

E6 Features

- Quick, simple assembly, and disassembly
- Rugged screw-together housing
- Positive latching connector
- Accepts .010 in. axial shaft play
- 64 to 10,000 cycles per revolution (CPR)
- 256 to 40,000 pulses per revolution (PPR)
- 2 channel quadrature with optional index
- Multiple Output Drive Options
- Fits shaft diameters from 2mm to 1 in.



E6 Product Description

The E6 Series rotary encoder has a rugged glass-filled polymer enclosure that 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 internal components consist of a mylar disk mounted to a precision machined aluminum hub and an encoder module. 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.

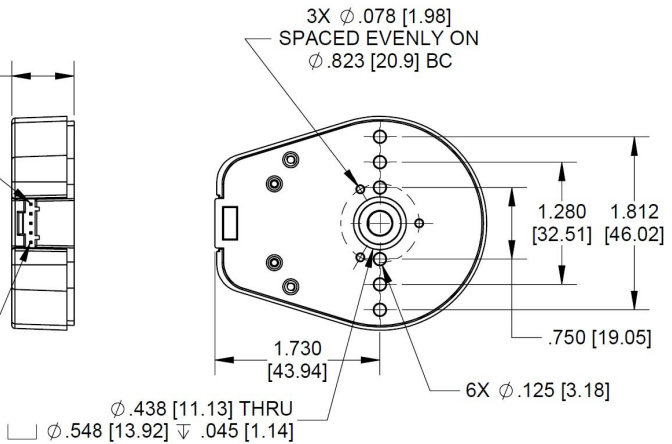
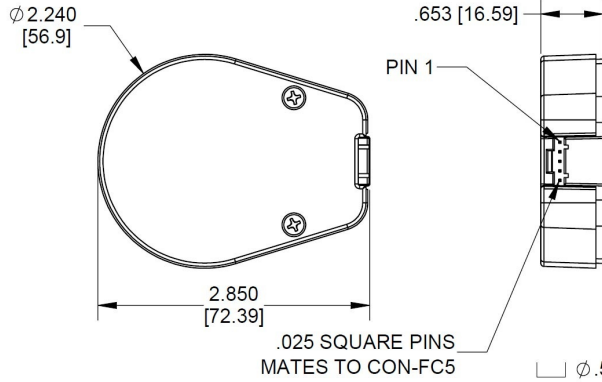
The single-ended output version (**S**-option) is typically used with cables of 10 feet or less. For longer cable lengths, the differential output version (**D**-option) is recommended.

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

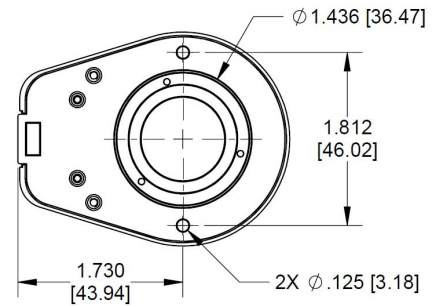
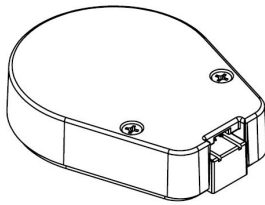
A secure connection to the E6 Series encoder is made through a 5-pin (single-ended versions) or 10-pin (differential, high-voltage or open-collector versions) latching connector. The mating connectors are available from US Digital with several cable options and lengths.

Mechanical Drawings

E6 Single-Ended Optical Kit Encoder (Default)



BASE OPTION FOR SHAFTS $\leq \phi$.394 [10]



BASE OPTION FOR SHAFTS $> \phi$.394 [10]

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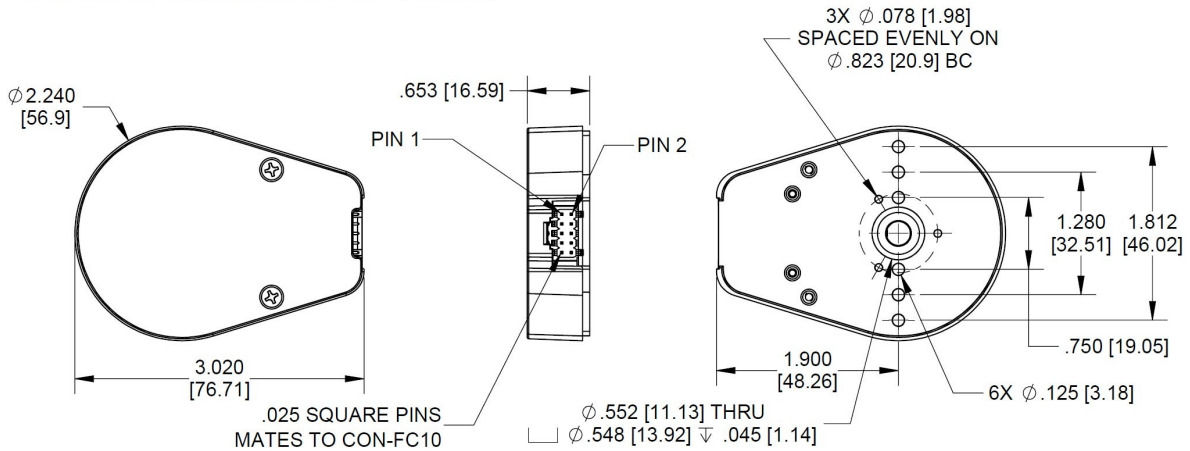
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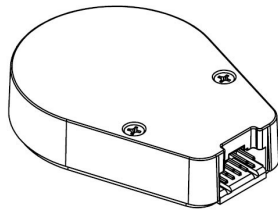
UNITS: INCHES [MM]
 METRIC SHOWN FOR REFERENCE ONLY

RELEASE DATE: 05/19/2021

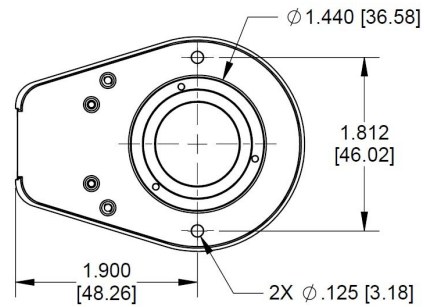
E6 Differential Optical Kit Encoder (Default)



RELEASE DATE: 05/19/2021



BASE OPTION FOR SHAFTS $\leq \phi .394$ [10]



BASE OPTION FOR SHAFTS $> \phi .394$ [10]

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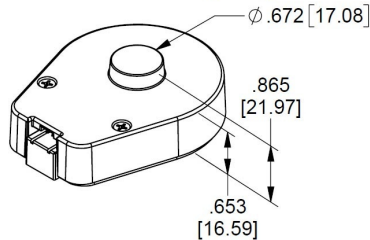
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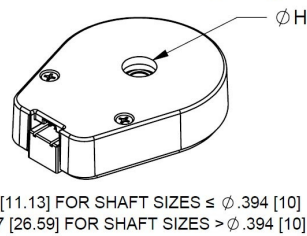
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E6 Optical Kit Encoder (Base and Cover Options)

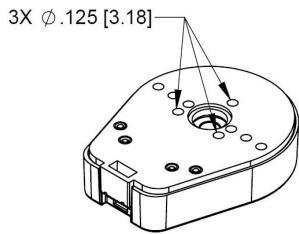
E-OPTION COVER
(EXTENSION FOR SHAFT
LENGTHS UP TO .750 [19.05])



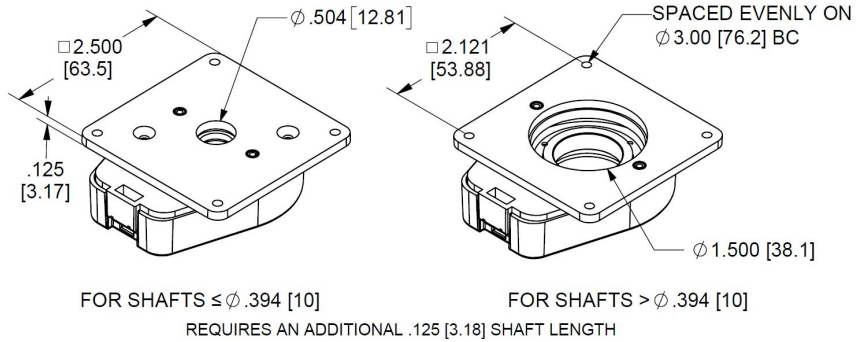
H-OPTION COVER
(HOLE FOR SHAFT
LENGTHS OVER .750 [19.05])



3-OPTION BASE
(.078 HOLES BECOME .125)



M-OPTION BASE
(MOUNTING PLATE)



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UNITS: INCHES [MM]
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Specifications

ENVIRONMENTAL

PARAMETER	VALUE	UNITS
Operating Temperature (CPR < 3600)	-40 to 100	C
Operating Temperature (CPR ≥ 3600)	-25 to 100	C
Electrostatic Discharge		
Single-ended (-A, -S version), IEC 61000-4-2	± 4	KV
Differential (-D, -L version), Human Body Model	± 2	
High-Voltage, Open-collector (H, C option), IEC 61000-4-2	± 4	
Vibration (10Hz to 2kHz, sinusoidal)	20	G
Shock (6 milliseconds half-sine)	75	G

PARAMETER	VALUE	UNITS
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MECHANICAL

PARAMETER	VALUE	UNITS
Max. Shaft Axial Play	±0.010	in.
Max. Shaft Runout	0.004 T.I.R.	in.
Max. Acceleration	250000	rad/sec ²
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 Single-Ended (S option) Differential (D, L option) High-Voltage, Open-Collector (H, C option)	1.55 1.83 1.83	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	
2 Mounting Screw Size	#2-56 or #4-40	
3 Screw Bolt Circle Diameter (2)	0.823 ± 0.005	in.
2 Screw Bolt Circle Diameter	0.750 ± 0.005	in.
Required Shaft Length (3) With E-option (2) With H-option	0.445 to 0.570 0.445 to 0.750 > 0.445	in.
Index Alignment to Hub Set Screw	180 Typical	degrees

(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

SINGLE-ENDED (S) / DIFFERENTIAL (D) / HIGH-VOLTAGE (H) / OPEN-COLLECTOR (C) OPTION:

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

BROADCOM / AVAGO 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 side of the encoder.

SINGLE-ENDED OPTION

- S option provides 5V TTL compatible outputs
- Specifications apply over the entire operating temperature range
- Typical values are specified at $V_{CC} = 5.0V_{DC}$ and $25^{\circ}C$
- 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

DIFFERENTIAL OPTION

- D Option provides differential line driver output
- Specifications apply over the entire operating temperature range
- Typical values are specified at $V_{CC} = 5.0V_{DC}$ and $25^{\circ}C$
- 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		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	$I_{OL} = 20mA$ max.
High-level Output	2.4	3.4		V	$I_{OH} = -20mA$ max.
Differential Output Rise/Fall Time			15	nS	

HIGH-VOLTAGE OPTION

- H option uses a higher supply voltage and provides both single-ended and open-collector outputs
- Single-ended outputs are 5V TTL compatible (same as S option). See Pin-out.
- Specifications apply over the entire operating temperature range
- For complete details, see the EM1 (<https://www.usdigital.com/products/encoders/incremental/modules/em1/>) or EM2 (<https://www.usdigital.com/products/encoders/incremental/modules/em2/>) product pages

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Supply Voltage	7.5		30.0	V	
Supply Current, 24V power		8	10	mA	CPR < 500, no load
		16	19	mA	CPR \geq 500 and < 2000, no load
		22	25	mA	CPR \geq 2000, no load
Open Collector "On" Resistance		2		ohms	
Open Collector Sink Current			200	mA	
Output Low Voltage		0.4		V	200 mA sink current

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Open Collector Pullup Voltage			50	V	

PIN-OUTS

5-PIN SINGLE-ENDED S OPTION (1)		10-PIN DIFFERENTIAL D OPTION (2)		10-PIN DIFFERENTIAL L OPTION (2)(3)		10-PIN SINGLE-ENDED A-OPTION (2)(3)	
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

10-PIN HIGH-VOLTAGE H OPTION (2)

Pin	Description
1	Ground
2	Ground
3	Index- (open collector)
4	Index+ (single-ended)
5	A- channel (open collector)
6	A+ channel (single-ended)
7	7.5-30V power
8	7.5-30V power
9	B- channel (open collector)



10-PIN HIGH VOLTAGE (Single-ended)
H OPTION (2)

- (1) 5-pin single-ended mating connector is CON-FC5 (<https://www.usdigital.com/products/accessories/connectors/con-fc5/>).
- (2) 10-pin differential mating connector is CON-FC10 (<https://www.usdigital.com/products/accessories/connectors/con-fc10/>).
- (3) Broadcom / Avago compatible version.

ACCESSORIES

1. Centering Tool

Part #: CTOOL - (Shaft Diameter)

This reusable tool centers the shaft within the encoder base during assembly. It is required for the proper functioning of the encoder.

2. Hex Tool

Part #: HEXD-050

Hex driver, 0.050" flat-to-flat for #3-48 or #4-48 set screws. Included with **-B** or **-1** packaging options for order quantities of 10 or more.

Part #: HEXW-050

Hex wrench, 0.050" flat-to-flat for #3-48 or #4-48 set screws. Included with **-B** or **-1** packaging options for order quantities of 9 or less. Included with **-3** packaging option for all order quantities.

3. Spacer Tool

This reusable tool sets the proper spacing between the disk and sensor during assembly. It is required for the proper functioning of the encoder.

Part #: SPACER-E6S

Description: For shaft sizes < 0.472"

Part #: SPACER-E6L

Description: For shaft sizes 12mm to 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"

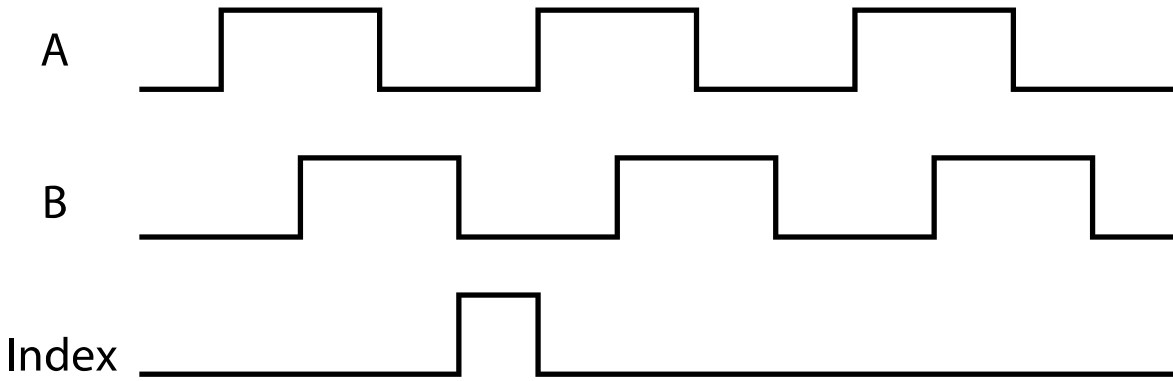
Use: Hub/Disk Mounting for 2mm - 1/4" Bore

Quantity Required: 1

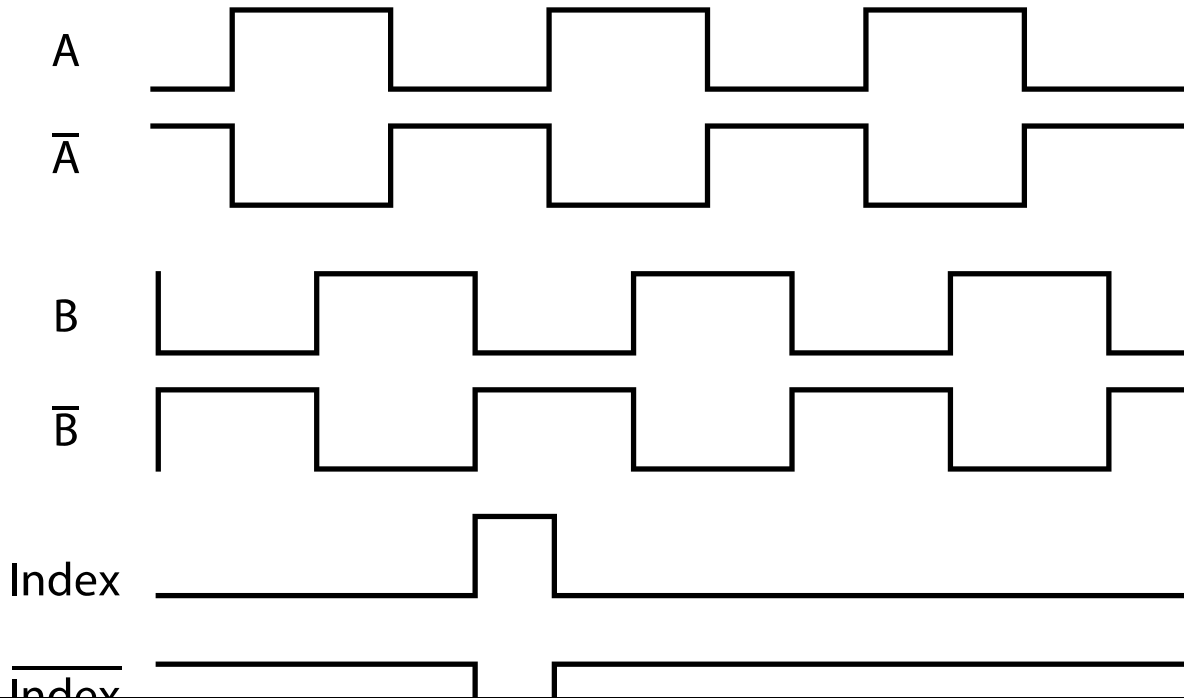
Screw is included

OUTPUT WAVEFORMS

SINGLE-ENDED



DIFFERENTIAL





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 (<https://www.usdigital.com/company/warranty>) for details.

Configuration Options

E6	CPR (Cycles Per Revolution)	Bore Size	Index	Output	Cover	Base	Packaging
		079 (2.0mm)	IE (Index)	S (Single-Ended)	D (Default)	D (Default)	B (Encoders packaged in bulk. Every order includes one centering tool, hex tool and spacer tool. An additional set of tools is included for each 100 encoders ordered.)
	64	118 (3.0mm)	NE (Non-Index)	H (Single-Ended High-Voltage)	E (Extended)	3 (1/8" Mounting Holes)	
	100	125 (1/8")			H (Through-Hole)	M (3" Diameter Bolt Circle)	
	200	156 (5/32")		D (Differential)			
	400	157 (4.0mm)		L (Avago 10-pin Differential)			
	500	188 (3/16")		A (Avago 10-pin Single-Ended)			
	512	197 (5.0mm)					
	800	236 (6.0mm)					
	1000	250 (1/4")					
	1024	313 (5/16")					
	1800	315 (8.0mm)					
	2000	375 (3/8")					1 (Encoders packaged individually. Every order includes one centering tool, hex tool and spacer tool. An additional set of tools is included for each 100 encoders ordered.)
	2048	394 (10.0mm)					
	2500	472 (12.0mm)					
	3600	500 (1/2")					
	4000	551 (14.0mm)					
	4096	625 (5/8" Bore)					
	5000	750 (3/4" Bore)					
	7200	787 (20.0mm)					
	8000	875 (7/8")					
	8192	984 (25.0mm)					
	10000	1000 (1")					3 (Encoders packaged individually. Every order includes one

*centering
tool, hex tool
and spacer
tool per
encoder.)*

PLEASE NOTE: This chart is for informational use only. Certain product configuration combinations are not available. Visit the E6 product page (<https://www.usdigital.com/products/E6>) for pricing and additional information.