S4 Features

- Miniature size
- Low High retention snap-in polarized connector
- Tracks from 0 to 30,000 cycles/sec
- Ball-bearing option tracks up to 10,000 RPM
- Wide operating temperatures
- 100 to 360 cycles per revolution (CPR)
- 400 to 1,440 pulses per revolution (PPR)
- 2 channel quadrature TTL squarewave outputs

The S4 is no longer available for purchase.

The S4 is no longer available for purchase, and has been replaced by our recently released S4T *(/products/encoders/incremental/shaft/s4t/)*. The S4T is a redesigned, enhanced version of the S4, and is already available for purchase.

S4 Product Description

The S4 miniature 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 without index. The encoder utilizes a mylar disk, metal shaft, and bushing or bearing. It operates from a single +5VDC supply.

The S4 encoder is available with ball bearings for motion control applications or static drag to feel like a potentiometer for the front-panel manual interface.

The reflective sensor incorporates an LED light source and a monolithic photodetector with signal shaping electronics, providing two-channel bounceless quadrature TTL outputs.
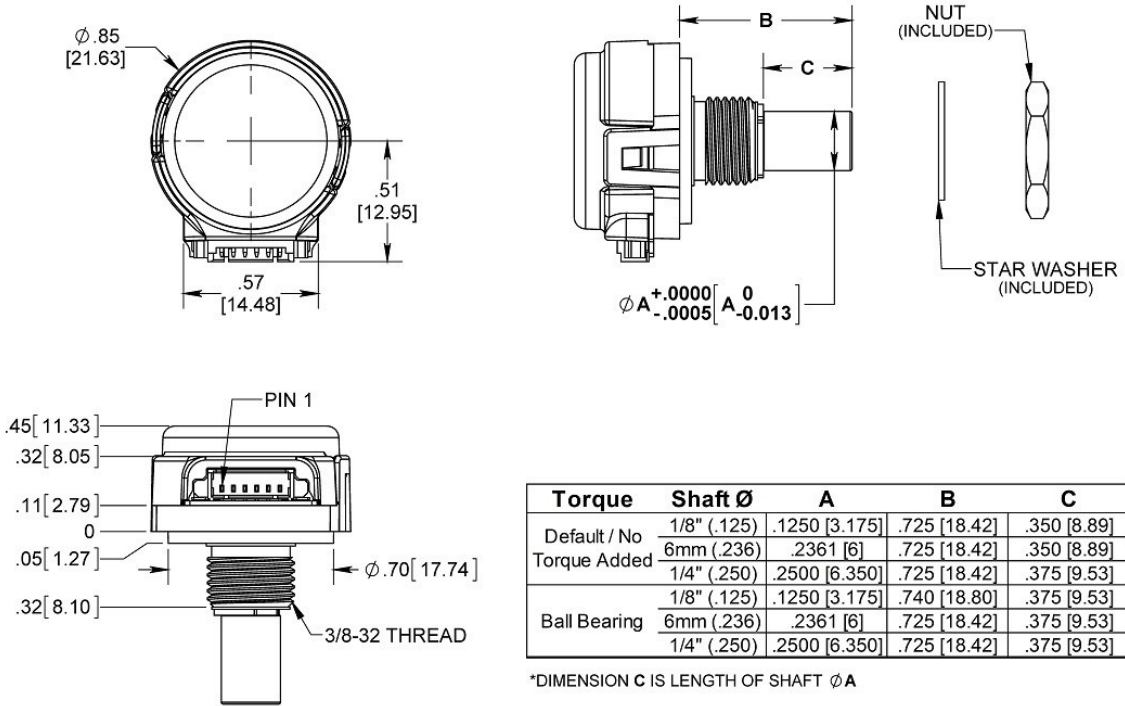
You can connect the S4 by using a high retention 4 conductor snap-in polarized 1.25mm pitch connector. The mating connector is polarized and should attach smoothly to the encoder; do not force. See below for Cables & Connectors.

Please note: On January 16, 2012, US Digital modified the S4 part number. The S4 optical encoder is now offered with a differential output option; thus, we changed the S4 part number to accommodate either the *single-ended* or *differential* output options. The S4 part number also has a place holder added for a possible future index option. The index option is currently unavailable, and there is no projected date at which it will be made available. We also removed the current "Power" option for the S4 from the part number. The power option is very rarely selected and therefore is being eliminated from the S4 part number.

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Page: 1 of 5
11/13/2024 58708
S4

Mechanical Drawings

S4 Differential Miniature Optical Shaft Encoder

RELEASE DATE: 12/09/2011

Torque	Shaft Ø	A	B	C
Default / No Torque Added	1/8" (.125)	.1250 [3.175]	.725 [18.42]	.350 [8.89]
	6mm (.236)	.2361 [6]	.725 [18.42]	.350 [8.89]
	1/4" (.250)	.2500 [6.350]	.725 [18.42]	.375 [9.53]
Ball Bearing	1/8" (.125)	.1250 [3.175]	.740 [18.80]	.375 [9.53]
	6mm (.236)	.2361 [6]	.725 [18.42]	.375 [9.53]
	1/4" (.250)	.2500 [6.350]	.725 [18.42]	.375 [9.53]

*DIMENSION **C** IS LENGTH OF SHAFT Ø**A**

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UNITS: INCHES [MM]
METRIC SHOWN FOR REFERENCE ONLY

Specifications

ENVIRONMENTAL

PARAMETER	VALUE	UNITS
Vibration (5Hz to 2kHz)	20	G
Operating Temperature	-20 to 100	C
Electrostatic Discharge, IEC 61000-4-2 Single-ended (**S**-option) Differential (**D**-option)	± 3 ± 15	kV

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Page: 2 of 5
11/13/2024 58708
S4

MECHANICAL

SPECIFICATION	SLEEVE BUSHING	BALL BEARING
Max. Acceleration	10000 rad/sec²	250000 rad/sec²
Max. Shaft Speed	100 rpm	15000 rpm
Max. Shaft Torque	0.5 ±0.2 in-oz (**D**-option) 0.3 in-oz (**N**-option)	0.05 in-oz
Max. Shaft Loading	2 lbs. dynamic 20 lbs. static	1 lb.
Bearing Life	> 1,000,000 revolutions	$L_{10} = (22/F_r)^3$ * Where L_{10} = bearing life in millions of revs, and F_r = radial shaft loading in pounds
Weight	0.46 oz.	0.42 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 *(https://www.usdigital.com/support/resources/reference/technical-docs/technical-bulletins/shaft-and-bore-tolerances-tb1001/)*	

* only valid with negligible axial shaft loading.

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Page: 3 of 5
11/13/2024 58708
S4

PHASE RELATIONSHIP
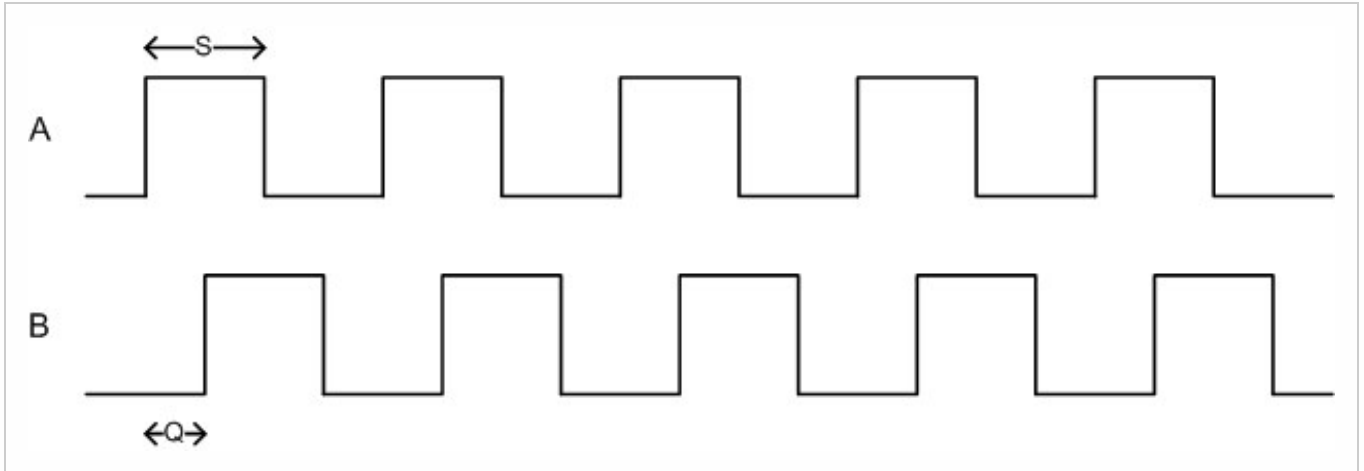
PARAMETER	TYP.	MAX.	UNITS
Symmetry, S	180 ± 16	180 ± 75	electrical degrees
Quadrature Delay, Q	90 ± 10	90 ± 60	electrical degrees

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

(2) Typical values represent the encoder performance at typical mounting alignment, whereas the maximum values represent the encoder performance across the range of recommended mounting tolerance.

SINGLE-ENDED ELECTRICAL

SPECIFICATIONS	MIN.	TYP.	MAX.	UNITS	NOTES
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		21	27	mA	no load
Low-level Output			0.4	V	I_{OL} = 6 mA
High-level Output	2.4			V	I_{OH} = -1 mA
Rise Time		500		ns	CL = 25 pF, RL = 2.7 kΩ
Fall Time		100		ns	

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Page: 4 of 5
11/13/2024 58708
S4

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DIFFERENTIAL ELECTRICAL

SPECIFICATIONS	MIN.	TYP.	MAX.	UNITS	NOTES
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		23	29	mA	no load
Differential Output Voltage	3.0	3.8		V	RL = 100 ohm
Differential Output Rise/Fall Time			20	ns	

PIN-OUT

4-PIN SINGLE-ENDED (1)		6-PIN DIFFERENTIAL (2)	
Pin	**Description**	**Pin**	**Description**
1	+5VDC power	1	Ground
2	A channel	2	A channel
3	Ground	3	A- channel
4	B channel	4	+5VDC power
		5	B channel
		6	B- channel

(1) 4-pin single-ended mating connector is CON-MIC4 *(https://www.usdigital.com/products/CON-MIC4)*

(2) 6-pin differential mating connector is CON-MIC6 *(https://www.usdigital.com/products/CON-MIC6)*

Notes

- 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

S4

PLEASE NOTE: This chart is for informational use only. Certain product configuration combinations are not available. Visit the S4 product page *(https://www.usdigital.com/products/S4)* for pricing and additional information.

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Page: 5 of 5
11/13/2024 58708
S4

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