E6 Features

- Kit Version for mounting on a motor or other shaft
- Supports 22 shaft sizes (2 to 25 mm and 1/8 in. to 1 in.)
- For NEMA 23 to NEMA 34 and larger motors
- 21 Resolutions from 64 to 10,000 CPR (256 to 40,000 PPR)
- Optional Index channel, Differential and High-Voltage Outputs
- Choice of 3 base styles and 3 cover options
- Secure latching connector/cable (sold separately)

E6 Product Description

US Digital's E6 motor encoder mounts directly to a motor or other rotating shaft. This optical encoder features a rugged, glass-filled polymer housing and is designed for easy installation and removal.

RoHS COMPLIANT

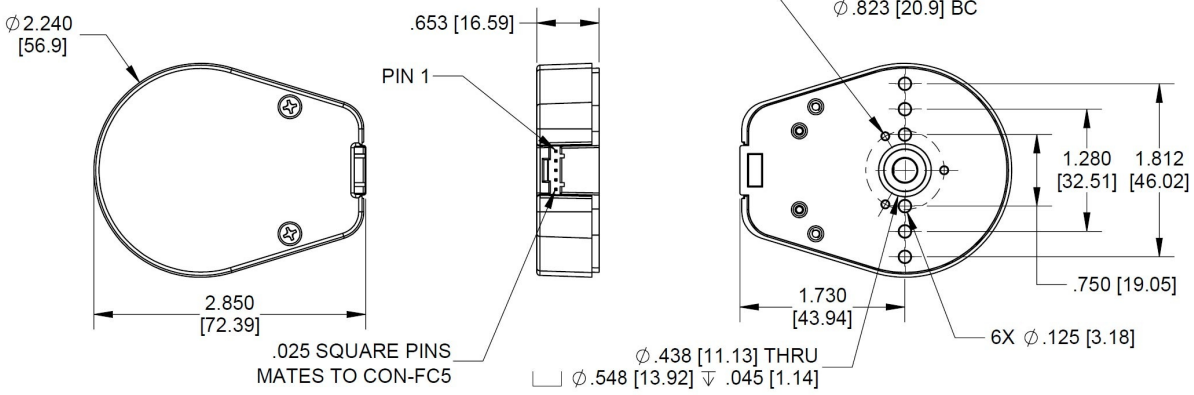
The E6 rotary encoder contains a precision machined aluminum hub with a specially patterned Mylar disk. This disk, in combination with our proprietary optical encoder module, creates a system that is highly tolerant to mechanical misalignment.

The E6 is a versatile motor encoder, with three base configurations and three cover styles which allows it to fit a wide range of applications. This optical rotary encoder also has four available outputs—single-ended, single-ended High-Voltage, differential, and Avago single-ended and differential. This incremental encoder is designed for use with a secure latching connector—connector/cable sold separately.

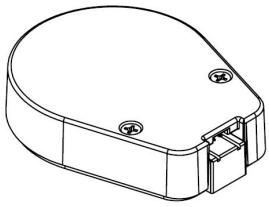
Mechanical Drawings

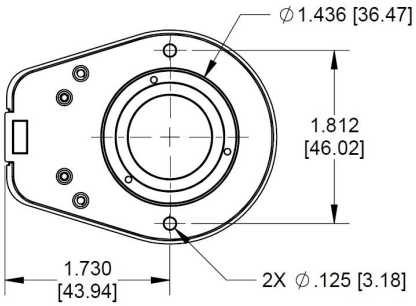
E6 Single-Ended Optical Kit Encoder (Default)

RELEASE DATE: 05/19/2021



BASE OPTION FOR SHAFTS ≤ ∅.394 [10]





BASE OPTION FOR SHAFTS > ∅.394 [10]

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]
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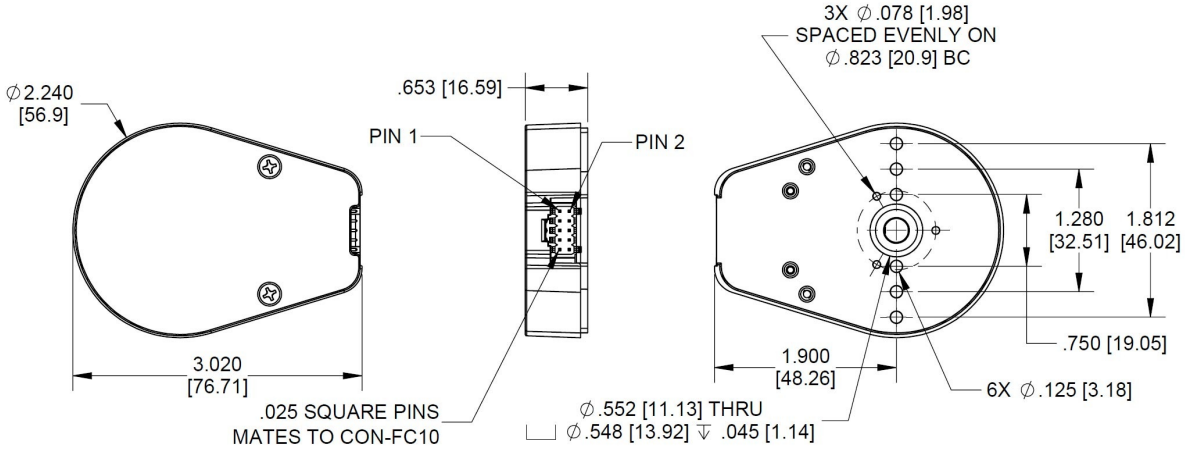
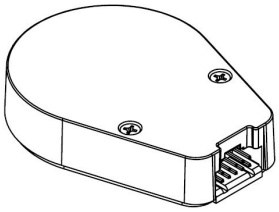
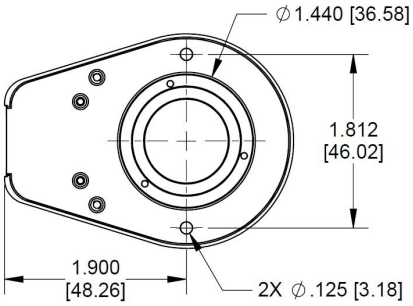
E6 Differential Optical Kit Encoder (Default)

RELEASE DATE: 05/19/2021



BASE OPTION FOR SHAFTS ≤ ∅.394 [10]





BASE OPTION FOR SHAFTS > ∅.394 [10]

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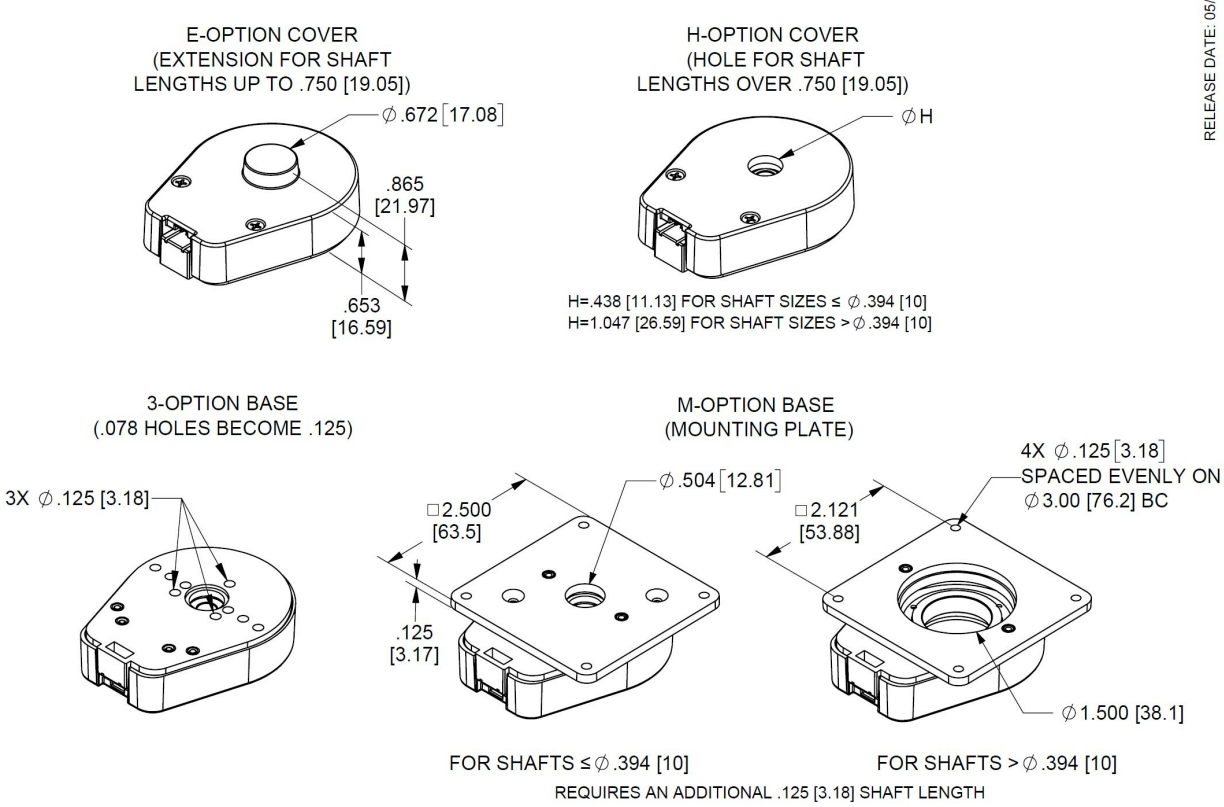
E6 Optical Kit Encoder (Base and Cover Options)

RELEASE DATE: 05/19/2021



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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 Differential (-D, -L version), Human Body Model High-Voltage, Open-collector (H, C option), IEC 61000-4-2	 ± 4 ± 2 ± 4	 kV
Vibration (10Hz to 2kHz, sinusoidal)	20	G
Shock (6 milliseconds, half-sine)	75	G

PARAMETER	VALUE	UNITS

MECHANICAL

PARAMETER	VALUE	UNITS
Max. Shaft Axial Play	±0.010	in.
Max. Shaft Runout	0.004 T.I.R.	in.
Max. Acceleration	250000	rad/sec²
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-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	
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 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		29	36	mA	CPR < 1000, no load
		56	65	mA	CPR ≥ 1000 and < 3600, no load
		74	88	mA	CPR ≥ 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 ≥ 500 and < 2000, no load
		22	25	mA	CPR ≥ 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 H OPTION (2)	(Single-ended)

(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

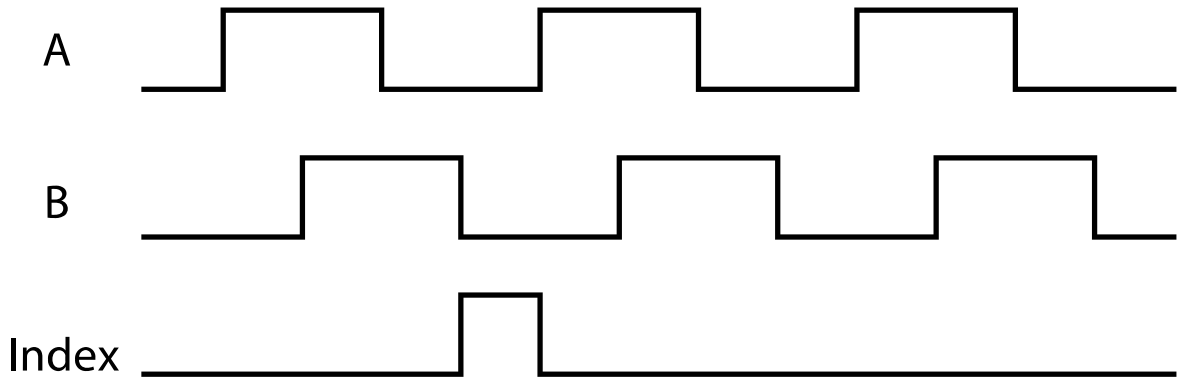
Quantity Required: 2
Screws are included

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

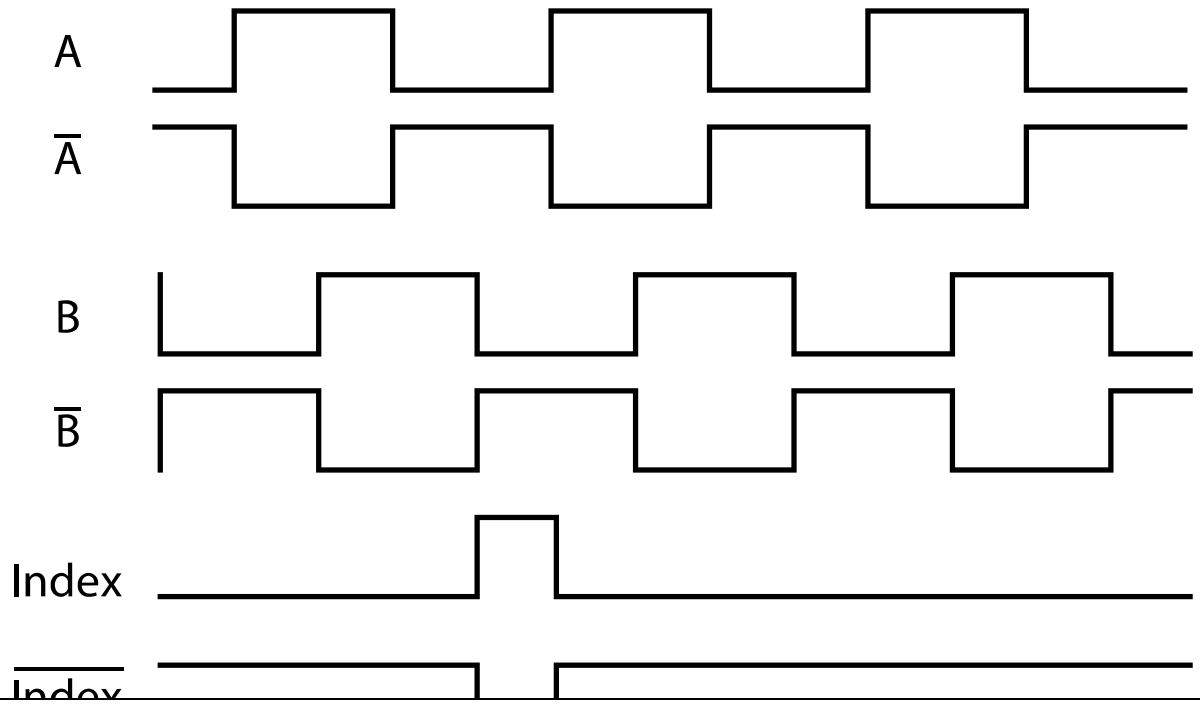
Part #: SCREW-448-125-SS
Description: Socket Head Set Screw, 4-48 UNC x 1/8"
Use: Hub/Disk Mounting for 2mm - 1/4" Bore
Quantity Required: 1
Screw is included

OUTPUT WAVEFORMS

SINGLE-ENDED



DIFFERENTIAL



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

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.