

Contact Wire Inspection System (Low-speed)

Wire position and wear

Measuring up to eight contact wires simultaneously

The CIS-LS combines a camera system for recording the wire wear and a laser scanner for detecting the contact wire position.

Position and wear of contact wires are important parameters for an efficient, condition-based catenary maintenance. With its low-speed Contact Wire Inspection System CIS-LS, Fraunhofer IPM offers a combined optical measurement system for recording the vertical and horizontal position of up to eight contact wires simultaneously while also measuring their degree of wear.

Non-contact optical measurement

The CIS-LS by Fraunhofer IPM measures wire position and wear contactlessly in one single measurement process. In contrast to the CIS, the sensors of this low-speed variant are vertically mounted inside the wagon, except for the illumination panel, which is fitted on the roof (see image page 2). The CIS-LS comprises

- Contact Wire Recording System CRS
- Wire Wear Monitoring System WWS

Reliable operation at up to 60 km/h

The system is suitable for use at speeds of up to 60 km/h. A processing unit inside the inspection train provides the operators on site

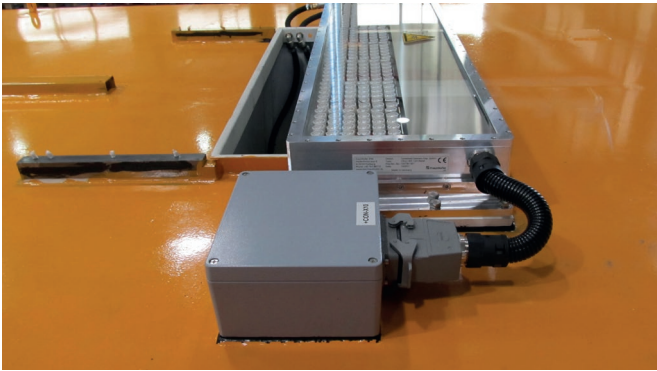
with processed position data that has already been compensated for the train's roll, which is recorded separately. Additional features, such as the automatic cleaning of the measurement window, ensure that the system operates reliably and requires little maintenance. The CIS-LS features its own lighting unit, meaning it can be operated reliably at any light situation, including at night, in tunnels, or under bridges.

Camera-based wire wear detection

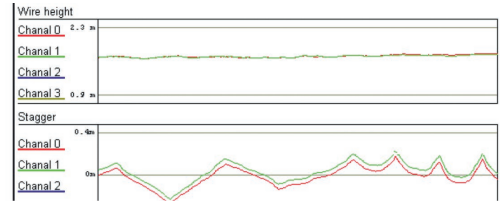
A camera is used to identify the level of wire wear. The residual thickness of contact wires with a round cross section is calculated from the width of their sliding surface. The system's camera-based measuring unit records the sliding surface and uses this information to

Railroad measurement systems by Fraunhofer IPM

Fraunhofer IPM develops optical measuring systems for monitoring the condition of rail infrastructure. Experts in measuring techniques and optics, designers, electrical and software engineers work together on supplying turn-key solutions for the special requirements of infrastructure operators and providers of surveying services. The robust measuring systems are deployed throughout the world and are characterized by their speed, precision and reliability.



actual measurement
 wire wear:
 channel 0: 8.9
 channel 2: 7.2
 position:
 h0: 1717 s0: -46
 h1: 1698 s1: 7
 h2: 10000 s2: 10000



Left: Typical arrangement of the CIS-LS on a train's roof. An LED panel illuminates the measurement environment. Above: Typical measurement results.

derive data about the degree of wear. One line-image is acquired every millimeter. Typically, a measurement value is generated every 12 mm.

Laser scanner for detecting wire position

The laser-based measuring unit (CRS), used to record contact wire position, was significantly upgraded for integration into the CIS-LS. Higher scan frequencies have improved the system's precision. The measurement range has been extended to 10 meters, while the sampling rate, i.e. the number of measuring points per scan, has been increased sixfold.

Modular system

The modular setup of the CIS-LS' acquisition unit comprises the WWS and CRS. As a one-box solution, the system can be mounted flexibly on a broad range of measuring vehicles, on the sole condition that the LED-panel be placed nearby. Optimized illumination with two LED panels instead of one allows measurements at up to 120 km/h, while maintaining all specifications. A customer friendly software features the analysis of the catenary system.

Technical specifications

Low Speed Contact Wire Inspection System CIS-LS

Allowed range of wire position Sensor mounted about 1 m below roof	Height: 700–2,600 mm above roof Stagger: ± 500 mm
Uncertainty for height and stagger	5 mm (1σ, 3 m, R= 10%), in relation to the acquisition unit
Resolution of thickness	0.1–0.2 mm (depending on wire position)
Accuracy of thickness (typical value)	from ± 0.3 mm to ± 0.5 mm (determined by height of wire and degree of wear)
Measuring rate	One line image per millimeter; typically one measurement value every 12 mm
Speed of measuring vehicle	Up to 60 km/h (one illumination panel)
Max. number of detectable contact wires	8 (maximum height distance of 40 mm)
Ambient temperature range - Storage - Measurement	- 15 to + 60 °C + 5 to + 35 °C (inside vehicle)

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All specifications and features are subject to modification without notice.

