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Description

The E3 is a high resolution rotary encoder with a molded polycarbonate 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 E3 is easy to add to existing applications and only consists of four main components; base, cover, hub/code wheel and optical encoder module.

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.

The base and cover are both constructed of rugged 20% glass filled polycarbonate. 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 (sold separately). The cover is securely attached to the base with two 4-40 flat head screws to provide a resilient package protecting the internal components.

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

Connection to the E3 product is made through either a 5-pin locking or standard connector (sold separately). 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
- Tracks from 0 to 300000 cycles/sec
- 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)
- -40 to +100C operating temperature

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

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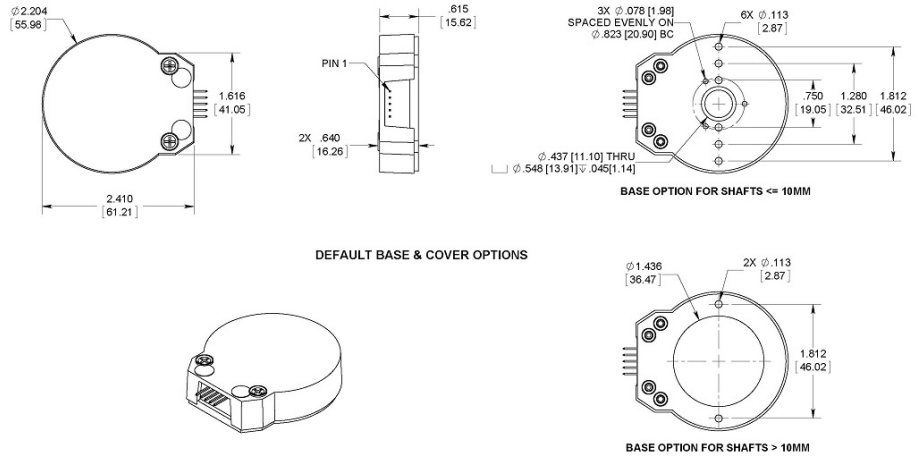
Default

E3 Optical Kit Encoder

RELEASE DATE: 11/14/2011



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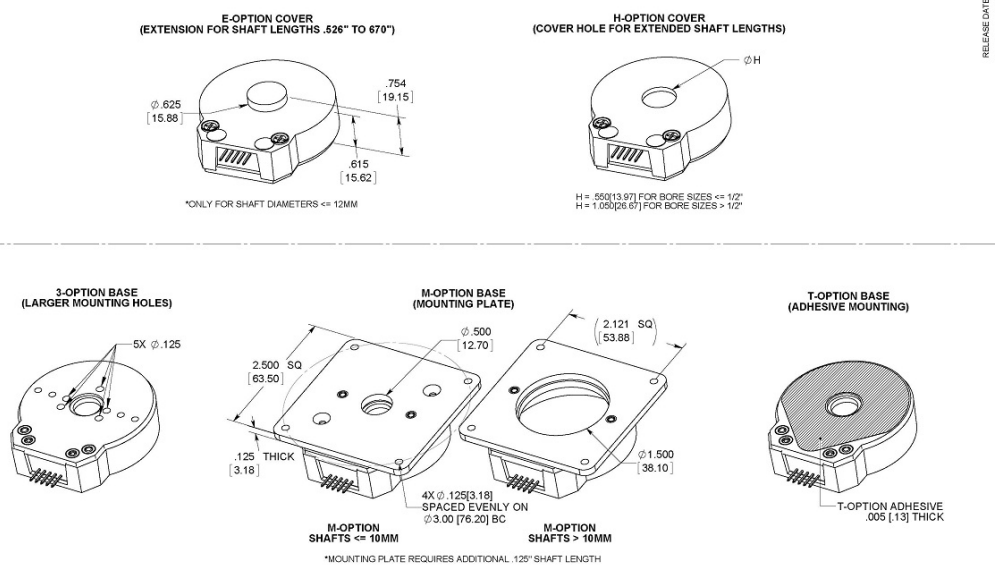
UNITS: INCHES [MM]
METRIC DIMENSIONS FOR REFERENCE ONLY

Base & Cover Options

E3 Optical Kit Encoder Base & Cover Options

RELEASE DATE: 11/14/2011



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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, Human Body Model	± 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/sec²
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-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 (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 ± 5	mechanical degrees

Parameter	Value	Units
Technical Bulletin TB1001 - Shaft and Bore Tolerances		Download

(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 x 10^6) / 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/label side of the encoder.

Electrical

- Specifications apply over entire operating temperature range.
- Typical values are specified at Vcc = 5.0Vdc and 25 ° C.
- For complete details, see the EM1 andEM2 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

Parameter	Min.	Typ.	Max.	Units	Conditions
	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 isCON-C5 orCON-LC5

Options

Index

Provides a single pulse per revolution.

3-option

3-option makes all five of these hole diameters .125". The .438" diameter center hole can mate with a motor boss for alignment. If a motor boss is lacking, a centering tool is usually required to mount the base in proper position to the shaft.

E-option

The **E**-option provides a cylindrical extension to the cover allowing for longer shafts of up .670". This option is only for shaft diameters <.472".

H-option

The **H**-option adds a hole to the cover for the shaft to pass through.

- Shafts <=1/2", a 0.55" diameter hole is supplied.
- Shafts >1/2", a 1.05" diameter hole is supplied.

M-option

These adapter plates are for mounting to a 3" diameter bolt circle. Use two 4-40 x 1/4" screws (sold separately) to attach the **E3** base to the plate. Comes attached when ordered with encoder.

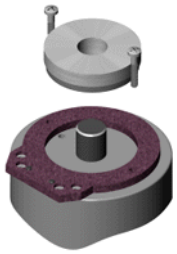
T-option

When mounting holes are not available, a pre-applied transfer adhesive (with peel-off backing) is available for "stick-on" mounting. Use the centering tool (sold separately) to slide the base into position. **T**-option specifies transfer adhesive on the standard mounting base.

Instructions: To use transfer ahesive, peel off paper backing and slip tool into center hole of the base and slide both down shaft as one piece. Press to form a good bond, then slip tool off and continue with the standard mounting instructions. A centering tool is highly recommended when using transfer adhesive.

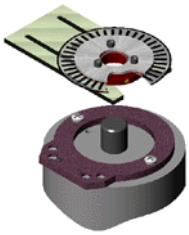
Assembly Instructions

For Shafts Greater Than 0.394" (10mm):



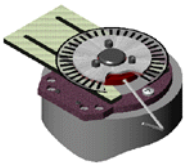
1. Base Mounting

Secure the base to the mounting surface using two or three screws (sold separately). If a centering tool is used, slip it over the shaft and into the center hole of the base. Tighten the mounting screws and then remove the centering tool.



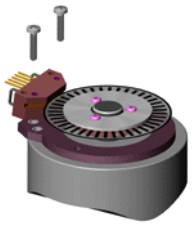
2. Spacer Installation

Push the spacer tool onto the bottom section of the hub/disk assembly. Make sure the spacer tool snaps only on the lower part of the hub. Align hub set screws as shown in drawing.



3. Hub/Disk Assembly Installation

Slip the hub over the shaft until it bottoms out against the spacer tool. Make sure the spacer tool clears the mounting screws on the base. Tighten both set screws with the hex wrench provided while pressing down on the hub. Remove the spacer tool.



4. Encoder Module Installation

Orientate the module with the connector pins toward the top. Slide the module from front to back, being careful not to damage the disk. Stop when the two alignment pins on the base fit into the holes of the module. Secure with two 4-40 1/2" pan head screws (supplied).

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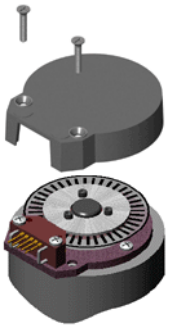
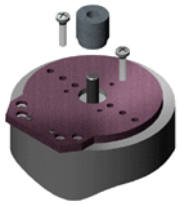


5. Cover Installation

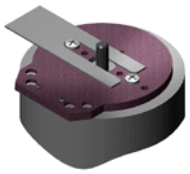
Place the cover over the assembly and secure with the two 4-40 5/8" flat head screws (supplied).

For Shafts Less Than or Equal To 0.394" (10mm):



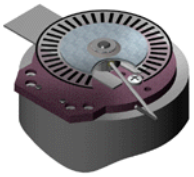
1. Base Mounting

Secure the base to the mounting surface using two or three screws (sold separately). If a centering tool is used, slip it over the shaft and into the center hole of the base. Tighten the mounting screws and then remove the centering tool.



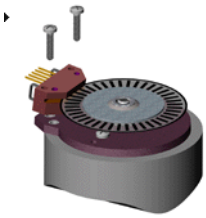
2. Spacer Installation

Place the spacer tool around the shaft, flat on the base.



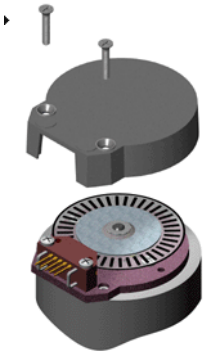
3. Hub/Disk Assembly Installation

Slip the hub over the shaft until it bottoms out against the spacer tool. Tighten the set screw with the hex wrench provided while pressing down on the hub. Remove the spacer tool.



4. Encoder Module Installation

Orientate the module with the connector pins toward the top. Slide the module from front to back, being careful not to damage the disk. Stop when the two alignment pins on the base fit into the holes of the module. Secure with two 4-40 1/2" pan head screws (supplied).



5. Cover Installation

Place the cover over the assembly and secure with the two 4-40 5/8" flat head screws provided.

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-265
Description: For shafts ≤ 0.394"

Part #: SPACER-260
Description: For shaft sizes 0.5" or 12mm

Part #: SPACER-555
Description: For shafts ≥ 0.551"

4. Screws

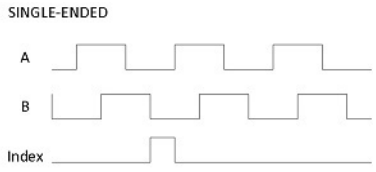
Screws for base mounting must be purchased separately. Screws for mounting the housing to the base are included.

Part #: SCREW-080-250-PH
Description: Pan Head, Cross Drive #0-80 UNF x 1/4"
Quantity Required for Mounting: 3 per encoder

Part #: SCREW-256-250-PH
Description: Pan Head, Cross Drive #2-56 UNC x 1/4"
Quantity Required for Mounting: 2 per encoder

Part #: SCREW-440-250-PH
Description: Pan Head, Cross Drive #4-40 UNC x 1/4"
Quantity Required for Mounting: 2 per encoder

Output Waveforms



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Ordering Information

E3 - [ ] - [ ] - [ ] - [ ] - [ ] - [ ]

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CPR
64
100
200
400
500
512
1000
1024
1800
2000
2048
2500
3600
4000
4096
5000
7200
8000
8192
10000

Bore
079 = *2mm*
118 = *3mm*
125 = *1/8"*
156 = *5/32"*
157 = *4mm*
188 = *3/16"*
197 = *5mm*
236 = *6mm*
250 = *1/4"*
313 = *5/16"*
315 = *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"*

Index
NE = *No Index*
IE = *Index*

Cover
D = *Default*
E = *Cover Extension*
H = *Hole in Cover*

Base
D = *Default*
3 = *0.125" diam. for five base mounting holes*
M = *4-hole mounting adapter plate*
T = *Transfer adhesive*

Packaging
B = *Encoder components packaged in bulk. One spacer tool and one hex wrench for orders up to 9 units, for orders of 10...*
1 = *Encoders Individually packaged. One spacer tool and one hex wrench for orders up to 9 units, for orders of 10 units...*
2 = *Encoders packaged individually with one spacer tool and one hex wrench per encoder.*
3 = *Encoders packaged individually with one spacer tool, one hex wrench, and one centering tool per encoder.*

Notes

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

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Base Pricing

Quantity	Price
1	$89.80
5	$61.95
10	$54.93

For volume discounts, please contact us at sales@usdigital.com or 800.736.0194.

- Add 11% per unit for **CPR** of 3600 , 4000 , 4096 , 5000 , 7200 , 8000 , 8192 or 10000
- Add $12.00 per unit for **Bore** of 12mm , 1/2" , 14mm , 5/8"
- Add $16.00 per unit for **Bore** of 3/4" , 20mm , 7/8" , 25mm or 1"
- Add $7.00 per unit for **Base** of 4-hole mounting adapter plate
- Add $6.00 per unit for **Base** of Transfer adhesive
- Add $3.00 per unit for **Packaging** of Encoders Individually packaged. One spacer tool and one hex wrench for orders up to 9 units, for orders of 10 units and above one spacer tool and one hex driver per 100 encoders.
- Add $4.00 per unit for **Packaging** of Encoders packaged individually with one spacer tool and one hex wrench per encoder.
- Add 18% per unit for **Index** of IE or **CPR** greater than or equal to 2000.
- Add $7.00 per unit for **Packaging** of 3, $13.00 per unit if the bore size is greater than 394

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