

S5 Features

- Shafted rotary encoder
- 25 Resolutions from 32-5,000 CPR (128-20,000 PPR)
- Two shaft sizes: 6 mm, 1/4 in.
- Three torque options
- Optional Index channel, Differential, and High-Voltage outputs
- Secure latching connector/cable (sold separately)



US Digital S5 Rotary Shaft Encoder Description

The S5 rotary shaft encoder converts shaft position or speed into a quadrature output signal. This rotary encoder delivers up to 20,000 PPR resolution in a glass-filled polymer housing. Available in two shaft sizes: 6 mm, 1/4 in.



US Digital offers three different torque options for various uses:

- Default (-D): sleeve bushing with higher damping for human interface applications.
- Ball bearing (-B): miniature precision ball bearings suitable for high-speed applications.
- Light static drag (-N): sleeve bushing with lower damping for low-speed applications.

This optical rotary encoder features three output options: single-ended, single-ended High-Voltage, and differential. For differential versions, the internal line driver (26C31) can source and sink 20mA at TTL levels. The recommended receiver is the industry-standard 26C32.

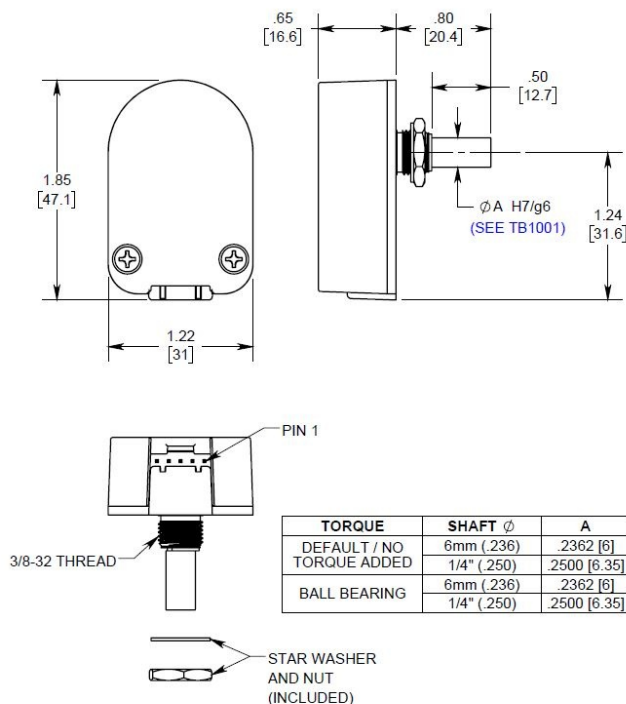
The S5 incremental encoder is designed for use with a secure latching connector. After you make your selections in the Product Configurator, compatible cables and connectors will be displayed below and must be ordered separately.

Mechanical Drawings

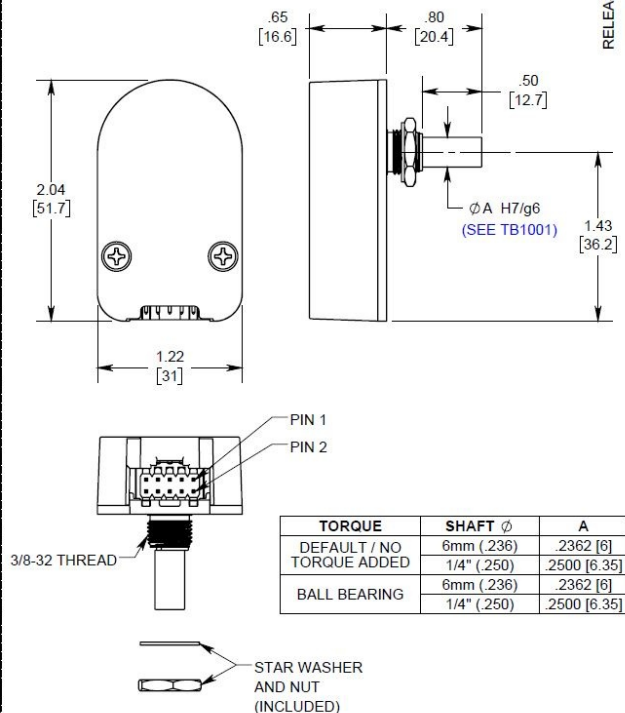
S5 Optical Shaft Encoder

RELEASE DATE: 03/19/2018

SINGLE-ENDED OUTPUT VERSION
(5 PIN)



DIFFERENTIAL OUTPUT VERSION
(10 PIN)



Specifications

ENVIRONMENTAL

Parameter	Value	Units
Operating Temperature, CPR < 2000	-40 to 100	C
Operating Temperature, CPR ≥ 2000	-25 to 100	C
Electrostatic Discharge		kV
Single-ended (S option), IEC 61000-4-2	± 4	
Differential (D, L option), Human Body Model	± 2	
High-Voltage, Open-collector (H, C option), IEC 61000-4-2	± 4	
Vibration (10Hz to 2kHz, sinusoidal)	20	G
Shock (6 milliseconds, half-sine)	75	G

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 in-oz (D-option) 0.3 in-oz (N-option)	0.05 in-oz (B-option)
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 (S option)	1.01 oz.	1.15 oz.
Differential (D option)	1.28 oz.	1.42 oz.
High-Voltage, Open-Collector (H, C option)	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/components/modules/em1/>) and EM2 (<https://www.usdigital.com/products/encoders/incremental/components/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 OPTION

- S option provides 5V TTL compatible outputs
- 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/components/modules/em1/>) or EM2 (<https://www.usdigital.com/products/encoders/incremental/components/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 OPTION

- D Option provides differential line driver outputs
- 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/components/modules/em1/>) and EM2 (<https://www.usdigital.com/products/encoders/incremental/components/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	

HIGH-VOLTAGE OPTION

- H option uses a higher supply voltage and provides both single-ended and open-collector outputs
- Single-ended outputs are 5V TTL compatible (same as S option). See Pin-out.
- Specifications apply over the entire operating temperature range
- For complete details, see the EM1 (<https://www.usdigital.com/products/encoders/incremental/components/modules/em1/>) or EM2 (<https://www.usdigital.com/products/encoders/incremental/components/modules/em2/>) product pages

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Supply Voltage	7.5		30.0	V	
Supply Current, 24V power	8	10	mA		CPR < 500, no load
	16	19	mA		CPR $\geq$ 500 and < 2000, no load
	22	25	mA		CPR $\geq$ 2000, no load
Open Collector "On" Resistance	2			ohms	
Open Collector Sink Current			200	mA	
Output Low Voltage		0.4	V		200 mA sink current
Open Collector Pullup Voltage		50	V		

PIN-OUTS

5-PIN SINGLE-ENDED S OPTION (1)		10-PIN DIFFERENTIAL D OPTION (2)	
Pin	Description	Pin	Description
1	Ground	1	Ground
2	Index	2	Ground
3	A channel	3	Index-
4	+5VDC power	4	Index+
5	B channel	5	A- channel
		6	A+ channel
		7	+5VDC power
		8	+5VDC power
		9	B- channel
		10	B+ channel

10-PIN HIGH-VOLTAGE H OPTION (2)	
Pin	Description
1	Ground
2	Ground
3	Index- (open collector)
4	Index+ (single-ended)
5	A- channel (open collector)
6	A+ channel (single-ended)
7	7.5-30V power
8	7.5-30V power
9	B- channel (open collector)
10	B+ channel (single-ended)

| S5 Rotary Shaft Encoder

- (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/>).

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.

Configuration Options

S5	CPR (Cycles Per Revolution)	Shaft Diameter	Index	Output	Torque
			IE (Index)	S (Single-Ended)	D (Default Torque)
	32	236 (6mm)	NE (Non-Index)	H (Single-Ended High-Voltage)	B (Ball Bearing)
	50	250 (1/4")		D (Differential)	N (Light Static Drag)
	96				
	100				
	192				
	200				
	250				
	256				
	360				
	400				
	500				
	512				
	540				
	720				
	800				
	900				
	1000				
	1024				
	1250				
	2000				
	2048				
	2500				
	4000				
	4096				
	5000				

PLEASE NOTE: This chart is for informational use only. Certain product configuration combinations are not available. Visit the S5 product page (<https://www.usdigital.com/products/S5>) for pricing and additional information.

