



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.

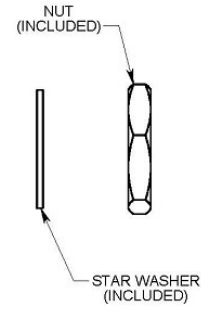
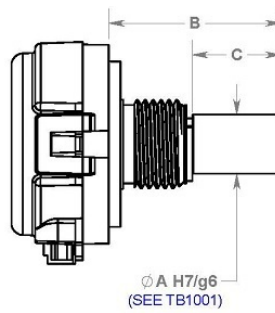
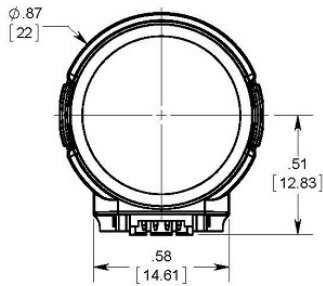


The S4T uses a high retention, 4 conductor snap-in polarized 1.25mm pitch connector. Mating cables and connectors (see the Cables (<https://www.usdigital.com/products/accessories/cables/>)/Connectors (<https://www.usdigital.com/products/accessories/connectors/>) web page) are not included and are available separately.

Mechanical Drawings

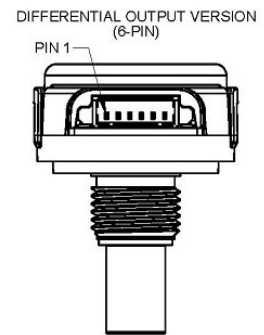
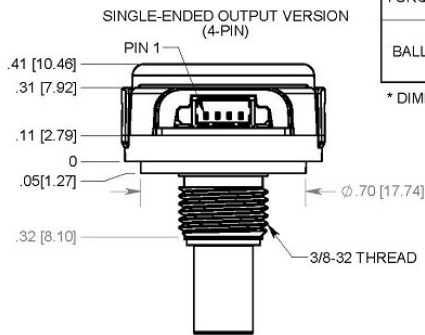
S4T Miniature Optical Shaft Encoder

RELEASE DATE: 01/20/2015



TORQUE	SHAFT ϕ	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 ϕ A



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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)	± 12	KV
Differential (-D version)	± 7	
Shock, 6 milliseconds, half-sine	75	G
Vibration (20Hz to 2kHz, sinusoidal)	20	G



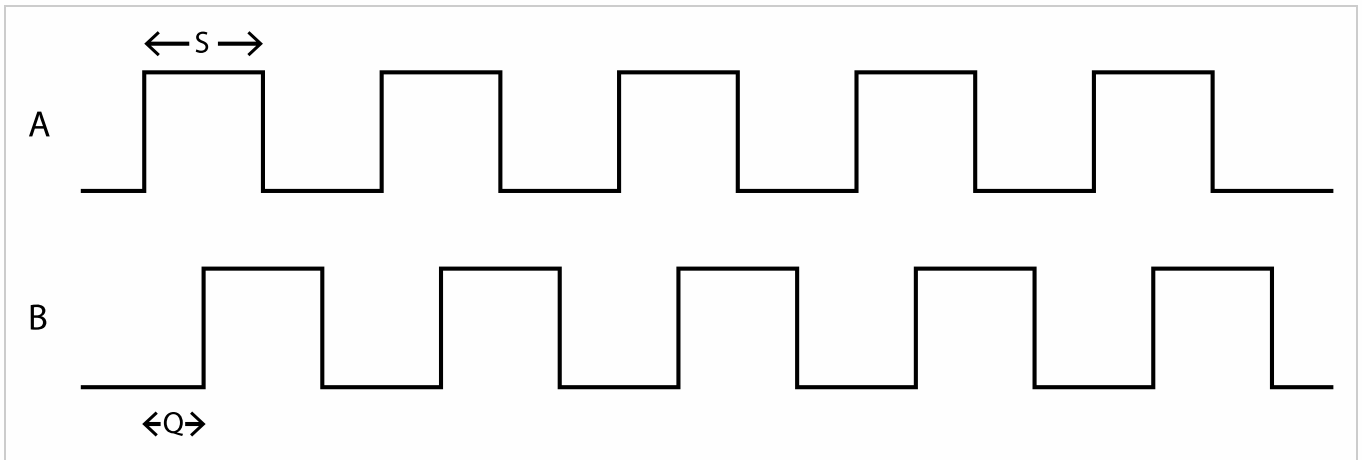
MECHANICAL

SPECIFICATION	SLEEVE BUSHING	BALL BEARING
Max. Acceleration	10000 rad/sec ²	250000 rad/sec ²
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 (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 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/>)



PRODUCT CHANGE NOTIFICATIONS

Title	Date	Description	Download
E4T and S4T Cover and Base Update - PCN 7192	3/3/2022	As part of our ongoing continuous improvement efforts, and to avoid any potential disruption to our supply chain, US Digital has decided to standardize our plastic material. Based on this, the E4T and S4T encoder cover and base will change from PBT (Polybutylene Terephthalate) to PC (polycarbonate).	Download (https://cdn.usdigital.com/assets/pcns/E4T%20Update_PCN-7192.pdf)
Updated PCB for E4T and S4T - PCN 6466	1/29/2018	This notice is to inform our customers of a PCB design change that is being implemented for all the E4T and S4T product lines. The new PCBs will improve overall product performance and enhance robustness of these product lines. The new PCBs can be identified by their blue color (instead of black) and have two mounting holes that mate with the base plate instead of one hole and one slot. This change has no impact on form, fit or function for either the E4T or S4T.	Download (https://www.usdigital.com/support/resources/product-change-notifications/pcn-6466-updated-pcb-for-e4t-and-s4t/)
E4T, S4T and E8T Laser Markings - PCN 6227	8/8/2017	This notification is to inform our customers of a change to product markings for the E4T, E8T, and S4T series of encoders. The new marking will be utilized across all three product lines. We are making this change to improve readability for our customers and to provide consistency across the product lines.	Download (https://www.usdigital.com/support/resources/product-change-notifications/pcn-6227-e4t-s4t-and-e8t-laser-markings/)

Notes

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