



OPTICAL ENCODERS

- Eliminates Rotary Mechanical Contacts
- Accurate Resolution up to 1024 Positions
- Logic Compatible
- Selects Menu or Display Items
- Includes Data Input Switch
- Up to 1 Billion Trouble-Free Cycles

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OPTICAL ENCODERS

High Resolution

Ball Bearing, 4-Pin	Series 63K	2
Ball Bearing, 5-Pin	Series 63R	4
Hollow Shaft	Series 63T	6
20mm	Series 63Q	8
20mm Absolute Encoding	Series 63A.....	10

ACCESSORIES

Control Knobs	Series 11K	12
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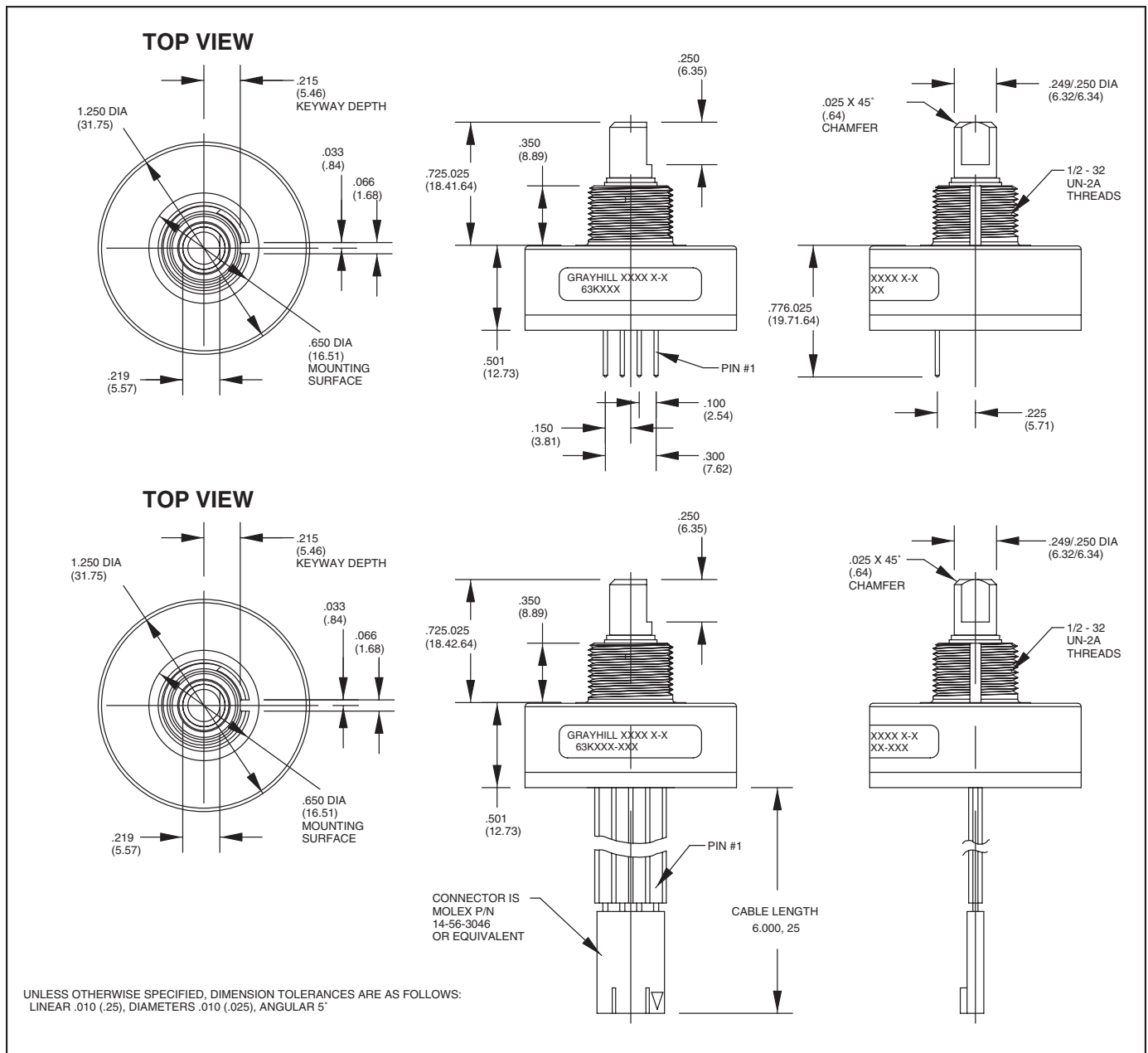
SERIES 63K
High Resolution, Ball Bearing,
4-Pin

FEATURES

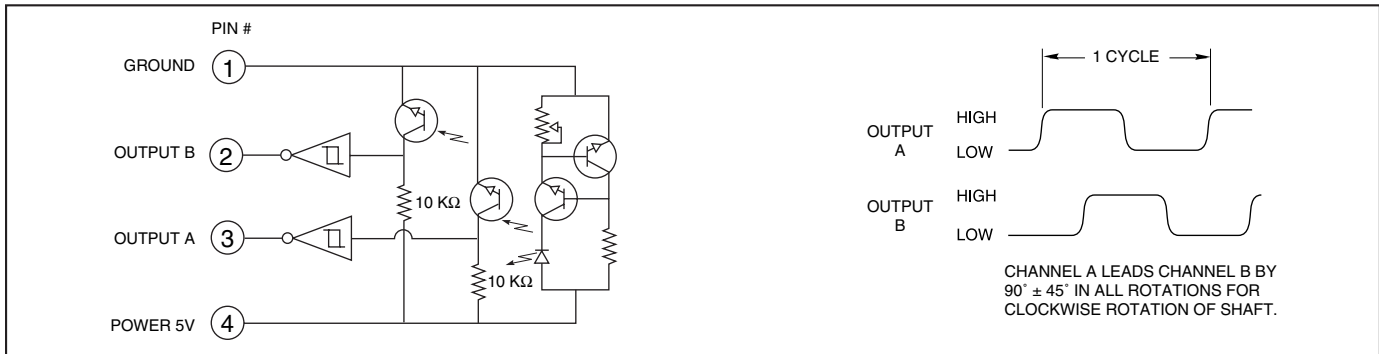
- 25, 32, 50, 64, 100, 128 and 256 Cycles per Revolution Available
- Sealed Version Available
- Rugged Construction
- Cable or Pin Version
- 300 Million Rotational Cycles
- 5,000 RPM Shaft Rotation



DIMENSIONS In inches (and millimeters)



CIRCUITRY AND WAVEFORM: Standard Quadrature 2-Bit Code



SPECIFICATIONS

Electrical Ratings

Operating Voltage: 5 ±.25 Vdc
Supply Current: 30 mA maximum at 5 Vdc
Logic Output Characteristics:
 Output Type: Open collector with integrated Schmitt Trigger and 10 KW pull-up resistor
 Maximum Sink Current: 16 mA at .40 volts
Power Consumption: 150 mW maximum
Optical Rise Time: 500 nS typical
Optical Fall Time: 14 nS typical

Mechanical Ratings

Mechanical Life: 300 million revolutions
Time Life: Guaranteed for 10 years of continuous operation (calculated from emitter degradation data)
Mounting Torque: 20 in-lbs maximum
Terminal Strength: 5 lbs terminal pull-out force minimum
Solderability: 95% free of pin holes and voids
Externally Applied Shaft Force:
 Axial: 15 lbs maximum; Radial: 15 lbs maximum
Operating Torque: 0.5 in-oz maximum (no detents) for unsealed versions

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: 100g for 6 mS, half-sine wave with velocity change of 12.3 ft/s. Test 2: 100g for 6 mS, sawtooth wave with velocity change of 9.7 ft/s.

Materials and Finishes

Bushing: Zinc diecast
Housing: Zytel FR-50
Shaft: Stainless steel insert molded into nylon rotor support
Code Rotor and Aperture: Chemically etched stainless steel/electroformed nickel
Printed Circuit Board: NEMA Grade FR-4. Five microinches minimum gold over 100 microinches minimum nickel over copper
Optical Barrier: Polyphenylene sulfide, 94 V-0

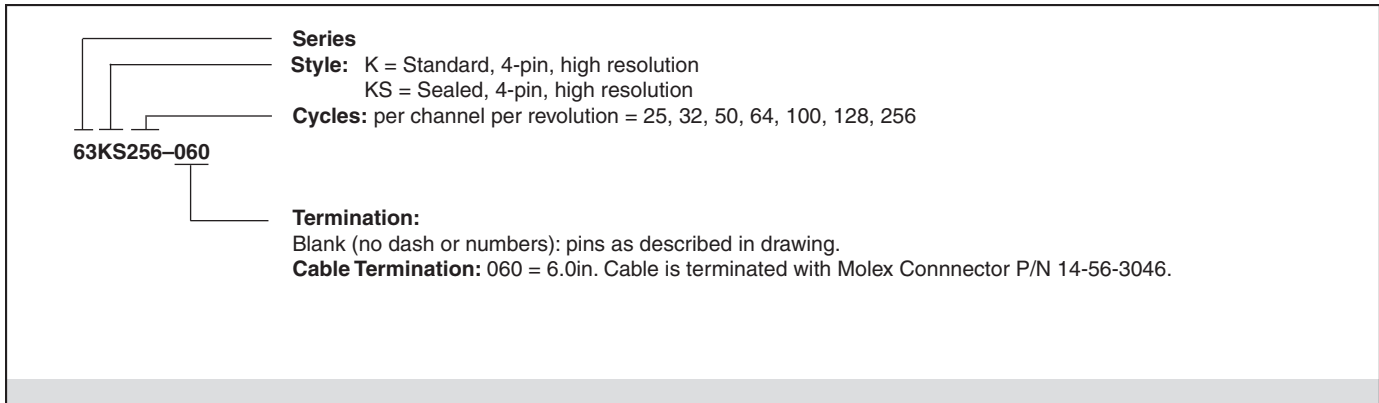
Backplate: Polyester
Header: Phosphor bronze, 200 microinches tin over 50 microinches nickel (pin version only)
Infrared Emitter: Gallium aluminum arsenide
Photo IC: Planar silicon
Retaining Ring: Stainless steel
Cable: 26 AWG, stranded/tinned wire, PVC coated on .100 (2,54) centers (cable version only)
Connector: Glass-filled PCT, UL94V-0

Bearing Subassembly

Bearing: NSK ABEC 5 (stainless steel)
Preload Collar: 303 stainless steel

Optical and Mechanical Encoders

ORDERING INFORMATION



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

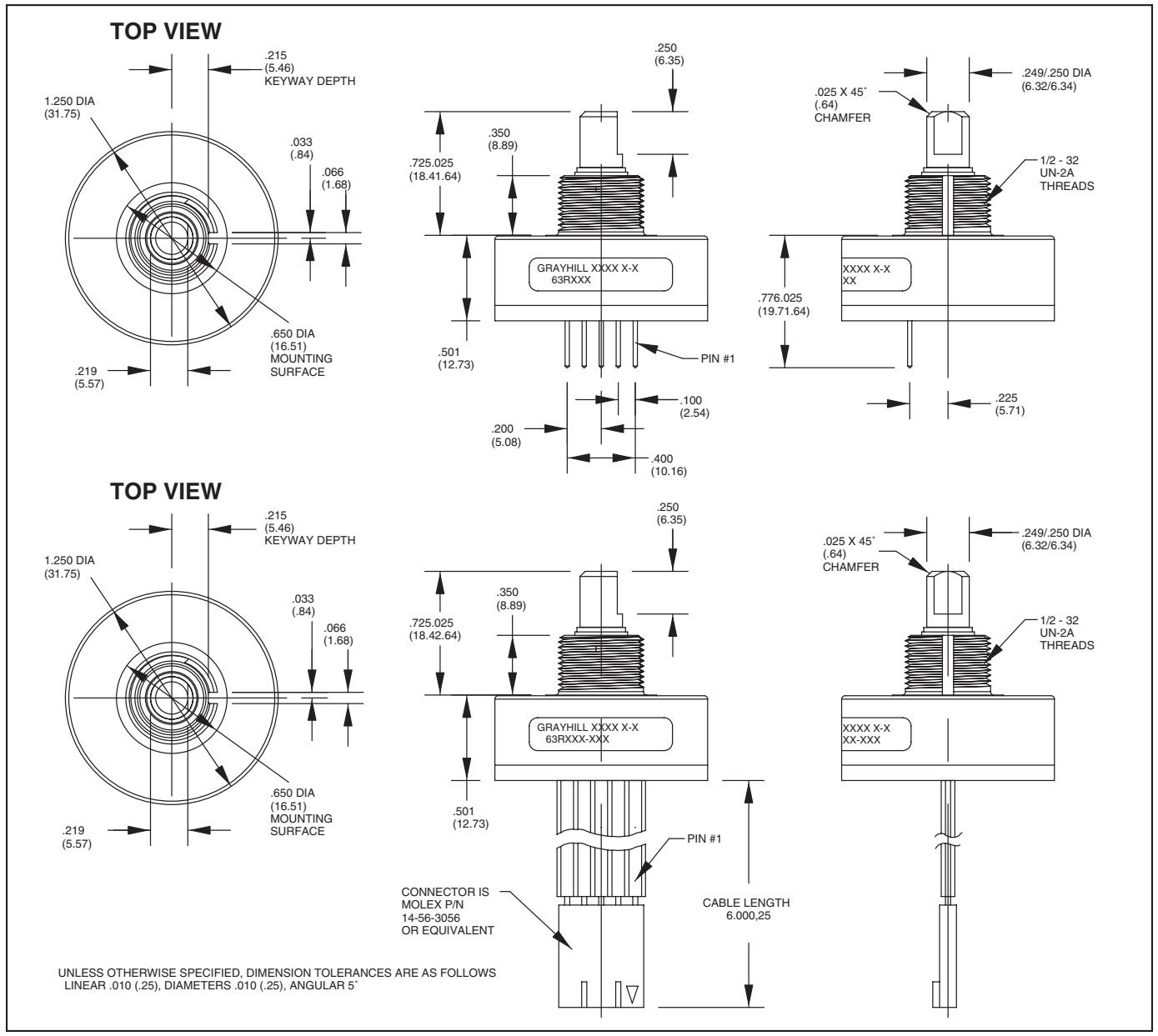
SERIES 63R
High Resolution, Ball Bearing,
5-pin (Polarized Connection)

FEATURES

- 25, 32, 50, 64, 100, 128 and 256 Cycles per Revolution Available
- Sealed Version Available
- Rugged Construction
- Cable or Pin Versions
- 300 Million Rotational Cycles
- 5000 RPM Shaft Rotation
- Index Pulse Available

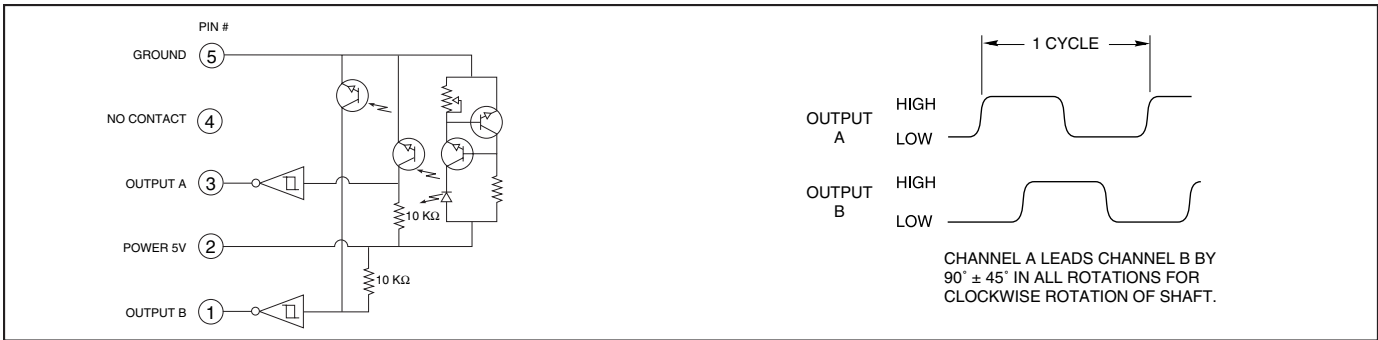


DIMENSIONS In Inches (and millimeters)



Optical and Mechanical Encoders

CIRCUITRY AND WAVEFORM: Standard Quadrature 2-Bit Code



SPECIFICATIONS

Electrical Ratings

Operating Voltage: $5 \pm .25$ Vdc

Supply Current: 30 mA maximum at 5 Vdc

Logic Output Characteristics:

Output Type: Open collector with integrated Schmitt Trigger and 10 KW pull-up resistor

Maximum Sink Current: 16 mA at .40 volts

Power Consumption: 150 mW maximum

Optical Rise Time: 500 nS typical

Optical Fall Time: 14 nS typical

Mechanical Ratings

Mechanical Life: 300 million revolutions

Time Life: Guaranteed for 10 years of continuous operation (calculated from emitter degradation data)

Mounting Torque: 20 in-lbs maximum

Terminal Strength: 5 lbs terminal pull-out force minimum

Solderability: 95% free of pin holes and voids

Externally Applied Shaft Force:

Axial: 15 lbs maximum; Radial: 15 lbs maximum

Operating Torque: 0.5 in-oz maximum (no detents) for unsealed versions

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: 100g for 6 mS, half-sine wave with velocity change of 12.3 ft/s. Test 2: 100g for 6 mS, sawtooth wave with velocity change of 9.7 ft/s.

Materials and Finishes

Bushing: Zinc diecast

Housing: Zytel FR-50

Shaft: Stainless steel insert molded into nylon rotor support

Code Rotor and Aperture: Chemically etched stainless steel/electroformed nickel

Printed Circuit Board: NEMA Grade FR-4.

Five microinches minimum gold over 100

microinches minimum nickel over copper

Optical Barrier: Polyphenylene sulfide, 94 V-0

Backplate: Polyester

Header: Phosphor bronze, 200 microinches tin over 50 microinches nickel (pin version only)

Infrared Emitter: Gallium aluminum arsenide

Photo IC: Planar silicon

Retaining Ring: Stainless steel

Cable: 26 AWG, stranded/tinned wire, PVC coated on .100 (2,54) centers (cable version only)

Connector: Glass-filled PCT, UL94V-0

Bearing Subassembly

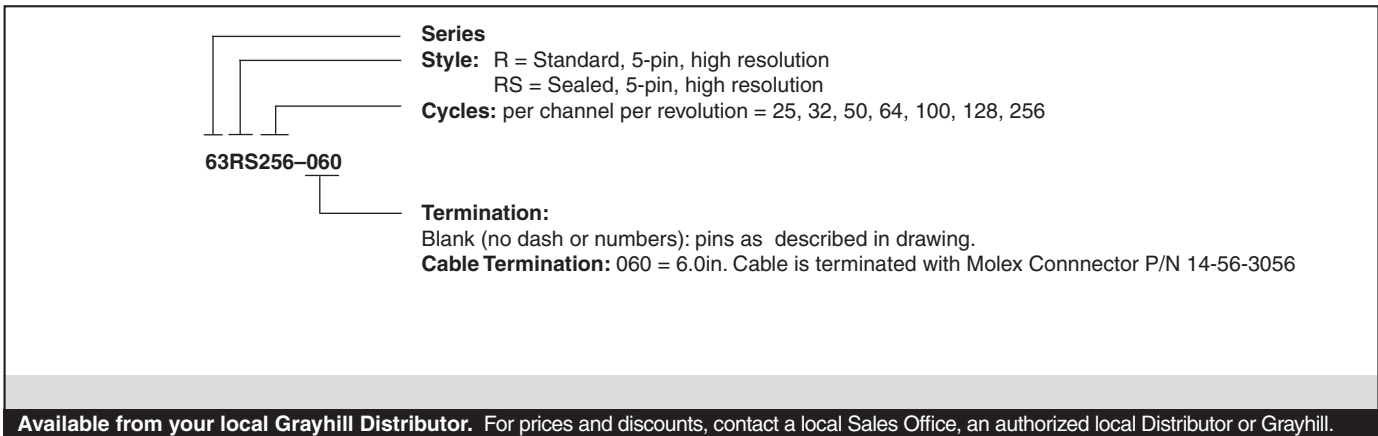
Bearing: NSK ABEC 5 (stainless steel)

Preload Collar: 303 stainless steel

Spacer: 303 stainless steel

Bellville Spring: spring steel (stainless)

ORDERING INFORMATION



SERIES 63T
High Resolution, Hollow Shaft

FEATURES

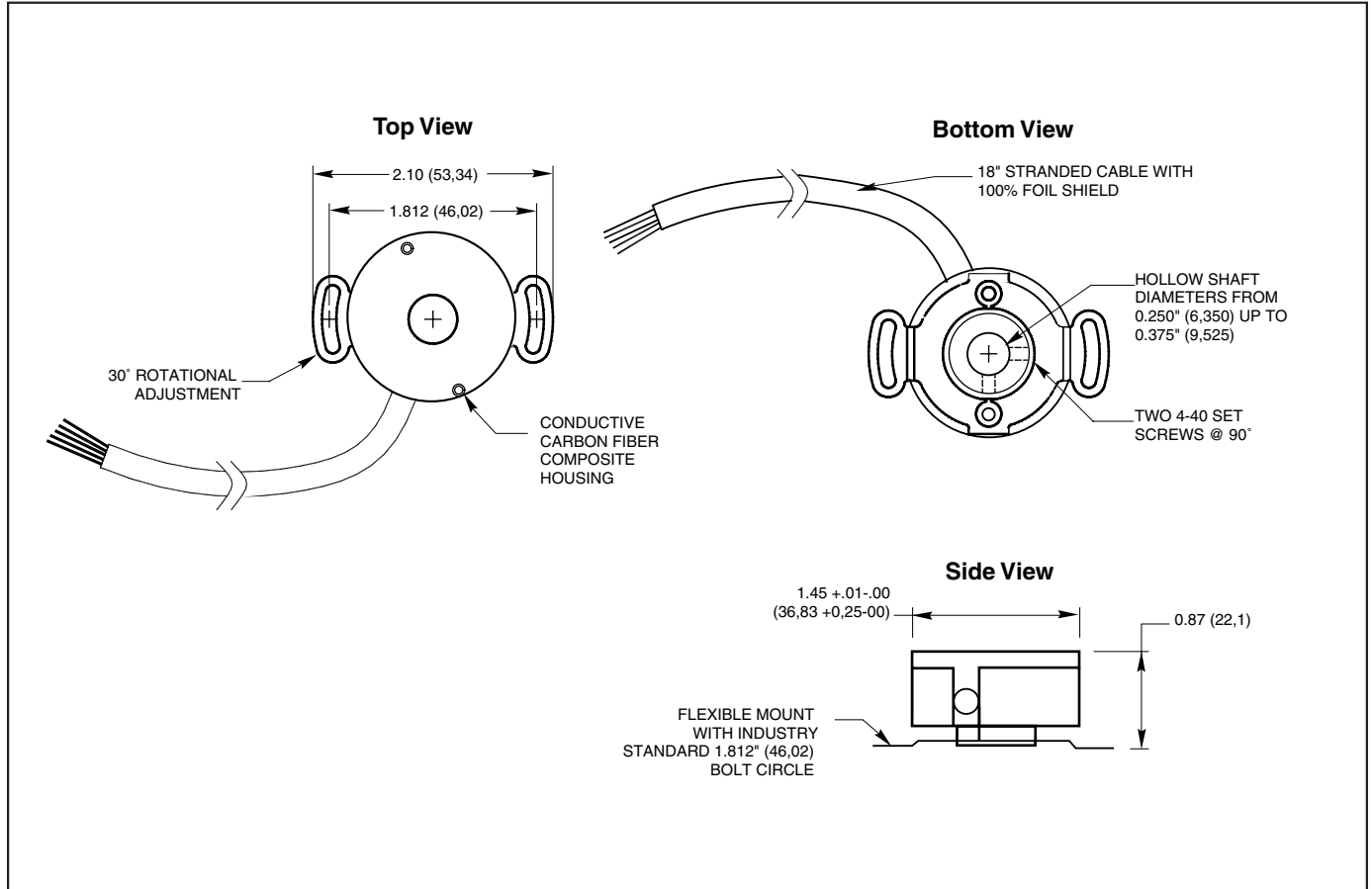
- Low Profile
- Simplified Encoder Attachment
- Resolutions up to 1024 Lines per Revolutions
- Three-Phase Commutation in 4,6 or 8 Pole Versions
- Conductive Carbon Fiber Housing
- Standard 1.812" (46mm) Bolt Circle Mounting
- Hollow Shaft Sizes Up to .375" or 10mm in Diameter
- High Noise Immunity
- Cost Competitive with Modular Encoders
- Industry Standard Line Drivers

APPLICATIONS

- Steer by Wire
- Fractional Horse Power Motors
- Machine Tool Controls
- Material Handling
- Flow Meters

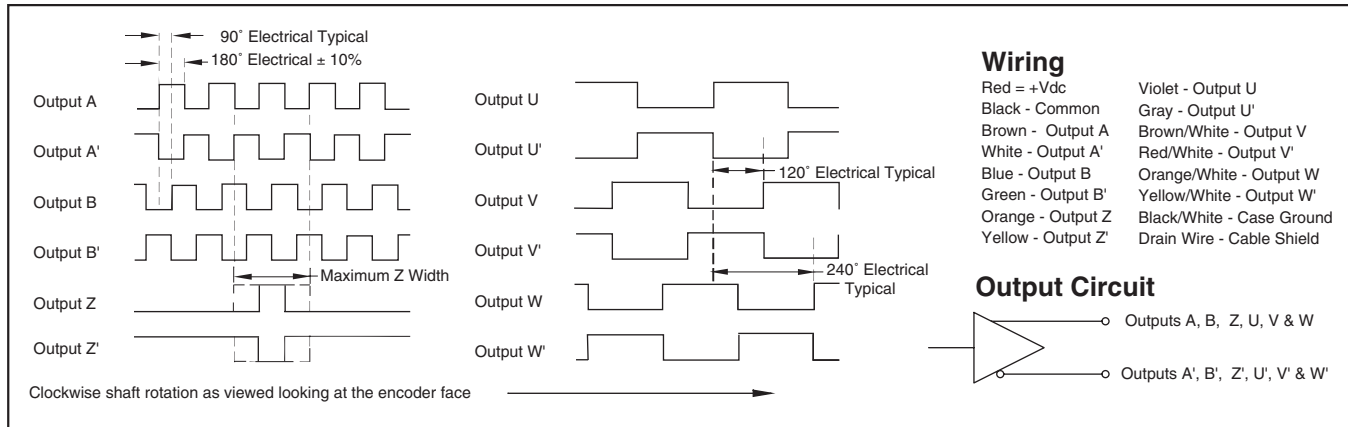


DIMENSIONS In inches (and millimeters)



Optical and Mechanical Encoders

WAVEFORM, CIRCUITRY, AND WIRING DIAGRAM Standard Quadrature 2-Bit Code



SPECIFICATIONS

Electrical Ratings

Input Voltage: 5 ± 5% Vdc or 5-26 Vdc
Ripple Current: 2% peak-to-peak @ 5 Vdc
Output Circuits: AM26LS31 RS422A line driver, OL7272 line driver, TTL
Logic Output Characteristics:
 Output Type: Quadrature with channel A leading channel B for CW rotation with index centered over A
Frequency Response: 200 kHz
Symmetry: 180° ± 10% typical
Minimum Edge Separation: 54 electrical degrees
Commutation Format: Three phase: 4, 6 or 8 poles
Commutation Accuracy: ± 1° mechanical
Input Current Requirements: 125 mA typical, 5 Vdc plus interface loads

Mechanical Ratings

Maximum Shaft Speed: 8,000 RPM
Hollow Shaft Diameter: 0.250", 0.312", 0.375", 6mm, 8mm, 10mm
Radial Shaft Movement: 0.007" (0,178mm) T.I.R.
Axial Shaft Movement: ± 0.030" (7,62mm)
Housing: Carbon fiber composite (case ground via cable)
Housing Volume Resistivity: 10² ohm-cm
Termination:
 Standard: 15-conductor stranded cable, 28 AWG, 18" (457mm) in length
 Non-commutation and TTL output: 9-conductor stranded cable, 28 AWG, 18" in length
Mounting: 1.812" (46mm) bolt circle
Acceleration: 1x10⁵ radians per second²
Moment of Inertia: 1.5 x 10⁻⁴ oz-in-s²
Accuracy: ± 8 arc minutes

Environmental Ratings

Operating Temperature Range: -20°C to 100°C typical; -20°C to 120°C optional (contact Grayhill for more information)
Storage Temperature Range: -40°C to 125°C
Relative Humidity: 98% non-condensing
Vibration: 20G's @ 50-500 CPS
Mechanical Shock: 50g @ 11mS duration

OPTIONS

Contact Grayhill for custom terminations, resolutions, mounting configurations, and shaft couplings and configurations.

ORDERING INFORMATION

Series
Resolution: (quadrature cycles per revolution) A = 500, B = 512, C = 1000, D = 1024, E = 256
Voltage: L = 5.0 ± 5% Vdc, H = 5-26 Vdc
Output Option: 1 = AM26LS31 RS422A Line Driver, 2 = OL7272, 5-26 Vdc Line Driver, 3 = TTL, 4 = RS422A, for A, B, Z; Open Collector for U, R, W
Mounting: 1 = Std. 1.812" flex
 2 = Size 15 Resolver Mount

Index Gating: 0 = Ungated index; 1 = Gated to A, 180°; 2 = Gated to A and B, 90°
Motor Poles: 4 = 4 pole, 6 = 6 pole, 8 = 8 pole, 0 = no commutation
Hollow Shaft Size: 1 = 0.250", 2 = 0.312", 3 = 0.375", 4 = 6mm, 5 = 8mm, 6 = 10mm

63TAL-1-1-4-2-1

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

Optical and Mechanical Encoders

SERIES 63Q
High Resolution, 20mm

FEATURES

- Miniature Size, 20mm (0.787") Diameter
- Resolutions up to 1024 Lines per Revolution
- Single Ended and Differential Outputs
- 1 Billion Rotational Life Cycles
- Conductive Carbon Fiber Housing
- IP 50 Sealing
- High Noise Immunity
- Low Supply Current Requirements

APPLICATIONS

- Steer by Wire
- Fractional Horse Power Motors
- Machine Tool Controls
- Material Handling
- Flow Meters

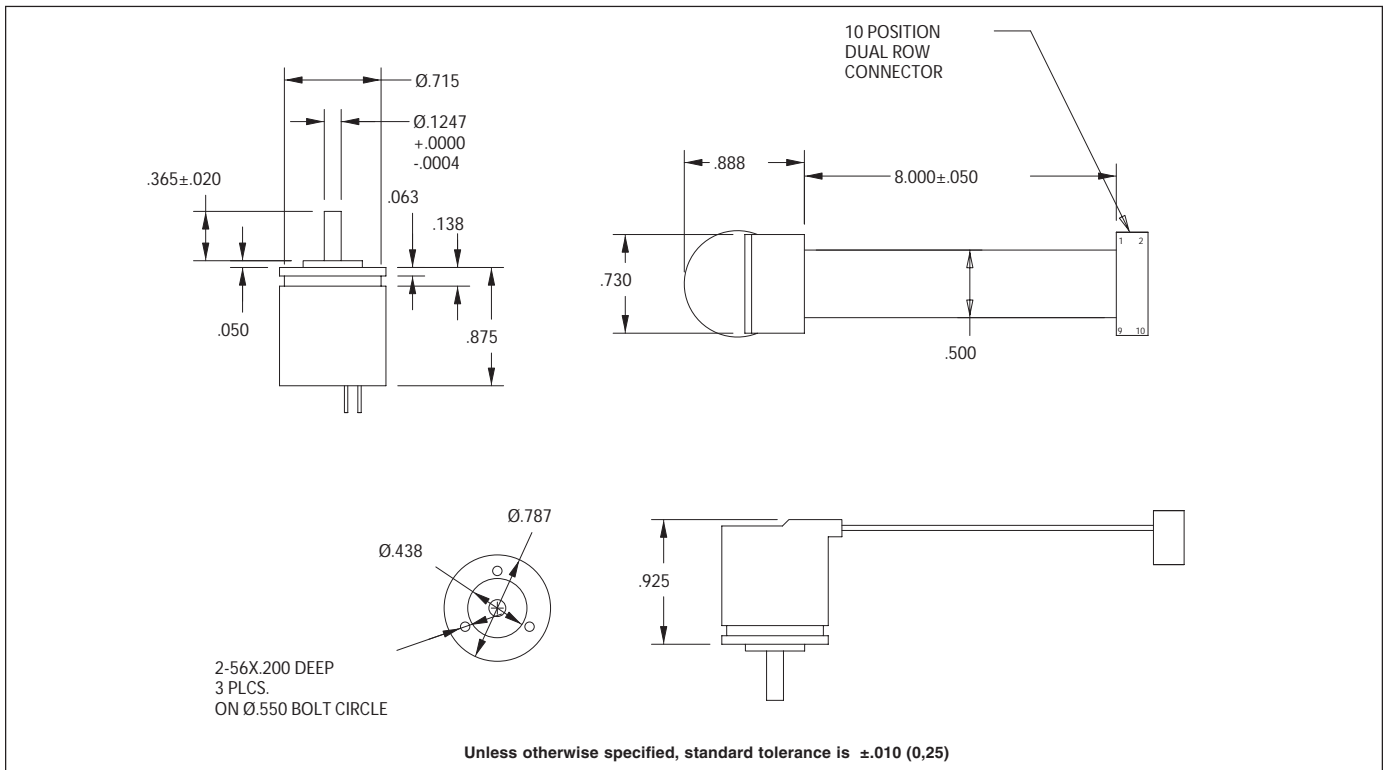


DESCRIPTION

The Series 63Q is intended for applications requiring high performance, high-resolution digital feedback in a very small package. It provides the resolution of larger encoder packages but in a package only 20mm (0.787") in diameter. Outputs can be configured in either single ended, open collector or internal pull-up resistor, or with an industrial standard RS422A differential line driver. The

sensing scheme also embodies a much simplified encoder design, which ultimately results in longer service life, and less down time due to feedback device failure. The encoder housing is constructed of a conductive carbon fiber composite that provides the EMI shielding of an all metal housing and the performance of a lightweight robust assembly.

DIMENSIONS In inches (and millimeters)



Optical and Mechanical Encoders

PIN WIRING, CIRCUITRY, AND WAVEFORM STANDARD

Pin Wiring	Waveforms	Output Circuits
Pin #1 Common Pin #2 +Vdc Pin #3 Z Pin #4 Z' Pin #5 B Pin #6 B' Pin #7 A Pin #8 A' Pin #9 N/C Pin #10 Case		TTL Output RS422A Line Driver, OL7272 5-26VDC Line Driver

SPECIFICATIONS

Electrical Ratings

Input Voltage: 5.0 ± 5% Vdc or 5-26 Vdc

Input Current Requirements: 100 mA maximum output option 1 and 2, 50 mA maximum output option 3; plus interface loads

Ripple Current: 2% peak-to-peak @ 5 Vdc

Output Circuits: AM26LS31 RS422A line driver, OL7272 line driver, TTL

Logic Output Characteristics:

Output Type: Quadrature with channel A leading channel B for CW rotation with ungated index pulse true over A and B high

Frequency Response: 200 kHz

Symmetry: 180° ±10% typical

Minimum Edge Separation: 54 electrical degrees

Mechanical Ratings

Maximum Shaft Speed: 8,000 RPM

Shaft Diameter: 0.125" (3,175)

Shaft Material: Stainless steel

Bearings: Radial ball bearing, R2 type

Radial Shaft Load: 2 lbs maximum

Axial Shaft Load: 1 lbs maximum

Housing: Carbon fiber composite (case ground via connector)

Housing Volume Resistivity: 10⁻² ohm-cm

Termination: Two rows of 5 pins on 0.100" centers. 8" ten conductor ribbon cable with 2x5 connector

Mounting: Servo

Moment of Inertia: 9.5x10⁻⁶ oz-in-sec²

Acceleration: 1x10⁵ radians per second²

Environmental Ratings

Operating Temperature Range: 0 to 70°C typical; -20°C to 100°C optional (contact Grayhill for more information)

Storage Temperature Range: -40°C to 125°C

Relative Humidity: 98% non-condensing

Vibration: 20G's @ 50-500 CPS

Mechanical Shock: 50G @ 11mS duration

OPTIONS

Contact Grayhill for custom terminations, resolutions, mounting configurations, shaft couplings and configurations, and absolute positioning up to 256 positions.

Optical and Mechanical Encoders

ORDERING INFORMATION

63QAL-1-P

- Series**
- Resolution:** (quadrature cycles per revolution) A = 500, B = 512, C = 1000, D = 1024
- Voltage:** L = 5 ±5% Vdc, H = 5-26 Vdc
- Termination:** C = 8" cable with connector, P = pin (no cable)
- Output Option:** 1 = RS422A line driver; 2 = OL7272 (5-26 Vdc) line driver; 3 = TTL output

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

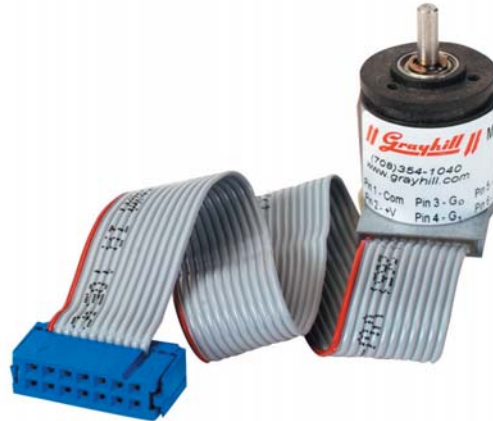
SERIES 63A
High Resolution, 20mm,
Absolute Encoding

FEATURES

- Miniature Size, 20mm (0.787") Diameter
- Single Ended Outputs
- Long Service Life
- Conductive Carbon Fiber Housing
- IP 50 Sealing
- High Noise Immunity
- Low Supply Current Requirements
- 8-Bit Gray Code or Binary Output
- Single Turn 8-Bit Word

APPLICATIONS

- Steer by Wire
- Machine Tool Controls
- Material Handling
- Flow Meters
- Any Application Requiring Discrete Digital Positioning and Angular Detection at Start Up.

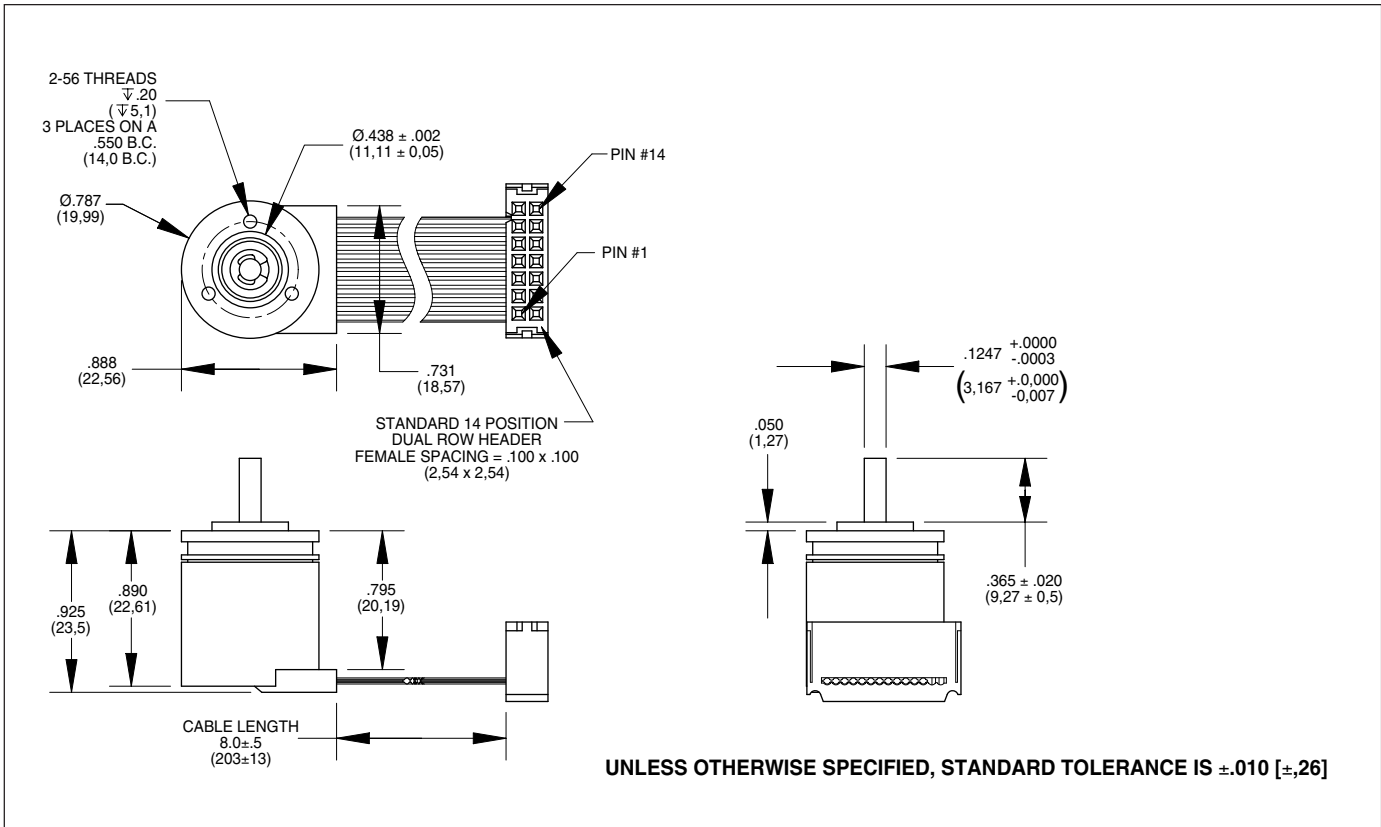


DESCRIPTION

The Series 63A is intended for applications requiring high performance, high-resolution digital feedback in a very small package. The Series 63A encoder provides 8-bit absolute resolution in a package only 20mm (0.787") in diameter.

Outputs can be configured in either gray code or binary code. The encoder housing is constructed of a conductive carbon fiber composite that provides the EMI shielding of an all metal housing and the performance of a lightweight robust assembly.

DIMENSIONS In inches (and millimeters)



Optical and Mechanical Encoders

SPECIFICATIONS

Electrical Ratings

Input Voltage: 5.0 ± 5% Vdc or 5-26 Vdc

Input Current Requirements: 40 mA maximum plus interface loads

Ripple Current: 2% peak-to-peak @ 5 Vdc

Output Circuits: TTL Compatible

VOH >3.80v@-8mA, VOL<0.44v@8mA

VOH >2.50v@-20mA, VOL<0.50v@20mA

Output Format:

Gray code or Binary Code: 8-bit, single turn, single ended. Gray code option utilizes low true Chip Enable (CE') that is pulled down with internal 10K resistor. Positive TTL signal to CE' will force the 8-bit outputs to tri-state condition allowing for shared data paths between encoders, easing basic microprocessor bus interfacing.

Frequency Response: 50 kHz

Output Count Increase: Clockwise rotation (Option A); counter clockwise rotation (Option B) See ordering information.

Positional Accuracy: ±0.5 LSB maximum error

Mechanical Ratings

Maximum Shaft Speed: 8,000 RPM

Shaft Diameter: 0.125" (3,175mm)

Shaft Material: Stainless steel

Bearings: Radial ball bearing, R2 type

Radial Shaft Load: 2 lbs maximum

Axial Shaft Load: 1 lb maximum

Housing: Carbon fiber composite (case ground via connector)

Housing Volume Resistivity: 10⁻² ohm-cm

Termination: 8" 12-conductor ribbon cable with 2x7 connector

Mounting: Servo

Moment of Inertia: 9.5x10⁻⁶ oz-in-sec²

Acceleration: 1x10⁵ radians per second²

Environmental Ratings

Operating Temperature Range: 0 to 70°C typical; -20°C to 100°C optional (contact Grayhill for more information)

Thermal Shutdown: Tambiant max. vs. input voltage max. 40C°= 25.0v, 60°C = 20.0v, 80°C = 15.0v, 100°C = 10.0v (Total load currents=30 mA)

Storage Temperature Range: -40°C to 125°C

Humidity: 98% non-condensing

Vibration: 20g @ 50-500 CPS

Mechanical Shock: 50g @ 11mS duration

ELECTRICAL CONNECTIONS

Pin#	Gray Code	Binary Code	Pin#	Gray Code	Binary Code
1	COM	COM	8	G ₅	2 ⁵
2	+V	+V	9	G ₆	2 ⁶
3	G ₀	2 ⁰	10	G ₇	2 ⁷
4	G ₁	2 ¹	11	Case	Case
5	G ₂	2 ²	12	CE'	N.C.
6	G ₃	2 ³	13	N.C.	N.C.
7	G ₄	2 ⁴	14	N.C.	N.C.

OPTIONS

Contact Grayhill for custom terminations and temperature ratings.

ORDERING INFORMATION

Series:

Resolution: 256 Absolute Positions

Voltage: L = 5.0 ±5% Vdc, H = 5-26 Vdc

63A256-L-G-A

Output Count Increase: A = shaft turned clockwise*, B = shaft turned counterclockwise* (*flange side view)

Output Option: B = Binary, G = Gray Code

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

Optical and Mechanical Encoders

CONTROL KNOBS

Ideally Suited for Encoder and Rotary Switches

FEATURES

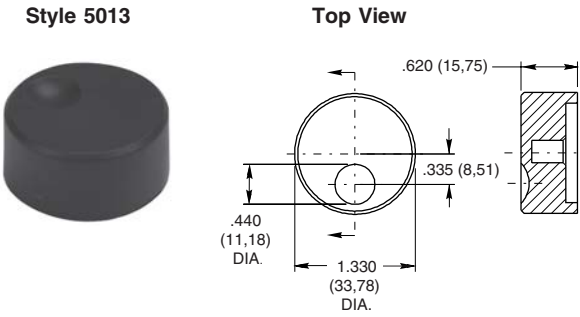
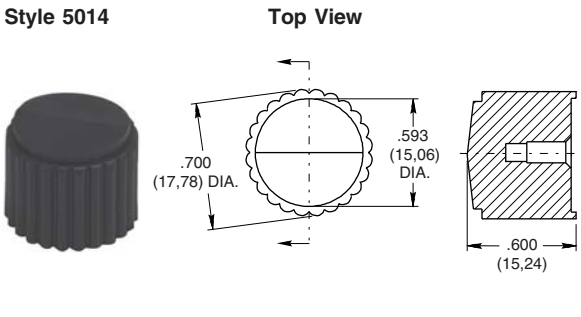
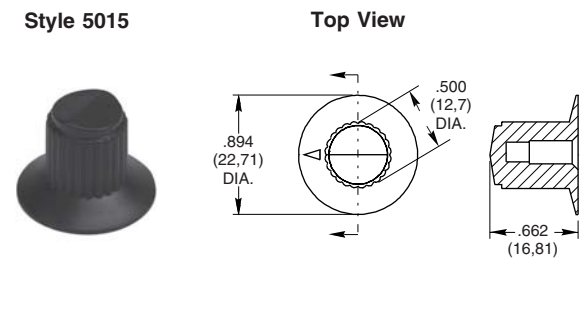
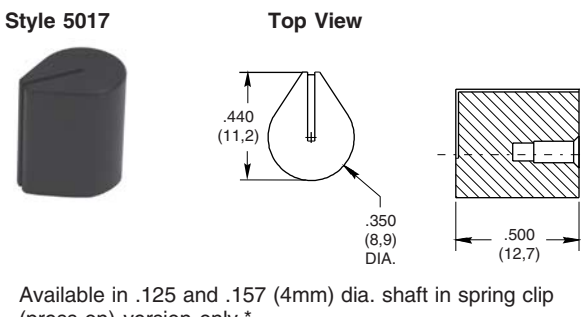
- Standard Fit for Grayhill Encoder and Rotary Switches
- Custom Materials, Styles, Colors and Markings Available
- Standard Black or Gray
- Choice of Spring Clip (Press-On) or Metal Insert with Set Screw Versions

Contact Grayhill for special design considerations



Optical and Mechanical Encoders

DIMENSIONS In inches (and millimeters)

<p>Style 5013</p>  <p>Available in .250 Dia. Shaft only.*</p>	<p>Style 5014</p> 
<p>Style 5015</p> 	<p>Style 5017</p>  <p>Available in .125 and .157 (4mm) dia. shaft in spring clip (press-on) version only.*</p>

*See Ordering Information.

DIMENSIONS In inches (and millimeters)

<p>Style 5019</p>	<p>Style 5020</p> <p>Available in ABS, .250 dia. shaft in spring clip (press-on). The locking clip is also available, requires a custom shaft.**</p>
<p>Style 5028</p>	<p>Style 5029</p>

*See Ordering Information.

**Contact Grayhill representative

ORDERING INFORMATION

11K5028-KCNB

Series
Style*: 5013, 5014, 5015, 5017, 5019, 5020, 5028, 5029
 (see dimension drawings for style options)

Shaft Diameter:
J = .125 dia. shaft
E = .157 (4mm) dia. shaft
K = .250 dia. shaft

Knob Color:
B = Black
G = Gray

Material:
A = ABS (available on the styles 5017 and 5020 only)
N = Nylon

Version:
C = Spring Clip (press-on)
L = Locking Clip (available on the style 5020 only)
M = Metal Insert w/Set Screw(s)

Custom materials, styles and colors are available.
 For prices and discounts, contact a local sales office or Grayhill.

Optical and Mechanical Encoders