

Contact Wire Inspection System

Wire position and wear

Measuring up to eight contact wires simultaneously

The Contact Wire Inspection System CIS 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 Contact Wire Inspection System CIS, 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 by Fraunhofer IPM measures wire position and wear contactlessly in one 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 compensated for the train's

roll, which is recorded separately. Additional features, such as automatic cleaning of the measurement window, ensure that the system operates reliably and requires little maintenance. The CIS 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 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 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.



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



CIS with open lid showing the individual sensors: 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 laser-based measuring unit (CRS) records the contact wire position. The system scans at high frequencies, reaching high precision. The measurement range extends from 0.5 m to 4 m depending on the environmental conditions.

For pole detection, another laser-based system (LPS) can be integrated into the CIS. LPS completes the measurement data by precise pole location, where GNSS fails to yield location data due to local coverage problems. This way, it helps to reliably

locate defective sections identified during position and wear measurement.

Low-Speed Contact Wire Inspection System 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. (For more information see separate data sheet)

Technical specifications

Contact Wire Recording System CRS

Height range	from 750 mm 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 WWS

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 LPS

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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