

S1 Features

- Ball-bearing option tracks to 10,000 RPM
- 2-channel quadrature, TTL squarewave outputs
- 3rd channel index option available on some resolutions
- 32 to 5,000 cycles per revolution (CPR)
- 128 to 20,000 pulses per revolution (PPR)
- Wide operating temperature
- Single +5VDC supply



S1 Product Description

The S1 series 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 with or without index. It operates from a single +5VDC supply.



The S1 is designed to drive cables up to 10 feet long. For longer cable lengths, adding a PC4 (<https://www.usdigital.com/products/accessories/interfaces/cable-drivers/pc4/>)/PC5 (<https://www.usdigital.com/products/accessories/interfaces/cable-drivers/pc5/>) differential line driver is recommended.

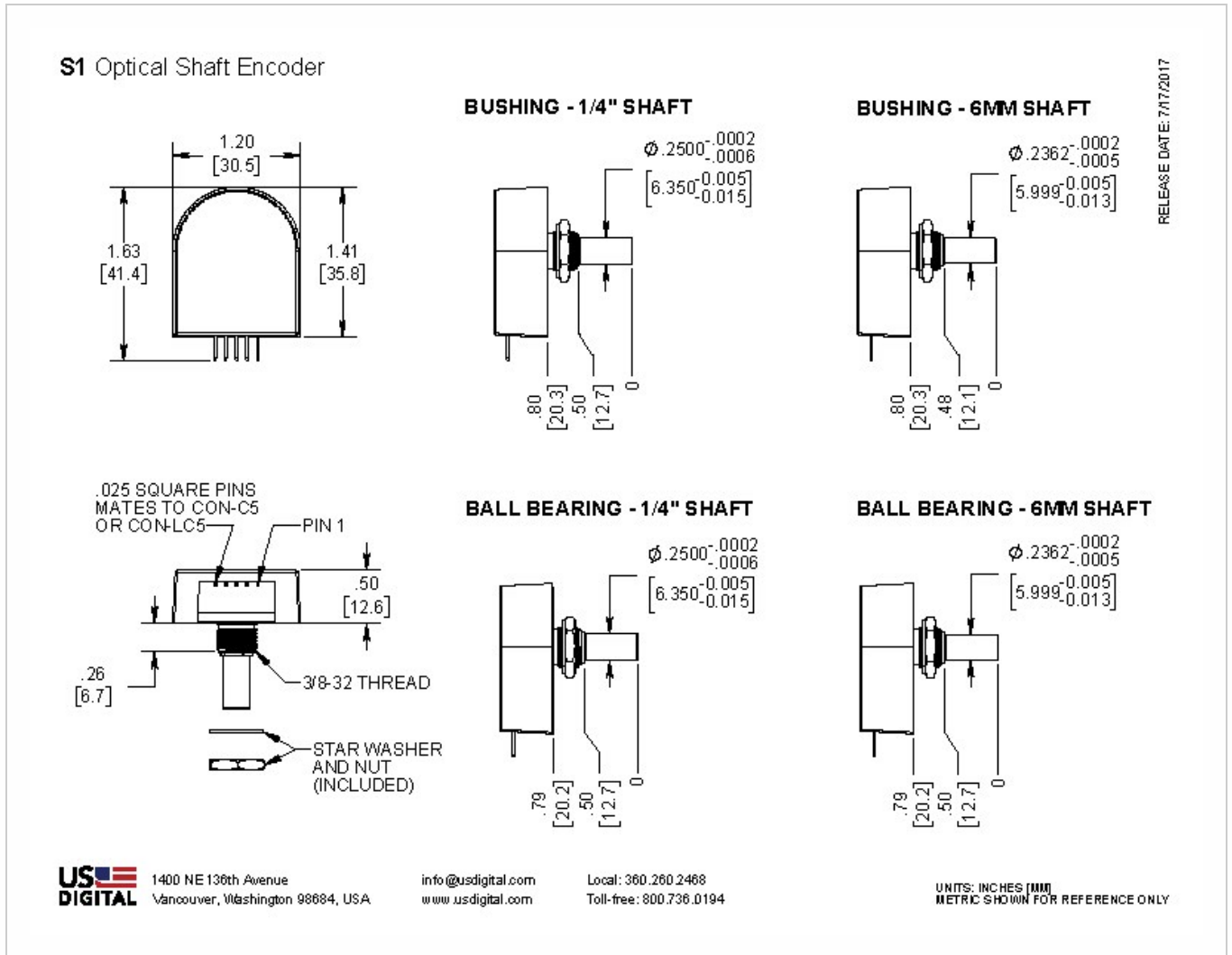
Three shaft torque versions are available. The *standard torque* version has a sleeve bushing designed to provide torque and feel ideal for front panel human interface applications.

The *no torque added* option has a sleeve bushing that does not intentionally add torque for low RPM applications where a small amount of torque is acceptable.

The *ball-bearing* version uses miniature precision ball bearings that are suitable for high-speed and ultra-low torque applications.

Connection to the S1 series encoder is made through a 5-pin standard connector. The mating connectors are available from US Digital with several cable options and lengths.

Mechanical Drawings



Specifications

ENVIRONMENTAL

PARAMETER	VALUE	UNITS
Operating Temperature, CPR < 2000	-40 to 100	C
Operating Temperature, CPR ≥ 2000	-25 to 100	C
Electrostatic Discharge, IEC 61000-4-2	± 4	kV
Vibration (10Hz to 2kHz, sinusoidal)	20	G
Shock (6 milliseconds, half-sine)	75	G

MECHANICAL

PARAMETER	SLEEVE BUSHING	BALL BEARING
Max. Acceleration	250000 rad/sec ²	250000 rad/sec ²
Max. Shaft Speed (mechanical)	100 rpm (1)	10000 rpm (1)
Max. Shaft Torque	0.5 ±0.2 in-oz 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	$L_{10} = (19.3/F_r)^3$ * Where L_{10} = bearing life in millions of revs, and F_r = radial shaft loading in pounds
Weight	0.70 oz.	0.70 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 EM1 (<https://www.usdigital.com/products/encoders/incremental/modules/em1/>) or EM2 (<https://www.usdigital.com/products/encoders/incremental/modules/em2/>) product pages.

PHASE RELATIONSHIP

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

ELECTRICAL

- Specifications apply over the entire operating temperature range.
- Typical values are specified at $V_{cc} = 5.0V_{dc}$ and $25^{\circ}C$.
- For complete details, see the EM1 (<https://www.usdigital.com/products/encoders/incremental/modules/em1/>) or EM2 (<https://www.usdigital.com/products/encoders/incremental/modules/em2/>) product pages.

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		27	33	mA	CPR < 500, no load
		54	62	mA	CPR \geq 500 and < 2000, no load
		72	85	mA	CPR \geq 2000, no load
Low-level Output			0.5	V	$I_{OL} = 8mA$ max., CPR < 2000
			0.5	V	$I_{OL} = 5mA$ max., CPR \geq 2000
		0.25		V	no load, CPR \geq 2000
High-level Output	2.0			V	$I_{OH} = -8mA$ max. and CPR < 2000
	2.0			V	$I_{OH} = -5mA$ max. and CPR \geq 2000
		4.8		V	no load and CPR < 2000
		3.5		V	no load and CPR \geq 2000
Output Current Per Channel	-8		8	mA	CPR < 2000
	-5		5	mA	CPR \geq 2000
Output Rise Time		110		nS	CPR < 2000
		50		nS	CPR \geq 2000, $\pm 5mA$ load
Output Fall Time		100		nS	CPR < 2000
		50		nS	CPR \geq 2000, $\pm 5mA$ load



PIN-OUT

PIN	DESCRIPTION
1	Ground
2	Index
3	A channel
4	+5VDC power
5	B channel

Note: 5-pin single ended mating connector is CON-C5 (<https://www.usdigital.com/products/accessories/connectors/con-c5/>) or CON-LC5 (<https://www.usdigital.com/products/accessories/connectors/con-lc5/>)

Notes

- Cables and connectors are not included and must be ordered separately.
- 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

S1	CPR (Cycles Per Revolution)	Shaft Diameter	Index	Torque	Housing
	32	236 (6mm)	IE (Index)	D (Default Torque)	D (Default)
	50	250 (1/4")	NE (Non-Index)	B (Ball Bearing)	
	96			N (Light Static Drag)	
	100				
	120				
	192				
	200				
	250				
	256				
	360				
	400				
	500				
	512				
	540				
	720				
	800				
	900				
	1000				
	1024				
	1250				
	2000				
	2048				
	2500				
	4000				
	4096				
	5000				

PLEASE NOTE: This chart is for informational use only. Certain product configuration combinations are not available. Visit the S1 product page (<https://www.usdigital.com/products/S1>) for pricing and additional information.