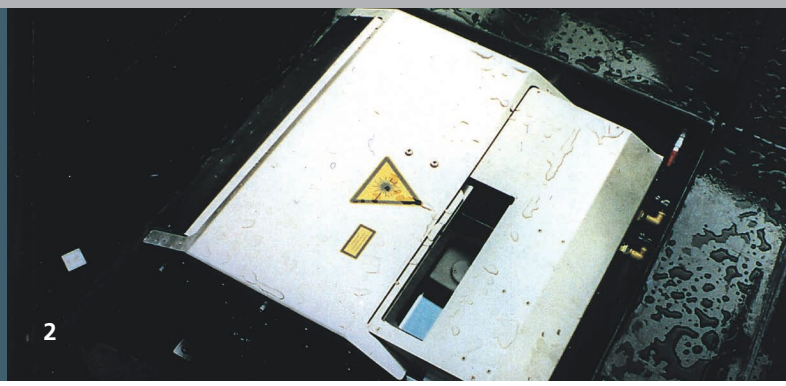
Fraunhofer
IPM

FRAUNHOFER INSTITUTE FOR PHYSICAL MEASUREMENT TECHNIQUES IPM



1 *CRS captures the position of contact wires at speeds up to 350 km/h.*
2 *Top view of the CRS sensor with hermetically sealed housing.*

CONTACT WIRE RECORDING SYSTEM CRS

Optical tracking of up to ten contact wires

Regularly measuring the actual height and stagger of contact wires forms the basis for an efficient, condition-based catenary maintenance. This 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.

Based on more than ten years' experience Fraunhofer IPM has developed the new Contact Wire Recording System CRS. Its high precision and speed together with powerful software provide an excellent tool for catenary maintenance - from the evaluation of newly built standard lines to the less frequent but difficult recording of conductor rail lines. CRS determines optically the position of up to ten contact wires. 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

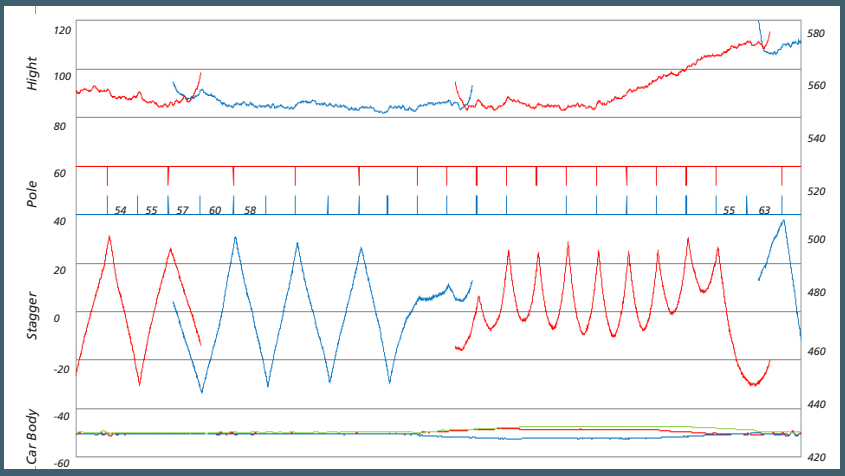
The CRS sensor is based on laser scanners using the phase shift measurement technique. A rotating polygonal mirror assembly deflects a modulated laser beam to the contact wires covering a scanning angle of 70 degree and collects the returning radiation for analysis. Together with the corresponding scanning 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

Fraunhofer Institute for Physical Measurement Techniques IPM
Heidenhofstrasse 8
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 Markus Leidinger
Business Development Manager
Phone +49 761 8857-413
markus.leidinger@ipm.fraunhofer.de

www.ipm.fraunhofer.de/railway



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

3 *Schematic visualization of measured and processed data by the CRS.*

value every 24.5 cm. The extraordinary 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.

Reliable operation worldwide

CRS recalibrates itself before each scan: This ensures precise and stable results even under extreme temperatures and over long periods of time. The housing is hermetically sealed (IP67). CRS can be equipped with systems for climatization and semi-automatic cleaning. Service by Fraunhofer IPM includes the system's adaptation to country-specific requirements as well as training of the operating staff.

CRS is based on the experience of more than 30 railway measurement systems developed by Fraunhofer IPM, which are successfully operating for railroad organizations all over the world. The system is eye-safe according to IEC60825. The laser is automatically switched off, when the mirror stops rotating.

The System is available as a standalone device or as part of the Contact Wire Inspection System CIS. This multi-sensor system combines measurement technology for wire wear and wire position and, optionally, for pole detection.

Technical Specifications

CLASS 1 LASER PRODUCT

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 million measurements per sec.
Number of measurements per scan	1,800 (at 400 Hz)
Number of contact wires	up to 10 measured simultaneously
Laser	infrared, eye-safe (laser class I)
Temperature range	–20 °C to +50 °C (operating) –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.

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:

- *Clearance Profile Scanner CPS*
- *High-Speed Profiler HSP*
- *Laser Pole Detection System LPS*
- *Wire Wear Monitoring System WWS*
- *Sector Profile Scanner SPS*
- *Rail Track Scanner RTS*

TransQ

Railroad measurement systems by Fraunhofer IPM are qualified according to TransQ-standards.