

S5 Features

- Small size
- 32 to 5,000 CPR (128 to 20,000 PPR)
- Optional differential/line-driver output
- Positive latching connector
- 2-channel quadrature, TTL squarewave outputs
- 3rd channel index option
- Ball-bearing option tracks to 10,000 RPM
- Wide operating temperature
- Single +5VDC supply



S5 Product 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. It operates from a single +5VDC supply.



Three shaft torque versions are available. The *standard torque* version has a sleeve bushing designed to provide torque and feel ideal for front panel human interface applications.

The *no torque added* option has a sleeve bushing 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) latching connector (sold separately). The mating connectors are available from US Digital with several cable options and lengths.

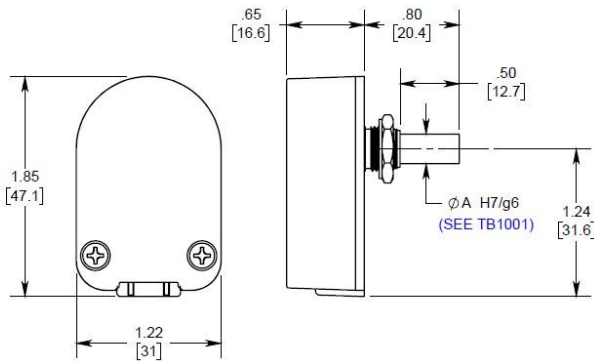
The internal differential line driver (26C31) can source and sink 20mA at TTL levels for differential versions. The recommended receiver is the industry-standard 26C32. Maximum noise immunity is achieved when the differential receiver is terminated with a 150 Ω resistor in series with a .0047 μ F capacitor placed across each differential pair. The capacitor conserves power; otherwise, power consumption would increase by approximately 20mA per pair or 60mA for 3 pairs.

Mechanical Drawings

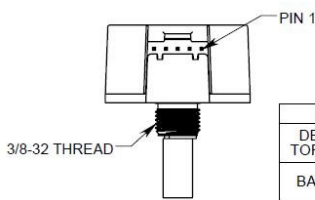
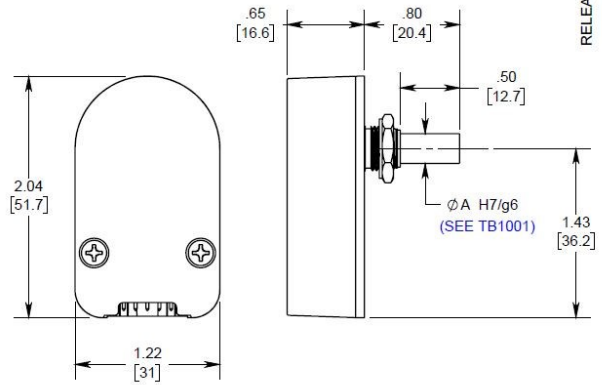
S5 Optical Shaft Encoder

RELEASE DATE: 03/19/2018

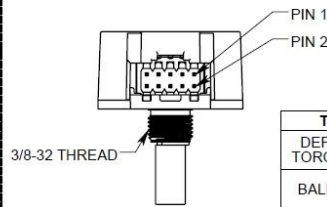
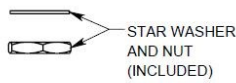
SINGLE-ENDED OUTPUT VERSION
(5 PIN)



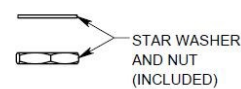
DIFFERENTIAL OUTPUT VERSION
(10 PIN)



TORQUE	SHAFT ϕ	A
DEFAULT / NO TORQUE ADDED	6mm (.236)	2362 [6]
	1/4" (.250)	2500 [6.35]
BALL BEARING	6mm (.236)	2362 [6]
	1/4" (.250)	2500 [6.35]



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Specifications

ENVIRONMENTAL

PARAMETER	VALUE	UNITS
Operating Temperature, CPR < 2000	-40 to 100	C
Operating Temperature, CPR \geq 2000	-25 to 100	C
Vibration (5Hz to 2kHz)	20	G
Electrostatic Discharge		
Single-ended (-S version), IEC 61000-4-2	± 4	
Differential (-D version), Human Body Model	± 2	



MECHANICAL

PARAMETER	SLEEVE BUSHING	BALL BEARING
Max. Acceleration	250000 rad/sec ²	250000 rad/sec ²
Max. Shaft Speed (mechanical)	100 rpm (1)	10000 rpm (1)
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	$L_{10} = (19.3/F_r)^3$ * Where L_{10} = bearing life in millions of revs, and F_r = radial shaft loading in pounds
Weight		
Single-ended	1.01 oz.	1.15 oz.
Differential	1.28 oz.	1.42 oz.
Max. Shaft Runout	0.0015 in. T.I.R.	0.0015 in. T.I.R.
Max. Panel Nut Tightening Torque	20 in-lbs	20 in-lbs
Technical Bulletin TB1001 - Shaft and Bore Tolerances		Download (https://www.usdigital.com/support/resources/reference/technical-docs/technical-bulletins/shaft-and-bore-tolerances-tb1001/)

* Only valid with negligible axial shaft loading.

(1) The maximum speed due to electrical considerations is dependent on the CPR. See the EM1

(<https://www.usdigital.com/products/encoders/incremental/modules/em1/>) and EM2 (<https://www.usdigital.com/products/encoders/incremental/modules/em2/>) product pages.

PHASE RELATIONSHIP

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



SINGLE-ENDED ELECTRICAL

- Specifications apply over the entire operating temperature range.
- Typical values are specified at $V_{cc} = 5.0V_{dc}$ and $25^{\circ}C$.
- For complete details, see the EM1 (<https://www.usdigital.com/products/encoders/incremental/modules/em1/>) or EM2 (<https://www.usdigital.com/products/encoders/incremental/modules/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 \geq 500 and < 2000, no load
		72	85	mA	CPR \geq 2000, no load
Low-level Output			0.5	V	$I_{OL} = 8mA$ max., CPR < 2000
			0.5	V	$I_{OL} = 5mA$ max., CPR \geq 2000
		0.25		V	no load, CPR \geq 2000
High-level Output	2.0			V	$I_{OH} = -8mA$ max. and CPR < 2000
	2.0			V	$I_{OH} = -5mA$ max. and CPR \geq 2000
		4.8		V	no load and CPR < 2000
		3.5		V	no load and CPR \geq 2000
Output Current Per Channel	-8		8	mA	CPR < 2000
	-5		5	mA	CPR \geq 2000
Output Rise Time		110		nS	CPR < 2000
		50		nS	CPR \geq 2000, $\pm 5mA$ load
Output Fall Time		100		nS	CPR < 2000
		50		nS	CPR \geq 2000, $\pm 5mA$ load



DIFFERENTIAL ELECTRICAL

- Specifications apply over the entire operating temperature range.
- Typical values are specified at $V_{CC} = 5.0V_{DC}$ and $25^{\circ}C$.
- For complete details, see the EM1 (<https://www.usdigital.com/products/encoders/incremental/modules/em1/>) and EM2 (<https://www.usdigital.com/products/encoders/incremental/modules/em2/>) product pages.

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		29	36	mA	CPR < 500, no load
		56	65	mA	CPR \geq 500 and < 2000, no load
		74	88	mA	CPR \geq 2000, 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
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 is CON-FC5 (<https://www.usdigital.com/products/accessories/connectors/con-fc5/>).

(2) 10-pin differential mating connector is CON-FC10 (<https://www.usdigital.com/products/accessories/connectors/con-fc10/>).



PRODUCT CHANGE NOTIFICATIONS

Title	Date	Description	Download
EM1 & EM2 Update - PCN 4199	1/14/2014	Based on our continuous process improvement program, US Digital is changing the current marking method for our EM1 and EM2 encoder modules to a serialization method. This change will allow for each module to have a unique code; the current marking method is based on a date code system that includes all encoder modules produced within a specific week / year. The serialization system will be based on a hexadecimal system.	Download (https://www.usdigital.com/support/resources/product-change-notifications/pcn-4199-em1-em2-update/)
EM1 LED Die - PCN 1016	2/7/2013	<p>As part of US Digital's continual assurance of supply strategy, we have qualified additional sources for our LED die used in our EM1 encoder module, which in turn impacts all of the following products:</p> <p>EM1, E2, E3, E5, E6, H1, H15, H3, H5, H6, HB5M, HB6M, HD25, PE, S1, S2, S5, S6, T5 and T6</p> <p>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.</p>	Download (https://www.usdigital.com/support/resources/product-change-notifications/pcn-1016-em1-led-die/)

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 (<https://www.usdigital.com/company/warranty>) for details.