

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 6 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 110-ohm resistor in series with a .0047 microfarad 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.



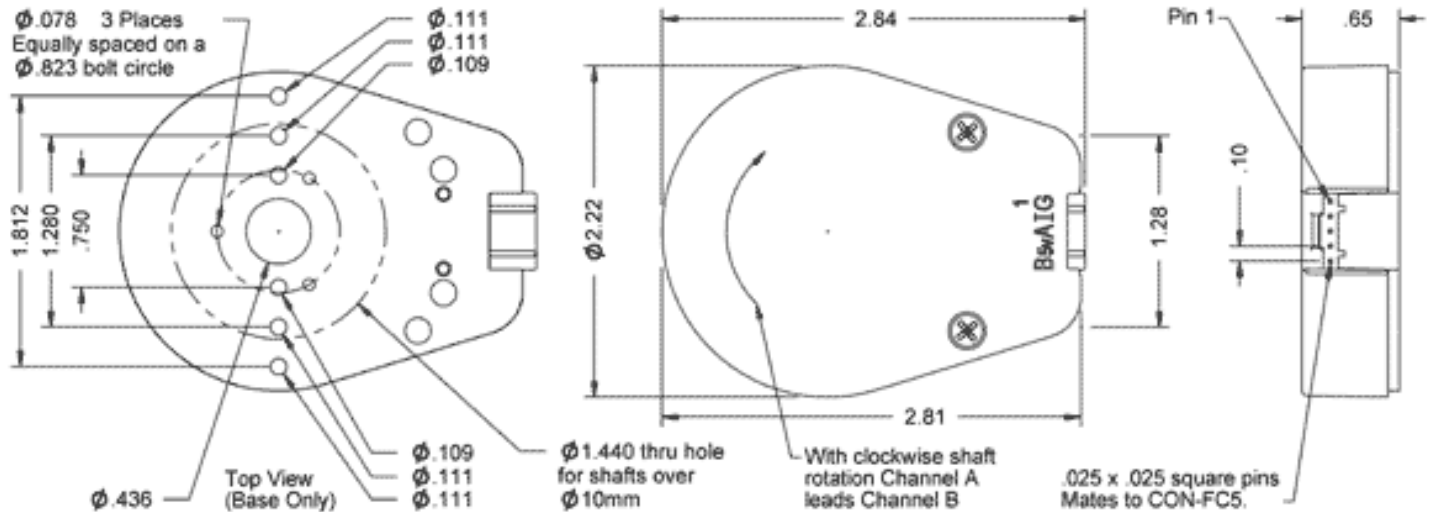
Features

- ▶ Quick, simple assembly and disassembly
- ▶ Rugged screw-together housing
- ▶ Positive finger-latching connector
- ▶ Accepts .010" axial shaft play
- ▶ Tracks from 0 to 100,000 cycles/sec
- ▶ 256 to 10,000 pulses per revolution (PPR)
- ▶ 2 channel quadrature TTL squarewave outputs
- ▶ Optional index (3rd channel)
- ▶ -40 to +100C operating temperature
- ▶ Fits shaft diameters from 2mm to 1"

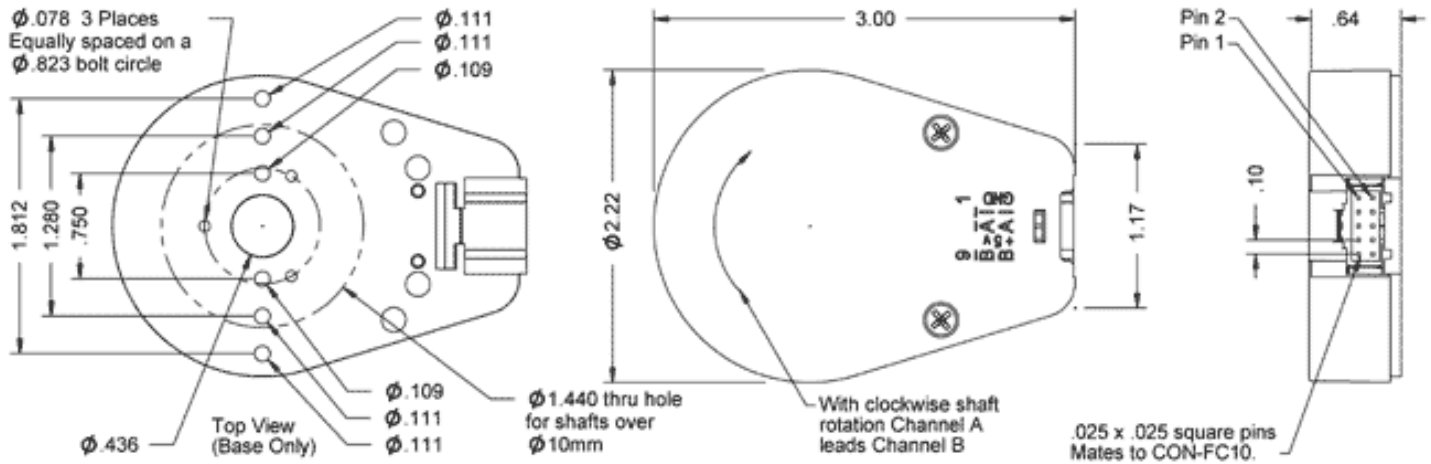
Related Products & Accessories

- CA-FC10-SH-FC10 10-Pin Latching / Latching Shielded Cable (Base price \$26.20)
- CA-FC10-SH-NC 10-Pin Latching / Unterminated Shielded Cable (Base price \$13.60)
- CA-FC10-W8-NC 10-Pin Latching / Unterminated 8-Wire Discrete Cable (Base price \$13.10)
- CA-FC10L-SH-FC10L 10-Pin Latching / Latching Shielded Cable (Agilent Pin-Out) (Base price \$26.20)
- CA-FC10L-SH-NC 10-Pin Latching / Unterminated Shielded Cable (Agilent Pin-Out) (Base price \$13.60)
- CA-FC5-SH-FC5 5-Pin Latching / Latching Shielded Cable (Base price \$16.76)
- CA-FC5-SH-NC 5-Pin Latching / Unterminated Shielded Cable (Base price \$8.88)
- CA-FC5-SS-MD6 5-Pin Latching / 6-Pin Modular Unshielded Cable (Base price \$13.11)
- CA-FC5-W4-NC 5-pin Latching / Unterminated 4-Wire Discrete Cable (Base price \$8.38)
- CA-FC5-W5-NC 5-Pin Latching / Unterminated 5-Wire Discrete Cable (Base price \$8.38)
- CON-FC10 10-Pin Finger Latching Connector (Base price \$8.40)
- CON-FC5 5-Pin Finger Latching Connector (Base price \$3.15)
- CTOOL Centering Tool for E2, E3, E5, E6, and E7P (Base price \$5.25)
- HEXD-050 Hex Driver - .050" (Base price \$5.25)
- HEXW Hex Wrench (Base price \$0.53)
- SCREW Threaded Fasteners (Base price \$0.26)
- SPACER Spacer Tool (Base price \$0.95)

Single-Ended



Differential



Mechanical

Parameter	Dimension	Units
Moment of Inertia	8.0×10^{-6}	oz-in-s ²
Hub Set Screw	3-48 or 4-48	in.
Hex Wrench Size	.050	in.
Encoder Base Plate Thickness	.135	in.
3 Mounting Screw Size	0-80	in.
2 Mounting screw size	2-56 or 4-40	in.
3 Screw Bolt Circle Diameter	$.823 \pm .005$	in.
2 Screw Bolt Circle Diameter	$.750 \pm .005$	in.
Required Shaft Length	.445 to .570*	in.
With E-option	.445 to .750*	in.
With H-option	$\geq .445^*$	in.
Single-ended (S-option) Weight	1.55	oz.
Differential (D-option, L-option) Weight	1.83	oz.
Index alignment to hub set screw	$180^\circ \pm 5^\circ$	mech. degrees

* Only for shaft diameters $< .472$ ".

** Add $.125$ " to the required shaft length when using M-option.

Avago / Agilent / HP Direct Replacement

Avago / Agilent / HP Direct Replacement:

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

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

, 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).

Absolute Maximum Ratings

Parameter	Max.	Units
Vibration (5Hz to 2kHz)	20	G
Shaft Axial Play	±0.010	in.
Shaft Eccentricity Plus Radial Play	0.004	in.
Acceleration	250,000	rad/sec ²
Maximum RPM	minimum value of (6000000 / CPR) and (60000)	rpm
e.x. CPR = 2500, max. rpm = 2400		
e.x. CPR = 512, max. rpm = 11718		
e.x. CPR = 200, max. rpm = 30000		
e.e. CPR = 64, max. rpm = 60000		

- Note that radial play translates directly to position inaccuracy.
- Note: 60000 rpm is the maximum rpm due to mechanical considerations. The maximum rpm due to the module's 100kHz maximum count frequency is (6000000/CPR).

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 (see the [EM1 / HEDS](#) page).

Single-ended Electrical

- Specifications apply over entire operating temperature range.
- Typical values are specified at Vcc = 5.0Vdc and 25 ° C.
- For complete details see the EM1 and HEDS product pages.

Resolution	Supply Current	Output voltage low	Output voltage high	Based on
	Typ / Max	Max	Min	
100, 200, 400, 500, 512, 1000, 1024 CPR, non-index	17 / 40 mA	0.4 volts @ 3.2mA	2.4 volts @ -200uA	Low-res HEDS
2000, 2048 CPR, non-index	57 / 85 mA	0.5 volts @ 8mA	2.4 volts @ -40uA	High-res HEDS
64 CPR, with index	27 / 30 mA	0.5 volts @ 8mA	2.0 volts @ -8mA	EM1

	Supply Current	Output voltage low	Output voltage high	
100, 200, 400, 500, 1000, 1024 CPR, with index	57 / 85 mA	0.5 volts @ 8mA	2.4 volts @ -40uA	High-res HEDS
1800 CPR, with index	55 / 57 mA	0.5 volts @ 8mA	2.0 volts @ -8mA	EM1
2000, 2048 CPR, with index	57 / 85 mA	0.5 volts @ 8mA	2.4 volts @ -40uA	High-res HEDS
2500 CPR, with index	55 / 57 mA	0.5 volts @ 8mA	2.0 volts @ -8mA	EM1

Differential Electrical

Specification	Min.	Typ.	Max.	Units	Notes
Supply	4.5	5.0	5.5	Volts	
Current Consumption					
Index: 64 CPR	-	28	53	mA	No load
Index: 1800, 2500 CPR	-	56	59	mA	No load
Index: All Other Resolutions	-	58	88	mA	No load
Non-index: <2000 CPR	-	18	43	mA	No load
Non-index: >=2000	-	58	88	mA	No load
Non-index: 2500	-	56	59	mA	No load
Output Voltage					
Sourcing to +5	2.4	3.4	-	Volts	@ -20mA
Sinking to Ground	-	0.2	0.4	Volts	@ 20mA

Torque

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
Module to Base	3.5-4 in-lbs

Disk Optics

Be sure to keep different diameters, resolutions and options separated. The resolution of the optoelectronic modules and the code wheels must match. Index and non-index parts cannot be mixed since the optical patterns are different. An identifier is stamped on each optoelectronic module.

For Agilent Modules (HEDS):

The 2-channel (non-index) version can be identified by a 9100 or 9200. The 3-channel (index) version can be identified by a 9140. One letter specifies the resolution as shown in the table below.

For US Digital Modules (EM1):

The first number identifies the size of the disk this module is to be used with. The second number identifies the resolution as shown in the table below. The 3-channel (index) version is standard and is not denoted unless the module is non-index. The 2-channel (non-index) can be identified by a -N.

Disk	Standard	Index
64	-	2-64
100	S	S
200	C	C
400	E	E
500	E	F
512	A	-
1000	B	B
1024	J	J
1800	-	2-1800
2000	T	T
2048	U	T
2500	2-2500-N	2-2500

 **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**

Centering Tools (May need to order separately, only included with PKG3-packaging option).

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.

Hex Tools (May need to order separately, see below for more information).

Part #: HEXD-050 (only included with default or PKG1-packaging options).

Description: Hex driver, .050" flat-to-flat for 3-48 or 4-48 set screws.

Part #: HEXW-050 (only included with PKG2 or PKG3-packaging options).

Description: Hex wrench, .050" flat-to-flat for 3-48 or 4-48 set screws.

Spacer Tools (Do not need to order separately, included with ALL packaging options).

Part #: SPACER-265

Description: For shaft sizes <.472"

Part #: SPACER-555

Description: For shaft sizes 12MM to 1"

Screws (For base mounting only, screws for mounting the housing to the base are already 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

Pin-outs

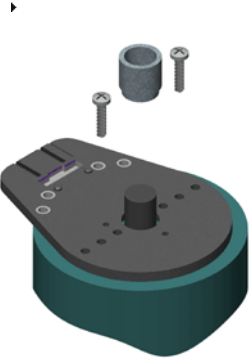
5-pin Single-ended	10-pin Differential Standard	10-pin Differential (L-option)	10-pin Single-ended (A-option)
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Pin	Description	Pin	Description	Pin	Description	Pin	Description
1	Ground	1	Ground	1	No connection	1	A channel
2	Index	2	Ground	2	+5VDC power	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

Assembly Instructions

View the PDF version of this document.

For Shafts Less Than Or Equal To 0.394" (10mm)



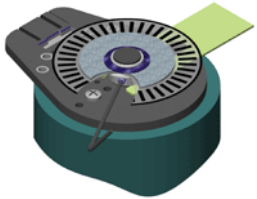
1. Base Mounting

Secure the base to the mounting surface using two or three screws. If a centering tool is used, slip it over the shaft and into the center hole of the base. Tighten mounting screws. Remove centering tool.



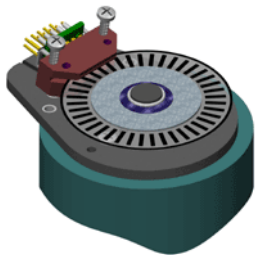
2. Spacer Installation

Place spacer tool on optic module as shown below.



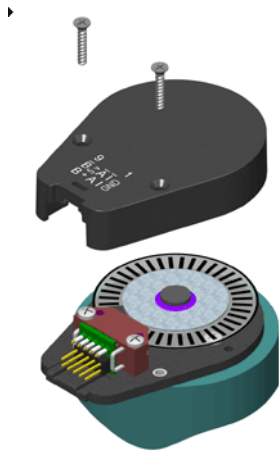
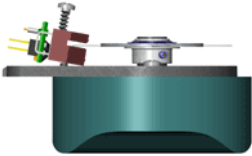
3. Codewheel Installation

Slip codewheel over shaft with mylar disk towards top until it bottoms out against the spacer tool. Tighten set screw with hex wrench provided while pressing down on hub.



4. Encoder Module Installation

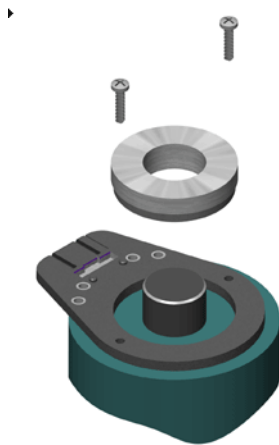
Slip optical module into position until two alignment pins slip into holes of module (thick side of module towards bottom). Secure with 4-40 x 1/2" screws (supplied).



5. Cover Installation

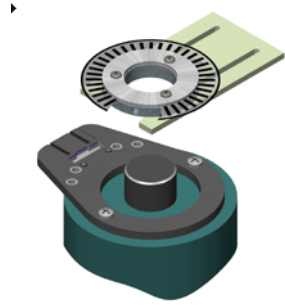
Place housing (cover) over assembly and secure with two 4-40 x 5/8" cover screws (supplied).

For Shafts Greater Than 0.394" (10mm):



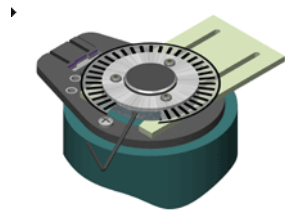
1. Base Mounting

Secure the base to the mounting surface using two or three screws. If a centering tool is used, slip it over the shaft and into the center hole of the base. Tighten mounting screws. Remove centering tool.



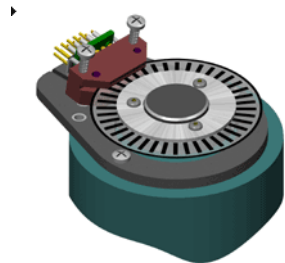
2. Spacer Installation

Place spacer tool on optic module as shown below.



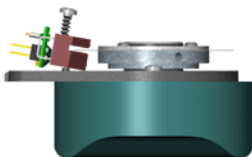
3. Codewheel Installation

Slip codewheel over shaft with mylar disk towards top until it bottoms out against the spacer tool. Tighten set screw with hex wrench provided while pressing down on hub.



4. Encoder Module Installation

Slip optical module into position until two alignment pins slip into holes of module (thick side of module towards bottom). Secure with 4-40 x 1/2" screws (supplied).





5. Cover Installation

Place housing (cover) over assembly and secure with two 4-40 x 5/8" cover screws (supplied).

Please note:

- Shown using the Differential version
- These instructions are compatible for all versions of the E6.

 **Ordering Information**

E6 - - - - - - -

CPR	Bore	Index	Output	Cover	Base	Packaging
64	079 =	N =No Index	S =Single-ended	D =Default	D =Default	B =Packaged in bulk. One spacer tool and one hex.
100	2mm	I =Index (3rd channel)	D =Differential	E =Cover Extension	3 =0.125" diam. for five base mounting holes	1 =Packaged individually. One spacer tool and one hex driver per 100 encoders.
200	118 =		L =Avago Compatible Differential	H =Hole in Cover	M =Adds 4-hole mounting adapter plate.	2 =Packaged individually with one spacer tool and one hex wrench per encoder.
400	3mm				T =Adds transfer adhesive to base	3 =Packaged individually with one spacer tool, one hex wrench, and one centering tool per encoder.
500	125 =		A =Avago Compatible 10-pin Single-ended			
512	1/8"					
1000	156 =					
1024	5/32"					
1800	157 =					
2000	4mm					
2048	188 =					
2500	3/16"					
	197 =					
	5mm					
	236 =					
	6mm					
	250 =					
	1/4"					
	312 =					
	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 I when CPR is 64, 1800 or 2500
- ▶ Base must be something other than 3 when Bore is 472
- ▶ Cover must be something other than E when Bore is 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	\$61.95
10	\$54.93
50	\$49.25
100	\$45.83

- ▶ 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 I or **CPR** greater than or equal to 1000.
- ▶ Add \$7.00 per unit for **Packaging** of 3, \$13.00 per unit if the bore size is greater than 394