

SERIES 60AD

Optical Encoder with integrated Joystick and Pushbutton

FEATURES

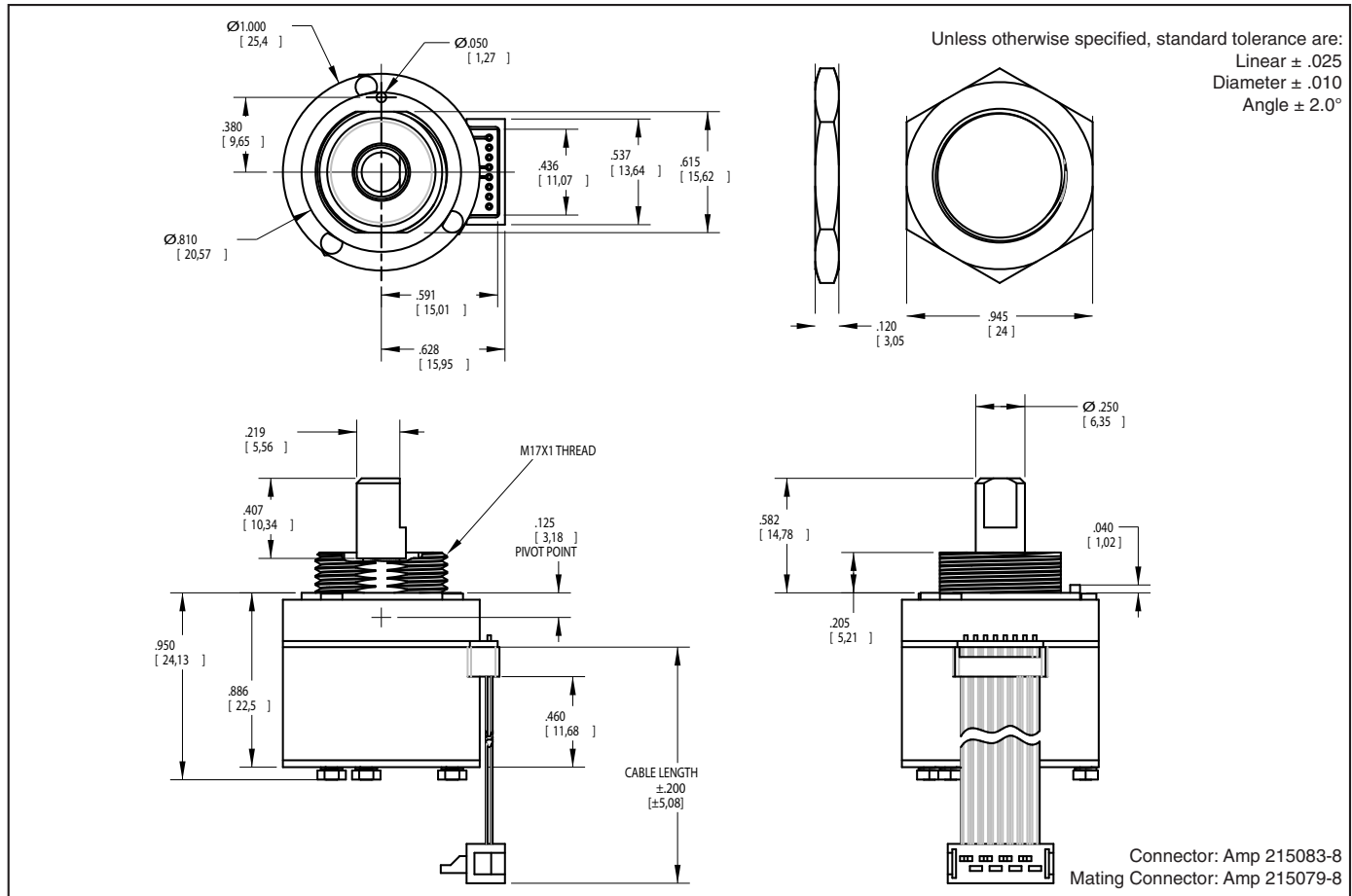
- Dome contacts provide excellent tactile feedback in all directions
- Choices of actuation force, cable length and termination
- Customized solutions available

APPLICATIONS

- Aerospace
- Automotive
- Medical devices



DIMENSIONS in inches (and millimeters)



Optical and Mechanical Encoders

ORDERING INFORMATION

60AD18-4-M-060S

Angle of Throw: 18= 18° or 20 positions
 Joystick: 4= Four contacts & 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
 Force Option: (see table) L=low, M=medium, H=high

| | OPTION | | |
|-------------------------------------|-----------|-----------|-----------|
| | L | M | H |
| 1 ACTUATION FORCE (JOYSTICK) [g] | 550±200 | 725±200 | 1050±250 |
| 2 ACTUATION FORCE (PUSHBUTTON) [g] | 625±200 | 800±200 | 1100±250 |
| 3 AVERAGE ROTATIONAL TORQUE [in-oz] | 1.50±0.75 | 3.50±1.75 | 5.00±2.00 |

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 | NEUTRAL | HIGH |
| 2 | HIGH | HIGH |
| 3 | HIGH | NEUTRAL |
| 4 | HIGH | LOW |
| 5 | NEUTRAL | LOW |
| 6 | LOW | LOW |
| 7 | LOW | NEUTRAL |
| 8 | LOW | HIGH |
| 9 | NEUTRAL | NEUTRAL |

SPECIFICATIONS

Rotary Specifications

- Operating Voltage:** 5.00 \pm 0.25 Vdc
- Supply Current:** 20mA max at 5 Vdc
- Minimum Sink Current:** 2.0mA at 5 Vdc
- Power Consumption:** 0.1mW max at 5 Vdc
- Output:** Open collector phototransistor, 2.2k Ω external pull-up resistors are required
- Output Code:** 2-Bit quadrature, channel A leads channel B by 90° in clockwise rotation
- Logic Output Characteristics:**
 High: No less than 3.5 Vdc
 Low: No greater than 1.0 Vdc
- Mechanical Life:** 1 million rotational cycles (through all positions and a full return)
- Rotational Torque:** see table
- Maximum Rotational Speed:** 100 RPM
- Mounting Torque:** 15 in-lbs. maximum
- Shaft Push/Pull Out Force:** 45 lbs min.
- Shaft Side-Load Force:** 20 lbs. min.
- Terminal Strength:** 15 lbs pull-out force min.

Pushbutton Specifications

- Rating:** 10 mA at 5 Vdc resistive
- Contact Resistance:** less than 10 ohms
- Contact Bounce:** < 4ms make, <10 ms break
- Mechanical Life:** 1 million actuations min.
- Actuation Force:** see table
- Pushbutton Travel:** .027 \pm .010 in.

Joystick Specifications

- Supply Current:** 5mA max
- Output Code:** 2-Bit
- Logic Output Characteristics:**
 Neutral Position: 2.5 \pm 0.5 Vdc
 High-State Position: >4.5 Vdc
 Low-State Position: <0.5 Vdc
- Mechanical Life:** 500k cycles min.
- Actuation Force:** see table
- Angle of Throw:** 3.5° +2°/-1°

Environmental Ratings

- Operating Temp. Range:** -40°C to 85°C
- Storage Temp. Range:** -55°C to 100°C
- Relative Humidity:** 96 hours at 90-95% humidity at 40°C
- Vibration:** Harmonic motion with amplitude of 15g, within 10 to 2000 Hz for 12 hours
- Mechanical Shock:**
 Test 1: 100g for 6ms half-sine wave with a velocity change of 12.3 ft/s
 Test 2: 100g for 6ms sawtooth wave with a velocity change of 9.7 ft/s

Materials and Finishes

- Detent Housing:** Nylon 6/10
- Shaft:** Nylon 6/10
- Shaft Insert:** 303 stainless steel
- Joystick Housing:** Nylon 6,10
- Centering Plate:** Nylon 6,10
- Detent Balls:** Carbon steel
- Detent Springs:** Music wire
- Dome Contacts:** Stainless steel
- Dome Housings:** Polycarbonate over brass-lead frame
- Dome Retainers:** Nylon 6,0; 30% glass-filled
- Joystick Actuators:** Polyphthalamide; 50% glass filled
- Pushbutton Dome Retainer:** Polycarbonate
- Printed Circuit Board:** NEMA grade FR-4. Glass-cloth epoxy, double clad with copper
- Infrared Emitter:** Gallium arsenide
- Phototransistor:** Planar silicon
- Resistors:** Metal oxide on ceramic substrate
- Solder:** 95.5% SN, 3% AG, 0.5% CU

OPTIONS

Contact Grayhill for custom terminations, rotational torque, number of positions, shaft configurations, and resolutions.