



1 The CPS detects changes in the clearance profile.

2 CPS is a robust encapsulated measurement system for mobile applications.



CLEARANCE PROFILE SCANNER CPS

Measuring geometrical changes of structure gauge

Shifting ballast beds or objects infringing the clearance profile pose hazards for rail vehicles. Railroad operators have to carry out inspections regularly to avoid rail vehicles being obstructed or being put at risk. The Clearance Profile Scanner CPS records clearance profiles fast and non-tactile. The optical system provides three-dimensional data in real-time using the track's center line as reference. Tunnel surfaces or objects infringing the gauge profile are recorded and identified by software. Thus, maintenance teams receive very detailed information on the infrastructure.

frequency modulated laser beam on the surroundings and deflects the returning light for deflection and analysis. The CPS is based on phase shift measurement for determining the distance. The exact position of each measurement point is calculated from the distance value and the angle of the scanning mirror. A two-dimensional image is derived from the mirror's rotational movement, the inspection car's motion provides the third dimension. The system works at scanning frequencies in the range of 10 to 200 Hz with a sampling frequency of up to 2 million measurements per second. A computer, located inside the inspection car, evaluates and visualizes the data before sending it to the inspection car's PC network.

Up to two million measurements per second

The CPS sensor is mounted at the inspection car's front. A rotating mirror projects a high

Robust housing

The sensor unit comprises a fixed optical window and is located in a hermetically sealed housing. If not in operation a casing

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



3



4

protects the sensor head from dirt or vandalism. Buffered vehicles can have a sensor head mounted on a slide, which is moved automatically into measurement position.

Complete solution

Additional sensors for compensating the vehicle's roll are not required since the CPS itself identifies its position in relation to the track's center line. CPS not only measures the clearance profile: optional software packages offer the possibility to obtain further specific information such as:

- contact wire position
- distance to adjacent track
- ballast profile
- ballast level between rails

The CPS has been successfully deployed on measurement trains around the world for more than ten years. The system is continuously being enhanced.

The clearance profile scanner's design is in accordance with DIN EN 60825-1:2008. An internal calibration before every scan leads to precise and stable results – even under extreme temperatures and over long periods. The Clearance Profile Scanner CPS is eye-safe according to IEC60825.

3 The scanning data provides information on objects interfering with the clearance profile (marked red).

4 CPS sensor head mounted on an inspection train.

Technical Specifications

**CLASS 1
LASER PRODUCT**

Measurement range	1 – 10 m (up to 30 m using a reduced bandwidth)
Distance resolution	about 1 mm
Intensity resolution	12 bit
Uncertainty at an object reflectivity of 90 %	3 mm at 5 m (σ -value)
Uncertainty at an object reflectivity of 10 %	7 mm at 5 m (σ -value)
Scanning angle	$\approx 350^\circ$
Scanning speed	10 – 200 revolutions per sec.
Measurement rate	up to 2 million measurements per second
Number of measurements per profile	5,000 (at 200 rev./s)
Point distance at 5 m	6.2 mm
Profiling density at 50 km/h	one profile each 7 cm (at 200 rev./s)
Ambient temperature	- 20 °C to + 50 °C (in operation; temperature control included)

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. Railroad measurement systems made by Fraunhofer IPM:

- High-Speed Profiler HSP
- Contact Wire Recording System CRS
- Laser Pole Detection System LPS
- Wire Wear Monitoring System WWS
- Sector Profile Scanner SPS
- Rail Track Scanner RTS



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

All specifications and features are subject to modification without notice.