

# Contact Wire Inspection System Low-Speed

**Measuring position and wear of up to eight contact wires simultaneously**

*The CIS-LS 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 Low-Speed (CIS-LS), Fraunhofer IPM offers a combined optical measurement system that can record 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 in a single, contactless measurement process. Different from the Contact Wire Inspection System (CIS), the sensors of the low-speed variant are mounted vertically inside the wagon, except for the illumination panel, which is fitted to the roof (see image on 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 can be used at speeds of up to 60 km/h. A processing unit inside the inspection train provides the operators on site with

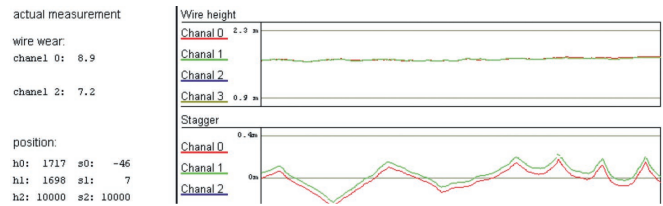
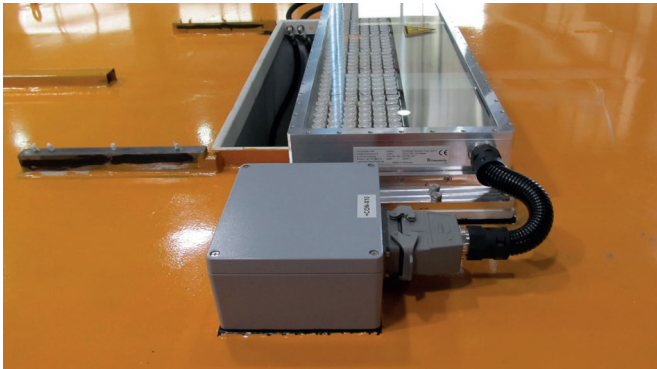
processed position data that has already been adjusted for the train's roll, which is recorded separately. As the sensor is located inside the cabin, it can be cleaned easily without the need for an expensive automatic cleaning facility. The CIS-LS features its own lighting unit, meaning it can be operated 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 system's camera-based measuring unit records the sliding surface and uses this information to derive data about the degree of wear. One line

## 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.



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

image is acquired every millimeter. Typically, a measurement value is generated every 12 mm.

### Laser scanner for detecting wire position

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

### Modular system

The CIS-LS's acquisition unit is modular and comprises the WWS and CRS. As a one-box solution, the system can be flexibly mounted on different measuring vehicles, provided the LED panel can be placed nearby. Two LED panels instead of one provide optimized illumination and allow measurements at up to 120 km/h while maintaining all specifications. The 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<br>Sensor mounted about 1 m below roof | Height: 700–2,600 mm above roof<br>Stagger: $\pm 500$ mm                            |
| Uncertainty for height and stagger                                    | 5 mm ( $1\sigma$ , 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 $\pm 0.3$ mm to $\pm 0.5$ 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                                             | –15 to 60 °C                                                                        |
| - Storage                                                             | 5 to 35 °C (inside vehicle)                                                         |
| - Measurement                                                         |                                                                                     |

All specifications and features are subject to modification without notice.

**CLASS 1  
LASER PRODUCT**

### Contact

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

Dr. Kira Zschiesche  
Group Manager  
Mobile Railway Measurement Techniques  
Phone +49 761 8857-172  
kira.zschiesche@ipm.fraunhofer.de

Fraunhofer Institute for Physical  
Measurement Techniques IPM  
Georges-Köhler-Allee 301  
79110 Freiburg, Germany  
www.ipm.fraunhofer.de/en

