# 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™ POWERLINK

LEINE LINDE

Leine & Linde AB T +46-(0)152-265 00 F +46-(0)152-265 05 info@leinelinde.com www.leinelinde.com

## Sensor parameters

The combination of a high-resolution rotary encoder and the developed mechanics results in a resolution of 5 nm or 0.025 με (µm/m; microstrain) in a measuring range of ± 5 000 με. The mechanically permissible working range is ± 17 500 με. 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

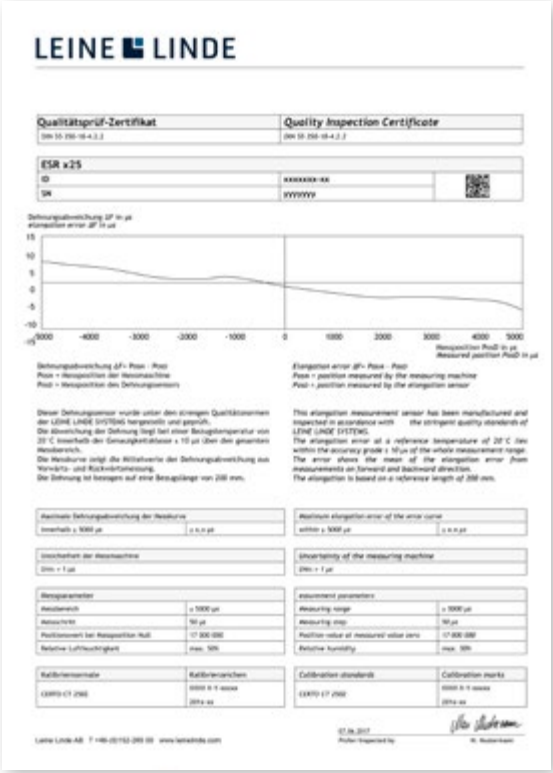
In the ESR strain sensors, signal acquisition, digitization and transmission are performed by a highly integrated opto-ASIC. This results in unique advantages for users:

- 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 application-specific 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.


LEINE LINDE

Qualitätsprüf-Zertifikat | Quality Inspection Certificate

ESR x25

## Suitable for different needs

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

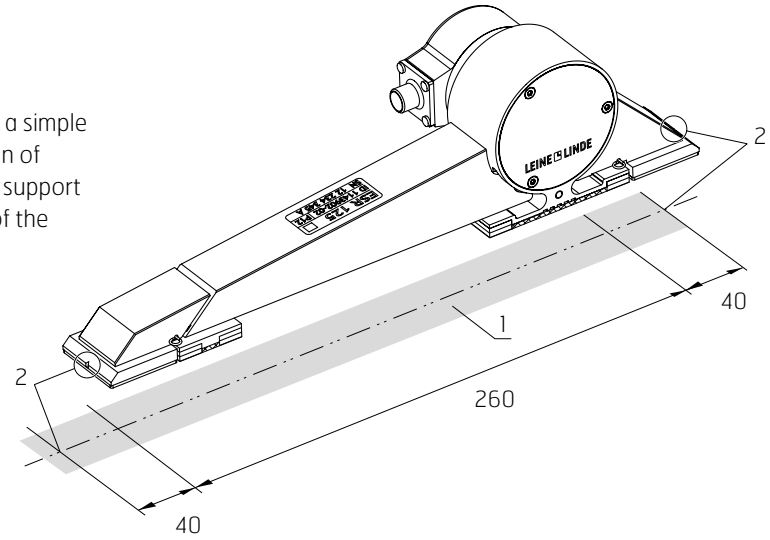
The sensor can be used for permanent or short-term measurement installations, depending on the user's needs. If there is a need for a movable installation, extra adapter sets can be ordered, and then the sensor can be either reused, or moved between the different installations.

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<br>8 x $10^{-6}$ K | Austenitic steel<br>16 x $10^{-6}$ K | CFRP<br>1 x $10^{-6}$ K |
|---|---|---|---|
| ESR 125<br>Adhesive installation | 1143902-01 | 1143902-02 | 1143902-03 |
| ESR 225<br>Adhesive installation<br>(screw-on adapter) | 1221549-01<br>(including adapter) | 1221549-02<br>(including adapter) | 1221549-03<br>(including adapter) |
| ESR 225 – accessories | Adapter set for adhesive installation 1225450-01 | | |
| | Template for adhesive installation 1222784-01 | | |
| ESR 325<br>Screw-on installation<br>(screw-on adapter) | 1221551-01<br>(including adapter) | 1221551-02<br>(including adapter) | 1221551-03<br>(including adapter) |
| ESR 325 – accessories | Adapter set for screw-on assembly 1225451-01 | | |
| | Drilling template for screw-on assembly 1223311-01 | | |
| ESR 425<br>Magnet installation<br>(screw-on adapter) | 1247400-01<br>(including adapter) | 1247400-02<br>(including adapter) | 1247400-03<br>(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 VDC ...14VDC | 3.6 VDC ...14VDC | 3.6 VDC ...14VDC | 3.6 VDC ...14VDC |
| **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/s² | < 50 m/s² | < 50 m/s² | < 20 m/s² |
| **Shock [IEC 60068-2-27]** | < 300 m/s2 | < 100 m/s² | < 100 m/s² | < 40 m/s² |

## Dimensions