

LA-10

Absolute position, linear Electric Encoder™



The **LA-10** is a member of the LA series of linear encoders , which is based on Netzer Precision Electric Encoder™ technology. This, state-of-the-art, technology offers many features:

- High precision absolute position
- Low read-head profile (≤ 6 mm)
- High tolerance to mechanical installation
- High tolerance to contaminants
- High tolerance to temperature, shock, moisture as well as EMI, RFI and magnetic fields
- Digital SSI , AqB or analog Sine/Cosine outputs

Mechanical parameters	
Measurement length (max)	150 mm
Air gap (read head / scale)	0.8 ± 0.1 mm
Read head weight	4 gr
Read head dimensions	40 x 10 x 6 mm
Read head construction materials	Ultem™ polymer and FR-4 PCB
Scale width / thickness	10 / 0.6 mm
Scale material	FR-4 PCB

The **LA-10** comprises an electric field generating scale and an holistic ¹ receiving read-head , it has two operational modes: Coarse and Fine, which generate signals proportional to the sine and cosine of the measured displacement.

The Coarse channel provides the absolute position and its period length extends the length of the scale. The Fine channel provides the accuracy and resolution and its standard period length is 4mm.

Digital SSI output is available using the external SC2SSi module.

Electrical parameters	
Supply voltage	$5V \pm 5\%$ ⁽³⁾
Interconnection	Teflon - insulated , flying 32 AWG leads
Environmental	
EMC	IEC 6100-6-2, IEC 6100-6-4
Operating temperature range	-20°C to $+85^{\circ}\text{C}$ ⁽⁵⁾
Relative humidity	<98 % - non condensing
Shock endurance	IEC 60068-2-27 ; 100 g for 11 ms
Vibration endurance	IEC 60068-2-6 ;20 g 10 – 2000 Hz

Operations characteristics	
Period length – Fine mode	4 mm
Resolution (using 12 bit A/D)	0.5 μm
Accuracy ⁽⁶⁾	< 20 μm
Maximum operational speed ⁽⁷⁾	4 m / sec
Output signal latency ⁽⁸⁾	250 μs

Absolute position output options	
Analog	Sine/Cosine
Digital	SSi

Incremental position output options	
Analog	Sine/Cosine
Digital	AqB + Index
Digital	AqB

Output signal parameters	
Signal latency ⁽⁸⁾	~250 µSec
Output code	binary
Serial output SSI	Differential RS-422
Clock SSI	Differential RS-422
Monoflop time	25 µSec
Clock frequency	0.5 ÷ 2.5 MHz
Payload	14 ÷ 44 bit

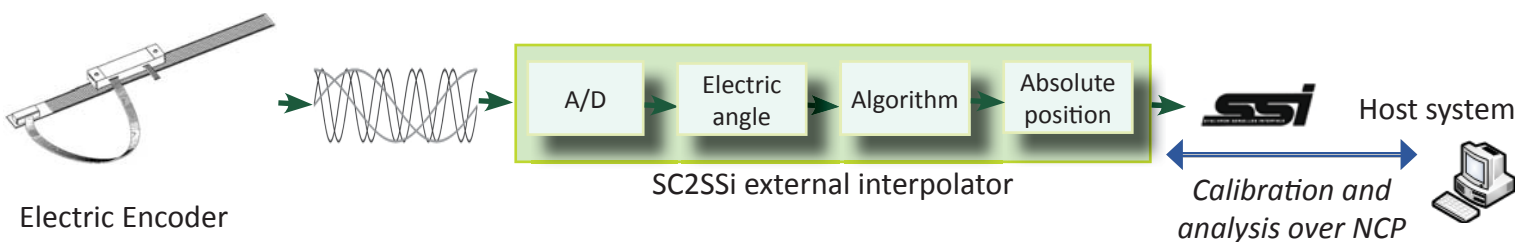
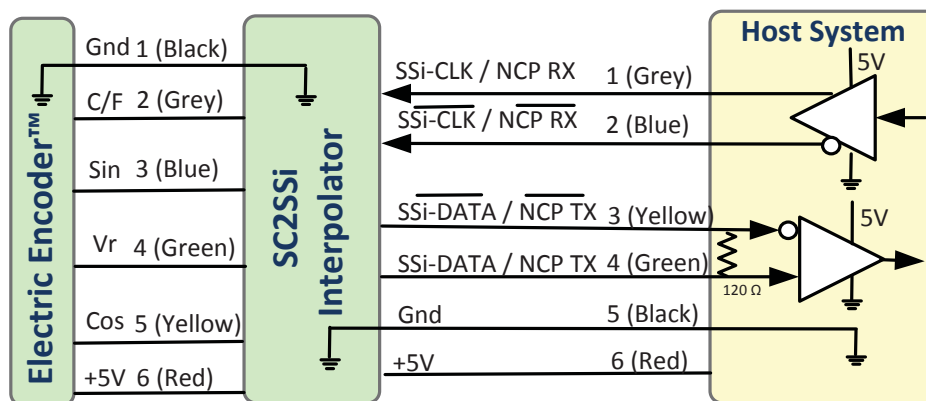
Electrical parameters	
Current consumption	~ 180 mA

Operational characteristics	
Period length – Fine mode	4 mm
Resolution (using 12 bit A/D)	0.5 µm
Accuracy ⁽⁶⁾	< 20 µm
Maximum operational speed ⁽⁷⁾	4 m / sec
Output signal latency ⁽⁸⁾	250 µs

The native outputs signals are analog Sine / Cosine and the digital outputs are obtained by using the external module SC2SSi . Synchronous Serial Interface (SSI) transmits the absolute position data from the Electric Encoder™ in response to controller clock pulses. The encoder and controller are linked by clock and data differential signal lines.

Figure 1 illustrates the SSI timing diagram as implemented in the SC2SSi module. The module also provides advanced calibration and monitoring options using the **NCP (Netzer Communication Protocol)** and factory supplied software tools.

SC2SSi - Wires color code			
#	Name	Color	Function
1	Clock +	Grey	SSI Clock
2	Clock -	Blue	
3	Data -	Yellow	SSI Data
4	Data+	Green	
5	GND	Black	Ground
6	+5V	Red	Power supply



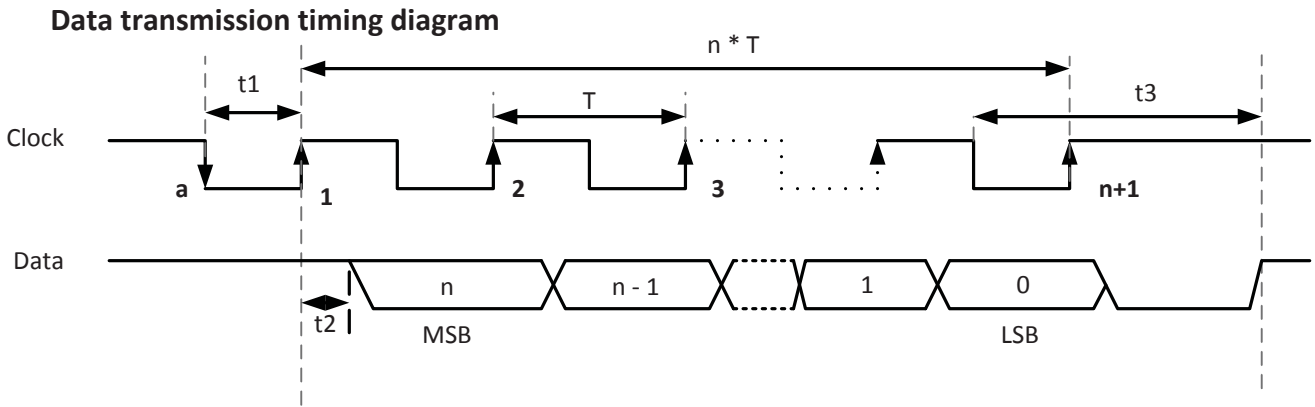


Figure - 1

n = total number of data bits.

T = clock period (sec) - user defined.

1/T = clock frequency 0.5 ÷ 2.5 MHz (user defined).

t1 = minimum time required for the encoder to freeze data and preset the shift registers before receiving the first rising edge to prompt the MSB

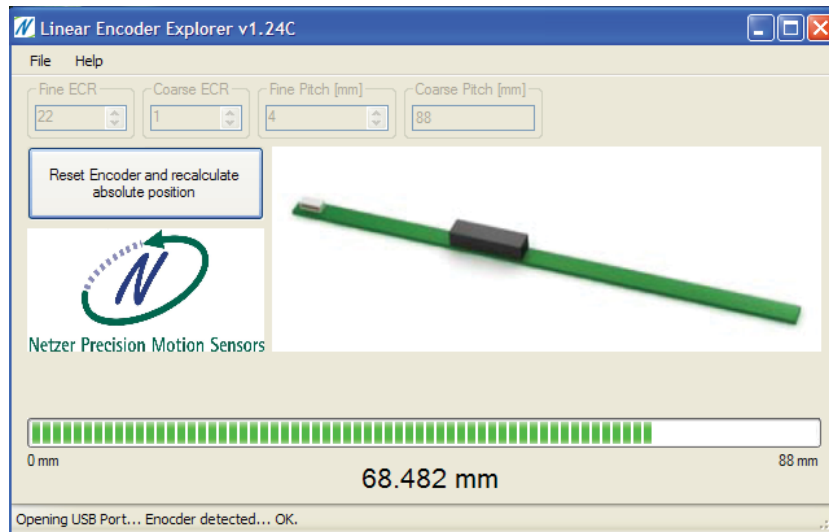
t2 = data transmission delay (increases with cable length)

t3 = required delay to refresh position data between subsequent position reads.

Position calibration & signal analysis with SSI interface:

The Electric Encoder™ processing capabilities enable calibration, built-in tests (BIT) and advanced setup, using the available software tools, such as:

- A. Simple calibration procedure using the Encoder Explorer (CAA , Offsets , Zero position setting).
- B. Field aid for validating proper mechanical mounting.



Output signal parameters

Signal latency ⁽⁸⁾	250 μ Sec
Fine-mode output noise (DC to 1kHz) ⁽¹⁰⁾	100 μ V (p-p)
Fine-mode output amplitude ⁽¹¹⁾	0.5V \pm 20%
Coarse-mode output amplitude ⁽¹¹⁾	0.3V \pm 0.1V
Phase relationship on Read-head movement away from the scale connector	Sine leads Cosine
Signal bandwidth	DC to 1 kHz

Electrical parameters

Output resistance	<1 Ω
Current consumption ⁴	\sim 10 mA

Operational characteristics

Period length – Fine mode	4 mm
Resolution (using 12 bit A/D)	0.5 μ m
Accuracy ⁽⁶⁾	< 20 μ m
Maximum operational speed ⁽⁷⁾	4 m / sec
Output signal latency ⁽⁸⁾	250 μ s

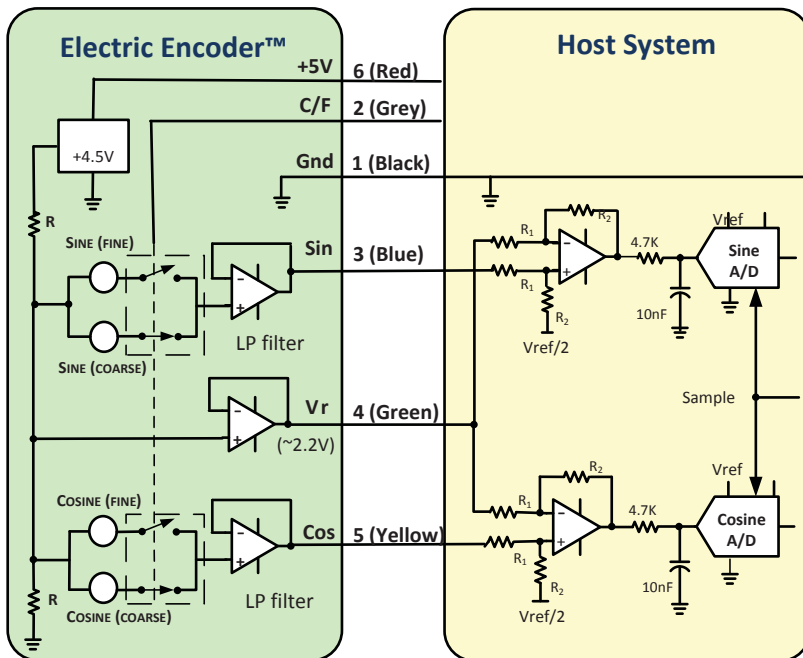
Coarse and Fine channels

The LA-10 has two operation modes selectable by a logic C/F command; logic "0" selects the Coarse-mode with a period length which extends the full length of the encoder scale, while logic "1" (+3V to +5V) selects the Fine-mode with it's 4 mm period length. Switching time is less then 1 ms.

The Coarse-mode outputs need to be read only upon system initiation, after which the encoder is permanently switched to the Fine mode. Coarse and Fine sine/cosine pairs are used to calculate the initial absolute position, from that point tracking the Fine-channel outputs provides the absolute mechanical position.

Absolute Position calculation:

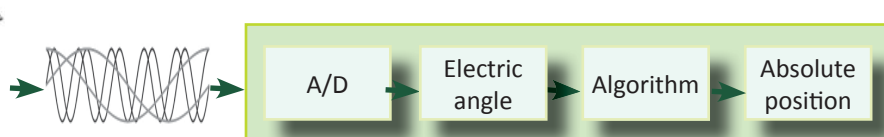
The analog Sine /Cosine outputs convey the electric angle of the Coarse or Fine signals. The absolute mechanical position is computed by digitizing the analog signals and applying factory-supplied algorithms (available as C code). Please refer to AN-02 and AN-03 .



Wires color code			
#	Name	Color	Function
1	GND	Black	Ground
2	C/F	Grey	Coarse / Fine
3	Sine	Blue	Sine signal
4	Vr	Green	V reference
5	Cosine	Yellow	Cosine signal
6	+5V	Red	Power supply



Electric Encoder



Host system

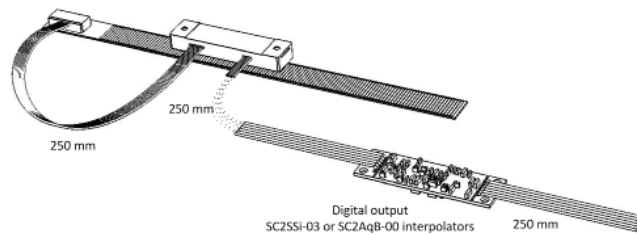
Notes

1. The output signals are generated by the whole area of the read head.
2. Accuracy may degrade depending on mounting tolerances.
3. The encoder includes an internal 4.5V LDO voltage regulator.
4. For a micro-power version with current consumption down to 50 μ A @ 3V (consult factory).
5. Consult factory.
6. Not including dynamic error. For higher static accuracy (consult factory).
7. Determined by the Fine-channel period lengths and the internal low pass filters (for higher speed - see AN-03 and consult factory).
8. An inherent signal delay inversely proportional to the internal filter's cut-off frequency (1 kHz, 3rd order Bessel type) and resulting in a dynamic error proportional to the rotation speed - see AN-05
9. The linear resolution is determined by the Fine channel period - and the encoder inherent noise – see AN-05.
10. For measuring the noise and validating the interconnection integrity - see AN-02.
11. With nominal air gap.

Demo Units:

Demo units with sliding read - head are available with analog or digital outputs, USB based interface with the encoder and SSi explorer enable instant setup for demonstration, integration and analysis.

- CAT # : DKIT-LA-10-88-B-0-4-88 with analog output
- CAT # : DKIT-LA-10-88-B-D-4-88 with SC2SSi for SSi output



Scale parameter example					
Scale length	Measurement length (Max)	Fine pitch	Fine ECR's	Coarse pitch (effective)	Counts per measurement length
100	40	4	10	40	40,960
146	88	4	22	88	90,112
200	140	4	35	140	143,360

