



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

**Clockwise Rotation Truth Table:**

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

	AVERAGE ROTATIONAL TORQUE SPECIFICATIONS		
	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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