



## The Innovative Switch Company

Cole Instrument has applied its exceptional engineering expertise to produce a high quality optical encoder to meet your most demanding switching needs. This advanced optical technology uses no mechanical contacts, reducing noise and eliminating contact bounce. The Cole Optical Encoder offers greater reliability and longer life than conventional rotary switches.

Precision construction in a clean room environment, materials that meet the strictest standards, and stringent inspection and testing procedures ensure that the Cole Optical Encoder will provide the ultimate in performance and reliability.

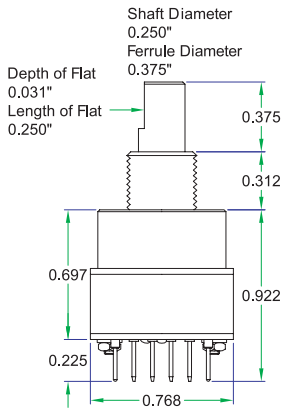


## OPTICAL ENCODERS

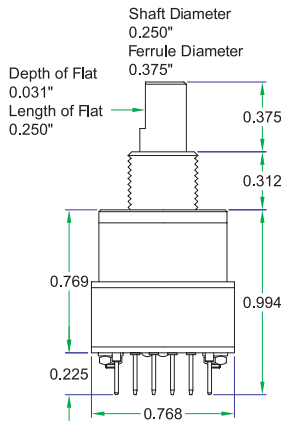
High Reliability, Photo-Electric Switching Switches

# OPTICAL ENCODERS

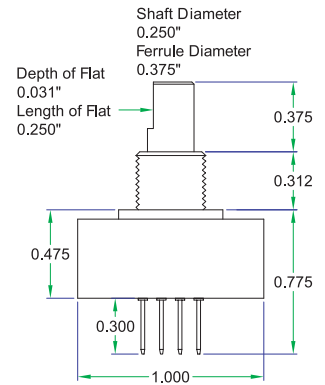
High Reliability, Photo-Electric Switching Switches



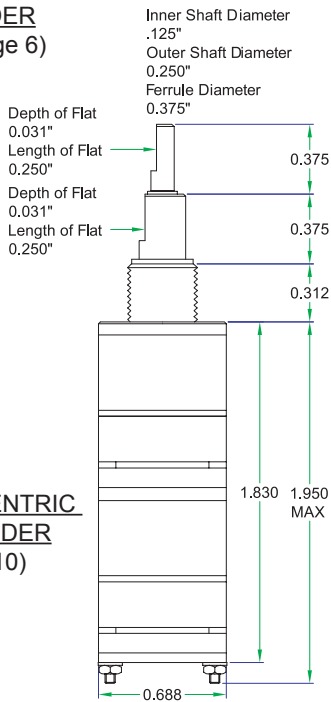
**OE-39H/S22 SERIES  
ABSOLUTE POSITIONING  
ENCODER**  
(See Page 6)



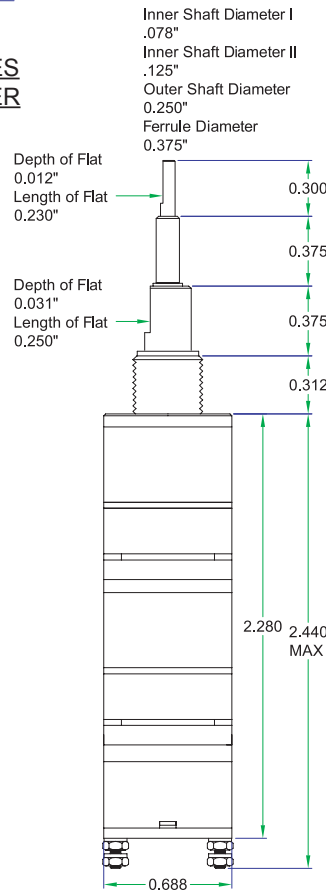
**OE-39H & S SERIES  
OPTICAL ENCODER**  
(See Page 3)



**OE-36 SERIES  
OPTICAL ENCODER**  
(See Page 14)



**OE-39C CONCENTRIC  
SHAFT ENCODER**  
(See Page 10)



**OE-39TCT TRICENTRIC  
SHAFT ENCODER**  
(See Page 9)

**NOTES:**

- OE-39H & S Series Optical Encoder - .250 Shaft Dia., .375 Ferrule Dia., .688 Body Dia., Panel Seal., (See Page 3)
- OE-39H/S22 Series Absolute Positioning Encoder - .250 Shaft Dia., .375 Ferrule Dia., .688 Body Dia., Panel Seal., (See Page 6)
- OE-39TCT Tricentric Shaft Encoder - .078 Inner Shaft Dia., .125 Inner Shaft Dia., .250 Ferrule Dia., .688 Body Dia., (See Page 9)
- OE-39C Concentric Shaft Encoder - .125 Inner Shaft Dia., .250 Outer Shaft Dia., .250 Ferrule Dia., .688 Body Dia., (See Page 10)
- OE-36 Series Optical Encoder - .250 Shaft Dia., .375 Ferrule Dia., .688 Body Dia., Panel Seal., (See Page 14)



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INSTRUMENT CORP.

2650 South Croddy Way Phone: 714.556.3100  
P.O. Box 25063 Fax: 714.241.9061  
Santa Ana, CA 92799-5063 Email: sales@cole-switches.com

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# OPTICAL ENCODERS

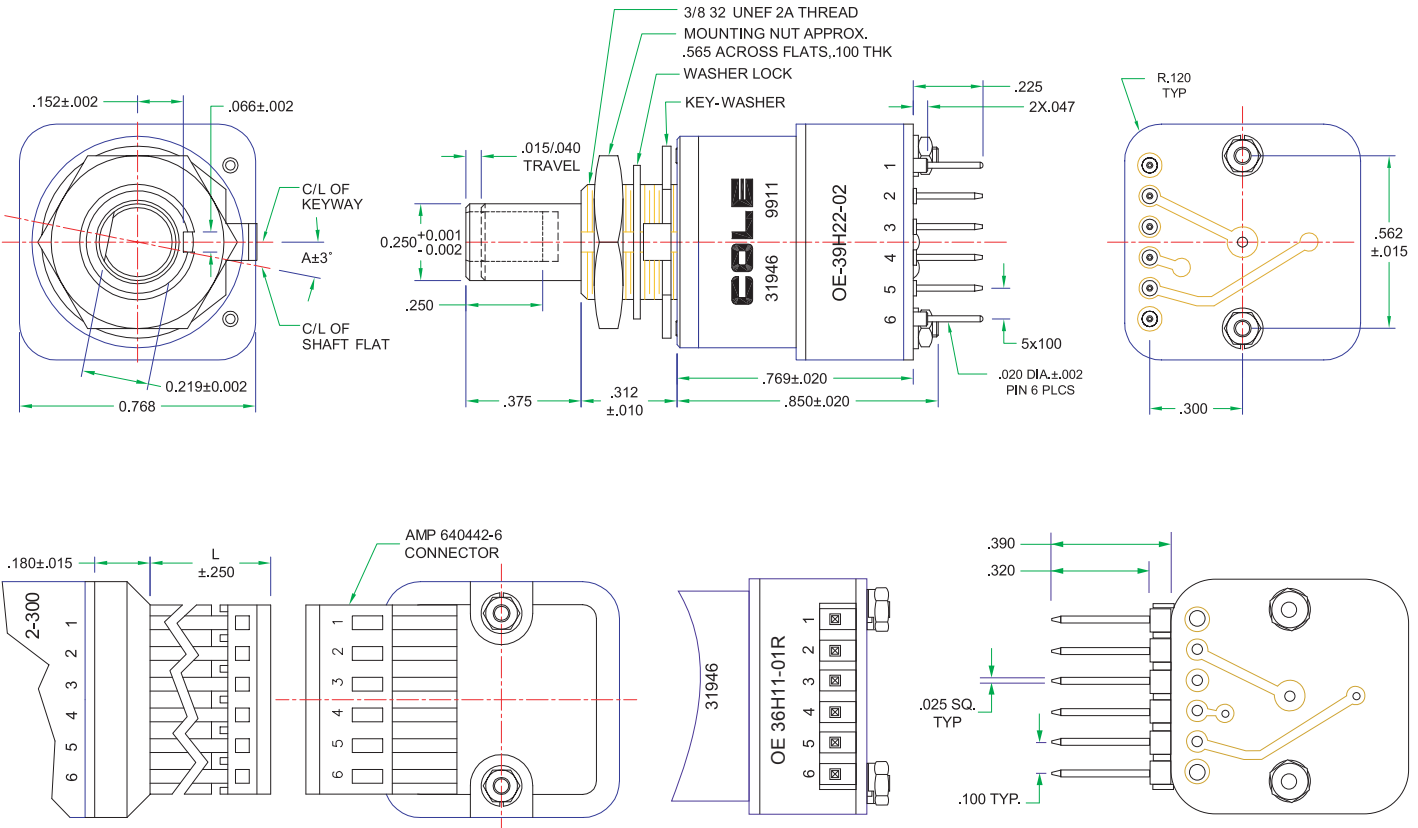
High Reliability, Photo-Electric Switching Switches

## OE-39H & S SERIES OPTICAL ENCODERS

STANDARD QUADRATURE 2-BIT CODE 16, 24, 28 OR 32 POSITIONS WITH OR WITHOUT PUSH BUTTON

### FEATURES:

- Position Screen Cursor
- Permits Visual Concentration
- Economic Touch Screen Alternative
- Push button For Entry Function
- Detent For Tactile Feedback And Minimal Backlash
- Optical Coupling For Long Life
- More Friendly Than Keyboard
- Metal Detent Sprockets For More Than a Million Trouble Free Rotations



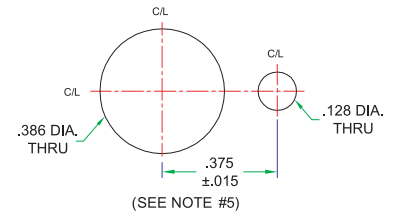
WITH CABLE TERMINATION

WITH RIGHT ANGLE TERMINATION

### NOTES:

1. Unless otherwise specified, tolerances are  $\pm .005$
2. Shown 16-position switch with integral push button switch.
3. Angle "A":
 

16 positions.....	11.25°
20 positions.....	9.00°
24 positions.....	7.50°
28 positions.....	6.43°
32 positions.....	5.63°
4. Dimension "L" (Cable Termination): from 2.0 to 25.0 inches in increment of 1/2 inch.
5. Key Washer (.432"), Shaft and Panel Seal are Optional.



SUGGESTED MOUNTING HOLE



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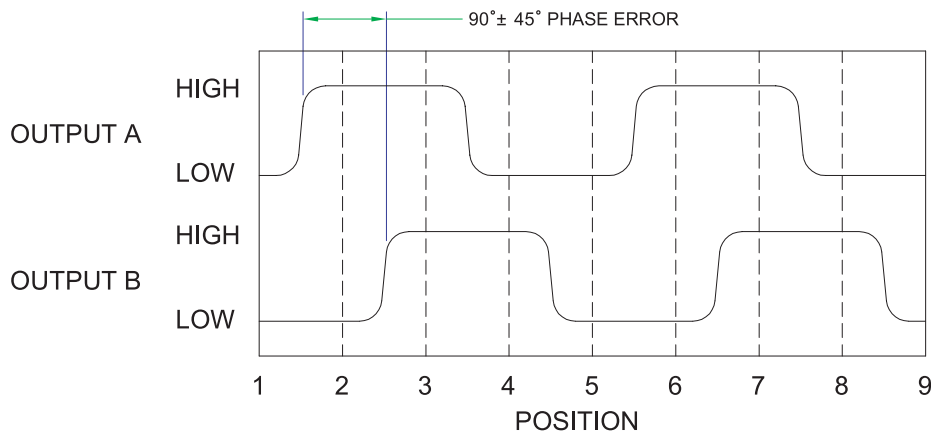
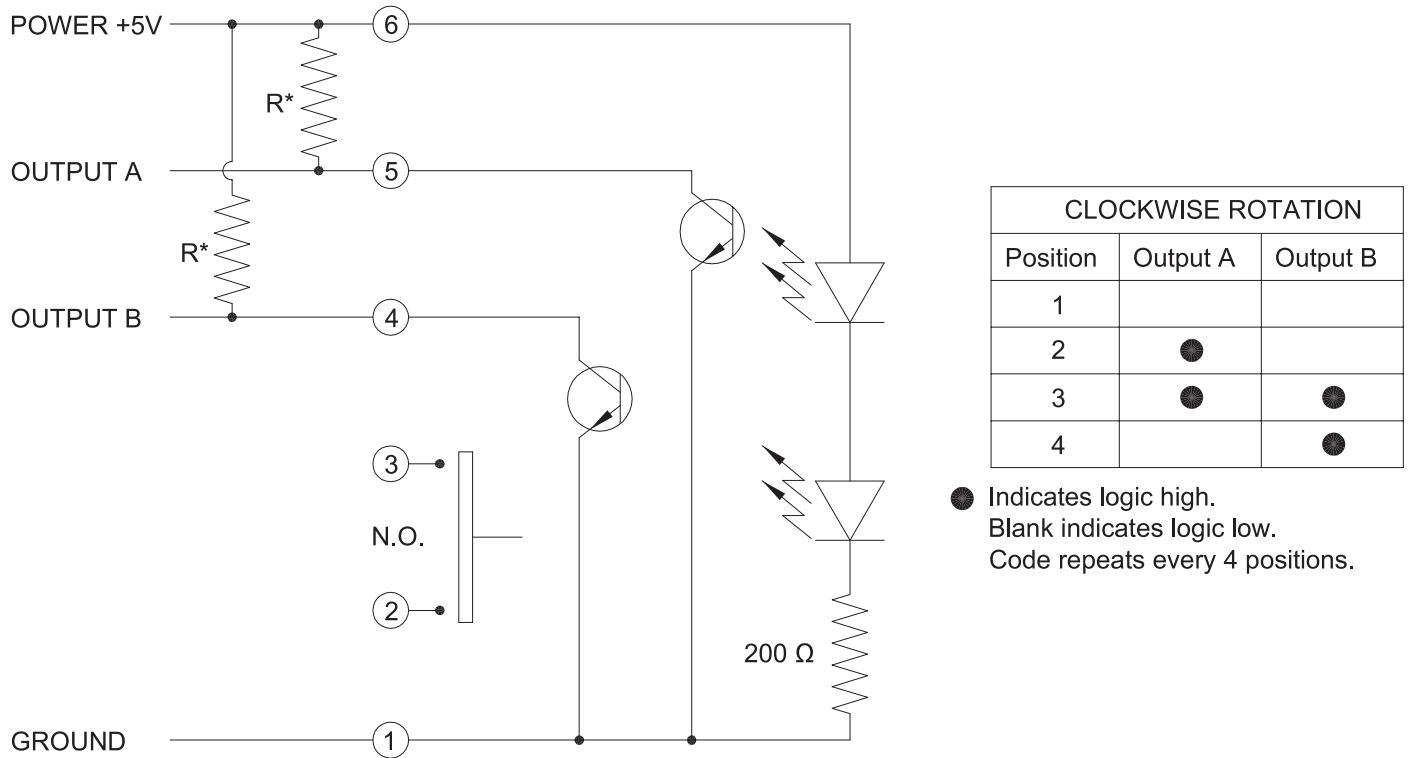
# OPTICAL ENCODERS

High Reliability, Photo-Electric Switching Switches

## OE-39H & S SERIES OPTICAL ENCODERS

STANDARD QUADRATURE 2-BIT CODE 16, 24, 28 OR 32 POSITIONS WITH OR WITHOUT PUSHBUTTON

### CIRCUITRY, TRUTH TABLE AND WAVEFORM



#### NOTES:

- \* External pull up resistors required for operation is suggested 4.7 kΩ.
- \*\* Without push button - no terminals or cable connection on terminals #2 and 3.  
Terminals #4, 5 and 6 will become #2, 3 and 4 respectively.



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# OPTICAL ENCODERS

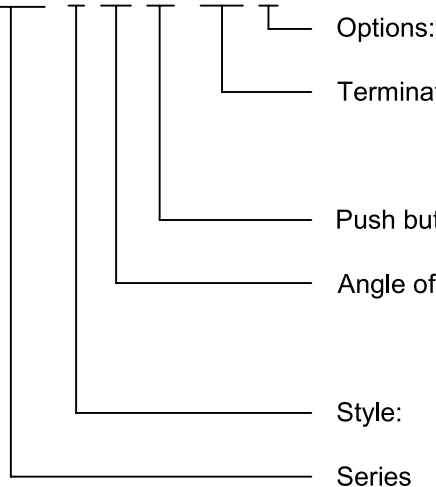
High Reliability, Photo-Electric Switching Switches

## OE-39H & S SERIES OPTICAL ENCODERS STANDARD QUADRATURE 2-BIT CODE 16, 24, 28 OR 32 POSITIONS WITH OR WITHOUT PUSH BUTTON

SPECIFICATIONS			
<b>Push Button Switch Ratings</b>		<b>Material &amp; Finishes</b>	
Rating (Make & Brake)	50 mA @ 100 VDC	Detent & Switch Housing	Thermoplastic
Contact Resistance	Less than 20 mW initial (TTL, CMOS compatible)	Bushing	Zinc Alloy, Cadmium Plated
Voltage Breakdown	250 VAC between mutually insulated parts	Shaft	Thermoplastic
Contact Bounce	Less than 20 milliseconds	Detent Sprockets (OE-39H only)	Brass
Actual Life	1 million cycles of operations minimum	Detent Balls	High Carbon Steel
Actual Force	250 grams minimum, 500 grams maximum	Detent Spring	Music Wire
<b>Rotary Encoder Ratings</b>		Printed Wiring Boards	.032 thick FR-4, Gold over Nickel over Copper
Coding	2 bit quadrature coded output	Terminals	Brass, Gold Plated over Nickel
Operating Voltage	5.0 ± .5 VDC	Through Bolts	Brass
Supply Current	30 mA maximum @ 5 VDC	Nuts	Stainless Steel
Logic Low Maximum	.5 V	Strain Relief	Thermoplastic (Cable version only)
Logic High Maximum	2.5 V	Aperture	Stainless Steel, Black Oxide
Logic Rise and Fall Times	<30 ms @ 16.6 RPM	Cable	26AWG, Stranded/Tinned Wire, PVC Coated on .100 Centers, (Cable version only)
Operating Torque	1.5 in-oz ±50%		
Rotational Life	OE-39H 1 million cycles of operation minimum	<b>Mounting Hardware</b>	
	OE-39S 100,000 cycles of operation minimum		
Temperature Range	-40°C to 65°C	One Steel, Cadmium Plated Nut, Lock Washer & One .375" (.432" - Optional) Stainless Steel, Annealed Key Washer - with each switch	
Humidity	90 - 95% Relative Humidity @ 40°C for 92 hrs		
Vibration Resistance	10 - 2000 Hz @ 15 gr or .060" double amplitude		
Mechanical Shock	High and Medium Impact		

### ORDERING INFORMATION

OE39 S 22 02 - 035 P



P - Panel and Shaft seals.  
R - Right Angle Termination.  
Y - .432" Key Washer.  
Blank (no dash or numbers) - pin as described in drawing.  
Cable Termination 035 = 3.5" (See Page 3 for Note #4) with Standard AMP Connector 640442-6.  
Contact factory if specific connector is needed.  
01 - Without Push button.  
02 - With Push button.  
11 - 11.25° or 32 positions.      18 - 18° or 20 positions.  
12 - 12.84° or 28 positions.      22 - 22.5° or 16 positions.  
15 - 15° or 24 positions.  
H - Heavy Duty Detent.  
S - Standard Version.



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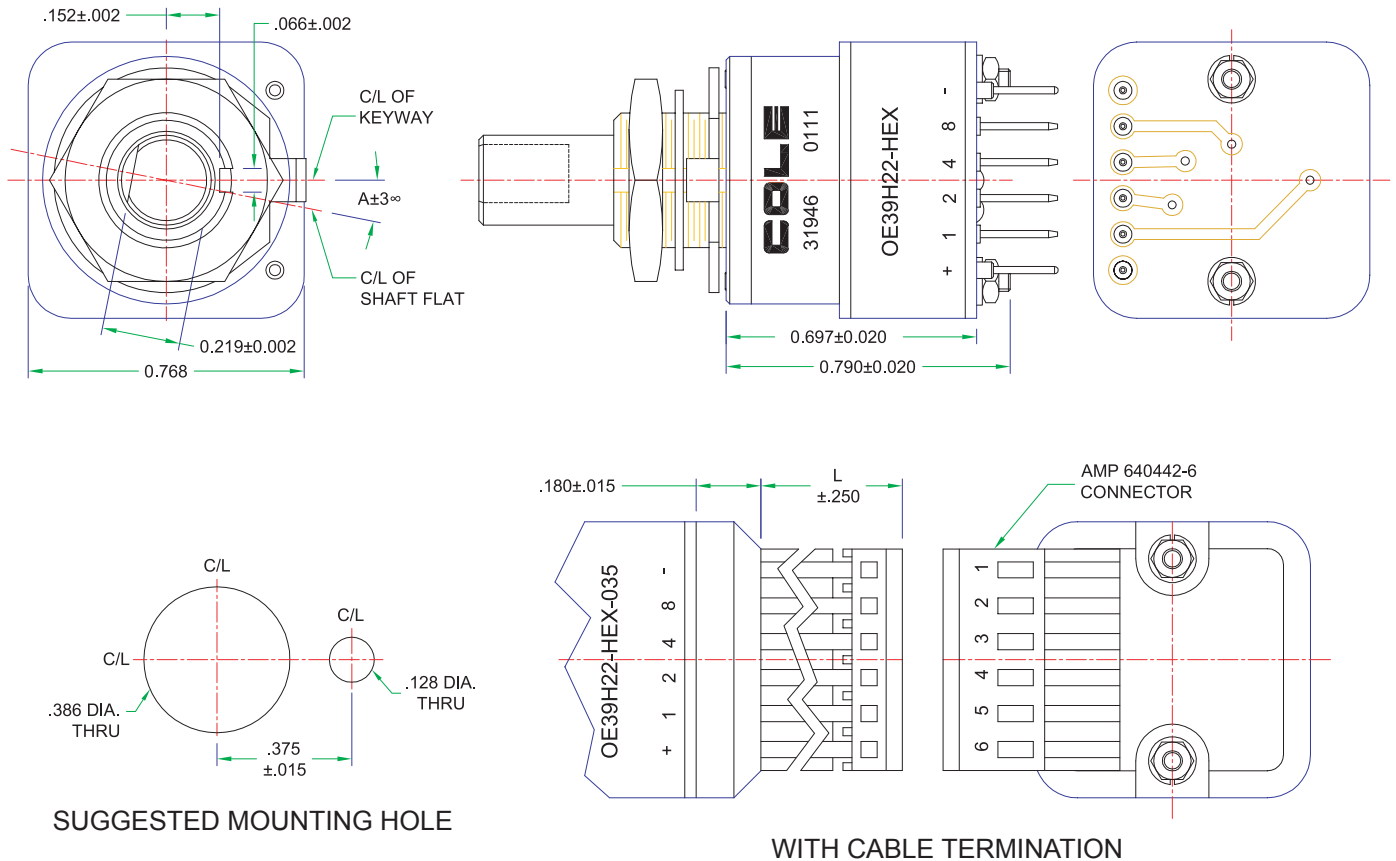
# OPTICAL ENCODERS

High Reliability, Photo-Electric Switching Switches

## OE-39H/S22 SERIES ABSOLUTE POSITIONING ENCODERS 4-BIT HEXA OR BINARY CODED DECIMAL OUTPUT, 16 POSITIONS

### APPLICATION:

4-bit Optical Encoders are best in application where absolute positioning of the shaft is needed to be determined. This is achieved by utilizing a unique coded output on each and every position of the shaft.



### NOTES:

1. Unless otherwise specified, tolerances are  $\pm .005$
2. Shown 16-position switch with integral push button switch.
3. Angle "A":
 

16 positions.....	11.25°
24 positions.....	7.50°
28 positions.....	6.43°
32 positions.....	5.63°
4. Dimension "L" (Cable Termination): from 2.0 to 25.0 inches in increment of 1/2 inch.
5. Key Washer (.432"), Shaft and Panel Seal are Optional.



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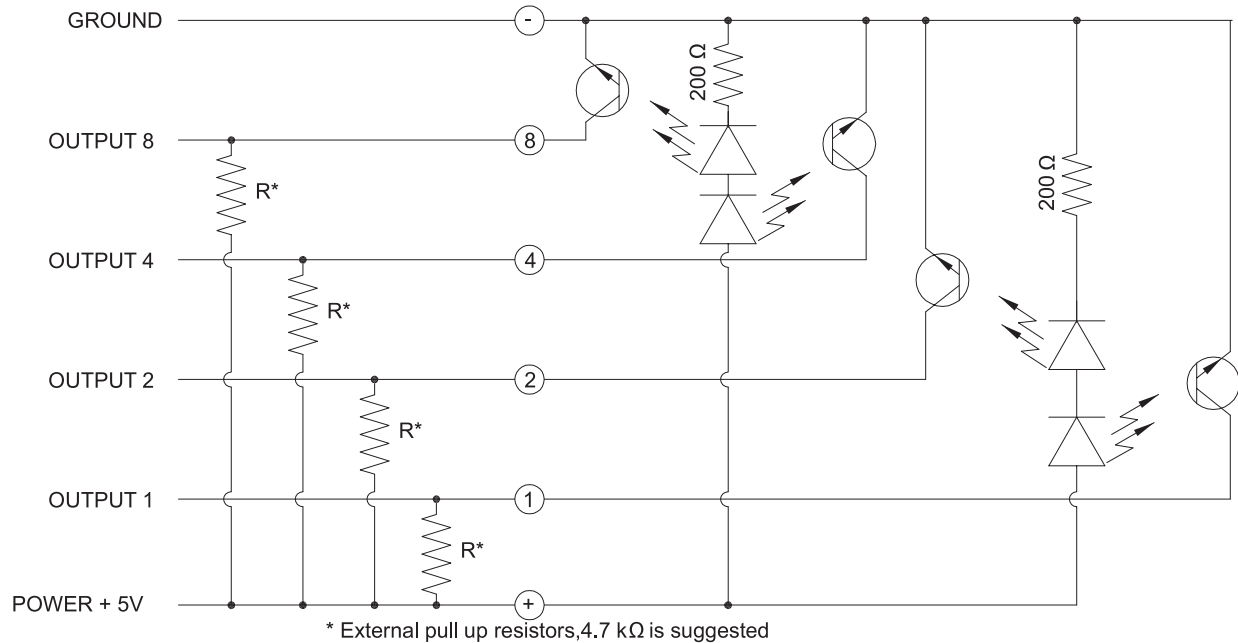
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# OPTICAL ENCODERS

High Reliability, Photo-Electric Switching Switches

## OE-39H/S22 SERIES ABSOLUTE POSITIONING ENCODERS 4-BIT HEXA OR BINARY CODED DECIMAL OUTPUT, 16 POSITIONS

### CIRCUITRY AND TRUTH TABLE



Output	Switch Positions															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1		●		●		●		●		●		●		●		●
2			●	●			●	●			●	●			●	●
4					●	●	●	●					●	●	●	●
8									●	●	●	●	●	●	●	●

Output	Switch Positions															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1		●	●			●	●			●	●			●	●	
2			●	●	●	●					●	●	●	●		
4					●	●	●	●	●	●	●	●				
8									●	●	●	●	●	●	●	●

● Indicates logic high; blank indicates logic low



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# OPTICAL ENCODERS

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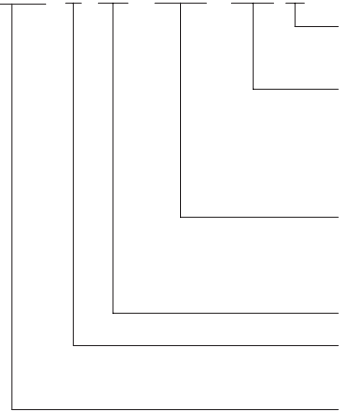
## OE-39H/S22 SERIES ABSOLUTE POSITIONING ENCODERS 4-BIT HEXA OR BINARY CODED DECIMAL OUTPUT, 16 POSITIONS

### SPECIFICATIONS

Push Button Switch Ratings		Material & Finishes	
Rating (Make & Brake)	50 mA @ 100 VDC	Detent & Switch Housing	Thermoplastic
Contact Resistance	Less than 20 mW initial (TTL, CMOS compatible)	Bushing	Zinc Alloy, Cadmium Plated
Voltage Breakdown	250 VAC between mutually insulated parts	Shaft	Thermoplastic
Contact Bounce	Less than 20 milliseconds	Detent Sprockets (OE-39H only)	Brass
Actual Life	1 million cycles of operations minimum	Detent Balls	High Carbon Steel
Actual Force	250 grams minimum, 500 grams maximum	Detent Spring	Music Wire
Rotary Encoder Ratings		Printed Wiring Boards	.032 thick FR-4, Gold over Nickel over Copper
Coding	2 bit quadrature coded output	Terminals	Brass, Gold Plated over Nickel
Operating Voltage	5.0 ± .5 VDC	Through Bolts	Brass
Supply Current	30 mA maximum @ 5 VDC	Nuts	Stainless Steel
Logic Low Maximum	.5 V	Strain Relief	Thermoplastic (Cable version only)
Logic High Maximum	2.5 V	Aperture	Stainless Steel, Black Oxide
Logic Rise and Fall Times	<30 ms @ 16.6 RPM	Cable	26AWG, Stranded/Tinned Wire, PVC Coated on .100 Centers, (Cable version only)
Operating Torque	1.5 in-oz ±50%		
Rotational Life	OE-39H 1 million cycles of operation minimum	<b>Mounting Hardware</b>	
	OE-39S 100,000 cycles of operation minimum		
Temperature Range	-40°C to 65°C	One Steel, Cadmium Plated Nut, Lock Washer & One .375" (.432" - Optional) Stainless Steel, Annealed Key Washer - with each switch	
Humidity	90 - 95% Relative Humidity @ 40°C for 92 hrs		
Vibration Resistance	10 - 2000 Hz @ 15 gr or .060" double amplitude		
Mechanical Shock	High and Medium Impact		

### ORDERING INFORMATION

OE39 S 22 - HEX - 035 P



- Options: P - Panel and Shaft seals.  
Y - .432" Key Washer.
- Termination: Blank (no dash or numbers) - pin as described in drawing.  
Cable Termination 035= 3.5" (See Page 6 for Note #4)  
with Standard AMP Connector 640442-6.  
Contact factory if specific connector is needed.
- Output Code: HEX - HEXA DECIMAL  
BCD - BINARY CODED DECIMAL  
Contact Cole Instrument if specific, 4 bit code is needed
- Angle of Throw: 22-22.5° or 16 positions.
- Style: H - Heavy Duty Detent.  
S - Standard Version.
- Series



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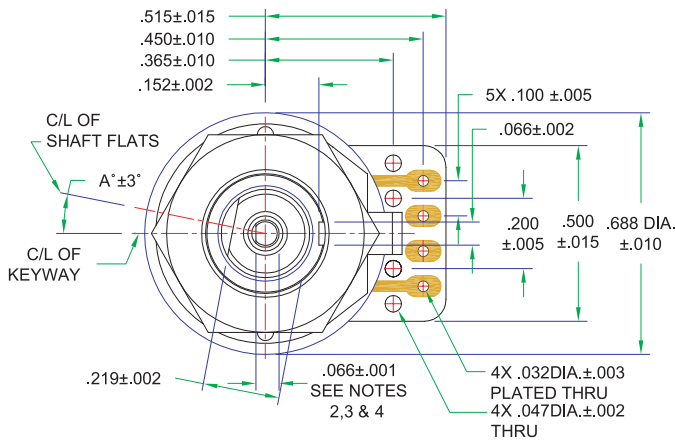
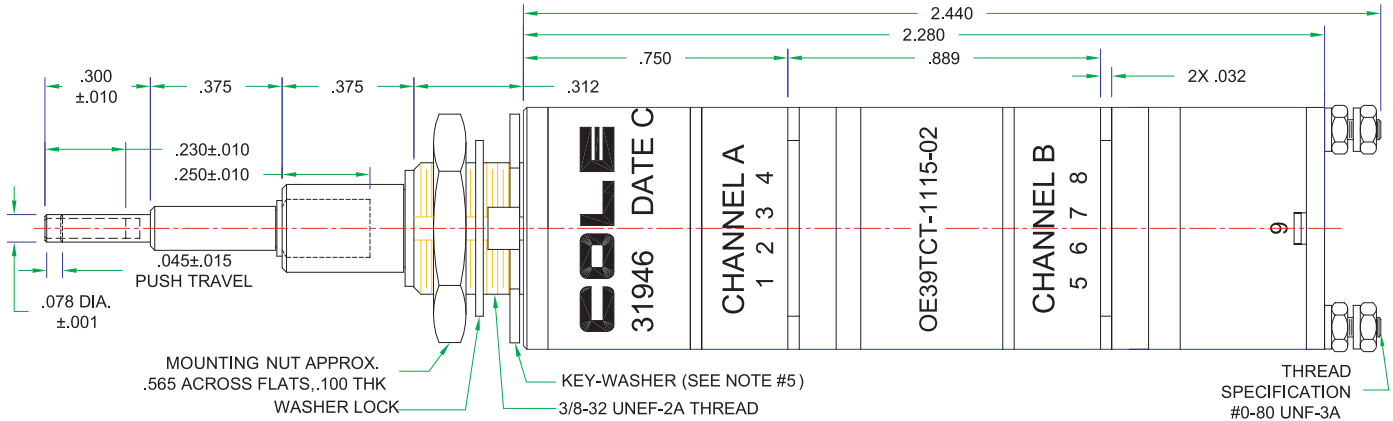
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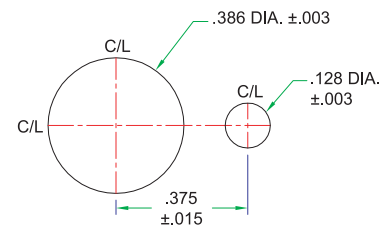
# OPTICAL ENCODERS

High Reliability, Photo-Electric Switching Switches

## OE39TCT & OE39TCN SERIES, TRICENTRIC SHAFTS, DUAL CHANNEL ENCODER WITH PUSH BUTTON SWITCH



**FRONT VIEW  
(FROM SHAFT END)**



**SUGGESTED MOUNTING HOLE**

### NOTES:

1. Unless otherwise specified, tolerances are  $\pm .020$
2. Shaft flats are oriented as shown, when switch is in Pos. 1
3. Angle "A":
 

16 positions.....	11.25°
24 positions.....	7.50°
28 positions.....	6.43°
32 positions.....	5.63°
4. Switch has two concentric continues turn shafts and on OE39TCT & TCN Series - third inner free to turn or non-turn shaft for actuation of momentary pushbutton switch.
5. Key Washer (.432"), Shaft and Panel Seal are Optional.



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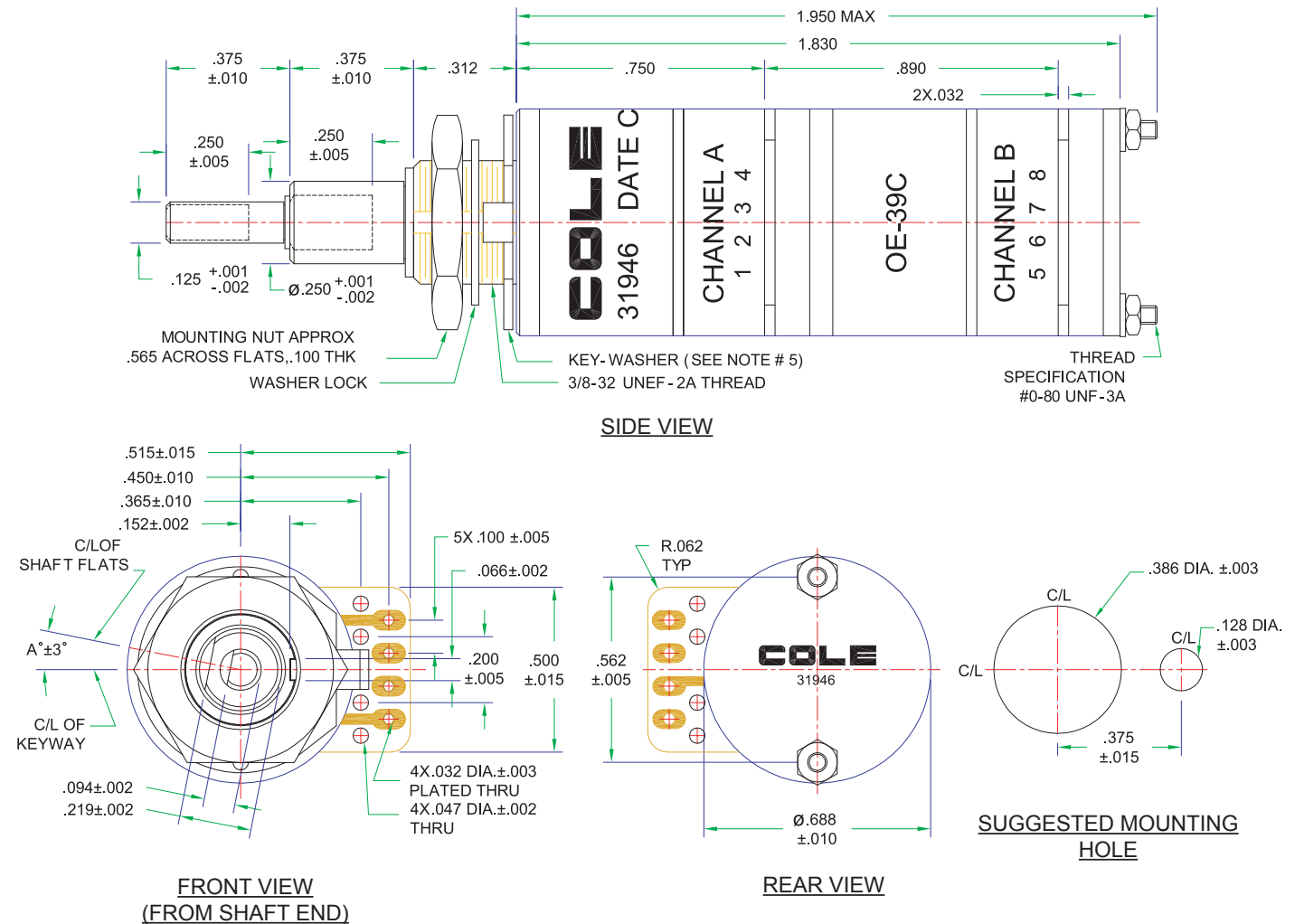
High Reliability, Photo-Electric Switching Switches

## OE-39C CONCENTRIC SHAFT ENCODERS

DUAL CHANNEL WITH STANDARD QUADRATURE 2-BIT CODE OUTPUT, 16, 24, 28 OR 32 POSITIONS WITHOUT PUSH BUTTON

### FEATURES:

- Stainless Steel Concentric Shaft.
- Saves Space On Crowded Instrument.
- Optical Coupling for Long Life.
- Integrated or Independent Push button Switch for Entry Function.
- Metal Detent Sprockets for More Than a Million Trouble-Free Rotations.



### NOTES:

1. Unless otherwise specified, tolerances are ±.020
2. Shaft flats are oriented as shown, when switch is in Pos. 1
3. Angle "A":
  - 16 positions.....11.25°
  - 24 positions.....7.50°
  - 28 positions.....6.43°
  - 32 positions.....5.63°
4. Key Washer (.432"), Shaft and Panel Seal are Optional.



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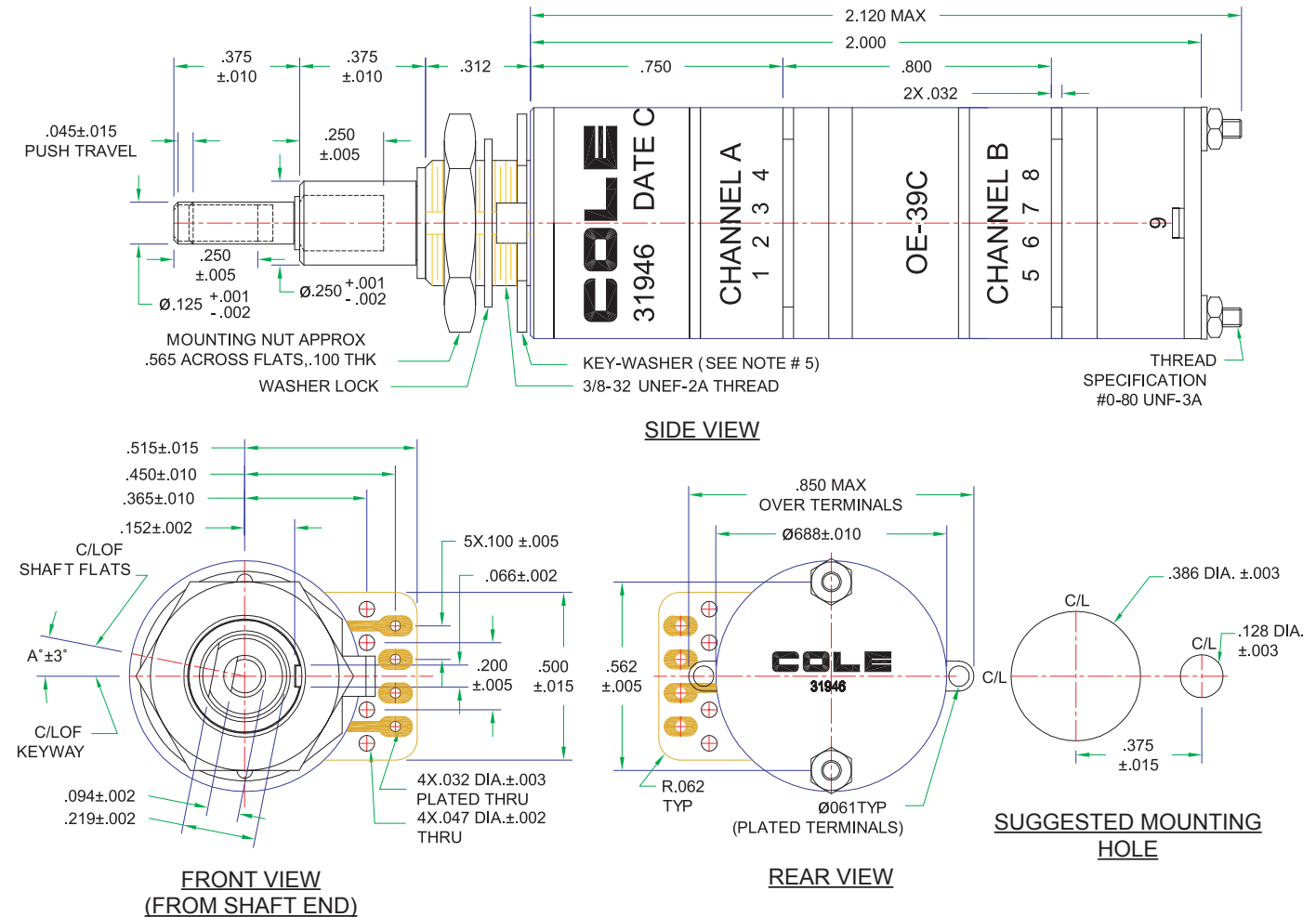
High Reliability, Photo-Electric Switching Switches

## OE-39C CONCENTRIC SHAFT ENCODERS

DUAL CHANNEL WITH STANDARD QUADRATURE 2-BIT CODE OUTPUT, 16, 24, 28 OR 32 POSITIONS WITH PUSH BUTTON

### FEATURES:

- Stainless Steel Concentric Shaft.
- Saves Space On Crowded Instrument.
- Optical Coupling for Long Life.
- Integrated or Independent Push button Switch for Entry Function.
- Metal Detent Sprockets for More Than a Million Trouble-Free Rotations.



### NOTES:

1. Unless otherwise specified, tolerances are ±.020
2. Shaft flats are oriented as shown, when switch is in Pos. 1
3. Angle "A":
 

16 positions.....	11.25°
24 positions.....	7.50°
28 positions.....	6.43°
32 positions.....	5.63°
4. Key Washer (.432"), Shaft and Panel Seal are Optional.



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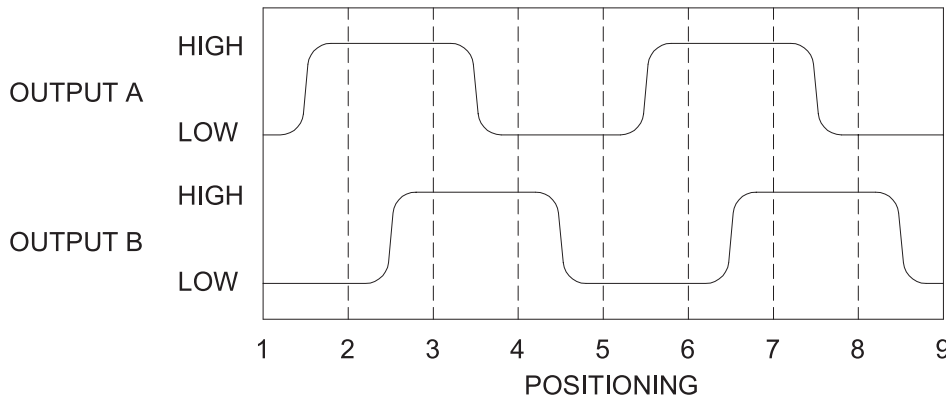
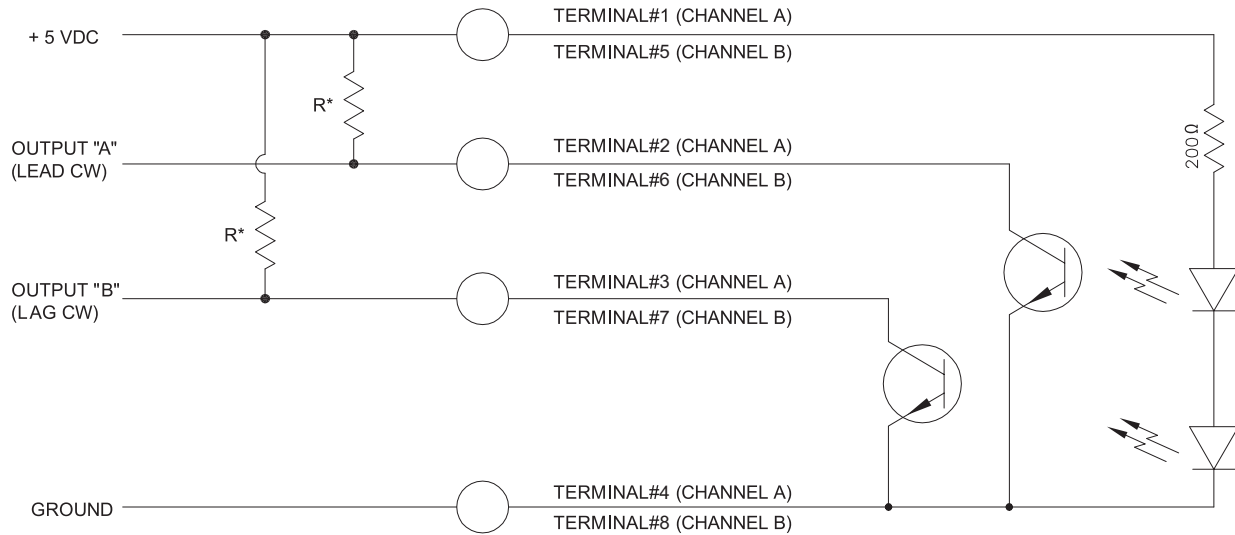
# OPTICAL ENCODERS

High Reliability, Photo-Electric Switching Switches

## OE-39C, TCT & TCN SERIES ENCODERS

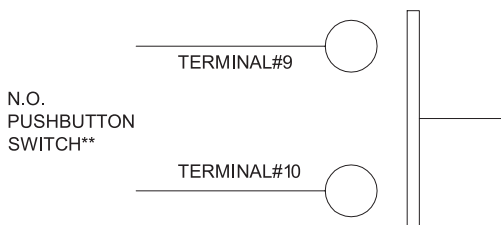
DUAL CHANNEL WITH STANDARD QUADRATURE 2-BIT CODE OUTPUT, 16, 24, 28 OR 32 POSITIONS WITH OR WITHOUT PUSH BUTTON

### CIRCUITRY, TRUTH TABLE AND WAVEFORM



CLOCKWISE ROTATION		
Position	Output A	Output B
1		
2	●	
3	●	●
4		●

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



#### NOTES:

\* External pull up resistors required for operation is suggested 4.7 kΩ.

\*\* For OE-39TC only.



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High Reliability, Photo-Electric Switching Switches

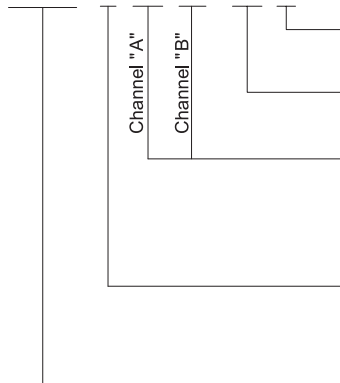
## OE-39C, TCT & TCN SERIES ENCODERS DUAL CHANNEL WITH STANDARD QUADRATURE 2-BIT CODE OUTPUT, 16, 24, 28 OR 32 POSITIONS WITH OR WITHOUT PUSH BUTTON

### SPECIFICATIONS

Push Button Switch Ratings		Material & Finishes	
Rating (Make & Brake)	50 mA @ 100 VDC	Detent & Switch Housing	Thermoplastic
Contact Resistance	Less than 20 mW initial (TTL, CMOS compatible)	Bushing	Zinc Alloy, Cadmium Plated
Voltage Breakdown	250 VAC between mutually insulated parts	Shaft	Stainless Steel
Contact Bounce	Less than 20 milliseconds	Detent Sprockets	Brass
Actual Life	1 million cycles of operations minimum	Detent Balls	High Carbon Steel
Actual Force	400 grams minimum, 500 grams maximum	Detent Spring	Music Wire
Rotary Encoder Ratings		Printed Wiring Boards	.032 thick FR-4, Gold over Nickel over Copper
Coding	2 bit quadrature coded output	Through Bolts	Brass
Operating Voltage	5.0 ± .5 VDC	Nuts	Stainless Steel
Supply Current	50 mA maximum @ 5 VDC	Aperture	Stainless Steel, Black Oxide
Logic Low Maximum	.5 V	Cable	26AWG, Stranded/Tinned Wire, PVC Coated on .100 Centers, (Cable version only)
Logic High Maximum	2.5 V		
Load Current:	2 mA maximum per channel		
Logic Rise and Fall Time	15 ms		
Operating Torque	(for 16 detented positions)	Mounting Hardware	
Outer Shaft	12 ± 4 in-oz	One Steel, Cadmium Plated Nut, Lock Washer & One .375" (.432" - Optional) Stainless Steel, Annealed Key Washer - with each switch	
Inner Shaft	9 ± 4 in-oz		
Rotational Life	1 million cycles of operations minimum		
Temperature Range	-40°C to 80°C		
Vibration Resistance	MIL-STD 202, Method 204, Condition B		
Mechanical Shock	MIL-STD 202, Method 204, Condition C & I		

### ORDERING INFORMATION

OE39 C 22 11 - 02 Y



- Options: Blank - Regular Key Washer  
Y-.432" Key Washer.
- Push button Option: 01 -Without Push button.  
02 -With Push button.
- Angle of Throw: 11 -11.25° or 32 positions.  
12 -12.84 or 28 positions.  
15 -15° or 24 positions.  
22 -22.5° or 16 positions.
- Style: C -Concentric Shaft  
TCT -Tricentric with free to turn inner shaft  
TCN -Tricentric with non-turn inner shaft
- Series



**COLE**  
INSTRUMENT CORP.

2650 South Croddy Way Phone: 714.556.3100  
P.O. Box 25063 Fax: 714.241.9061  
Santa Ana, CA 92799-5063 Email: sales@cole-switches.com

[www.cole-switches.com](http://www.cole-switches.com)  
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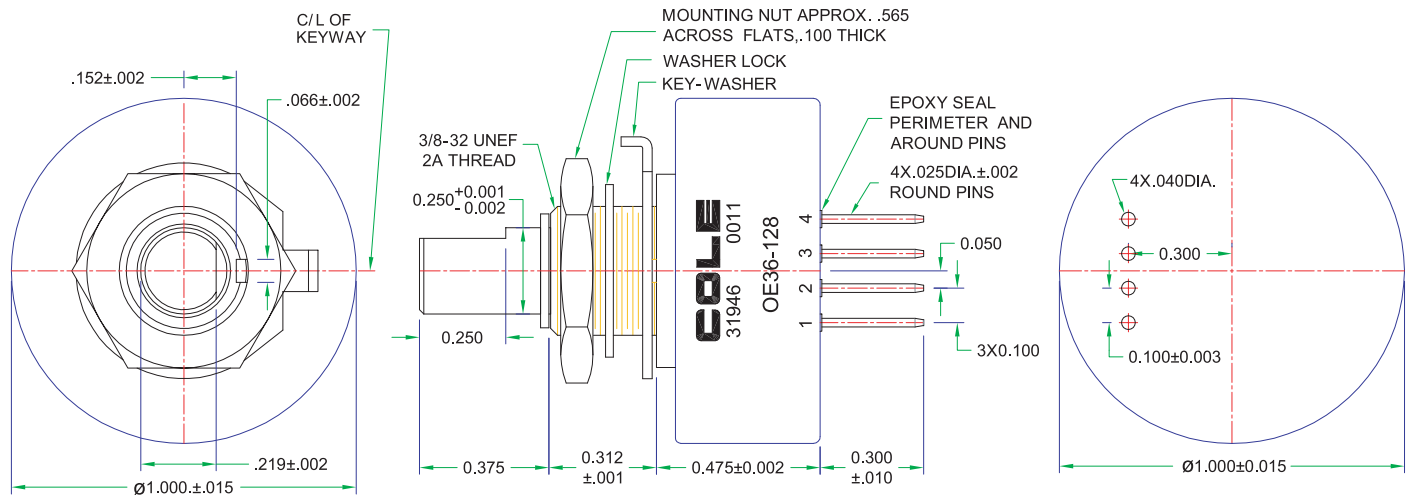
# OPTICAL ENCODERS

High Reliability, Photo-Electric Switching Switches

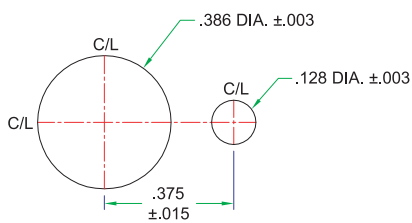
## OE-36 SERIES OPTICAL ENCODERS HIGH RESOLUTION, STANDARD QUADRATURE 2-BIT CODE 50, 64, 100, 128 OR 256 PULSES PER CHANNEL, PER REVOLUTION

### FEATURES:

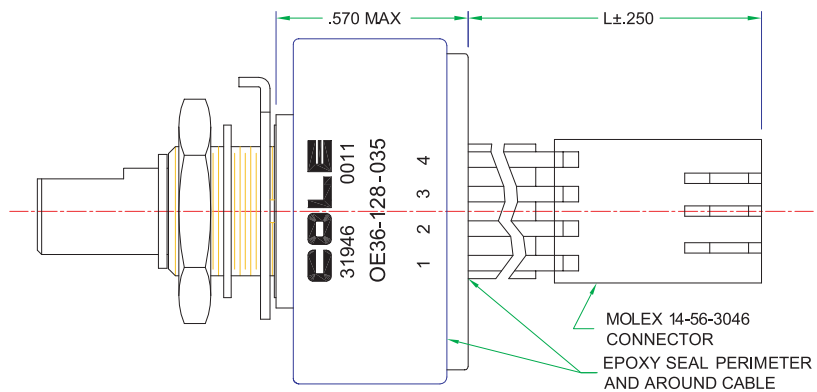
- \* High Resolution.
- \* Optical Coupling for Long Life.
- \* Capable of Directly Driving TTL Loads.
- \* Internal Temperature Compensation.
- \* Optional Bearing for High Speed.
- \* Optional .432" Key Washer, Shaft and Panel Seals.
- \* Cable or Pinned Version.
- \* Optional Connector.



RECOMMENDED  
PCB LAYOUT



SUGGESTED MOUNTING HOLE



WITH CABLE TERMINATION

### NOTES:

1. Unless otherwise specified, tolerances are  $\pm 0.005$
2. Dimension "L" (Cable Termination): from 2.0 to 25.0 inches in increment of 1/2 inch.
3. Bearing, Key Washer (.432"), Shaft and Panel Seal are optional.



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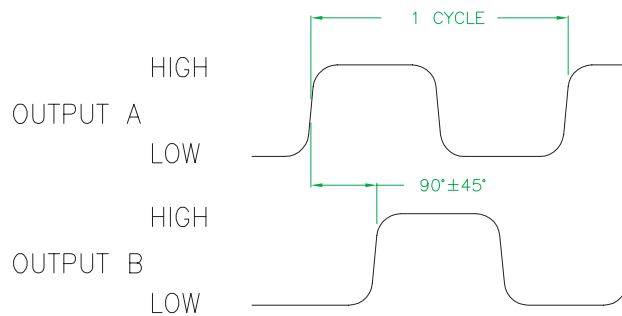
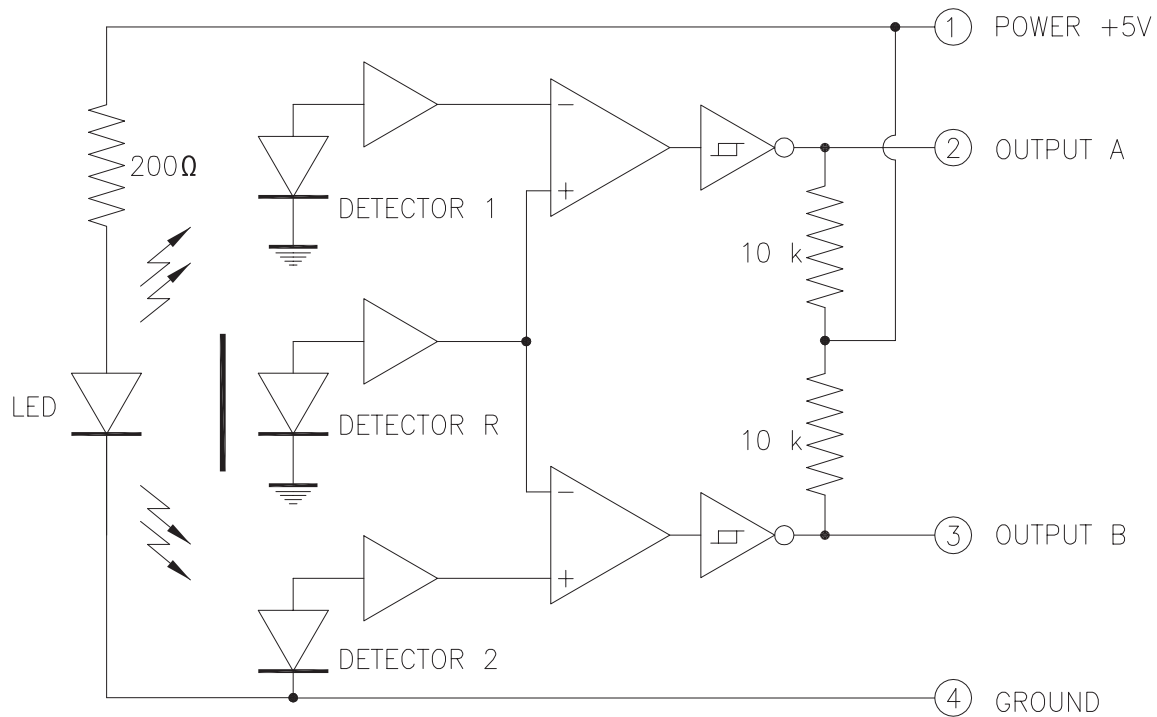
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# OPTICAL ENCODERS

High Reliability, Photo-Electric Switching Switches

OE-36 SERIES OPTICAL ENCODERS  
 HIGH RESOLUTION, STANDARD QUADRATURE 2-BIT CODE  
 50, 64, 100, 128 OR 256 PULSES PER CHANNEL, PER REVOLUTION

## CIRCUITRY, TRUTH TABLE AND WAVEFORM



Clockwise Rotation: "A" leads "B" by  $90^\circ \pm 45^\circ$   
 (Channel "B" leads Channel "A" in the Counter Clockwise direction).



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# OPTICAL ENCODERS

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## SPECIFICATIONS

### Rotary Encoder Ratings

Coding	2 bit quadrature coded output
Operating Voltage	5.0 ± .5 VDC
Continuous Forward Current	50 mA
Power Dissipation	100 mW
Output Type	Open Collector with integrated Schmitt Trigger
Output	Preconditioned Schmitt Trigger photo IC
Output Rise and Fall Time	100 ns typical
Mechanical Life	5 million revolutions
Time Life	10 years of continuous operation
Operating Temperature	-40°C to 85°C
Storage Temperature	-40°C to 85°C
Humidity	90-95% Relative Humidity @ 40°C for 92 hrs
Vibration Resistance	10-2000 Hz @ 15g or .060" double amplitude
Mechanical Shock	High and Medium Impact

### Material & Finishes

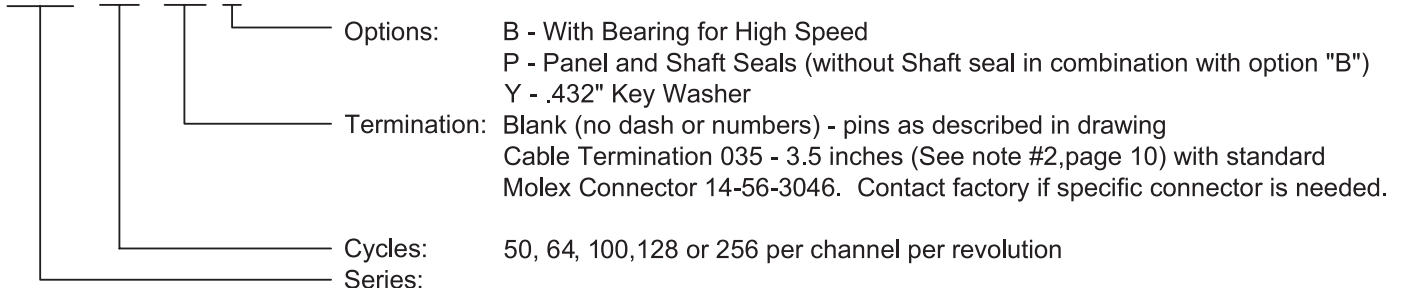
Switch Housing	Thermoplastic
Bushing	Brass Nickel Plated
Shaft	Stainless Steel
Aperture	Stainless Steel, Black Oxide
Retaining Ring	Stainless Steel
Printed Wiring Boards	.032 thick FR-4, Gold over Nickel over Copper
Terminal	Brass, Gold Plated over Nickel
Strain Relief	Thermoplastic (Cable version only)
Cable	26AWG, Stranded/Tinned Wire, PVC Coated on .100 Centers, (Cable version only)

### Mounting Hardware

One Steel, Cadmium Plated Nut, Lock Washer & One .375" (.432" - Optional) Stainless Steel, Annealed Key Washer - with each switch

## ORDERING INFORMATION

OE36 - 128 - 035 P



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