



**CIRCUITRY, TRUTH TABLE, AND WAVEFORM** Standard Quadrature 2-Bit Code

Position	Output A	Output B
1		
2	•	
3	•	•
4		•

• Indicates logic high; blank indicates logic low.  
Code repeats every 4 positions.

**SPECIFICATIONS**

**Environmental Specifications**  
**Operating Temp. Range:** -40°C to 85°C  
**Storage Temp. Range:** -55°C to 100°C  
**Humidity:** 96 Hours at 90–95% humidity at 40°C  
**Mechanical Vibration:** Harmonic motion with amplitude of 15G's, within a varied frequency of 10 to 2000 Hz  
**Mechanical Shock:** Test 1: 100G for 6 mS, half sine wave with a velocity change of 12.3 ft/s; Test 2: 100G for 6 mS, sawtooth wave with a velocity change of 9.7 ft/s

**Rotary Electrical and Mechanical Specifications**

**Operating Voltage:** 5.00 ±0.25 Vdc  
**Supply Current:** 25mA max at 5.25Vdc  
**Output:** Open collector phototransistor, external pull up resistors are required  
**Output Code:** 2-Bit quadrature, channel A leads channel B by 90° electrically during clockwise rotation of the shaft  
**Logic Output Characteristics:**  
 Logic High shall be no less than 3.8 Vdc  
 Logic Low shall be no greater than 0.8Vdc  
**Minimum Sink Current:** 2.0 mA  
**Power Consumption:** 132mW maximum (includes power in 2 pull-up resistors)  
**Mechanical Life:**  
 Non-Detent 3 Million Cycles  
 Low & Medium 1 Million Cycles  
 High 1/2 Million Cycles  
 1 cycle is a rotation through all positions and a full return

	LOW	MEDIUM	HIGH
	±0.50 IN-OZ	±1.40 IN-OZ	±1.60 IN-OZ
8 POSITION	1.10	1.85	2.75
12 POSITION	1.00	1.70	2.95
16 POSITION	1.40	2.35	3.40
20 POSITION	1.35	2.05	2.80
24 POSITION	1.25	1.95	2.95
32 POSITION	0.95	1.40	2.15

Torque shall be within 50% of initial value throughout life  
**Mounting Torque:** 15 in-lbs maximum  
**Shaft Push-Out Force:** 45 lbs minimum  
**Shaft Pull-Out Force:** 45 lbs minimum  
**Terminal Strength:** 15 lbs minimum terminal pull-out force for cable or header termination  
**Solderability:** 95% free of pin holes and voids

**Pushbutton Electrical & Mechanical Specifications**

**Rating:** 10 mA at 5 Vdc  
**Contact Resistance:** <10Ω  
**Life:** 3 million actuations minimum  
**Contact Bounce:** <4 ms Make, <10 ms Break  
**Actuation Force:** 9-950±150grams, 5-510±150 grams, 4-400±100 grams, 3-300±90 grams, 2-200±75 grams  
**Shaft Travel:** .025±.010 inch

**Materials and Finishes**

**Bushing:** Zamak 2  
**Shaft:** Aluminum or Zamak 2  
**Retaining Ring:** Stainless steel  
**Pushbutton Actuator:** Zytel 70G33L  
**Detent Spring:** Music wire  
**Detent Ball:** Stainless steel

**Code Housing:** Polyamide polymer, nylon 6/10 alloy UL94HB

**Code Rotor:** Delrin 100

**Printed Circuit Boards:** NEMA grade FR-4, double clad with copper, plated with gold over nickel

**Infrared Emitting Diode Chips:** Gallium aluminum arsenide

**Silicon Phototransistor Chips:** Gold and Aluminum Alloys

**Resistor:** Metal oxide on ceramic substrate

**Solder Pins:** Brass, plated with tin

**Pushbutton Dome:** Stainless steel

**Backplate:** Stainless steel

**Cable:** Copper stranded with topcoat in PVC insulation (Cable version only)

**Connector (.050 Center):** PA4.6 with tin over nickel plated phosphor bronze

**Connector (.100 Center):** Nylon UL94V-2, tin plated copper alloy

**Label:** TT406 Thermal transfer cast film

**Solder:** Sn/Ag/Cu, Lead-Free, No Clean

**Lubricating Grease:** NYE nyogel 774L

**Hex Nut:** Nickel, plated with brass

**Lockwasher:** Zinc Plated Spring Steel with Clear Trivalent Chromate Finish

**Header:** Hi-Temp glass filled thermoplastic UL94V-0, phosphor bronze (pin versions only)

**Strain Relief:** Glass filled thermoplastic (.100 center cable versions only)

**OPTIONS**

Contact Grayhill for custom terminations, shaft and bushing configurations, rotational torque pushbutton force, and code output.

**ORDERING INFORMATION**

**Angle of Throw**

- 45=45° for Code Change and 8 Detent Positions
- 30=30° for Code Change and 12 Detent Positions
- 22=22.5° for Code Change and 16 Detent Positions
- 18=18° for Code Change and 20 Detent Positions
- 15=15° for Code Change and 24 Detent Positions
- 11=11.25° for Code Change and 32 Detent Positions

**Rotational Torque Option**

- N = Non-detent
- L = Low Torque (available with 0, 4, 5, 9 pushbutton only)
- M = Medium Torque (available with 0, 5, 9 pushbutton only)
- H = High Torque (available with 0, 9 pushbutton only)

**Termination**

- C = .050 Center Ribbon Cable with Connector
- S = .050 Center Ribbon Cable with .100 Stripped End
- P = .050 Center Pins with .130 Length
- CH = .100 Center Ribbon Cable with Connector
- SH = .100 Center Ribbon Cable with .100 Stripped End
- PH = .100 Center Pins with .230 Length

**Cable Length**

Cable Termination: 040=4.0in or 040in. Cable is terminated with Amp Connector P/N 3-640442-6 See Amp Mateability Guide for mating connector details.

**Pushbutton Option**

- 0 = NO PUSHBUTTON
- 9 = 950 Grams
- 5 = 510 Grams
- 4 = 400 Grams
- 3 = 300 Grams
- 2 = 200 Grams

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