

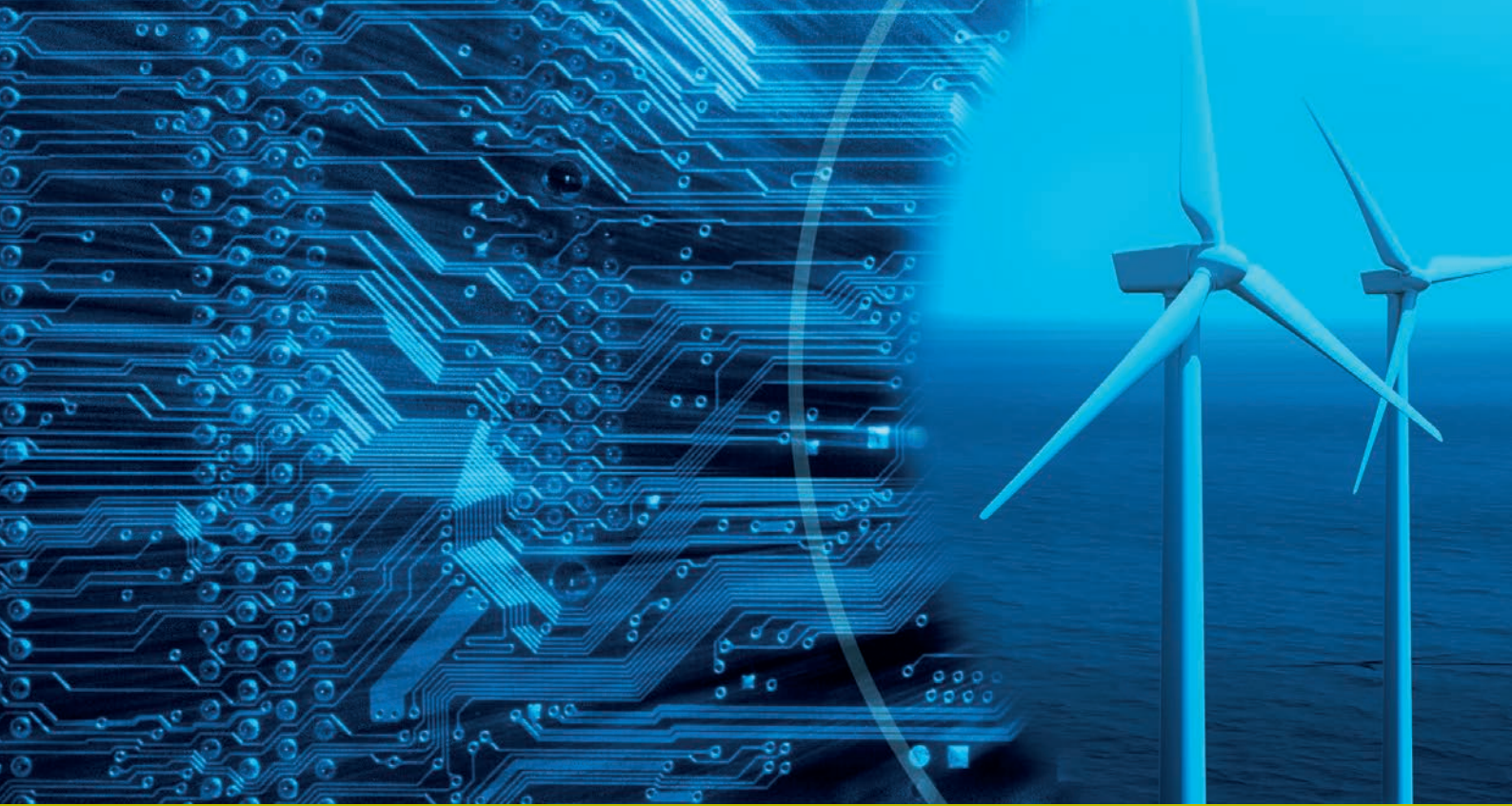
HEIDENHAIN



Structural Health Monitoring

**Protect your investments
with precise, digital sensor technology**

HEIDENHAIN | LEINE LINDE



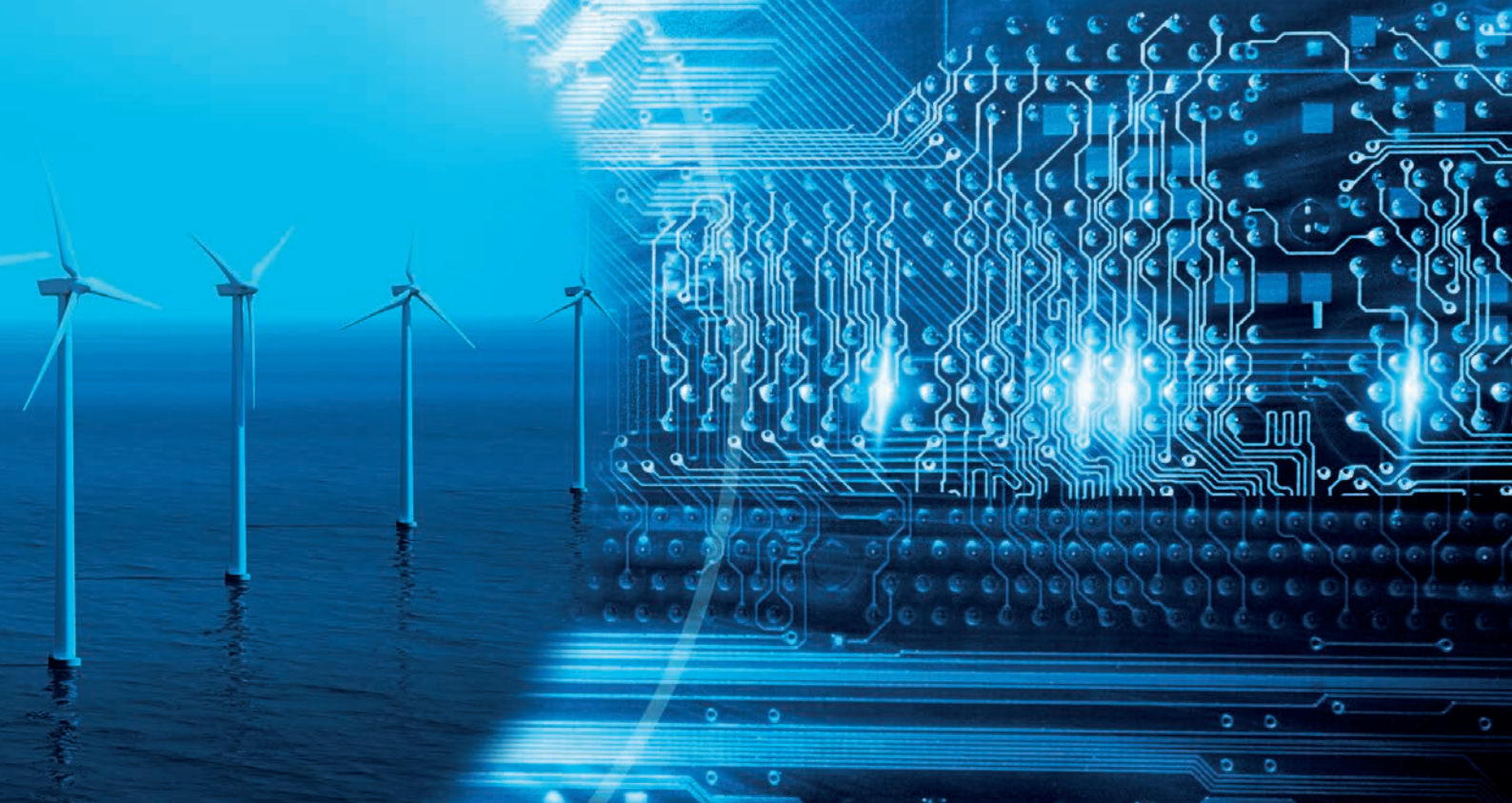
Structural Health Monitoring

Wind turbines, industrial structures, civil structures, and buildings are subject to various loads based on environmental factors and operating conditions. The high-quality ESR sensors from HEIDENHAIN and LEINE LINDE can measure these loads with exceptional accuracy. Measurements from these sensors can detect even the tiniest alteration, movement, or vibration:

- Strain down to $0.025 \mu\epsilon$
- Dynamic vibrations up to 30 kHz

The ESR strain sensors feature a digital interface that reliably transmits data over long distances. Transmitted measurement data are accompanied by sensor-related diagnostic and status data. Acceleration and temperature data from external sensors can be relayed as well.





Benefits of ESR sensors:

- High resolution
- Wide measuring range
- Rapid scanning
- Highly dynamic measurement
- Digital interfaces
- Sturdy design
- Tension-free measuring principle
- Easy installation

The ESR strain sensors combine the expertise of HEIDENHAIN and LEINE LINDE, yielding an innovative technology for strain and load measurement on structural and industrial assets.

Versatile installation

The right mounting technology for every application:

ESR 125: direct adhesive mounting

- For permanent installation

ESR 225: adhesive anchors

- For repeated measurement campaigns

ESR 325: screw-on anchors

- For fixed-period installation

ESR 425: magnetic mounting

- Rapid installation for short-term measuring tasks

These installation options make the ESR strain sensors suitable for both long-term operation and short-term measurement campaigns.

Wind turbines

Benefits of ESR sensors:

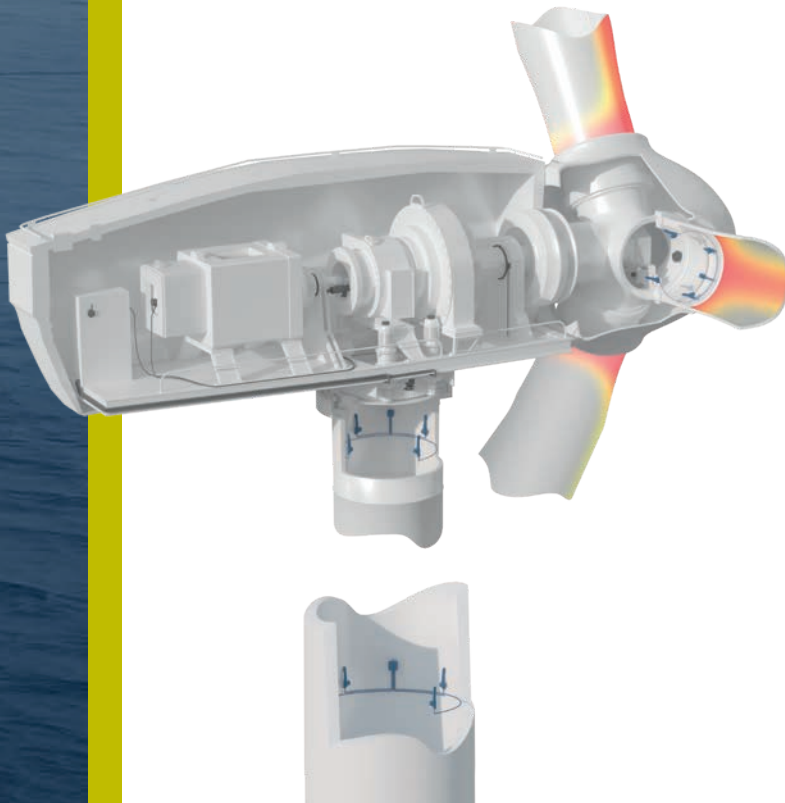
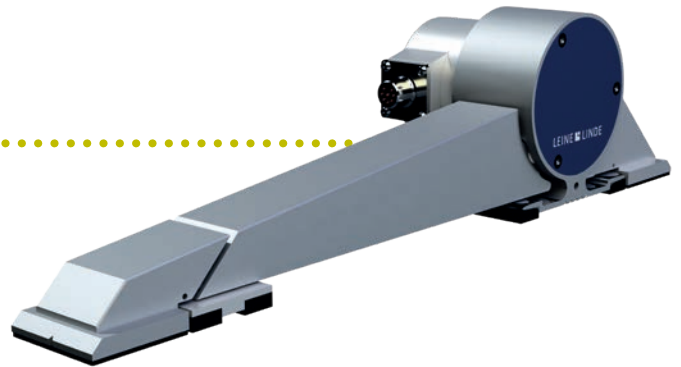
- High scanning frequency
- Digital interface
- Sensor status monitoring



Precise measurements for optimal performance

Wind-turbine service life and effectiveness are greatly affected by the wind forces acting on the rotor blades and tower. ESR sensors deliver exact, highly dynamic measurements of these loads. Based on these measurements, control strategies for individual rotor blade adjustment ensure optimal energy production and reduced-load pitch control. The ESR sensors directly measure the strain near the root of the rotor blade, with two to eight sensors installed per blade.

- The high-accuracy measurements of the ESR sensors create a perfect data pool for reliably verifying mathematical simulations. The ESR sensors also feature a built-in temperature sensor, enabling enhanced temperature compensation during system operation. Other sensor status information can be called at any time.



Areas of application

- Pitch control
- Continuous structural monitoring
- Inspection of large components (rotor blades, towers)

Bridges, substructures, and buildings

Benefits of ESR sensors:

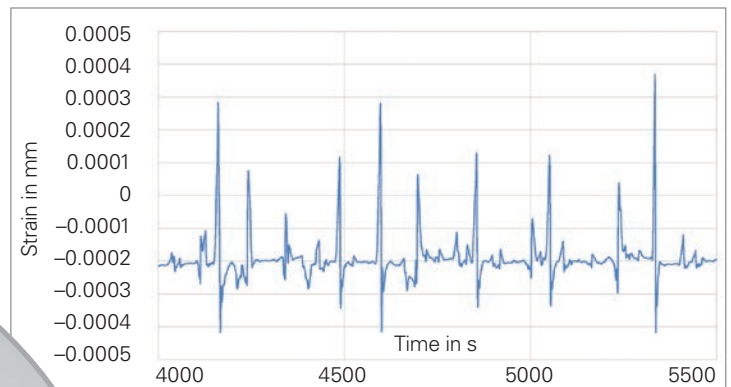
- Sturdy enclosed design
- High-accuracy measurements
- Sensor status monitoring



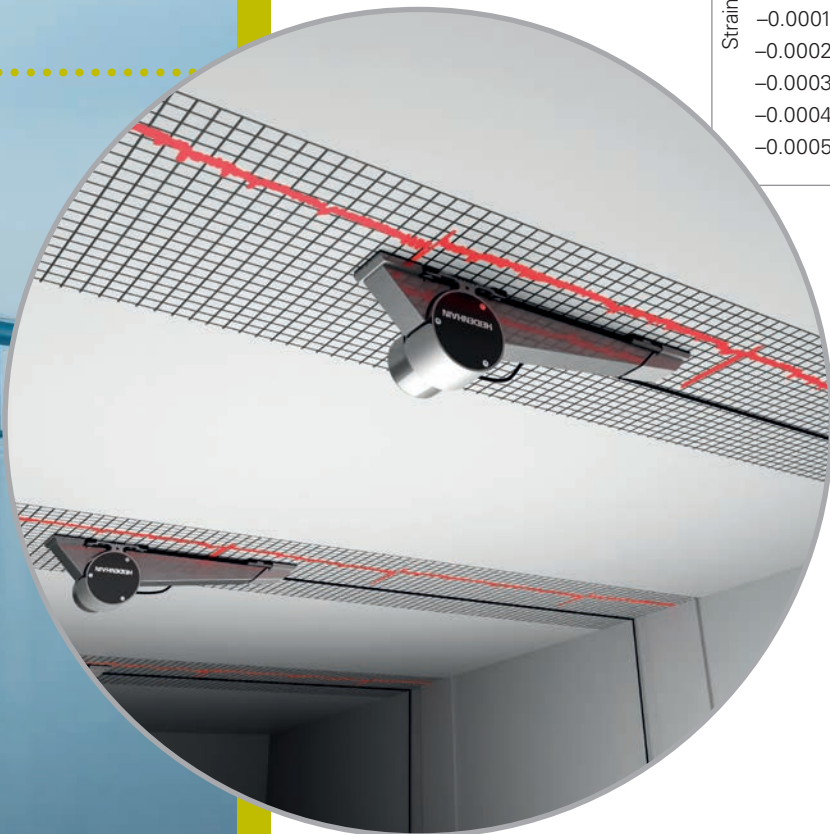
Detailed analysis of dynamic measurements

Accurate and dependable measurement data are essential for monitoring and analyzing structural health. The ESR strain sensors offer decisive benefits in this field. Thanks to their rugged design, the ESR sensors can be flexibly deployed in adverse weather and harsh environments. Changeable installation options make them suitable for widely varying applications. The ESR sensors also feature built-in status monitoring, informing you about all key operational parameters.

- The ESR strain sensor stands out for its high accuracy and dynamic sensitivity. Measurements at a resolution of $0.025 \mu\epsilon$ can register even the tiniest change. This resolution, combined with a high scanning rate, allows the sensor to measure even the smallest vibrations with extreme accuracy.



Exceptional accuracy for dynamic bridge loading



Areas of application

- Long-term structural monitoring
- Crack monitoring
- Load monitoring

Machines, industrial assets, storage and retrieval systems

Benefits of ESR sensors:

- Highly dynamic strain and vibration measurement
- Fast and lossless data transmission
- Flexible mounting options for easy installation



Stay ahead with pinpointed monitoring

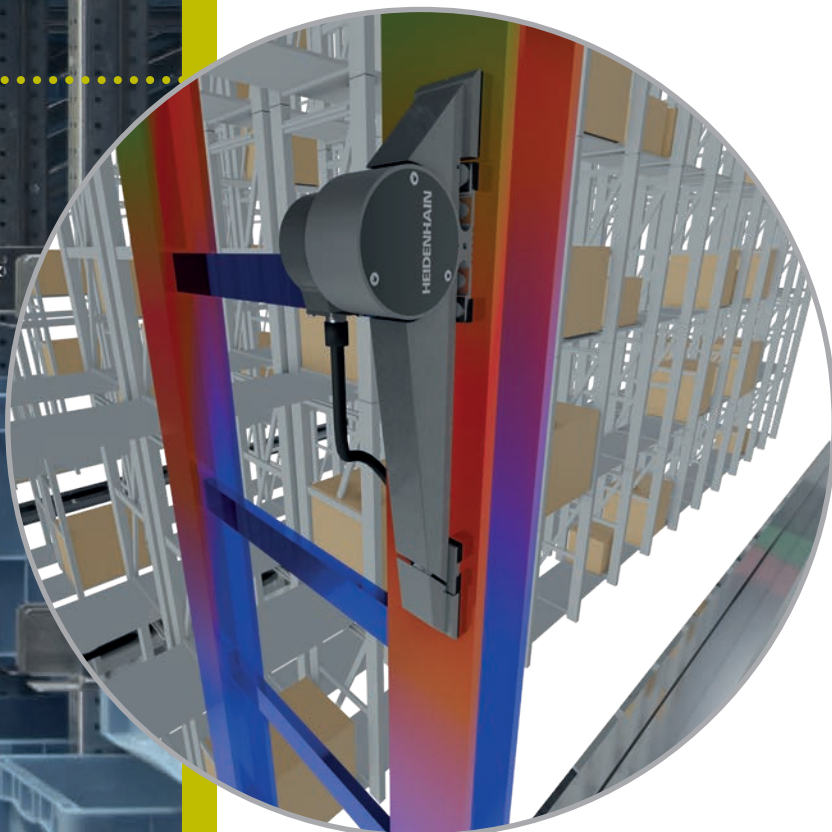
Machines and industrial assets are often exposed to large moving masses. The resulting static and kinematic forces can cause deformations and vibrations, leading to inaccuracy and material fatigue. The ESR sensors can measure these loads with great exactness.

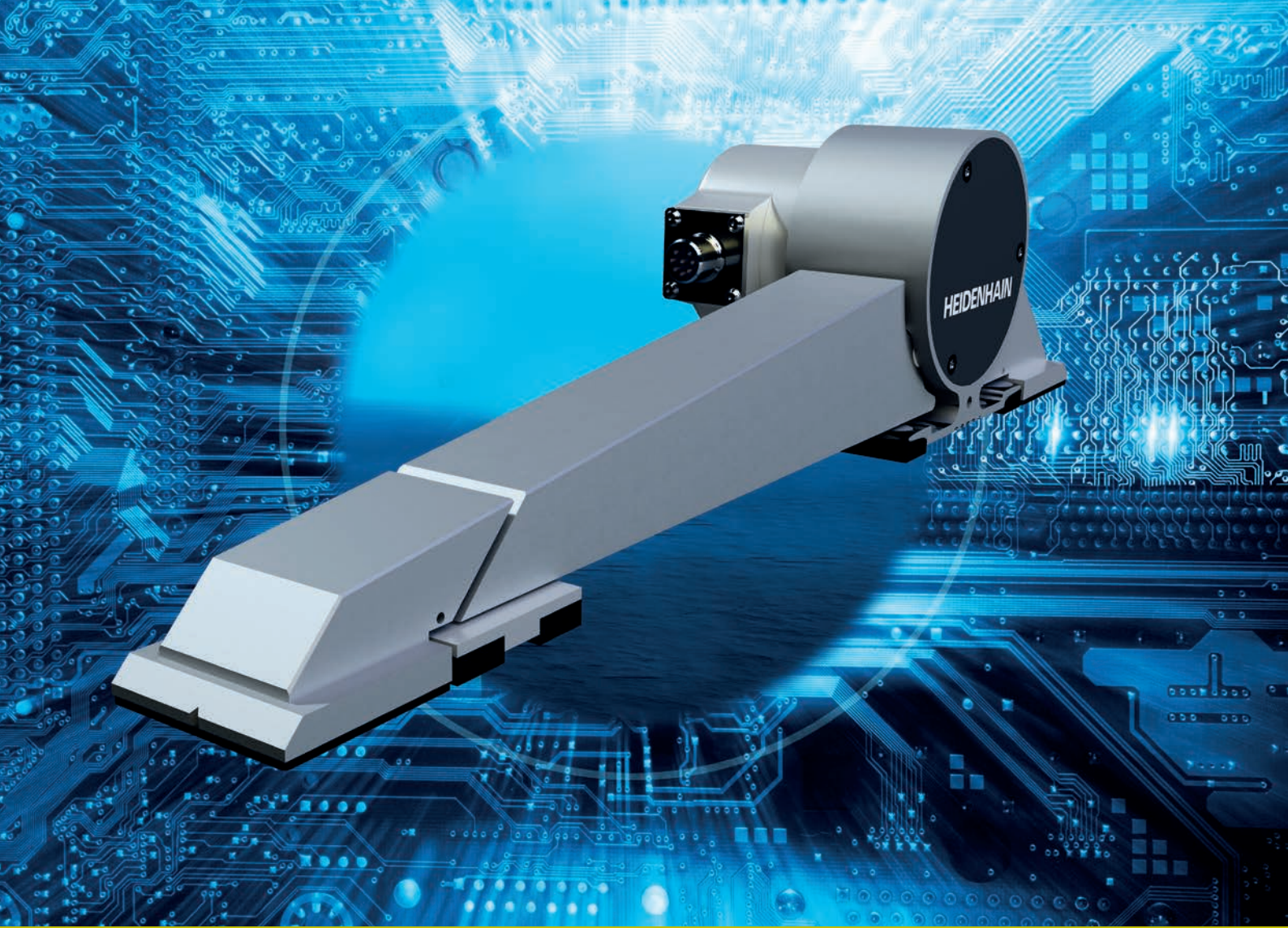
- Their flexible mounting design enables fast, easy, and changeable sensor installation. Thanks to fast data transmission and a high scanning rate, the ESR sensors can measure even slight vibrations with precision. The ESR sensors give you unique options for optimizing your industrial structures.



Areas of application

- Vibration load measurement
- Machine model verification
- Load-induced deformation detection
- Control loop optimization

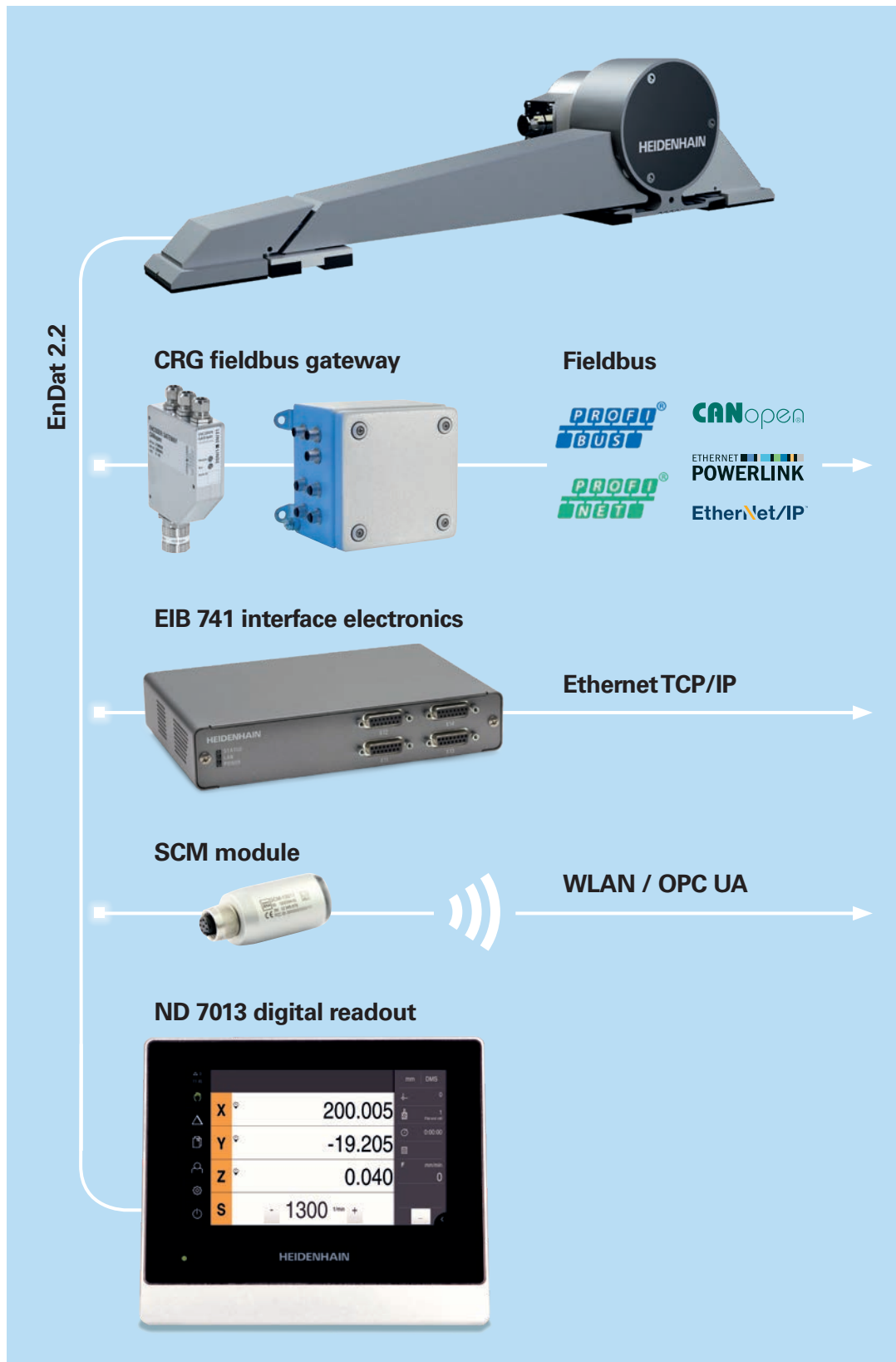




Precise and robust strain measurement

- Proven sensor technology
- High resolution and low signal noise
- Forceless measurement and operation
- Integrated temperature sensor
- Installable on existing structures

Interface electronics: Gather and visualize data



The ESR strain sensors combine the expertise of HEIDENHAIN and LEINE LINDE, yielding an innovative technology for strain and load measurement on structural and industrial assets.

HEIDENHAIN specializes in high-accuracy measurement and control technology.

HEIDENHAIN

LEINE LINDE develops customized rotary encoders and sensor solutions for demanding environments.

LEINE LINDE



For more information, visit
structural-monitoring.heidenhain.com

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