

## Product data

### Features

- Highly miniaturized linear encoder
- Differential inductive sensing principle
- Insensitive to magnetic interference fields
- Robust against oil, water, dust, particles
- Programmable resolution and maximum speed
- Optional with cable, connector and holder

### Applications

- Linear actuators
- Industrial / laboratory / office automation
- X-Y stages
- Pick & Place assembly equipment
- High-speed motion control
- Mechatronics applications

### Key Specifications

Output format.....A and B in quadrature  
 Resolution.....down to 0.02  $\mu\text{m}$   
 Maximum speed .....up to 32 m/s  
 Airgap .....up to 0.6 mm  
 Supply.....5 V, 10 mA  
 Temperature .....-20 to 100°C

### Description

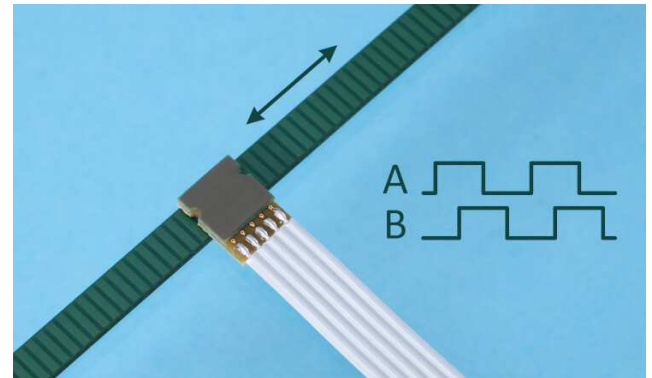
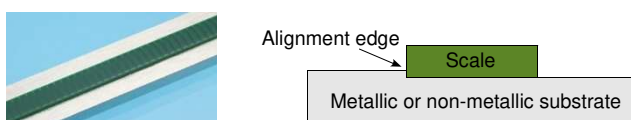
The ID1102L incremental encoder kit consists of an encoder and a linear scale (Fig. 1). The encoder is an integrated circuit in a PCB housing. It provides incremental A and B output signals in quadrature (Fig. 2). The linear scale is a PCB with passive copper strips. The orientation of the encoder is selected in Table 1.

### Resolution, maximum speed and airgap

The resolution and the maximum speed of the encoder are user-programmable or can be programmed ex-factory. The resolution depends on a filter setting that limits the maximum speed of the encoder vs. the scale. The resolution also depends on the maximum distance between the encoder and the scale. The resolution and maximum speed for a certain maximum air-gap are selected in Tables 2 and 3.

### Scales

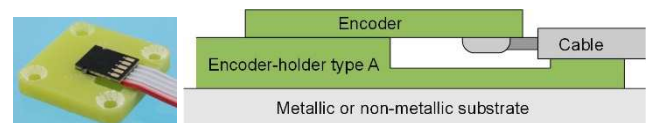
Scales with different lengths (Fig. 4) are selected in Table 5. Each scale has a backside adhesive layer and may be mounted on any substrate, using a 0.1 – 0.2 mm high alignment edge for correct positioning in front of the encoder.



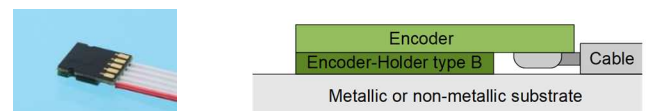
### Encoder holders

Different encoder holder options are available and can be selected in Table 6.

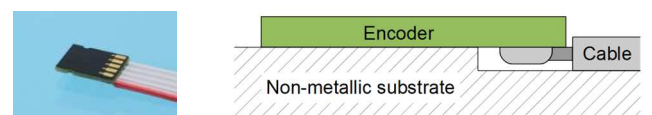
The encoder holder **type A** (Fig. 5) may be mounted on any substrate using 4 screw-holes. It has a strain relief for the cable. Holder type A is for evaluation purposes only.



The encoder holder **type B** (Fig. 3) may be mounted on any substrate. Use half-holes on encoder PCB housing and alignment pins for accurate positioning.



The encoder without holder may be mounted on non-metallic substrates. Use half-holes on encoder housing and alignment pins for accurate positioning.



### Encoder cable and connector

The encoder can be supplied with a flat cable of pitch 1.27 mm and a connector (Fig. 6). The cable length and the connector type are selected in Tables 7 and 8.

### Encoder programming

The Evaluation and Programming Tool (EPT) including an interface board and the ASSIST software is available for the linearization and programming of the encoder.

### 3D models of encoder, holders and scales

STEP models available on [www.posic.com](http://www.posic.com).

## Specifications

### Recommended Operating Conditions

Parameter	Symbol	Remark	Min	Typ	Max	Unit
Supply voltage	VDD		4.5	5.0	5.5	V
Operating Temperature	T <sub>A</sub>		-20		100	°C
Airgap	Z			0.2		mm
Lateral tolerance scale	$\Delta Y$	TPLS01, scale width 3.7 mm			0.2	mm
		TPLS02, scale width 4.4 mm			0.5	mm
Airgap tolerance	$\Delta Z$				0.1	mm

### Electrical Characteristics

Electrical characteristics over recommended operating conditions, typical values at VDD = 5.0 V, T<sub>A</sub> = 25°C.

Parameter	Symbol	Remark	Min	Typ	Max	Unit
Supply current	I <sub>DD</sub>	No load	8	10	15	mA
Maximum output frequency	F	A/B output signals	0.8	1	1.2	MHz
High level output voltage*	V <sub>OH</sub>	I <sub>L</sub> = 2 mA	VDD-0.5			V
Low level output voltage*	V <sub>OL</sub>	I <sub>L</sub> = 2 mA			0.5	V
Rise time, fall time	t <sub>r</sub> , t <sub>f</sub>	C <sub>L</sub> = 47 pF			20	ns

If A is pulled up and B pulled down during power-up, the encoder enters into a test mode with a 50 kHz square wave on all outputs.

### Encoding Characteristics

Encoding characteristics over recommended operating conditions, typical values at VDD = 5.0 V, T<sub>A</sub> = 25°C, airgap = 0.2 mm, speed = max speed/10.

Parameter	Symbol	Remark	Min	Typ	Max	Unit
Pulse width error	$\Delta P$	Nominal value 180°e		10	50	°e
State width error	$\Delta S$	Nominal value 90°e		10	60	°e
Phase shift error	$\Delta \Phi$	Nominal value 90°e		10	45	°e

### Linearity

For high-resolution high-precision applications, it is possible to linearize the encoder by means of a Look-Up Table (LUT) that is located inside the encoder. The LUT can be programmed in volatile or in non-volatile memory by means of the Evaluation and Programming Tool (EPT) or it can be pre-programmed by ex-factory. The LUT option is selected in Table 4.

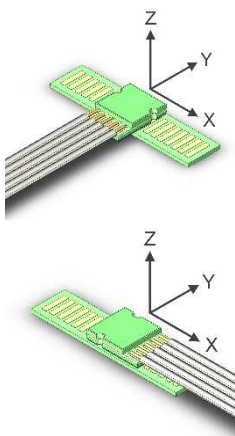


Fig. 1 Coordinate system XYZ.

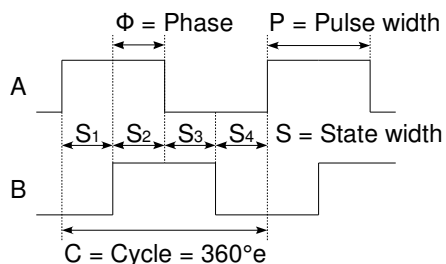


Fig. 2 Encoder output signals A and B in quadrature.

### Definitions

Airgap	Distance between encoder and scale in Z-direction. See Fig. 1.
Cycle	One A quad B period, see Fig. 2.
CPP	Cycles Per scale-Period.
°e	Electrical degree (one Cycle is 360°e)
Phase shift $\Phi$	Number of electrical degrees between the center of the high state of channel A and the center of high state of channel B. Nominal 90°e. Fig. 2.
Pulse width P	Number of electrical degrees that an output is high during one cycle. Nominal 180°e. Fig. 2.
State width S	Number of electrical degrees between two neighboring A and B transitions. Nominal value is 90°e. See Fig. 2.



### Ordering information

Ordering code:	ID1102L-ABBCCD-EEEE-F-GGG-HH	
A	Orientation	Table 1
BB	Maximum speed	Table 2
CC	Resolution	Table 3
D	Look-Up Table	Table 4
EEEE	Linear scale	Table 5
F	Encoder holder	Table 6
GGG	Cable	Table 7
HH	Connector	Table 8

Table 1: Orientation. Arrows indicate direction of movement of the scale with rising edge A prior to B.

A	Orientation
0	Not progr.
3	0°
4	90°
5	180°
6	270°

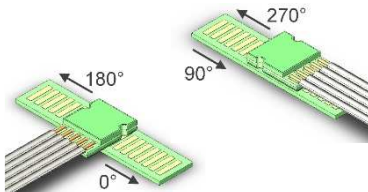


Table 2: Maximum speed

BB	Max speed (m/s)	Maximum value CC
00	Not programmed	
01	0.015	16
02	0.031	16
03	0.062	16
04	0.12	15
05	0.25	14
06	0.5	13
07	1	12
08	2	11
09	4	10
21	8	09
22	16	08
23	32	07

Lower Max speed leads to a lower jitter of the A/B outputs.

Table 3: Resolution

CC	Resolution		Maximum value BB	Maximum Airgap* (mm)
	Cycles per Period	µm		
00	Not programmed			
03	2	160	23	0.6
04	4	80	23	0.6
05	8	40	23	0.6
06	16	20	23	0.6
07	32	10	23	0.6

08	64	5	22	0.5
09	128	2.5	21	0.5
10	256	1.25	09	0.4
11	512	0.63	08	0.4
12	1'024	0.31	07	0.3
13	2'048	0.16	06	0.3
14	4'096	0.078	05	0.2
15	8'192	0.039	04	0.2
16	16'384	0.020	03	0.2

\* Recommended airgap = 0.2 mm. Sequence of A and B transitions is correct up to Maximum Airgap, but encoding specifications may be out of range.

Table 4: Look-Up Table (LUT)

D	Look-Up Table programmed in OTP
0	Not programmed
1	Standard LUT, according to scale
8	Custom LUT, to be specified
9	Default LUT, no scale specified

Table 5: Linear scale (see Fig. 4)

EEEE	Scale	Dimensions
00000	No scale	
04026	TPLS04	L x W x T = 26 x 4.5 x 0.77 mm
05205	TPLS05	L x W x T = 205 x 4.5 x 0.77 mm

Table 6: Encoder holder

F	Encoder holder
0	No holder
A	Holder type A (Fig. 5) for evaluation only
B	Holder type B (Fig. 3)

Table 7: Cable

GGG	Cable
000	No cable
0xx	Flat ribbon cable, length xx cm

Table 8: Connector

HH	Connector
00	No connector
02	6-pin connector DIN 41651 (Fig. 6)
04	8-pin connector DIN 41651

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