



Optical Encoders

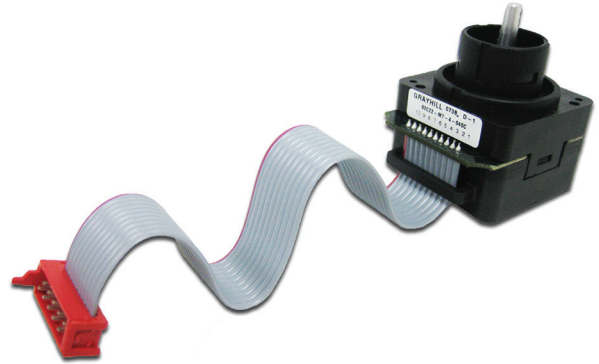
SERIES 60C Multi-Function Joystick

FEATURES

- Three-in-One Joystick, Optical Encoder and Pushbutton
- Compact Packaging
- Choices of Cable Length and Termination
- Customized Solutions Available

APPLICATIONS

- Avionics
- Medical Equipment
- Automotive Navigation, Information & Entertainment Equipment



The 60C is a cost-effective replacement of a stationary mouse or trackball with improved control over cursor movement. An integral Schmitt Trigger is used to stabilize against noise and vibration.

As a compact cursor control device, Grayhill's Series 60C is ideally suited for automotive and aviation dashboards, where use of separate joysticks, encoders and pushbuttons might be impractical. It provides all the functionality of a stationary mouse or trackball in a single unit with a 1"x1"x.661" deep housing. The joystick manipulates a cursor left, right, up and down; the rotary encoder facilitates sequential scrolling through menu options; and the pushbutton performs on-screen menu selects.

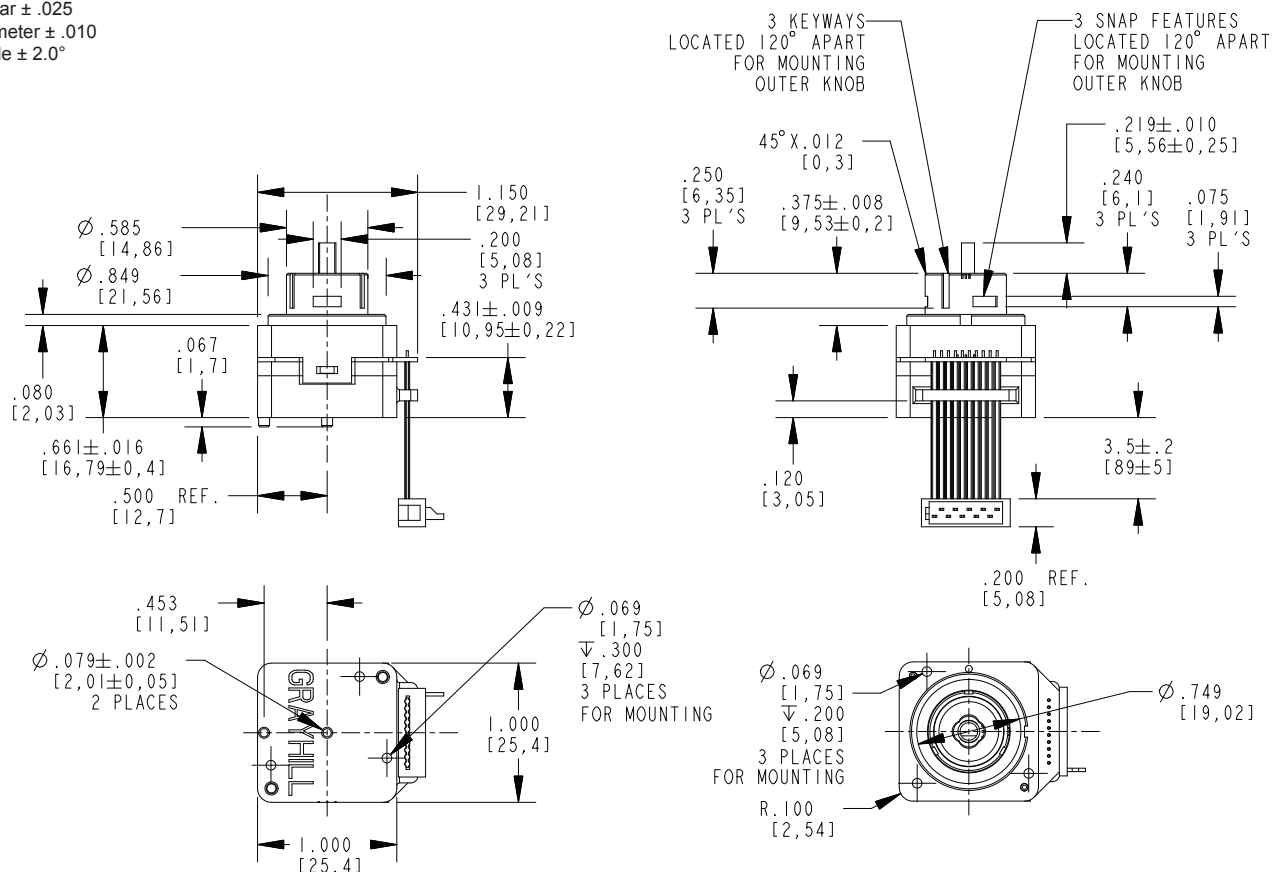
DIMENSIONS in inches (and millimeters)

Unless otherwise specified, standard tolerance are:

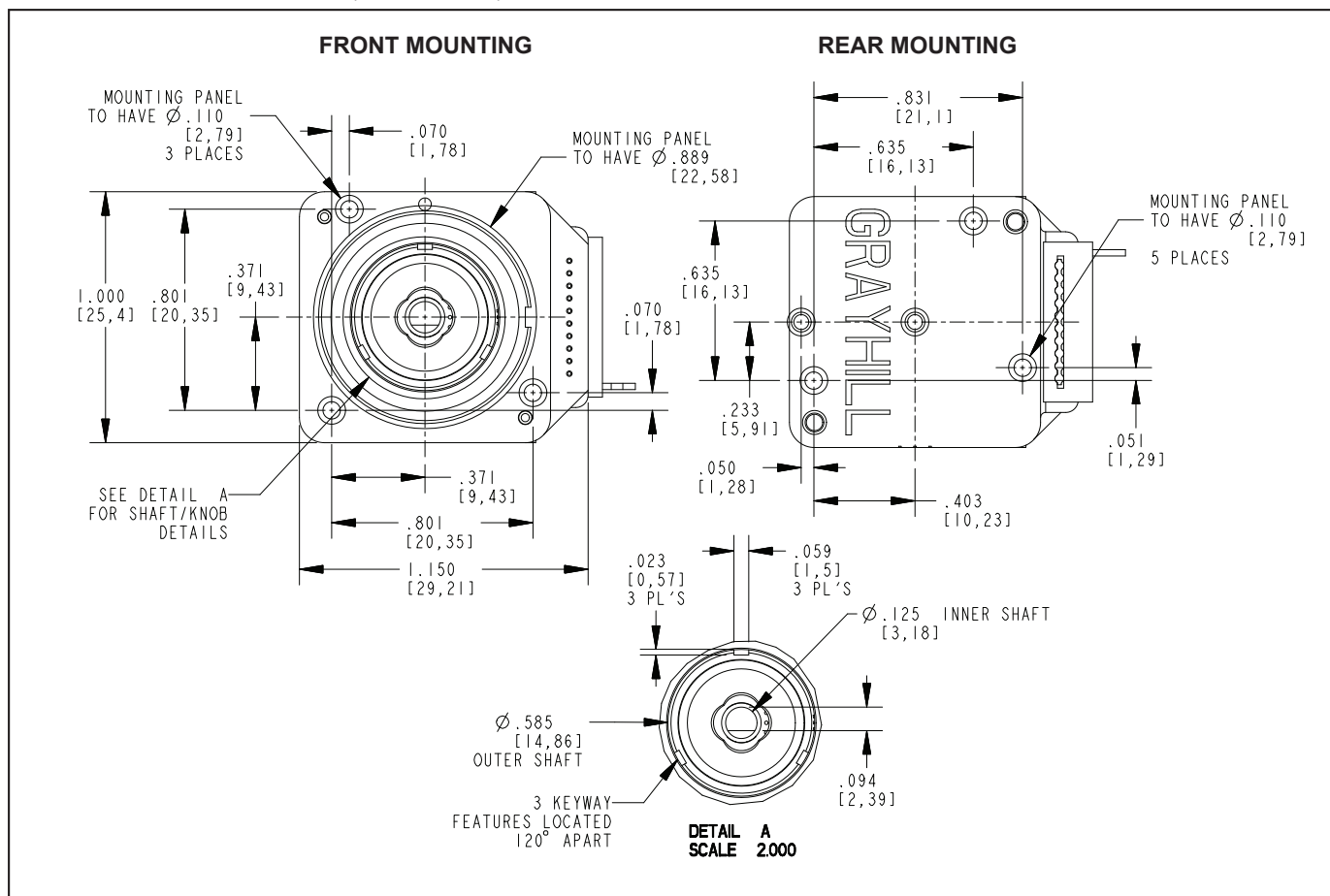
Linear $\pm .025$

Diameter $\pm .010$

Angle $\pm 2.0^\circ$



MOUNTING DETAILS in inches (and millimeters)

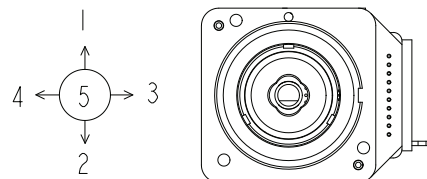


JOYSTICK OPERATION + ENCODER WAVEFORM AND TRUTH TABLE Standard Quadrature 2-Bit Code

JOYSTICK

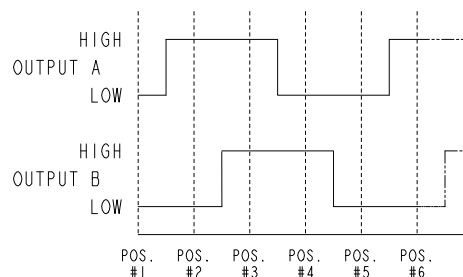
POSITION	BIT 1	BIT 2	BIT 3	BIT 4
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○

○ INDICATES LOGIC HIGH
○ INDICATES LOGIC LOW



ENCODER

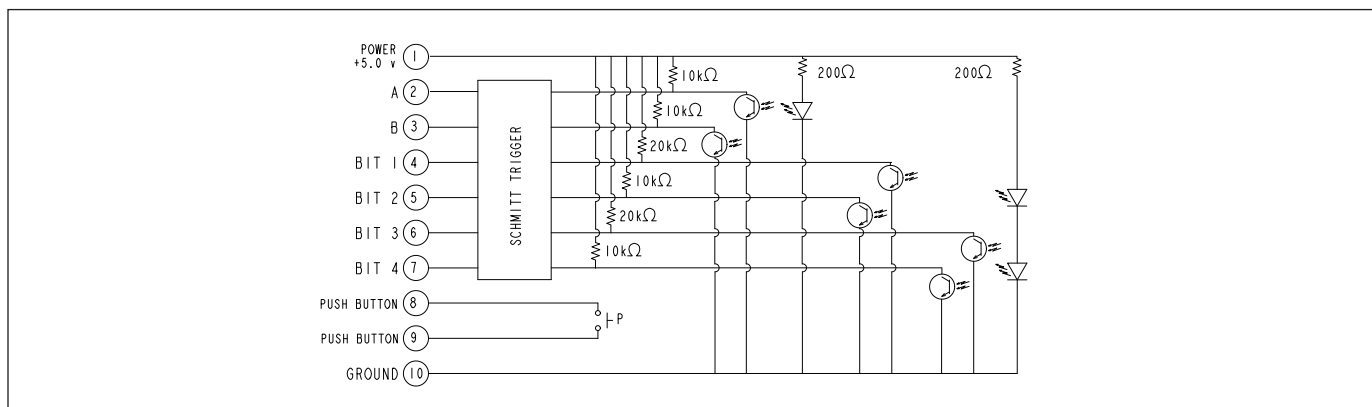
POSITION	OUTPUT A	OUTPUT B
#1	○	○
#2	○	○
#3	○	○
#4	○	○





Optical Encoders

SWITCH SCHEMATIC



SPECIFICATIONS

Rotary

Electrical and Mechanical Ratings

Operating Voltage: 5.00 ± 0.25 Vdc

Supply Current: 35mA TYP at 5 Vdc

Power Consumption: 175mW TYP at 5Vdc

Output: Direct output from inverting Schmitt trigger

Output Code: 2-Bit quadrature, channel A leads channel B by 90° in cw rotation

Logic Output Characteristics:

High: No less than 3.5 Vdc

Low: No greater than 1.0 Vdc

Mechanical Life: 500K rotational cycles

(through all positions and a full return)

Rotational Torque: medium torque option 3.00±2.00 in-oz, torque shall be within 50% of initial value throughout life

Mounting Torque: 15 in-oz. maximum

Shaft Push/Pull Out Force: 25 lbs minimum

Terminal Strength: 15 lbs terminal minimum

Joystick

Electrical and Mechanical Ratings

Operating Voltage: 5.00 ± 0.25 Vdc

Supply Current: 35mA at TYP at 5 Vdc

Power Consumption: 175mW TYP at 5Vdc

Output: Direct output from inverting Schmitt trigger

Logic Output Characteristics:

High: No less than 3.5 Vdc

Low: No greater than 1.0 Vdc

Mechanical Life: 500K cycles

(through all positions and a full return)

Angle of Throw: 8° max. in all directions

Pushbutton

Electrical and Mechanical Ratings

Rating: 10 mA at 5 Vdc resistive

Contact Resistance: less than 10 ohms

Contact Bounce: < 4ms make, 10 ms break

Mechanical Life: 500K actuations minimum

Actuation Force: option 7 = 485 ± 115grams

Pushbutton Travel: 0.033 ± 0.015 inches to contact; 0.075 inches maximum

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

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

Thermocycle: 4 hours cycling between -40°C to 85°C

Materials and Finishes

Bushing: Thermoplastic

Shaft Outer: Thermoplastic

Upper Housing: Thermoplastic

Pushbutton Rocker: Thermoplastic

Pushbutton Actuator: Thermoplastic

Inner Shaft Slide: Thermoplastic

Slider Plate: Thermoplastic

Backplate: Thermoplastic

Lightpipe, Joystick: Thermoplastic

Lightpipe, 16 pos: Thermoplastic

Centering Profile: Thermoplastic

Shaft Inner: Aluminum

Pins: Stainless steel

Barbed Rivet: Stainless steel

Detent Balls: Carbon steel 100 with nickel finish

Centering Balls: Carbon steel 100 with nickel finish

Detent Springs: Tinned music wire

Centering Springs: Tinned music wire

Cable ASM: .050 round conductor flat cable, PVC coated. Conductors are stranded, top-coated wire

Solder: 95.5% SN, 4% AG, 0.5% CU

Dome: Stainless steel

PCB 16 Pos: NEMA grade FR-4. Plating is gold or palladium over nickel

Infrared Emitter: Gallium aluminum arsenide

Phototransistor: Planar silicon

Resistor: Carbon film

Schmitt Trigger: RoHS Compliant TSSOP, 14 pin

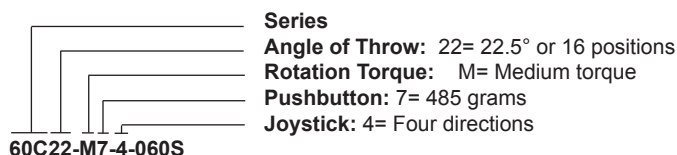
Lubricating Grease: Nyogel 774L

Label: TT406 Thermal transfer cast film

OPTIONS

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

ORDERING INFORMATION



Termination: 0.050" center ribbon cable with; C= Connector; S= 0.1" stripped end
Cable Length: 025 thru 250 in 1/2 inch increments, 060= 6.0 inch cable

Available from your local Grayhill Distributor. For prices and discounts, contact a local sales office, an authorized distributor, or Grayhill.

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