

## Description

On January 16, 2012, the S4 part number was modified. The S4 optical encoder is now offered with a differential output option; as a result, the S4 part number was changed 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 not available and there is not a projected date at which it will be made available. The current "Power" option for the S4 was also removed from the part number. The power option is very rarely selected and therefore is being eliminated from the S4 part number.

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 front-panel manual interface.

The reflective sensor incorporates an LED light source and a monolithic photo detector with signal shaping electronics, providing two channel bounceless quadrature TTL outputs.

The S4 can be connected 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.

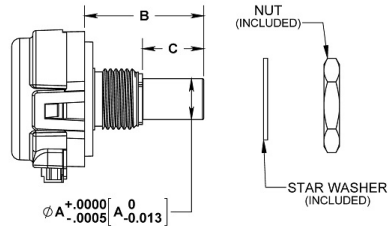
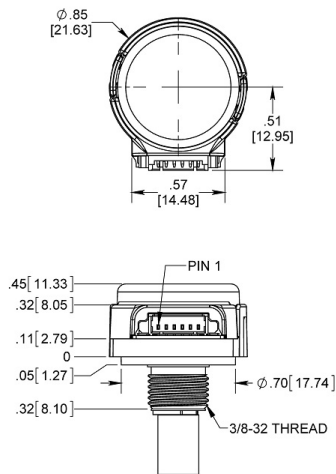


## Features

- Miniature size
- Low cost
- High retention snap-in polarized connector
- Tracks from 0 to 30,000 cycles/sec
- Ball bearing option tracks up to 7,000 or 15,000 RPM
- -20 to +100C operating temperature
- 100 to 360 cycles per revolution (CPR)
- 400 to 1440 pulses per revolution (PPR)
- 2 channel quadrature TTL squarewave outputs

## S4 Differential

### S4 Differential Miniature Optical Shaft Encoder



Torque	Shaft $\phi$	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]
	1/8" (.125)	.1250 [3.175]	.740 [18.80]	.375 [9.53]
Ball Bearing	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  $\phi A$

RELEASE DATE: 12/09/2011



1400 NE 136th Avenue  
Vancouver, Washington 98684, USA

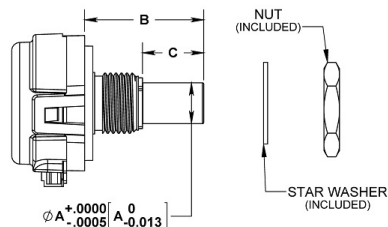
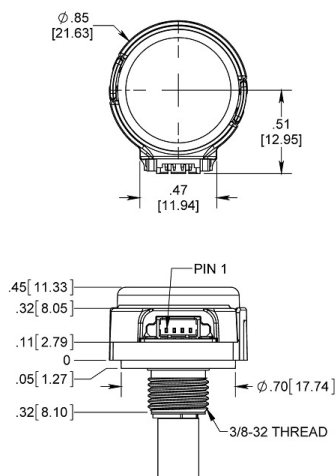
info@usdigital.com  
www.usdigital.com

Local: 360.260.2468  
Toll-free: 800.736.0194

UNITS: INCHES (MM)  
METRIC SHOWN FOR REFERENCE ONLY

## S4 Single Ended

### S4 Single-Ended Miniature Optical Shaft Encoder



Torque	Shaft $\phi$	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]
	1/8" (.125)	.1250 [3.175]	.740 [18.80]	.375 [9.53]
Ball Bearing	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  $\phi A$

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## Environmental

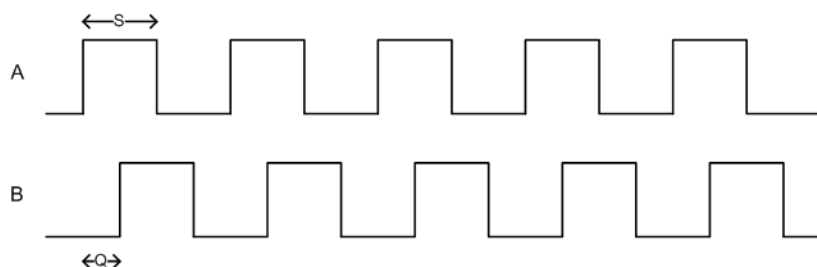
Parameter	Value	Units
Vibration (5Hz to 2kHz)	20	G
Max. Relative Humidity	90	%
Storage Temperature	-40 to 100	C
Operating Temperature	-20 to 100	C
Electrostatic Discharge, Human Body Model		
Single-ended ( <b>S</b> -option)	± 3	kV
Differential ( <b>D</b> -option)	± 15	

## Mechanical

Specification	Sleeve Bushing	Ball Bearing
Max. Acceleration	10000 rad/sec <sup>2</sup>	250000 rad/sec <sup>2</sup>
Max. Shaft Speed	100 rpm	15000 rpm
Max. Shaft Torque	0.5 ±0.2 in-oz ( <b>D</b> -option) 0.3 in-oz ( <b>N</b> -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		<a href="#">Download</a>

\* only valid with negligible axial shaft loading.

## Phase Relationship



Parameter	Typ.	Max.	Units
Symmetry, S	$180 \pm 16$	$180 \pm 75$	electrical degrees
Quadrature Delay, Q	$90 \pm 10$	$90 \pm 60$	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	IOL = 6 mA
High-level Output	2.4			V	IOH = -1 mA
Rise Time		500		ns	CL = 25 pF, RL = 2.7 k $\Omega$
Fall Time		100		ns	

## 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  
 (2) 6-pin differential mating connector is CON-MIC6

## Ordering Information

S4 -		-		-		-		-	
	<b>CPR</b>		<b>Shaft</b>		<b>Index</b>		<b>Output</b>		<b>Torque</b>
	100 =		125 = 1/8"		N = No Index		S = Single Ended		D = Default
	108 =		236 = Metric 6mm diameter shaft				D = Differential		B = Ball Bearing
	120 =		250 = 1/4"						N = Light Static Drag
	125 =								
	128 =								
	200 =								
	250 =								
	256 =								
	300 =								
	360 =								

## 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 for details.