

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.

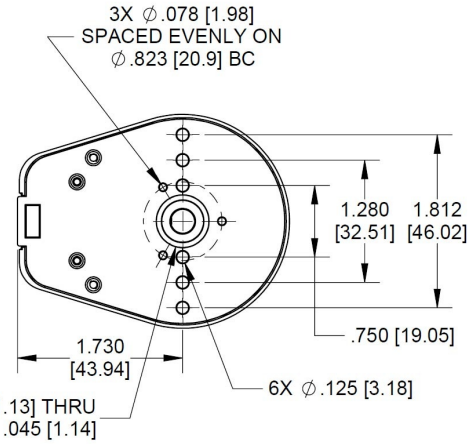
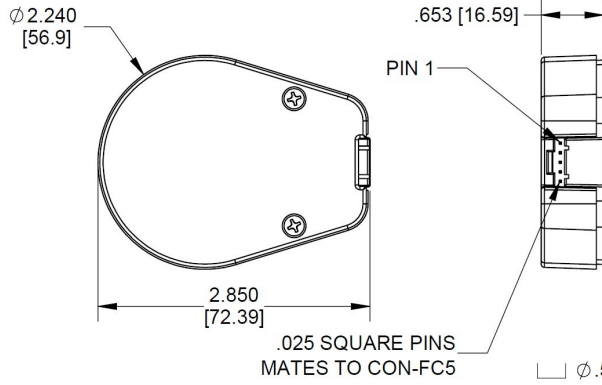
The single-ended output version (**S**-option) is typically used with cables of 10 feet or less. For longer cable lengths, the differential output version (**D**-option) is recommended.

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.

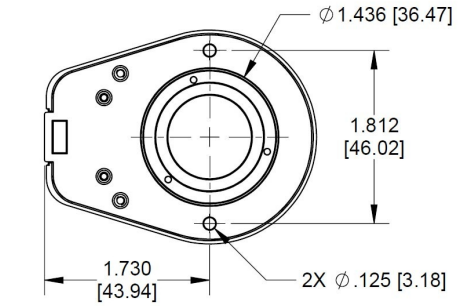
A secure connection to the E6 Series encoder is made through a 5-pin (single-ended versions) or 10-pin (differential, high-voltage or open-collector versions) latching connector. The mating connectors are available from US Digital with several cable options and lengths.

Mechanical Drawings

E6 Single-Ended Optical Kit Encoder (Default)



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



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

RELEASE DATE: 05/19/2021

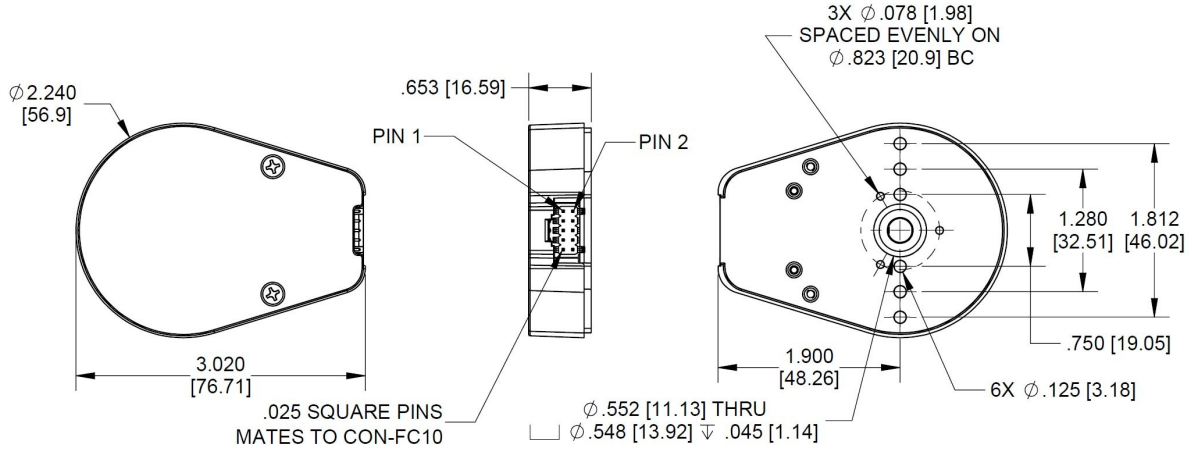
US DIGITAL 1400 NE 136th Avenue
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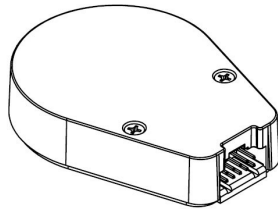
Local: 360.260.2468
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UNITS: INCHES [MM]
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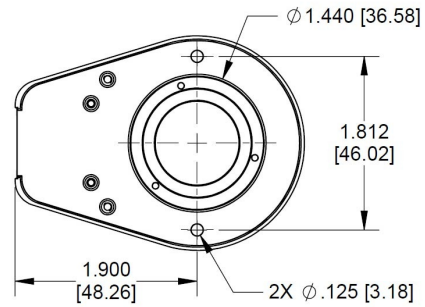
E6 Differential Optical Kit Encoder (Default)



RELEASE DATE: 05/19/2021



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



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

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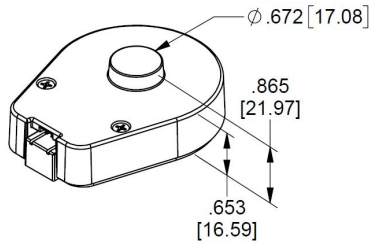
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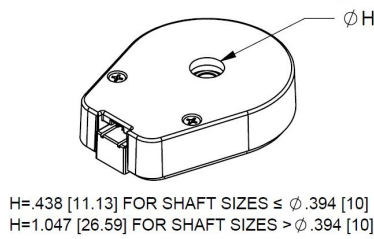
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E6 Optical Kit Encoder (Base and Cover Options)

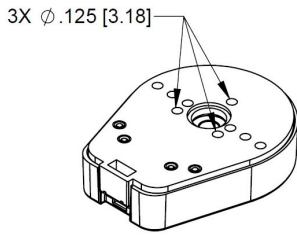
E-OPTION COVER
(EXTENSION FOR SHAFT
LENGTHS UP TO .750 [19.05])



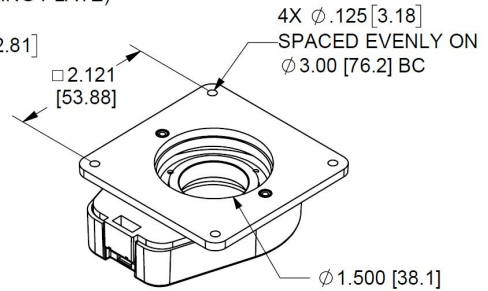
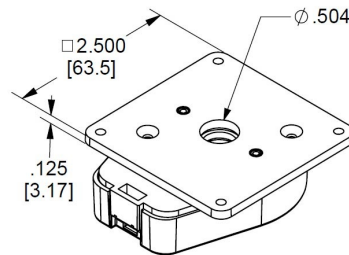
H-OPTION COVER
(HOLE FOR SHAFT
LENGTHS OVER .750 [19.05])



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



M-OPTION BASE
(MOUNTING PLATE)



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

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

REQUIRES AN ADDITIONAL .125 [3.18] SHAFT LENGTH

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Specifications

ENVIRONMENTAL

PARAMETER	VALUE	UNITS
Operating Temperature (CPR < 3600)	-40 to 100	C
Operating Temperature (CPR \geq 3600)	-25 to 100	C
Electrostatic Discharge		
Single-ended (-A, -S version), IEC 61000-4-2	± 4	
Differential (-D, -L version), Human Body Model	± 2	kV
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 Vcc = 5.0Vdc and 25°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)
- 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			30	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 H OPTION (2)	B+ channel (single-ended)
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- (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

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.

2. Hex Tool

Depending on the order quantity and 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

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, Phillips #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

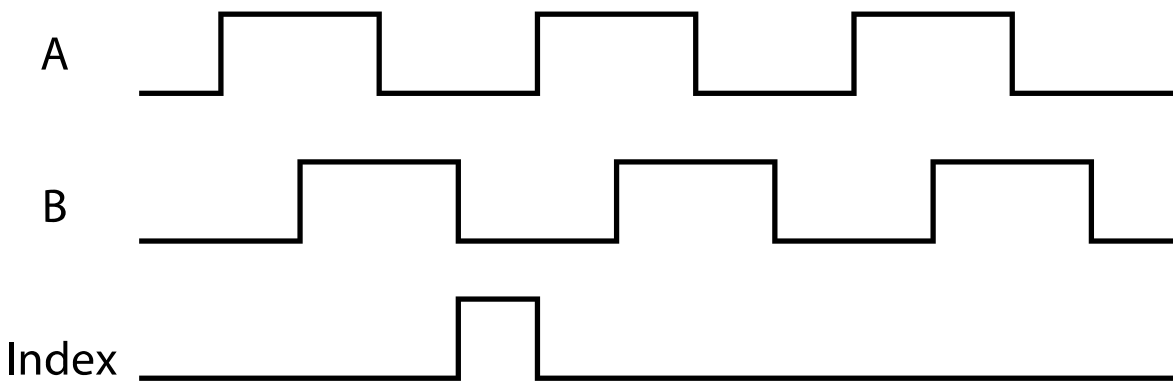
Description: Socket Head Set Screw, 4-48 UNC x 1/16"
Use: Hub/Disk Mounting for 5/16" - 10mm Bore
Quantity Required: 1
Screw is included

Part #: SCREW-448-125-SS

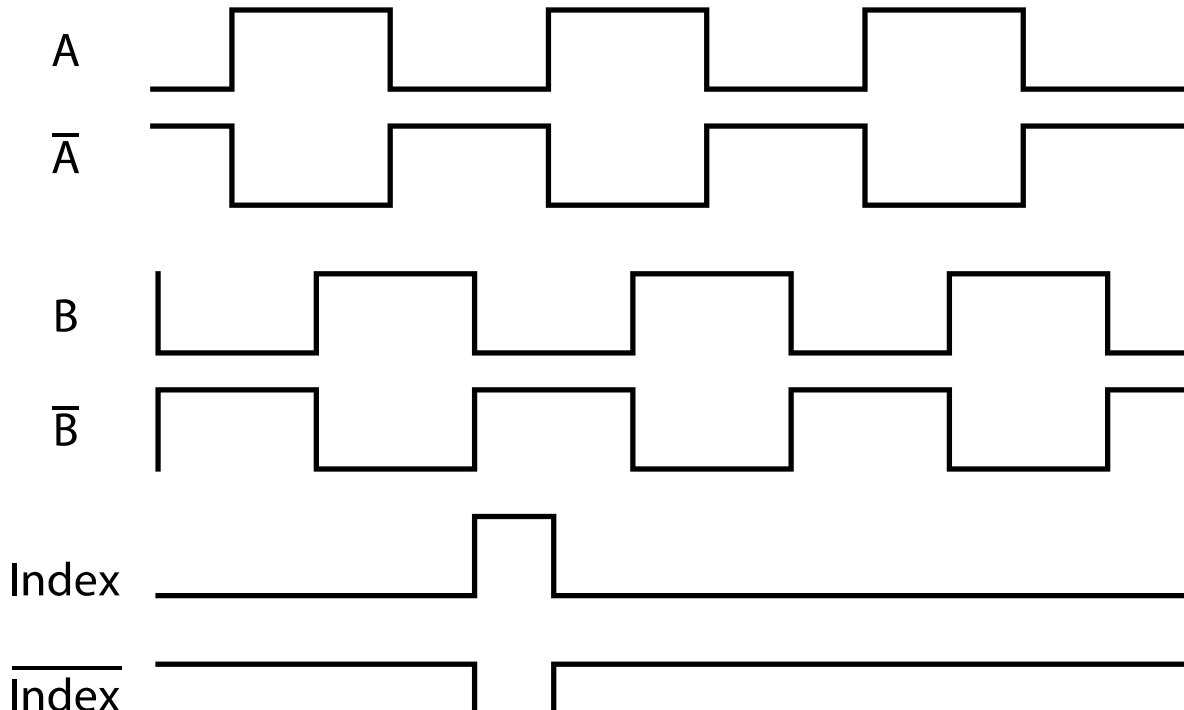
Description: Socket Head Set Screw, 4-48 UNC x 1/8"
Use: Hub/Disk Mounting for 2mm - 1/4" Bore
Quantity Required: 1
Screw is included

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