



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

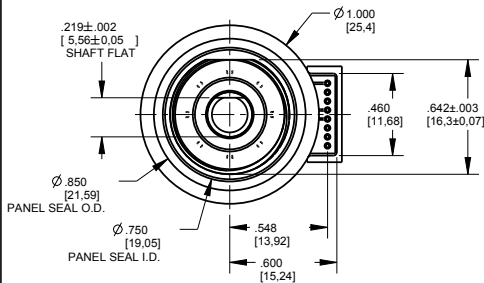
APPLICATIONS

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

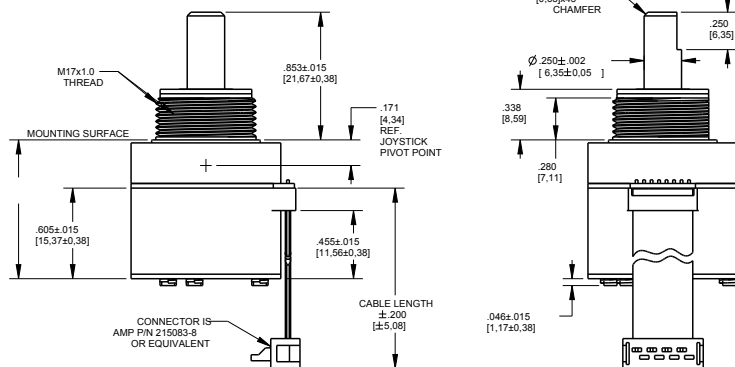


DIMENSIONS in inches (and millimeters)

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

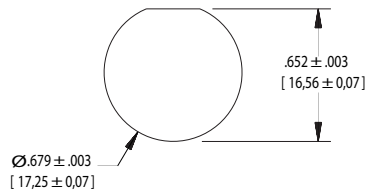


Cable Connector Version

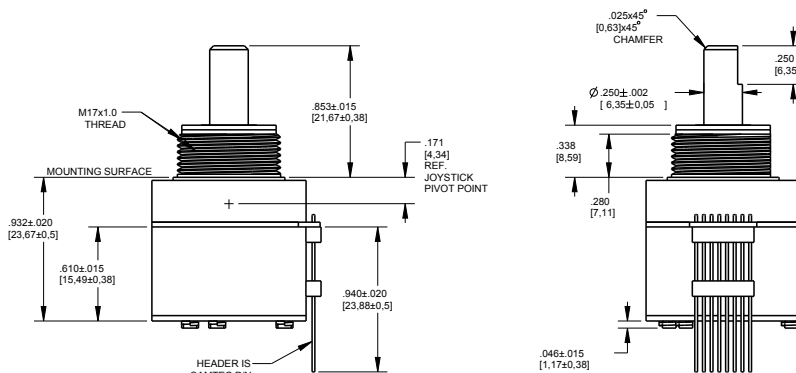


PANEL SEAL GASKET NOT SHOWN IN LOWER VIEWS TO ILLUSTRATE MOUNTING SURFACE

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 Ω).

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 Ω
- 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

Optical and Mechanical Encoders

Specifications are subject to change

X-ON Electronics

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