

Optical Encoders

SERIES 60A Joystick

FEATURES

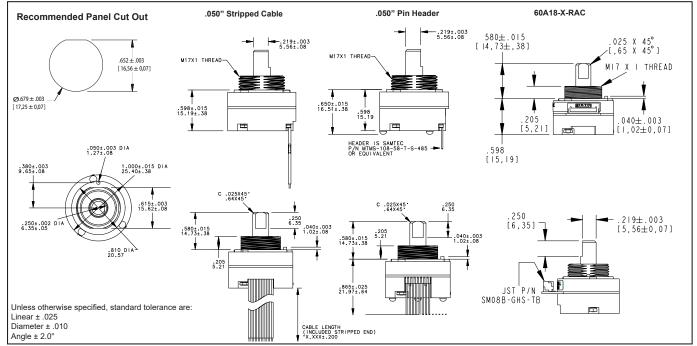
- Optical Encoder, Pushbutton, and Joystick in One Shaft
- Long Life, High Reliability
- Compatible with CMOS, HCMOS, and TTL Logic
- Choices of Cable Length and Termination
- · Customized Solutions Available

APPLICATIONS

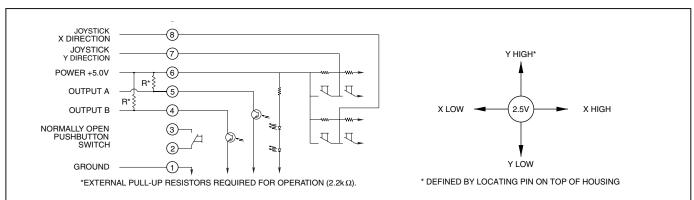
- Global Positioning/Driver Information Systems
- Medical Equipment Control
- Radio Control
- Robotics
- Commercial Appliances



DIMENSIONS in inches (and millimeters)



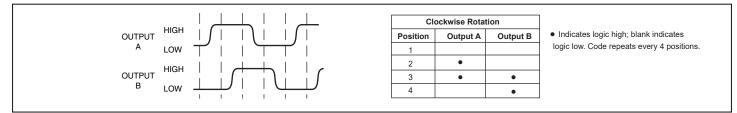
CIRCUITRY AND JOYSTICK OPERATION Standard Quadrature 2-Bit Code



Optical Encoders

Grayhill

WAVEFORM AND TRUTH TABLE Standard Quadrature 2-Bit Code



SPECIFICATIONS

Rotary Electrical and Mechanical Ratings

Operating Voltage: 5.00 ± 0.25 Vdc **Supply Current:** 20 mA maximum at 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:

High: No less than 3.5 Vdc

Low: No greater than 1.0 Vdc Minimum Sink Current: 2.0 mA Power Consumption: 100 mW maximum Mechanical Life: 1 million rotational cycles of operation (1 cycle is a rotation through all

positions and a full return) **Average Rotational Torque:** 2.0 ± 1.0 inoz initially, 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 Shaft Side-Load Force: 20 lbs max.

Terminal Strength: 15 lbs terminal pullout force minimum for cabled and header termination

Solderability: 95% free of pin holes and voids

Pushbutton Electrical and Mechanical Ratings

Rating: 10 mA at 5 Vdc resistive Contact Resistance: less than 10 ohms Life: 1 million actuations minimum Contact Bounce: < 4 mS make, 10 mS break Actuation Force: 400 ± 150 grams force Shaft Travel: 0.020 ± 0.010 inches

Joystick Electrical and Mechanical Ratings

Supply Current: 5 mA maximum Output Code: 2-Bit Logic Output Characteristics: Neutral: 2.5 ± 0.5 Vdc High: > 4.5 Vdc Low: < 0.5 Vdc Angle of Throw: 8° ± 2° in all directions Life: 500,000 actuations in each direction

Environmental Ratings

Operating Temperature Range: -40°C to 85°C

Storage Temperature 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 a varied 10 to 2000 Hz frequency 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

Assembly Studs: 305 Stainless steel Detent Housing: Polyamide polymer (nylon 6/10 alloy)

Printed Circuit Boards: Glass cloth epoxy double clad with copper gold over nickel plated

Infrared Emitting Diode Chips: Gallium aluminum arsenide

Silicon Phototransistor Chips: Gold and aluminum alloys

Resistors: Metal oxide on ceramic substrate **Solder Pins:** Brass, Plated with tin **Shaft:** Polyamide polymer (nylon 6/10 alloy)

with stainless steel insert

Detent Balls: Carbon steel plated with nickel Detent Springs: Music wire plated with tin Code Rotor: 33% Glass reinforced nylon 66 Pushbutton Dome: Stainless steel

Pushbutton Dome Retainer: Polycarbonate Joystick Housing: Polyamide polymer (nylon 6/10 alloy)

Joystick Contact: Stainless steel, silicone rubber, brass with silver cladding, high-temp thermoplastic, phosphor bronze with silver cladding

Cable: Copper stranded with plating in PVC insulation

Connector: PA 4.6 with tin over nickel plated phosphor bronze

Lockwashers: Stainless steel with passivate finish

Hex Nuts: 303 Stainless steel

Label: TT406 Thermal transfer cast film Solder: Sn/Ag/Cu, Lead-Free, No Clean Mounting Nut: Polyurethane

Lubricating Grease: Nye nyogel 774L

OPTIONS

Contact Grayhill for custom terminations, rotational torque, number of positions, shaft configurations, and resolutions. Control knobs are also available.

ORDERING INFORMATION

60A18-4-040S	 Series Angle of Throw: Detent: 18 = 18° or 20 positions; Non-detent: 08 = 18° or 20 positions; Non-Turn: 00 = Joystick and Pushbutton only Joystick Contacts: 2 = 2 Discrete Contacts 4 = 4 Discrete Contacts 8 = 4 Contacts in 8 possible directions 	60A18-X-RAC
	 Termination: S = 4.0in Stripped cable; .050" centers; C = 4.0in Cable with Amp Connector P/N 215083-8; .050" centers; (See Amp Mateability Guide for mating connector details) P = Pins; .050" centers RAC = Right Angle Connector: JST SM08B-GHS-TB(LF)(SN); .050" centers (See JST Connector Guide for mating connector details) Cable Length: 020 = 2in. 030 = 3in. 040 = 4in. 050 = 5in. 060 = 6in. 080 = 8in. 100 = 10in. 120 = 12.5in *Eliminate cable length if ordering "P" or "RAC" termination option 	
	*60A18-4-RAC available as standard P/N, for additional options, please contact Grayhill	