E3 Features

- Quick, simple assembly, and disassembly
- Rugged screw-together housing
- Accepts .010 in. axial shaft play
- Small size
- 64 to 10,000 cycles per revolution (CPR)
- 256 to 40,000 pulses per revolution (PPR)
- 2 channel quadrature TTL square wave outputs
- Optional index (3rd channel)

E3 Product Description

The E3 is a high-resolution rotary encoder with a rugged glass-filled polymer enclosure, which utilizes either a 5-pin high-retention or standard connector. This optical incremental encoder is designed to easily mount to and dismount from an existing shaft to provide digital feedback information.

The internal components consist of a mylar disk mounted to a precision machined aluminum hub and an encoder module. The hub is available for diameters up to 1 in. The module contains a highly collimated solid-state light source and monolithic phased array sensor, which together provide a system extremely tolerant to mechanical misalignments.

The E3 is normally designed for applications of 10 feet or less. For applications requiring longer cable lengths, we recommend adding a PC4 *(https://www.usdigital.com/pc4/)* / PC5 *(https://www.usdigital.com/pc5/)* differential line driver or check out our E6 *(https://www.usdigital.com/products/encoders/incremental/kit/e6/)* which has an optional differential output.

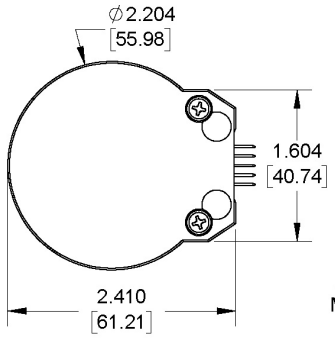
Attachment of the base to a surface may be accomplished by utilizing one of several machine screw bolt circle options. Positioning of the base to the centerline of a shaft is ensured by use of a centering tool. The cover is securely attached to the base with two 4-40 flat head screws to provide a resilient package protecting the internal components.

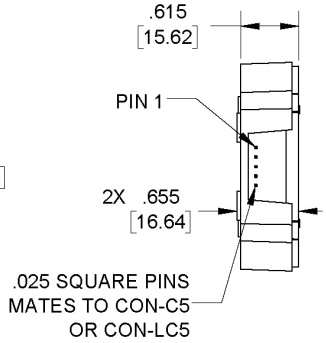
Connection to the E3 product is made through either a 5-pin high-retention or standard connector. The mating connectors are available from US Digital with several cable options and lengths.

Mechanical Drawings

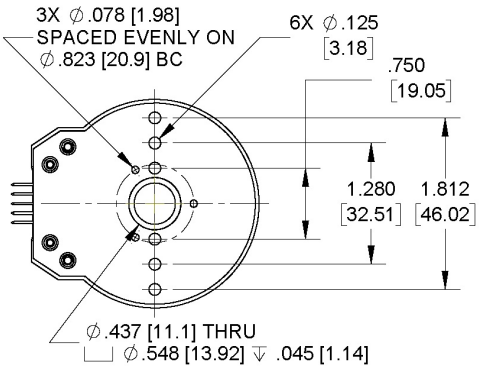
E3 Optical Kit Encoder (Default)

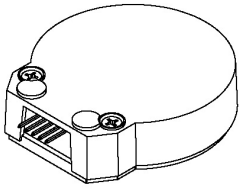
RELEASE DATE: 7/24/2025





BASE OPTION FOR SHAFTS ≤ ∅.394 [10]





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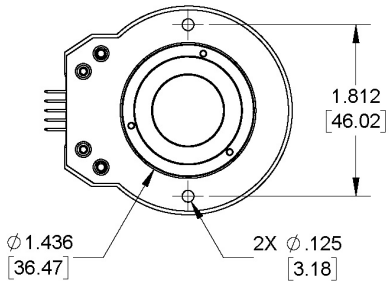

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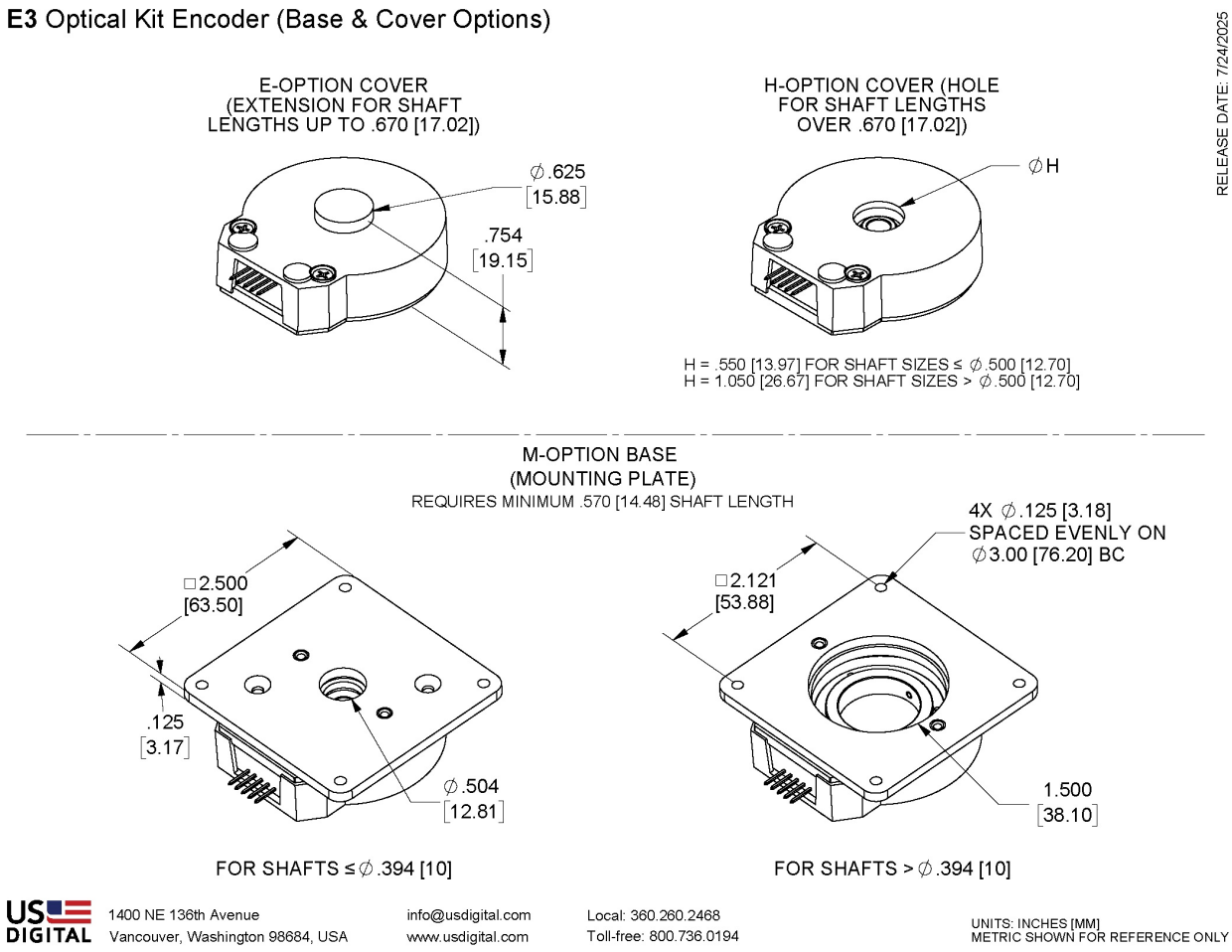
UNITS: INCHES [MM]
METRIC SHOWN FOR REFERENCE ONLY



Specifications

ENVIRONMENTAL

PARAMETER	VALUE	UNITS
Operating Temperature, CPR < 2000	-40 to 100	C
Operating Temperature, CPR ≥ 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

PARAMETER	VALUE	UNITS
Max. Shaft Axial Play	±0.010	in.
Max. Shaft Runout	0.004 T.I.R.	in.
Max. Acceleration	250000	rad/sec²
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-s²
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 (3) With E-option (2) With H-option	0.445 to 0.525 0.445 to 0.670 > 0.445	in. in. in.
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 Vcc = 5.0Vdc and 25°C.
- For complete details, see the EM1 *(https://www.usdigital.com/products/encoders/incremental/modules/em1/)* and EM2 *(https://www.usdigital.com/products/encoders/incremental/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 ≥ 1000 and < 3600, no load
		72	85	mA	CPR ≥ 3600, no load
Low-level Output			0.5	V	I_{OL} = 8mA max., CPR < 3600
			0.5	mA	I_{OL} = 5mA max., CPR ≥ 3600
		0.05		mA	no load, CPR < 3600
		0.25		mA	no load, CPR ≥ 3600
High-level Output	2.0			V	I_{OH} = -8mA max., CPR < 3600
	2.0			V	I_{OH} = -5mA max., CPR ≥ 3600
		4.8		V	no load, CPR < 3600
		3.5		V	no load, CPR ≥ 3600
Output Current Per Channel	-8		8	mA	CPR < 3600
	-5		5	mA	CPR ≥ 3600
Output Rise Time		110		nS	CPR < 3600
		50		nS	CPR ≥ 3600
Output Fall Time		35		nS	CPR < 3600
		50		nS	CPR ≥ 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 ≤ 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, Philips #4-40 UNC x 1/4"
Use: Base Mounting
Quantity Required: 2
Screws are not included

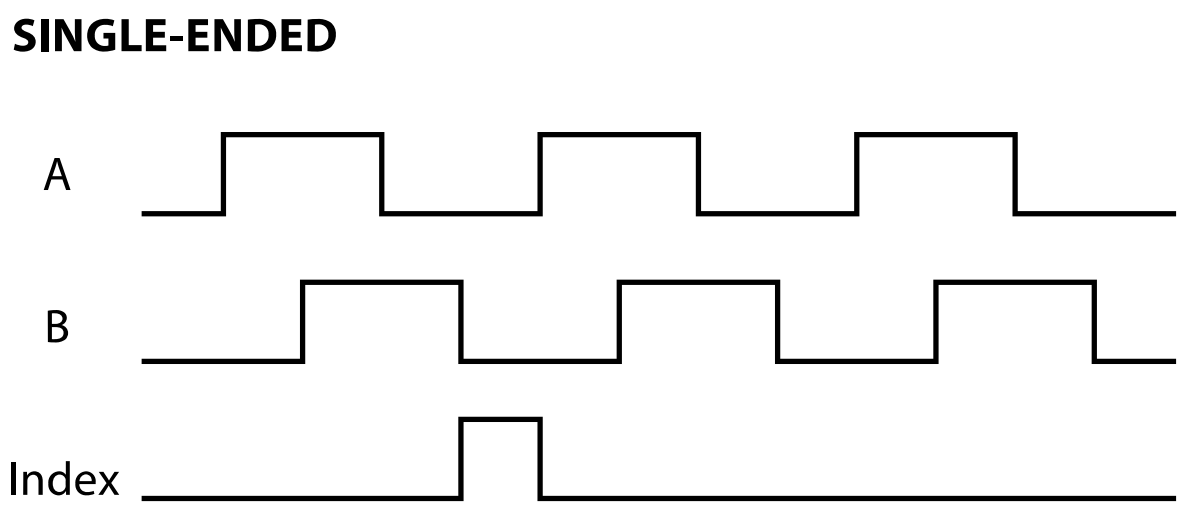
Part #: SCREW-440-500-PH
Description: Pan Head, Phillips #4-40 UNC x 1/2"
Use: Module Mounting
Quantity Required: 2
Screws are included

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



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
		64		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.
		100		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.
		200		125 (*1/8"*)				H (*Through-Hole*)				Individual (3) - Includes one centering, hex, and spacer tool with each encoder.
		400		156 (*5/32"*)								
		500		157 (*4.0mm*)								
		512		188 (*3/16"*)								
		1000		197 (*5.0mm*)								
		1024		236 (*6.0mm*)								
		1800		250 (*1/4"*)								
		2000		313 (*5/16"*)								
		2048		315 (*8.0mm*)								
		2500		375 (*3/8"*)								
		3600		394 (*10.0mm*)								
		4000		472 (*12.0mm*)								
		4096		500 (*1/2"*)								
		5000		551 (*14.0mm*)								
		7200		625 (*5/8" Bore*)								
		8000		750 (*3/4" Bore*)								
		8192		787 (*20.0mm*)								
		10000		875 (*7/8"*)								
				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.