sensors rotary linear

motion

systems

controls

Linear absolute displacement sensors



The TR-Family of Linear Encoders

2	Rotary encoders Linear encoders Motion Systems	
	LA / LP - linear absolute measurement system with up to 4 m stroke 4 Questions lead to the most suitable sensor	
	What do you want to measure?	
	Rotary movements	
	· Linear movements	
	Where do you want to measure?	
	· Heavy duty application	
	 Special environmental conditions (EX. acids, food industry) 	
	 Which resolution do you need? Incremental or absolute Single- or Multi-Turn Steps per revolution, number of revolutions Which interface does your control provide? Direct connection (SSI, Analog, INC, Sin/Cos etc.) 	
	Field bus (Profibus, Interbus, CAN etc.)	
	Integrated control functions (cams)	



Measuring Principle

Functional description

The measuring principle is based on a travel time delay measurement (ultrasonic range). The ultrasonic travel time is proportional to the distance and is processed electronically. Current pulses are sent through a magnetostricitve wire, positioned inside a protective tube, creating a ring-shaped magnetic field around the wire. A non-contact permanent magnet serves as a position sensor, touching the waveguide with its magnetic field.

The magnetic field created by the current pulses generates a magnetostriction at the point of measurement due to the two differentially aligned magnetic fields. The resulting ultrasonic signals spread out from the position sensor in both directions. The ultrasonic signal moving towards the detector head is detected and converted into an electrical pulse. Ultrasonic waves moving towards the tube end are absorbed in the damping zone to prevent any echo effect.

The time difference between the transmission of the current pulse and the arrival of the torsion pulse is converted electronically into the distance information, which is provided either as a digital or analog output. If the position sensor is moved mechanically in a non energized state, the current position is available after the power supply is switched on again. The LA/LP-system is a non-contact and wearfree process. As the position sensor is a permanent magnet, it does not need any power supply.



Application

Linear movements are detected directly, converted into electrical information and can be processed by secondary devices, such as displays, control units and computers. Different interface modules allow the connection to interfaces for standard PLC, CNC controllers or industrial PCs.

As the measuring principle is non-contact, the absolute displacement sensors LA/LP can also be used in aggressive or harsh environments, such as dust, concrete, pressure or spray, splash and cooling water. The LP-series is also available with a measuring slide, which ensures the correct distance between the profile housing and the magnet.

Examples of typical linear absolute displacement sensor applications:

hydraulic presses

foundries

material handling technology

rolling, bending and casting plants

- machine tools or transfer machines
- injection moulding machines
- wood processing machines
- packaging machines

Description LA/LP

LA: Linear absolute displacement sensor

Linear absolute displacement measurement system for measuring lengths up to max. 4000 mm. If the magnet is moved mechanically in a non energized state, the current position is available after the power supply is switched on again. The LA-system is a non-contact and wearfree process. Due to their round tube the linear absolute displacement sensors are suitable for direct installation in hydraulic cylinders. The measuring rod reaches a static pressure resistance of 600 bar (TÜV-approved).

• LP: Linear absolute displacement sensor in extruded aluminium section

Linear absolute displacement measurement system for measuring lengths up to max. 4000 mm. In contrast to the LA-system, the measuring length of the LP-series is protected by an extruded aluminium section. If the magnet is moved mechanically in a non energized state, the current position is available after the power supply is switched on again. The LP-system is a non-contact and wearfree process. The LP-series is also available with a measuring slide for easier installation of the position sensor. The distance between the position sensor and the profile housing is determined by the measuring slide. Only the slide, which holds the magnet, needs to be moved.



Linear Sensor in Extra Flat Extruded Aluminium Section



	Standard	with Industrial Ethernet	
Measuring lengths	50 mm bis 4000 mm, in 50 mm steps > 4000 mm on request	bis zu 2000 mm, in 50 mm steps > 2000 mm on request	
Resolution	0,05 mm	0,005 mm	
Interfaces	analog synchronous serial start/stop	EtherCAT Powerlink	
Programmability		TR-WINProg	
Supply Protection class (DIN 40 050)	24 VDC -20% +10% < 4 W IP 65	24 VDC -20% +10% < 4 W IP 65	
Operating temperature	0 +70° C	0 +70° C	

LMP 30 SSI



optional



LMP 30 EtherCAT





For Installation in Hydraulic Cylinders







LA 46 Profibus-DP



Flange



Optional rod-end-mounting thread



Linear Sensor with Especially Flat Construction



	Standard	Custom-made product
Measuring lengths	50 mm bis 2000 mm, in 50 mm steps	intermediate lengths o.r.
Housing lengths	83 mm	
Resolution	max. 0,005 mm hysteresis < 0,02 mm	higher resolution o.r.
Interfaces	synchronous serial analog CANopen Profibus-DP (shows fieldbus address on the outside) DeviceNet Powerlink	other interfaces o.r.
Programmability	TR-WINProg Fieldbus device via bus	
Supply Protection class (DIN 40 050)	24 VDC±10% < 4 W IP 65	
Operating temperature	0 +70° C	-20 +70° C other operating temperatures o.r.
Options	various magnet holders available	



Linear Sensor with Universal Variety of Interfaces





For Installation in Hydraulic Cylinders







Linear Sensor in Extruded Aluminium Section



	Standard	Custom-made product	
Measuring length	150 mm 300 mm 500 mm 700 mm 750 mm 1000 mm 1500 mm 2000 mm 2500 mm 3000 mm 3500 mm 4000 mm	intermediate lenghts o.r. measuring lengths > 4000 mm o.r.	
Resolution	max. 0,01 mm		
Interfaces	analog start/stop synchronous serial asynchronous serial incremental serial CANopen Profibus-DP DeviceNet	other interfaces o.r.	
Programmability	depending on interfaces		
Supply Protection class (DIN 40 050)	24 V DC ±10% IP 65		
Operating temperature	-20 +70° C	other operating temperatures o.r.	
Options	Multimagnet-detection programmable signalbits		



Level Measurement in Acids

LA 80			
Measuring length	Standard 100 mm bis 1000 mm, in 50 mm steps	Custom-made product intermediate lengths o.r. measurement lengths > 1000 mm	
 Housing longth	90 mm	0.r.	
Resolution	0.01 mm, analog 12 bits / 16 bits		
Interfaces	analog synchronous serial incremental serial	other interfaces o.r.	
Programmability depending on interface			
Supply Protection class (DIN 40 050)	24 V DC ±10% according to connector type up to IP 65		
Operating temperature	re -20 +70° C other operating temp		
Options	housing PTFE		

Resistance list

The linear absolute displacement sensor LA 80 was especially constructed for applications in chemical aggressive media or for the electroplating industry. In order to reach a high media resistance, the measurement system is made of the plastic polypropylen (PP). Nevertheless, the characteristics of this kind of plastic change in different media* with varying degrees, according to the temperature.

legend:	+	swelling < 3%	loss of weight < 0,5%	ultimate elongation not changed
	/	swelling 3 - 8%	loss of weight 0,5 - 5%	ultimate elongation < 50%
	-	swelling > 8%	loss of weight > 5%	ultimate elongation > 50%

	concentration	characteristics at 20° C	characteristics at 60° C	characteristics at 100° C
Sulfurous acid		+	+	
Sea water		+	+	+
Soap solution, watery	any	+	+	
Spirits		+		
Oil of turpentine	technical pure	-		
Mineral spirits	technical pure	1	-	
Quinine		+	+	
Lemon juices		+	+	
Cola-concentrates		+	+	

LA 80 analog



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Installation

Installation instructions

General information

Strong stray magnetic or electrical interference fields close to the displacement sensor have to be avoided during the installation of the LA device. Inadmissible interference fields may influence the measuring accuracy. The maximum field strength close to the measuring rod is 3 mT.

Mechanics of the LA-system

The measuring value is coupled into the sensor rod without contact via the magnetic field of the position sensor. The accuracy of the measuring values depends - among other things - on the symmetry of the magnetic field geometry. Impact on the mechanics: the magnet has to be moved centrally and precisely axial parallel to the rod.

Mechanics of the LP-system

As there is no mechanical routing of the magnet, the installation of the displacement sensor is quite easy. The optimal glide characteristics of the measuring slide complement the contactless detection of the measuring position. In order to avoid additional wearing out of the glide routing on the slide, the tolerance data (angular and parallel misalignment) have to be respected.

The accuracy of the measuring values depends - among other things - on the symmetry of the magnetic field geometry. Impact on the mechanics of the LP-system without measuring slide: the magnet has to be moved centrally and precisely axial parallel to the rod. Exceeding the maximum distance of 4 mm between the magnet and the extruded aluminium section has to be avoided.

Important hints about the handling of the displacement sensor during the installation

- do not open
- do not hit or knock against
- do not drill or weld
- do not bend the measuring rod



- A holder for the linear absolute displacement sensor
- B position sensor
- C spacer for the magnet

If magnetizable fixing material is used, a 10 mm heavy spacer, made of non-magnetizable material, has to be used, keeping a distance of > 3 mm to the magnet's girth.

Screws made of non-magnetizable material have to be used for mounting the magnet. (e.g. brass, aluminium, plastic etc.).

D Hydraulic sealing on flange via O-ring

These data are also valid for the displacement sensor LP-38 without measuring slide!

- E recommended support of the measuring rod for rod lengths > 1,5 m (suggestion for the support)
- F option: threaded blind hole M4x5 at the end of the rod for rod mounting

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Programmable Absolute Fieldbus Encoders The standard in automation technology, available for all commercial fieldbus systems, such as Profibus, Interbus, CANopen, DeviceNet and Industrial Ethernet.

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Linear Absolute Displacement Sensors The compact class for linear absolute measurement. Directly bus capable, suitable for harsh environmental conditions and for installation in hydraulic cylinders.





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