



Optical Encoders

SERIES 60A Joystick

FEATURES

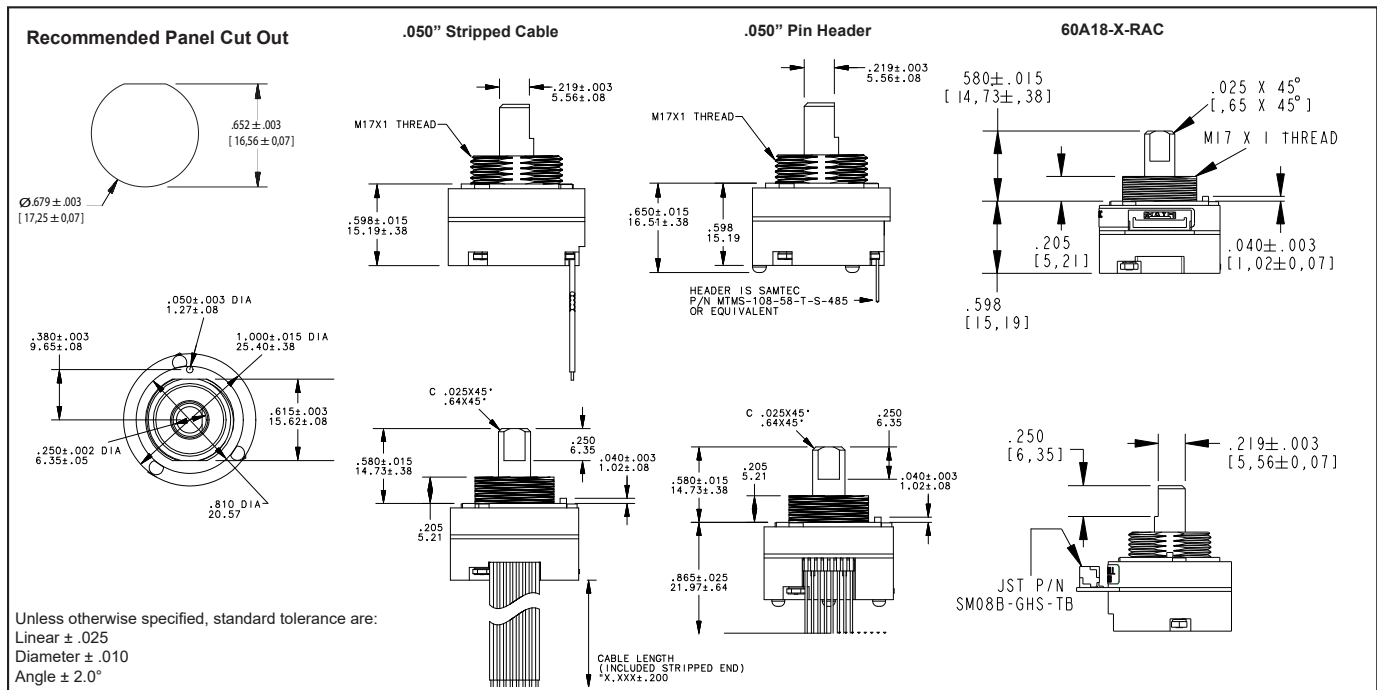
- Optical Encoder, Pushbutton, and Joystick in One Shaft
- Long Life, High Reliability
- Compatible with CMOS, HCMOS, and TTL Logic
- Choices of Cable Length and Termination
- Customized Solutions Available

APPLICATIONS

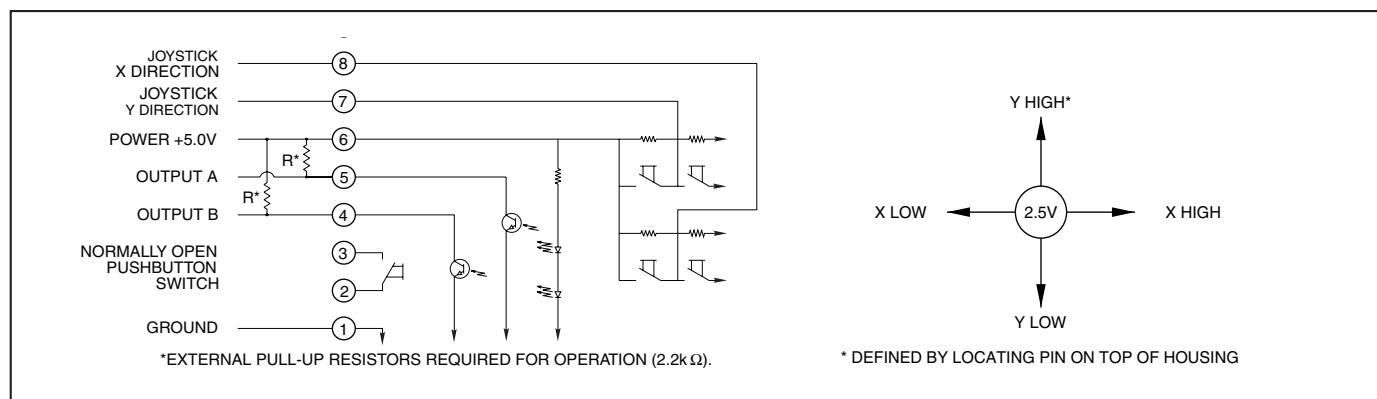
- Global Positioning/Driver Information Systems
- Medical Equipment Control
- Radio Control
- Robotics
- Commercial Appliances



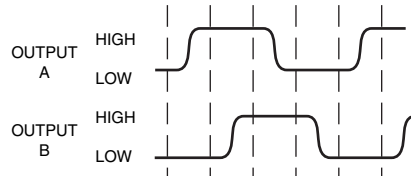
DIMENSIONS in inches (and millimeters)



CIRCUITRY AND JOYSTICK OPERATION Standard Quadrature 2-Bit Code



WAVEFORM AND TRUTH TABLE Standard Quadrature 2-Bit Code



| Clockwise Rotation | | |
|--------------------|----------|----------|
| Position | Output A | Output B |
| 1 | | |
| 2 | • | |
| 3 | • | • |
| 4 | | • |

• Indicates logic high; blank indicates logic low. Code repeats every 4 positions.

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 in-oz 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 pull-out force minimum for cabled and header termination
Solderability: 95% free of pin holes and voids

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

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

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

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

OPTIONS

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

ORDERING INFORMATION

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
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

60A18-4-040S

60A18-X-RAC

*60A18-4-RAC available as standard P/N, for additional options, please contact Grayhill

Optical and Mechanical Encoders