

Description

The E6 Series rotary encoder has a molded polycarbonate which 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 E6 Series is easy to add to existing applications and only consists of five main components; base, cover, hubdisk, 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 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.

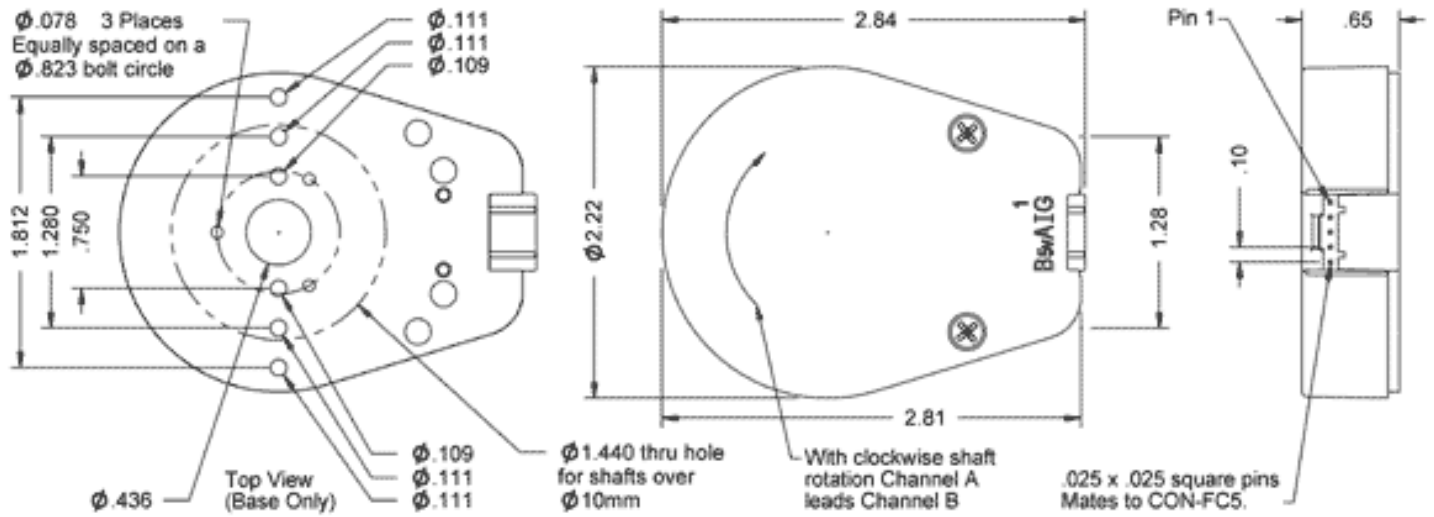
A secure connection to the E6 Series encoder is made through a 5-pin (single-ended versions) or 10-pin (differential versions) latching connector (sold separately). The mating connectors are available from US Digital with several cable options and lengths.



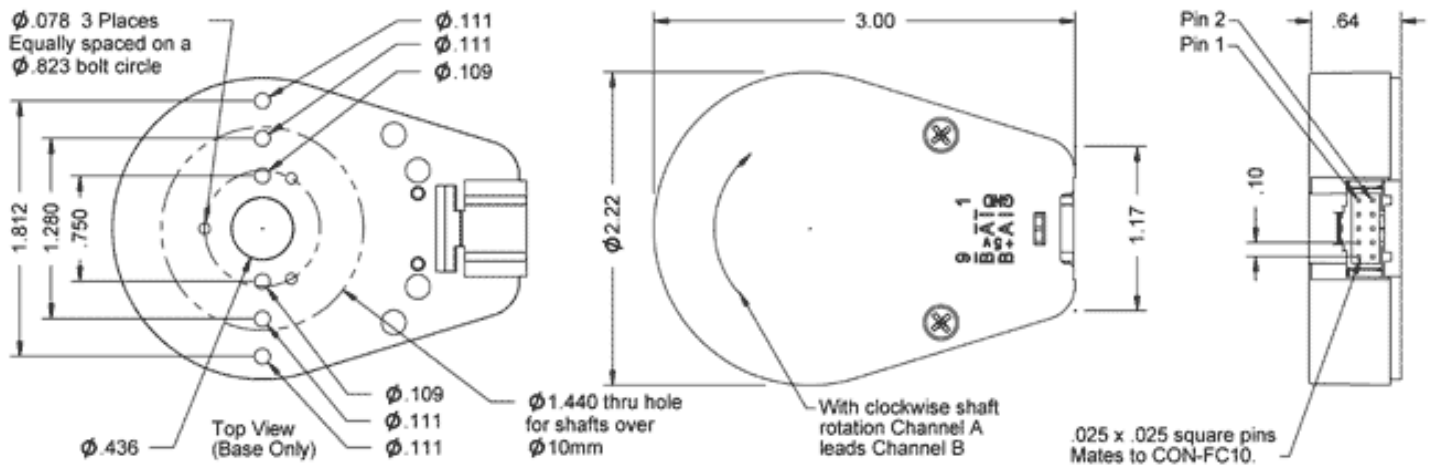
Features

- ▶ Quick, simple assembly and disassembly
- ▶ Rugged screw-together housing
- ▶ Positive latching connector
- ▶ Accepts .010" axial shaft play
- ▶ 64 - 10000 CPR
- ▶ 2 channel quadrature TTL squarewave outputs
- ▶ Optional index (3rd channel)
- ▶ Fits shaft diameters from 2mm to 1"

Single-Ended



Differential



Environmental

| Parameter | Value | Units |
|---|------------|-------|
| Operating Temperature (CPR < 3600) | -40 to 100 | C |
| Operating Temperature (CPR \geq 3600) | -25 to 100 | C |
| Vibration (5Hz to 2kHz) | 20 | G |
| Electrostatic Discharge, IEC 61000-4-2 | ± 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 ² |
| Max. RPM (2) (CPR ≤ 2500) e.x. CPR=2500, max. rpm=7200 e.x. CPR=100, max. rpm=60000 | minimum value of ((18 x 10 ⁶) / CPR) and (60000) | rpm |
| Max. RPM (2)(CPR > 2500 and ≤ 5000) e.x. CPR=4096, max. rpm=5273 | (21.6 x 10 ⁶) / CPR | rpm |
| Max. RPM (2)(CPR > 5000) e.x. CPR=10000, max. rpm=4320 | (43.2 x 10 ⁶) / CPR | rpm |
| Typical Product Weight | | |
| Single-Ended (S -option) | 1.55 | oz. |
| Differential (D -option, L -option) | 1.83 | |
| 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 (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 E-option (3) | 0.445 to 0.750 | |
| With H-option | > 0.445 | |
| Index Alignment to Hub Set Screw | 180 Typical | mechanical degrees |

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 |
| Adapter Plate to Mounting Surface | 4-6 in-lbs |

| Parameter | Torque |
|----------------|--------------|
| Module to Base | 3.5-4 in-lbs |

Phase Relationship

Single-Ended (S) / Differential (D) Option:

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

Avago/Agilent 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/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 and 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 \geq 1000 and < 3600, no load |
| | | 72 | 85 | mA | CPR \geq 3600, no load |
| Low-level Output | | | 0.5 | V | IOL = 8mA max., CPR < 3600 |
| | | | 0.5 | mA | IOL = 5mA max., CPR \geq 3600 |
| | | 0.05 | | mA | no load, CPR < 3600 |
| | | 0.25 | | mA | no load, CPR \geq 3600 |
| High-level Output | 2.0 | | | V | IOH = -8mA max., CPR < 3600 |
| | 2.0 | | | V | IOH = -5mA max., CPR \geq 3600 |
| | | 4.8 | | V | no load, CPR < 3600 |
| | | 3.5 | | V | no load, CPR \geq 3600 |
| Output Current Per Channel | -8 | | 8 | mA | CPR < 3600 |
| | -5 | | 5 | mA | CPR \geq 3600 |
| Output Rise Time | | 110 | | nS | CPR < 3600 |
| | | 50 | | nS | CPR \geq 3600 |
| Output Fall Time | | 35 | | nS | CPR < 3600 |
| | | 50 | | nS | CPR \geq 3600 |

Differential 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 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 | 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 (1) | | 10-pin Differential, Standard (2) | | 10-pin Differential (L-option) (2) | | 10-pin Single-ended (A-option) (2) | |
|------------------------|-------------|-----------------------------------|-------------|------------------------------------|---------------|------------------------------------|---------------|
| 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 |

- (1) 5-pin single ended mating connector is CON-FC5.
 (2) 10-pin differential mating connector is CON-FC10.

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.

M-option

This adapter plate is for mounting to a 3" diameter bolt circle.

View option:

- Single-ended / Differential Versions



T-option

When mounting holes are not applicable, a pre-applied transfer adhesive mounting option is available.

Instructions: The T-option includes transfer adhesive with a peel-off backing on the encoder base. First, peel the paper backing from the transfer adhesive. Next, align the centering tool with the center hole on the non-adhesive side of the encoder base. Slide the base (adhesive side down) with the centering tool over the motor shaft and press firmly to form a solid bond between the encoder base and mounting surface. Remove the centering tool and continue with the standard assembly. You are required to use the centering tool with the T-option to ensure proper placement.

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-E6S

Description: For shaft sizes < 0.472"

Part #: SPACER-E6L

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, Philips #0-80 UNF x 1/4"

Quantity Required for Mounting: 3 per encoder

Part #: SCREW-256-250-PH

Description: Pan Head, Philips #2-56 UNC x 1/4"

Quantity Required for Mounting: 2 per encoder

Part #: SCREW-440-250-PH

Description: Pan Head, Philips #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.

HEDR-6500

, HEDS-6505, HEDS-6540, HEDS-6545.

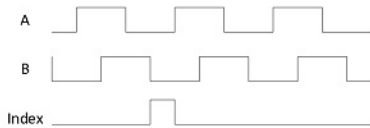
Notes:

▸ In order for the **E6** to be fully compatible, CA-3921-2FT* must also be ordered separately.

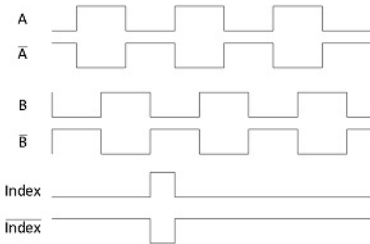
*Custom cable lengths are available (standard length is 2ft).

 **Output Waveforms**

SINGLE-ENDED



DIFFERENTIAL



 **Assembly Instructions**

E6 Assembly Instructions - 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 =Encoder components packaged in bulk. One spacer tool and one hex wrench for orders up to 9 units, for orders of 10... |
| 100 = | 2mm | Index | D =Differential | E =Cover | 3 =0.125" diam. | |
| 200 = | 118 = | IE = | L =Avago | Extension | for five base | |
| 400 = | 3mm | Index | Compatible | H =Hole in | mounting holes | |
| 500 = | 125 = | | Differential | Cover | M =Adds 4-hole | |
| 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 = | | | | | 1 =Encoders Individually packaged. One spacer tool and one hex wrench for orders up to 9 units, for orders of 10 units... |
| 2500 = | 3/16" | | | | | 2 =Encoders packaged individually with one spacer tool and one hex wrench per encoder. |
| 3600 | 197 = | | | | | 3 =Encoders packaged individually with one spacer tool, one hex wrench, and one centering tool per encoder. |
| 4000 | 5mm | | | | | |
| 4096 | 236 = | | | | | |
| 5000 | 6mm | | | | | |
| 7200 | 250 = | | | | | |
| 8000 | 1/4" | | | | | |
| 8192 | 313 = | | | | | |
| 10000 | 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" | | | | | |

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.