# SERIES 60AD

## Optical Encoder with integrated Joystick and Pushbutton

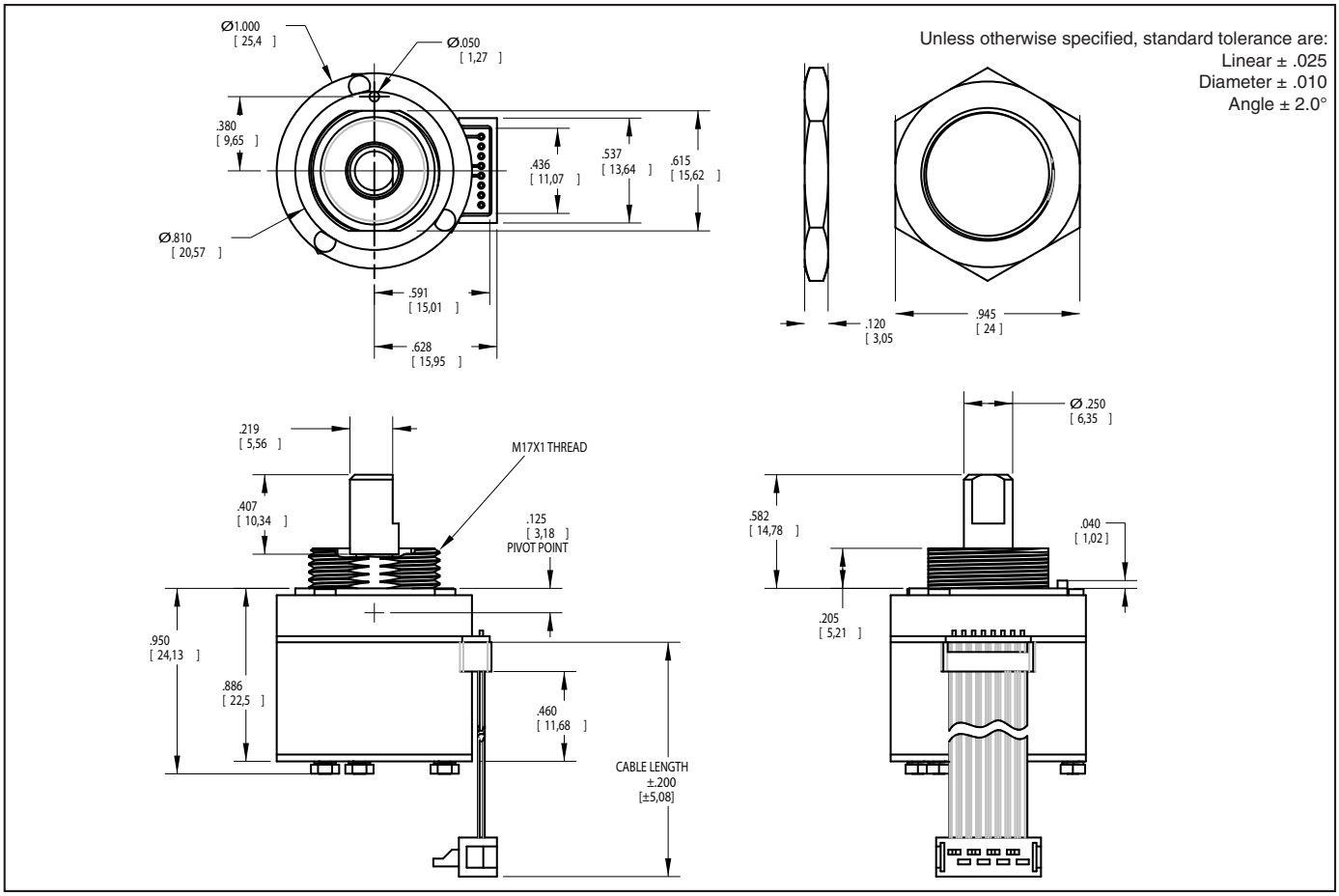
### FEATURES

- 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)




### ORDERING INFORMATION

**60AD18-4-M-060S**

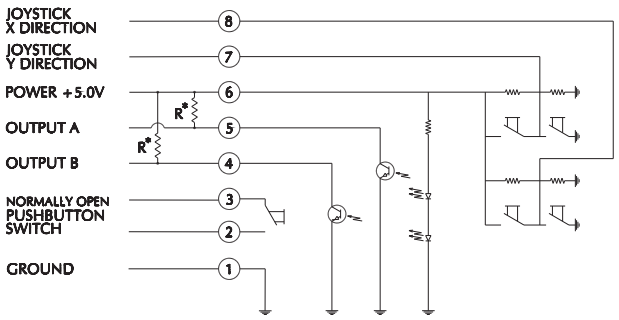
- **Angle of Throw:** 18= 18° or 20 positions
- **Joystick:** 4= Four contacts & directions; 8= Four contacts & eight directions
- **Termination:** 0.050" center P= pin header; C= connector; S= stripped cable
- **Cable Length:** 020 thru 250 in 1/2 inch increments, 060= 6.0 inch cable
- **Force Option:** (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

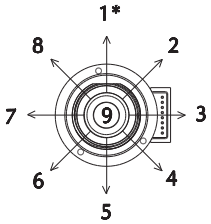
### SWITCH SCHEMATIC



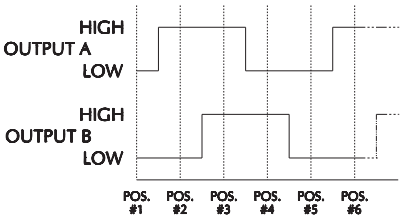

*EXTERNAL PULL-UP RESISTORS REQUIRED FOR OPERATION (2.2kΩ).

### 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 ± 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 ± .010 in.

### Joystick Specifications

**Supply Current:** 5mA max
**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:** 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.

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
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**Данный компонент на территории Российской Федерации**

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

http://moschip.ru/get-element

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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