

Contact Wire Inspection System

Measuring position and wear of up to eight contact wires simultaneously

The CIS uses cameras for recording wire wear and a laser scanner for detecting the contact wire position.

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

Non-contact optical measurement

The CIS by Fraunhofer IPM measures wire position and wear contactlessly in a single measurement process. The system comprises

- Wire Wear Monitoring System (WWS)
- Contact Wire Recording System (CRS)
- Laser Pole Detection System (LPS) (optional)

Reliable operation at up to 250 km/h

The CIS is mounted on the roof of an inspection car. Due to its high measurement frequency and rapid data processing, the system is suitable for use at speeds of up to 250 km/h. A processing unit inside the inspection train provides the operators on site with processed position data that has already been adjusted 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 has its own lighting unit, meaning it can be operated reliably in any lighting conditions, including at night, in tunnels, or under bridges.

Camera-based wire wear detection

Cameras are 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 CIS' camera-based measuring unit records the sliding surface and uses this information to derive data about the degree of wear. At a speed of 100 km/h, a line image is acquired every millimeter. Typically, a measurement value is generated every 12 mm.

Railroad measurement systems by Fraunhofer IPM

Fraunhofer IPM develops optical measurement systems for monitoring and mapping rail infrastructure. Experts in measurement techniques and optics, designers, and electrical and software engineers work together to supply turnkey solutions for the special requirements of infrastructure operators, planners, and providers of surveying services. The robust measurement systems are used around the world and are characterized by their speed, precision, and reliability.



The CIS installed on a train: The system is located between the two white air conditioning modules.



The CIS with open lid showing the individual sensors: The CRS (middle bottom), two LPS (left and right bottom), and LED panels for illumination. The cameras for wire wear measurement are located between the LED panels (not visible). The metal rails are used for the semi-automatic cleaning system.

Laser-based wire and pole detection

The CRS, a laser-based measuring unit, records the contact wire position. The system scans at high frequencies, achieving high precision. The measurement range extends from 0.5 m to 4 m, depending on the environmental conditions.

Another laser-based system, the LPS, can be integrated into the CIS for pole detection. The LPS provides precise pole location data where GNSS fails due to local coverage problems.

This helps to reliably locate defective sections identified during position and wear measurements.

Contact Wire Inspection System Low-Speed (CIS-LS)

With the CIS-LS, we offer a low-speed, low-priced version of the CIS. The CIS-LS records the vertical and horizontal position and wire wear of up to four contact wires simultaneously. (See separate product sheet for more information.)

Technical specifications

Contact Wire Recording System

Height range	from 750 mm to up to 3,600 mm (distance between contact wire and mounting plane of acquisition unit)
Stagger range	± 580 mm at 1,000 mm above mounting plane ± 700 mm at 3,200 mm
Uncertainty for height and stagger	5 mm (1σ , 3 m, $R = 10\%$), in relation to the acquisition unit

Wire Wear Monitoring System

Height range	750–2,600 mm above mounting plane
Accuracy of thickness (typical value)	from ± 0.3 mm to ± 0.5 mm (determined by height of wire and degree of wear)
Resolution of thickness	0.1–0.2 mm (depending on wire position)
Max. number of detectable contact wires	8 (maximum height distance of 40 mm)
Measurement rate	One line image per millimeter; typically one measurement value every 12 mm

Laser Pole Detection System

Measurement range	0.5–4 m
Diameters detected (e.g. of anchor arms)	12–200 mm

All specifications and features are subject to modification without notice. More detailed technical specifications on the individual systems are available on separate product sheets.

**CLASS 1
LASER PRODUCT**

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