RoHS COMPLIANT

Description

The E5 Series rotary encoder has a molded polycarbonate enclosure with 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 motor shaft to provide digital feedback information.

The E5 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 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 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 150 Ω resistor in series with a .0047 µF 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 E5 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.

Avago Replacements:

US Digital's E5 encoder may now be used as a replacement for Avago HEDL-5500, HEDL-5600.

Features

- Quick, simple assembly and disassembly
- Rugged screw-together housing
- Positive finger-latching connector
- Accepts .010" axial shaft play
- 32 to 5000 cycles per revolution (CPR)
- 128 to 20000 pulses per revolution (PPR)
- 2 channel quadrature TTL squarewave outputs
- Optional index (3rd channel)
- -25 to +100C operating temperature
- Mounting compatibility with HEDS-5500

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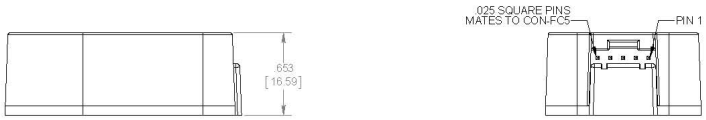
RoHS COMPLIANT

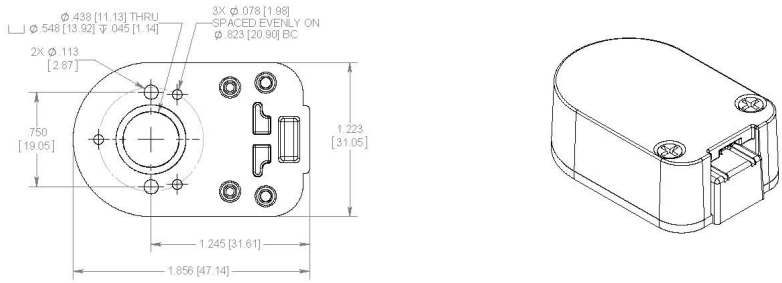
Single-Ended

E5 Single-Ended Optical Kit Encoder



RELEASE DATE: 7/2/2012

DEFAULT BASE & COVER OPTIONS SHOWN



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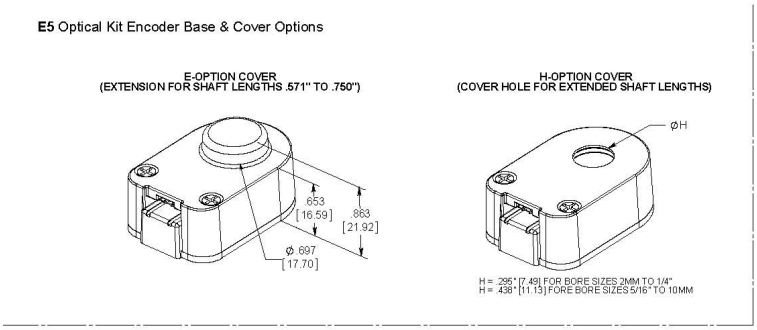
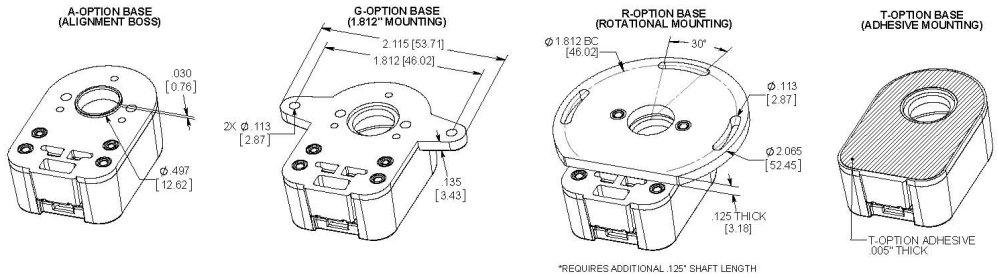
UNITS: INCHES [MM]
METRIC DIMENSIONS FOR REFERENCE ONLY

Base & Cover Options

E5 Optical Kit Encoder Base & Cover Options





*REQUIRES ADDITIONAL .125" SHAFT LENGTH

RELEASE DATE: 7/2/2012

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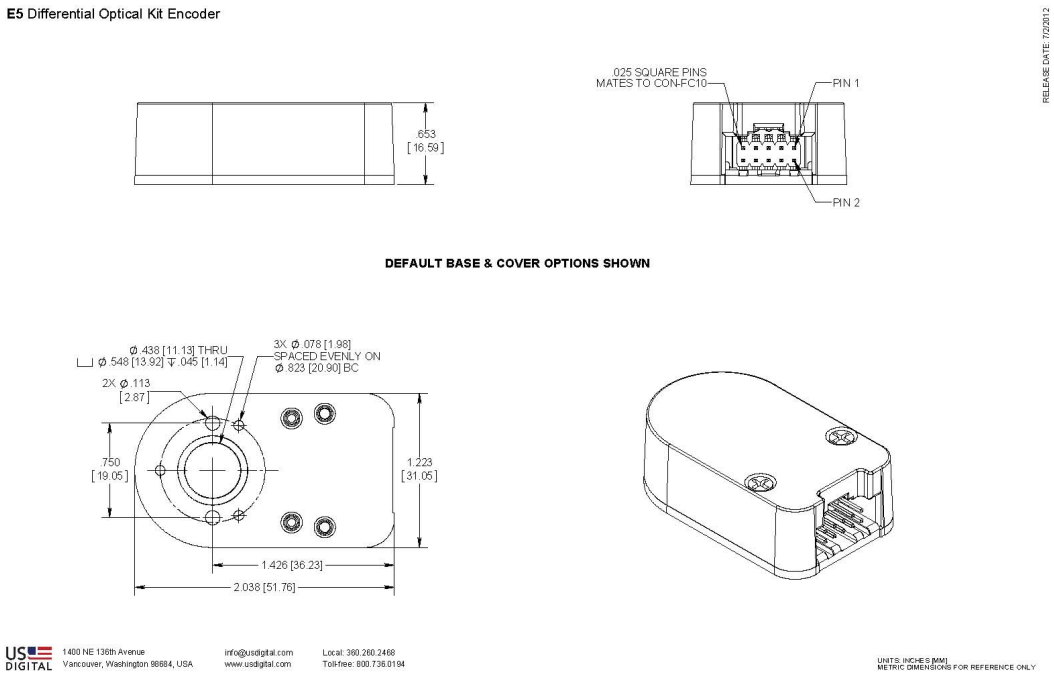
METRIC DIMENSIONS FOR REFERENCE ONLY

Differential



Environmental

Parameter	Value	Units
Operating Temperature, CPR < 2000	-40 to 100	C
Operating Temperature, CPR ≥ 2000	-25 to 100	C
Vibration (5Hz to 2kHz)	20	G
Electrostatic Discharge, Human Body Model	± 4	kV

Mechanical

Parameter	Value	Units
Max. Shaft Axial Play	±0.010	in.
Max. Shaft Eccentricity Plus Radial Play (1)	0.004	in.
Max. Acceleration	250000	rad/sec²
For CPR < 2000 Max. RPM (2) e.x. CPR=1250, max. rpm=14400 e.x. CPR=100, max. rpm=60000	minimum value of ((18 x 10^6) / CPR) and (60000)	rpm

Parameter	Value	Units
For CPR >= 2000 and < 4000 Max. RPM (2)	minimum value of ((21.6 x 10^6) / CPR) and (60000)	rpm
For CPR >= 4000 Max. RPM (2)	minimum value of ((43.2 x 10^6) / CPR) and (60000)	rpm
Typical Product Weight Single-ended (**S**-option) Differential (**D**-option, **L**-option)	 0.82 0.91	oz.
Codewheel Moment of Inertia	8.0 x 10^-6	oz-in-s²
Hub Set Screw	#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	0.823 ± 0.005	in.
2 Screw Bolt Circle Diameter	0.750 ± 0.005	in.
Required Shaft Length (3) With**E**-option (3) With**H**-option (3)	0.445 to 0.570 0.445 to 0.750 > 0.445	in.
Index alignment to hub set screw	180 ± 5	mechanical degrees
Technical Bulletin TB1001 - Shaft and Bore Tolerances		Download

(1) Position inaccuracy is proportional to shaft radial play.

(2) 60000 rpm is the maximum rpm due to mechanical considerations. The maximum rpm due to the module's 300kHz maximum count frequency is (18 x 10^6) / CPR.

(3) Add 0.125" to the required shaft length when using**R**-option.

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
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 (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 Vcc = 5.0Vdc and 25 ° C.
- For complete details, see the EM1 or EM2 product pages.

Parameter	Min.	Typ.	Max.	Units	Conditions
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		27	33	mA	CPR < 500, no load
		54	62	mA	CPR ≥ 500 and <2000, no load
		72	85	mA	CPR ≥ 2000, no load
Low-level Output			0.5	V	I_{OL} = 8mA max., CPR < 2000
			0.5	V	I_{OL} = 5mA max., CPR ≥ 2000
		0.25		V	no load, CPR ≥ 2000
High-level Output	2.0			V	I_{OH} = -8mA max. and CPR < 2000
	2.0			V	I_{OH} = -5mA max. and CPR ≥ 2000
		4.8		V	no load and CPR < 2000
		3.5		V	no load and CPR ≥ 2000
Output Current Per Channel	-8		8	mA	CPR < 2000
	-5		5	mA	CPR ≥ 2000
Output Rise Time		110		nS	CPR < 2000
		50		nS	CPR ≥ 2000, ± 5mA load
Output Fall Time		100		nS	CPR < 2000
		50		nS	CPR ≥ 2000, ± 5mA load

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 product page.

Parameter	Min.	Typ.	Max.	Units	Conditions
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		29	36	mA	CPR < 500, no load
		57	65	mA	CPR ≥ 500 and < 2000, no load
		73	88	mA	CPR ≥ 2000, 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 (2,3)	
Pin	Description	Pin	Description	Pin	Description
1	Ground	1	Ground	1	No Connection
2	Index	2	Ground	2	+5VDC power
3	A channel	3	Index-	3	Ground
4	+5VDC power	4	Index+	4	No connection
5	B channel	5	A- channel	5	A- channel
		6	A+ channel	6	A+ channel
		7	+5VDC power	7	B- channel
		8	+5VDC power	8	B+ channel
		9	B- channel	9	Index-
		10	B+ channel	10	Index+

(1) 5-pin single ended mating connector is CON-FC5.
(2) 10-pin differential mating connector is CON-FC10.
(3) Avago / Agilent / HP compatible version.

Options

Index

Provides a single pulse per revolution.

3-option

The **3**-option makes all five of these hole diameters .125". The .438" diameter center hole can also mate with a motor boss.

View option:

- Single-ended Version

- Differential Version

A-option

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

View option:

- Single-ended Version

- Differential Version

E-option

The **E**-option provides a cylindrical extention to the cover allowing for longer shafts of up to .750".

View option:

- Single-ended Version

- Differential Version

G-option

This option includes molded ears on the **E5** 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 **E5** 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".

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 1/4", a .295" diameter hole is supplied.
- Shafts 5/16" to 10mm, a .438" diameter hole is supplied.

View option:

- Single-ended Version

- Differential Version

L-option

Provides Avago / Agilent / HP compatible pin-out.

Please note: Only available for **E5D** and **E5MD** (differential versions).

R-option

This adapter is an 1/8" thick fiberglass adapter which is pre-mounted to the base of the encoder. It allows the **E5** 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. **Please note:** Only available in polycarbonate versions (**E5D** and **E5S**).

View option:

- Single-ended Version

- Differential Version

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. **Please note**: Only available in polycarbonate versions (**E5D** and **E5S**).

- 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 **E5** 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

Hex driver, 0.050" 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-4218

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, Cross Drive #0-80 UNF x 1/4"
Quantity Required for Mounting: 3 per encoder

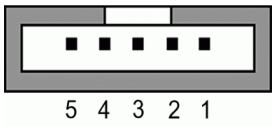
Part #: SCREW-256-250-PH
Description: Pan Head, Cross Drive #2-56 UNC x 1/4"
Quantity Required for Mounting: 2 per encoder

Part #: SCREW-440-250-PH
Description: Pan Head, Cross Drive #4-40 UNC x 1/4"
Quantity Required for Mounting: 2 per encoder

Wiring Diagram

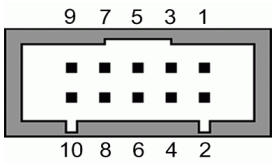
Single Ended

Pin	Function
1	Ground
2	Index
3	A
4	+5 VDC
5	B



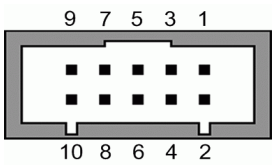
Differential

Pin	Function
1	Ground
2	Ground
3	Index-
4	Index
5	A-
6	A
7	+5 VDC
8	+5 VDC
9	B-
10	B

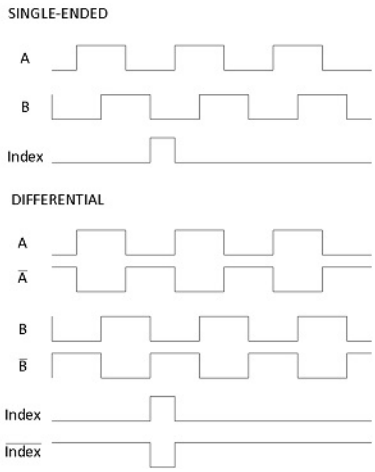


Differential (L-Option)

Pin	Function
1	N/C
2	+5 VDC
3	Ground
4	N/C
5	A-
6	A
7	B-
8	B
9	Index-
10	Index



Output Waveforms



Assembly Instructions

E5 Single-Ended Assembly Instructions - http://usdigital.com/assets/assembly/E5S%20Assembly_Instructions.pdf
E5 Differential Assembly Instructions - http://usdigital.com/assets/assembly/E5D%20Assembly_Instructions.pdf

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Ordering Information

E5 - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - [ ]

CPR	Bore	Index	Output	Cover	Base	Packaging
32 =	079 = *2mm*	NE = *No Index*	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 units and above one spacer tool and one hex driver per 100 encoders.*
50 =	118 = *3mm*	IE = *Index*	D =*Differential*	E =*Cover Extension*	3 =*Base Mounting Holes become .125"*	1 =*Encoders Individually packaged. One spacer tool and one hex wrench for orders up to 9 units, for orders of 10 units and above one spacer tool and one hex driver per 100 encoders.*
96 =	125 = *1/8"*		L =*Avago/Agilent compatible pin-out*	H =*Hole in Cover*	A =*Adds self-aligning shoulder to base*	2 =*Encoders packaged individually with one spacer tool and one hex wrench per encoder.*
100 =	156 = *5/32"*				G =*Adds 1.812 mounting "ears" to base*	3 =*Encoders packaged individually with one spacer tool, one hex wrench, and one centering tool per encoder.*
192 =	157 = *4mm*				R =*Adds 3-slot adapter to bottom of base*	
200 =	188 = *3/16"*				T =*Transfer Adhesive*	
250 =	197 = *5mm*					
256 =	236 = *6mm*					
360 =	250 = *1/4"*					
400 =	276 = *7mm*					
500 =	313 = *5/16"*					
512 =	315 = *8mm*					
540 =	375 = *3/8"*					
720 =	394 = *10mm*					
900 =						
1000 =						
1024 =						
1250 =						
2000 =						
2048 =						
2500 =						
4000 =						
4096 =						
5000 =						

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.

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Base Pricing

Quantity	Price
1	$74.90
5	$51.50
10	$43.09

For volume discounts, please contact us at sales@usdigital.com or 800.736.0194.

- Add 14% per unit for **CPR** of , , , , or
- Add 29% per unit for **Output** of Differential or Avago/Agilent compatible pin-out
- Add $7.00 per unit for **Base** of Adds 3-slot adapter to bottom of base
- Add $6.00 per unit for **Base** of Transfer Adhesive
- Add $3.00 per unit for **Packaging** of Encoders Individually packaged. One spacer tool and one hex wrench for orders up to 9 units, for orders of 10 units and above one spacer tool and one hex driver per 100 encoders.
- Add $4.00 per unit for **Packaging** of Encoders packaged individually with one spacer tool and one hex wrench per encoder.
- Add $7.00 per unit for **Packaging** of Encoders packaged individually with one spacer tool, one hex wrench, and one centering tool per encoder.
- Add 21% per unit for **Index** of IE or **CPR** greater than or equal to 1000.

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