



# Optical Encoders

## SERIES 60AR Rugged and Sealed Joystick

### FEATURES

- Three-in-One Joystick, Optical Encoder and Pushbutton
- Shaft and panel sealed to IP67 against liquids and particulates
- Choices of knobs, cable length and termination
- Customized solutions available

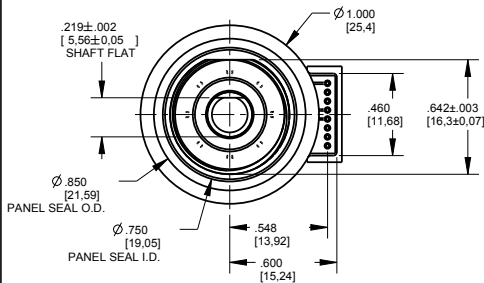
### APPLICATIONS

- Aerospace
- Military vehicles and devices
- Mobile electronics for outdoor use

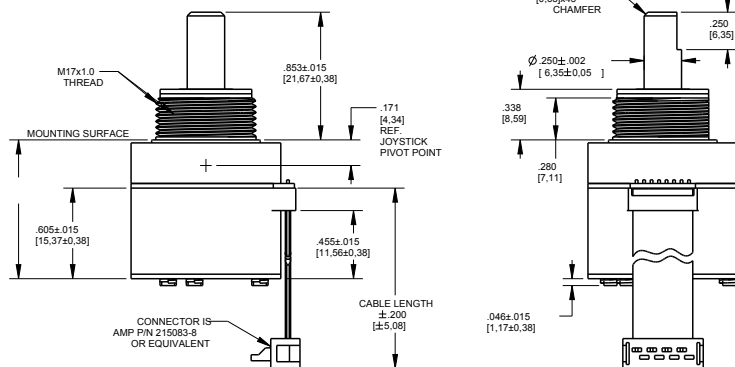


### DIMENSIONS in inches (and millimeters)

Unless otherwise specified, standard tolerance are:  
 Linear  $\pm .025$   
 Diameter  $\pm .010$   
 Angle  $\pm 2.0^\circ$

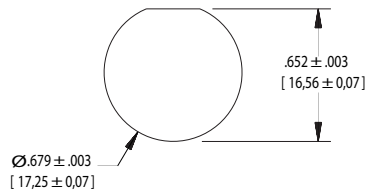


### Cable Connector Version

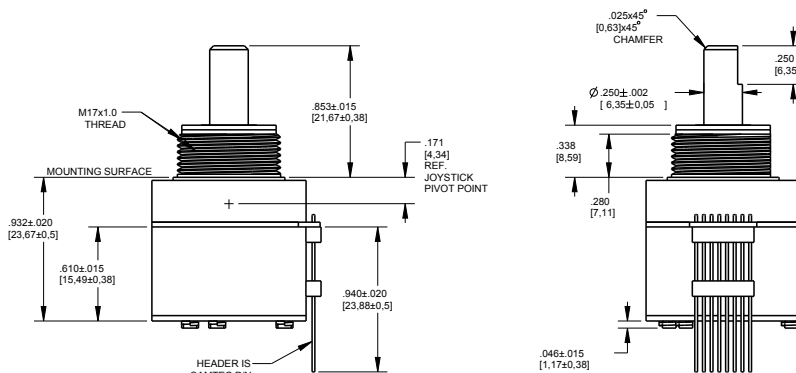


PANEL SEAL GASKET NOT SHOWN IN LOWER VIEWS TO ILLUSTRATE MOUNTING SURFACE

### Recommended Panel Cut Out



### Pin Version



PANEL SEAL GASKET NOT SHOWN IN LOWER VIEWS TO ILLUSTRATE MOUNTING SURFACE

### ORDERING INFORMATION

**60AR18-4-060S**

**Angle of Throw:** 18= 18° or 20 positions, 08= Non-detent or 20 positions, 00= Non-turn  
**Joystick:** 4= Four contacts & four directions; 8= Four contacts & eight directions

**Termination:** 0.050" center P= pin header; C= connector; S= stripped cable  
**Cable Length:** 020 thru 250 in 1/2 inch increments, 060= 6.0 inch cable, leave blank if pinned

For prices and custom configurations, contact a local sales office, an authorized distributor, or Grayhill's sales department.

**JOYSTICK OPERATION + ENCODER WAVEFORM AND TRUTH TABLE** Standard Quadrature 2-Bit Code

**SWITCH SCHEMATIC**

\* EXTERNAL PULL-UP RESISTORS REQUIRED FOR OPERATION (2.2k  $\Omega$ ).

**JOYSTICK POSITION DIAGRAM**  
\* INDICATES DIRECTION OF D-FLAT ON BUSHING

**ENCODER WAVEFORM (C.W. ROTATION)**

**ENCODER TRUTH TABLE (C.W. ROTATION)**

POSITION	OUTPUT A	OUTPUT B
#1	○	○
#2	○	○
#3	○	○
#4	○	○

○ INDICATES LOGIC-HIGH  
○ INDICATES LOGIC-LOW  
CODE REPEATS EVERY FOUR POSITIONS

**JOYSTICK TRUTH TABLE**

POSITION	X OUTPUT	Y OUTPUT
1	2.5	HIGH
2	HIGH	HIGH
3	HIGH	2.5
4	HIGH	LOW
5	2.5	LOW
6	LOW	LOW
7	LOW	2.5
8	LOW	HIGH
9	2.5	2.5

**SPECIFICATIONS**

**Environmental Specifications**

- Operating Temperature Range:** -40°C to 85°C
- Storage Temperature Range:** -40°C to 100°C
- Humidity:** 96 hours at 90-95% humidity at 40°C
- Mechanical Vibration:** Harmonic motion with amplitude of 15g, within a varied 10 to 2000 Hz frequency for 12 hours
- Mechanical shock:**  
 Test 1: 100g for 6Ms half sine wave with velocity change of 12.3 ft/s.  
 Test 2: 100g for 6 Ms sawtooth wave with velocity change of 9.7 ft/s.
- Shaft and panel Seal:** IP67, 1 meter submersion for 30 minutes

**Joystick Electrical & Mechanical Specifications**

- Supply Current:** 5 Ma, maximum
- Output Code:** 2-bit
- Logic Output Characteristics:** Neutral Position: 2.5±0.5 Vdc, High-state Position: >4.5 Vdc, Low-state Position: <0.5 Vdc
- Mechanical Life (Joystick):** 500k actuations, minimum in each direction
- Actuation Force (Joystick):** 1320±660g (X&Y directions only)
- Angle of Throw:** 4.0°±1.5° (X&Y directions only, at electrical contact)

**Pushbutton Electrical & Mechanical Specifications Rating:**

- 10 Ma at 5 Vdc, resistive
- Contact Resistance:** Less than 10  $\Omega$
- Contact Bounce:** <4 Ms make, <10 Ms break
- Mechanical Life (Pushbutton):** 1 million actuations, minimum
- Actuation Force (Pushbutton):** 1500±450g
- Pushbutton Travel:** .018±.005 in

**Rotary Electrical & Mechanical Specifications**

- Operating Voltage:** 5.00±25 Vdc
- Supply Current:** 20 Ma, maximum at 5 Vdc
- Minimum Sink Current:** 2.0 Ma for 5 Vdc
- 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 3.5 Vdc, Logic-low shall be no greater than 1.0 Vdc
- Optical Rise Time:** 30 ms, maximum
- Optical Fall Time:** 30 ms, maximum
- Mechanical Life (Rotational):** 1 million cycles, minimum (1 cycle is a rotation through all positions and a full return)
- Average Rotational Torque:** 4.6±2.0 in-oz, initial
- Shaft Push-out Force:** 60 lbs, minimum before failure
- Shaft Side-load Force:** 25 lbs, maximum before failure
- Terminal Strength:** 15 lbs pull-out force, minimum for cable or header termination
- Solderability:** 95% free of pin holes or voids
- Maximum Rotational Speed:** 100 Rpm
- Mounting Torque:** 15 in-lbs maximum