

SERIES 61A

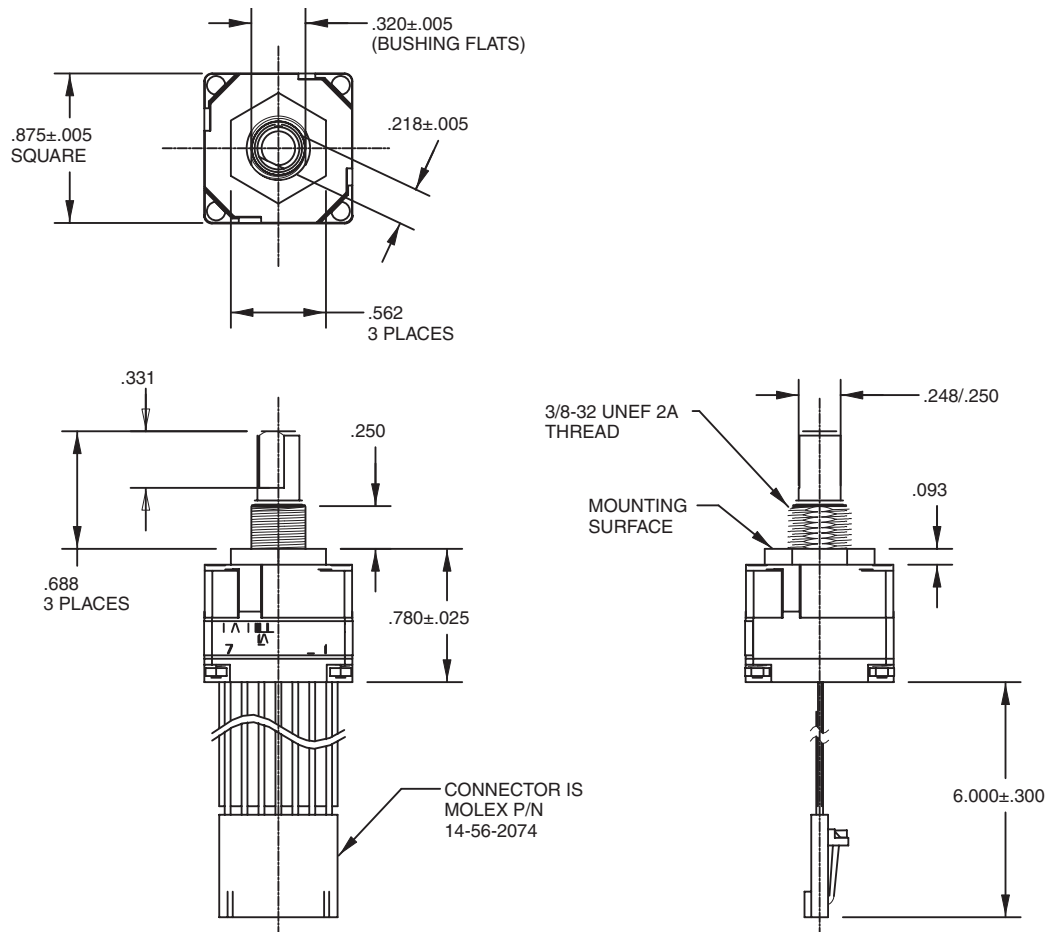
Custom, Absolute

FEATURES

- Absolute Position Sensing
- 3, 4, or 5-Bit Custom Output Coding
- 8 to 32 Positions
- Fixed Stops Only
- Angles of Throw to 45° (Design Specifications Will Dictate the Angle of Throw)

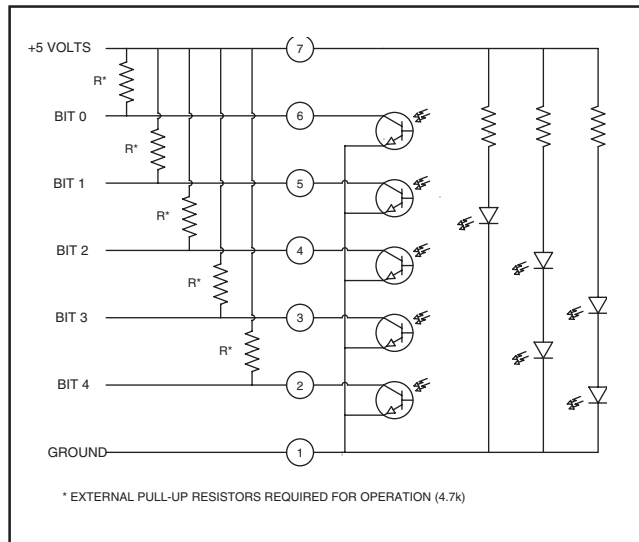


DIMENSIONS In inches (and millimeters)



UNLESS OTHERWISE SPECIFIED, DIMENSION TOLERANCES ARE AS FOLLOWS: LINEAR $\pm .010$ (0,25), DIAMETERS $\pm .010$ (0,25), ANGULAR ± 5

CIRCUITRY



TRUTH TABLE

3 BIT, 8 POSITION

Position	B2	B3	B4
1			
2			
3			
4			
5			
6			
7			
8			

● INDICATES LOGIC HIGH
BLANK INDICATES LOGIC LOW

4 BIT, 16 POSITION

Position	B1	B2	B3	B4
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

● INDICATES LOGIC HIGH
BLANK INDICATES LOGIC LOW

5 BIT, 32 AND 24 POSITION

Position	B0	B1	B2	B3	B4
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					

● INDICATES LOGIC HIGH
BLANK INDICATES LOGIC LOW

SPECIFICATIONS

Ratings

Operating Voltage: 5 ±.25V DC
Supply Current: 85 mA maximum at 5V DC
Life: 1 million cycles of operation; 1 cycle is rotation through all positions and a full return
Rotational Torque: 1.5 in-oz (Initial)
Output High: 3.8V minimum for CMOS & HCMOS; 2.7V minimum for TTL
Output Low: 0.8V maximum
Shaft Push Out Force: 25 lbs.
Mounting Torque: 10 in-lb maximum
Load Current: 5 mA maximum per channel
Logic Rise and Fall Times: 30 mSec typical

Environmental

Operating Temperature Range: -40°C to +85°C
Storage Temperature Range: -55°C to +100°C
Vibration: MIL-STD 202, method 204, condition B
Mechanical Shock: 100 g's, 6 ms, half Sine
 12.3 ft/s and 100 g's, 6 ms, sawtooth, 9.7 ft/s
Humidity: 90-95% Relative humidity at 40°C for 96 hrs.

Materials and Finishes

Detent Housing: Stainless Steel
Bushing: Brass, tin/zinc plated
Shaft: Stainless steel
Detent Balls: Steel, nickel-plated
Code Housings: Nylon 6/10
Backplate: Nylon 6/10

Aperture: Chemically etched stainless steel with black oxide finish

Rotor: Electroformed nickel and chemically etched stainless steel with black oxide finish

Detent Springs: Tinned music wire

PC Boards: NEMA grade FR-4

Through Bolts: Stainless steel, unplated

Through Bolt Nuts: Stainless steel

Mounting Hardware: One brass, tin/zinc-plated nut and one stainless steel, zinc-plated lockwasher supplied with each switch. Nut is 0.094 inches thick by 0.562 inches across flats.

ORDERING INFORMATION



Series

Style: A = unsealed

Number of positions: 32 = 32 positions with 10" of throw
 16 = 16 positions with 18" of throw
 8 = 8 positions with 26" of throw

Termination: Cable Termination: 060=6.0 inches. Cable is terminated with Molex connector P/N 14-56-2074.

Available from your local Grayhill Component Distributor. For prices and discounts, contact a local Sales Office, an authorized local Distributor, or Grayhill.

SERIES 62S

Compact 1/2" Package

FEATURES

- Compact Size, Requires Minimal Behind Panel Space
- 1/2 Million Rotations for High Torque
- 1 Million Rotational Cycles, 3 Million for Non-Detent Styles
- Optional Integral Pushbutton

- Choices of Cable Length and Terminations

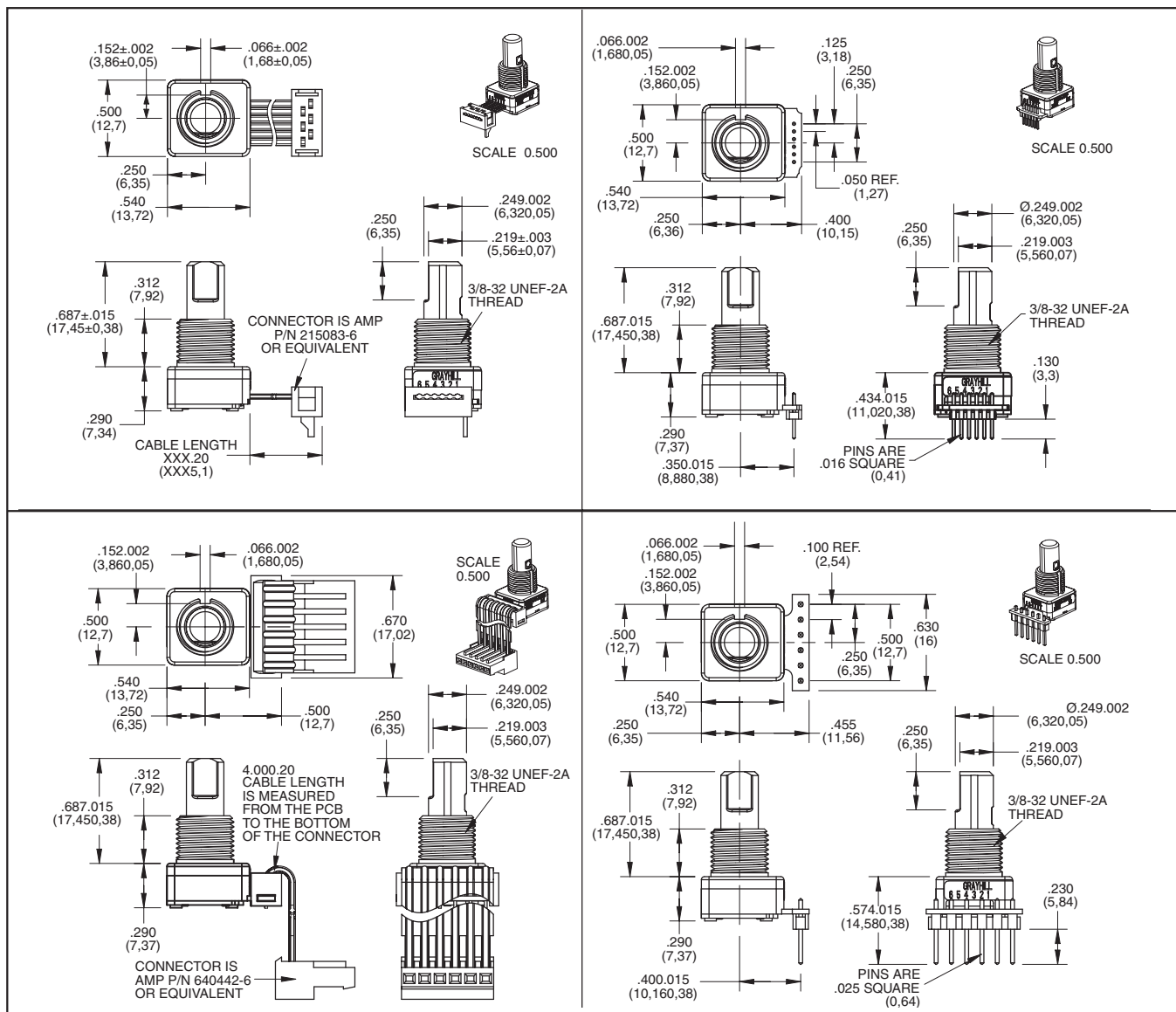
APPLICATIONS

- Global Positioning/Driver Information Systems
- Medical Equipment

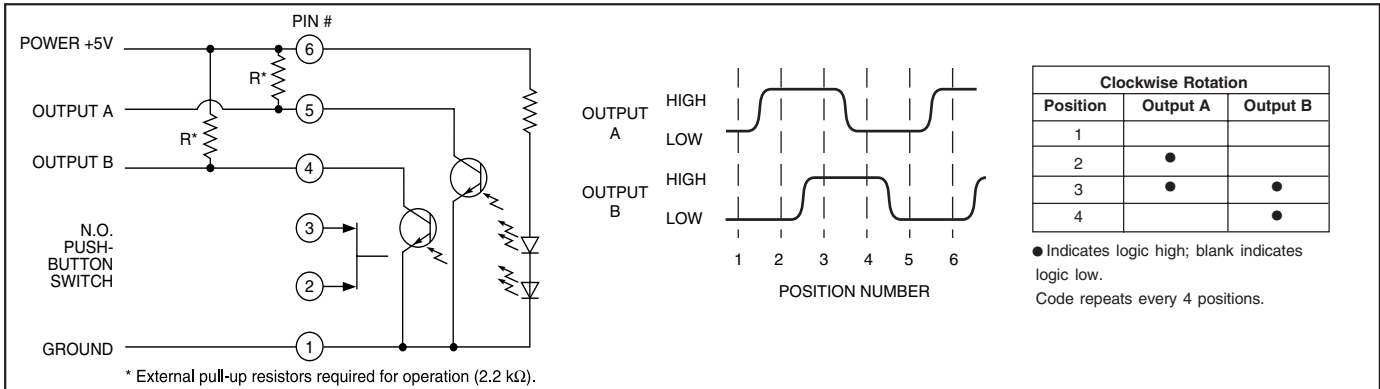


DIMENSIONS In inches (and millimeters)

Unless otherwise specified, standard tolerance is ± 0.010 (0,25)



CIRCUITRY, TRUTH TABLE, AND WAVEFORM Standard Quadrature 2-Bit Code



SPECIFICATIONS

Environmental Specifications

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

Storage Temperature Range: -55°C to 100°C

Humidity: 96 Hours at 90–95% humidity at 40°C

Mechanical Vibration: Harmonic motion with amplitude of 15G's, within a varied frequency of 10 to 2000 Hz

Mechanical Shock: Test 1: 100G for 6 mS, half sine wave with a velocity change of 12.3 ft/s; Test 2: 100G for 6 mS, sawtooth wave with a velocity change of 9.7 ft/s

Rotary Electrical and Mechanical Specifications

Operating Voltage: 5.00 $\pm$ 0.25 Vdc

Supply Current: 30mA maximum at 5Vdc

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:

Logic High shall be no less than 3.0 Vdc

Logic Low shall be no greater than 1.0 Vdc

Minimum Sink Current: 2.0 mA

Power Consumption: 150 mW maximum

Mechanical Life:

Non-Detent 3 Million Cycles

Low & Medium 1 Million Cycles

High 1/2 Million Cycles

1 cycle is a rotation through all positions and a full return

AVERAGE ROTATIONAL TORQUE SPECIFICATIONS			
	LOW ± 0.50 IN-OZ	MEDIUM ± 1.40 IN-OZ	HIGH ± 1.60 IN-OZ
8 POSITION	1.10	1.85	2.75
12 POSITION	1.00	1.70	2.95
16 POSITION	1.40	2.35	3.40
20 POSITION	1.35	2.05	2.80
24 POSITION	1.25	1.95	2.95
32 POSITION	0.95	1.40	2.15

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

Terminal Strength: 15 lbs minimum terminal pull-out force for cable or header termination

Solderability: 95% free of pin holes and voids

Pushbutton Electrical and Mechanical Specifications

Rating: 10 mA at 5 Vdc

Contact Resistance: <10 Ω

Life: 3 million actuations minimum

Contact Bounce: <4 ms Make, <10 ms Break

Actuation Force: 9-950 $\pm$ 250 grams, 5-510 $\pm$ 110 grams, 4-400 $\pm$ 100 grams, 3-300 $\pm$ 90 grams, 2-200 $\pm$ 75 grams

Shaft Travel: .020 $\pm$.010 inch

Materials and Finishes

Bushing: Zamak 2

Shaft: Aluminum or Zamak 2

Retaining Ring: Stainless steel

Pushbutton Actuator: Zytel 70G33L

Detent Spring: Music wire

Detent Ball: Stainless steel

Code Housing: Polyamide polymer, nylon 6/10 alloy UL94HB

Code Rotor: Delrin 100

Printed Circuit Boards: NEMA grade FR-4, double clad with copper, plated with gold over nickel

Infrared Emitting Diode Chips: Gallium aluminum arsenide

Silicon Phototransistor Chips: Gold and Aluminum Alloys

Resistor: Metal oxide on ceramic substrate

Solder Pins: Brass, plated with tin

Pushbutton Dome: Stainless steel

Backplate: Stainless steel

Cable: Copper stranded with topcoat in PVC insulation (Cable version only)

Connector (.050 Center): PA4.6 with tin over nickel plated phosphor bronze

Connector (.100 Center): Nylon UL94V-2, tin plated copper alloy

Label: TT406 Thermal transfer cast film

Solder: Sn/Ag/Cu, Lead-Free, No Clean

Lubricating Grease: NYE nyogel 774L

Hex Nut: Nickel, plated with brass

Lockwasher: Stainless steel

Header: Hi-Temp glass filled thermoplastic UL94V-0, phosphor bronze (pinned versions only)

Strain Relief: Glass filled thermoplastic (.100 center cable versions only)

OPTIONS

Contact Grayhill for custom terminations, shaft and bushing configurations, rotational torque pushbutton force, and code output. Control knobs are also available.

ORDERING INFORMATION

Angle of Throw

45=45° for Code Change and 8 Detent Positions
30=30° for Code Change and 12 Detent Positions
22=22.5° for Code Change and 16 Detent Positions
18=18° for Code Change and 20 Detent Positions
15=15° for Code Change and 24 Detent Positions
11=11.25° for Code Change and 32 Detent Positions

Rotational Torque Option

N = Non-detent
L = Low Torque (available with 0, 4, 5, 9 pushbutton only)
M = Medium Torque (available with 0, 5, 9 pushbutton only)
H = High Torque (available with 0, 9 pushbutton only)

Termination

C = .050 Center Ribbon Cable with Connector
S = .050 Center Ribbon Cable with .100 Stripped End
P = .050 Center Pins with .185 Length
CH = .100 Center Ribbon Cable with Connector
SH = .100 Center Ribbon Cable with .100 Stripped End
PH = .100 Center Pins with .230 Length

Cable Length

Cable Termination: 040=4.0in or 040in. Cable is terminated with Amp Connector P/N 640442-6
See Amp Mateability Guide for mating connector details.

Pushbutton Option

0 = NO PUSHBUTTON 4 = 400 Grams
9 = 950 Grams 3 = 300 Grams
5 = 510 Grams 2 = 200 Grams

SERIES 62AG

Price Competitive Solution

FEATURES

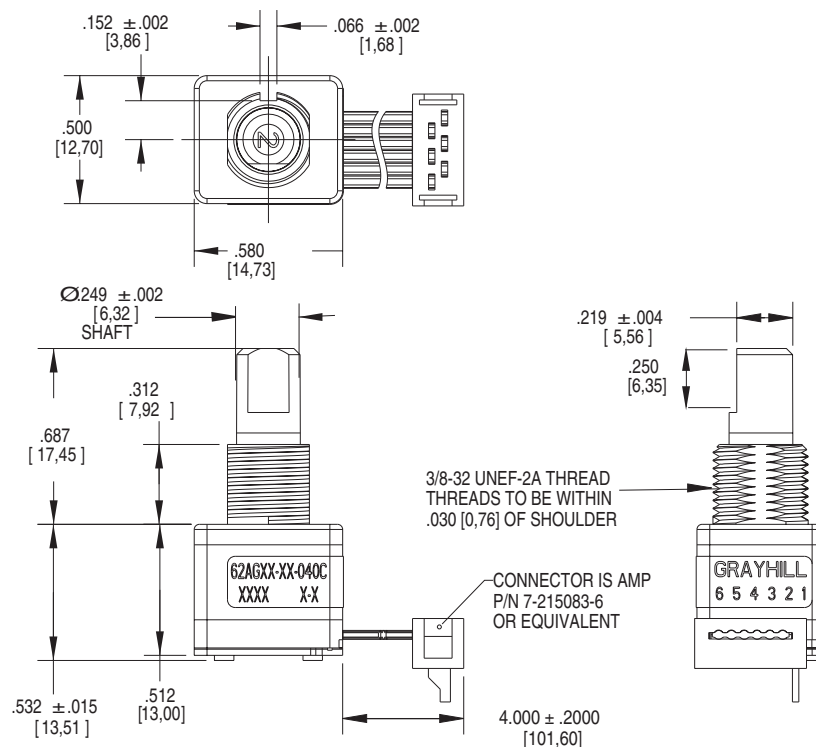
- Long Lasting (1 million cycles)
- Optional pushbutton
- Available in 16 and 32 Detent Positions
- 4 inch cable / connector assembly

APPLICATIONS

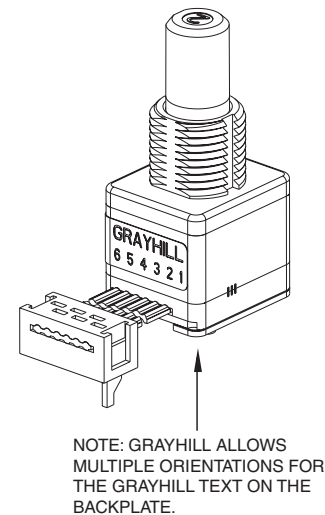
- Automotive audio, navigation & driver information systems
- Medical Equipment
- Test & Measurement Equipment
- Audio & Video Equipment



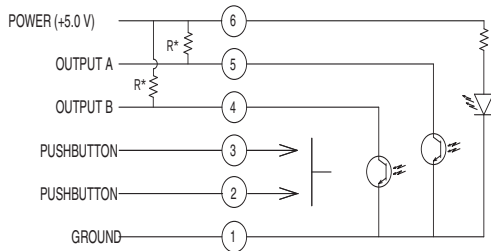
DIMENSIONS In inches (and millimeters)



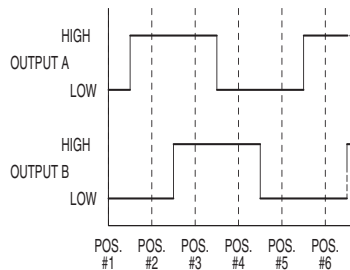
Unless otherwise specified, standard tolerances are:
 Linear $\pm .025$
 Diameter $\pm .010$
 Angle $\pm 2.0^\circ$



WAVEFORM AND TRUTH TABLE



*EXTERNAL 10k Ω PULL-UP RESISTORS REQUIRED FOR OPERATION



*CLOCKWISE SHAFT ROTATION

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

● INDICATES LOGIC HIGH; BLANK INDICATES LOGIC LOW.
CODE REPEATS EVERY FOUR POSITIONS.

SPECIFICATIONS

Environmental Specifications

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

Storage Temperature: -43°C to 38°C

Humidity: 96 Hours at 90-95% humidity at 40°C

Mechanical Vibration: Harmonic motion with amplitude of 15g within a varied frequency of 10 to 2000 Hz for 12 hours
Mechanical Shock

Test 1: 100g for 6 ms half-sine wave with a velocity change of 12.3 ft/s.

Test 2: 100g for 6 ms sawtooth wave with a velocity change of 9.7 ft/s.

Rotary Electrical and Mechanical Specifications

Operating Voltage: 5.00±0.25 Vdc

Supply Current: 30 mA maximum at 5 Vdc.

Logic Output Characteristics:

Logic high shall be no less than 3.0 Vdc

Logic low shall be no greater than 1.0 Vdc

Minimum sink current: 0.5 mA for 5 Vdc.

(Preliminary)

Power Consumption: 150 mW maximum for 5 Vdc

Output: Open Collector Phototransistor

Optical Rise Time: 30ms maximum.

Optical Fall Time: 30ms maximum.

Average Rotational Torque:

2.0±1.4 in-oz before life. 50% of initial value after 1 million cycles.

Mechanical Life: 1,000,000 cycles of operation. 1 cycle is a rotation through all positions and a full return.

Mounting Torque: 15in-lbs. maximum

Shaft Pushout Force: 45 lbs. minimum

Terminal Strength: 15 lbs. Cable pull out force minimum

Solderability: 95% free of pin holes and voids

Maximum rotational speed: 100 rpm.

Pushbutton Electrical and Mechanical Specifications

Rating: 10 mA @ 5 Vdc

Contact Resistance: <10 Ω (Compatible with CMOS or TTL)

Life: 1 million actuations minimum

Contact Bounce: <4 ms make, <10ms break

Actuation Force: 510±150 grams

Shaft Travel: .017 ± .008 INCH

Materials and Finishes

Bushing: Zamak 2

Shaft: Zamak 2

Detent Rotor: Reinforced Nylon Zytel 70G33L UL 94

Detent Spring: 303 Stainless Steel

Housing, Upper: Nylon 6/6 25% glass reinforced. Zytel FR-50

Light Pipe: Lexan, GE

Code Rotor: Delrin 100

Housing, Lower: Nylon 6/6 25% glass reinforced. Zytel FR-50

Pushbutton Actuator: Reinforced nylon. Zytel 70G33L. UL 94

Pushbutton Dome: Stainless Steel

Printed Circuit Board: NEMA Grade FR4, Double clad with copper, Plated with gold over nickel

Infrared Emitting Diode: Gallium Arsenide

Phototransistor Diode: NPN Silicon

Resistor: Metal oxide on ceramic substrate

Spacer: Pet plastic

Backplate: Stainless Steel

Label: TT406 thermal transfer cast film.

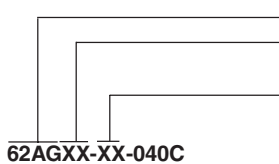
Solder: 96.5% tin / 3% silver / 0.5% copper. No clean.

Hex Nut: Brass, Plated with nickel

Lockwasher: Stainless steel

Cable: Copper Stranded with topcoat in PVC insulation

Connector (.050 center): PA4.6 with tin/nickel plated phosphor bronze.



Series

Angle of Throw: 22 = 22.5° for code change and 16 detent positions

11 = 11.25° for code change and 32 detent positions

Pushbutton Option: 01=No Pushbutton, 02=With Pushbutton

62AGXX-XX-040C

Termination: C = .050 Center ribbon Cable with connector

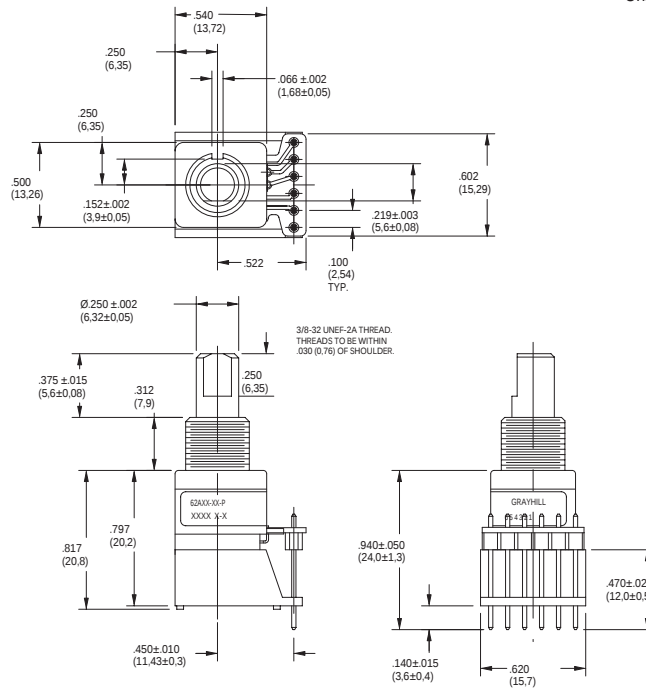
Cable Termination: 040=4.0 inches. Cable is terminated with Amp Connector P/N215083-6. See Amp Mateability Guide for Mating Connector for details.

Available from your local Grayhill Component Distributor. For pricing and discounts, contact a local Sales Office, an authorized local Distributor, or Grayhill.

DIMENSIONS In inches (and millimeters)

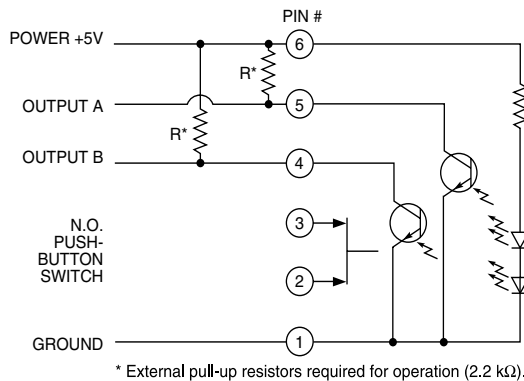
Pin Version

Unless otherwise specified, standard tolerance is ± 0.010 (0.25)



CIRCUITRY, TRUTH TABLE, AND WAVEFORM Standard Quadrature 2-Bit Code

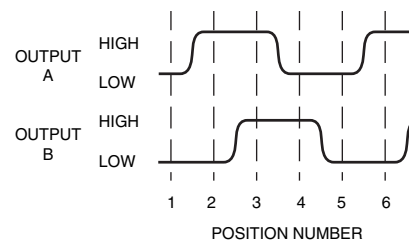
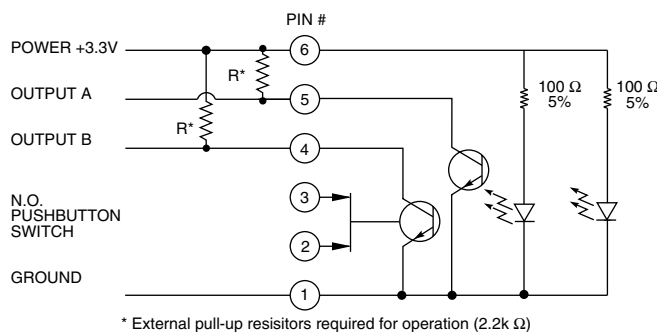
Standard 5.0 Volt (Styles A and D)



Clockwise Rotation		
Position	Output A	Output B
1		
2	●	
3	●	●
4		●

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

3.3 Volt (Style V only)



SPECIFICATIONS

Electrical and Mechanical Ratings

Rating: 5 Vdc, 10 mA, resistive

Contact Resistance: less than 10 ohms (TTL or CMOS compatible)

Pushbutton Life: 3 million actuations minimum

Contact Bounce: less than 4 mS at make and less than 10 mS at break

Actuation Force: 1000 ±300 grams

Pushbutton Travel: .010/.025 inch

Coding: 2-bit quadrature coded output

Operating Voltage: 5.0 ±.25 Vdc, 3.30±.125 Vdc (style V only)

Voltage Breakdown: 250 Vac between mutually insulated parts

Supply Current: 30 mA maximum

Logic Output Characteristics:

Logic High: 3.8 Vdc (5.0 Vdc); 2.3 (3.3 Vdc) minimum

Logic Low: 0.8 Vdc maximum

Rotational Life: 1,000,000 cycles minimum (One cycle is a rotation through all positions and a full return)

Minimum Sink Current: 2.0 mA for 5 Vdc; 1.0 mA for 3.3 Vdc

Power Consumption: 150 mW maximum for 5 Vdc; 80 mW for 3.3 Vdc

Optical Rise and Fall Times: less than 30 mS maximum

Operating Torque:

Style A and V: 2.0 ±1.4 in-oz. initially

Style D: 3.5 ±1.4 in-oz initially

Non-detent: less than 1.5 in-oz initially

Shaft Push Out Force: 45 lbs minimum

Mounting Torque: 15 in-lbs maximum

Terminal Strength: 15 lbs cable pull-out force minimum

Operating Speed: 100 RPM maximum

Axial Shaft Play: .010 maximum

Environmental Ratings

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

Storage Temperature Range: -55°C to 100°C

Relative Humidity: 90–95% at 40°C for 96 hours

Vibration Resistance: Harmonic motion with amplitude of 15G, within a varied 10 to 2000 Hz frequency for 12 hours per MIL-STD-202, Method 204

Mechanical Shock: Test 1: 100G for 6 mS, half sine, 12.3 ft/s; Test 2: 100G for 6 mS, sawtooth, 9.7 ft/s

Materials and Finishes

Code Housing: Reinforced thermoplastic

Shaft: Zinc or aluminum

Bushing: Zinc casting

Shaft Retaining Ring: Stainless steel

Detent Spring: Stainless steel

Printed Circuit Boards: NEMA grade FR-4 gold over nickel or palladium

Terminals: Brass, tin-plated

Mounting Hardware: One brass, nickel-plated nut and stainless steel lockwasher supplied with each switch. Nut is 0.094 inches thick by 0.562 inches across flats.

Rotor: Thermoplastic

Code Housing: Thermoplastic

Pushbutton Dome: Stainless steel

Dome Retaining Disk: Thermoplastic

Pushbutton Housing: Thermoplastic

Phototransistor: Planar Silicon NPN

Infrared Emitter: Gallium aluminum arsenide

Pushbutton Contact: Brass, nickel-plated

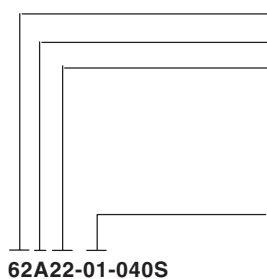
Flex Cable: 28 AWG, stranded/top coated wire, PVC coated on .050 or .100" centers (cabled version)

Header Pins: Phosphor bronze, tin-plated

Spacer: ABS

Backplate/Strain Relief: Stainless steel

ORDERING INFORMATION



Series

Style: A = 1/2" package, 5.0 Vdc Input, D = high torque w/5.0 Vdc input, V = 3.3 Vdc input

Angle of Throw:

Detent

11 = 11.25° or 32 positions

15 = 15° or 24 positions

18 = 18° or 20 positions

22 = 22.5° or 16 positions

30 = 30° or 12 positions

Non-detent (Styles A&V only)

01 = 11.25° or 32 positions

05 = 15° or 24 positions

08 = 18° or 20 positions

02 = 22.5° or 16 positions

03 = 30° or 12 positions

Pushbutton Option: 01 = w/o pushbutton, 02 = with pushbutton

Termination:

S = Stripped cable; .050" centers

SH = Stripped cable; .100" centers

C = Connector; .050" centers

CH = Connector; .100" centers

P = Pin; .100" centers

Cable Length: Cable Termination: 040 = 4.0in. Cable is terminated with Amp P/N 215083-6. See Amp Mateability Guide for Mating Connector details.

*Eliminate cable length if ordering pins. (Ex: 62A22-02-P).

These switches have Quadrature 2-bit code output and an optional shaft actuated pushbutton switch.

Custom materials, styles, colors, and markings are available. Control knobs available.

Available from your local Grayhill Component Distributor.

For prices and discounts, contact a local Sales Office, an authorized local Distributor, or Grayhill.

SERIES 62B

Push-Pull, High Torque

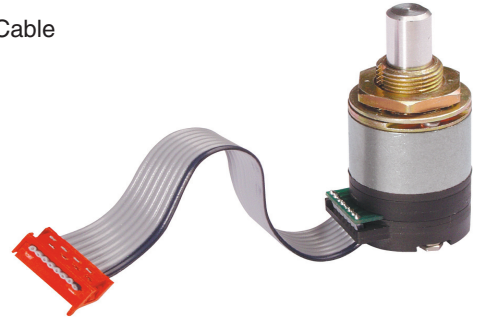
FEATURES

- Multiple Switching Functions Available in One Compact Device
- Push and Pull Travel Options
- Pull Shaft Resists Accidental Actuation
- High Rotational Torque for Positive Detent Feel and Superior Tactile Feedback
- Long Life, High Reliability
- CMOS, HCMOS, and TTL Compatible

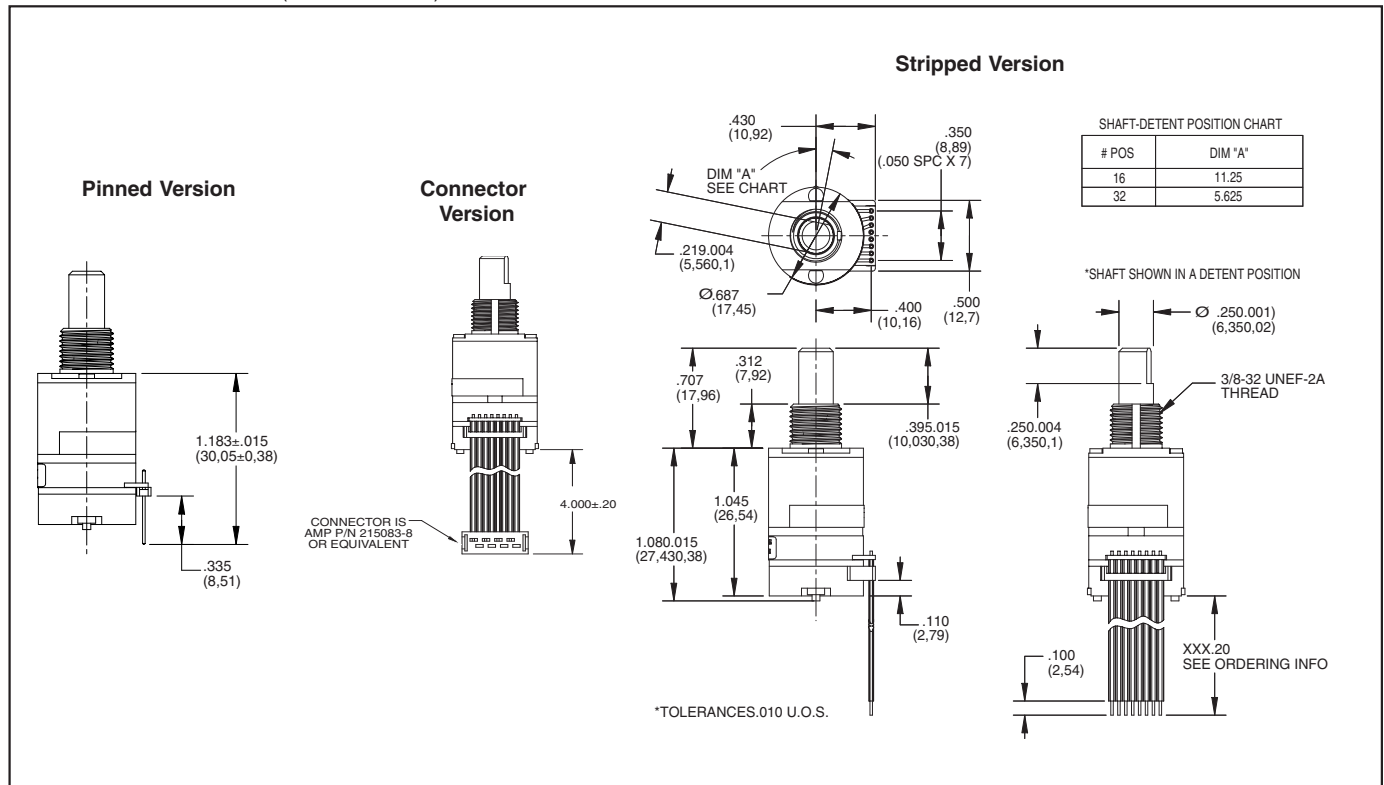
- Pin, Cable and Connector with Cable Termination Options
- Custom Modifications Available

APPLICATIONS

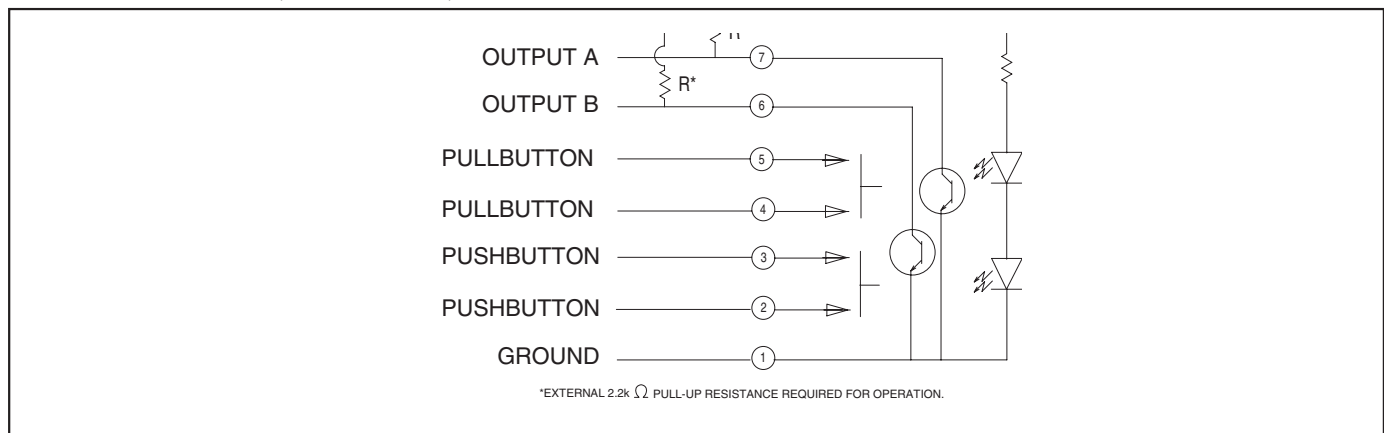
- Use for Menu Scrolling or Function Selection
- Avionics
- Industrial
- Medical



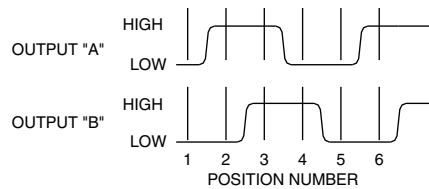
DIMENSIONS In inches (and millimeters)



SWITCH SCHEMATIC, WAVEFORM, AND TRUTH TABLE



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

Environmental Specifications

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

Storage Temperature Range: -55° C to 100° C

Humidity: 96 hours at 90-95% humidity at 40° C

Mechanical Vibration: Harmonic motion with amplitude of 15 g, within a varied frequency of 10 to 2000 Hz

Mechanical Shock:

Test 1: 100 g for 6 ms half-sine wave with a velocity change of 12.3 ft/sec

Test 2: 100 g for 6 ms sawtooth wave with a velocity change of 9.7 ft/sec

Rotary Electrical and Mechanical Specifications

Operating Voltage: 5.00±.25 Vdc

Supply Current: 30 mA maximum at 5 Vdc

Output: Open collector phototransistor, external pull-up resistors are required

Output Code: Two-bit quadrature, channel A leads channel B by 90° electrically during clockwise rotation of the shaft

Logic Output Characteristics:

Logic high signal shall be no less than 3.0 Vdc

Logic low signal shall be no greater than 1.0 Vdc

Minimum Sink Current: 2.0 mA

Power Consumption: 150 mW maximum

Mechanical Life: 1 million rotational cycles of operation. One cycle is a rotation through all positions and a full return

Average Rotational Torque: 6.0±1.5 in-oz initially. Torque shall be within 50% of initial value throughout life

Mounting Torque: 15 in-oz maximum

Shaft Push-Out Force: 45 lbs minimum

Shaft Pull-Out Force: 20 lbs minimum

Terminal Strength: 15 lbs minimum terminal pull-out force for cable or header termination

Solderability: 95% free of pin holes and voids

Pull-Button/Push-Button Electrical and Mechanical Specifications

Rating: 10 mA at 5 Vdc

Contact Resistance: <10 ohms

Life: 3 million actuations minimum

Contact Bounce: <4 ms make, <10 ms break

Actuation Force: 1700±450 g for both push and pull-button

Shaft Travel: .030±.010 standard travel. .050±.010 long travel

Materials and Finishes

Bushing: Zinc Diecast, Cadmium Plated per QQP-416, Class II, Type II

Shaft: Aluminum

Detent Cover: Powered Metal per SS-316N1-25

Through Bolts: 305 Stainless Steel

Through Bolts Nuts: 305 Stainless Steel

Shaft Travel Springs: Carbon Steel, Oil Dip Finish

Detent Ball: Stainless Steel

Detent Spring: Tinned Music Wire

Spacer/Push Dome Retainer: Ryton R-4

Push Actuator: Zytel 70G33L

Snap Dome: Stainless Steel

Printed Circuit Boards: Nema Grade FR4, Double Clad with Copper, Plated with Gold over Nickel

Infrared Light Emitting Diode Chips:

Gallium Aluminum Arsenide

Silicon Phototransistor Chips: Gold and Aluminum Alloys

Resistor: Metal Oxide on Ceramic Substrate

Solder Pins: Brass, Plated with Tin

Code Rotor: Delrin 100

Code Housing: Hiloy-610

Pull Dome Retainer: Ryton R-4

Pull Actuator: Polyurethane, Isoplast 101 LGF40 Blk

Cover: Ryton R-4

Cable: Copper Standard with Topcoat in PVC Insulation (Cabled Versions Only)

Connector: PA4.6 with Tin over Nickel Plated Phosphor Bronze (Cable/Connector Versions)

Label: TT406 Thermal Transfer Cast Film

Solder: Sn/Ag/Cu, lead-free, no clean

Lubricating Grease: Nye Nyogel 774L

Mounting Hex Nut: Tin/Zinc Over 1/2 Hard Brass

Lockwasher: 8-18 Stainless Steel, Passivate Finish

Pin Header: Hi-Temp Glass Filled Thermoplastic UL94V-0, Phosphor Bronze (Pinned Versions Only)

ORDERING INFORMATION



Series

Angle of Throw: 22 = 22.5° For Code Change and 16 Detent Positions.

11 = 11.25° For Code Change and 32 Detent Positions.

Push/Pull-Button Travel: S = Standard Travel (.030" Both Directions). L = Long Travel (.050" Both Directions)

Push/Pull Option: P = Pull-Button Only. PP = Push and Pull-Button

Termination: C = .050" Pitch Ribbon Cable with Connector

S = .050" Pitch Ribbon Cable with Stripped End

P = .050" Pitch Pin Header

Cable Termination: 040 = 4.0in. Cable is terminated with Amp Connector P/N 215083-6.

See Amp Mateability Guide for mating connector details.

*Eliminate cable length if ordering pins (Ex: 62B22-SP-P)

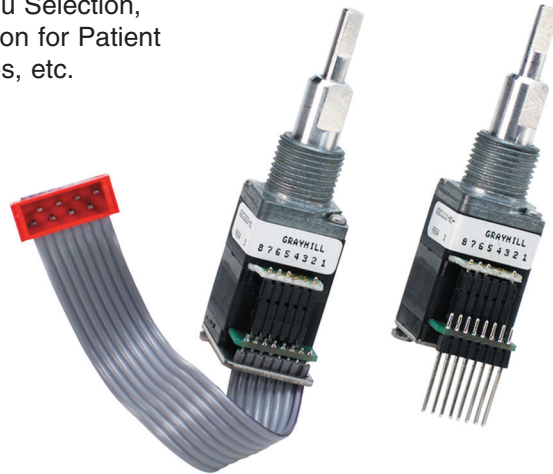
SERIES 62C Concentric Shaft

FEATURES

- Economical Size
- Combined Functionality
- Optically Coupled for More than a Million Cycles of Operations
- Optional Integral Pushbutton
- Compatible with CMOS, TTL, and HCMOS Logic
- Available with 12, 16, 24, and 32 Detent Positions for Each Code Section
- Choices of Cable Length and Terminations
- Available in 3.3 Volt Input.
(Contact Grayhill for details)

APPLICATIONS

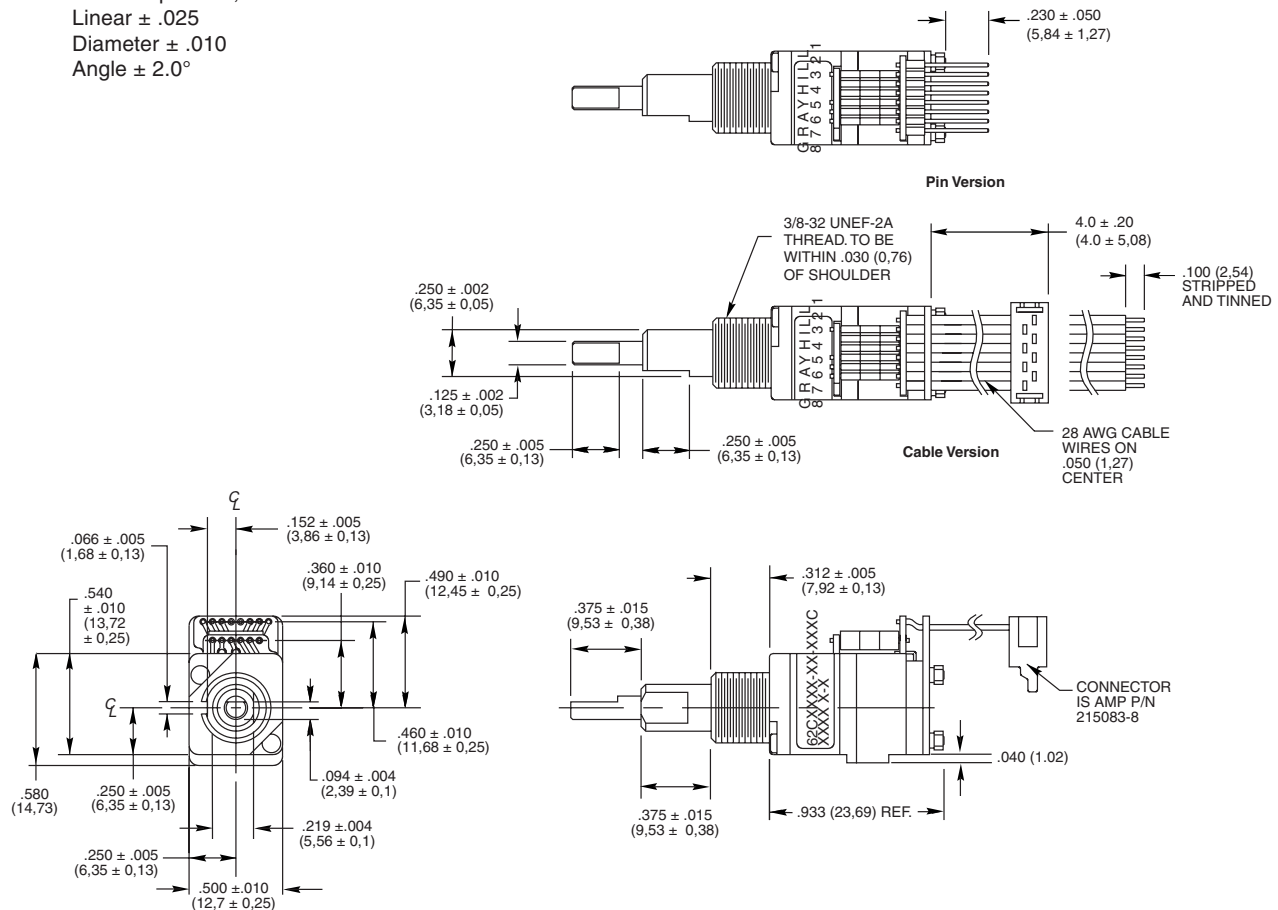
- Used to Set Radio Frequency, Drill Depth, RPM, Menu Selection, Parameter Selection for Patient Monitoring Devices, etc.



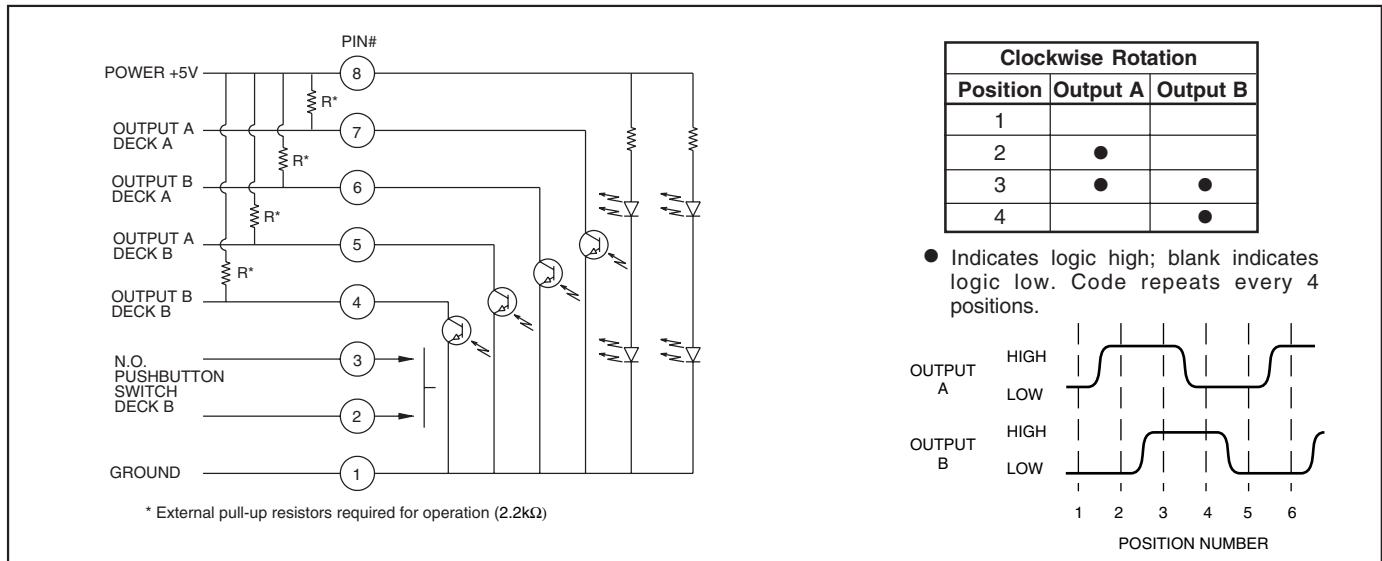
DIMENSIONS In inches (and millimeters)

Unless otherwise specified, standard tolerance are:

Linear $\pm .025$
Diameter $\pm .010$
Angle $\pm 2.0^\circ$



CIRCUITRY, TRUTH TABLE AND WAVEFORM: Standard Quadrature 2-Bit Code



SPECIFICATIONS

Pushbutton Switch Ratings

Rating: 5 Vdc, 10 mA, resistive
Contact Resistance: less than 10 ohms (TTL or CMOS compatible)
Voltage Breakdown: 250 Vac between mutually insulated parts
Contact Bounce: less than 4 mS at make, less than 10 mS at break
Actuation Life: 3,000,000 operations
Actuation Force: 1000 ± 300 grams
Pushbutton Travel: .010 / .025 inch

Encoder Ratings

Coding: 2-bit quadrature coded output
Operating Voltage: 5 ± .25 Vdc
Supply Current: 50 mA maximum at 5 Vdc
Logic High: 3.8V minimum
Logic Low: 0.8V maximum
Logic Rise and Fall Times: less than 30 mS
Operating Torque: 2.0 in-oz ± 1.4 in-oz initially

Rotational Life: more than 1,000,000 cycles of operation (1 cycle = 360° rotation and return)
Shaft Push Out Force: 45 lbs minimum
Mounting Torque: 15 in-lbs maximum
Operating Speed: 100 RPM maximum
Axial Shaft Play: .010 maximum for each shaft

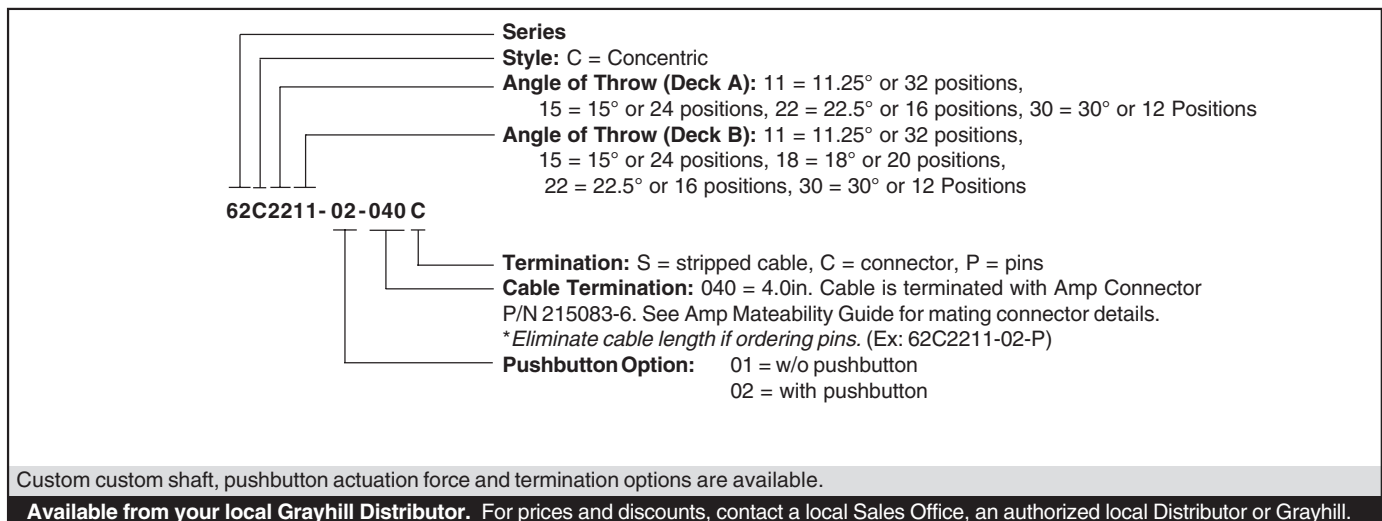
Environmental Ratings

Operating Temperature Range: -40°C to 85°C
Storage Temperature Range: -55°C to 100°C
Relative Humidity: 90–95% at 40°C for 96 hours
Vibration Resistance: Harmonic motion with amplitude of 15g, within a varied 10 to 2000 Hz frequency for 12 hours per MIL-STD-202, Method 204
Shock Resistance: Test 1: Tested at 100g for 6 mS, half sine, 12.3 ft/s Test 2: 100g for 6 mS, sawtooth, 9.7 ft/s

Materials and Finishes

Bushing: Zinc casting
Shaft: Aluminum
Shaft Retaining Ring: Stainless steel
Detent Spring: Stainless steel
Printed Circuit Board: NEMA grade FR-4
Terminals: Brass, tin-plated
Mounting Hardware: One brass, nickel-plated nut and lockwasher supplied with each switch. (Nut is 0.094 inches thick by 0.562 inches across flats)
Rotor: Thermoplastic
Code Housing: Reinforced thermoplastic
Pushbutton Dome: Stainless steel
Pushbutton Housing: Thermoplastic
Pushbutton Contact: Brass, nickel-plated
Dome Retaining Disk: Thermoplastic
Strain Relief: Stainless steel
Cable: 28 AWG, stranded/top coated wire, PVC coated on .050 centers (cable version only)
Header Pins: Phosphor bronze, tin-plated
Insulator: Glass-filled polyester
Spacer: Zinc casting

ORDERING INFORMATION



SERIES 62F

1/2" Package, Lighted Shaft

FEATURES

- Integrated Self-Lighting System for Knob Illumination
- 1 Million Rotational Cycles
- 1/2" Package
- Compatible with CMOS, TTL and HCMOS Logic
- Optional Integral Pushbutton
- Choices of Cable Length and Terminations
- Other Customized Solutions Available

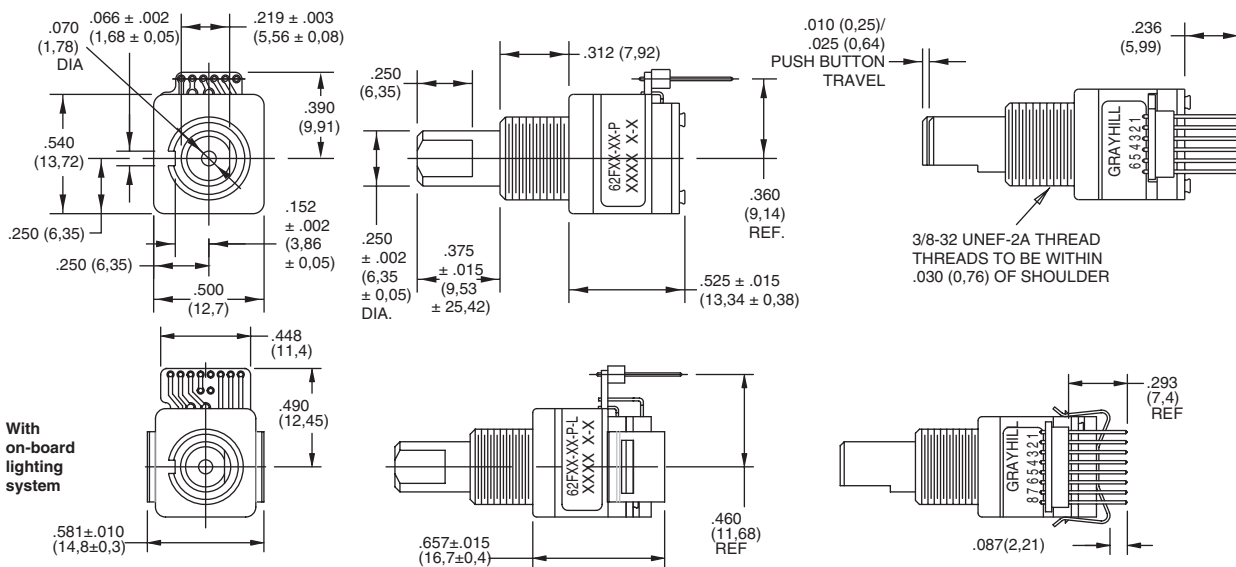
APPLICATIONS

- Global Positioning/Driver Information Systems
- Medical Equipment
- Cockpit Controls
- Mixing Boards

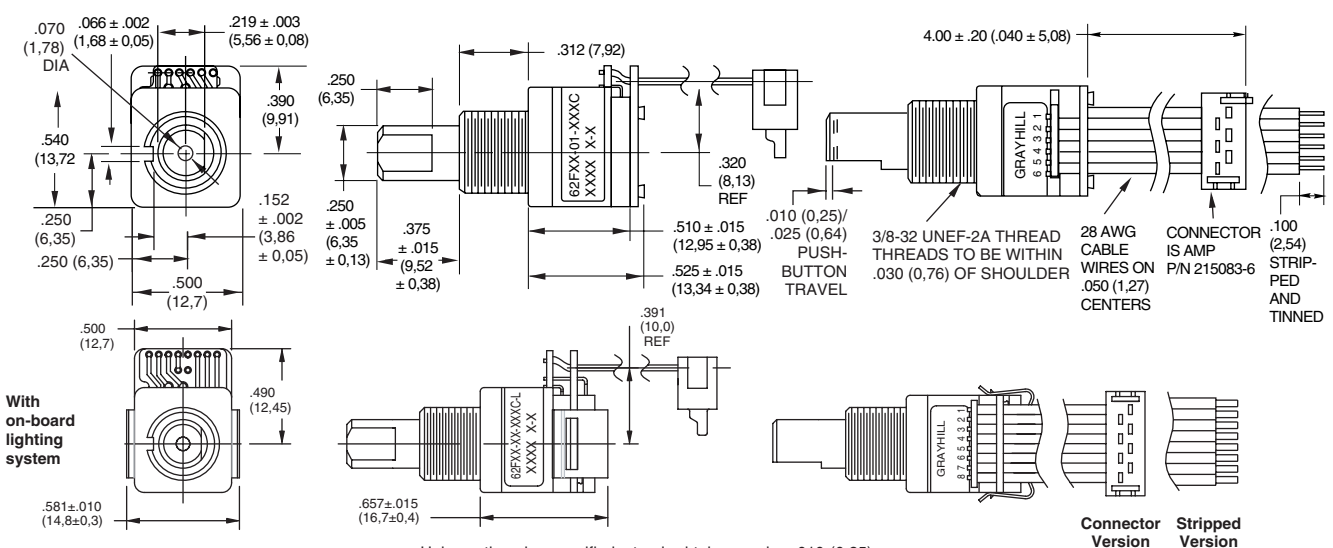


DIMENSIONS In inches (and millimeters)

Pin Version

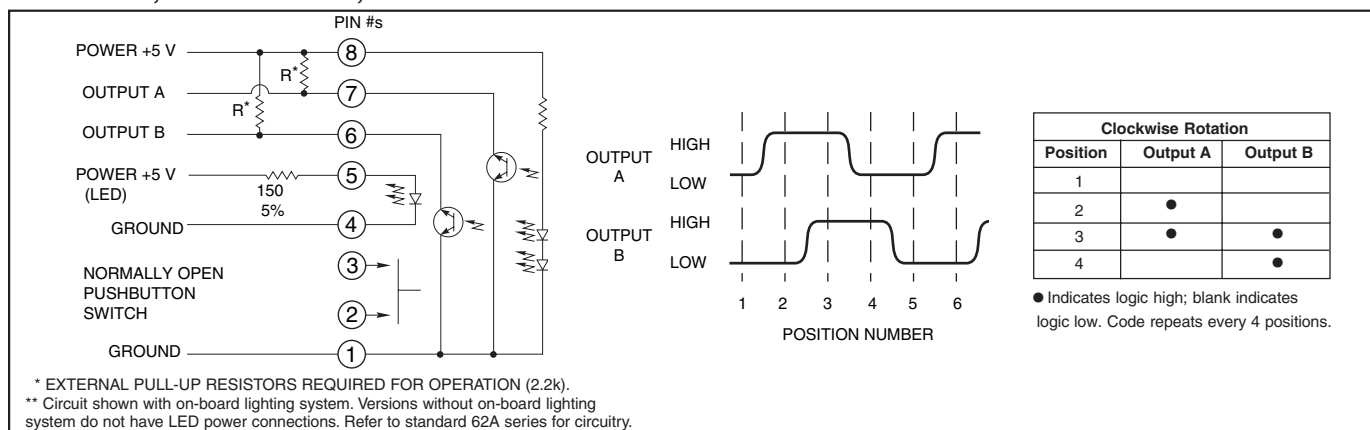


Cable Version



Unless otherwise specified, standard tolerance is ±.010 (0.25).

CIRCUITRY, TRUTH TABLE, AND WAVEFORM Standard Quadrature 2-Bit Code



SPECIFICATIONS

Pushbutton Switch Ratings

Rating: 5 Vdc, 10 mA, resistive

Contact Resistance: less than 10 ohms (TTL or CMOS compatible)

Pushbutton Life: 3 million actuations minimum

Contact Bounce: less than 4 mS at make and less than 10 mS at break

Actuation Force: 500 ±300 grams

Pushbutton Travel: .010/.025 inch

Switch Ratings

Coding: 2-bit quadrature coded output

Operating Voltage: 5.0 ±.25 Vdc

Voltage Breakdown: 250 Vac between mutually insulated parts

Supply Current: 30 mA maximum

Logic Output Characteristics:

Logic High: 3.8 Vdc minimum

Logic Low: 0.8 Vdc maximum

Rotational Life: 1,000,000 cycles minimum (One cycle is a rotation through all positions and a full return)

Minimum Sink Current: 2.0 mA

Power Consumption: 150mW maximum

Optical Rise and Fall Times: less than 30 mS maximum

Operating Torque:

Detent: 2.0 ±1.4 in-oz initially

Non-detent: less than 1.5 in-oz initially

Shaft Push Out Force: 45 lbs minimum

Mounting Torque: 15 in-lbs maximum

Terminal Strength: 15 lbs cable pull-out force minimum

Operating Speed: 100 RPM maximum

Axial Shaft Play: .010 maximum

Environmental Ratings

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

Storage Temperature Range: -55°C to 100°C

Relative Humidity: 90–95% at 40°C for 96 hours

Vibration Resistance: Harmonic motion with amplitude of 15G's, within a varied 10 to 2000 Hz frequency for 12 hours per MIL-STD-202, Method 204

Mechanical Shock: Test 1: 100G for 6 mS, half sine, 12.3 ft/s; Test 2: 100G for 6 mS, sawtooth, 9.7 ft/s

Materials and Finishes

Code Housing: Reinforced thermoplastic

Shaft: Aluminum

Bushing: Zinc casting

Shaft Retaining Ring: Stainless steel

Detent Spring: Stainless steel

Printed Circuit Boards: NEMA grade FR-4

gold over nickel or palladium

Terminals: Brass, tin-plated

Mounting Hardware: One brass, nickel-plated nut and stainless steel lockwasher supplied with each switch. Nut is 0.094 inches thick by 0.562 inches across flats

Rotor: Thermoplastic

Code Housing: Thermoplastic

Pushbutton Dome: Stainless steel

Dome Retaining Disk: Thermoplastic

Pushbutton Housing: Thermoplastic

Phototransistor: Planar Silicon NPN

Pushbutton Contact: Brass, nickel-plated

Flex Cable: 28 AWG, stranded/top coated wire, PVC coated on .050 or .100" centers (cabled version)

Header Pins: Phosphor bronze, tin-plated

Spacer: ABS

Backplate/Strain Relief: Stainless steel

Lockwasher: Stainless steel

Light Pipe: Thermoplastic

LED Housing: Thermoplastic

OPTIONS

Contact Grayhill for custom terminations, shaft and bushing configurations, and resolutions. Control knobs are also available.

ORDERING INFORMATION

Series

Angle of Throw: Detent

11 = 11.25° or 32 pos.	Non-detent
15 = 15° or 24 positions	01 = 11.25° or 32 positions
18 = 18° or 20 pos.	05 = 15° or 24 positions
22 = 22.5° or 16 positions	08 = 18° or 20 positions
	02 = 22.5° or 16 positions

Pushbutton Option: 01 = w/o pushbutton, 02 = with pushbutton

LED: blank = no LED, L = supplied with LED

Termination: S = Stripped cable; S-L = Stripped cable, LED; C = Connector; C-L = Connector, LED; P = Pin; P-L = Pin, LED

Cable Termination: 040 = 4.0in. Cable is terminated with Amp P/N 215083-6. See Amp Mateability guide for mating connector details.

*Eliminate cable length if ordering pins. (Ex: 62A22-02-P)

Custom materials, styles, colors, and markings are available. Control knobs available.

Available from your local Grayhill Component Distributor. For prices and discounts, contact a local Sales Office, an authorized local Distributor, or Grayhill.

SERIES 62H

High Torque, Concentric Shaft

FEATURES

- High Rotational Torque Provides Positive Tactile Feedback
- Optically Coupled for More than a Million Cycles
- Optional Integral Pushbutton
- Compatible with CMOS, TTL and HCMOS Logic

- Available in 8, 12 and 16 Detent Positions
- Choice of Cable Length and Terminations

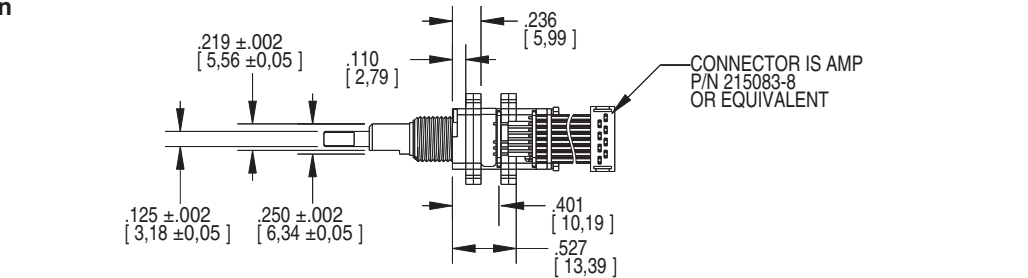
APPLICATIONS

- Avionics

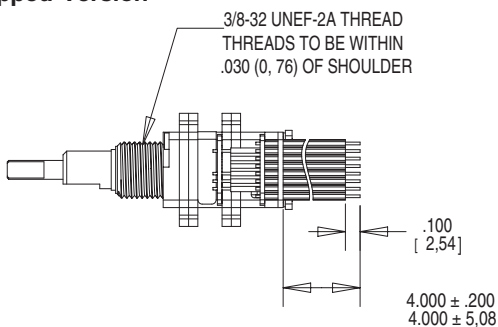


DIMENSIONS In inches (and millimeters)

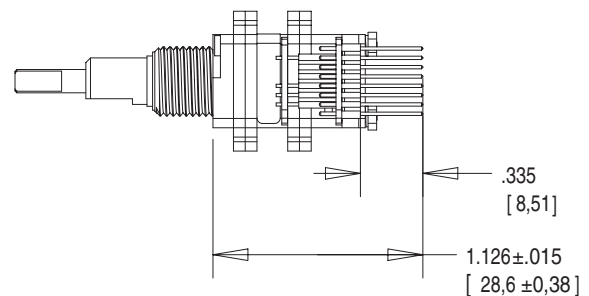
Cable Version



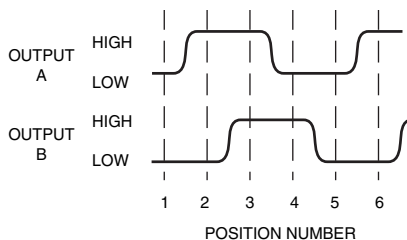
Stripped Version



Pin Version



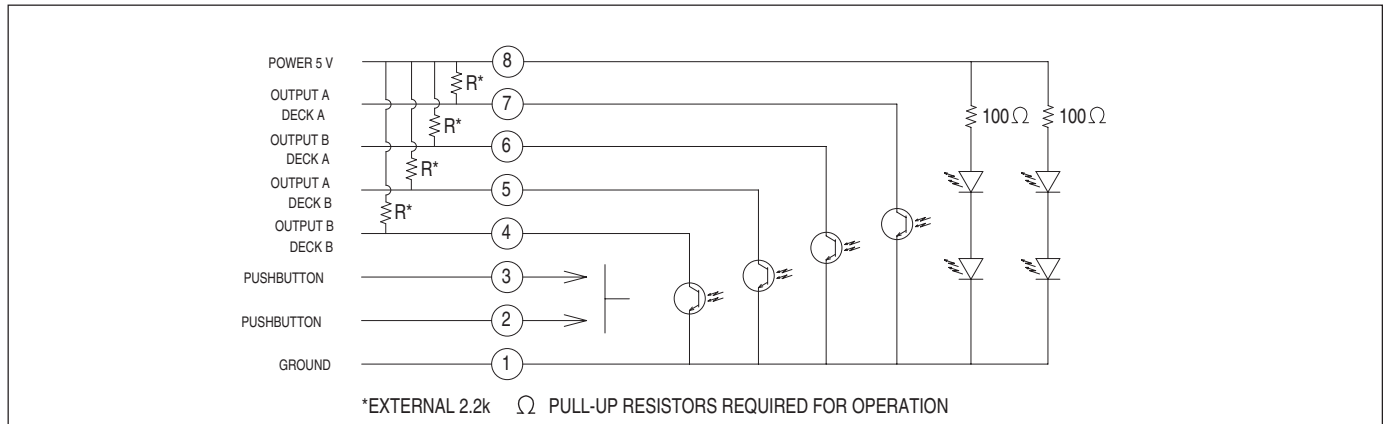
WAVEFORM AND TRUTH TABLE



Clockwise Rotation		
Position	Output A	Output B
1		
2	●	
3	●	●
4		●

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

CIRCUITRY



SPECIFICATIONS

Pushbutton Switch Ratings

Rating: at 5 Vdc, 10 mA, resistive
Contact Resistance: less than 10 ohms (TTL or CMOS compatible)

Pushbutton Life: 3 million actuations minimum

Voltage Breakdown: 250 Vac between mutually insulated parts

Contact Bounce: less than 4 mS at make and less than 10 mS at break

Actuation Force: 1100 $\pm$ 300g

Shaft Travel: .020 $\pm$.010 inch

Encoder Ratings

Coding: 2-bit quadrature coded output

Operating Voltage: 5.0 $\pm$.25 Vdc

Supply Current: 50 mA maximum@5.0 Vdc

Logic Output Characteristics:

Logic High: 3.0 Vdc minimum

Logic Low: 1.0 Vdc maximum

Mechanical Life: 1,000,000 cycles minimum (One cycle is a rotation through all positions and a full return)

Minimum Sink Current: 2.0 mA for 5 Vdc

Power Consumption: 150mW maximum

Output: open collector phototransistor

Logic Rise and Fall Times: less than 30 mS maximum

Operating Torque: 5.0 in-oz $\pm$ 1.5 in-oz initial

Shaft Push Out Force: 45 lbs minimum

Mounting Torque: 15 in-lbs maximum

Terminal Strength: 15 lbs cable pull-out force minimum

Operating Speed: 100 RPM maximum

Environmental Ratings

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

Storage Temperature Range: -55°C to 100°C

Vibration Resistance: Harmonic motion with amplitude of 15G, within a varied 10 to 2000 Hz frequency for 12 hours

Mechanical Shock: Test 1: 100G, 6 mS, half sine, 12.3 ft/s; Test 2: 100G, 6 mS, sawtooth, 9.7 ft/s

Relative Humidity: 90–95% at 40°C for 96 hours

Materials and Finishes

Code Housing: Reinforced thermoplastic

Shafts: Stainless Steel

Bushing: Zinc casting

Pushbutton Actuator: Zytel 70G33L

Shaft Retaining Rings: Stainless steel

Detent Spring: Stainless steel

Detent Ball: Stainless steel

Detent Section: Hiloy 610

Printed Circuit Boards: NEMA grade FR-4 gold over nickel or palladium

Terminals: Brass, tin-plated

Mounting Hardware: One brass, nickel-plated nut and stainless steel lockwasher supplied with each switch. Nut is 0.094 inches thick by 0.562 inches across flats

Rotor: Thermoplastic

Pushbutton Dome: Stainless steel

Phototransistor: Planar Silicon NPN

Infrared Emitter: Gallium aluminum arsenide

Flex Cable: 28 AWG, stranded/top coated wire, PVC coated on .050 or .100" centers (cabled version)

Header Pins: Brass, tin-plated

Spacer: Hiloy 610

Shim: Stainless Steel

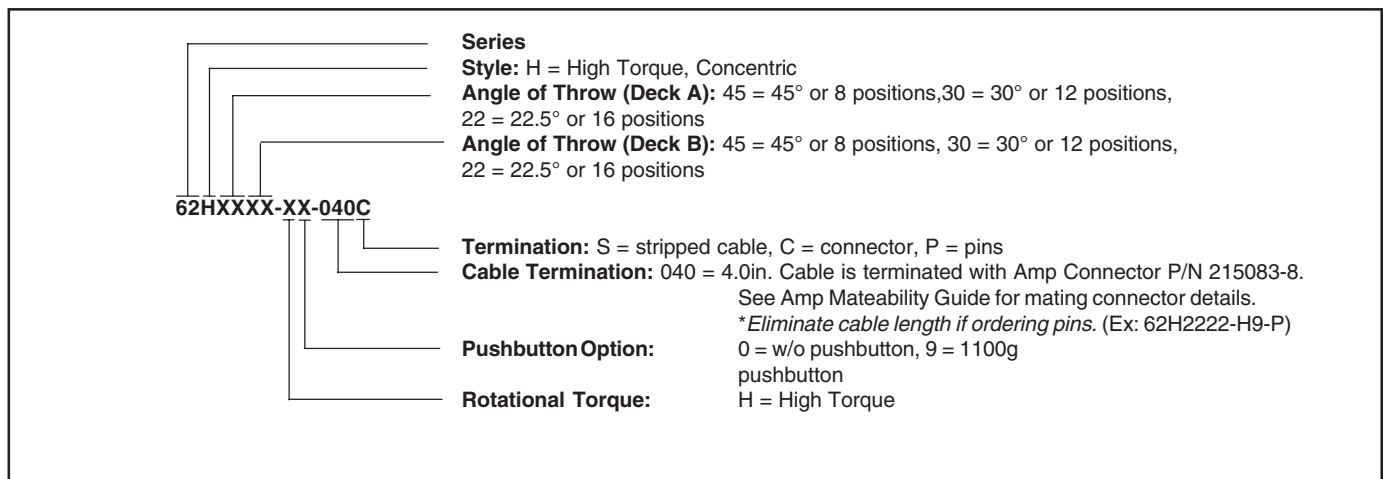
Backplate/Strain Relief: Stainless steel

Lockwashers: Stainless steel

Hex Nuts: Stainless steel

Studs: Stainless steel

ORDERING INFORMATION



SERIES 62HN

High Torque, Non-Turn
Concentric Shaft

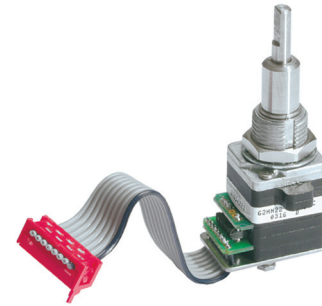
FEATURES

- High Rotational Torque Provides Positive Tactile Feedback
- Non-turn Pushbutton to Ensure Pushbutton Text and Orientation
- Optically Coupled for More than a Million Cycles
- Separate Pushbutton Function

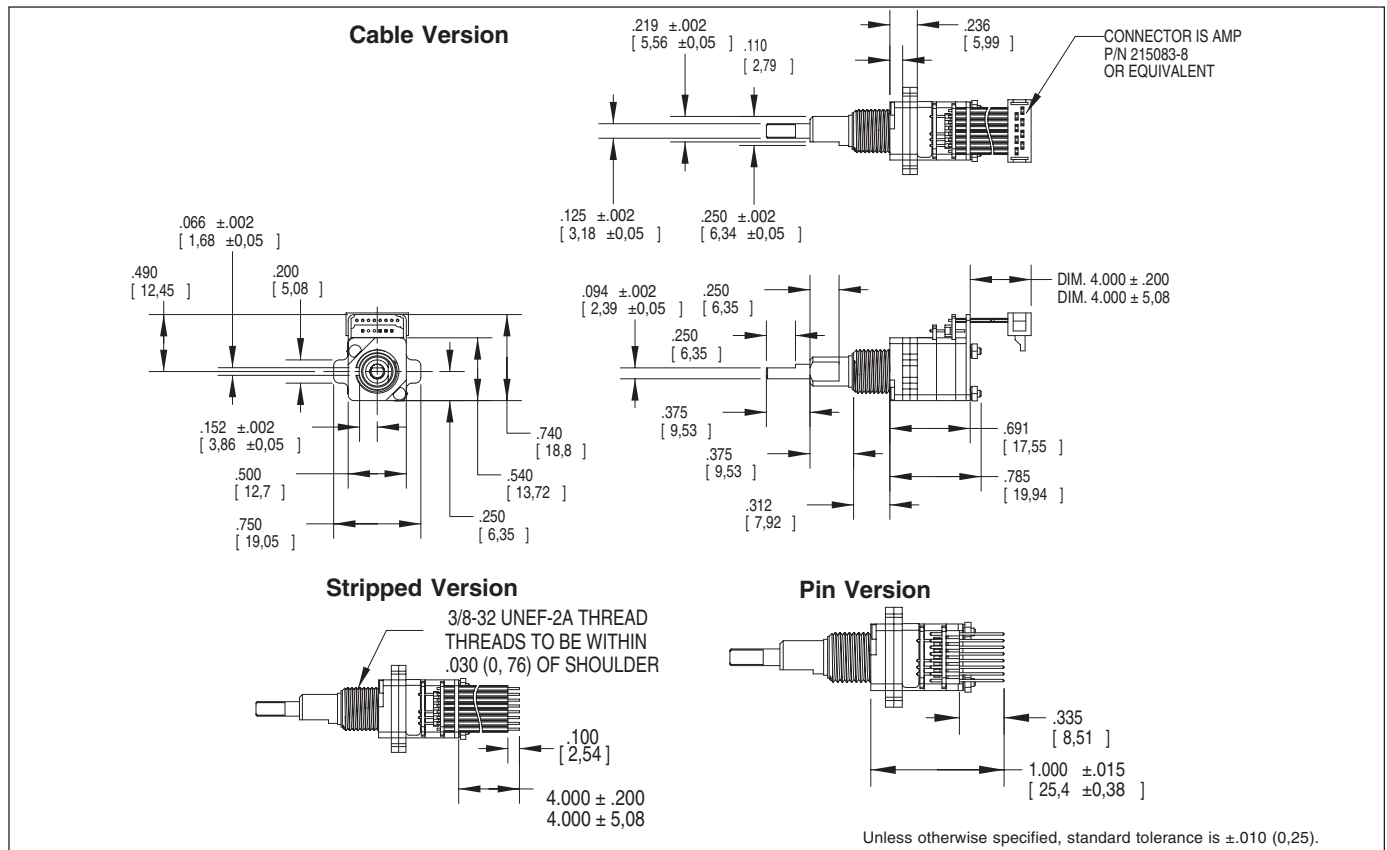
- Compatible with CMOS, TTL and HCMOS Logic
- Available in 8, 12 and 16 Detent Positions
- Choice of Cable Length and Terminations

APPLICATIONS

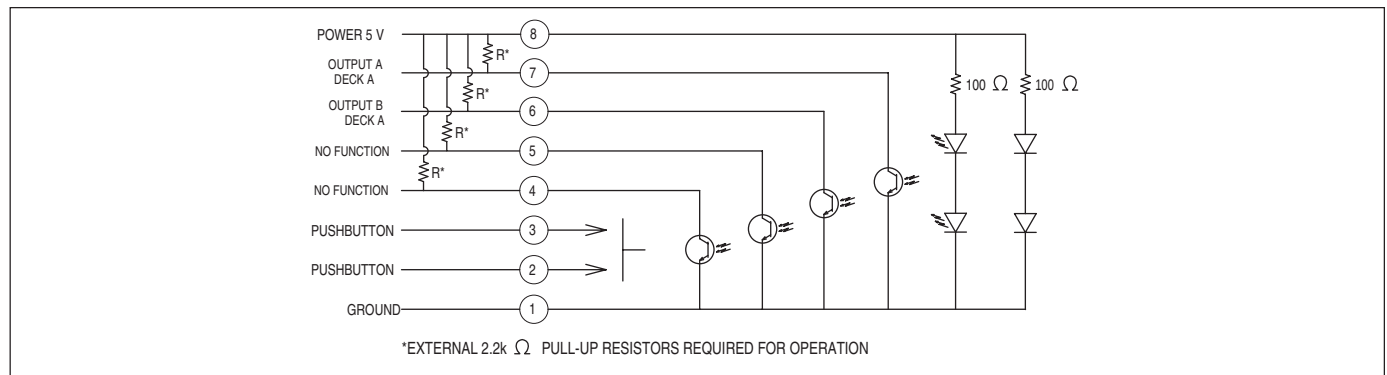
- Avionics



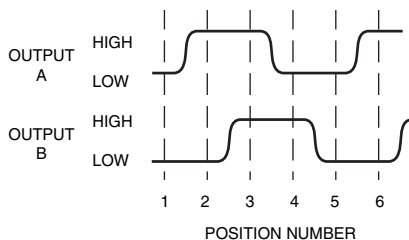
DIMENSIONS In inches (and millimeters)



CIRCUITRY



WAVEFORM AND TRUTH TABLE



Clockwise Rotation		
Position	Output A	Output B
1		
2	●	
3	●	●
4		●

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

SPECIFICATIONS

Pushbutton Switch Ratings

Rating: at 5 Vdc, 10 mA, resistive

Contact Resistance: less than 10 ohms (TTL or CMOS compatible)

Pushbutton Life: 3 million actuations minimum

Voltage Breakdown: 250 Vac between mutually insulated parts

Contact Bounce: less than 4 mS at make and less than 10 mS at break

Actuation Force: 1100 ±300g

Encoder Ratings

Coding: 2-bit quadrature coded output

Operating Voltage: 5.0 ±.25 Vdc

Supply Current: 30 mA maximum @ 5.0 Vdc

Logic Output Characteristics:

Logic High: 3.0 Vdc minimum

Logic Low: 1.0 Vdc maximum

Mechanical Life: 1,000,000 cycles minimum (One cycle is a rotation through all positions and a full return)

Minimum Sink Current: 2.0 mA for 5 Vdc

Power Consumption: 150mW maximum

Output: open collector phototransistor

Logic Rise and Fall Times: less than 30 mS maximum

Operating Torque: 5.0 in-oz +/- 1.5 in-oz initial

Shaft Push Out Force: 45 lbs minimum

Mounting Torque: 15 in-lbs maximum

Terminal Strength: 15 lbs cable pull-out force minimum

Operating Speed: 100 RPM maximum

Environmental Ratings

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

Storage Temperature Range: -55°C to 100°C

Vibration Resistance: Harmonic motion with amplitude of 15G, within a varied 10 to 2000 Hz frequency for 12 hours

Mechanical Shock: Test 1: 100G, 6 mS, half sine, 12.3 ft/s; Test 2: 100G, 6 mS, sawtooth, 9.7 ft/s

Relative Humidity: 90–95% at 40°C for 96 hours

Materials and Finishes

Code Housing: Reinforced thermoplastic

Shafts: Stainless Steel

Bushing: Zinc casting

Shaft Retaining Rings: Stainless steel

Detent Spring: Stainless steel

Detent Ball: Stainless steel

Detent Section: Hiloy 610

Printed Circuit Boards: NEMA grade FR-4 gold over nickel or palladium

Terminals: Brass, tin-plated

Mounting Hardware: One brass, nickel-plated nut and stainless steel lockwasher supplied with each switch. Nut is 0.094 inches thick by 0.562 inches across flats

Rotor: Thermoplastic

Pushbutton Dome: Stainless steel

Phototransistor: Planar Silicon NPN

Infrared Emitter: Gallium aluminum arsenide

Flex Cable: 28 AWG, stranded/top coated wire, PVC coated on .050 centers (cabled version)

Header Pins: Brass, tin-plated

Spacer: Hiloy 610

Shim: Stainless Steel

Endcap: Thermoplastic

Non-turn Pin: Stainless steel

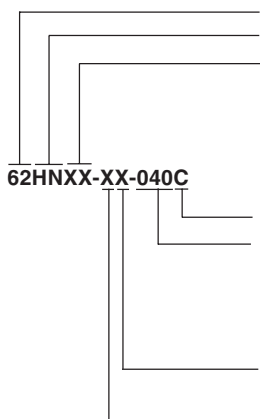
Backplate/Strain Relief: Stainless steel

Lockwashers: Stainless steel

Hex Nuts: Stainless steel

Studs: Stainless steel

ORDERING INFORMATION



Series

Style: HN = High Torque, Concentric, Non-Turn

Angle of Throw: 45 = 45° or 8 positions, 30 = 30° or 12 positions, 22 = 22.5° or 16 positions

Termination: S = stripped cable, C = connector, P = pins

Cable Termination: 040 = 4.0in. Cable is terminated with Amp Connector P/N 215083-6. See Amp Mateability Guide for mating connector details. *Eliminate cable length if ordering pins. (Ex: 62HN22-H9-P)

Pushbutton Option: 0 = w/o pushbutton, 9 = 1100g pushbutton

Rotational Torque: H = High Torque

Custom materials, styles, colors, and markings are available. Control knobs available.

Available from your local Grayhill Component Distributor.

For prices and discounts, contact a local Sales Office, an authorized local Distributor, or Grayhill.

SERIES 62HR

1/2" Package, Redundant Circuitry
High Torque

FEATURES

- Redundant Circuitry
- 1 Million Rotational Cycles
- Compatible with CMOS, TTL and HCMOS Logic
- Optional Integral Pushbutton
- Available in 12, 16, 24, and 32 Detent Positions
- Choices of Cable Length and Terminations
- Ideal for Critical Applications

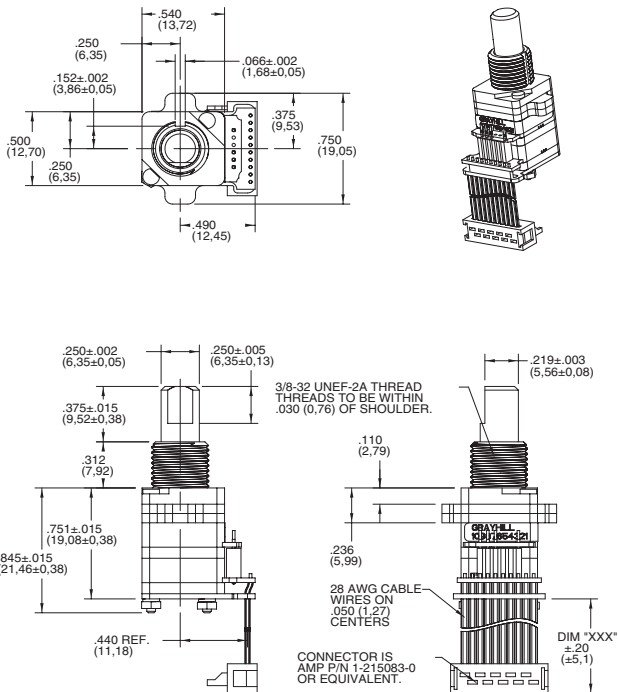
APPLICATIONS

- Cockpit Controls
- Medical Equipment



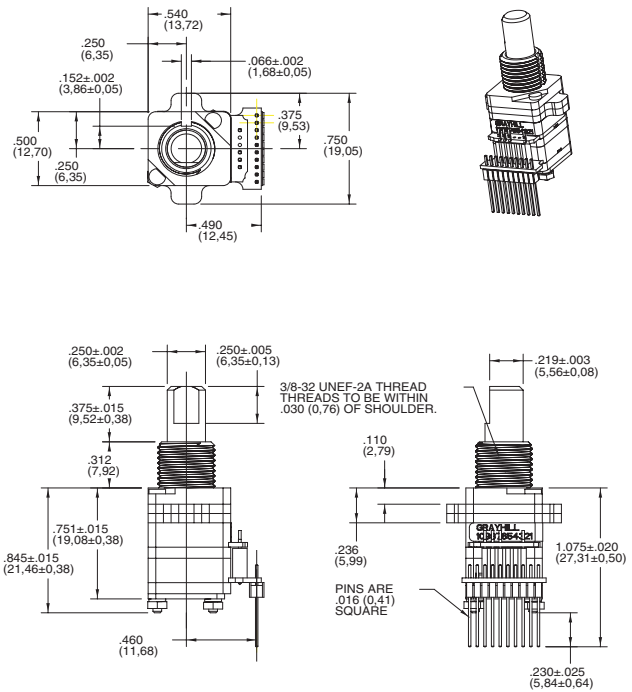
DIMENSIONS In inches (and millimeters)

SERIES 62HR WITH .050 CENTER RIBBON CABLE



UNLESS OTHERWISE SPECIFIED, STANDARD TOLERANCE IS $\pm .010$ (0,25).

SERIES 62HR WITH .050 CENTER TERMINAL PINS

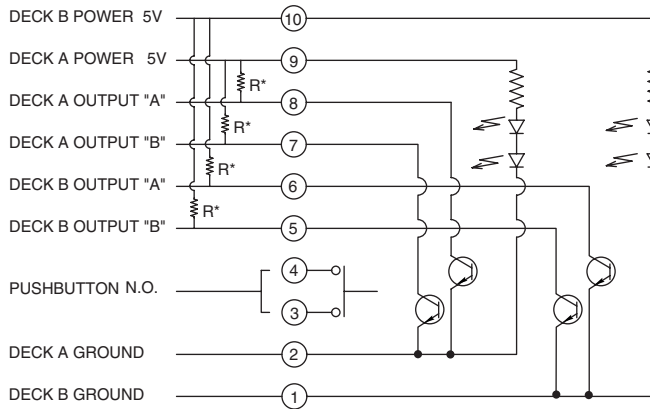


UNLESS OTHERWISE SPECIFIED, STANDARD TOLERANCE IS $\pm .010$ (0,25).

CIRCUITRY, TRUTH TABLE, AND WAVEFORM

Standard Quadrature 2-Bit Code

Switch Schematic



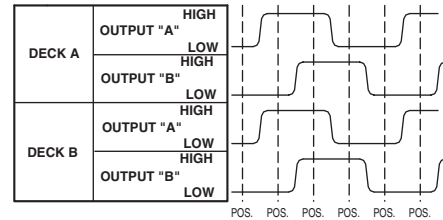
* 2.2k EXTERNAL PULL-UP RESISTORS REQUIRED FOR OPERATION

Truth Table (CW Rotation)

POSITION	DECK A		DECK B	
	OUTPUT 'A'	OUTPUT 'B'	OUTPUT 'A'	OUTPUT 'B'
1				
2	●		●	
3	●	●	●	●
4		●		●

● INDICATES LOGIC HIGH. BLANK INDICATES LOGIC LOW. CODE REPEATS EVERY 4 POSITIONS

Wave Form (CW Rotation)



SPECIFICATIONS

Pushbutton Switch Ratings

Rating: at 5 Vdc, 10 mA, resistive
Contact Resistance: less than 10 ohms (TTL or CMOS compatible)
Pushbutton Life: 3 million actuations minimum
Voltage Breakdown: 250 Vac between mutually insulated parts
Contact Bounce: less than 4 mS at make and less than 10 mS at break
Actuation Force: 1100 ±300g

Encoder Ratings

Coding: 2-bit quadrature coded output
Operating Voltage: 5.0 ±.25 Vdc
Supply Current: 30 mA maximum@5.0 Vdc
Logic Output Characteristics:
Logic High: 3.0 Vdc minimum
Logic Low: 1.0 Vdc maximum
Mechanical Life: 1,000,000 cycles minimum (One cycle is a rotation through all positions and a full return)
Minimum Sink Current: 2.0 mA for 5 Vdc
Power Consumption: 150mW maximum
Output: open collector phototransistor
Logic Rise and Fall: less than 30 mS maximum

Operating Torque: 5.0 in-oz +/- 1.5 in-oz initial
Shaft Push Out Force: 45 lbs minimum
Mounting Torque: 15 in-lbs maximum
Terminal Strength: 15 lbs cable pull-out force minimum
Operating Speed: 100 RPM maximum

Environmental Ratings

Operating Temperature Range: -40°C to 85°C
Storage Temperature Range: -55°C to 100°C
Vibration Resistance: Harmonic motion with amplitude of 15G, within a varied 10 to 2000 Hz frequency for 12 hours
Mechanical Shock: Test 1: 100G, 6 mS, half sine, 12.3 ft/s; Test 2: 100G, 6 mS, sawtooth, 9.7 ft/s
Relative Humidity: 90–95% at 40°C for 96 hours

Materials and Finishes

Code Housing: Reinforced thermoplastic
Shaft: Stainless Steel

Bushing: Zinc casting

Shaft Retaining Ring: Stainless steel

Detent Spring: Stainless steel

Detent Ball: Stainless steel

Detent Section: Hiloy 610

Printed Circuit Boards: NEMA grade FR-4 gold over nickel or palladium

Terminals: Brass, tin-plated

Mounting Hardware: One brass, nickel-plated nut and stainless steel lockwasher supplied with each switch. Nut is 0.094 inches thick by 0.562 inches across flats

Rotor: Thermoplastic

Pushbutton Dome: Stainless steel

Phototransistor: Planar Silicon NPN

Infrared Emitter: Gallium aluminum arsenide

Flex Cable: 28 AWG, stranded/top coated wire, PVC coated on .050" centers (cabled version)

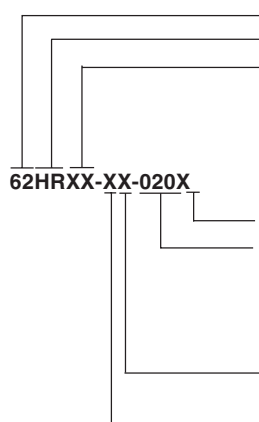
Header Pins: Brass, tin-plated

Spacer: Hiloy 610

Shim: Stainless Steel

Backplate/Strain Relief: Stainless steel

ORDERING INFORMATION



Series

Style: HR = High Torque, Redundant

Angle of Throw: 45 = 45° or 8 positions, 30 = 30° or 12 positions, 22 = 22.5° or 16 positions

Termination: S = stripped cable, C = connector, P = pins

Cable Length: 020 = 2.0 inches. Cable is terminated with Amp Connector P/N 1-215083-0. See Amp Mateability Guide for mating connector details. *Eliminate cable length if ordering pins. (Ex: 62HR22-H9-P)

Pushbutton Option: 0 = w/o pushbutton, 9 = 1100g pushbutton

Rotational Torque: H = High Torque

SERIES 62HS

High Torque

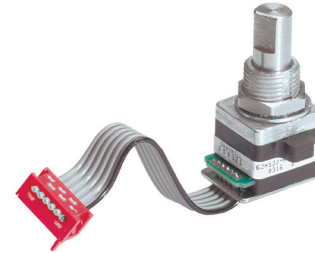
FEATURES

- High Rotational Torque Provides Positive Tactile Feedback
- Optically Coupled for More than a Million Cycles
- Optional Integral Pushbutton
- Compatible with CMOS, TTL and HCMOS Logic

- Available in 8, 12 and 16 Detent Positions
- Choice of Cable Length and Terminations

APPLICATIONS

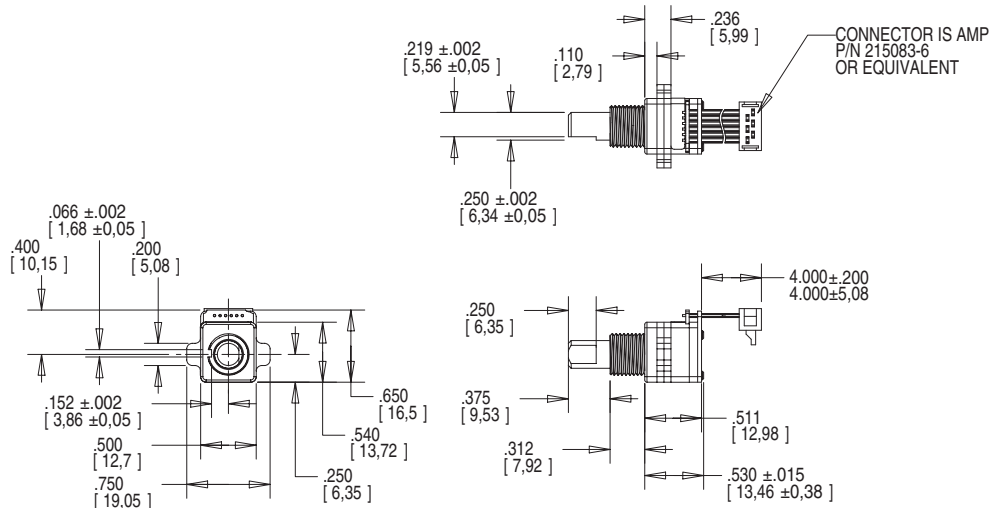
- Avionics



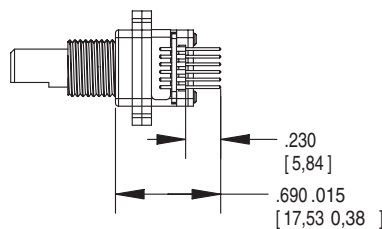
DIMENSIONS In inches (and millimeters)

Cable Version

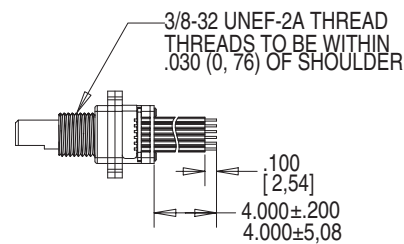
Unless otherwise specified, standard tolerance is ± 0.010 (0,25).



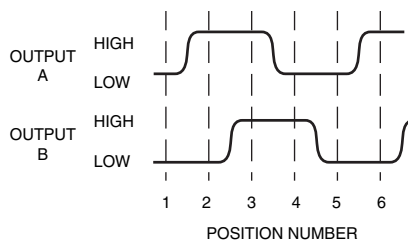
Pin Version



Stripped Version



WAVEFORM AND TRUTH TABLE



Clockwise Rotation		
Position	Output A	Output B
1		
2	●	
3	●	●
4		●

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

SERIES 62M Magnetic Detent

FEATURES

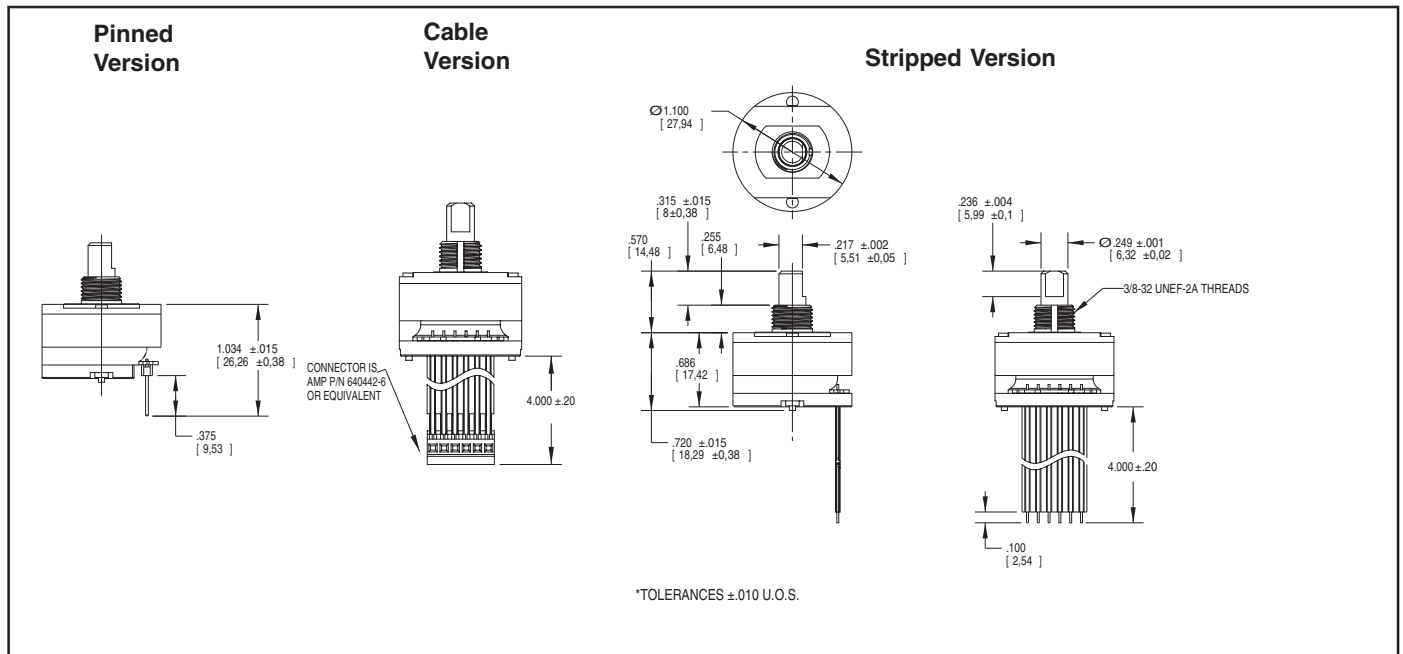
- Ultra Smooth Magnetic Detent
- 10 Million Rotational Cycles, Ten Times the Life of a Mechanical Detent System
- Optional Integrated Pushbutton
- Available in 24 Positions
- Choice of Cable Lengths

Applications

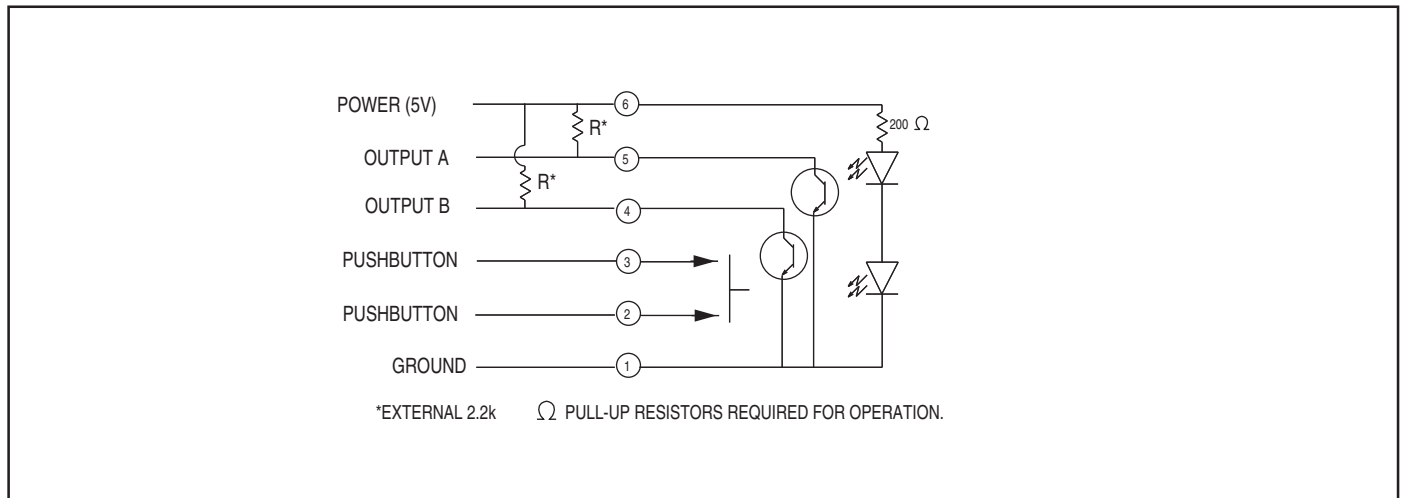
- Medical
- Audio
- Instrumentation



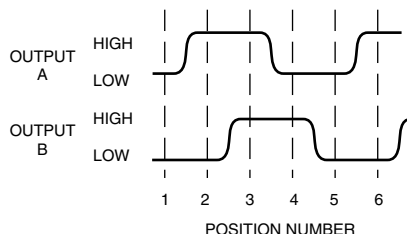
DIMENSIONS In inches (and millimeters)



SWITCH SCHEMATIC



WAVEFORM AND TRUTH TABLE



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

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

SPECIFICATIONS

Environmental Specifications

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

Storage Temperature Range: -55° C to 100° C

Humidity: 96 hours at 90-95% humidity at 40° C

Mechanical Vibration: Harmonic motion with amplitude of 15 g, within a varied frequency of 10 to 2000 Hz

Mechanical Shock:

Test 1: 100 g for 6 ms half-sine wave with a velocity change of 12.3 ft/sec

Test 2: 100 g for 6 ms sawtooth wave with a velocity change of 9.7 ft/sec

Rotary Electrical and

Mechanical Specifications

Operating Voltage: 5.00±.25 Vdc

Supply Current: 30 mA maximum at 5 Vdc

Output: Open collector phototransistor, external pull-up resistors are required

Output Code: Two-bit quadrature, channel A leads channel B by 90° electrically during clockwise rotation of the shaft

Logic Output Characteristics:

Logic high signal shall be no less than 3.0 Vdc

Logic low signal shall be no greater than 1.0 Vdc

Minimum Sink Current: 2.0 mA

Power Consumption: 150 mW maximum

Mechanical Life: 10 million rotational cycles of operation. One cycle is a rotation through all positions and a full return

Tolerances: H=1.70 ± 1.00 in-oz, M=1.25 ± 0.75 in-oz, L=0.75 ± 0.5 in-oz

Mounting Torque: 15 in-oz maximum

Shaft Pull-Out Force: 45 lbs minimum

Terminal Strength: 15 lbs minimum terminal pull-out force for cable or header termination

Solderability: 95% free of pin holes and voids

Pushbutton Electrical and Mechanical Specifications

Rating: 10 mA at 5 Vdc

Contact Resistance: <10 ohms

Life: 3 million actuations minimum

Contact Bounce: <4 ms make, <10 ms break

Actuation Force: 2=200±75 grams, 3=300±90 grams, 4=510±150 grams

Shaft Travel: .25 ± .010 inches

Materials and Finishes

Bushing: Zinc Diecast, Cadmium Plated per QQP-416, Class II, Type II

Insert Molded into 25% Glass Reinforced Nylon Zytel FR-50

Shaft: NdFeB XE-3594 over Grilamid LV23H

Stator: Powdered Metal per F-0000-20

Through Bolts: 305 Stainless Steel

Through Bolts Nuts: Stainless Steel

Spacer Washer: Brass

Snap Dome: Stainless Steel

Printed Circuit Boards: Nema Grade FR4, Double Clad with Copper, Plated with Gold over Nickel

Infrared Light Emitting Diode Chips:

Gallium Aluminum Arsenide

Silicon Phototransistor Chips: Gold and Aluminum Alloys

Resistor: Metal Oxide on Ceramic Substrate

Solder Pins: Brass, Plated with Tin

Code Rotor: Acetal (Delrin 100)

Code Housing: Polyamide Polymer (Nylon 6/10 Alloy)

Backplate Strain Relief: Hiloy-610

Cable: Copper Standard with Topcoat in PVC Insulation (Cabled Versions Only)

Connector: PA4.6 with Tin Plated Copper Alloy (Cable/Connector Versions)

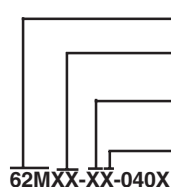
Label: TT406 Thermal Transfer Cast Film

Solder: Sn/Ag/Cu, Lead Free, No Clean

Mounting Hex Nut: Tin/Zinc Over 1/2 Hard Brass

Lockwasher: 8-18 Stainless Steel, Passivate Finish

Pin Header: Hi-Temp Glass Filled Thermoplastic UL94V-0, Phosphor Bronze (Pinned Versions Only)



Series

Angle of Throw: 15 = 15° for code change and 24 detent positions

Rotational Torque: H=High Torque (1.70 in-oz), M=Medium Torque (1.25 in-oz), L=Low Torque (0.75 in-oz)

Pushbutton Option: 0=Non-Pushbutton, 2 = 200 grams, 3 = 300 grams, 4 = 510 grams

Termination: CH = .100 Cable with connector, SH = Cable with Stripped-End, PH = Pin Header

Cable Termination: 040 = 4.0in. Cable is terminated with Amp Connector P/N 215083-6. See Amp Mateability Guide for mating connector details.

*Eliminate cable length if ordering pins (Ex: 62M22-42-PH)

SERIES 62N

1/2" Package, non-turn, Dedicated Shaft

FEATURES

- Non-turn Pushbutton to Ensure Pushbutton Text and Orientation
- Separate Pushbutton Function
- Low Cost
- Economical Size
- Optically Coupled for More than a Million Cycles
- Compatible with CMOS, TTL and HCMOS Logic

- Available in 12, 16, 24, and 32 Detent Positions (Non-detent Also Available)
- Choices of Cable Length and Terminations

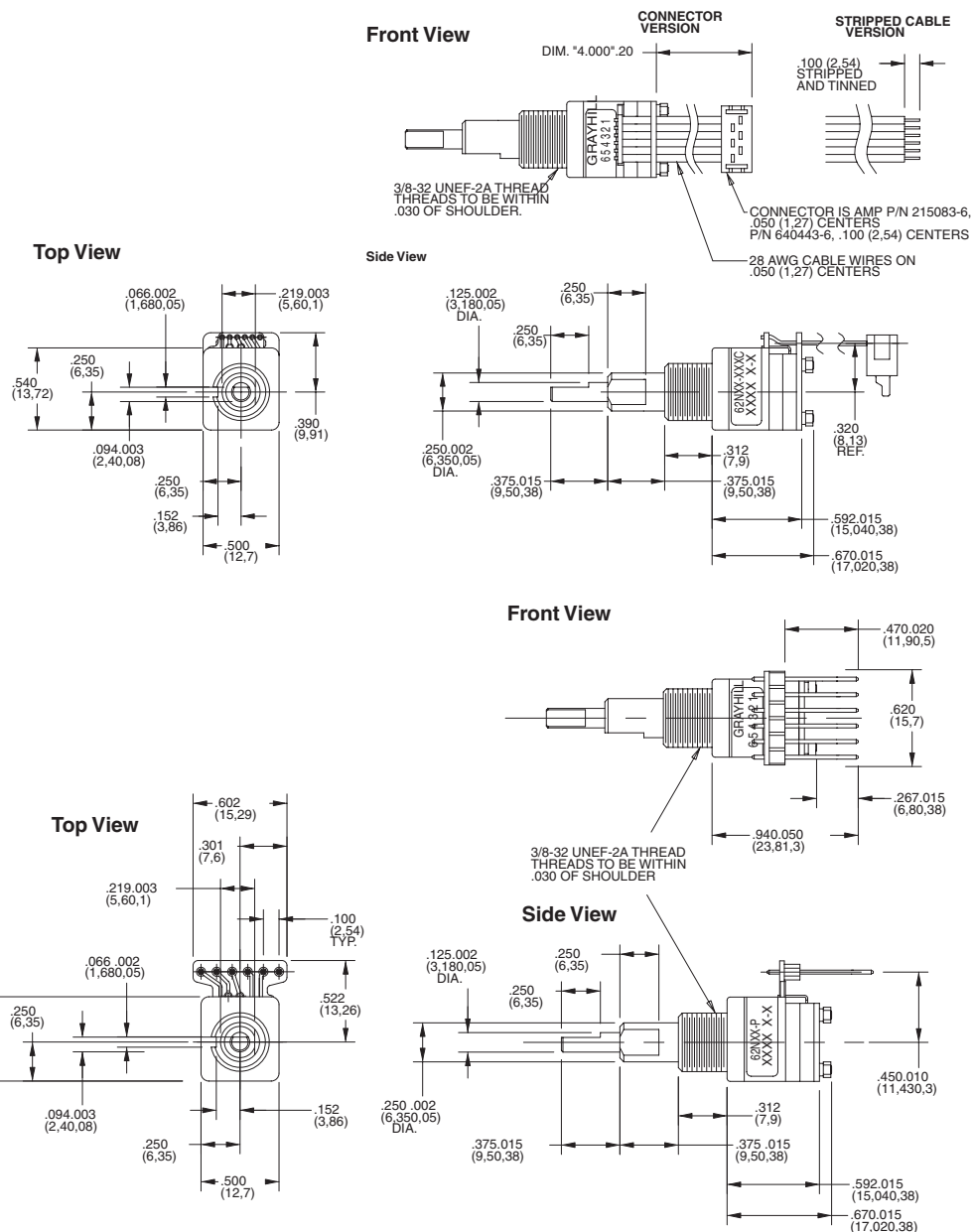
APPLICATIONS

- Global Positioning/Driver Information Systems
- Medical Equipment
- Cockpit Controls
- Mixing Boards



DIMENSIONS In inches (and millimeters)

Cable Version



Unless otherwise specified, standard tolerances are ± 0.10 (0,25)

SPECIFICATIONS

Pushbutton Switch Ratings

Rating: at 5 Vdc, 10 mA, resistive
Contact Resistance: less than 10 ohms (TTL or CMOS compatible)
Pushbutton Life: 3 million actuations minimum
Voltage Breakdown: 250 Vac between mutually insulated parts
Contact Bounce: less than 4 mS at make and less than 10 mS at break
Actuation Force: 1000 $\pm$ 300g
Pushbutton Travel: .010/.025 inch

Encoder Ratings

Coding: 2-bit quadrature coded output
Operating Voltage: 5.0 $\pm$.25 Vdc
Supply Current: 30 mA maximum @ 5.0 Vdc
Logic Output Characteristics:
Logic High: 3.8 Vdc minimum
Logic Low: 0.8 Vdc maximum
Mechanical Life: 1,000,000 cycles minimum (One cycle is a rotation through all positions and a full return)
Minimum Sink Current: 2.0 mA for 5 Vdc
Power Consumption: 150mW maximum
Output: open collector phototransistor
Logic Rise and Fall Times: less than 30 mS maximum

Operating Torque:

Detent: 2.0 in-oz $\pm$ 70% initially
Non-Detent: less than 1.5 in-oz initially
Shaft Push Out Force: 45 lbs minimum
Mounting Torque: 15 in-lbs maximum
Terminal Strength: 15 lbs cable pull-out force minimum
Operating Speed: 100 RPM maximum

Environmental Ratings

Operating Temperature Range: -40°C to 85°C
Storage Temperature Range: -55°C to 100°C
Vibration Resistance: Harmonic motion with amplitude of 15G, within a varied 10 to 2000 Hz frequency for 12 hours
Mechanical Shock: Test 1: 100G, 6 mS, half sine, 12.3 ft/s; Test 2: 100G, 6 mS, sawtooth, 9.7 ft/s
Relative Humidity: 90–95% at 40°C for 96 hours

Materials and Finishes

Code Housing: Reinforced thermoplastic
Shafts: Aluminum
Bushing: Zinc casting
Shaft Retaining Ring: Stainless steel

Detent Spring: Stainless steel

Printed Circuit Boards: NEMA grade FR-4 gold over nickel or palladium

Terminals: Brass, tin-plated

Mounting Hardware: One brass, nickel-plated nut and stainless steel lockwasher supplied with each switch. Nut is 0.094 inches thick by 0.562 inches across flats

Rotor: Thermoplastic

Code Housing: Thermoplastic

Pushbutton Dome: Stainless steel

Dome Retaining Disk: Thermoplastic

Pushbutton Housing: Thermoplastic

Phototransistor: Planar Silicon NPN

Infrared Emitter: Gallium aluminum arsenide

Pushbutton Contact: Brass, nickel-plated

Flex Cable: 28 AWG, stranded/top coated wire, PVC coated on .050 or .100" centers (cabled version)

Header Pins: Phosphor bronze, tin-plated

Spacer: Thermoplastic

Endcap: Thermoplastic

Non-turn Pin: Stainless steel

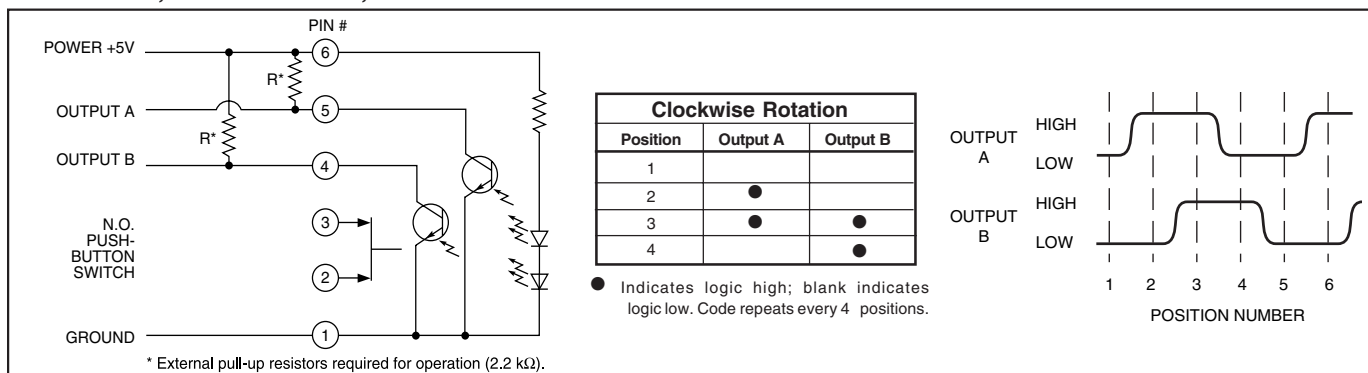
Backplate/Strain Relief: Stainless steel

Lockwashers: Stainless steel

Hex Nuts: Stainless steel

Studs: Stainless steel

CIRCUITRY, TRUTH TABLE, AND WAVEFORM Standard Quadrature 2-Bit Code



ORDERING INFORMATION

62N22-040S

Series and Style = 1/2" package, non-turn, dedicated shaft

Angle of Throw: Detent
 11 = 11.25° or 32 pos.
 15 = 15° or 24 positions
 22 = 22.25° or 16 positions
 30 = 30° or 12 positions

Non-detent
 01 = 11.25° or 32 positions
 05 = 15° or 24 positions
 02 = 22.5° or 16 positions
 00 = 30° or 12 positions

Termination: S = Stripped cable; .050" centers
 SH = Stripped cable; .100" centers
 C = Connector; .050" centers
 CH = Connector; .100" centers
 P = Pin; .100" centers

Cable Termination: 040 = 4.0in. Cable is terminated with Amp Connector P/N 215088-6. See Amp Mateability Guide for mating connector details.
 *Eliminate cable length if ordering pins (Ex: 62N22-P)

These switches have Quadrature 2-bit code output and an optional shaft actuated pushbutton switch.

Custom materials, styles, colors, and markings are available. Control knobs available.

Available from your local Grayhill Component Distributor.
 For prices and discounts, contact a local Sales Office, an authorized local Distributor, or Grayhill.

SERIES 62P

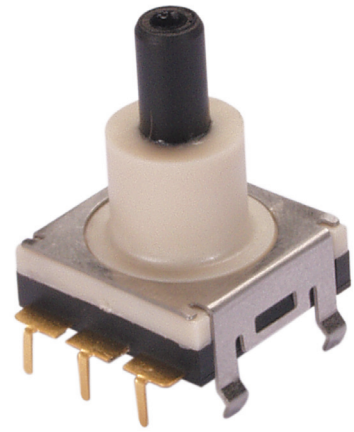
Low Cost, PC Mount

FEATURES

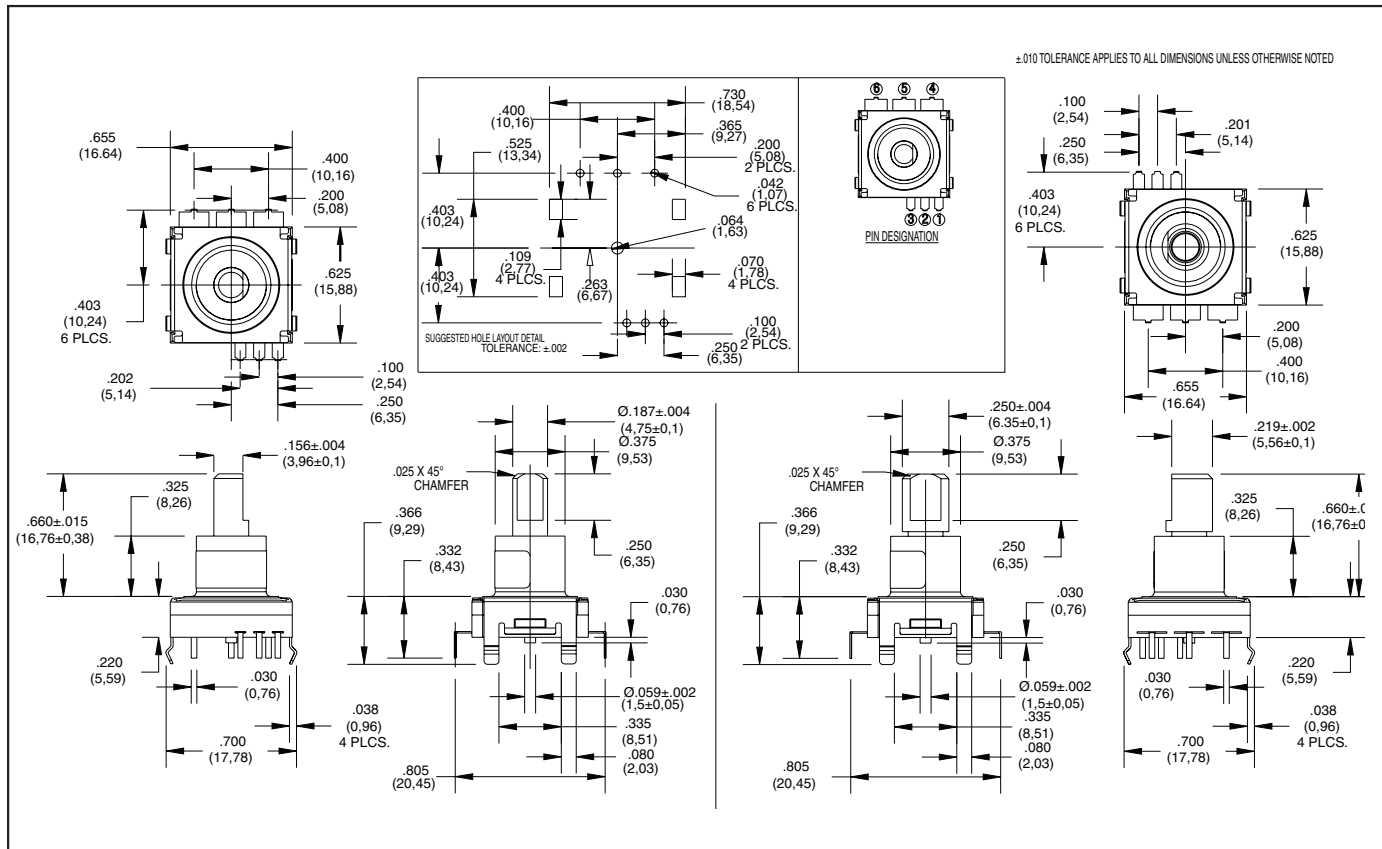
- Low Cost
- Compact Size
- PC Mount
- No De-Bouncing Required
- Reliable, Up to 2 Million Cycles
- Choice of Detent and Pushbutton Force
- Available in 16 Positions
- Quadrature Output

APPLICATION

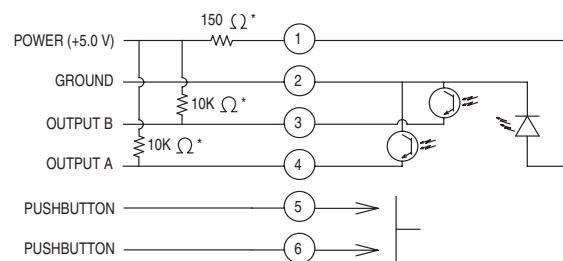
- Automotive Controls
- White Goods
- Audio



DIMENSIONS In inches (and millimeters)

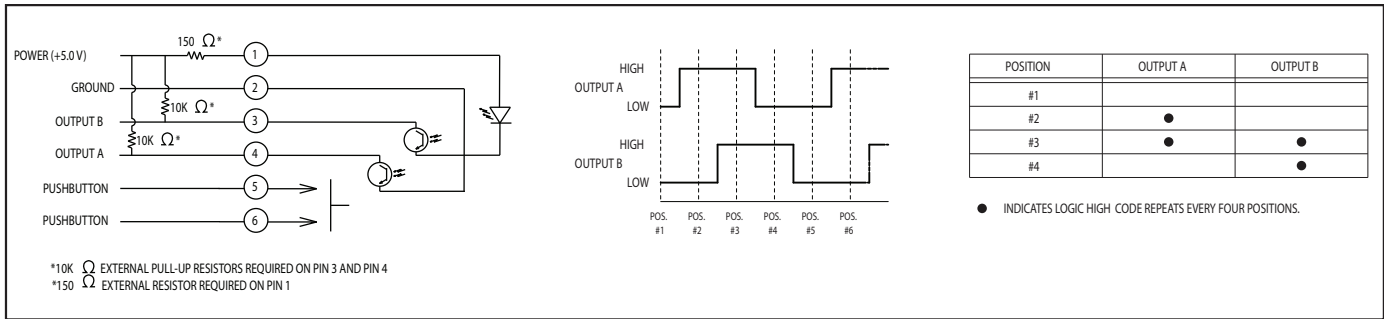


CIRCUITRY



*10K Ω EXTERNAL PULL-UP RESISTORS REQUIRED ON PIN 3 AND PIN 4
 *150 Ω EXTERNAL RESISTOR REQUIRED ON PIN 1

WAVEFORM AND TRUTH TABLE Standard Quadrature 2-bit Code



SPECIFICATIONS

Electrical Ratings

Operating Voltage: 5 Vdc +/- .25 Vdc
Supply Current: 30mA maximum at 5 Vdc
Logic High: 3.0V minimum
Logic Low: 1.0V maximum
Logic Rise and Fall: less than 30 ms

Pushbutton Switch Ratings

Rating: 5.0 Vdc at 10mA resistive
Contact Resistance: less than 10 ohms (TTL or CMOS compatible)
Voltage Breakdown: 250 Vac between mutually insulated parts
Contact Bounce: less than 4 ms at make and less than 10 ms at break
Actuation Life: 3,000,000 operations
Actuation Force: 6: 600 +/- 200 grams
 4: 450 +/- 150 grams
Shaft Travel: .015 ± .010 inch

Mechanical Ratings

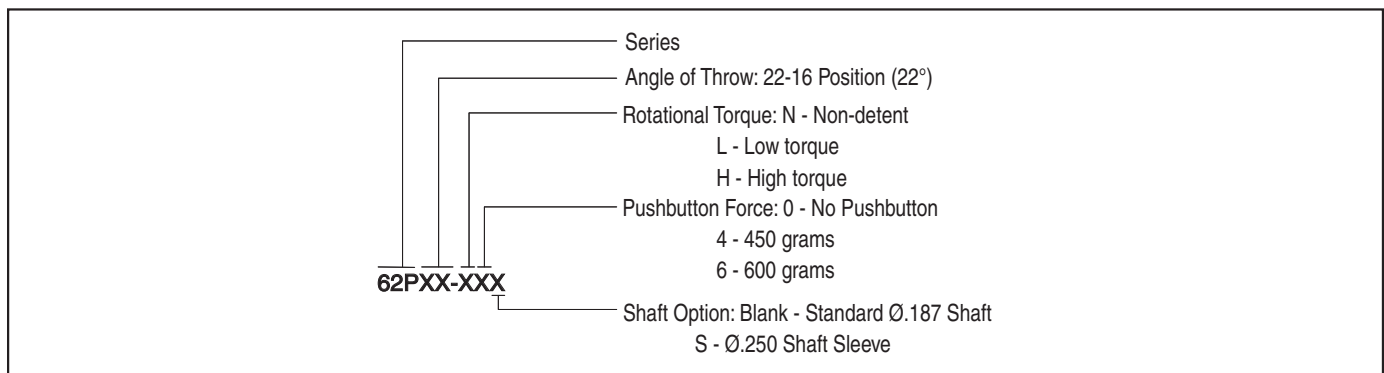
Operating Torque:
 H: 1.4 in-oz +/- 0.6 in-oz initial
 L: 0.6 in-oz +/- 0.3 in-oz initial
 N: <0.5 in-oz initial
Rotational Life:
 H&L: 500,000 cycles
 N: 2 million cycles
 (1 cycle = 360 degree rotation and return)
Shaft Push Out Force:
 20 lbs minimum
Operating Speed: 100 RPM maximum
Axial Shaft Play: .010 maximum
Environmental Ratings
Operating Temperature Range:
 -40°C to 85°C
Storage Temperature Range:
 -55°C to 100°C
Relative Humidity: 90-95% at 40°C for 96 hours
Vibration Resistance: Harmonic motion with Amplitude of 15g, within a varied 10 to 2000 Hz frequency for 12 hours per MIL-STD-202, Method 204
Mechanical Shock Resistance:
 Test 1: Tested at 100g for 6mS, half sine, 12.3 ft/s.

Test 2: 100g for 6mS, Sawtooth, 9.7 ft/s

Materials and Finishes

Code/Pushbutton Housing: Thermoplastic
Shaft: Thermoplastic
Code/Detent Rotor: Reinforced Thermoplastic
Bushing: Thermoplastic
Terminal Pins: Brass, Tin plated
Detent Spring: Stainless Steel
Dome: Stainless Steel
Pushbutton Contact: Nickel plated brass
Phototransistor: Planar Silicon
Detent Balls:
 .0625 dia. Stainless Steel
Infrared Emitter:
 Gallium Aluminum Arsenide
Label:
 White Thermal Transfer Cast Film.
 Adhesive Coated
Bracket: Stainless Steel, Tin plated

ORDERING INFORMATION



SERIES 62R

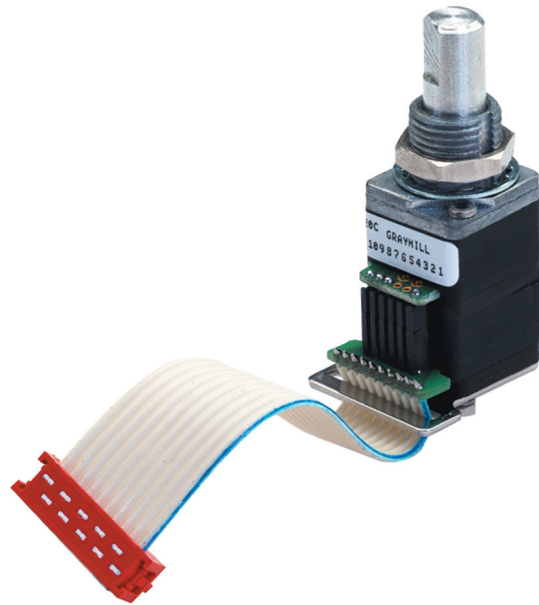
1/2" Package, Redundant Circuitry

FEATURES

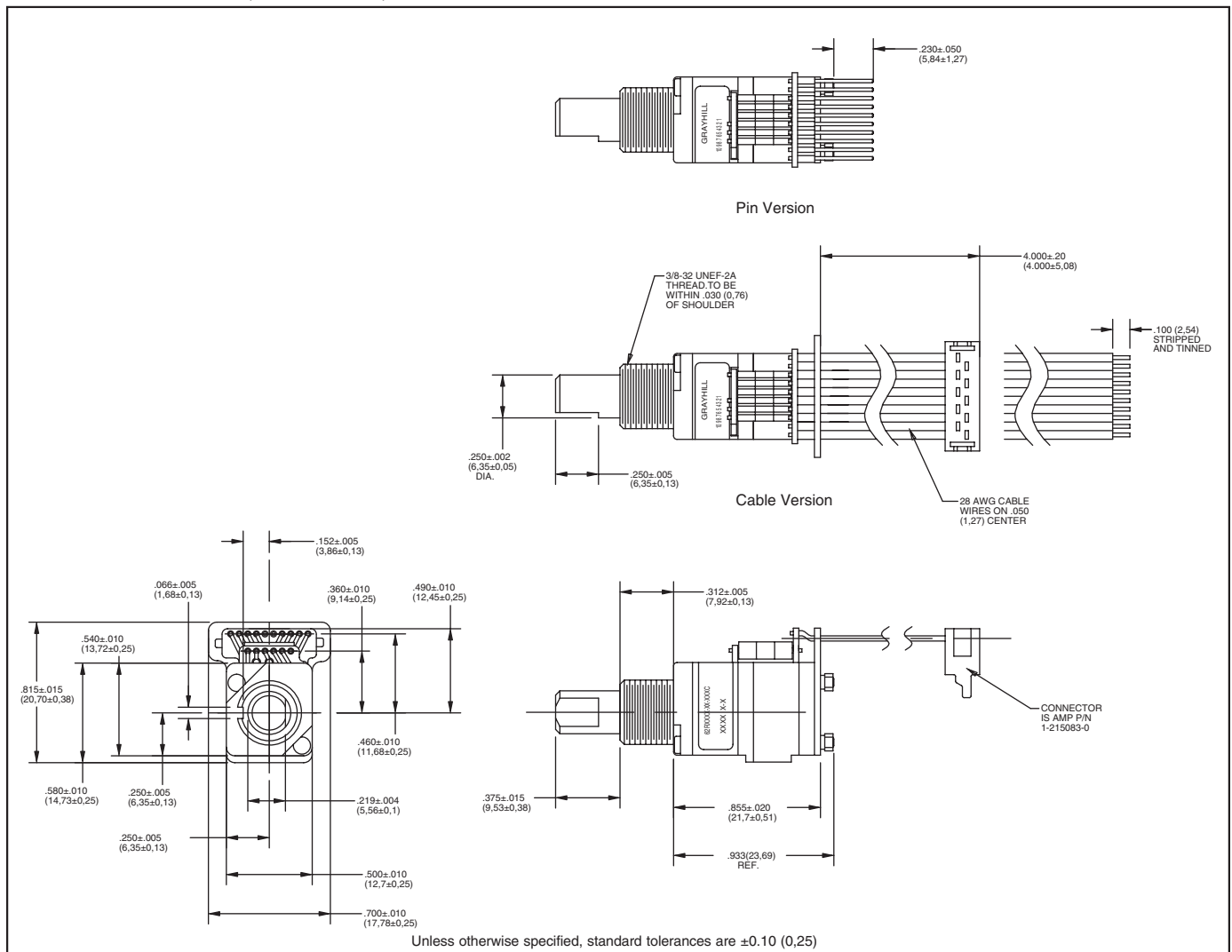
- Redundant Circuitry
- 1 Million Rotational Cycles
- Compatible with CMOS, TTL and HCMOS Logic
- Optional Integral Pushbutton
- Available in 12, 16, 24, and 32 Detent Positions
- Choices of Cable Length and Terminations
- Ideal for Critical Applications

APPLICATIONS

- Cockpit Controls
- Medical Equipment

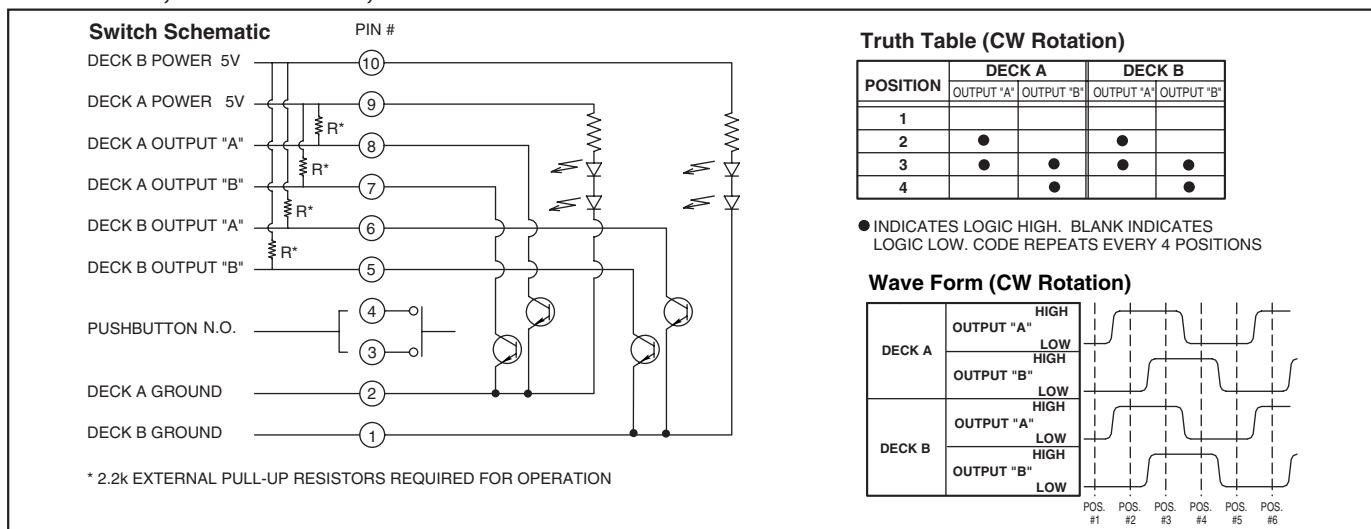


DIMENSIONS In inches (and millimeters)



CIRCUITRY, TRUTH TABLE, AND WAVEFORM

Standard Quadrature 2-Bit Code



SPECIFICATIONS

Pushbutton Switch Ratings

Pushbutton Rating: 10 mA, 5 Vdc, resistive
Contact Resistance: less than 10 ohms (TTL or CMOS compatible)
Pushbutton Life: 3 million actuations min.
Contact Bounce: less than 4 mS at make and less than 10 mS at break
Actuation Force: 1000 ±300 grams
Pushbutton Travel: .010/.025"

Switch Ratings

Coding: 2-bit quadrature coded output
Operating Voltage: 5.0 ±.25 Vdc
Voltage Breakdown: 250 Vac between mutually insulated parts
Supply Current: 30 mA maximum@5.0 Vdc (per deck)
Logic Output Characteristics:
 Logic High: 3.5 Vdc minimum
 Logic Low: 1.5 Vdc maximum
Mechanical Life: 1,000,000 cycles minimum (One cycle is a rotation through all positions and a full return)
Minimum Sink Current: 2.0 mA
Power Consumption: 150mW max. (per deck)
Output: open collector phototransistor
Optical Rise and Fall Times: less than 30

mS maximum

Operating Torque: 3.5 ±1.4 in-oz initially
Shaft Push Out Force: 45 lbs minimum
Mounting Torque: 15 in-lbs max.
Terminal Strength: 15 lbs cable pull-out force min.
Operating Speed: 100 RPM max.

Environmental Ratings

Operating Temperature Range: -40°C to 85°C
Storage Temperature Range: -55°C to 100°C
Vibration Resistance: Harmonic motion with amplitude of 15G's, within a varied 10 to 2000 Hz frequency for 12 hours
Mechanical Shock: Test 1: 100g, 6 mS, half sine, 12.3 ft/s; Test 2: 100g, 6 mS, sawtooth, 9.7 ft/s
Humidity: 90–95% at 40°C for 96 hours

Materials and Finishes

Shaft: Aluminum
Bushing: Zinc casting
Shaft Retaining Ring: Stainless steel
Detent Spring: Stainless steel
Printed Circuit Boards: NEMA grade FR-4 gold over nickel or palladium

Terminals: Brass, tin-plated

Mounting Hardware: One brass, nickel-plated nut and stainless steel lockwasher supplied with each switch. Nut is 0.094 inches thick by 0.562 inches across flats

Rotor: Thermoplastic**Code Housing:** Thermoplastic**Pushbutton Dome:** Stainless steel**Dome Retaining Disk:** Thermoplastic**Pushbutton Housing:** Thermoplastic**Phototransistor:** Planar Silicon NPN**Infrared Emitter:** Gallium aluminum arsenide**Pushbutton Contact:** Brass, nickel-plated

Flex Cable: 28 AWG stranded, halogen-free polyolefin insulation on .050" centers (cabled version)

Header Pins: Phosphor bronze, tin-plated**Spacer:** Zinc casting**Backplate/Strain Relief:** Stainless steel**Lockwasher(s):** Stainless steel**Hex Nuts:** Stainless steel**Studs:** Stainless steel

OPTIONS

Contact Grayhill for custom terminations, shaft and bushing configurations, and resolutions. Control knobs are also available.

ORDERING INFORMATION

Series
 Angle of Throw: 11 = 11.25° or 32 pos., 15 = 15° or 24 pos, 22 = 22.5° or 16 positions, 30 = 30° or 12 Positions
 Pushbutton Option: 01 = w/o pushbutton, 02 = with pushbutton
 62R22-01-040S

Series

Angle of Throw: 11 = 11.25° or 32 pos., 15 = 15° or 24 pos, 22 = 22.5° or 16 positions, 30 = 30° or 12 Positions

Pushbutton Option: 01 = w/o pushbutton, 02 = with pushbutton

Termination: .050" centers; S = Stripped cable, C = Connector, P = Pin

Cable Length: 040 = 4.0 inches. Cable is terminated with Amp Connector P/N 215083-8. See Amp Mateability Guide for mating connector details.

*Eliminate cable length if ordering pins. (Ex: 62R22-02-P)

Custom materials, styles, colors, and markings are available. Control knobs available.

Available from your local Component Grayhill Distributor. For prices and discounts, contact a local Sales Office, an authorized local Distributor, or Grayhill.

SERIES 61M

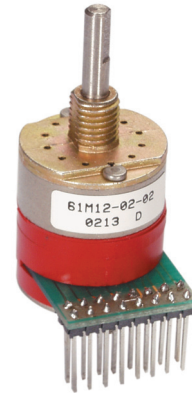
Optically Coupled for Simulated Mechanical Rotary Switch Output

FEATURES

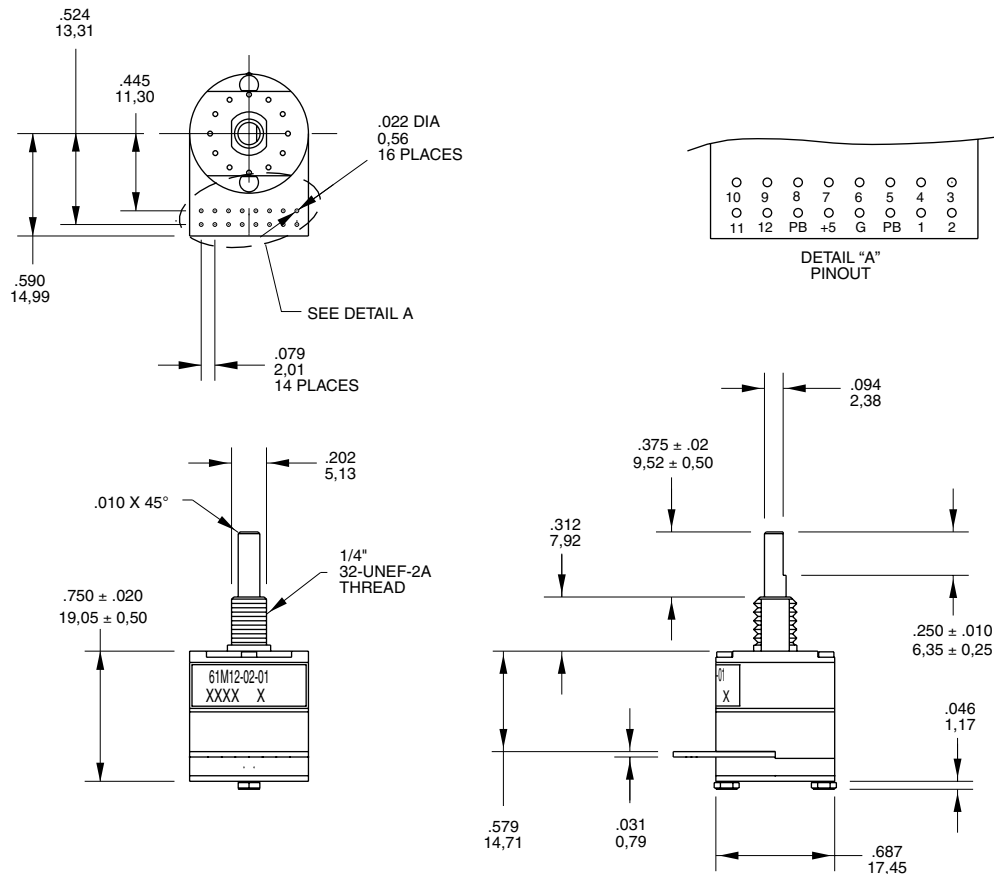
- Optical Alternative to Rotary Contacts
- One Pulse Per Detent Position Per Rotation
- Long Life of a Million Cycles
- With or Without Pushbutton
- Continuous Rotation and Fixed Stops Available
- Rugged Construction
- 8, 10 and 12 Positions Available

Applications

- Avionics
- Any application requiring rotary switch output and the increased reliability of an optical device

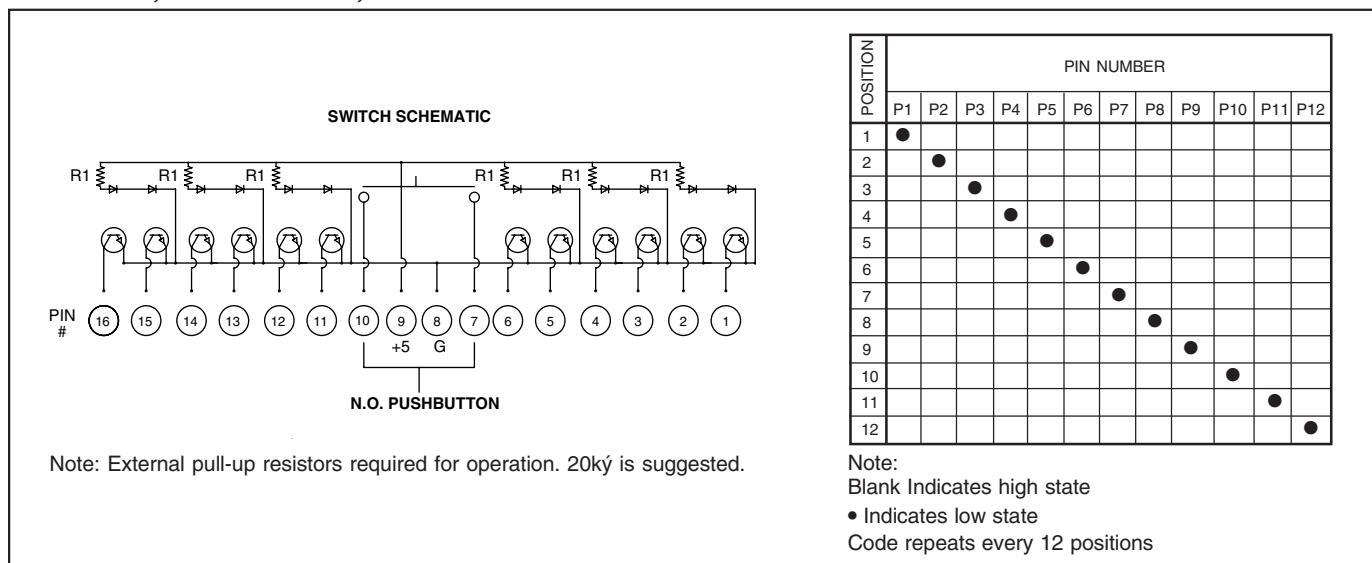


DIMENSIONS In inches (and millimeters)



Unless otherwise specified, standard tolerance is ±.010 (0,25).

CIRCUITRY, TRUTH TABLE, AND WAVEFORM Standard Quadrature 2-Bit Code



SPECIFICATIONS

Pushbutton Ratings

Operating Voltage: 5 Vdc, 60mA maximum, resistive
Contact Resistance: Less than 10 Ohms
Voltage Breakdown: 250 Vac between mutually insulated parts
Contact Bounce: Less than 4 mS at make and less than 10 mS at break
Actuation Life: 3,000,000 operations
Actuation Force: Maximum actuation force of 650 grams and a minimum force of 300 grams
Pushbutton Travel: .010/.025

Mechanical Ratings

Life Expectancy: 1 million cycles of operation; (1 cycle=360° rotation and return)
Rotational Torque: 10 in.-oz. $\pm$ 3 in.-oz. customs also available.
Shaft Pushout Force: 50 lbs. minimum
Mounting Torque: 20 in.-lbs. maximum

Switch Ratings

Output: One pulse per position per rotation (360 degrees CW/CCW)
Operating Voltage: 5.0 $\pm$.25 Vdc
Supply Current: 60mA maximum at 5 Vdc
Logic High: 3.8V minimum
Logic Low: .8V minimum
Logic Rise and Fall Time: 30mS Typ.

Environmental

Operating Temperature Range: -40°C to +85°C
Storage Temperature Range: -55°C to +100°C
Vibration: MIL-STD 202, Method 204, Condition B
Mechanical Shock: 100g's, 6 ms, Half Sine, 12.3 ft/s and 100g's, 6 ms, Sawtooth, 9.7 ft/s
Humidity: 90-95% Relative Humidity at 40°C for 96 hours

Materials and Finishes

Code Housing: Nylon (Red) Hiloy 610
Detent Housing: Stainless Steel
Rotor: Reinforced Thermoplastic, 30% Glass Filled Polyester
Bushing: Zinc Die Cast, Cadmium Plated
Shaft: Stainless Steel
Detent Balls: 302 Stainless Steel
Through Bolts: 305 Stainless Steel
Through Bolt Nuts: Stainless Steel
Printed Circuit Boards: NEMA Grade FR-4
Terminals: Copper Alloy
Aperture: Chem Etched Stainless Steel and/or Electroformed Nickel
Dome Retainer: Thermoplastic
Mounting Hardware: One Brass, cadmium-plated nut and lockwasher supplied with each switch

OPTIONS

Contact Grayhill for customer application needs.

ORDERING INFORMATION

