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1 *The LPS detects and counts poles (precisely) along the track.*
2 *Typical arrangement of LPS sensor heads next to pantograph.*

LASER POLE DETECTION SYSTEM LPS

To assess the condition of railroad networks railroad operators gather various data simultaneously: inspection cars measure the wire's position and wear, the condition of the tracks and the contact force of the pantograph at the same time. This facilitates a specific, condition-based maintenance. However, the maintenance teams can only find the defective sections efficiently, if the data is complemented with precise information on their location. In addition to GNSS (Global Navigation Satellite System), with potential local coverage problems, the Laser Pole Detection System LPS yields exactly this information.

Locating defective sections

A defective section can be located through the two poles confining it. The Laser Pole Detection System LPS by Fraunhofer IPM detects the catenary wire support structure along the tracks continuously and thus complements other measurement data by a precise location of the poles.

A laser distance measurement system forms the core of the LPS: The light of a high-frequency modulated laser beam is reflected by objects and collected by a lens onto a detector. The phase of the detected signal differs from the emitted signal due to the light's time of flight. From this phase shift the distance to the object is deduced.

The LPS consists of two acquisition units mounted side by side on the inspection car's rooftop. Each unit comprises two distance measurement systems with the beams directing vertically upwards. The system records a pole if both laser beams of an acquisition unit are reflected simultaneously. This two-fold reflection is the result of the pole's anchor arms, side holders or cantilevers. In addition, the two sensors determine the distance to distinguish such objects from others further above.

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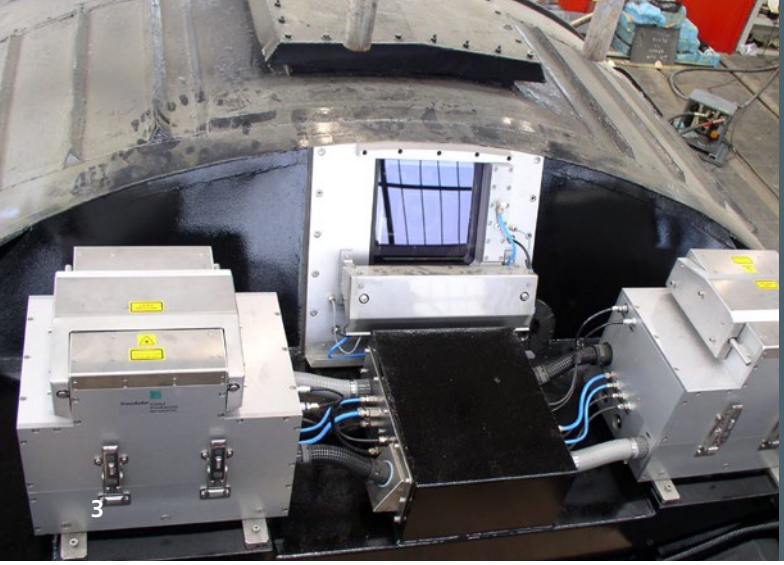

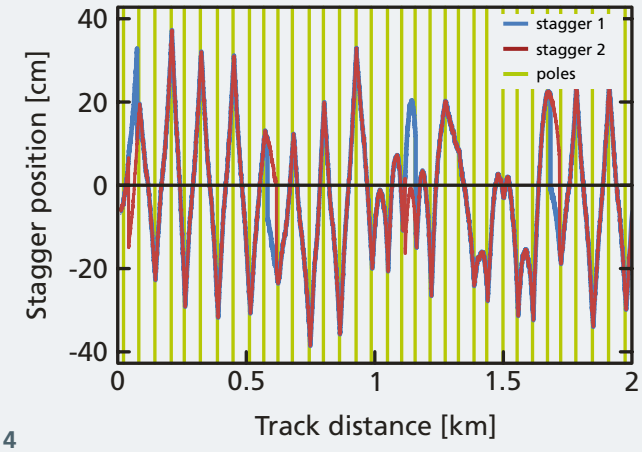

3 *LPS sensor heads feature robust housing and remote controlled cover.*
4 *Exemplary measurement performed by LPS on a section of 2 km.*

The values are digitized and transmitted as serial data flow to the data processing unit inside the car.

Optimized housing design

The LPS does not require daylight and carries out measurements in tunnels, under bridges and in train stations without additional lighting. The system is encased completely and actively kept at a specific temperature to minimize climatic effects. The glass window's cleaning is controlled from inside the inspection car. The sensor is protected by a pneumatically activated cover in case of extremely rough weather or during parking. Thus, the system does not require any maintenance over long periods.

Operation

The LPS 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.

The LPS is in operation in many countries all over the world, among them Austria, Belgium, Brazil, Finland, Great Britain, Hong Kong, Malaysia, The Netherlands and Romania.

Technical Specifications

Measurement method	laser distance measurement
Measurement range	0.5–4 m
Diameters detected (e.g. of anchor arms)	12–200 mm
Measurement rate	> 62,000 measurements per second
Vehicle velocity range	5–260 km/h
Application area	open sky, bridges, tunnels regular catenary or conductor rails
Ambient temperature	–20 °C to +50 °C (in operation) –20 °C to +70 °C (in storage)
Laser class	III R
Eye safety	laser is automatically switched off at speeds below 5 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*
- *Contact Wire Recording System CRS*
- *Wire Wear Monitoring System WWS*
- *Sector Profile Scanner SPS*
- *Rail Track Scanner RTS*