

Contact Wire Recording Catenary maintenance

Tracking height and stagger of up to eight contact wires

The CRS sensor in its hermetically sealed housing, mounted on the roof of a train

Regularly measuring the actual height and stagger of contact wires forms the basis for an efficient, condition-based catenary maintenance. The Contact Wire Recording System CRS by Fraunhofer IPM is an excellent tool for tracking contact wires with high precision and speed.

Automated optical measurement

Precise measurement of contact wire position is essential to ensure reliable operation of electrified railway lines. Automated systems, mounted on the roof of special measurement vehicles, are increasingly replacing manual measurements. These systems face considerable speed requirements, particularly on high-speed lines, to avoid obstructing the regular traffic due to low driving speeds of the measurement vehicles.

The CRS by Fraunhofer IPM enables precise measurements at high speeds, providing an excellent tool for evaluating newly built standard lines or less frequent, but difficult recording of conductor rail lines. The CRS determines the position of up to eight contact wires optically. Employing active lighting and automatic maintenance features, it operates

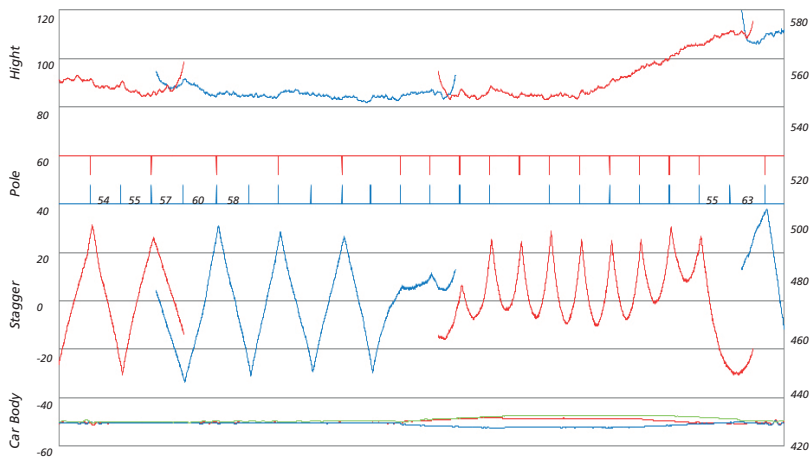
day and night, even in highly polluted areas. Inspection runs can be carried out in regular operation, since the system is designed to provide reliable data even at speeds of 350 km/h.

24.5 cm pitch at 350 km/h

The CRS sensor is based on laser scanners using the phase shift measurement technique. A rotating polygonal mirror assembly deflects a modulated laser beam to the contact wires covering a scanning angle of 70 degree and collects the returning radiation for analysis. Together with the corresponding scanning angle each measured distance value yields the position of the contact wire. The scanning rate of typically 400 Hz ensures a high measurement density: Even at 350 km/h travelling speed the system measures one height and stagger value every 24.5 cm. The extraordinary

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.



	X1	ZZ1	H1	X2	ZZ2	H2
	19,3000	16,3	546,9	19,3000	16,3	546,9
	19,3002	15,9	547,2	19,3002	15,9	547,2
	19,3004	15,8	546,9	19,3004	15,8	546,9
	19,3006	15,4	547,1	19,3006	15,4	547,1
	19,3008	15,3	547,0	19,3008	15,3	547,0
	19,3010	15,3	546,9	19,3010	15,3	546,9
	19,3012	14,9	546,9	19,3012	14,9	546,9
	19,3014	14,7	547,0	19,3014	14,7	547,0
	19,3016	14,1	547,0	19,3016	14,1	546,9
	19,3018	14,1	546,9	19,3018	14,1	546,9
	19,3020	14,2	546,8	19,3020	14,3	546,8
	19,3022	13,7	546,8	19,3022	13,7	546,8

Schematic visualization of measured and processed data by the CRS

measurement rate of 1 million points per second yields about 1,800 points per scanning line resulting in at least 6 values per scan on typical contact wires. The car body's roll on the bogie can be measured by a combination of at least three linear transducers. The CRS software processes the data and calculates stagger and height values with reference to the track's center.

(IP67). The CRS is eye-safe according to IEC60825. The laser is automatically switched off when the mirror stops rotating.

The CRS can be equipped with climatization and/or semi-automatic cleaning units. The System is available as a standalone device or as part of the Contact Wire Inspection System CIS, a multi-sensor system that combines measurement technology for wire wear and wire position and, optionally, for pole detection.

Reliable operation even under extreme conditions

The CRS recalibrates itself before each scan: This ensures precise and stable results even at extreme temperatures and over long periods of time. The system's housing is hermetically sealed

Service by Fraunhofer IPM includes the system's adaptation to country-specific requirements as well as training of the operating staff.

Technical specifications

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
Scanning angle	70°
Uncertainty for height and stagger	5 mm (1σ, 3 m, R= 10%), in relation to the acquisition unit
Scanning frequency	Typically 400 scans / sec.
Resulting pitch	One value for every 7 cm at 100 km/h (24.5 cm at 350 km/h)
Measurement rate	1 mio. measurements/sec.
Number of measurements per scan	1,800 (at 400 Hz)
Number of contact wires	Up to 8 measured simultaneously
Laser	Infrared, eye-safe (laser class I)
Temperature range	-20 °C to +50 °C (in operation) -20 °C to +70 °C (in storage)
Velocity of inspection car	Up to 350 km/h

All specifications and features are subject to modification without notice.



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 Mobile Terrestrial Scanning
 Phone +49 761 8857-289
 philipp.olshausen@ipm.fraunhofer.de

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

