



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

| | |
|--|--|
| 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 minimum |
| 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 maximum 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) |

**When device is mounted by normal mounting means.

*RoHS Directive 2002/95/EC Jan. 27, 2003 including annex and RoHS Recast 2011/65/EU June 8, 2011.
Specifications are subject to change without notice.
Customers 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

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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, U |
| 25 | 25 mm | R, U |

| 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 (0.050 "/1.27 mm pitch centers in-line) and stripped/tinned leads |
| 2 | 6 " Cable with Female Connector (0.050 "/1.27 mm pitch centers in-line) on both ends |
| 3 | 12 " Cable with Female Connector (0.050 "/1.27 mm pitch centers in-line) and stripped/tinned leads |
| 4 | 12 " Cable with Female Connector (0.050 "/1.27 mm pitch centers in-line) on both ends |

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

Cable and Connector Options:

- H-290-4 = 6 " Cable with Female Connector (0.050 "/1.27 mm pitch centers in-line) and stripped/tinned leads
- H-290-1 = 6 " Cable with Female Connector (0.050 "/1.27 mm pitch centers in-line) on both ends
- H-290-2 = 12 " Cable with Female Connector (0.050 "/1.27 mm pitch centers in-line) and stripped/tinned leads
- H-290-3 = 12 " Cable with Female Connector (0.050 "/1.27 mm pitch centers in-line) on both ends

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

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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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Cable/Connector Options

Cable Assembly, Connector on One End



Cable Assembly, Connector on Both Ends



| HARDWARE NUMBER | DESCRIPTION | "A" DIM. |
|-----------------|--|------------------------------|
| H-290-4 | CABLE ASSEMBLY, CONNECTOR ON ONE END | 152.4 ± 5.0 (6.0 ± .197) |
| H-290-2 | CABLE ASSEMBLY, CONNECTOR ON ONE END | 304.8 ± 5.0 (12.0 ± .197) |
| H-290-1 | CABLE ASSEMBLY, CONNECTOR ON BOTH ENDS | 152.4 ± 5.0 (6.0 ± .197) |
| H-290-3 | CABLE ASSEMBLY, CONNECTOR ON BOTH ENDS | 304.8 ± 5.0 (12.0 ± .197) |

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

Terminal Configurations

Radial (shown with optional mounting bracket)



Recommended PCB Layout



Axial (shown with optional mounting bracket)



Recommended PCB Layout



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Electrical Block Diagram



Quadrature Output



32 DETENT / 8 PPR



Terminal Diagram



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.

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REV. 12/12

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