E2 Optical Kit Encoder

Description:

The **E2** is a rotary encoder with a molded polycarbonate enclosure, which utilizes either a 5-pin locking or standard connector. This optical incremental encoder is designed to easily mount to and dismount from an existing shaft to provide digital feedback information.

The **E2** is easy to add to existing applications and only consists of four main components; base, cover, hub/code wheel and optical encoder module.

The **E2** is normally designed for applications of 6 feet or less. For longer cable lengths, adding a **PC4** / **PC5** differential line driver is recommended.

The base and cover are both constructed of 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.

Connection to the **E2** product is made through either a 5-pin locking or standard connector (sold separately). The mating connectors are available from US Digital with several cable options and lengths.

Features:

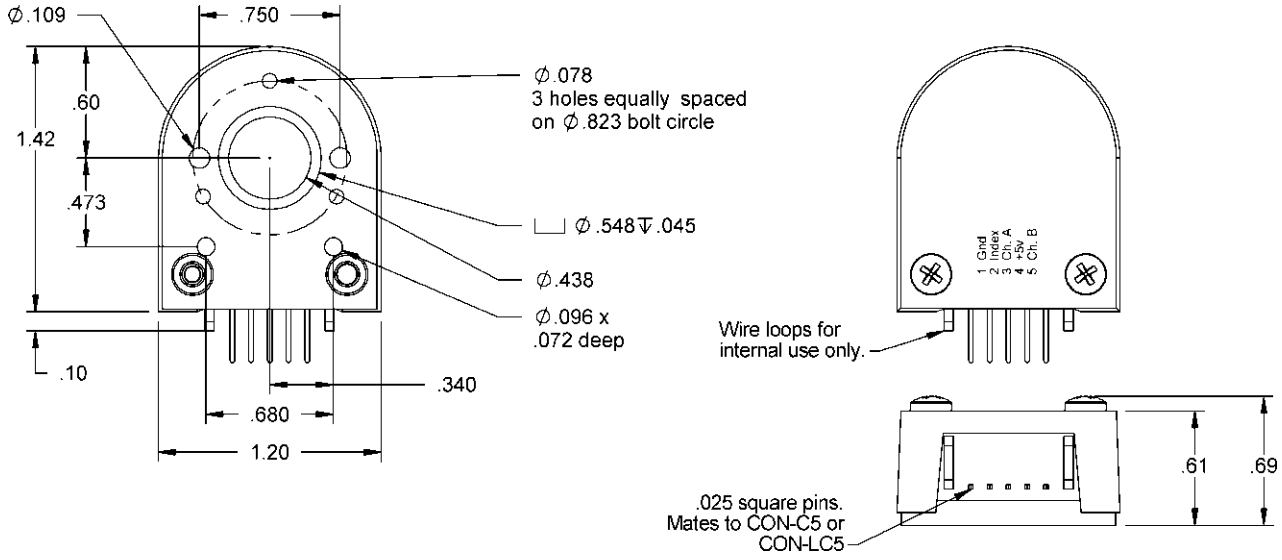
- Quick, simple assembly and disassembly
- Rugged screw-together housing
- Low cost
- Accepts ±.010" axial shaft play
- Small size
- Tracks from 0 to 100,000 cycles/sec
- 32 to 1250 cycles per revolution (CPR)
- 128 to 5000 pulses per revolution (PPR)
- 2 channel quadrature TTL squarewave outputs
- Optional index (3rd channel)
- -40 to +100°C operating temperature
- Mounting compatibility with Agilent HEDS-5500
- Fits shaft diameters .079" to .394" or 2mm to 10mm
- Single +5V supply
- Flush back, through shaft hole, or extended back
- Flat or self-aligning base
- Adapts to 1.812" bolt circle (2 or 3 holes)
- US Digital warrants its products against defects in materials and workmanship for two years. See complete warranty for details.

Avago / Agilent Direct Replacements:

US Digital's **E2** encoder may now be used as direct replacements for Avago / Agilent's **HEDS-5500**, **HEDS-5505**, **HEDS-5540**, **HEDS-5545**, **HEDS-5600**, **HEDS-5640**, **HEDS-5645**.

For additional information and compatible part numbers please visit our website at: *http://www.usdigital.com/products/avago/*

Mechanical Drawing:



Mechanical Specifications:

Parameter	Dimension	Units
Moment of Inertia	8.0 x 10^{-6}	oz-in-s^2
Hub Set Screw Size	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 ±.005	in.
2 Screw Bolt Circle Diameter	.750 ±.005	in.
Required Shaft Length	.445 to .570*	in.
With **E**-option	.445 to .795*	in.
With **H**-option	>.445*	in.

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

Pin-out:

Pin	Description
1	Ground
2	Index
3	A channel
4	+5VDC power
5	B channel

Electrical Specifications:

For complete details see the **EM1 / HEDS** data sheet.

Phase Relationship:

B leads A for clockwise shaft rotation, and A leads B for counterclockwise rotation viewed from the cover/label side of the encoder (*see the **EM1 / HEDS** data sheet*).

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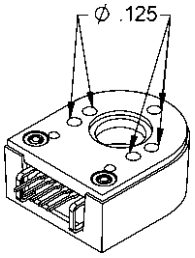
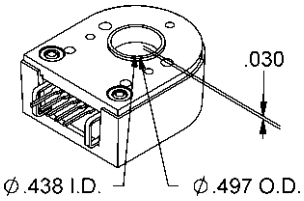


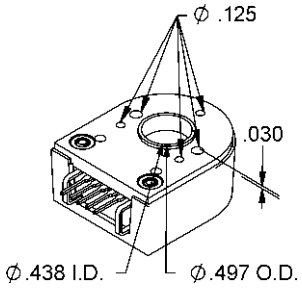
3-option:

3-option makes all five of these hole diameters .125". If desired, the two .096" diameter recesses will mate with matching aligning pins. The .438" diameter center hole can also mate with a motor boss.



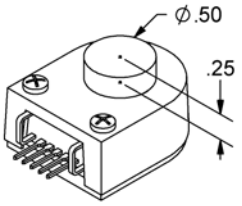
A-option:

A-option adds a .497" diameter alignment shoulder designed to slip into a .500" diameter recess in the mounting surface centered around the shaft.



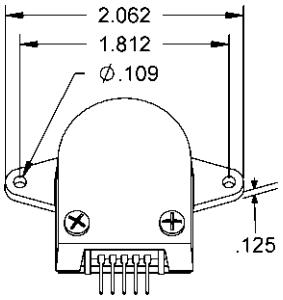
A3-option:

A3-option makes all five of these hole diameters .125". If desired, the two .096" diameter recesses will mate with matching aligning pins. The .438" diameter center hole can also mate with a motor boss. Besides the hole size changes, the **A3**-option adds a .497" diameter alignment shoulder designed to slip into a .500" diameter recess centered around the shaft.



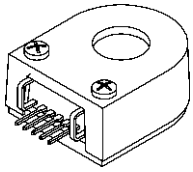
E-option:

The **E**-option provides a cylindrical extension to the cover allowing for longer shafts of up to .795".



G-option:

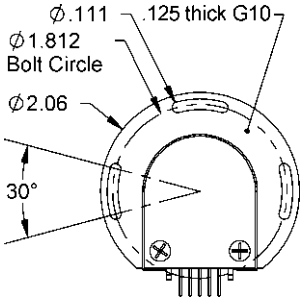
This option includes molded ears on the base which enable it to be mounted to a 1.812" diameter bolt circle. The mounting holes are designed to fit 4-40 screws. Because the ears are molded to the base this does not increase the thickness of the encoder and does not add to the required shaft length. This option will work with shaft lengths of .445" to .570".



H-option:

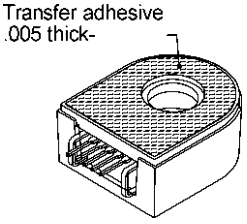
The **H**-option adds a hole to the cover for the shaft to pass through.

- Shafts <.375", a .375" diameter hole is supplied.
- Shafts >=.375", a .500" diameter hole is supplied.



R-option:

This adapter is an 1/8" thick fiberglass adapter which is pre-mounted to the base of the encoder. It allows the **E2** to be rotated ±15° while operating for index orientation. Use three 4-40 x 1/4" screws (sold separately). When installing the hub, rotate the index to the approximate position. After assembly, with the 3 screws loose, rotate while operating to the desired index location and tighten. Note that this adds 1/8" to the required shaft length.



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.

Instructions: Peel off paper backing and slip tool into center hole of base and slide both down shaft as one piece. Press to form a good bond, then slip tool off and continue with standard mounting instructions. A centering tool is highly recommended when using this option.

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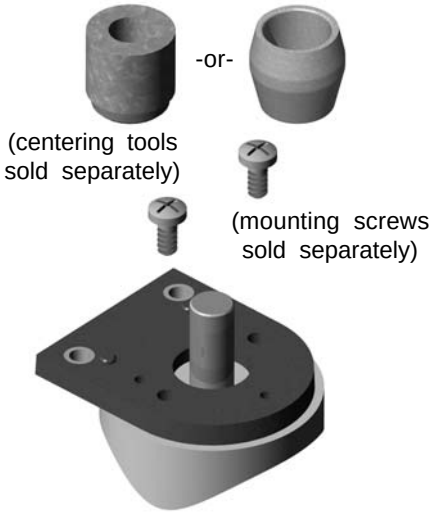
Assembly Instructions:

1. Base Mounting

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



2. Spacer Installation

- For shafts less than 3/8", snap spacer tool clip around shaft. (Fig. A)
- For shafts equal to or larger than 3/8", place spacer tool next to shaft. (Fig. B)

Figure A

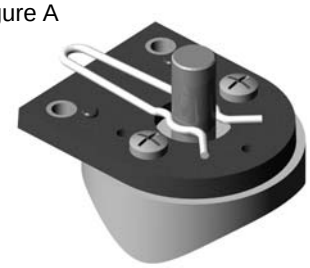
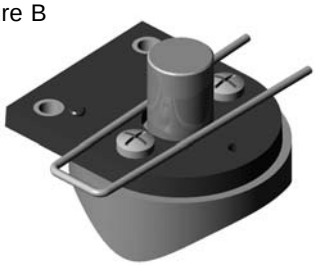
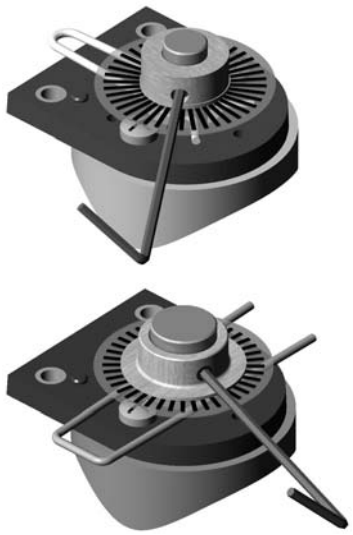


Figure B



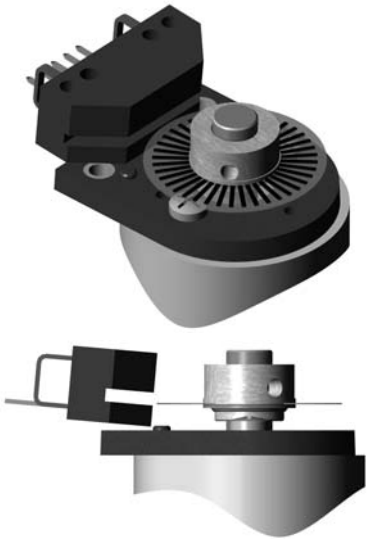
3. Hub Disk Assembly Installation

Slip hub disk assembly over shaft with disk side down until it bottoms out against 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 should be out.



5. Cover Installation

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

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):
Only available in 3-channel (index) version and are identified by a 1 for 1" disk. The second number indentifies the resolution as shown in the table below (*in italics*).

Disk	Standard	Index
32	-	*1-32*
50	S	S
96	C	C
100	C	C
110	C	-
120	C	-
192	E	E
200	E	E
250	F	F
256	F	F
360	G	G

Disk	Standard	Index
400	H	H
500	A	A
512	I	I
540	I	-
720	-	*1-720*
900	-	*1-900*
1000	B	*1-1000*
1016	J	-
1024	J	*1-1024*
1250	-	*1-1250*

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Accessories:

Spacer Tools:	
SPACER-96 For shaft sizes <=.315".	**Price: $0.53**
SPACER-4192 For shaft sizes .375" or .394".	**Price: $0.53**

Hex Tools:	
HEXD-3404 Hex driver, .050" flat-to-flat for 3-48 or 4-48 set screws.	**Price: $5.25**
HEXW-349 Hex wrench, .050" flat-to-flat for 3-48 or 4-48 set screws.	**Price: $0.53**

Base Mounting Screws:	
SCREW-184 (qty. 3) 080 x 1/4"	**Price: $0.26**
SCREW-176 (qty. 2) 256 x 1/4"	**Price: $0.26**
SCREW-290 (qty. 2) 4-40 x 1/4"	**Price: $0.26**

➢ Quantity shown are required for mounting.

Centering Tool:
This reusable tool provides a simple method for accurately centering the **E2** base onto the shaft. It is recommended for the following situations:

➢ When using mounting screws smaller than 4-40.
➢ When using the **3**-hole mounting pattern.
➢ When using the **T**-option transfer adhesive.

CTOOL - ☐

Price $5.25

Shaft Diameter: Code	Size
079	2mm
118	3mm
125	1/8"
156	5/32"
157	4mm
187	3/16"
197	5mm
237	6mm
250	1/4"
312	5/16"
315	8mm
375	3/8"
394	10mm

Absolute Maximum Ratings:

Parameter	Max.	Units
Vibration (5 to 2kHz)	20	g
Shaft Axial Play	±0.010	in.
Shaft Eccentricity Plus Radial Play	0.004	in.
Acceleration	250,000	rad/sec^2

➢ Note that radial play translates directly to position inaccuracy.

Torque Specifications:

Parameter	Torque
Hub Set Screw to Shaft	2-3 in.-lbs.
Cover (4-40 screws through cover into base)	2-3 in.-lbs.
Base to Mounting Surface	4-6 in.-lbs.
Base to Mounting Adapter Plate	4-6 in.-lbs.
Adapter Plate to Mounting Surface (4-40 screws)	4-6 in.-lbs.

Compatible Cables & Connectors:

5-pin Locking or Standard:

Locking	Standard	Description
CON-LC5	CON-C5-22*	Connector
CA-1094-1FT	CA-434-1FT	Connector on one end with 4 12" wires
CA-1095-1FT	CA-435-1FT	Connector on one end with 5 12" wires
CA-3935-6FT	CA-3934-6FT	Connector on one end of a 6' shielded round cable
CA-1630-6FT	CA-576-6FT	Connector on both ends of a 6' shielded round cable

* 22 AWG is standard. 24, 26 and 28 AWG are also available.

Attention:
➢ The **E2** and accompanying cables are typically designed for cable lengths of 6 feet or less; for longer cable lengths, the **PC4** / **PC5** differential line driver and accompanying cables are recommended.
➢ Specify cable length when ordering.
➢ Custom cable lengths are available. See the **Cables / Connectors** data sheet for more information.

Ordering Information:

Price:
$40.95/ 1
$36.44 / 10
$31.07 / 50
$27.53 / 100

Index/HiRes*:
$50.37 / 1
$44.82 / 10
$38.22 / 50
$33.86 / 100

Cost Modifiers:
➢ Add $6.00 for **R**-option.
➢ Add $6.00 for **T**-option.
➢ Add $3.00 for **PKG1**-option.
➢ Add $4.00 for **PKG2**-option.
➢ Add $7.00 for **PKG3**-option.

E2 - ☐ — ☐ — ☐ — ☐

CPR:		
32***	400	
50	500	
96	512	
100	540**	
110**	720***	
120**	900***	
192	1000	
200	1016**	
250	1024	
256	1250***	
360		

Shaft Diameter: Code	Size
079	2mm
118	3mm
125	1/8"
156	5/32"
157	4mm
187	3/16"
197	5mm
237	6mm
250	1/4"
312	5/16"
315	8mm
375	3/8"
394	10mm

Options: (specify in order shown)
I = Index (3rd channel)
E = Adds a cylindrical extension to the cover allowing for longer shafts.
H = Adds hole in cover to allow shaft to pass through.
A = Adds self-aligning shoulder to base.
3 = Changes diameter of all five base mounting holes to .125".
A3 = Adds self-aligning shoulder to base and changes diameter of all five base mounting holes up to .125".
G = Adds 1.812 mounting "ears" to base.
R = Adds 3-slot adapter to bottom of base.
T = Adds transfer adhesive to base.****

Packaging Options:
(default) = Encoder components packaged in bulk. One spacer tool and one hex driver per 100 encoders.
PKG1 = Each encoder packaged individually. One spacer tool and one hex driver per 100 encoders.
PKG2 = Each encoder packaged individually with one spacer tool and one hex wrench per encoder.
PKG3 = Each encoder packaged individually with one spacer tool, one hex wrench, and one centering tool per encoder.

Important: When a centering tool is needed it may be most cost effective to use the default packaging option and to order a centering tool separately. This is especially true when ordering a single encoder.

Notes:
* Index / resolutions >=1000 CPR.
** Index option not available.
*** 32, 720, 900, 1250 CPR only available with index.
**** A centering tool is highly recommended when using **T**-option.

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