#### **S2 Features**

- 2-channel quadrature, TTL square wave outputs
- 3rd channel index option
- 64 to 10,000 CPR (256 to 40,000 PPR)
- Ball-bearing option tracks to 10,000 RPM
- Wide operating temperature
- Single +5V supply



### **S2 Product Description**

The S2 series high resolution 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 S2 is our first generation ball-bearing optical shaft encoder and is available for those customers who have designed it into their products; however, the S6 (https://www.usdigital.com/products/encoders/incremental/shaft/s6/) is recommended for new designs in place of the S2.

The S2 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.

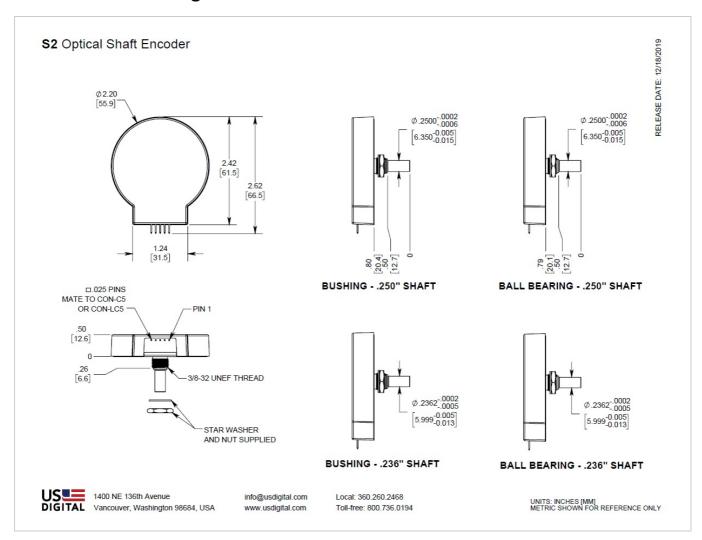
Three shaft torque versions are available:

- The *default torque* version has a sleeve bushing designed to provide torque and feel ideal for front panel human interface applications.
- The *ball-bearing* version uses miniature precision ball bearings that are suitable for high-speed and ultra-low torque applications.
- The *light static drag* option has a sleeve bushing that does not intentionally add torque for low RPM applications where a small amount of torque is acceptable.

Connection to the S2 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	С
Operating Temperature, CPR ≥ 2000	-25 to 100	С
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/sec²	250000 rad/sec <sup>2</sup>
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	1.28 oz.	1.28 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 Bore Tolerances	- Shaft and	Download (https://www.usdigital.com/support/resources/reference/technical-docs/technical-bulletins/shaft-and-bore-tolerances-tb1001/)

<sup>\*</sup> 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/) and 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 Vcc = 5.0Vdc and 25°C.
- For complete details, see the EM1 (https://www.usdigital.com/products/encoders/incremental/modules/em1/) and 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 < 1000, no load
		54	62	mA	CPR ≥ 1000 and < 3600, no load
		72	85	mA	CPR ≥ 3600, no load
Low-level Output			0.5	V	I <sub>OL</sub> = 8mA max., CPR < 3600
			0.5	mA	I <sub>OL</sub> = 5mA max., CPR ≥ 3600
		0.05		mA	no load, CPR < 3600
		0.25		mA	no load, CPR ≥ 3600
High-level Output	2.0			V	I <sub>OH</sub> = -8mA max., CPR < 3600
	2.0			V	I <sub>OH</sub> = -5mA max., CPR ≥ 3600
		4.8		V	no load, CPR < 3600
		3.5		V	no load, CPR ≥ 3600
Output Current Per Channel	-8		8	mA	CPR < 3600
	-5		5	mA	CPR ≥ 3600
Output Rise Time		110		nS	CPR < 3600
		50		nS	CPR ≥ 3600
Output Fall Time		35		nS	CPR < 3600
		50		nS	CPR ≥ 3600



#### **PIN-OUT**

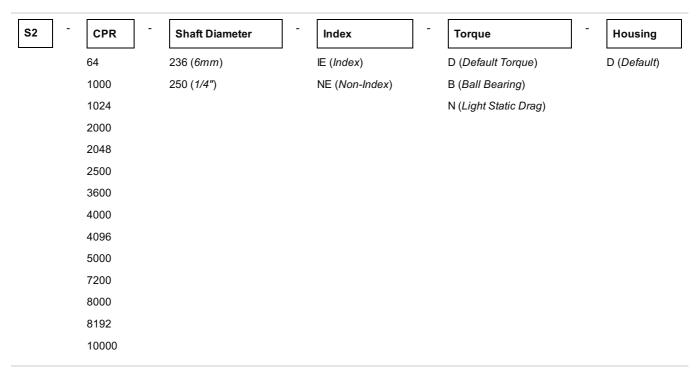
PIN	DESCRIPTION
1	Ground
2	Index
3	A channel
4	+5VDC power
5	B channel

**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**



**PLEASE NOTE: This chart is for informational use only.** Certain product configuration combinations are not available. Visit the S2 product page (https://www.usdigital.com/products/S2) for pricing and additional information.

