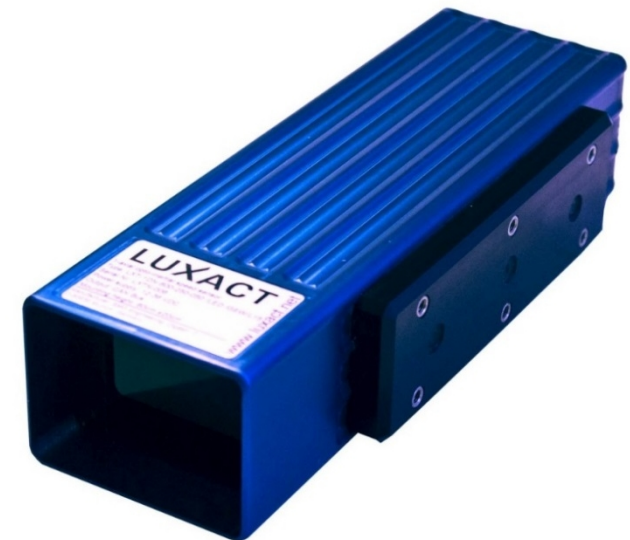
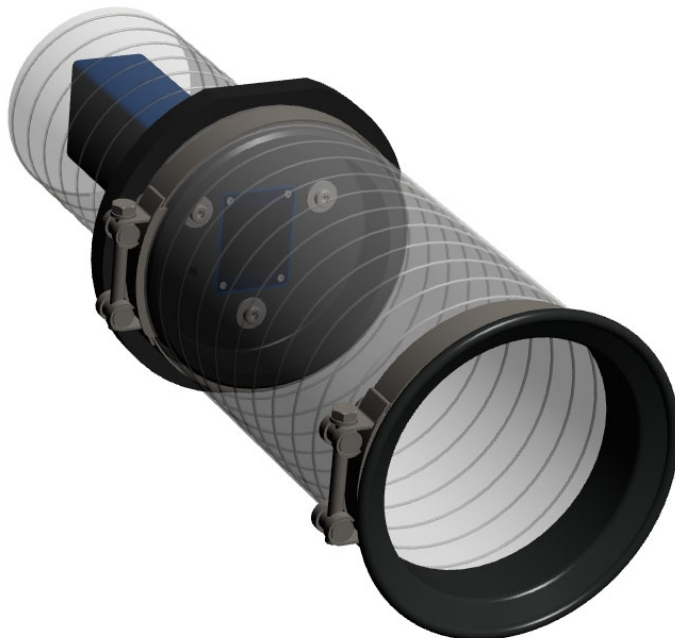


# LUXACT Neo 1D

**Optical Distance and Speed Measurement Sensor  
for ETCS and Wheel Slide Protection**



# LUXACT® Distance and Speed Measurement Sensor

## Integral optical-inertial platform



- ❑ New, in-house developed, optical measuring principle
  - A random scattering surface, which is moving beneath the sensor, reflects the light towards sensor's optical system
  - The reflected light is conditioned by innovative LUXACT® optics. There is no need to keep the sensor optical focus on the surface, hence, conditioning is independent from the height.
  - Due to movement of the sensor over scattering surface, the intensity of received light is modulated with a frequency which is proportional to the relative velocity of a vehicle.
  - The conditioned light is received by a mesh of photo detectors and converted into an electrical signal, which is further process by powerful DSP and FPGAs
- ❑ Aperture free optics
  - provides sufficient light to sensors matrix at any light and surface conditions,
  - ensures significant signal-to-noise ratio and measurement robustness even under heavy-duty conditions.
- ❑ High dynamic range of photo detectors
  - Introduced photo detectors offer a high dynamic range and enable the use even at rapidly changing surfaces with large differences in the reflection factors (e.g. snow – roadbed, sleeper - snow)
- ❑ Combination of two independent measuring technologies and benefits from its synergy

	Optical LUXACT® technology	Inertial (accelerometer) technology
Uncertainty of distance and speed measurement	0,1 %	approx. 1-5 %
Repeatability of distance and speed measurement	0,07 %	ca. 1-5 %
Sensitivity at low accelerations	very good	poor
Identification of moving direction at low accelerations	yes	limited
Susceptibility to snow, rain, dust, dirt, moisture	low	no
Installation height	300 - 1300 mm	unlimited
Identification of acceleration direction ( <i>acceleration/slow down ≠ moving direction!</i> )	no	yes

# LUXACT<sup>®</sup> Distance and Speed Measurement Sensor

## ETCS on-board odometry application. Advantages at a glance.



### ❑ Uncompromised signal availability

- Synergy of novel optical technology in coaction with inertial acceleration measurement offers a robust, stable measurement with high level of signal availability, even under adverse conditions. Likelihood of loss of speed data is reduced drastically and considerably lower as for conventional solutions.

### ❑ High accuracy at speed from 3 m/min up to 500 km/h

- Whether extremely slow (down to 3 m/min) or high speed (up to 500 km/h), LUXACT<sup>®</sup> offers accurate distance and speed data in real-time at remarkable uncertainty of less than 0,1%.

### ❑ Accurate results at any surface

- Thanks to its optical measuring principle LUXACT<sup>®</sup> Sensors are immune to dynamic changes of surface properties while driving, whether caused by surface material changes (e.g. steel, concrete, wood, ground), or caused by rain, moisture, snow, ice, dust, spray etc.

### ❑ Immune to height fluctuations

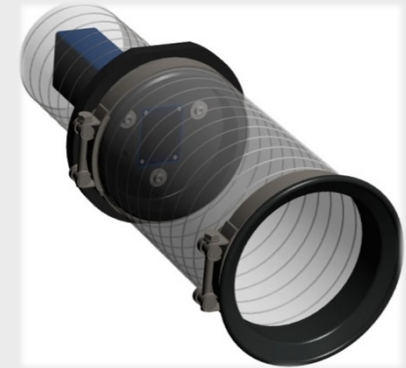
- Installation height of LUXACT<sup>®</sup> Sensors may vary within 300...1200mm above the ground. Sensor-to-surface height fluctuations, caused by rolling stock pitch and surface unevenness (railway sleepers, junction points, level grade crossings etc.) may vary in a range of  $\pm 30\%$  of installation height, without affecting the accuracy.

### ❑ Easy installation and integration into existing infrastructure

- LUXACT<sup>®</sup> Sensors may be mounted nearly at any place of railcar body. Field of view of a sensor to be directed toward roadway. To compensate an error caused by sensors misalignment to vehicle's longitudinal axle, auto-align function is introduced.
- No additional interface boxes are required. LUXACT<sup>®</sup> Sensors provide plug-and-play interfaces like CAN bus or RS485, which can be adjusted to specific ETCS manufacturer's needs.

### ❑ EMC, vibration proof, mechanical protection

- Sturdy and robust materials of the body ensure high performance even under harsh environmental conditions (dust, mud, hailstone, etc.) and make it tolerant to high vibrations usual for Rolling Stock.
- Integral housing of LUXACT sensor with fully integrated electronics provides excellent EMC protection. Specially designed power supply module is successfully tested according to requirements for railway electronics ((EN-50155 & EN-60950-1)



# LUXACT<sup>®</sup> Distance and Speed Measurement Sensor

## Special application for Railway



### ETCS Onboard Odometry Unit

- Seamless replacement for Doppler Radar for retrofit & OEM
- Elimination of well-known reliability & uncertainty issues

### Testing and Development

- Breaking test according to European Norms (DIN EN 14531-6:2009)
- Configuration and Inspection of break characteristics
- Vehicle dynamics tests – Reference up to 500 km/h for acoustics, traveling comfort, performance tests

### Measurements

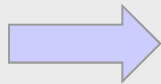
- Routing and infrastructure measurement vehicles

### Path length as a productivity measure

- Path length measurement for railway construction machines (e.g. cleaning, gravel processing machines, tamping machines)
- Slip and slide free path length measurement proportional to production

### Further special applications

- Independent reference for anti slippage systems for vehicles with all-wheel drives (e.g. shunting locomotive)
- Positioning for automated loading of cargo trains



### Important features for special applications

- ✓ Accurate measurement from 1 m/min, also under tough environmental conditions
- ✓ Easy and quick installation at any place by means of magnets and suction heads

# LUXACT<sup>®</sup> Distance and Speed Measurement Sensor

## Comparison of technologies at hand



	LUXACT <sup>®</sup> Optical-inertial sensors	Conventional optical sensors	Doppler GPS with ground station	Radar sensors	Conventional Odometer
Slip and slide free	Yes	Yes	Yes	Yes	No
Accuracy of Speed measurement	< 0,1 % FSO	< 0,2 % FSO	0,1 Km/h 95% CEP	< 1 %	1/400 of wheel revolution (consider constant wheel dia & no slide)
Behavior in Snow / Ice / Wet conditions	No loss of accuracy	Considerable loss of spec. accuracy	Considerable loss of spec. accuracy	Uncertainty in signal availability	No loss of accuracy
Specified range of installation height (gap between sensor and surface) [mm]	300 – 1300	20-50	Not relevant	20-80	Not relevant
Impact of height fluctuation on measurement accuracy	No impact	Considerable impact	Not relevant	Minor impact	Not relevant
Detection of moving direction	Yes	No	Yes	No	Yes
Data output	50 - 1000 Hz	Up to 250 Hz	5 Hz (100 Hz with Interpolation)	1 Pulse/4mm	400 Pulse/Revol.
Impact of covered environment (bridges, tunnels, urban areas, valleys, train stations)	No impact	No impact	Considerable loss of spec. accuracy; Uncertainty in signal availability	No impact	No impact

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