

## S4T Features

- Small size
- Low cost
- High retention snap-in polarized connector
- -20C to 100C operating temperature
- 100 to 1,000 cycles per revolution (CPR)
- 400 to 4,000 pulses per revolution (PPR)
- 2-channel quadrature TTL square wave outputs



## S4T Product Description

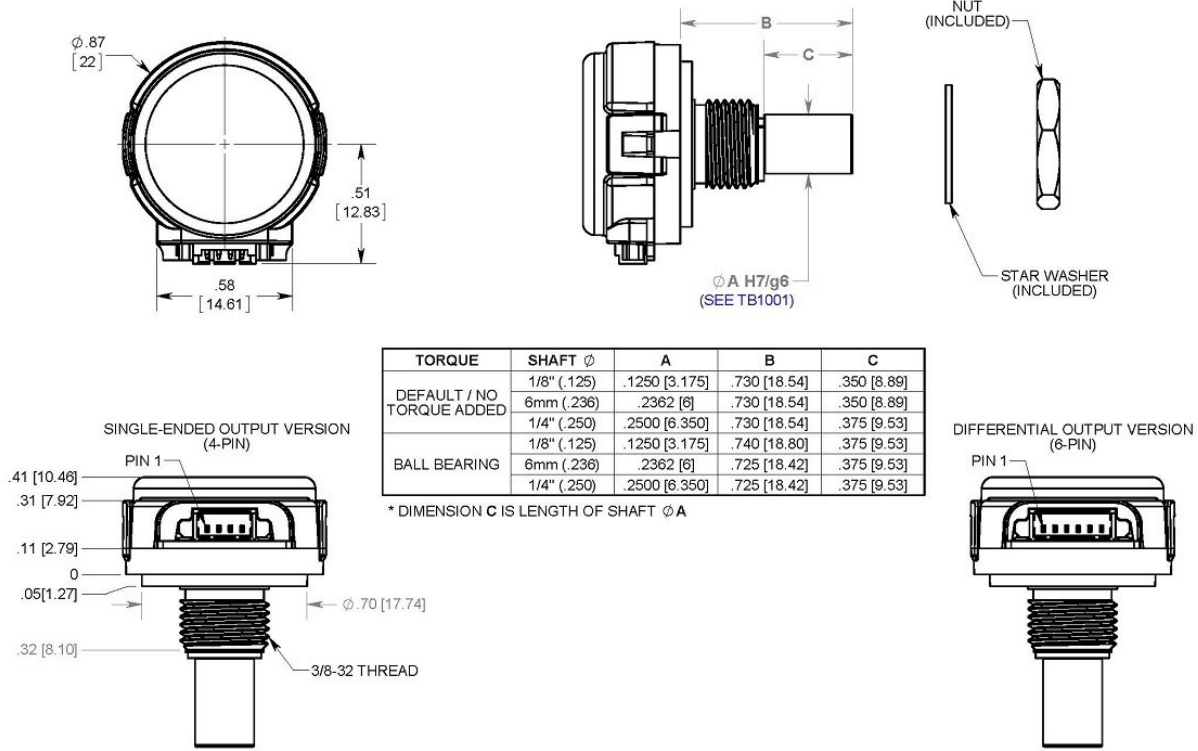
The S4T miniature optical shaft encoder is a non-contacting rotary to digital converter. The S4T contains an LED light source, monolithic photodetector, and mylar disk. The S4T encoder is available with shaft bushing or ball bearings for motion control applications or with shaft torque designed to feel 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 (<https://www.usdigital.com/products/accessories/cables/>)/Connectors (<https://www.usdigital.com/products/accessories/connectors/>) web page) are not included and are available separately.

## Mechanical Drawings

S4T Miniature Optical Shaft Encoder



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UNITS: INCHES [MM]  
METRIC SHOWN FOR REFERENCE ONLY

## Specifications

### ENVIRONMENTAL

PARAMETER	VALUE	UNITS
Operating Temperature	-20 to 100	C
Electrostatic Discharge, IEC 61000-4-2		
Single-ended (-S version)	$\pm 12$	kV
Differential (-D version)	$\pm 7$	
Vibration (10Hz to 2kHz, sinusoidal)	20	G
Shock (6 milliseconds, half-sine)	75	G



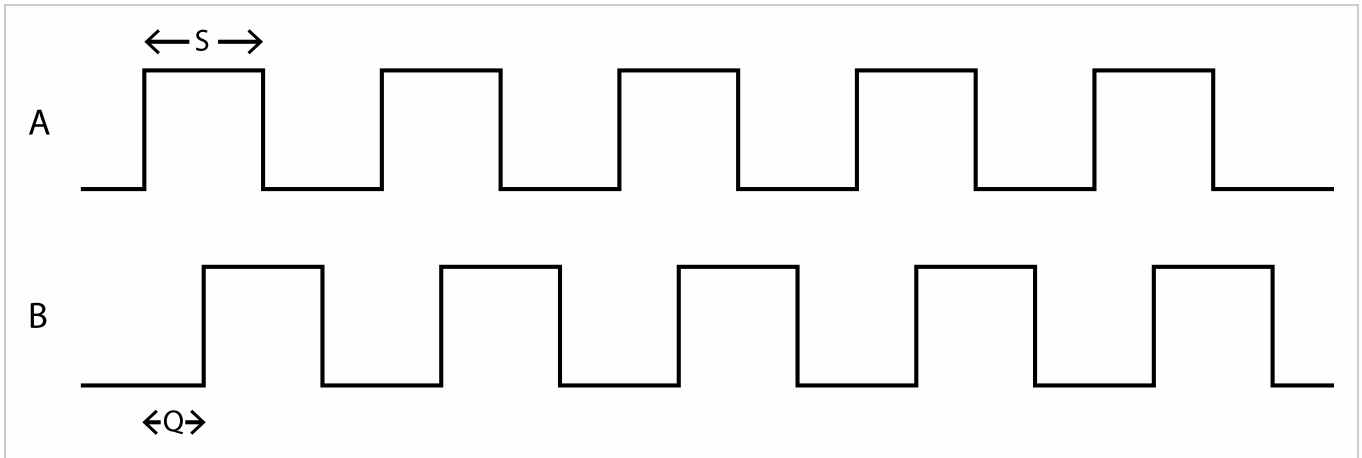
## MECHANICAL

SPECIFICATION	SLEEVE BUSHING	BALL BEARING
Max. Acceleration	10000 rad/sec <sup>2</sup>	250000 rad/sec <sup>2</sup>
Max. Shaft Speed (1) (mechanical)	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	> 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 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 ( <a href="https://www.usdigital.com/support/resources/reference/technical-docs/technical-bulletins/shaft-and-bore-tolerances-tb1001/">https://www.usdigital.com/support/resources/reference/technical-docs/technical-bulletins/shaft-and-bore-tolerances-tb1001/</a> )	

\* only valid with negligible axial shaft loading.

(1) The maximum speed due to electrical considerations is dependent on the CPR. See the E4T (<https://www.usdigital.com/products/encoders/incremental/kit/e4t/>) product page.

## PHASE RELATIONSHIP



PARAMETER	MIN.	TYP.	MAX.	UNITS
Symmetry, $S$	105	180	255	electrical degrees
Quadrature Delay, $Q$	30	90	150	electrical degrees

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

## SINGLE-ENDED ELECTRICAL

SPECIFICATIONS	MIN.	TYP.	MAX.	UNITS	NOTES
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		25	30	mA	CPR $\leq$ 500, no load
		34	42	mA	CPR $>$ 500, no load
Low-level Output			0.4	V	CPR $\leq$ 500, $I_{OL} = 8$ mA
					CPR $>$ 500, $I_{OL} = 5$ mA
		0.035		V	no load
High-level Output	2.4			V	CPR $\leq$ 500, $I_{OH} = -8$ mA
					CPR $>$ 500, $I_{OH} = -5$ mA
		4.0		V	no load
Output Rise Time		100		ns	no load
Output Fall Time		50		ns	no load



## DIFFERENTIAL ELECTRICAL

SPECIFICATIONS	MIN.	TYP.	MAX.	UNITS	NOTES
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		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
Single-Ended Output Voltage Low		0.25	0.60	V	Typ. @ no load, Max. @ 4.5mA 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/accessories/connectors/con-mic4/>)

(2) 6-pin differential mating connector is CON-MIC6 (<https://www.usdigital.com/products/accessories/connectors/con-mic6/>)

## Notes

- Cables and connectors are not included and must be ordered separately.
- For ordering information please see the Compatible Cables / Connectors section above.



## Configuration Options

S4T	CPR (Cycles Per Revolution)	Shaft Diameter	Output	Torque
	100	125 (1/8")	S (Single-Ended)	D (Default Torque)
	108	236 (6mm)	D (Differential)	B (Ball Bearing)
	120	250 (1/4")		N (Light Static Drag)
	125			
	128			
	200			
	250			
	256			
	300			
	360			
	400			
	500			
	512			
	720			
	800			
	1000			

**PLEASE NOTE: This chart is for informational use only.** Certain product configuration combinations are not available. Visit the S4T product page (<https://www.usdigital.com/products/S4T>) for pricing and additional information.