

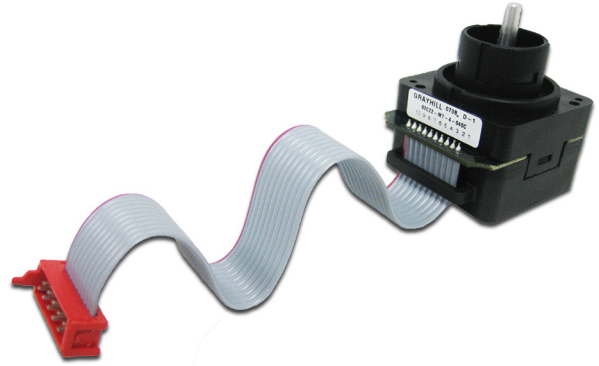
## SERIES 60C Multi-Function Joystick

### 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

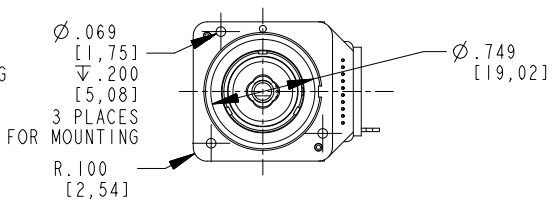
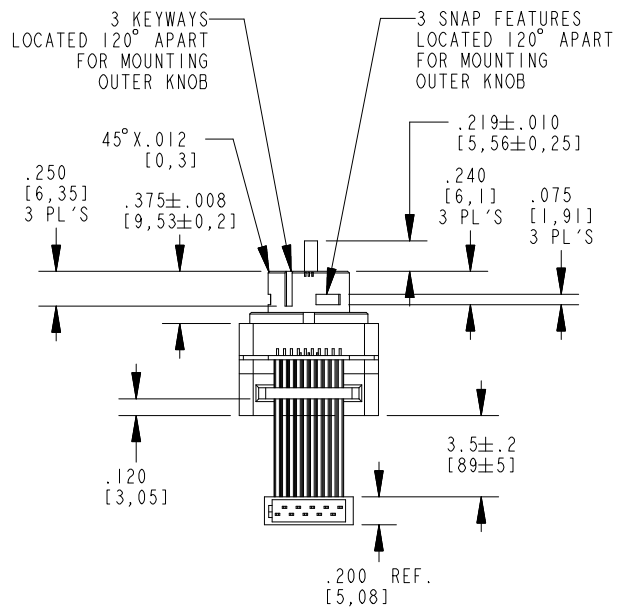
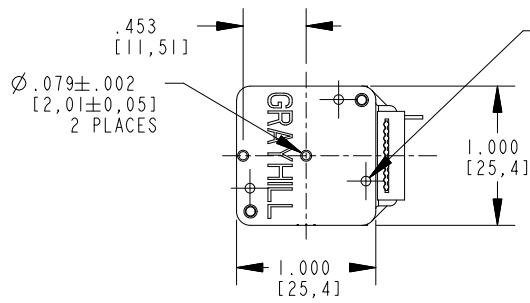
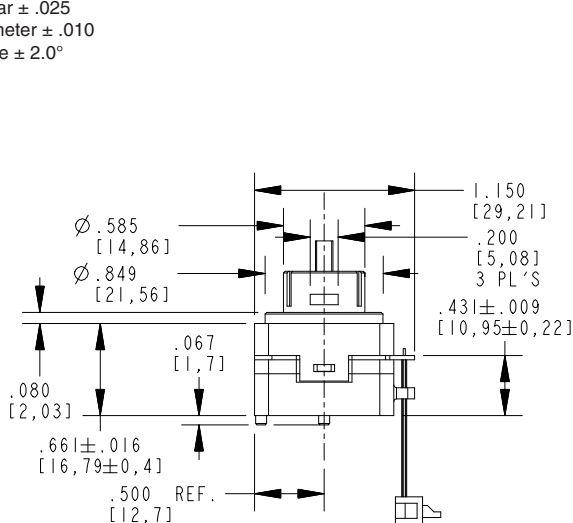


The 60C is a cost-effective replacement of a stationary mouse or trackball with improved control over cursor movement. An integral Schmitt Trigger is used to stabilize against noise and vibration.

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.

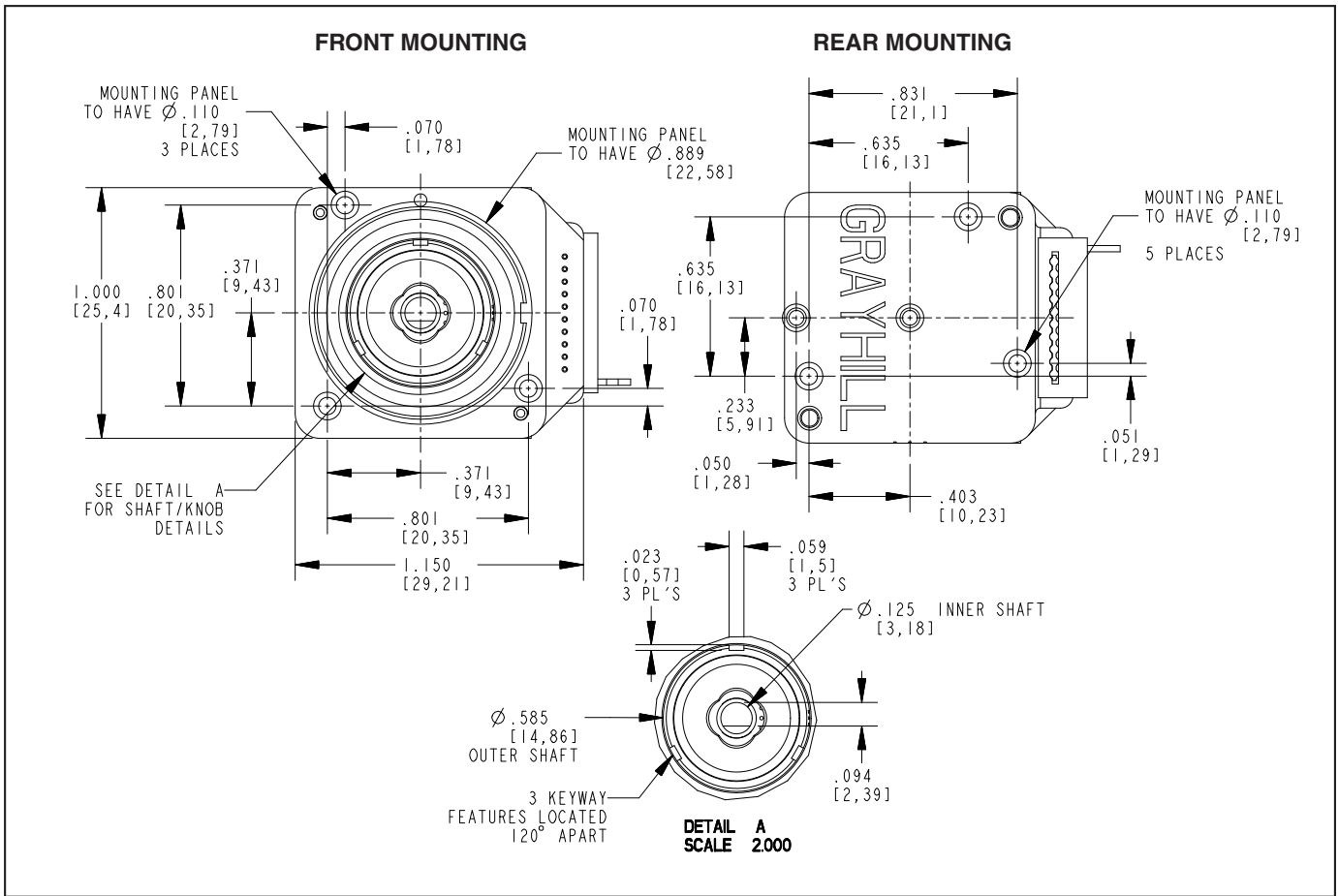
### DIMENSIONS in inches (and millimeters)

Unless otherwise specified, standard tolerance are:  
 Linear ± .025  
 Diameter ± .010  
 Angle ± 2.0°



Optical and Mechanical Encoders

**MOUNTING DETAILS** in inches (and millimeters)



Optical and Mechanical Encoders

**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

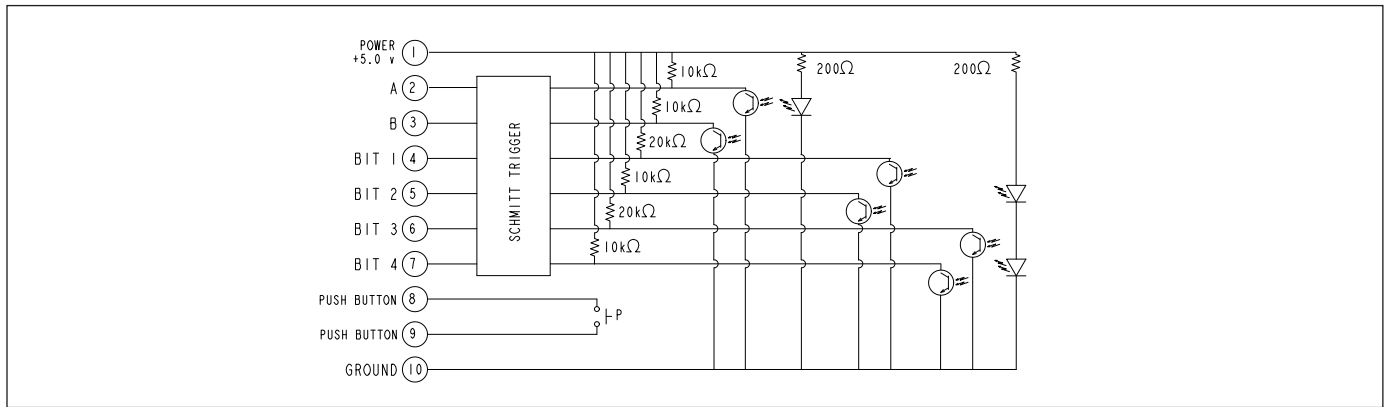
**ENCODER**

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

Diagram showing joystick positions 1-5 and a corresponding encoder housing view.

Waveform showing HIGH and LOW levels for OUTPUT A and OUTPUT B across positions #1 to #6.

**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-lbs. 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

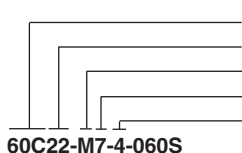
**Lubricating Grease:** Nyogel 774L

**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**



**Series**  
**Angle of Throw:** 22= 22.5° or 16 positions  
**Rotation Torque:** M= Medium torque  
**Pushbutton:** 7= 485 grams  
**Joystick:** 4= Four directions

60C22-M7-4-060S

**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.