Fraunhofer IPM

Laser Pole Detection
Locating defective sections

Determining the position of poles at 250 km/h

Typical arrangement of LPS sensor heads next to pantograph. The sensor yields location information to complement GNSS data and helps locating defective sections.

To assess the condition of railroad networks, railroad operators gather various data simultaneously. In order to easily find the defective sections, maintenance teams need precise infomation on their location. The Laser Pole Detection System LPS by Fraunhofer IPM yields exactly this information, thus complementing GNSS data.

To ensure targeted condition monitoring and maintenance of the rail network, rail operators measure the wire's position and wear, the condition of tracks and the contact force of pantographs. Precise location information is needed for maintenance teams to find the defective sections identified. The LPS yields exactly this information, in addition to GNSS (Global Navigation Satellite System) with potential local coverage problems.

Locating defective sections

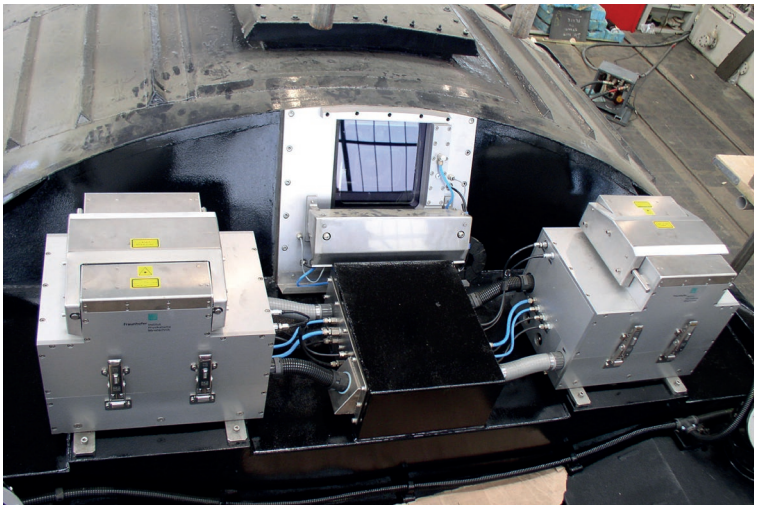
A defective section can be located through the two poles confining it. The LPS detects the catenary wire support structure along the tracks continuously and thus complements other measurement data by a precise location of the poles.

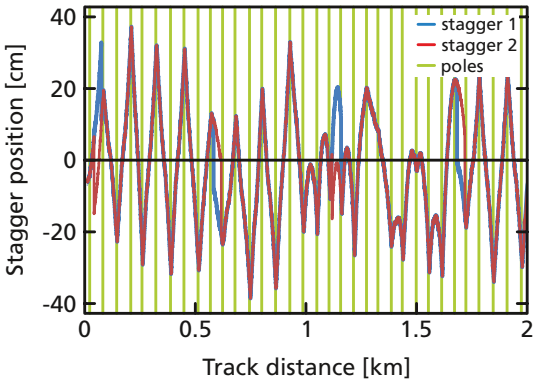
A laser distance measurement system forms the core of the LPS: The light of a high-frequency modulated laser beam is reflected by objects and collected by a lens onto a detector. The phase of the detected signal differs from the emitted signal due to the light's time of flight. From this phase shift 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 directed 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. The values are digitized and transmitted as serial data flow to the data processing unit inside the car.

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.





Left: LPS sensor heads feature robust housing and remote controlled cover. Right: Exemplary measurement performed by LPS on a section of 2 km.

Optimized housing design

The LPS does not require daylight, carrying out measurements in tunnels, under bridges and in train stations without additional lighting. The system is fully encased 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. The CIS multi-sensor system combines measurement technology for wire wear and wire position.

The LPS has been in operation in many countries all over the world, among them Austria, Belgium, Brazil, Finland, Great Britain, Hong Kong, Indonesia, 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 – 250 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.

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