ESR STRAIN SENSOR SERIES

Robust and precise strain measurement



The ESR strain sensor series provides precise strain measurement with a direct digital output interface. This is a future-proof choice, even when harsh environmental conditions prevail.

Leine Linde presents a new way to measure and monitor strain in mechanical structures and improve machine control. This can be used for all conceivable applications such as cranes, steel mills and wind turbines.

Fatigue-free measurement concept

The ESR strain sensor series is based on an electro-optical rotary encoder in which the signal conversion takes place directly in the sensor and thus the measurement signal contains an extremely low noise even with long cable lengths. This technique has been known for many years, matured and manufactured industrially.

For the strain measurement the change in length of a reference distance of 200 mm is used. The material of the measuring arm can be adapted to the material of the object to be measured, for a built-in passive temperature compensation.

The design also realizes a completely fatigue-free measurement concept, since there is no strain put on the mechanics in this construction. Installation and commissioning is made simpler, and quality and repeatability of results are significantly improved compared to previously available strain measurement technology.

Data interface and fieldbus converter

All sensors of the ESR series use the bidirectional EnDat 2.2 interface for data transmission. This can either be read directly into the measurement data acquisition or

system control, or be connected to a fieldbus by means of gateways.

Various gateways are available for connecting one or up to four ESR sensors to the following fieldbuses:

PROFIBUS [®] PROFINET [®] CANopen [®] EtherNet/IP [™] POWERLIN	ET [®] CANopen [®] EtherNet/IP [™] POWERLINK
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LEINE 🗳 LINDE

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Sensor parameters

The combination of a high-resolution rotary encoder and the developed mechanics results in a resolution of 5 nm or 0.025 $\mu\epsilon$ (μ m/m; microstrain) in a measuring range of ± 5 000 $\mu\epsilon$. The mechanically permissible working range is \pm 17 500 $\mu\epsilon$. Thanks to the robust sensor construction with a non-slip housing made of aluminum, it is IP 66 protected and can be used in a temperature range from -40 °C to +100 °C.

Advantages and benefits of digital strain measurement

In the ESR strain sensors, signal acquisition, digitization and transmission are performed by a highly integrated opto-ASIC. This results in unique advantages for users:

- Very high resolution of the measurement signal leads to more information about the application
- Very low signal noise makes elaborate filtering unnecessary
- Digital interface enables lossless data transmission even with long cable lengths
- CRC-tested data transmission provides a high level of security with regard to measured value changes

- High sampling frequency also enables measurement in dynamic applications
- Integrated temperature sensor enables on-site measurement of ambient temperature
- Self-monitoring of the sensor helps preventive maintenance
- Integrated memory can be used to store applicationspecific information and automate machine commissioning

Measurement reports and certificates

As part of the production, every product is extensively tested and measured for precision. A quality control certificate compliant to DIN 55 350-18-4.2.1 is supplied with each sensor. The certificate documents sensor accuracy by specifying the respective item and series number. The certificate also states the calibration standard and ensures compliance with national and international standards and traceability.

Optional: a quality control certificate compliant to DIN 55 350-18-4.2.2, or DAkkS calibration according to DIN EN ISO/IEC 17025, can be performed on demand. The created calibration certificate documents a generally recognized traceability of the measuring device by an independent and neutral body.

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Suitable for different needs

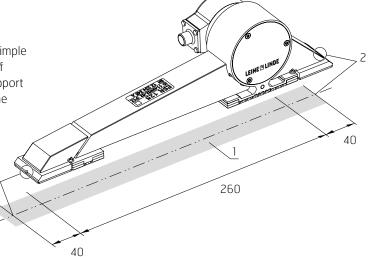
The ESR sensor measures strain and compression along a measuring axis. When transverse contraction occurs, the sensor is insensitive.

The sensor can be used for permanent or short-term measurement installations, depending on the user's needs. If there is a need for a movable installation, extra adapter sets can be ordered, and then the sensor can be either reused, or moved between the different installations.

The different sensor variants have different methods for fixation: adhesive, screw-on, or magnetic installation. All variants also come with a choice of material for the measurement arm, in order to enable passive temperature compensation. Glass fiber reinforce polymer (GFRP), austenitic steel, and carbon fiber reinforced polymer (CFRP), all have different coefficients of thermal expansion, see the table below.

Easy alignment

The design as well as markings on the sensor enable a simple and accurate alignment of the sensor in the direction of measurement. The enclosed assembly aid serves to support the positioning of the measuring arm in the center of the measuring range.



- 1. Along the measurement axis, a distance of 200 mm is used as the reference for measurement.
- 2. The markings are used for alignment of the measurement axis (notch and bead principle).

Sensor variants and accessories

Material * Variant	GFRP 8 x 10 ⁻⁶ K	Austenitic steel 16 x 10 ⁻⁶ K	CFRP 1 x 10 ⁻⁶ K	
ESR 125 Adhesive installation	1143902-01	1143902-02	1143902-03	
ESR 225 Adhesive installation (screw-on adapter)	1221549-01 (including adapter)	1221549-02 (including adapter)	1221549-03 (including adapter)	
560.005	Adapter set for adhesive installation 1225450-01			
ESR 225 - accessories	Template for adhesive installation 1222784-01			
ESR 325 Screw-on installation (screw-on adapter)	1221551-01 (including adapter)	1221551-02 (including adapter)	1221551-03 (including adapter)	
ESR 325 - accessories	Adapter set for screw-on assembly 1225451-01			
ESK 325 - accessones	Drilling template for screw-on assembly 1223311-01			
ESR 425 Magnet installation (screw-on adapter)	1247400-01 (including adapter)	1247400-02 (including adapter)	1247400-03 (including adapter)	

* Coefficient of thermal expansion of the ESR measurement section.

Technical data				
	ESR 125	ESR 225	ESR 325	ESR 425
Measuring step	0.025 με	0.025 με	0.025 με	0.025 με
Measuring range	+/- 5 000 με	+/- 5 000 με	+/- 5 000 με	+/- 5 000 με
Permissible mechanical working range	+/- 17 500 με	+/- 17 500 με	+/- 17 500 με	+/- 17 500 με
Power supply	3.6 VDC14VDC	3.6 VDC14VDC	3.6 VDC14VDC	3.6 VDC14VDC
Output signal	EnDat 2.2	EnDat 2.2	EnDat 2.2	EnDat 2.2
Connection	M12 connector 8-pin	M12 connector 8-pin	M12 connector 8-pin	M12 connector 8-pin
Operating temperature	-40°C+100°C	-40°C+100°C	-40°C+100°C	-40°C+80°C
Ingress protection class [IEC 60529]	IP 66	IP 66	IP 66	IP 66
Vibration [IEC 60068-2-26]	< 200 m/s ²	< 50 m/s ²	< 50 m/s ²	< 20 m/s ²
Shock [IEC 60068-2-27]	< 300 m/s2	< 100 m/s ²	< 100 m/s ²	< 40 m/s ²

Dimensions

