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 squarewave 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 locking or standard connector. This optical incremental encoder is designed to easily mount to and dismount from an existing shaft to provide digital feedback information.

RoHS COMPLIANT

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 longer cable lengths, adding a PC4 *(https://www.usdigital.com/pc4/)* / PC5 *(https://www.usdigital.com/pc5/)* differential line driver is recommended.

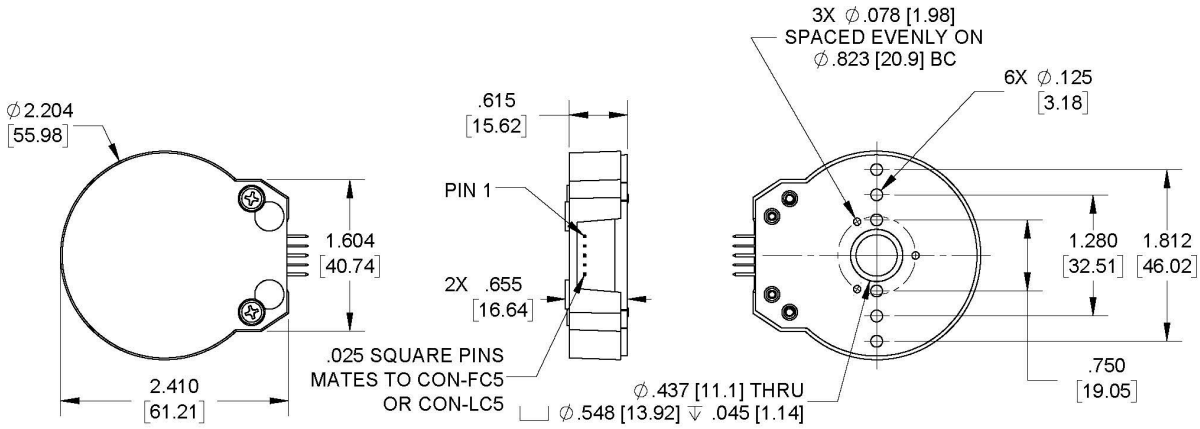
Attachment of the base to a surface may be accomplished by utilizing one of several machine screw bolt circle options. Positioning of the base to the centerline of a shaft is ensured by use of a centering tool. The cover is securely attached to the base with two 4-40 flat head screws to provide a resilient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

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

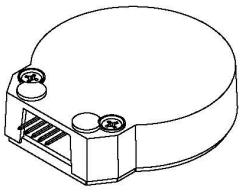
Mechanical Drawings

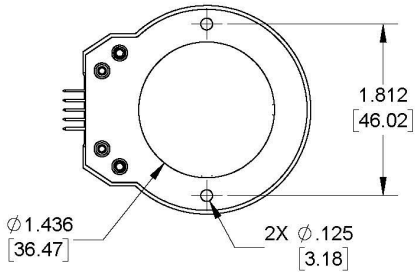
E3 Optical Kit Encoder (Default)

RELEASE DATE: 7/8/2019



BASE OPTION FOR SHAFTS ≤ ∅.394 [10]



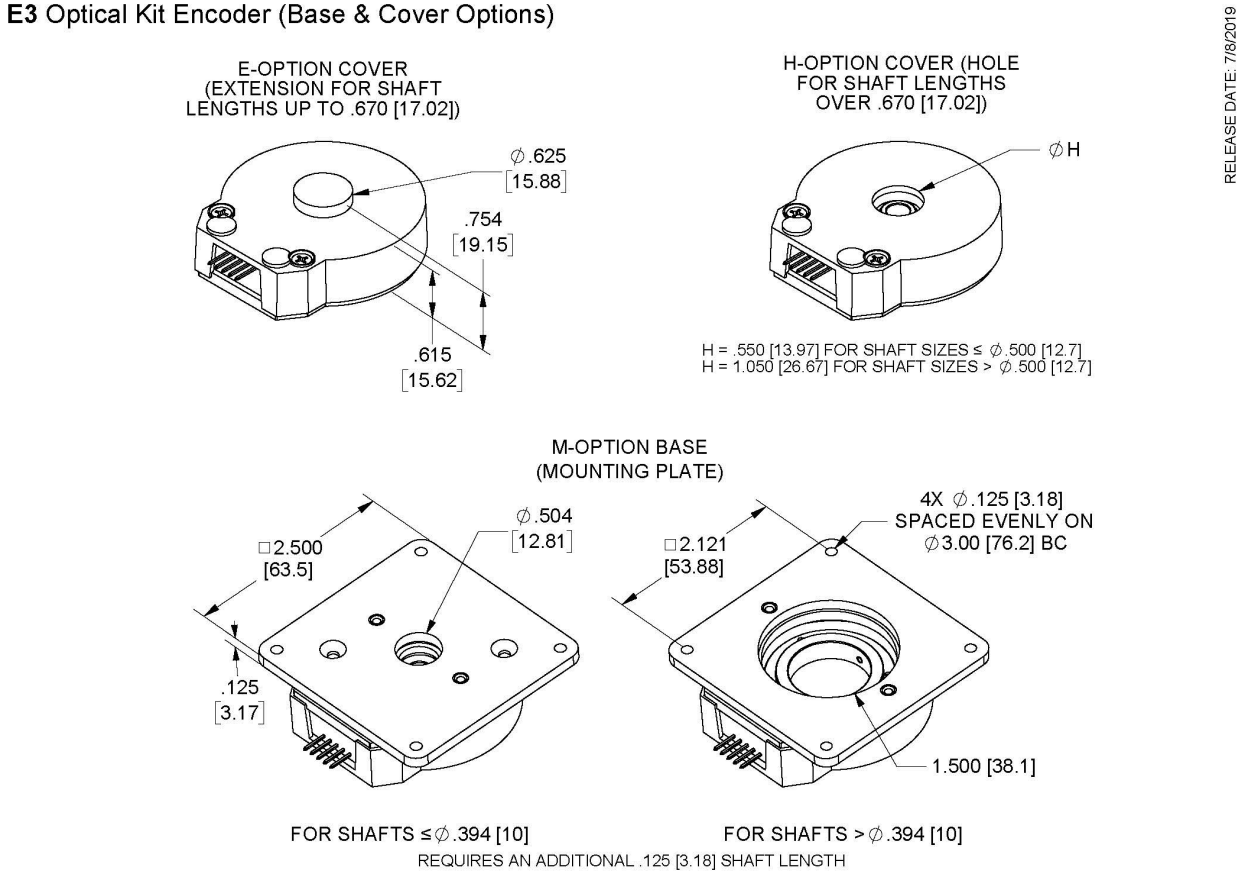


BASE OPTION FOR SHAFTS > ∅.394 [10]

US DIGITAL
1400 NE 136th Avenue
Vancouver, Washington 98684, USA
info@usdigital.com
www.usdigital.com
Local: 360.260.2468
Toll-free: 800.736.0194

UNITS: INCHES [MM]
METRIC SHOWN FOR REFERENCE ONLY

E3 Optical Kit Encoder (Base & Cover Options)



Specifications

ENVIRONMENTAL

PARAMETER	VALUE	UNITS
Operating Temperature (CPR < 3600)	-40 to 100	C
Operating Temperature (CPR ≥ 3600)	-25 to 100	C
Vibration (5Hz to 2kHz)	20	G
Electrostatic Discharge, IEC 61000-4-2	± 4	kV

MECHANICAL

PARAMETER	VALUE	UNITS
Max. Shaft Axial Play	±0.010	in.

PARAMETER	VALUE	UNITS
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.
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.

PARAMETER	VALUE	UNITS
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

The centering tool is only included with the **-3** packaging option. It has to be ordered separately for other packaging options.

Part #: CTOOL - (Shaft Diameter)
Description: This reusable tool provides a simple method for accurately centering the E3 base onto the shaft in order to promote concentricity and thus, higher accuracy. It is recommended for the following situations:

- When using mounting screws smaller than #4-40.
- When the position of the mounting holes is in question.
- When using the 3-hole mounting pattern.
- When using the T-option transfer adhesive.

Instructions: When mounting encoder base, slide centering tool down shaft until it slips into centering hole of encoder base. Tighten mounting screws, then remove centering tool.

2. Hex Tool

Depending on the order packaging option, either a hex driver or hex wrench is included.

Part #: HEXD-050
Description: Hex driver, 0.050" flat-to-flat for #3-48 or #4-48 set screws. Only included with **-B** or **-1** packaging options.

Part #: HEXW-050
Description: Hex wrench, 0.050" flat-to-flat for #3-48 or #4-48 set screws. Only included with **-2** or **-3** packaging options.

3. Spacer Tool

A spacer tool is included for all packaging options.

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

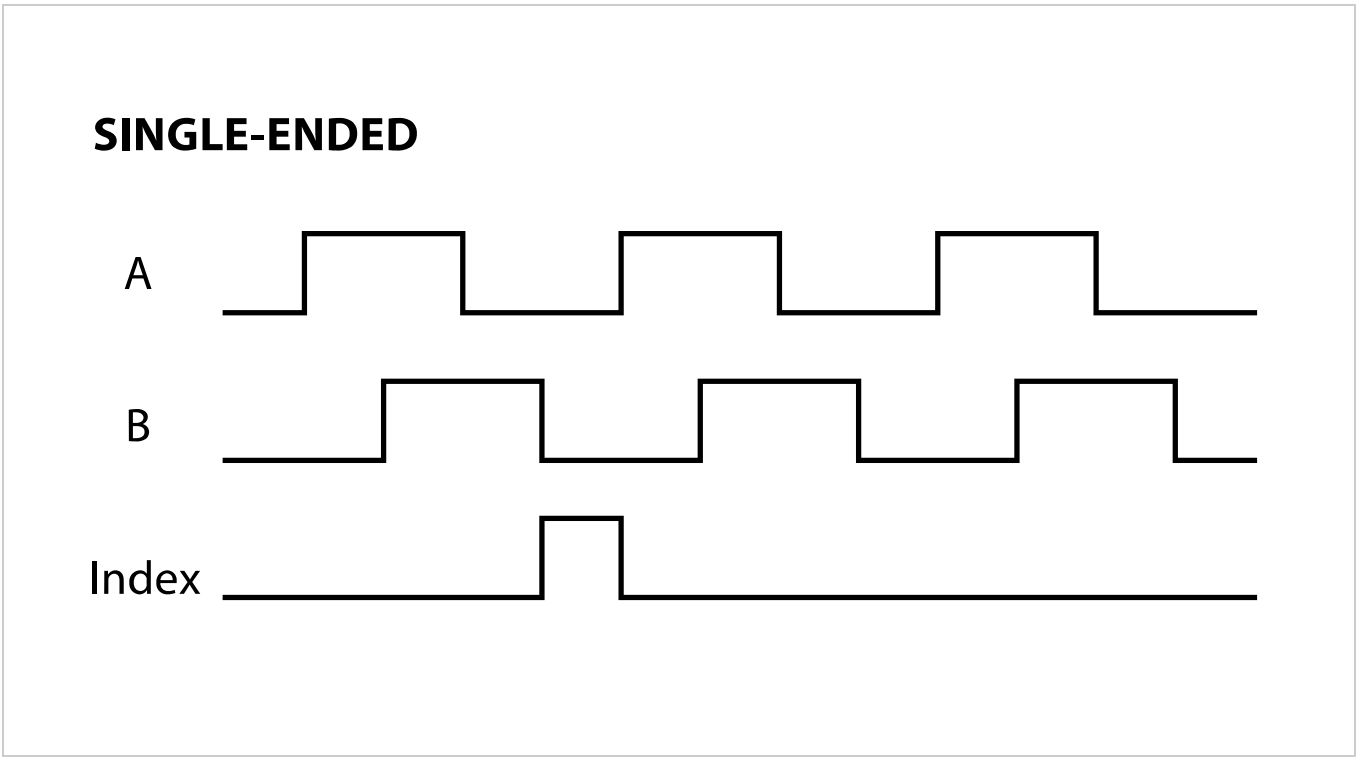
Part #: SCREW-440-500-PH
Description: Pan Head, Phillips #4-40 UNC x 1/2"
Use: Module Mounting
Quantity Required: 2
Screws are included

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	-	BORE	-	INDX	-	COVER	-	BASE	-	PACKAGING
		64		079 (*2.0mm*)		IE (*Index*)		D (*Default*)		D (*Default*)		B (*Encoders packaged in bulk. Every order includes one hex tool and spacer tool. An additional set of tools is included for each 100 encoders ordered.*)
		100		118 (*3.0mm*)		NE (*Non-Index*)		E (*Extended*)		M (*3" Diameter Bolt Circle*)		1 (*Encoders packaged individually. Every order includes one hex tool and spacer tool. An additional set of tools is included for each 100 encoders ordered.*)
		200		125 (*1/8"*)				H (*Through-Hole*)				2 (*Encoders packaged individually. Every order includes one hex tool and spacer tool per encoder.*)
		400		156 (*5/32"*)								3 (*Encoders packaged individually. Every order includes one centering tool, hex tool and spacer tool per encoder.*)
		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.