

## Description

The E6 Series rotary encoder has a molded polycarbonate which utilizes either a 5-pin or 10-pin latching connector. This optical incremental encoder is designed to easily mount to and dismount from an existing shaft to provide digital feedback information.

The E6 Series is easy to add to existing applications and only consists of five main components; base, cover, hubdisk, optical encoder module and internal differential line driver (differential version only).

The single-ended output version (**S**-option) is typically used with cables of 10 feet or less. For longer cable lengths, the differential output version (**D**-option) is recommended.

The base and cover are both constructed of a 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 mylar disk mounted to a precision machined aluminum hub and an encoder module. 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.

A secure connection to the E6 Series encoder is made through a 5-pin (single-ended versions) or 10-pin (differential versions) latching connector (sold separately). The mating connectors are available from US Digital with several cable options and lengths.

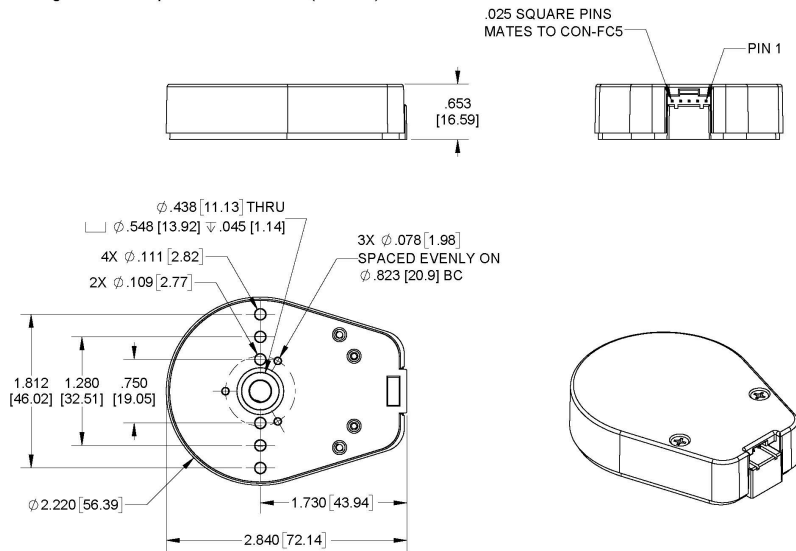


## Features

- ▶ Quick, simple assembly and disassembly
- ▶ Rugged screw-together housing
- ▶ Positive latching connector
- ▶ Accepts .010" axial shaft play
- ▶ 64 - 10000 CPR
- ▶ 2 channel quadrature TTL squarewave outputs
- ▶ Optional index (3rd channel)
- ▶ Fits shaft diameters from 2mm to 1"

**Single-Ended Optical**

E6 Single-Ended Optical Kit Encoder (Default)



RELEASE DATE: 8/11/2019

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

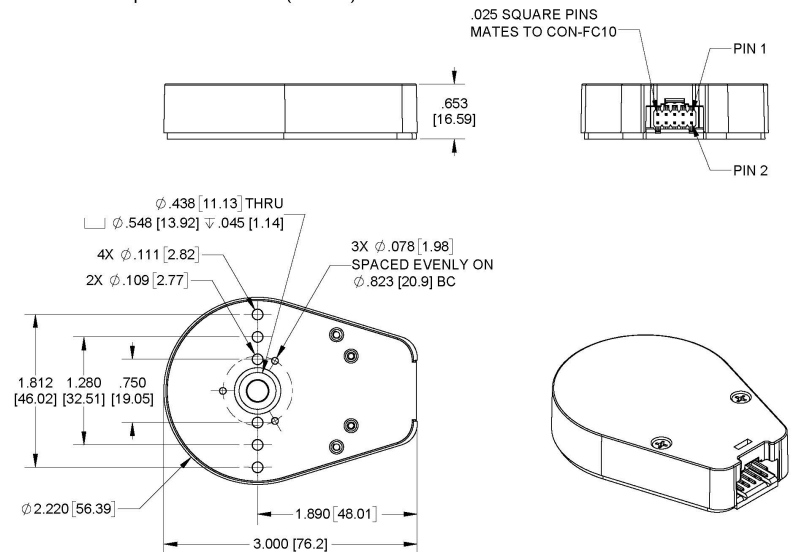
info@usdigital.com  
www.usdigital.com

Local: 360.260.2468  
Toll-free: 800.736.0194

UNITS: INCHES [MM]  
METRIC SHOWN FOR REFERENCE ONLY

**Differential Optical**

E6 Differential Optical Kit Encoder (Default)



RELEASE DATE: 8/11/2019

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Vancouver, Washington 98684, USA

info@usdigital.com  
www.usdigital.com

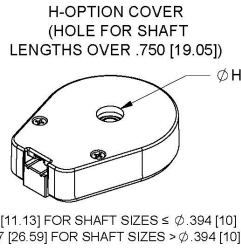
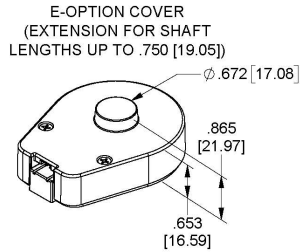
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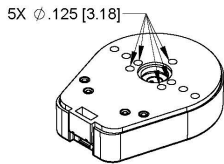
 **Base and Cover Options**

E6 Optical Kit Encoder (Base and Cover Options)

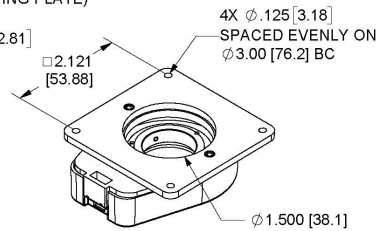
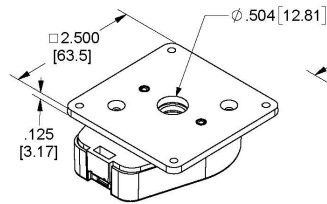
RELEASE DATE: 9/11/2019



**3-OPTION BASE**  
(LARGER MOUNTING HOLES)



**M-OPTION BASE**  
(MOUNTING PLATE)



FOR SHAFTS ≤  $\phi$ .394 [10]      FOR SHAFTS >  $\phi$ .394 [10]  
REQUIRES AN ADDITIONAL .125 [3.18] SHAFT LENGTH

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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	Dimension	Units
Max. Shaft Axial Play	±0.010	in.
Max. Shaft Eccentricity Plus Radial Play (1)	0.004	in.
Max. Acceleration	250000	rad/sec <sup>2</sup>
Max. RPM (2) ( <b>CPR ≤ 2500</b> ) e.x. CPR=2500, max. rpm=7200 e.x. CPR=100, max. rpm=60000	minimum value of ((18 x 10 <sup>6</sup> ) / CPR) and (60000)	rpm
Max. RPM (2)( <b>CPR &gt; 2500 and ≤ 5000</b> ) e.x. CPR=4096, max. rpm=5273	(21.6 x 10 <sup>6</sup> ) / CPR	rpm
Max. RPM (2)( <b>CPR &gt; 5000</b> ) e.x. CPR=10000, max. rpm=4320	(43.2 x 10 <sup>6</sup> ) / CPR	rpm
Typical Product Weight		
Single-Ended ( <b>S</b> -option)	1.55	oz.
Differential ( <b>D</b> -option, <b>L</b> -option)	1.83	
Codewheel Moment of Inertia	8.9 x 10 <sup>-5</sup> for bore < 12mm 4.0 x 10 <sup>-4</sup> for bore ≥ 12 mm	oz-in-s <sup>2</sup>
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	
2 Mounting Screw Size	#2-56 or #4-40	
3 Screw Bolt Circle Diameter (3)	0.823 ± 0.005	in.
2 Screw Bolt Circle Diameter	0.750 ± 0.005	in.
Required Shaft Length (4)	0.445 to 0.570	in.
With E-option (3)	0.445 to 0.750	
With H-option	> 0.445	
Index Alignment to Hub Set Screw	180 Typical	mechanical degrees

## 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

Parameter	Torque
Module to Base	3.5-4 in-lbs

## Phase Relationship

### Single-Ended (S) / Differential (D) Option:

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

### Avago/Agilent compatible pin-out (A, L) Option:

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

## Single-ended Electrical

- Specifications apply over entire operating temperature range.
- Typical values are specified at  $V_{cc} = 5.0V_{dc}$  and  $25^{\circ}C$ .
- 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
	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

## Differential Electrical

- Specifications apply over entire operating temperature range.
- Typical values are specified at  $V_{cc} = 5.0V_{dc}$  and  $25^{\circ}C$ .
- 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		29	36	mA	CPR < 1000, no load
		56	65	mA	CPR $\geq$ 1000 and < 3600, no load
		74	88	mA	CPR $\geq$ 3600, no load
Low-level Output		0.2	0.4	V	IOL = 20mA max.
High-level Output	2.4	3.4		V	IOH = -20mA max.
Differential Output Rise/Fall Time			15	nS	

## Pin-outs

5-pin Single-ended (1)		10-pin Differential, Standard (2)		10-pin Differential (L-option) (2)		10-pin Single-ended (A-option) (2)	
Pin	Description	Pin	Description	Pin	Description	Pin	Description
1	Ground	1	Ground	1	No connection	1	A channel
2	Index	2	Ground	2	+5VDC power	2	+5VDC power
3	A channel	3	Index-	3	Ground	3	Ground
4	+5VDC power	4	Index+	4	No connection	4	No connection
5	B channel	5	A- channel	5	A- channel	5	No connection
		6	A+ channel	6	A+ channel	6	Ground
		7	+5VDC power	7	B- channel	7	+5VDC power
		8	+5VDC power	8	B+ channel	8	B+ channel
		9	B- channel	9	Index-	9	+5VDC power
		10	B+ channel	10	Index+	10	Index

- (1) 5-pin single ended mating connector is CON-FC5.  
 (2) 10-pin differential mating connector is CON-FC10.

## Options

### Index

Provides a single pulse per revolution.

### 3-option

3-option makes all five of these hole diameters .125".

**View option:**

- Single-ended Version



- Differential Version



**E-option**

The **E**-option provides a cylindrical extension to the cover allowing for longer shafts of up to .750".

Please note: Only available for shaft diameters <.472".

**View option:**

- Single-ended Version



- Differential Version



**H-option**

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

- Shafts 2mm to 10mm, a .438" diameter hole is supplied.
- Shafts 12mm to 1", a 1.047" diameter hole is supplied.

**View option:**

- Single-ended Version



- Differential Version



**L-option**

Provides Avago / Agilent / HP differential compatible pin-out. See direct replacement information above.

**M-option**

This adapter plate is for mounting to a 3" diameter bolt circle.

**View option:**

- Single-ended / Differential Versions



**T-option**

When mounting holes are not applicable, a pre-applied transfer adhesive mounting option is available.

**Instructions:** The T-option includes transfer adhesive with a peel-off backing on the encoder base. First, peel the paper backing from the transfer adhesive. Next, align the centering tool with the center hole on the non-adhesive side of the encoder base. Slide the base (adhesive side down) with the centering tool over the motor shaft and press firmly to form a solid bond between the encoder base and mounting surface. Remove the centering tool and continue with the standard assembly. You are required to use the centering tool with the T-option to ensure proper placement.

**View option:**

- Single-ended Version



- Differential Version



 **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 E6 base onto the shaft. 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, .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, .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-E6S**

**Description:** For shaft sizes < 0.472"

**Part #: SPACER-E6L**

**Description:** For shaft sizes 12mm to 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

## Avago Direct Replacement

### Avago Direct Replacement:

US Digital's E6 encoder may now be used as a direct replacement for the following Avago encoders:

HEDL-6500, HEDL-6505, HEDL-6540, HEDL-6545.

HEDM-6500, HEDM-6505, HEDM-6540, HEDM-6545.

HEDR-6500

, HEDS-6505, HEDS-6540, HEDS-6545.

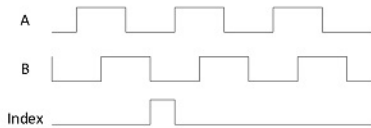
**Notes:**

▸ In order for the **E6** to be fully compatible, CA-3921-2FT\* must also be ordered separately.

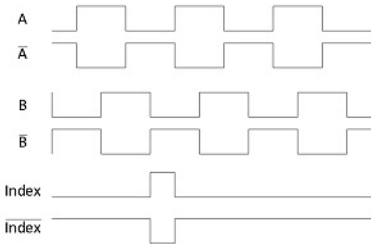
\*Custom cable lengths are available (standard length is 2ft).

 **Output Waveforms**

SINGLE-ENDED



DIFFERENTIAL



 **Assembly Instructions**

E6 Assembly Instructions - [http://usdigital.com/assets/general/E6\\_Assembly\\_Instructions.pdf](http://usdigital.com/assets/general/E6_Assembly_Instructions.pdf)

 **Ordering Information**

E6 -  -  -  -  -  -  -

CPR	Bore	Index	Output	Cover	Base	Packaging
64 =	079 =	NE =No	S =Single-ended	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	D =Differential	E =Cover	3 =0.125" diam.	
200 =	118 =	IE =	L =Avago	Extension	for five base	
400 =	3mm	Index	Compatible	H =Hole in	mounting holes	
500 =	125 =		Differential	Cover	M =Adds 4-hole	1 =Encoders Individually packaged. One spacer tool and one hex wrench for orders up to 9 units, for orders of 10 units...
512 =	1/8"		A =Avago		mounting adapter	
1000 =	156 =		Compatible 10-pin		plate.	
1024 =	5/32"		Single-ended		T =Adds transfer	2 =Encoders packaged individually with one spacer tool and one hex wrench per encoder.
1800 =	157 =				adhesive to base	
2000 =	4mm					
2048 =	188 =					3 =Encoders packaged individually with one spacer tool, one hex wrench, and one centering tool per encoder.
2500 =	3/16"					
3600	197 =					
4000	5mm					
4096	236 =					
5000	6mm					
7200	250 =					
8000	1/4"					
8192	313 =					
10000	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"					

## Notes

- Cables and connectors are not included and must be ordered separately.
- US Digital warrants its products against defects in materials and workmanship for two years. See complete warranty for details.