

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.

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". 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 / 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.

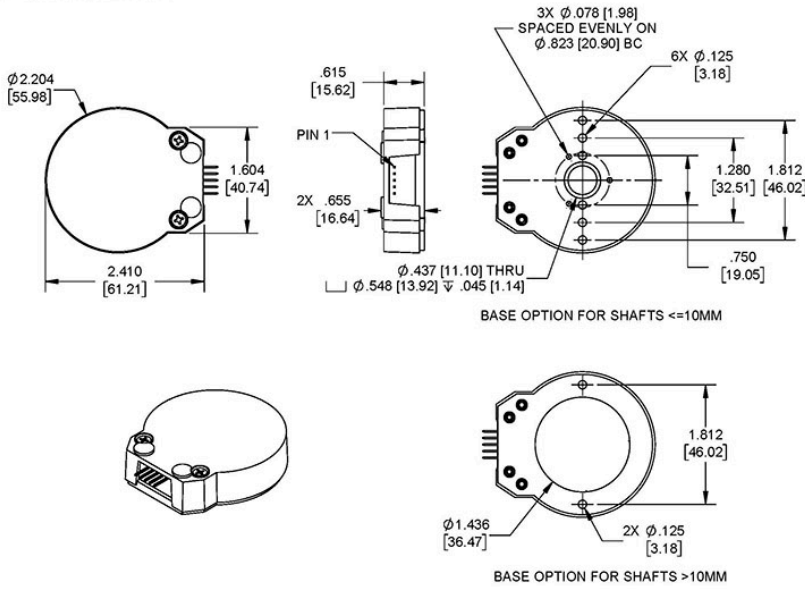


Features

- ▶ Quick, simple assembly and disassembly
- ▶ Rugged screw-together housing
- ▶ Accepts .010" axial shaft play
- ▶ Small size
- ▶ 64 to 10000 cycles per revolution (CPR)
- ▶ 256 to 40000 pulses per revolution (PPR)
- ▶ 2 channel quadrature TTL squarewave outputs
- ▶ Optional index (3rd channel)

Default

E3 Optical Kit Encoder



RELEASE DATE 01/29/2019

US DIGITAL 1400 NE 136th Avenue
Vancouver, Washington 98684, USA

info@usdigital.com
www.usdigital.com

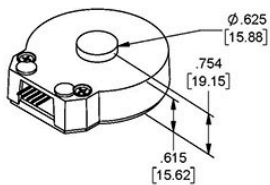
Local: 360.260.2468
Toll-free: 800.736.0194

UNITS: INCHES (MM)
METRIC SHOWN FOR REFERENCE ONLY

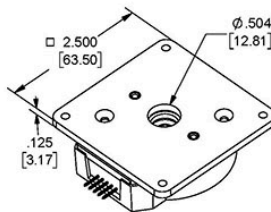
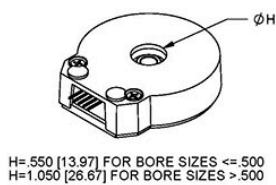
Base & Cover Options

E3 Optical Kit Encoder Base & Cover Options

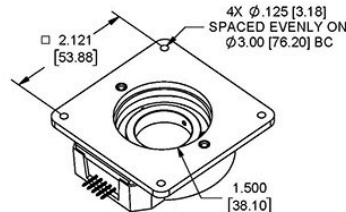
E-OPTION COVER (EXTENSION FOR SHAFT LENGTHS .526" TO .670")



H-OPTION COVER (HOLE FOR EXTENDED SHAFT LENGTHS)



M-OPTION BASE (MOUNTING PLATE)
REQUIRES AN ADDITIONAL .125" SHAFT LENGTH
FOR SHAFTS \leq 10MM



FOR SHAFTS $>$ 10MM

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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.
Max. Shaft Eccentricity Plus Radial Play (1)	0.004	in.
Max. Acceleration	250000	rad/sec ²
Max. RPM (2) (CPR ≤ 2500) e.x. CPR=2500, max. rpm=7200 e.x. CPR=100, max. rpm=60000	minimum value of ((18 x 10 ⁶) / CPR) and (60000)	RPM
Max. RPM (2) (CPR > 2500 and ≤ 5000) e.x. CPR=4096, max. rpm=5273	(21.6 x 10 ⁶) / CPR	RPM
Max. RPM (2) (CPR > 5000) e.x. CPR=10000, max. rpm=4320	(43.2 x 10 ⁶) / CPR	RPM
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 (3)	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 (4) With E-option (3) 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	mechanical degrees

Technical Bulletin TB1001 - Shaft and Bore Tolerances

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- (1) Position inaccuracy is proportional to shaft radial play.
- (2) 60000 rpm is the maximum rpm due to mechanical considerations. The maximum rpm due to the module's 300kHz maximum count frequency is $(18 \times 10^6) / \text{CPR}$.
- (3) Only for shaft diameters $< 0.472"$.
- (4) Add 0.125" to all required shaft lengths when using M-option.

Torque Specifications

Parameter	Torque
Hub Set Screw to Shaft	2-3 in-lbs
Cover (4-40 screws through cover into base)	2-4 in-lbs
Base to Mounting Surface	4-6 in-lbs
Base to Mounting Adapter Plate	4-6 in-lbs
Adapter Plate to Mounting Surface	4-6 in-lbs
Module to Base	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 entire operating temperature range.
- Typical values are specified at $V_{cc} = 5.0\text{Vdc}$ and 25°C .
- For complete details, see the EM1 and 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	IOL = 8mA max., CPR < 3600
			0.5	mA	IOL = 5mA max., CPR ≥ 3600
		0.05		mA	no load, CPR < 3600
		0.25		mA	no load, CPR ≥ 3600
High-level Output	2.0			V	IOH = -8mA max., CPR < 3600

Parameter	Min.	Typ.	Max.	Units	Conditions
2.0			V		IOH = -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 or 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

Screws for base mounting must be purchased separately. Screws for mounting the housing to the base are included.

Part #: SCREW-080-250-PH

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

Quantity Required for Mounting: 3 per encoder

Part #: SCREW-256-250-PH

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

Quantity Required for Mounting: 2 per encoder

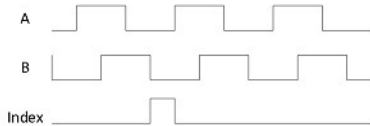
Part #: SCREW-440-250-PH

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

Quantity Required for Mounting: 2 per encoder

 **Output Waveforms**

SINGLE-ENDED



 **Assembly Instructions**

E3 Assembly Instructions for Shafts E3 Assembly Instructions for Shafts > to 10mm -

<http://usdigital.com/assets/assembly/E3%20Assembly%20Instructions%20for%20Shafts%20Greater%20than%2010mm.pdf>

 **Ordering Information**

E3 - - - - - -

CPR	Bore	Index	Cover	Base	Packaging
64	079 =	NE =No	D =Default	D =Default	B =Encoder components packaged in bulk. One spacer tool and one hex wrench for orders up to 9 units, for orders of 10...
100	2mm	Index	E =Cover	M =4-hole mounting adapter plate	
200	118 =	IE =Index	Extension		
400	3mm		H =Hole in Cover		1 =Encoders individually packaged. One spacer tool and one hex wrench for orders up to 9 units, for orders of 10 units...
500	125 = 1/8"				2 =Encoders packaged individually with one spacer tool and one hex wrench per encoder.
512	156 =				3 =Encoders packaged individually with one spacer tool, one hex wrench, and one centering tool per encoder.
1000	5/32"				
1024	157 =				
1800	4mm				
2000	188 =				
2048	3/16"				
2500	197 =				
3600	5mm				
4000	236 =				
4096	6mm				
5000	250 = 1/4"				
7200	313 =				
8000	5/16"				
8192	315 =				
10000	8mm				
	375 = 3/8"				
	394 =				
	10mm				
	472 =				
	12mm				
	500 = 1/2"				
	551 =				
	14mm				
	625 = 5/8"				
	750 = 3/4"				
	787 =				
	20mm				
	875 = 7/8"				
	984 =				
	25mm				
	1000 = 1"				

Notes

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