SL FORPS UIC 54 Fiber-Optic Rail Sensor

Continuous Load and Vibration Data for Conventional Main Lines

Overview

Conventional main lines carry the bulk of a rail network's traffic, mixing passenger and freight services on track that has to stay available day after day. Understanding how that track and the vehicles running over it are performing, without pulling the line out of service, is a constant balancing act for infrastructure managers.

The SL FORPS UIC 54 is the fiber-optic rail sensor built for the UIC54 profile, one of the most widely used rail sections on conventional main lines. It replaces the intermediate rail pad and measures the vertical load each train applies to the rail, capturing vibration and shock across a wide frequency range from within the existing track structure.

Powered by Sensor Line technology, the UIC 54 variant brings a field-proven fiber-optic measurement approach to Quarterhill's rail portfolio.

Built for the UIC54 Profile

The UIC 54 variant is sized specifically for UIC54 rail, with a 165 × 140 × 7 mm pad that takes the place of the standard intermediate layer. It is rated for wheel loads up to 150 kN and train speeds up to 500 km/h, while still resolving loads as low as 1 kN, so a single sensor handles both the heavy forces of everyday traffic and the finer signals used for diagnostics. Because UIC54 is such a common main-line section, the UIC 54 sensor fits a large share of existing conventional track without special adaptation.

Sensing Load Through the Rail Pad

The UIC 54 works as a direct replacement for the elastomer intermediate layer beneath the rail. A special fiber-optic structure is embedded in the pad, and as a train passes, the vertical load transmitted from the rail to the sensor reduces the amount of light passing through that structure. Opto-electronic interfaces convert this change in light transmission into signals for analysis.

Because the measurement is optical at the point of sensing, the sensor is immune to electromagnetic interference, and the fiber-optic signal path stays free of electrical noise, which matters on electrified main lines with continuous traction current nearby.

What a Single Installation Can Measure

One UIC 54 installation supports a broad set of track and rolling-stock measurements, including:

- Vibration and shock analysis
- Flat-wheel detection
- Axle load and weigh-in-motion measurement
- Track-bed condition analysis
- Axle and wagon counting
- Speed measurement
- Direction detection
- Train-length detection

For a mixed-traffic main line, that range lets a single sensing point contribute to both infrastructure monitoring and traffic analysis rather than requiring separate systems for each.

A Drop-In Replacement for the Rail Pad

The UIC 54 installs quickly and in nearly any weather, without mechanical processing of the rail or sleeper. Because it takes the place of the intermediate pad, there is no need to drill, cut, or alter existing track components, which keeps possession time and installation cost down, an important consideration on busy lines where access windows are limited.

Made for Years of Unattended Service

Main-line track exposes equipment to weather, vibration, electrical noise, and, in many locations, interference from animals or vandalism. The UIC 54 is designed for a long service life with minimal maintenance and needs no recalibration once installed. Its fiber-optic design is immune to electromagnetic interference, and the sensor body carries an IP 67 rating (excluding the fiber-optic connectors). The connecting cable is protected by a metal-spiral cover that guards against animal damage, and the sensor is built to resist theft and vandalism. An integrated temperature sensor is available as an option where thermal data is also useful.

From Sensor Signal to Usable Data

The sensor pairs with opto-electronic interface units that digitize its signal for analysis. The SL XD-1100 provides a single-channel digital interface, while the SL MX-210 series offers multi-channel interfaces in two-, three-, and four-channel configurations, so several sensors along a section can feed a single processing point.

In Service Across Main-Line and Urban Networks

SL FORPS sensors are deployed across a wide range of rail environments, including the Marmaray crossing and the Ankara-Istanbul line in Turkey, main and high-speed lines in Spain such as Barcelona-Figueras and the Madrid corridors, the Madrid metro, and tram networks in Poland. This track record spans conventional main-line, high-speed, metro, and light-rail service.

UIC 54 Specifications

Performance

Specification	Value
Rail profile	UIC54
Maximum train speed	up to 500 km/h
Maximum wheel load	150 kN
Minimum detectable load	1 kN
Average life (MTTF)	more than 5 years
Operating temperature	-30 °C to 85 °C
Storage temperature	-30 °C to 85 °C
Humidity	up to 100%
Protection rating	IP 67 (excluding fiber-optic connectors)

UIC 54 Dimensions & Weight

Model	Dimensions	Weight
SL FORPS UIC54	165 × 140 × 7 mm	220 g

Fiber-Optic Cable

Property	Value
Outer diameter	10 mm
Length	Up to 40 m (20 m with temperature sensor option)
Weight	135 g/m
Maximum short-term pull tension	50 N
Minimum bending radius	50 mm
Protective cover	Metal spiral

Connector

Property	Value
Construction	Plastic FSMA
Length	34 mm
Maximum diameter	8.5 mm

How to Specify a UIC 54 Sensor

UIC 54 sensors are specified using the format **SL FORPS X-Y-ZZ(T)**

Code	Description
X	Rail type (UIC54)
Y	Connector type (1 = plastic FSMA, 2 = reusable metal FSMA)
ZZ	Cable length in meters (10 m standard)
(T)	Optional integrated analog temperature sensor

Dependable Monitoring for the Conventional Network

The UIC 54 brings the SL FORPS platform to the conventional main lines that carry most of a network's traffic, combining a profile-matched pad with durable, low-maintenance fiber-optic measurement. Powered by Sensor Line technology, it gives infrastructure managers a continuous source of load, speed, and condition data from inside the track itself, supporting safety, maintenance planning, and long-term investment decisions across the everyday network.