

## Description

The S4T miniature optical shaft encoder is a non-contacting rotary to digital converter. The S4T contains an LED light source, monolithic photo detector and mylar disk. The S4T encoder is available with a shaft bushing or ball bearings for motion control applications, or with shaft torque designed to feel like a potentiometer for front-panel manual interfaces. The encoder converts real-time shaft angle, speed, and direction into TTL-compatible quadrature outputs without index. It operates from a single +5VDC supply.

The S4T uses a high retention, 4 conductor snap-in polarized 1.25mm pitch connector. Mating cables and connectors (See the Cables / Connectors web page) are not included, and are available separately.



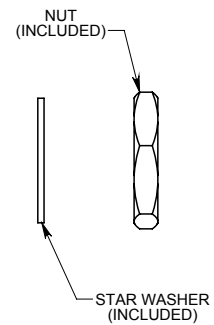
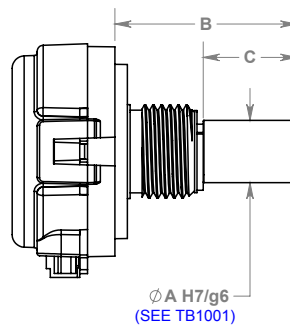
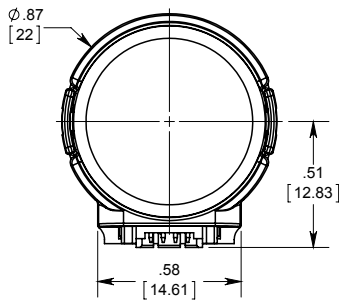
## Features

- Small size
- Low cost
- High retention snap-in polarized connector
- -20C to 100C operating temperature
- 100 to 1000 cycles per revolution (CPR)
- 400 to 4000 pulses per revolution (PPR)
- 2 channel quadrature TTL square wave outputs

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 **Mechanical Drawing**

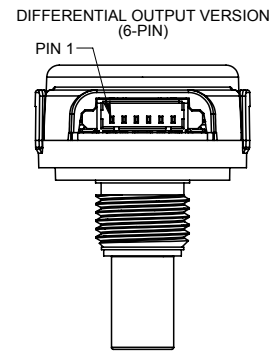
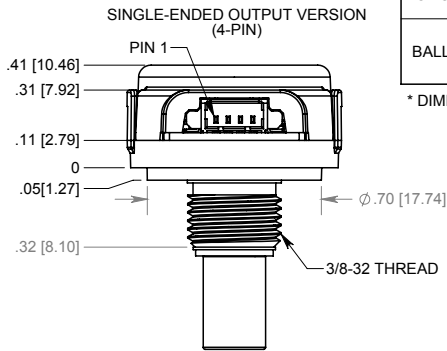
**S4T Miniature Optical Shaft Encoder**



RELEASE DATE: 01/20/2015

TORQUE	SHAFT $\phi$	A	B	C
DEFAULT / NO TORQUE ADDED	1/8" (.125)	.1250 [3.175]	.730 [18.54]	.350 [8.89]
	6mm (.236)	.2362 [6]	.730 [18.54]	.350 [8.89]
	1/4" (.250)	.2500 [6.350]	.730 [18.54]	.375 [9.53]
BALL BEARING	1/8" (.125)	.1250 [3.175]	.740 [18.80]	.375 [9.53]
	6mm (.236)	.2362 [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  $\phi A$



UNITS: INCHES [MM]  
METRIC SHOWN FOR REFERENCE ONLY

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### Environmental

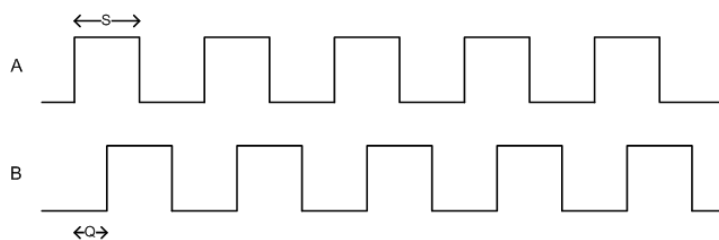
Parameter	Value	Units
Operating Temperature	-20 to 100	C
Electrostatic Discharge, IEC 61000-4-2		
Single-ended (-S version)	± 12	kV
Differential (-D version)	± 7	
Shock, 6 millisecond, half-sine	75	G
	20	G

### 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 for CPR < 500 12000 rpm for CPR = 500
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	> 1000000 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	0.48 oz.	0.43 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



Parameter	Min.	Typ.	Max.	Units
Symmetry, S	105	180	255	electrical degrees
	30	90	150	electrical degrees

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

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### Single-ended Electrical

Specifications	Min.	Typ.	Max.	Units	Notes
Supply Voltage	4.5	5.0	5.5	V	
		25	30	mA	CPR ≤ 500, no load
		34	42	mA	CPR > 500, no load
Low-level Output			0.4	V	IOL = 8 mA
		0.035		V	no load
High-level Output	2.4			V	IOH = -8 mA
		4.0		V	no load
Output Rise Time		100		ns	no load

Specifications	Min.	Typ.	Max.	Units	Notes
Output Fall Time		50		ns	no load

### Differential Electrical

Specifications	Min.	Typ.	Max.	Units	Notes
Supply Voltage	4.5	5.0	5.5	V	
		27	32	mA	CPR ≤ 500, no load
		36	44	mA	CPR > 500, no load
Single-Ended Output Voltage High	4.75	5.0		V	Min. @ 25mA load, Typ. @ no load
		0.25	0.60	V	Typ. @ no load, Max. @ 4.5mA load
	3.0	3.8		V	RL = 100 ohm
			20	ns	

### Pin-out

#### 4-pin Single-ended (1)

#### 6-pin Differential (2)

Pin			
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

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### Ordering Information

S4T -  -  -  -

CPR	Shaft	Output	Torque
100	125 = 1/8" diameter	S = Single Ended	D = Default
108	236 = 6mm diameter	D = Differential	B = Ball Bearing
120	250 = 1/4" diameter		N = Light Static Drag
125			
128			
200			
250			
256			
300			
360			
400 =			
500 =			
512 =			
1000 =			

#### 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.

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