

LUXACT 1D ETCS

Slip-free Odometry Unit for Railway ETCS Application with 100% speed signal availability

LUXACT Neo 1D optical sensors provide ETCS with a reliable and powerful onboard reference for speed and position information of rolling stock. Measurements are largely not affected by environmental disturbances like abrupt changing surface properties (reflectivity, material, medium), heights to the ground variations, spume, snow flurry, EM noise and objects crossing the field of vision.

LUXACT complies with the challenging requirements for railroad security systems (ETCS/ERTMS) in aspects of high reliability of speed & distance signals acquired by train's onboard system. A supplementary integrated 6 DOF inertial measurement unit and high-sensitivity GPS receiver raise dramatically the reliability of measurements under demanding weather conditions in order to provide operation within sensor's specification with 24/7/365 (year-round) availability. The system is highly integrated in a compact and rugged IP67 protected sensor body. The brain of the sensor is high efficiency DSP & FPGA combined with 24-bit ADCs performing complex real-time calculations. This flexible and powerful structure allows the implementation of special customer's algorithms as well e.g. Odometry FFFIS.

LUXACT™ smart sensor fusion algorithm selects automatically the best available signal between optical or GPS and can process wheel odometer data as a fallback level. All signals are corrected by integrated 6 DOF Inertial Measurement Unit.

Features

- speed uncertainty $\leq 0,2\%$ RMS
- distance uncertainty $\leq 0,1\%$ CEP
- maximum availability due to multi-sensor fusion algorithm
- ETCS ready
- Fire & smoke norm compliant
- clear start-up and standstill till 0,2 km/h
- slip, direction & roll-back detection
- low & constant latency

LUXACT Technology

Key property of highly innovative optical LUXACT Technology is independence of absolute readings from height fluctuations & working surface type. LUXACT Neo 1D Sensors are based on **two independent measuring principles, optical and inertial** using benefits of both - quite on the contrary to the traditional axle odometers, optical, Doppler radar & GPS-based sensors. The high grade innovative optical system with a wide aperture enables clear signal even in demanding environments. Special aerodynamic splash & dirt protector is field proved in long-term testing.

Typical measurement surfaces

Ballast bed, rail, wood, concrete, bare ice, ice & snow, water, spume, snow flurry, blank steel, gaps and any mix of above-mentioned.



Figure 1: LUXACT 1D ETCS with splashguard and stone protector



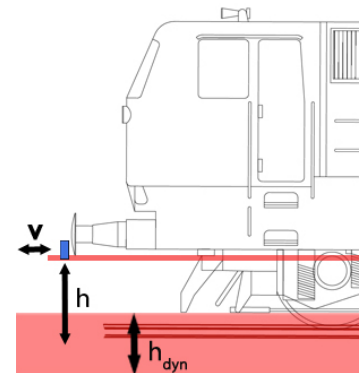
Figure 2: Field installation with additional stone protector

General specification

Parameter	Unit	Value	
Typical vehicles		for regional trains	for high-speed trains
Speed ranges available	km/h	0,2-270	0,5-500
Nominal mounting heights available h	mm	300 / 500	500 / 700
Dynamic height working range h_{dyn}	%	± 30 of h	
Speed uncertainty 3σ	% FS RMS	$\leq 0,2$	
Distance uncertainty 3σ	%	$\leq 0,1$ at $s > 200m$	
Update rate	Hz	50 / 250 / 1000	
Filtering		none needed	
Latency		constant	
Delay to physical events	ms	3 @ 50Hz output rate 2 @ 1000Hz output rate	
Light source / MTTF		invisible LED, 100.000h	
Accelerometers		Range $\pm 16g$, Resolution $< 0,5$ mg	
3x accelerometers in x, y, z axle		Bandwidth 0-20 Hz, Noise $< 0,1$ mg/VHz	
Gyro		Range ± 2000 °/s, Resolution $< 0,02$ °/s	
3x gyros in x, y, z axle		Bandwidth 0-20 Hz, Noise < 0.004 °/s VHz	

Output interfaces

CAN bus	Intel/Motorola format, 2.0A/2.0B with Baud rate: 500, 1000 kbit/sec Key parameters (Standard): longitudinal compensated ground speed v_L incl. direction information longitudinal compensated distance s 3x accelerations a & 3x angular rates Ω Diagnostic signal: optical signal quality k
TTL	TTL 0-5V pulses for speed & distance data 100Hz per 1 km/h. 1 pulse = 2,77mm In combination with DRC option: quadrature A/B TTL output
Trigger	Highly accurate event-based internal calculations. Any potential-free NO trigger, power supply integrated.
HTN	Regulated heating of the splash guard for de-icing



Physical properties

Size	Vertical version: Dia x H: $\varnothing 240 \times 660$ mm (incl. splash guard)
Weight	4,5 kg with stone protector, 1,2 kg with lightweight splashguard
Protection	IP67
Operating conditions	-40...+85 °C, 10 – 90% relative humidity, without condensing
Shock	50 g Half-Sine, 6ms
Vibration	15g, 10 ... 150Hz
Power supply	9...36 VDC / 110VDC inverse-polarity protection, EMI protection
Power consumption	ca. 15W without heating system