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Description

The **S5** series optical shaft encoder is a non-contacting rotary to digital converter. Useful for position feedback or manual interface, the encoder converts real-time shaft angle, speed, and direction into TTL-compatible quadrature outputs with or without index. The encoder utilizes an unbreakable mylar disk, metal shaft and bushing, LED light source, and monolithic electronics. It operates from a single +5VDC supply.

Three shaft torque versions are available. The standard torque version has a sleeve bushing lubricated with a viscous motion control gel to provide torque and feel that is ideal for front panel human interface applications.

The no torque added option has a sleeve bushing and a low viscosity lubricant (that does not intentionally add torque) for low RPM applications where a small amount of torque is acceptable.

The ball bearing version uses miniature precision ball bearings that are suitable for high speed and ultra low torque applications.

A secure connection to the **S5** series encoder is made through a 5-pin (single-ended version) or 10-pin (differential version) finger-latching connector (sold separately). The mating connectors are available from US Digital with several cable options and lengths.

For differential version: 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.

Features

- Small size
- Low cost
- Optional differential / line-driver output
- Positive finger-latching connector
- 2-channel quadrature, TTL squarewave outputs
- 3rd channel index option
- Ball bearing option tracks to 10,000 RPM
- -40C to +100C operating temperature
- Single +5VDC supply

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

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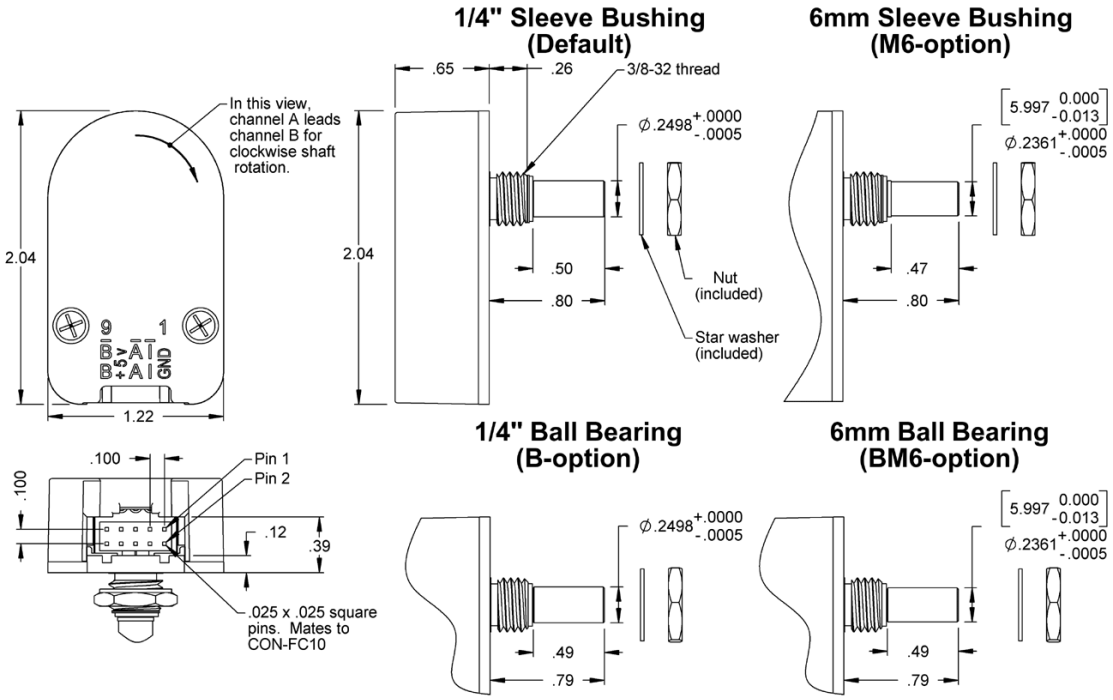
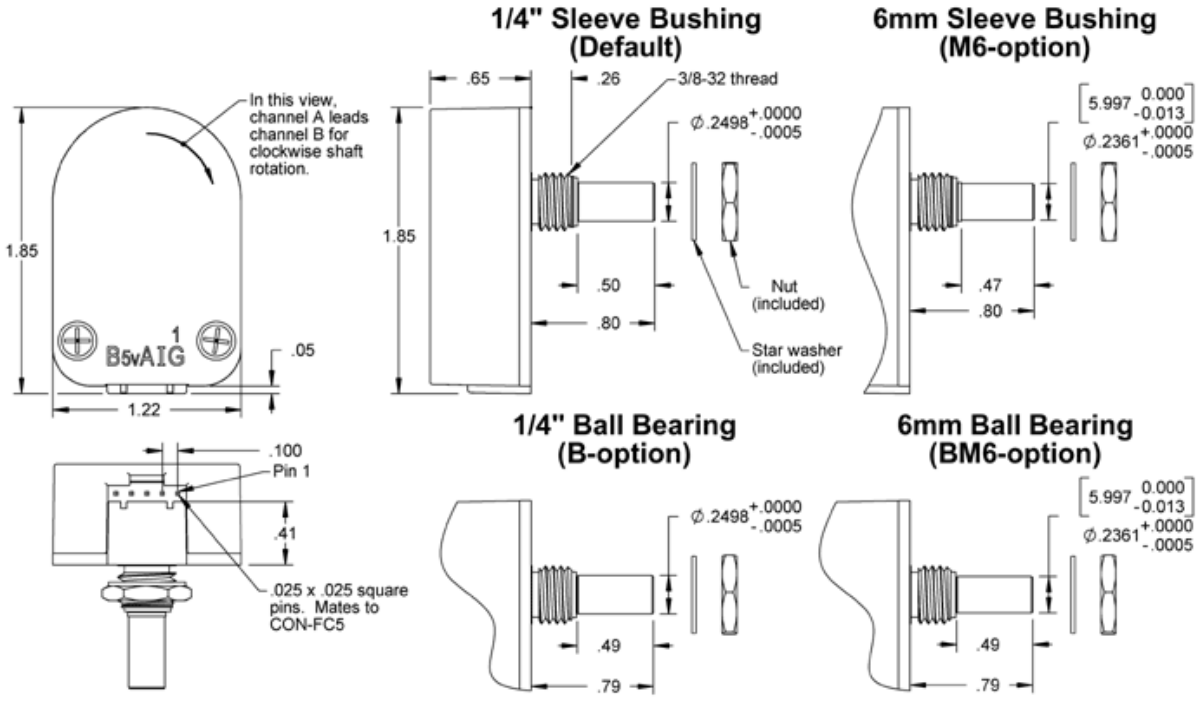
Differential



Single-Ended



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Environmental

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

Mechanical

Parameter	Sleeve Bushing	Ball Bearing
Max. Acceleration	250000 rad/sec²	250000 rad/sec²
Max. Shaft Speed	100 rpm	10000 rpm
Max. Shaft Torque	0.5 ± 0.2 in-oz 0.3 in-oz (**N**-option)	0.05 in-oz
Max. Shaft Loading	2 lbs. dynamic 20 lbs. static	1 lb.
Bearing Life	> 1000000 revolutions	$L10 = (19.3/Fr)^3$ * Where $L10$ = bearing life in millions of revs, and Fr = radial shaft loading in pounds
Weight Single-ended Differential	 1.01 oz. 1.28 oz.	 1.15 oz. 1.42 oz.
Max. Shaft Total Indicated Runout	0.0015 in.	0.0015 in.
Max. Panel Nut Tightening Torque	20 in-lbs	20 in-lbs
Technical Bulletin TB1001 - Shaft and Bore Tolerances		Download

* only valid with negligible axial shaft loading.

Phase Relationship

B leads A for clockwise shaft rotation, and A leads B for counterclockwise rotation viewed from the shaft side of the encoder (*see the EM1 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 product page.

Parameter	Min.	Typ.	Max.	Units	Conditions
Supply Voltage	4.5	5.0	5.5	V	

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Parameter	Min.	Typ.	Max.	Units	Conditions
Supply Current		27	33	mA	CPR < 500, no load
		50	62	mA	CPR ≥ 500, no load
Low-level Output			0.5	V	I_{OL} = 8mA max.
High-level Output	2.0			V	I_{OH} = -8mA max.
	4.2	4.8		V	no load
Output Current Per Channel	-8		8	mA	
Output Rise Time		110		nS	
Output Fall Time		35		nS	

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, 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	

Pin-outs

5-pin Single-ended: (1)

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

10-pin Differential Standard: (2)

Pin	Description
1	Ground

Pin	Description
2	Ground
3	Index-
4	Index+
5	A- channel
6	A+ channel
7	+5VDC power
8	+5VDC power
9	B- channel
10	B+ channel

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

Product Change Notifications

Title	Date	Description	Download
E5 Insert Overmold - PCN 1008	8/23/2011	In an effort to enhance the robustness of our E5 encoder; the four threaded inserts pressed into the base are being replaced with similar threaded nuts that will be insert-molded into the encoder base. This change in process will retain the insert with much greater strength.	Download
E5 Laser Marking - PCN 1009	8/23/2011	The primary purpose for this change is to create a more durable and longer lasting solution compared to the previous stick on label solution. The E5 encoder covers will now have the US Digital logo, part number, lot code, and pin-outs laser marked onto the top surface.	Download
E5 Mold Update - PCN 1007	8/23/2011	The plastic E5 base and covers have been redesigned for improved moldability and aesthetics. Design changes are primarily alteration of surface drafts, additional or increased corner radii and additional coring out of thick regions. This update was carefully done to preserve the size and shape of the encoder. The new parts are dimensionally equivalent and will fit within the envelope of the previous parts. Only the E-option covers and the G-option bases have features with dimensional changes.	Download
EM1 LED Die - PCN 1016	2/7/2013	As part of US Digital?s continual assurance of supply strategy, we have qualified ad ditional sources for our LED die used in our EM1 encoder module, which in turn impacts all of the following products: EM1, E2, E3, E5, E6, H1, H15, H3, H5, H6, HB5M, HB6M, HD25, PE, S1, S2, S5, S6, T5 and T6 The device specification will remain the same, i.e. there will be no change to form, fit or function of the product(s) as specified by US Digital. The appropriate quality and reliability testing has been performed on representative products to ensure normal parametric distribution, consistent with US Digital's quality and reliability standards.	Download

EM1 Component Change Notice	N/A	Unless otherwise specified, the US Digital EM1 optical encoder module will be phased in to replace our previous encoder module, HEDS-9000 Series, supplied by Avago Technologies.	View

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Ordering Information

S5 - [ ] - [ ] - [ ] - [ ] - [ ]

CPR	Shaft	Index	Output	Torque
32 =	236 =*Metric 6mm diameter shaft (static drag).*	NE =*No Index*	S =*Single-ended*	D =*Default*
50 =	250 =*1/4" diameter*	IE =*Index*	D =*Differential*	B =*Ball Bearing*
96 =				N =*No torque added*
100 =				
192 =				
200 =				
250 =				
256 =				
360 =				
400 =				
500 =				
512 =				
540 =				
720 =				
900 =				
1000 =				
1024 =				
1250 =				

Rules

- Index must be equal to NE when CPR is equal to 32

Notes

- Cables and connectors are not included and must be ordered separately.
- For ordering information please see the Compatible Cables / Connectors section above.
- US Digital warrants its products against defects in materials and workmanship for two years. See complete warranty for details.

Base Pricing

Quantity	Price
1	$88.50
5	$65.85
10	$56.87

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

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- Add $1.00 per unit for **Shaft** of Metric 6mm diameter shaft (static drag).
- Add 23% per unit for **Output** of Differential
- Add $5.80 per unit for **Torque** of Ball Bearing
- Add 17% per unit for **Index** of IE or **CPR** greater than or equal to 1000.

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