

## Description

The E6 Series rotary encoder has a molded polycarbonate which utilizes either a 5-pin or 10-pin finger-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, hub/code wheel, 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.

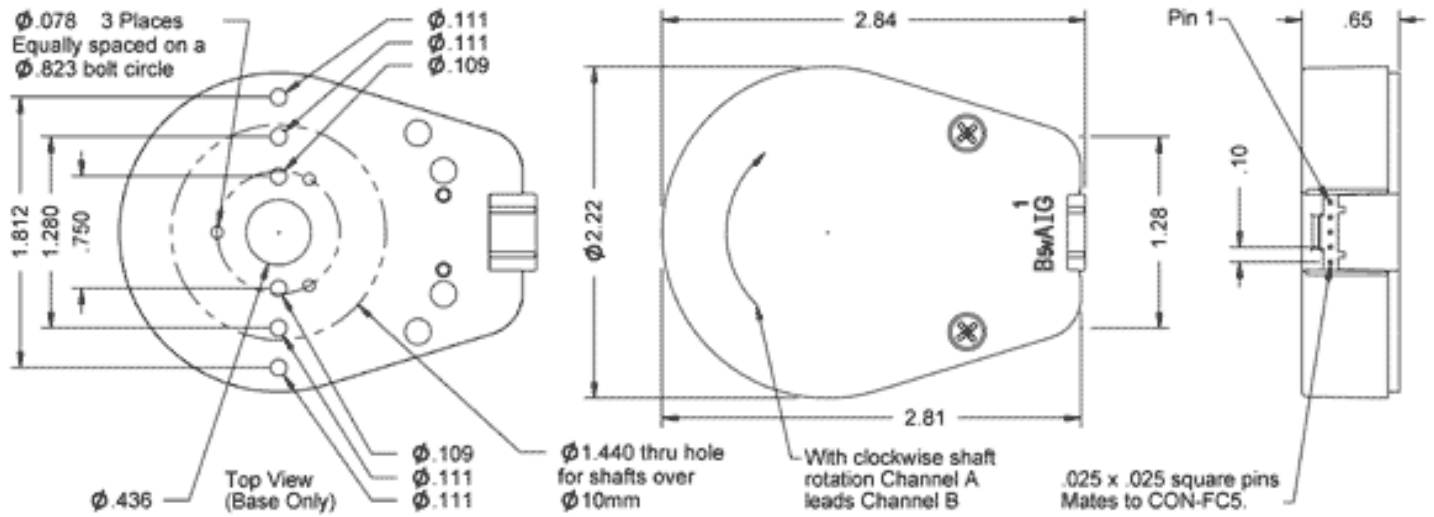
The base and cover are both constructed of a rugged 20% glass filled polycarbonate. Attachment of the base to a surface may be accomplished by utilizing one of several machine screw bolt circle options. Positioning of the base to the centerline of a shaft is ensured by use of a centering tool (sold separately). 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 shatterproof 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.

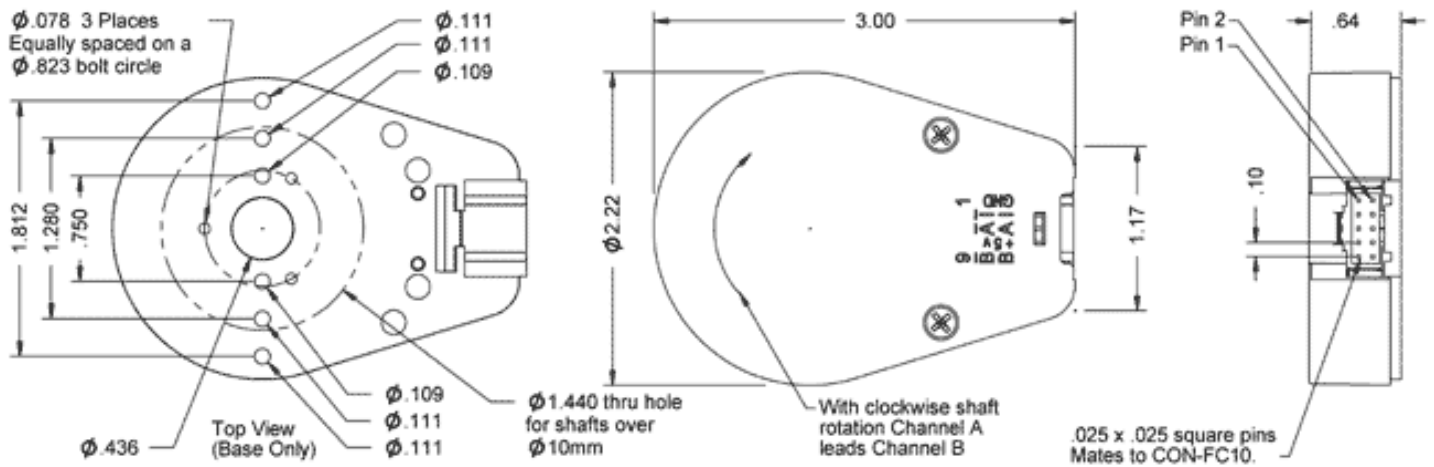
For differential versions: the internal differential line driver (26C31) can source and sink 20mA at TTL levels. The recommended receiver is industry standard 26C32. Maximum noise immunity is achieved when the differential receiver is terminated with a 150  $\Omega$  resistor in series with a .0047  $\mu$ F capacitor placed across each differential pair. The capacitor simply conserves power; otherwise power consumption would increase by approximately 20mA per pair, or 60mA for 3 pairs.

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

**Single-Ended**



**Differential**



**Environmental**

Parameter	Value	Units
Operating Temperature	-40 to 100	C
Vibration (5Hz to 2kHz)	20	G
Electrostatic Discharge, Human Body Model	$\pm 4$	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) e.x. CPR=2500, max. rpm=7200 e.x. CPR=100, max. rpm=60000	minimum value of $((18 \times 10^6) / \text{CPR})$ and (60000)	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 <b>E</b> -option (3)	0.445 to 0.750	
With <b>H</b> -option	> 0.445	
Index alignment to hub set screw	180 ± 5	mechanical degrees

(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

Parameter	Torque
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.

## 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 product page.

Parameter	Min.	Typ.	Max.	Units	Conditions
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		27	30	mA	CPR < 1000, no load
		55	57	mA	CPR $\geq$ 1000, no load
Low-level Output			0.5	V	IOL = 8mA max.
High-level Output	2.0			V	IOH = -8mA max.
	4.2	4.8		V	no load
Output Current Per Channel	-8		8	mA	
Output Rise Time		110		nS	
Output Fall Time		35		nS	

## 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 product page.

Parameter	Min.	Typ.	Max.	Units	Conditions
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		29	33	mA	CPR < 1000, no load
		57	60	mA	CPR $\geq$ 1000, 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      10-pin Differential, Standard      10-pin Differential (L-option)      10-pin Single-ended (A-option)**

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

 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.

**Please note:** Only available for **E6D** and **E6MD** (10-pin versions).

**M-option**

This adapter plate is for mounting to a 3" diameter bolt circle. Use two 4-40 x 1/4" screws (sold separately) to attach the **E6D** base to the plate. Comes attached when ordered with encoder.

**View option:**

- Single-ended / Different Versions



**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.

## 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-265**

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

**Part #: SPACER-555**

**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, 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

 **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.**
- HEDS-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).

 **Product Change Notifications**

Title	Date	Description	Download
		As part of US Digital's continual assurance of supply strategy, we have qualified additional sources for our LED die used in our EM1 encoder module, which in turn impacts all of the following products:	<a href="#">Download</a>
EM1 LED Die - PCN 1016	2/7/2013	EM1, E2, E3, E5, E6, H1, H15, H3, H5, H6, HB5M, HB6M, HD25, PE, S1, S2, S5, S6, T5 and T6  The device specification will remain the same, i.e. there will be no change to form, fit or function of the product(s) as specified by US Digital. The appropriate quality and reliability testing has been performed on representative products to ensure normal parametric distribution, consistent with US Digital's quality and reliability standards.	

 **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 =Packaged in bulk. One spacer tool and one hex.
100 =	2mm	Index	D =Differential	E =Cover	3 =0.125" diam.	
200 =	118 =	IE =	L =Avago	Extension	for five base	1 =Packaged individually. One spacer tool and one hex driver per 100 encoders.
400 =	3mm	Index	Compatible	H =Hole in	mounting holes	2 =Packaged individually with one spacer tool and one hex wrench per 100 encoders.
500 =	125 =		Differential	Cover	M =Adds 4-hole	3 =Packaged individually with one spacer tool, one hex wrench, and one centering tool per encoder.
512 =	1/8"		A =Avago		mounting adapter	
1000 =	156 =		Compatible 10-pin		plate.	
1024 =	5/32"		Single-ended		T =Adds transfer	
1800 =	157 =				adhesive to base	
2000 =	4mm					
2048 =	188 =					
2500 =	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"					

## Rules

- › Index must be equal to NE when CPR is equal to 64
- › Base must be something other than 3 when Bore is greater than or equal to 472
- › Cover must be something other than E when Bore is greater than 394

## 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.

Base Pricing

Quantity	Price
1	\$89.80
5	\$61.95
10	\$54.93
50	\$49.25

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

- ▶ 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 24% per unit for **Output** of Differential , Avago Compatible Differential or Avago Compatible 10-pin Single-ended
- ▶ Add \$7.00 per unit for **Base** of Adds 4-hole mounting adapter plate.
- ▶ Add \$6.00 per unit for **Base** of Adds transfer adhesive to base
- ▶ Add \$3.00 per unit for **Packaging** of Packaged individually. One spacer tool and one hex driver per 100 encoders.
- ▶ Add \$4.00 per unit for **Packaging** of 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