

E3 Features

- Kit Version for mounting on a motor or other shaft
- Support 22 shaft sizes (2 to 25 mm and 1/8 in. to 1 in.)
- For NEMA 23 to NEMA 34 and larger motors
- 20 Resolutions from 64 to 10,000 CPR (256-40,000 PPR)
- 2 channel quadrature output with an optional index channel
- Choice of 2 base styles and 2 cover options
- High retention connector/cable (sold separately)



US Digital Motor Encoder E3 Description

The US Digital E3 motor encoder mounts directly to a motor or other rotating shaft. This optical encoder features a rugged, glass-filled polymer housing and is designed for easy installation and removal.



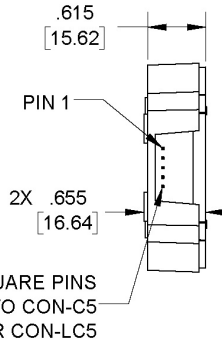
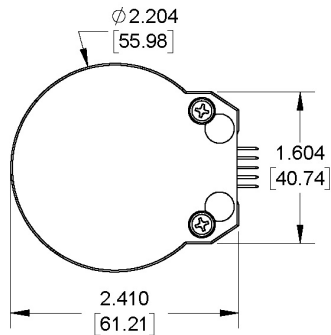
The E3 optical rotary encoder contains a precision machined aluminum hub with a specially patterned Mylar disk. This disk, in combination with our proprietary optical encoder module, creates a system that is highly tolerant to mechanical misalignment.

The E3 is available with two base configurations and two cover styles, which allow it to fit a wide range of applications. The output for this optical rotary encoder is single-ended. If your application requires a differential output (due to needing a cable over 10 feet or is located in an electrically noisy environment) you can either add a PC4 (<https://www.usdigital.com/pc4/>) / PC5 (<https://www.usdigital.com/pc5/>) differential line driver or check out our E5 (<https://www.usdigital.com/products/encoders/incremental/kit/e5/>), which includes an optional differential output.

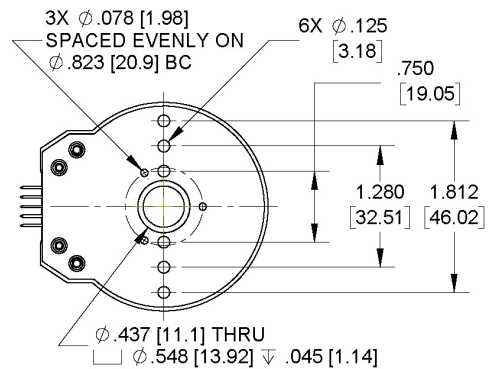
This incremental encoder is designed for use with a high-retention or standard connector/cable, which are sold separately.

Mechanical Drawings

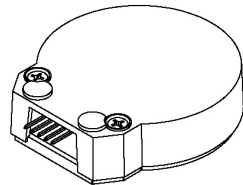
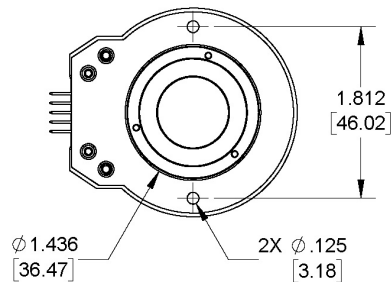
E3 Optical Kit Encoder (Default)



BASE OPTION FOR SHAFTS $\leq \phi .394$ [10]



BASE OPTION FOR SHAFTS $> \phi .394$ [10]



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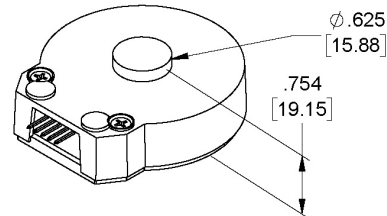
UNITS: INCHES [MM]
METRIC SHOWN FOR REFERENCE ONLY

RELEASE DATE: 7/24/2025

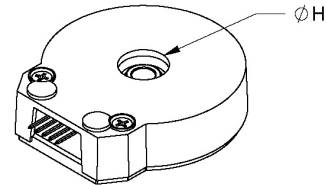
E3 Optical Kit Encoder (Base & Cover Options)

RELEASE DATE: 7/24/2025

E-OPTION COVER
(EXTENSION FOR SHAFT
LENGTHS UP TO .670 [17.02])

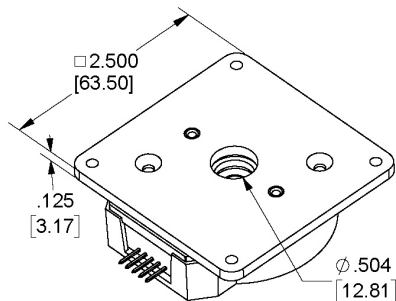


**H-OPTION COVER (HOLE
FOR SHAFT LENGTHS
OVER .670 [17.02])**

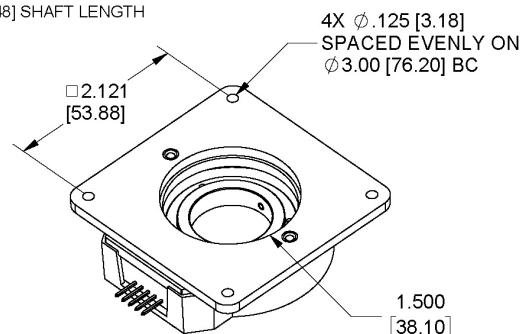


H = .550 [13.97] FOR SHAFT SIZES $\leq \phi .500$ [12.70]
H = 1.050 [26.67] FOR SHAFT SIZES $> \phi .500$ [12.70]

**M-OPTION BASE
(MOUNTING PLATE)**
REQUIRES MINIMUM .570 [14.48] SHAFT LENGTH



FOR SHAFTS $\leq \phi .394$ [10]



FOR SHAFTS $> \phi .394$ [10]

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Specifications

ENVIRONMENTAL

PARAMETER	VALUE	UNITS
Operating Temperature, CPR < 2000	-40 to 100	C
Operating Temperature, CPR $\geq$ 2000	-25 to 100	C
Electrostatic Discharge, IEC 61000-4-2	± 4	kV
Vibration (10Hz to 2kHz, sinusoidal)	20	G
Shock (6 milliseconds, half-sine)	75	G

MECHANICAL

PARAMETER	VALUE	UNITS
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PARAMETER	VALUE	UNITS
Max. Shaft Axial Play	±0.010	in.
Max. Shaft Runout	0.004 T.I.R.	in.
Max. Acceleration	250000	rad/sec ²
For CPR ≤ 2500: Max. RPM (1) Max. A/B Frequency e.x. CPR=2500, Max. RPM=7200 e.x. CPR=100, Max. RPM=60000	minimum value of ((18 x 10 ⁶) / CPR) and (60000) 300	RPM kHz
For CPR = 3600, 4000, 4096, 5000: Max. RPM (1) Max. A/B Frequency	(21.6 x 10 ⁶) / CPR 360	RPM kHz
For CPR = 7200, 8000, 8192, 10000: Max. RPM (1) Max. A/B Frequency	(43.2 x 10 ⁶) / CPR 720	RPM kHz
Typical Product Weight	1.28	oz.
Codewheel Moment of Inertia	8.9 x 10 ⁻⁵ for bore < 12mm 4.0 x 10 ⁻⁴ for bore ≥ 12 mm	oz-in-s ²
Hub Set Screw	#3-48 or #4-48	
Hex Wrench Size	0.050	in.
Encoder Base Plate Thickness	0.135	in.
3 Mounting Screw Size	#0-80	
3 Screw Bolt Circle Diameter (2)	0.823 ± 0.005	in.
2 Mounting Screw Size	#2-56 or #4-40	
2 Screw Bolt Circle Diameter	0.750 ± 0.005	in.
2 Screw Bolt Circle Diameter	1.280 ± 0.005	in.
2 Screw Bolt Circle Diameter	1.812 ± 0.005	in.

PARAMETER	VALUE	UNITS
Required Shaft Length	0.445 to 0.525	in.
(3)	0.445 to 0.670	in.
With E-option (2)	> 0.445	in.
With H-option		
Index alignment to hub set screw	180 ± Typical	degrees
Technical Bulletin TB1001 - Shaft and Bore Tolerances	Download (https://www.usdigital.com/support/resources/reference/technical-docs/technical-bulletins/shaft-and-bore-tolerances-tb1001/)	

(1) 60000 RPM is the maximum rpm due to mechanical considerations. The maximum RPM due to the module's maximum frequency response is dependent upon the module's resolution (CPR).

(2) Only for shaft diameters < 0.472".

(3) Add 0.125" to all required shaft lengths when using M-option.

TORQUE SPECIFICATIONS

PARAMETER	VALUE	TORQUE
Hub Set Screw	2-3	in-lbs
Cover Screw	2-4	in-lbs
Base Mounting Screw (#0-80)	1-2	in-lbs
Base Mounting Screw (#2-56)	2-3	in-lbs
Base Mounting Screw (#4-40)	4-6	in-lbs
Adapter Plate Mounting Surface (#2-56 screws)	2-3	in-lbs
Adapter Plate Mounting Surface (#4-40 screws)	4-6	in-lbs
Module Mounting Screw	3.5-4	in-lbs

PHASE RELATIONSHIP

A leads B for clockwise shaft rotation, and B leads A for counterclockwise rotation viewed from the cover side of the encoder.

ELECTRICAL

- Specifications apply over the entire operating temperature range.
- Typical values are specified at $V_{CC} = 5.0V_{DC}$ and $25^{\circ}C$.
- For complete details, see the EM1 (<https://www.usdigital.com/products/encoders/incremental/components/modules/em1/>) and EM2 (<https://www.usdigital.com/products/encoders/incremental/components/modules/em2/>) product pages.

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		27	33	mA	CPR < 1000, no load
		54	62	mA	CPR $\geq$ 1000 and < 3600, no load
		72	85	mA	CPR $\geq$ 3600, no load
Low-level Output			0.5	V	$I_{OL} = 8mA$ max., CPR < 3600
			0.5	mA	$I_{OL} = 5mA$ max., CPR $\geq$ 3600
		0.05		mA	no load, CPR < 3600
		0.25		mA	no load, CPR $\geq$ 3600
High-level Output	2.0			V	$I_{OH} = -8mA$ max., CPR < 3600
	2.0			V	$I_{OH} = -5mA$ max., CPR $\geq$ 3600
		4.8		V	no load, CPR < 3600
		3.5		V	no load, CPR $\geq$ 3600
Output Current Per Channel	-8		8	mA	CPR < 3600
	-5		5	mA	CPR $\geq$ 3600
Output Rise Time		110		nS	CPR < 3600
		50		nS	CPR $\geq$ 3600
Output Fall Time		35		nS	CPR < 3600
		50		nS	CPR $\geq$ 3600



PIN-OUT

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

Note: 5-pin single-ended mating connector is CON-C5 (<https://www.usdigital.com/products/accessories/connectors/con-c5/>) or CON-LC5 (<https://www.usdigital.com/products/accessories/connectors/con-lc5/>)

ACCESSORIES

1. Centering Tool

Part #: CTOOL - (Shaft Diameter)

This reusable tool centers the shaft within the encoder base during assembly. It is required for the proper functioning of the encoder.

2. Hex Tool

Part #: HEXD-050

Hex driver, 0.050" flat-to-flat for #3-48 or #4-48 set screws. Included with **-B** or **-1** packaging options for order quantities of 10 or more.

Part #: HEXW-050

Hex wrench, 0.050" flat-to-flat for #3-48 or #4-48 set screws. Included with **-B** or **-1** packaging options for order quantities of 9 or less. Included with **-3** packaging option for all order quantities.

3. Spacer Tool

This reusable tool sets the proper spacing between the disk and sensor during assembly. It is required for the proper functioning of the encoder.

Part #: SPACER-E3S

Description: For shafts $\leq 0.394"$

Part #: SPACER-E3L

Description: For shafts 12mm - 1"

4. Screws

Part #: SCREW-080-250-PH

Description: Pan Head, Philips #0-80 UNF x 1/4"

Use: Base Mounting

Quantity Required: 3

Screws are not included

Part #: SCREW-256-250-PH

Description: Pan Head, Philips #2-56 UNC x 1/4"

Use: Base Mounting

Quantity Required: 2

Screws are not included

Part #: SCREW-348-125-SS

Description: Socket Head Set Screw, 3-48 UNC x 1/8"

Use: Hub/Disk Mounting for 12mm - 1" Bore

Quantity Required: 2

Screws are included

Part #: SCREW-440-250-PH

Description: Pan Head, Phillips #4-40 UNC x 1/4"

Use: Base Mounting

Quantity Required: 2

Screws are not included

Part #: SCREW-440-500-PH

Description: Pan Head, Phillips #4-40 UNC x 1/2"

Use: Module Mounting

Quantity Required: 2

Screws are included

Part #: SCREW-440-625-FH

Description: Flat Head, Phillips 4-40 UNC x 5/8"

Use: Cover Mounting

Quantity Required: 2

Screws are included

Part #: SCREW-448-063-SS

Description: Socket Head Set Screw, 4-48 UNC x 1/16"

Use: Hub/Disk Mounting for 5/16" - 10mm Bore

Quantity Required: 1

Screw is included

Part #: SCREW-448-125-SS

Description: Socket Head Set Screw, 4-48 UNC x 1/8"

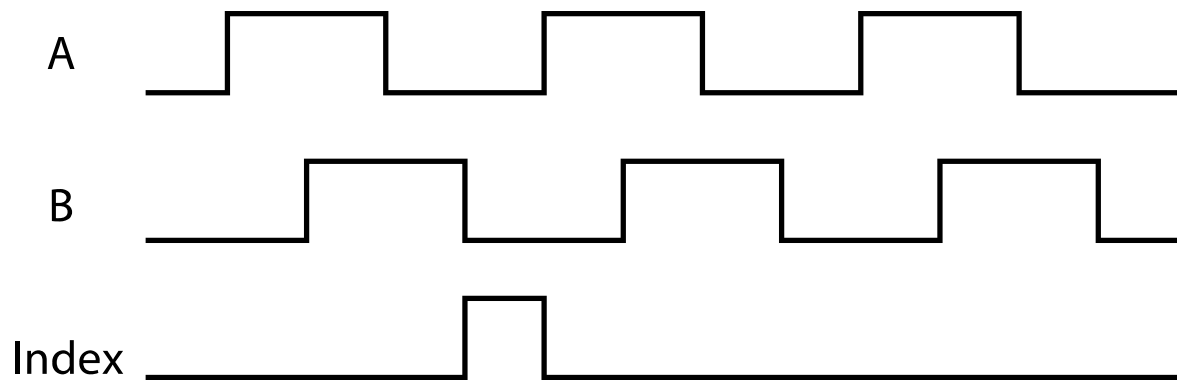
Use: Hub/Disk Mounting for 2mm - 1/4" Bore

Quantity Required: 1

Screw is included

OUTPUT WAVEFORMS

SINGLE-ENDED



Notes

- 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.
- Cables and connectors are not included and must be ordered separately.

Configuration Options

E3	CPR (Cycles Per Revolution)	Bore Size	Index	Cover	Base	Packaging
		079 (2.0mm)	IE (Index)	D (Default)	D (Default)	Bulk (B) - Includes one centering, hex and spacer tool per order, plus an extra set per 100 encoders.
	64	118 (3.0mm)	NE (Non-Index)	E (Extended)	M (3" Diameter Bolt Circle)	Individual (1) - Includes one centering, hex, and spacer tool per order, plus an extra set per 100 encoders.
	100	125 (1/8")		H (Through-Hole)		Individual (3) - Includes one centering, hex, and spacer tool with each encoder.
	200	156 (5/32")				
	400	157 (4.0mm)				
	500	188 (3/16")				
	512	197 (5.0mm)				
	1000	236 (6.0mm)				
	1024	250 (1/4")				
	1800	313 (5/16")				
	2000	315 (8.0mm)				
	2048	375 (3/8")				
	2500	394 (10.0mm)				
	3600	472 (12.0mm)				
	4000	500 (1/2")				
	4096	551 (14.0mm)				
	5000	625 (5/8" Bore)				
	7200	750 (3/4" Bore)				
	8000	787 (20.0mm)				
	8192	875 (7/8")				
	10000	984 (25.0mm)				
		1000 (1")				

PLEASE NOTE: This chart is for informational use only. Certain product configuration combinations are not available. Visit the E3 product page (<https://www.usdigital.com/products/E3>) for pricing and additional information.