



S16 Features

- **NEW FOR '22!**
- Small size (16mm OD)
- Low Cost
- Snap-in polarized connector
- 250/256 to 4,000/4096 cycles per revolution (CPR)
- 1,000/1024 to 16000/16384 pulses per revolution (PPR)
- Single +5V supply



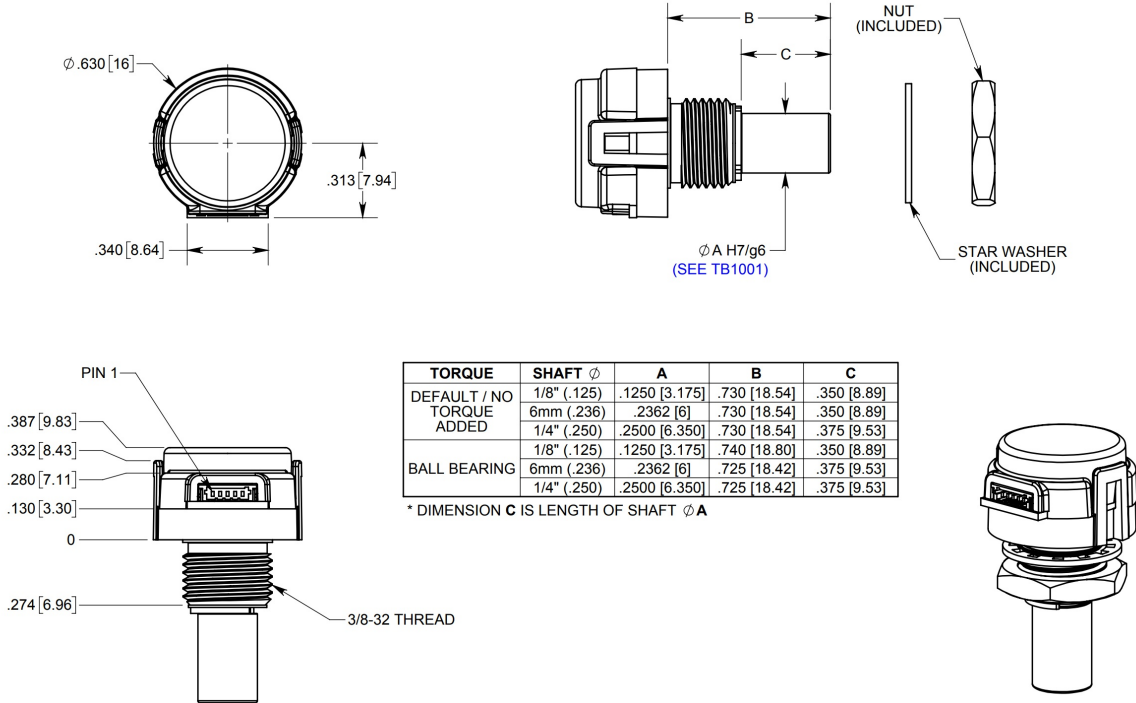
S16 Product Description

The S16 16mm micro-optical shaft encoder is designed to provide A, B, and Index digital quadrature signals for high volume restricted space applications. The S16 encoder is available with either a bushing or ball bearing system for high speed applications. The shaft torque is designed to provide the feel of a potentiometer for front-panel manual interfaces. The S16 series encoder is connected using a 5-conductor, polarized, 0.8mm pitch connector (Hirose part number DF52-5P-0.8C). The mating cable (see the Cables web page) is not included and is available separately.



Mechanical Drawings

S16 Micro Optical Shaft Encoder



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]
BALL BEARING	1/4" (.250)	.2500 [6.350]	.730 [18.54]	.375 [9.53]
	6mm (.236)	.2362 [6]	.740 [18.80]	.350 [8.89]
	1/4" (.250)	.2500 [6.350]	.725 [18.42]	.375 [9.53]

* DIMENSION C IS LENGTH OF SHAFT ϕ A

RELEASE DATE: 03/30/2021

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UNITS: INCHES [MM]
METRIC SHOWN FOR REFERENCE ONLY

Specifications

ENVIRONMENTAL

PARAMETER	VALUE	UNITS
Operating Temperature	-40 to 100	C
Electrostatic Discharge, IEC 61000-4-2	±12	kV
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 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 E16 (<https://www.usdigital.com/products/encoders/incremental/kit/e16/>) product page.



ELECTRICAL

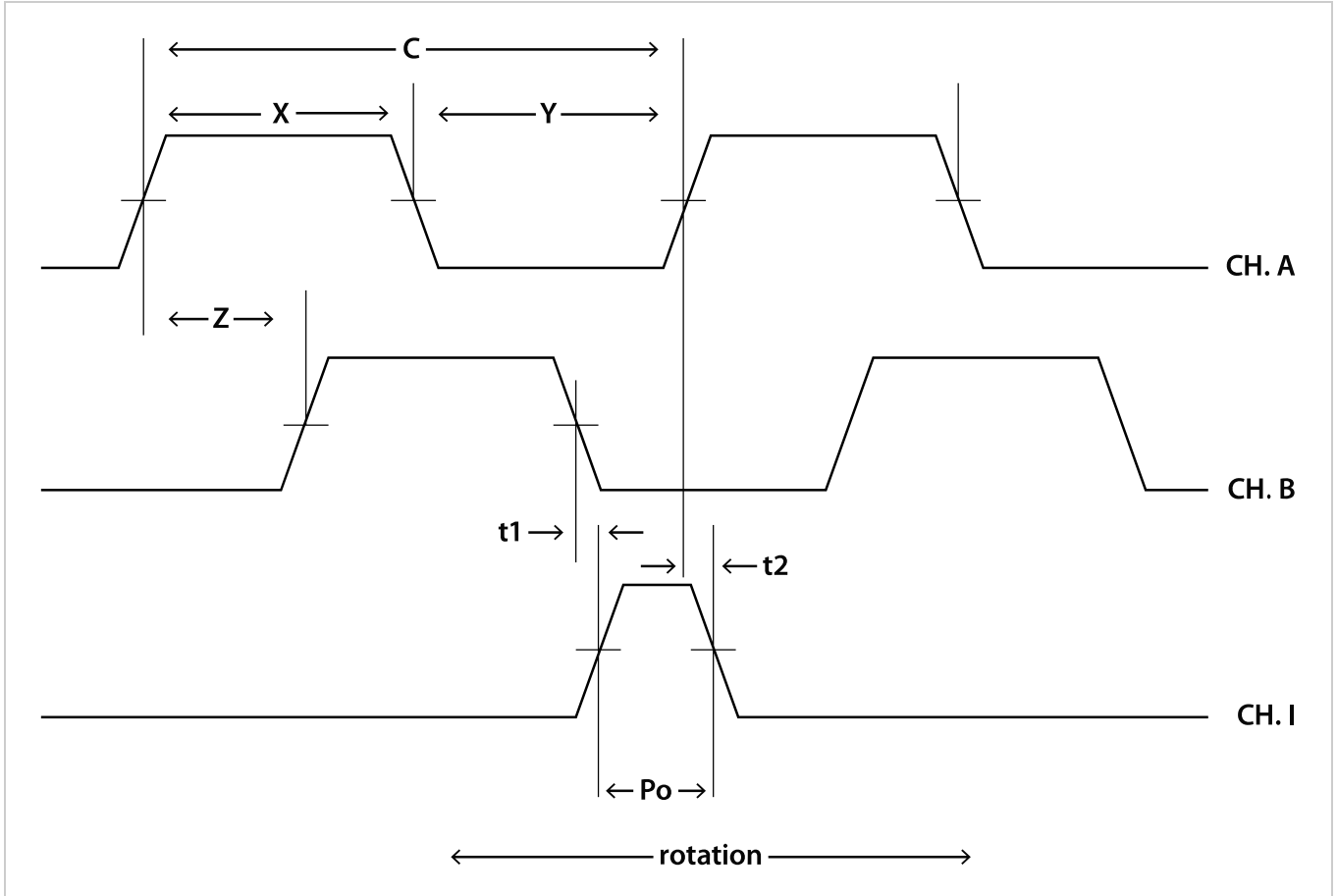
PARAMETER	MIN.	TYP.	MAX.	UNITS	NOTES
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		18	26	mA	no load
Low-level Output			0.4	V	$I_{OL} = 4 \text{ mA}$, $V_{CC} = 5V$
		0.1		V	no load
High-level Output	4.7			V	$I_{OH} = 4 \text{ mA}$, $V_{CC} = 5V$
		4.9		V	no load
Output Rise Time		80	135	ns	no load
Output Fall Time		80	135	ns	no load
Maximum Output Frequency					
250/256 CPR	0.2			MHz	
500/512 CPR	0.4			MHz	
1,000/1,024 CPR	0.8			MHz	
2,000/2,048 CPR	1.6			MHz	
4,000/4,096 CPR	1.85			MHz	

PHASE RELATIONSHIP

- Specifications apply over the entire operating temperature range.
- Values are for the worst error over full rotation.
- Refer to the timing diagram below.

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Symmetry	X, Y	150	180	210	$^{\circ}e$ <i>(https://www.usdigital.com/support/resources/glossary/#glossary_e)</i>
Quadrature	Z	60	90	120	$^{\circ}e$ <i>(https://www.usdigital.com/support/resources/glossary/#glossary_e)</i>
Index Pulse Width	Po	60	90	120	$^{\circ}e$ <i>(https://www.usdigital.com/support/resources/glossary/#glossary_e)</i>
Ch. I Rise After Ch. B or Ch. A Fall	t1		10		ns
Ch. I Fall After Ch. B or Ch. A Rise	t2		10		ns

TIMING DIAGRAM



CPR

The number of Cycles (C) of the A or B outputs Per Revolution.

Index (I)

The index output goes high once per revolution, coincident with the low states of channels A and B, nominally 1/4 of one cycle (90°e).

One Shaft Rotation

360 mechanical degrees.

One Electrical Degree (°e)

1/360th of one cycle.

One Cycle (C)

360 electrical degrees (°e). Each cycle can be decoded into 1, 2, or 4 states, referred to as x1, x2, or x4 resolution multiplication.

PPR

The number of resolvable Positions Per Revolution of the encoder disk with x4 quadrature decoding.

Quadrature (Z)

The phase lag or lead between channels A and B in electrical degrees, nominally 90°e.

Symmetry

A measure of the relationship between (X) and (Y) in electrical degrees, nominally 180°e.



PIN-OUT

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

Notes

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

Configuration Options

S16	CPR	Shaft Diameter	Output	Torque
	250	125 (1/8")	S (Single-Ended)	D (Default Torque)
	256	236 (6mm)		B (Ball Bearing)
	500	250 (1/4")		N (Light Static Drag)
	512			
	1000			
	1024			
	2000			
	2048			
	4000			
	4096			

PLEASE NOTE: This chart is for informational use only. Certain product configuration combinations are not available. Visit the S16 product page (<https://www.usdigital.com/products/S16>) for pricing and additional information.