

## E16 Features

- Push-on hub - spring loaded collet design
- Fits shaft diameters of 1.5mm (0.059 in.) and 2mm (0.079 in.)
- 250/256 to 4,000/4096 cycles per revolution (CPR)
- 1,000/1024 to 16000/16384 pulses per revolution (PPR)
- Single +5V supply



## E16 Product Description

The E16 16mm micro optical encoder is designed to provide A, B and Index digital quadrature signals for high volume, restricted space applications. The E16 utilizes an innovative, push-on encoder disk which accepts shaft diameters of 1.5mm and 2mm.



The E16 is designed to be a one-time installation micro optical encoder, the base provides mounting holes for two M1.6-0.35, length 3mm screws on a 10mm bolt circle. The encoder cover is easily snapped onto the base and is marked with the connector pin-out.

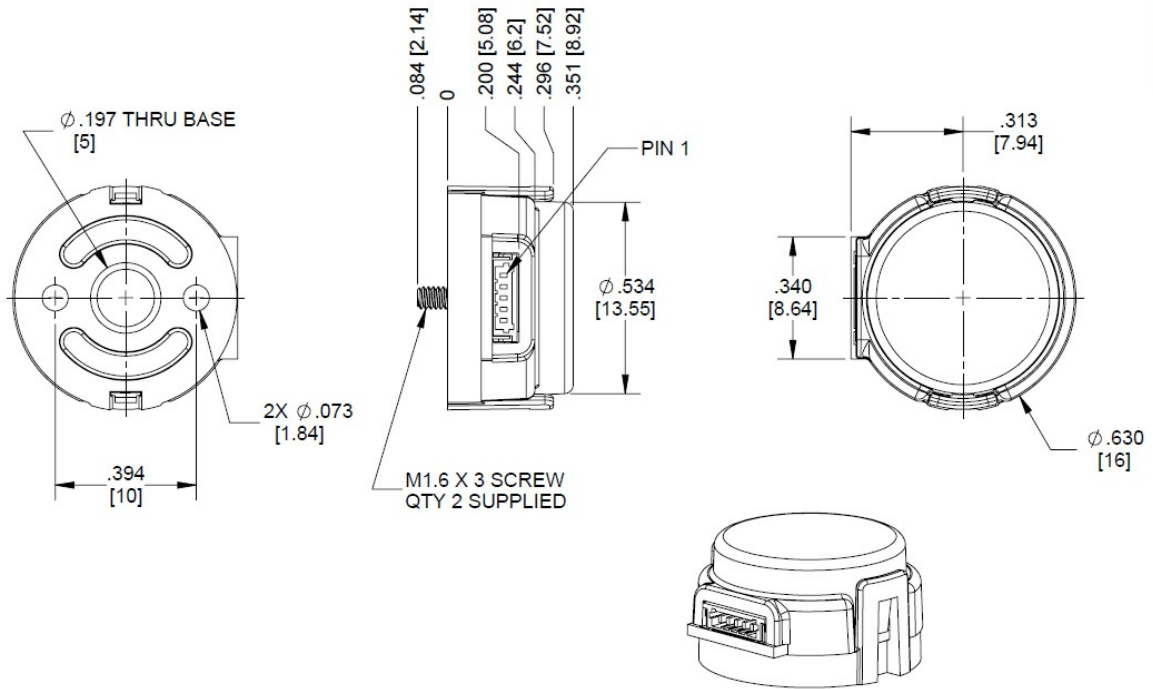
The E16 series encoder is connected using a 5-conductor, polarized, 0.8mm pitch connector (Hirose part number DF52-5P-0.8C). Mating cable (see the Cables web page) is not included and is available separately.

**Please Note:** Due to the E16's design, it is recommended for use as a one-time installation.

## Mechanical Drawings

## E16 Micro Optical Kit Encoder

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UNITS: INCHES [MM]  
METRIC SHOWN FOR REFERENCE ONLY

## Specifications

### ENVIRONMENTAL

PARAMETER	VALUE	UNITS
Operating Temperature	-40 to 100	C
Electrostatic Discharge, IEC 61000-4-2	±12	kV
Shock, 6 millisecond, half-sine	75	G
Vibration (20Hz to 2kHz, sinusoidal)	20	G



## MECHANICAL

PARAMETER	VALUE	UNITS
Max. Shaft Axial Play	±0.010	in.
Max. Shaft Runout	0.002 T.I.R.	in.
Max. Acceleration	250000	rad/sec <sup>2</sup>
Maximum RPM, CPR = 250/500/1000/2000	48000	RPM
Maximum RPM, CPR = 256/512/1024/2048	46875	RPM
Maximum RPM, CPR = 4000	27750	RPM
Maximum RPM, CPR = 4096	27099	RPM
Codewheel Moment of Inertia	2.8 x 10 <sup>-7</sup>	oz-in-s <sup>2</sup>
Mounting Screw Size Default (D-option base)	M1.6 x 3	mm
Screw Bolt Circle Diameter	10 ±0.13	mm
Minimum Shaft Length (1)	6	mm
Maximum Shaft Length (1)	7.75	mm
Mounting Screw Torque	1-2	in-lbs
Technical Bulletin TB1001 - Shaft and Bore Tolerances		Download ( <a href="https://www.usdigital.com/media/yyvb4qsy/tb_1001.pdf">https://www.usdigital.com/media/yyvb4qsy/tb_1001.pdf</a> )

(1) Including axial play.

## ELECTRICAL

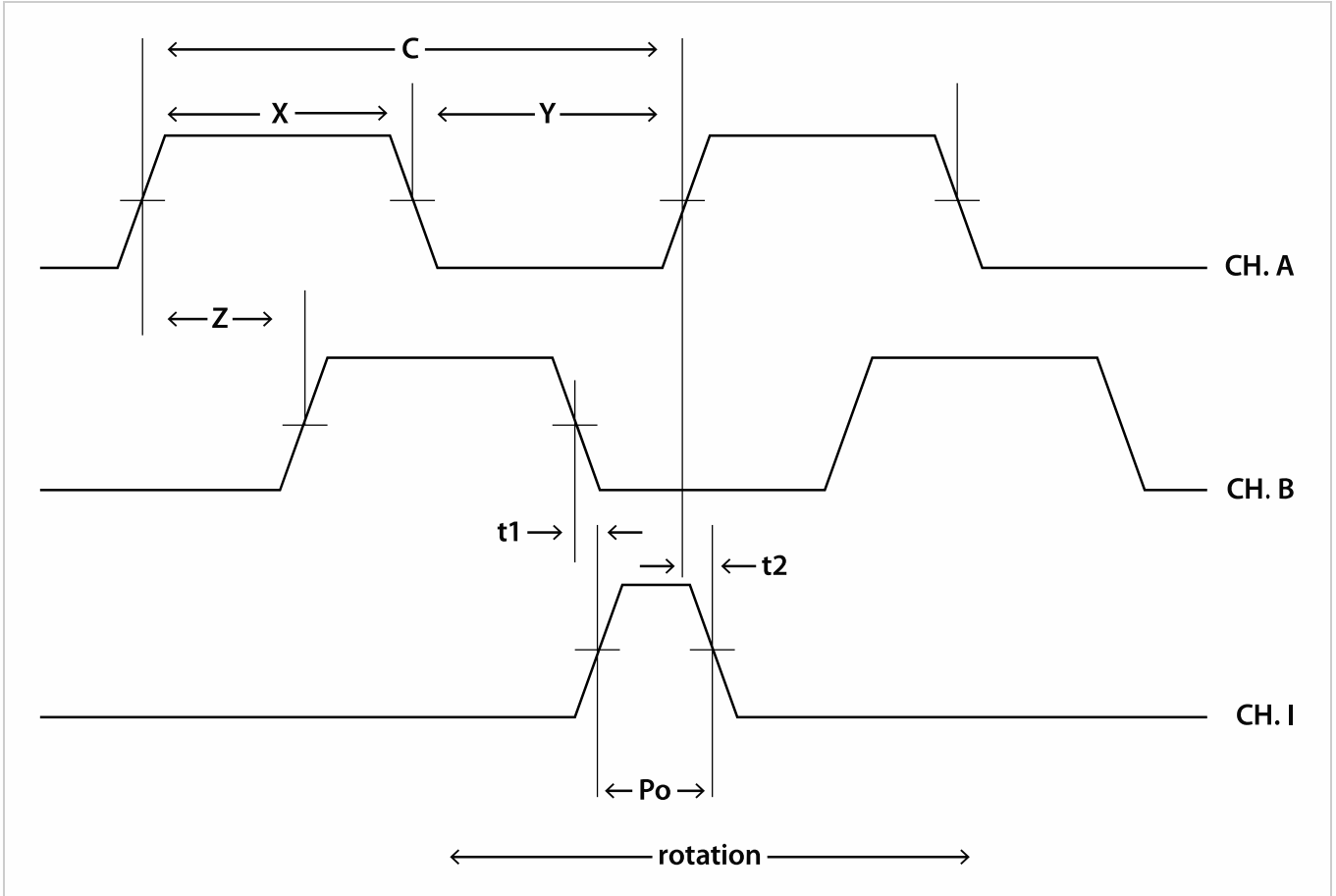
PARAMETER	MIN.	TYP.	MAX.	UNITS	NOTES
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		18	26	mA	no load
Low-level Output			0.4	V	$I_{OL} = 4 \text{ mA}$ , $V_{CC} = 5V$
		0.1		V	no load
High-level Output	4.7			V	$I_{OH} = 4 \text{ mA}$ , $V_{CC} = 5V$
		4.9		V	no load
Output Rise Time		80	135	ns	no load
Output Fall Time		80	135	ns	no load
Maximum Output Frequency					
250/256 CPR	0.2			MHz	
500/512 CPR	0.4			MHz	
1,000/1,024 CPR	0.8			MHz	
2,000/2,048 CPR	1.6			MHz	
4,000/4,096 CPR	1.85			MHz	

## PHASE RELATIONSHIP

- Specifications apply over the entire operating temperature range.
- Values are for the worst error over full rotation.
- Refer to the timing diagram below.

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Symmetry	X, Y	150	180	210	$^{\circ}e$ ( <a href="https://www.usdigital.com/support/resources/glossary/#glossary_e">https://www.usdigital.com/support/resources/glossary/#glossary_e</a> )
Quadrature	Z	60	90	120	$^{\circ}e$ ( <a href="https://www.usdigital.com/support/glossary/#glossary_e">https://www.usdigital.com/support/glossary/#glossary_e</a> )
Index Pulse Width	Po	60	90	120	$^{\circ}e$ ( <a href="https://www.usdigital.com/support/glossary/#glossary_e">https://www.usdigital.com/support/glossary/#glossary_e</a> )
Ch. I Rise After Ch. B or Ch. A Fall	t1		10		ns
Ch. I Fall After Ch. B or Ch. A Rise	t2		10		ns

## TIMING DIAGRAM



**CPR**

The number of Cycles (C) of the A or B outputs Per Revolution.

**Index (I)**

The index output goes high once per revolution, coincident with the low states of channels A and B, nominally 1/4 of one cycle (90°e).

**One Shaft Rotation**

360 mechanical degrees.

**One Electrical Degree (°e)**

1/360th of one cycle.

**One Cycle (C)**

360 electrical degrees (°e). Each cycle can be decoded into 1, 2, or 4 states, referred to as x1, x2, or x4 resolution multiplication.

**PPR**

The number of resolvable Positions Per Revolution of the encoder disk with x4 quadrature decoding.

**Quadrature (Z)**

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

**Symmetry**

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



## PIN-OUT

PIN	DESCRIPTION
1	Ground
2	Index
3	A channel
4	+5VDC power
5	B channel

## ACCESSORIES

### 1. CENTERING TOOL\*

**Part #: CTOOL-E16-(Shaft Diameter)**

**Description:** This reusable tool is used to accurately center the **E16** base on the shaft.

### 2. SPACER TOOL\*

**Part #: SPACER-E16**

**Description:** This reusable tool is used to properly space the codewheel from the encoder.

\*Both the CTOOL and SPACER-E16 tools are included with all packaging options.

### 3. SCREWS

**Part #: SCREW-M16-3MM-PH**

**Description:** Pan Head, Philips M1.6-0.35, length 3mm.

**Use:** Base Mounting

**Quantity Required:** 2

Screws are included

## Notes

- Cables and connectors are not included and must be ordered separately.
- US Digital® warrants its products against defects in materials and workmanship for two years. See complete warranty (<https://www.usdigital.com/company/warranty>) for details.