

## Description

The E7P quick assembly optical incremental kit encoder is designed for high volume, low cost, mid-resolution OEM motion control applications. The E7P was designed as a big brother to the E4P encoder and offers higher resolutions, a wider range of shaft diameters, and mounts to additional bolt circles. The E7P uses a 5V supply and offers two TTL quadrature outputs. A single chip reflective encoder module incorporates an LED, monolithic detector and molded lenses. The phased array technology accepts far wider mechanical tolerance and misalignment than traditional aperture type encoders.

Two screws secure the base using one of three bolt circles. The precision machined aluminum reflective codewheel pushes on by hand using a spacing tool to securely grip the shaft while eliminating set screws (patent pending). The cover snaps on to complete the assembly in seconds.

When mounting holes are not available, a centering tool and stick-on version is available. The T-option specifies a base with a transfer adhesive pre-applied. The backing is peeled off and the base is slid down the shaft guided by the centering tool.

The single-ended output version has a 4-pin connector and is designed to drive cables up to six feet long.

The differential output version has a 6-pin connector and is designed for driving longer cable lengths and maximizes noise immunity. The internal 26C31 differential line driver can source and sink 20 mA at TTL levels. The recommended receiver is industry standard 26C32. Maximum noise immunity is achieved when the differential receiver is terminated with a 110  $\Omega$  resistor in series with a .0047  $\mu$ F capacitor placed across each differential pair. The capacitor simply conserves power. Otherwise power consumption would increase by approximately 20 mA per pair, or 40 mA for 2 pairs.



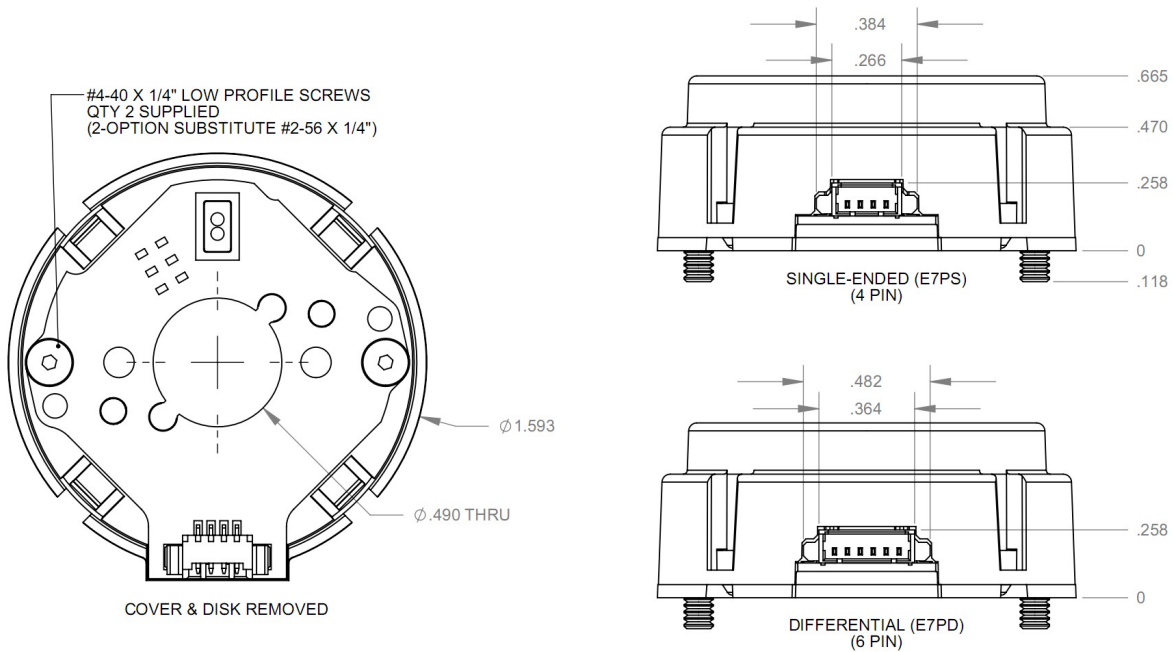
## Features

- ▶ Quick simple assembly
- ▶ A and B quadrature TTL outputs
- ▶ Fits shaft diameters from 0.118" (3mm) to 0.394" (10mm)
- ▶ Frequency response DC to 60 kHz
- ▶ 180 to 720 cycles per rev (CPR)
- ▶ 720 to 2880 quadrature states per rev.
- ▶ Accepts .020" axial shaft play
- ▶ Single-ended or differential output option
- ▶ 5 V supply

**Related Products & Accessories**

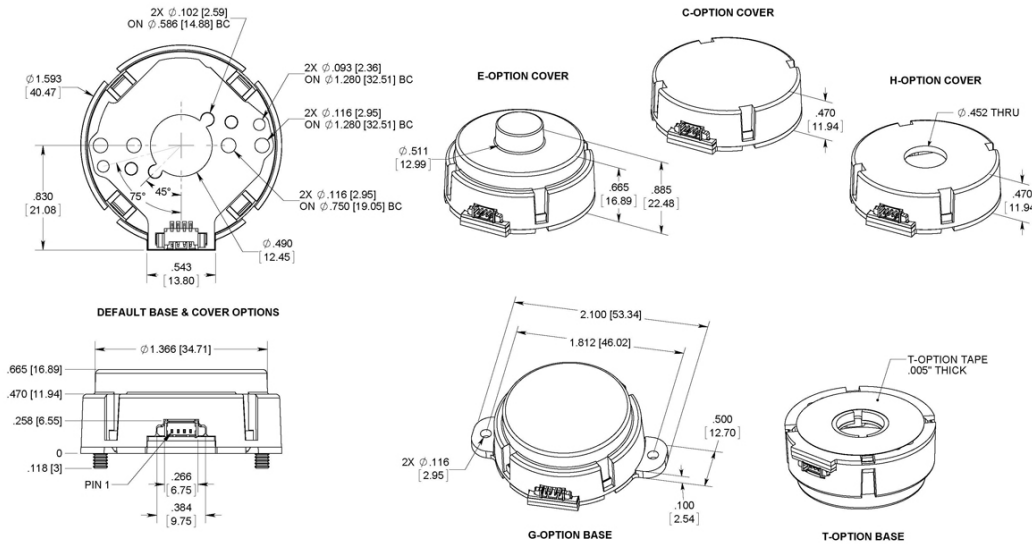
- CA-FC5-SH-MIC4 5-Pin Latching / 4-Pin Micro Shielded Cable (Base price \$15.18)
- CA-MD6-SS-MIC4 6-Pin Modular / 4-Pin Micro Silver Satin Cable (Base price \$11.53)
- CA-MIC4-SH-NC 4-Pin Micro / Unterminated Shielded Cable (Base price \$7.30)
- CA-MIC4-W4-NC 4-Pin Micro / Unterminated 4-Wire Discrete Cable (Base price \$6.80)
- CA-MIC6-SH-NC 6-Pin Micro / Unterminated Shielded Cable (Base price \$10.46)
- CA-MIC6-W6-NC 6-Pin Micro / Unterminated 6-Wire Discrete Cable (Base price \$9.96)
- CON-MIC4 4-Pin Micro Connector (Base price \$3.15)

**Mechanical Drawing**



8329.jpg

E7P Single-Ended OEM Optical Kit Encoder



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UNITS: INCHES (MM) METRIC DIMENSIONS FOR REFERENCE ONLY

## Mechanical

Parameter	Dimension	Units
Moment of Inertia	7.03 x 10 <sup>-5</sup>	oz-in-s <sup>2</sup>
Required Shaft Length		
With D-Cover option	0.355 to 0.587	in.
With C-Cover option	0.355 to 0.430	in.
With E-Cover option	0.355 to 0.836	in.
With H-Cover option	>=0.355	in.

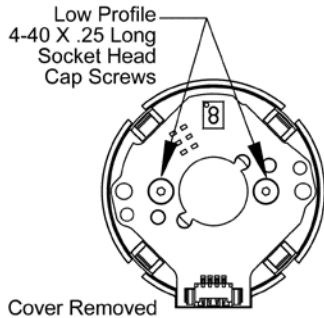
## Bolt Circle Mounting

Bolt Circle	Option to Specify	Screws Included*	Hex Tool Included*
0.750"	D-option	low profile #4-40 x 1/4"	.050" hex driver
1.280"	D-option	low profile #4-40 x 1/4"	.050" hex driver
1.280"	2-option	standard #2-56 x 1/4"	5/64" hex wrench
1.812"	G-option	standard #4-40 x 1/4"	3/32" hex wrench

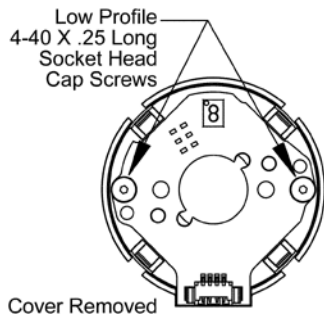
\* The set of screws and hex tool included with each encoder depend on the option and bolt circle as shown above.

Although standard socket head cap screws will work when mounting the **E7P**, to maximize clearance between the codewheel and the top of the screw head, we recommend low profile socket head cap screws when using the holes on the **E7P** board. Both standard or low profile socket head cap screws will work with the **G**-option.

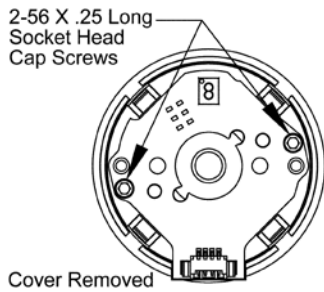
**0.750" Bolt Circle / Low Profile #4-40 x 1/4":**



**1.280" Bolt Circle / Low Profile #4-40 x 1/4":**

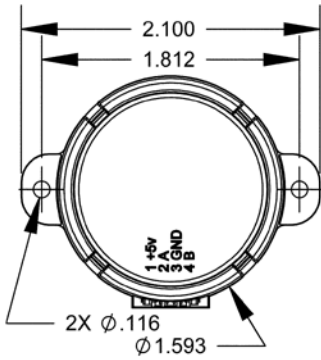


**1.280" Bolt Circle / #2-56 x 1/4" (2-option):**



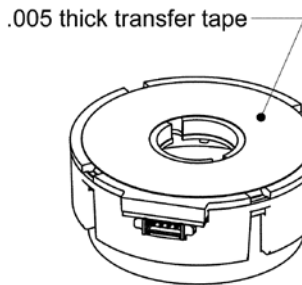
Provides two #2-56 x " screws in place of two #4-40 x 1/4".

**1.812" Bolt Circle / #4-40 x 1/4" (G-option):**



Provides mounting ears on the base allowing for a 1.812" bolt circle.

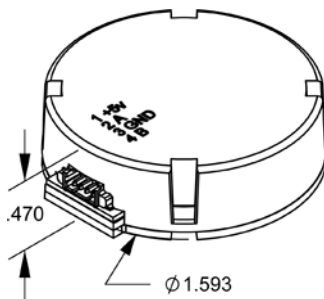
### Transfer Adhesive Mounting (T-option)



The T-option base provides a transfer adhesive (with peel-off backing) that may be used when mounting holes are not available. A centering tool is required when using this option.

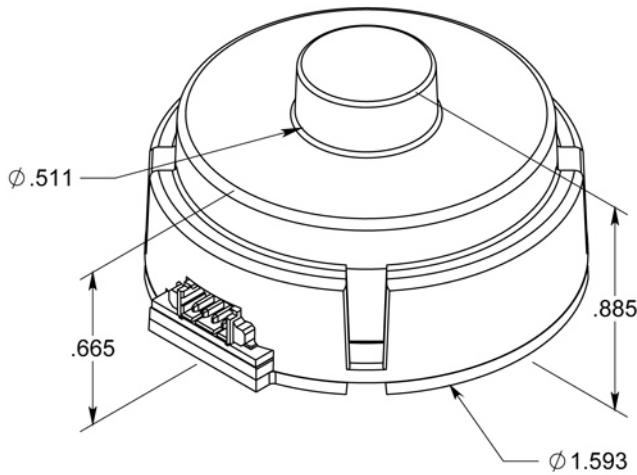
### Housing Cover Options

Compact (C-option):



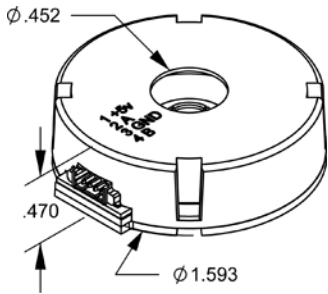
Provides the lowest profile.

Extension in Shaft (E-option):



Provides an extension to the cover allowing for longer shafts of up to 0.836".

**Hole in Housing (H-option):**



Provides a 0.452" diameter hole to the cover allowing for shafts to pass through.

**Absolute Maximum Ratings**

Parameter	Min.	Max.	Units
Vibration (5 Hz to 2kHz)	-	20	G
Shaft Axial Play	-	±.020	in.
Off-axis Mounting Tolerance	-	0.010	in.
Acceleration	-	250,000	rad/sec <sup>2</sup>
Maximum RPM e.x. CPR = 720, max. rpm = 5000 e.x. CPR = 180, max. rpm = 20000	-	minimum value of (3600000/CPR) and (60000)	rpm
Relative Humidity	-	90	%
Storage Temperature	-40	100	C

Parameter	Min.	Max.	Units
Operating Temperature	-20	100	C

▸ Note: 60000 rpm is the maximum rpm due to mechanical considerations. The maximum rpm due to the module's 60kHz maximum count frequency is (3600000/CPR).

### Torque

Parameter	Torque
Base to Mounting Surface Screws	2-3 in.-lbs.

### Materials

Part	Material
Base, Cover	20% glass filled polycarbonate
Codewheel	Aluminum

### Phase Relationship

A leads B for clockwise shaft rotation, and B leads A for counterclockwise rotation viewed from the cover/label side of the encoder (see the AEDR page).

### Single-ended Electrical

Specifications	Min.	Typ.	Max.	Units	Notes
Supply Current	-	21	27	mA	
Supply Voltage	4.5	-	5.5	V	
High Level Output	2.4	-	-	V	I <sub>oh</sub> = -2 mA
Low Level Output	-	-	0.4	V	I <sub>ol</sub> = 8 mA
Rise Time	-	500	-	ns	CI = 25 pF, RI = 2.7 kΩ
Fall Time	-	100	-	ns	
Frequency Response	-	-	60	kHz	

For complete details see the AEDR page.

### Differential Electrical

Specifications	Min.	Typ.	Max.	Units	Notes
Supply Current	-	22	30	mA	

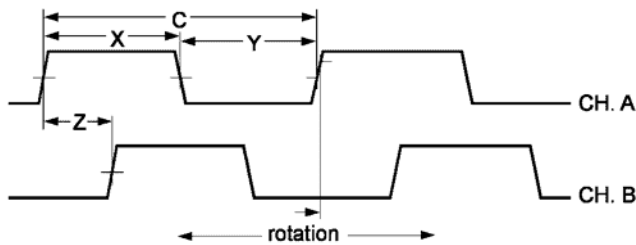
Specifications	Min.	Typ.	Max.	Units	Notes
Supply Voltage	4.5	-	5.5	V	
High Level Output	2.4	3.4	-	V	I <sub>oh</sub> = -20 mA
Low Level Output	-	0.2	0.4	V	I <sub>ol</sub> = 20 mA
Rise Time	-	500	-	ns	
Fall Time	-	100	-	ns	
Frequency Response	-	-	60	kHz	

For complete details see the AEDR page.

### Encoding Characteristics

Parameter	Typ.	Max.	Units
Symmetry Error	16	75	deg.
Quadrature Error	12	60	deg.

### Timing Diagram



**CPR (N):**

The number of Cycles Per Revolution.

**One Shaft Rotation:**

360 mechanical degrees, N cycles.

**One Electrical Degree (e):**

1/360th of one cycle.

**One Cycle (C):**

360 electrical degrees (e). Each cycle can be decoded into 1 or 4 codes, referred to as X1 or X4 resolution multiplication.

**Symmetry:**

A measure of the relationship between (X) and (Y) in electrical degrees, nominally 180e.

**Quadrature (Z):**



The phase lag or lead between channels A and B in electrical degrees, nominally 90e.

**Position Error:**

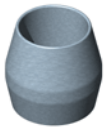
The difference between the actual shaft position and the position indicated by the encoder cycle count.

**Cycle Error:**

An indication of cycle uniformity. The difference between an observed shaft angle which gives rise to one electrical cycle, and the nominal angular increment of 1/N of a revolution.

 **Accessories**

**Centering Tools (May need to order separately, only included with PKG3-packaging option).**



Part #: CTOOL - (Shaft Diameter)

**Description:** This reusable tool provides a simple method for accurately centering the E7P base to the shaft. It is required when using the T-option.

**Spacer Tools (Do not need to order separately, included with ALL packaging options).**



Part #: SPACER-E7P

**Description:** Self-spacing tool for placement of hub. Round. Polycarbonate.

**Screws**



Part #: SCREW-2381

**Description:** 2-56 x 1/4" socket head cap screw

**Quantity Required for Mounting:** 2 per encoder



Part #: SCREW-9127

Description: 4-40 x 1/4" low profile socket head cap screw

Quantity Required for Mounting: 2 per encoder



Part #: SCREW-2394

Description: 4-40 x 1/4" socket head cap screw

Quantity Required for Mounting: 2 per encoder

## Pin-outs

4-pin Single-ended		6-pin Differential	
Pin	Description	Pin	Description
1	+5VDC power	1	Ground
2	A channel	2	A channel
3	Ground	3	A- channel
4	B channel	4	+5VDC power
		5	B channel
		6	B- channel

Ordering Information

E7P	CPR	Bore	Output	Cover	Base	Packaging
	180	118 =	S =Single-ended	D =Default	D =Default	B =Encoder components packaged in bulk. One spacer tool per 100 encoders.
	200	3mm		C =Compact Cover	2 =Two #2-56 x 1/4" mounting screws	1 =Each encoder packaged individually. One spacer tool per 100 encoders.
	250	125 = 1/8"	D =Differential	E =Cover Extension	G =Adds mounting "ears" to base to	2 =Each encoder packaged individually. One spacer tool per encoder.
	256	156 =		H =Hole in Cover	T =Adds transfer adhesive to base	3 =Each encoder packaged individually. One spacer tool and one centering tool per encoder.
	360	5/32"				
	400	157 =				
	500	4mm				
	512	188 =				
	600	3/16"				
	625	197 =				
	720	5mm				
		236 =				
		6mm				
		250 = 1/4"				
		313 =				
		5/16"				
		315 =				
		8mm				
		375 = 3/8"				
		394 =				
		10mm				

Notes

- ▶ US Digital warrants its products against defects in materials and workmanship for two years. See complete warranty for details.

Base Pricing

Quantity	Price
1	\$47.85
10	\$34.41
50	\$26.75
100	\$22.07

- ▶ Add 20% per unit for **Output** of Differential
- ▶ Add 15% per unit for **Base** of Adds transfer adhesive to base
- ▶ Add \$3.00 per unit for **Packaging** of Each encoder packaged individually. One spacer tool per 100 encoders.
- ▶ Add \$4.00 per unit for **Packaging** of Each encoder packaged individually. One spacer tool per encoder.

▸ Add \$7.00 per unit for **Packaging** of Each encoder packaged individually. One spacer tool and one centering tool per encoder.