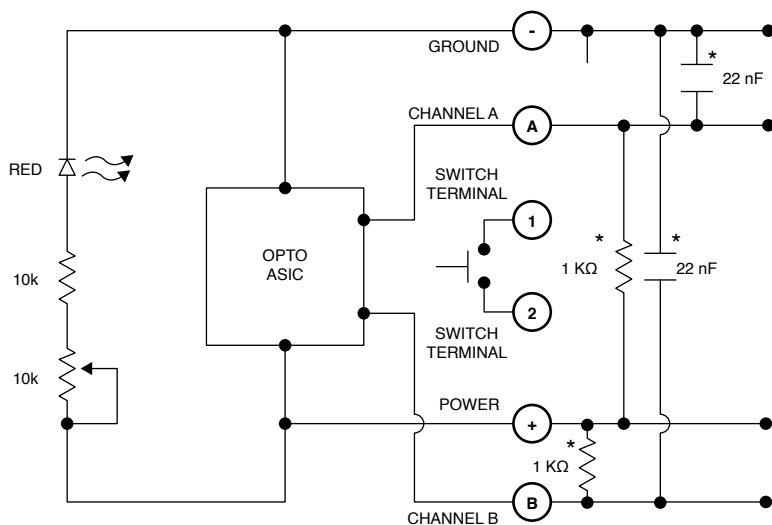
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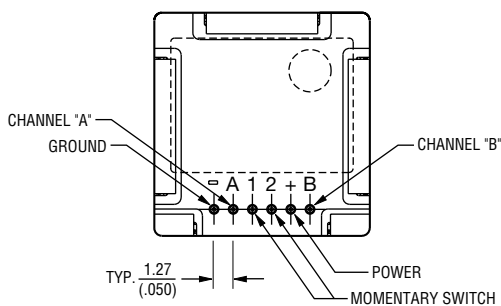


14 mm Optical Encoder Electrical Diagram

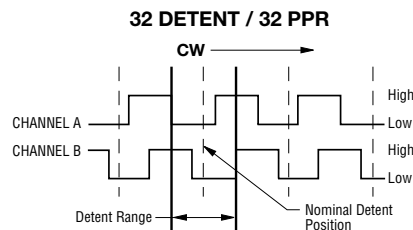
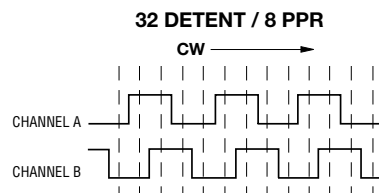
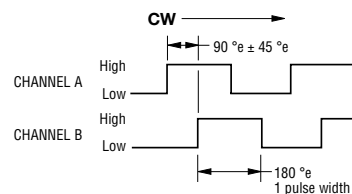


*External pull-up resistors (1K ohms) and filter caps (22 nF) recommended for proper operation. Utilization of a filter circuit will yield a typical rise time of 50 microseconds. See schematic.

Terminal Diagram



Quadrature Output



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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