

Data Sheet for Angle Sensors

Optical incremental Encoder

Series SPF



- Optical resolution 250 to 4096 pulses / 360°
- 16 mm housing
- 9.8 mm housing depth
- Shaft diameters: 6 mm, 6.35 mm, 3.175 mm
- Ball or sleeve bearing
- Supply voltage 5 VDC
- Signal Output TTL
- 5-pole connector

The SPF 16 mm encoder is designed to provide digital A, B and index quadrature signals for applications where space is at a premium. The encoder is available with either plain or ball bearings. The shaft torque is designed to give the feel of a potentiometer for manual interfaces on the front panel. The encoder is connected with a 5-pin connector with 0.8 mm pitch (Hirose part number DF52-5P-0.8C).

Electrical Data	TTL
Output signal	5 V - A, B
Number of pulses	250..4096 ppr.
Output voltage high	≥ 2.4 V @ 4 mA with load (4.9 V @ no load)
Output voltage low	≤ 0.4 V @ 4 mA with load (0.1 V @ no load)
Differential output voltage	-
Limit frequency	100 kHz
Supply voltage	5 VDC ±10 %
Power consumption no load	≤ 26 mA (typ. 18 mA)
Output capacity	4 mA per channel (A or B)
Output electronics	TTL
Switch on-delay (rise time, fall time)	Typ. 80 (max. 135 ns)

Mechanical and Environmental Data, Miscellaneous

Mechanical angle of rotation /stroke 1.)	360° without stop
Lifetime 2.)	> 1 Mio. shaft revolutions for sleeve bearing
Bearing	Sleeve bearing or ball bearing
Max. operational speed	
Sleeve bearing	100 rev./min
Ball bearing	15000 rev./min
Max. acceleration	
Sleeve bearing	10000 rad/sec ²
Ball bearing	250000 rad/sec ²
Operational torque @ RT 1.) 2.)	
Sleeve bearing with low torque (Version NT)	0.21 Ncm
Sleeve bearing with increased torque	0.35 Ncm
Ball bearing with very low torque (Version KL)	0.03 Ncm
Operating temperature range	-40 °C +100 °C
Storage temperature range	-40 °C +100 °C
Protection grade shaft side (IEC 60529) standard	IP40

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Mechanical and Environmental Data, Miscellaneous

Vibration (IEC 68-2-6, Test Fc)	20 g / 20 bis 2000 Hz / sine waveform
Shock (IEC 68-2-27, Test Ea)	75 g / 6 ms / halfsine
Housing diameter / length	16 mm
Housing depth	9.83 mm
Shaft diameter	6 mm, 6.35 mm, 3.175 mm
Shaft type	Solid shaft
Max. radial load	< 1 N
Max. shaft load	< 8.9 N (sleeve bearing) / < 4,4 N (ball bearing)
Connection type	Hirose connector DF52-5P-0.8C (5-pin)
Connection position	Radial
Sensor mounting	Bushing
Mass	app. 14 g
Fastening parts included in delivery	Hex nut and tooth washer
Fastening torque mounting nut	< 2.25 Nm
Material shaft	Stainless steel with sleeve bearing Brass with ball bearing
Material housing	Plastic
Material disc	Mylar
Immunity ESD, human body model (MIL-STD-883, Method 3015.8)	± 12 kV (Line Driver)

1.) According IEC 60393

2.) Determined by climatic conditions according to IEC 68-1, para. 5.3.1 without load collectives

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Order code

Description	Selection: standard=black/bold , possible <i>options=grey/italic</i>					
Series	SPF					
Shaft diameter*: <i>Ø3.17 mm (1/8")</i>		3,17				
Ø6 mm		6				
Ø6.35 mm (1/4")		6,35				
Resolution in pulses per revolution:						
250 ppr.			250			
256 ppr.			256			
500 ppr.			500			
512 ppr.			512			
1000 ppr.			1000			
1024 ppr.			1024			
2000 ppr.			2000			
2048 Ppr.			2048			
4000 Ppr.			4000			
4096 Ppr.			4096			
Supply voltage: Standard: 5 V				5		
Output signal: Standard: A+B+Z					BZ	
Output electronics: Standard: TTL						TTL
Bearing: Standard: Sleeve bearing with standard torque 0.35 ± 0.15 Ncm <i>Standard: sleeve bearing with low torque 0.20 ± 0.15 Ncm</i> <i>Option ball bearing with very low torque 0.04 Ncm</i>						- NT KL

* The shaft length depends on the shaft bearing used and the diameter - see table on the next page.

For series requirements, you can obtain these and other customised solutions

For example:

- Cable and connector assembly

Order example SPF

Requirement:

Shaft diameter 6 mm, resolution 256 imp./U , power supply 5 V, 2 channels A+B+Z, output electronics TTL, plain bearing with standard torque

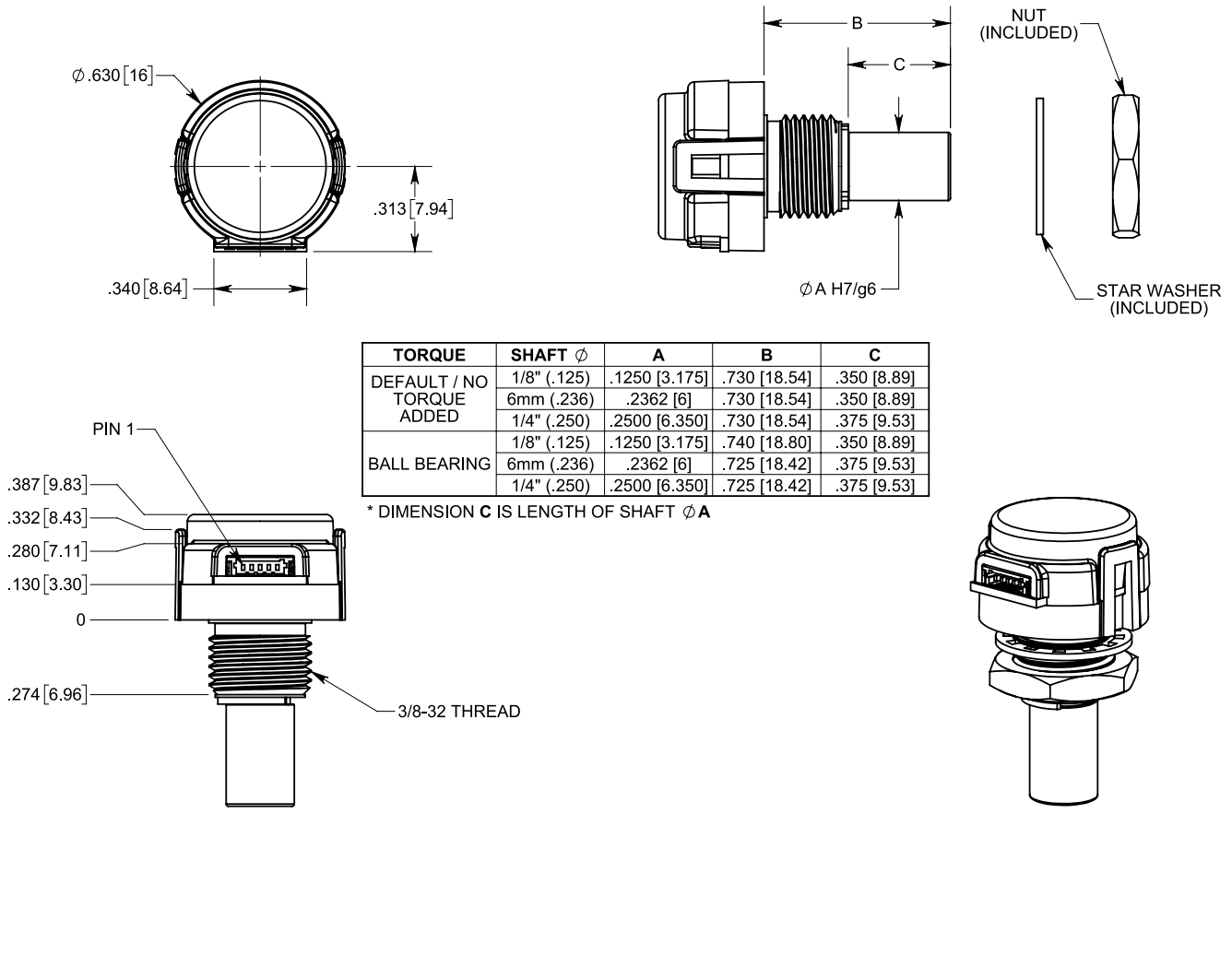
Example for order code: SPF 6 256 5 BZ TTL

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Drawing



Technical drawing of an optical incremental encoder. The drawing includes a front view, a side view, and a detail view of the encoder housing. Dimensions are provided in inches and millimeters. A table lists torque and shaft diameter specifications for different configurations. A note indicates that dimension C is the length of the shaft.

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]
	1/8" (.125)	.1250 [3.175]	.740 [18.80]	.350 [8.89]
	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

Pin assignment

Function	PIN
GND	1
Index Z	2
Channel A	3
+5 VDC, Supply Voltage	4
Channel B	5

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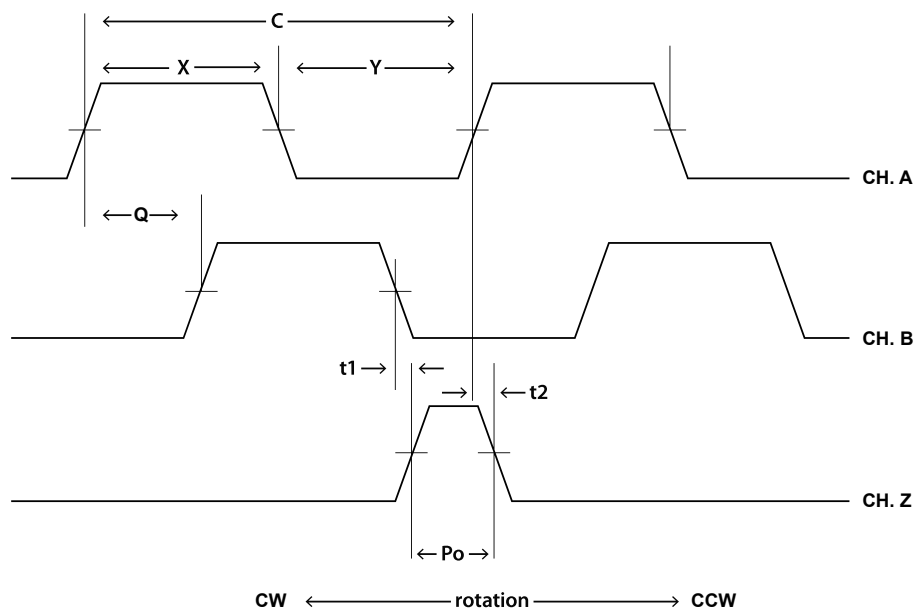
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Phase Relation

- The specifications apply to the entire operating temperature range
- They indicate the largest possible error over one full revolution

Parameter	Symbol	Min.	Typ.	Max.	Unit
Symmetry	X, Y	150	180	210	°
Quadrature	Q	60	90	120	°
Width of index pulse	Po	60	90	120	°
Channel Z Rise time after fall of chan. A or B	t1		10		ns
Channel Z Fall time after fall of chan. A or B	t2		10		ns



Index (Z)

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

One cycle (C)

360 electrical degrees (°). Each cycle can be decoded into 1, 2 or 4 states, which is call x2 or x4.

Quadrature (Q)

The phase shift between channels in degrees, nominally 90°.

Symmetry

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



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