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1 *The CIS allows detecting contact wire wear and position fast and efficiently with one single system.*
2 *CIS combines a camera system for recording the wire wear (illustrated) and a laser scanner for detecting the contact wire position.*

Fraunhofer Institute for Physical Measurement Techniques IPM
Georges-Köhler-Allee 301
79110 Freiburg, Germany

Contact
Prof Dr Alexander Reiterer
Head of Department
Object and Shape Detection
Phone +49 761 8857-183
alexander.reiterer@ipm.fraunhofer.de

Dr Philipp von Olshausen
Group Manager
Phone +49 761 8857-289
philipp.olshausen@ipm.fraunhofer.de

www.ipm.fraunhofer.de/railway

CONTACT WIRE INSPECTION SYSTEM CIS

Detection of wire position and wear

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 ten contact wires simultaneously while also measuring their degree of wear. CIS is the only system worldwide to measure wire position and wear contactlessly in one single measurement process. The CIS comprises

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

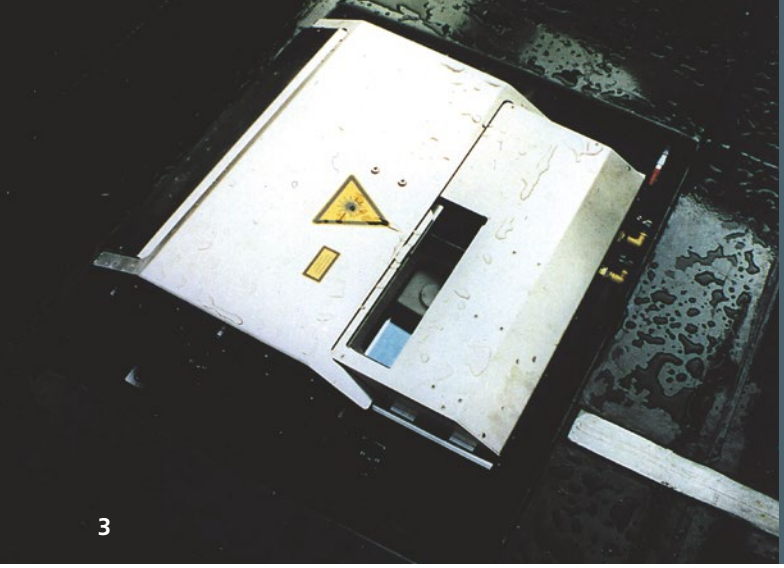
Reliable operation at up to 350 km/h

The Contact Wire Inspection System 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 350 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 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

** More detailed information on the individual systems is available on separate product sheets.*



3 *Top view of the contact wire position sensor in its hermetically sealed housing.*
4 *Typical arrangement of the laser pole detection system LPS with sensor heads next to pantograph.*

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 reading is taken every 13 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. 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.

Laser-based pole detection

For pole detection another laser-based system (LPS) can be integrated into the CIS. LPS completes other 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.

Technical Specifications

CLASS 1 LASER PRODUCT

Contact Wire Range System CRS

Height range	750–3,600 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	800– 2,100 mm above mounting plane
Uncertainty	from ± 0.3 mm to ± 0.5 mm (mainly determined by the degree of wear)
Max. number of detectable contact wires	10 (maximum height distance of 40 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 is available on separate product sheets.

Railway Measurement Technology at 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 turnkey 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.

Other railroad measurement systems made by Fraunhofer IPM:

- *High-Speed Profiler HSP*
- *Clearance Profile Scanner CPS*
- *Wire Wear Monitoring System WWS*
- *Contact Wire Recording System CRS*
- *Laser Pole Detection System LPS*
- *Contact Wire Inspection System CIS-LS*
- *Sector Profile Scanner SPS*
- *Tunnel Inspection System TIS*