

LUXACT® 1D Rail

Slip-free, speed-over-ground sensor with dynamic yaw, pitch and roll correction

The new LUXACT® 1D Rail sensor is a multifunctional, powerful tool for contactless, slip-free speed over ground measurement. This sensor incorporates the proven and tested, unique LUXACT® optical technology, which is free of environment disturbances, like abrupt changing surface properties, heights to the ground variations, splashes of water, EM noise and objects crossing the field of vision. In addition, sensor's versatile body contains a six degree of freedom inertial measurement unit (IMU) which is tightly coupled with optical speed measurement by a proprietary sensor fusion algorithm. Measurement results are available directly in CAN bus, RS-485 and TTL pulses and can be processed by all industry standard loggers and DAQ systems.

LUXACT® 1D Rail corresponds to requirements of modern automotive & railways R&D engineers for a universal and robust high-precision speed over ground system. Integrated IMU increases dramatically the dynamic response, signal availability under optically adverse conditions and accuracy due to yaw, pitch and roll corrections of the optical signal during dynamic testing scenarios.

Unlike other systems, surface-specific recalibration or IMU setup are not required making the testing process more efficient.



Highlights

- Speed and distance uncertainty $\leq 0,1\%$
- Distance uncertainty for a passenger car during ABS brake test from 100 km/h (ca. 40m): $\leq 0,1\%$
- Tested on all industry typical surfaces without recalibration: asphalt, concrete, wetness, ice/snow, cobblestones etc.
- Low & constant latency
- Dynamic speed correction by yaw, roll and pitch angles
- Clear speed signal on start-up from 0,2 km/h and clear 0 km/h at standstill
- Integrated high precision brake triggers processing with automatic brake test analysis

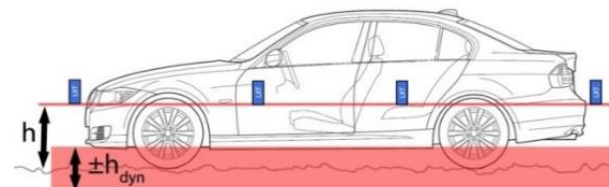
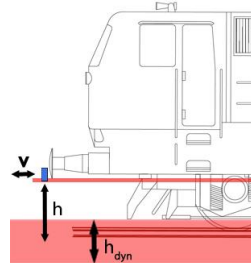
LUXACT® optical technology

LUXACT® sensors base on a unique, proven & tested optical measurement principle, which enables contactless speed and distance measurement over ground independent from surface properties and with strong height to ground fluctuations. LUXACT® 1D Rail opens new areas of application for this technology: the tiny size allows a practical mounting under the low-floor train and on car body, while integrated IMU corrects the optical speed using integrated 6DOF IMU. This device delivers in real-time precise and reliable results, even during highly dynamic testing scenarios, like brake or performance testing. All results show a high repeatability and increase data integrity even under adverse conditions.

Technical specification – LUXACT® 1D Rail

Performance specification

Parameter	Unit	Value			
		Low Speed	Standard	High-Speed	Ultra-High-Speed
Speed range in x axle	km/h	0,1-150	0,2-300	0,3-400	0,4-500
Measurement range accelerations	m/s ²	±156 in x, y, z axle			
Measurement range angular velocity	°/s	±2000 around x, y, z axle			
Speed uncertainty 3σ	% FS RMS	≤0,1			
Distance uncertainty 3σ	%	≤0,1 at s >200m			
Resolution acceleration	mg	0,5			
Resolution angular rate	°/s	0,02			
Bandwidth inertial data	Hz	0 to 20 Hz (256 Hz without Filter)			
Nominal mounting height h	mm	550	600		
Dynamic height range h _{dyn}	mm	±165 mm	±200 mm without impact on measurement uncertainty		
Measurement rate (=Output rate)	Hz	250 (optional: 800)			
Filter		none needed			
Latency to physical Event	ms	3-50ms, depending on IMU data filter			
Light source / MTF		invisible LED light / 100.000h			



Data Interfaces

CAN raw

galvanically isolated, 120 Ω terminator in the sensor
baudrate: 500 kbit/s, Intel format, 2.0A

TTL Output

0-5 V TTL quadrature, galvanically isolated
Standard: 1000 pulses ≙ 1000 mm, 1000 Hz ≙ 1 m/s
*Low res: 1000 pulses ≙ 360 mm, 360 Hz ≙ 1 m/s

Trigger Input

potential-free triggers or TTL signals incl. power supply 12V for active sensors.
Usage: auto calculation of brake distance / other events

RS485*

output of all values as in CAN bus.
Industry standard protocols available.

*optional

Specifications can be changed without notice. Further information:

Phone: +49 89 9982081-10

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Physical properties		
Parameter		
Dimensions (L x W x H)	mm	90 x 82 x 187 without connectors
Weight	g	1050
Ingress protection class		IP66 & IP68
Operational conditions		-40°C to +85°C, 10 to 90% rel. humidity non-condensing
Shock / Vibration		50 g Half-Sine 6 ms / 30 g, 10 to 150 Hz
Without equipment damage		High vibrations result in reduced measurement spec
Power supply	V DC	12...36 overvoltage and inverse-polarity protection. EM Filter EN-55022 Class B
Input power		20 W
Measurement parameters and connectivity		

AUX connector

Trigger input

Brake pedal / light barrier

TTL Input:

Quadrature / TTL from wheel encoder or fuel flowmeter



AUX

CAN

CAN connector

Permanent signals:

- longitudinal speed
- distance
- acceleration x, y, z
- angle rate um x, y, z
- quality of optical signal

Triggered signals:

- > Distance since trigger
- > Speed at trigger moment
- > Time since trigger
- > Average deceleration from trigger to standstill: a(v,t), a(s,t), a(v,s), MFDD
- > Brake test quality (traffic light indicator)

TTL output:

- ✓ TTL Quadrature signal (speed, distance, direction)

Scope of delivery

1x LUXACT 1D Rail incl. 1x standard carbon splashguard & 4x side mounting angles MAS-1DC
 1x CAN & power cable 5m with 9 DSUB female connector and 4mm Banana connector. IP69K on sensor side
 1x Manufacturer's calibration certificate according to ISO/IEC 17025
 1x ABS case offering enough space for sensor, mounting, logger & cables
 1x USB stick with CAN .dbc files, Software and User Manual

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Optional mounting on a vehicle

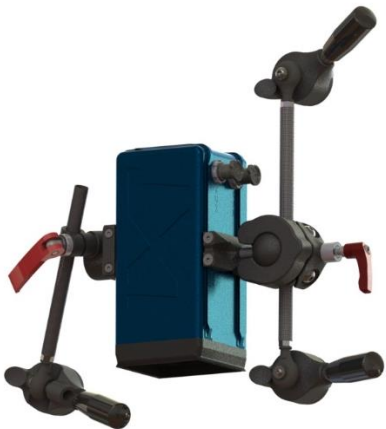
Frontal mounting with **MPL-1DR** mounting plate



Top mounting with **MPL-1DR** mounting plate



Side mounting with flexible **MF3C** magnetic mounting



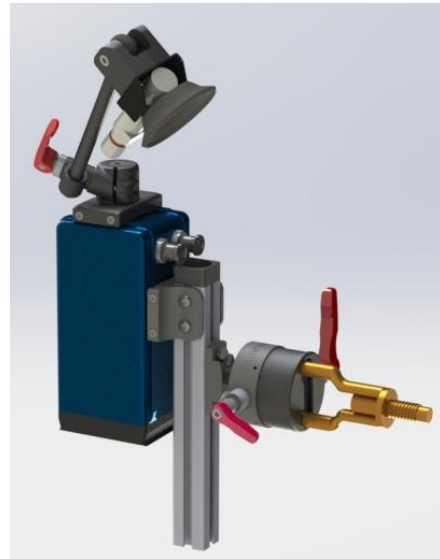
Side mounting with flexible **SFX3C** suction cup mounting



Mounting with **TWB-C** on a car's tow-bar with $\varnothing 50$ mm ball



Mounting with **TFX3** on a car's standard towing eye



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Options & Accessories		
Name	Part number	Description
LXT-1DR	L10129	Basic part number for LUXACT 1D Rail sensor
Firmware options		
D080	L20112	Output & measurement rate increase to 800 Hz
GPS	L20105	GPS input for LUXACT certified RS485 GPS sensors. All GPS data (incl. time) are included in CAN data
EXT	L20104	TTL input for external sensors like odometers or flowmeters
RS485	L20107	Data output same as CAN bus via RS-485 (cable not included)
Cables		
KVC..	...10 L20120 – 10 m ...20 L20121 – 20 m	Extension of originally delivered CAN cable (5m) Length 10 or 20 m. Others on request. IP69K at sensor's side, power cable 2m
KR..	...10 L20147– 10 m ...20 L20148 – 20 m	Extra cable for RS-485 output. Length 10 or 20 m. Others on request IP69K at sensor's side, power cable 2m
KT..	...5 L20118 – 5 m ...10 L20119 – 10 m	Extra cable for RS-485 output. Length 5 or 10 m. Others on request IP69K at sensor's side, power cable 2m
KC..	...5 L20115 – 5 m ...10 L20116 – 10 m ...20 L20117 – 20 m	Extra cable for RS-485 output. Length 5 or 10 m. Others on request IP69K at sensor's side, power cable 2m
KCG05	L20124	Extra cable for CAN & RS-485 output. Length 5 m. Others on request IP69K at sensor's side, power cable 2m
KCT05	L20126	Extra cable for CAN & TTL output. Length 5 m. Others on request IP69K at sensor's side, power cable 2m
KTR02	L20127	Trigger cable for all LUXACT sensors. Length 2m. IP69K at sensor's side. M12 socket with mating M12 plug
Mounting accessories		
MF3C	L20149	Flexible 3-point magnetic mounting for curved surfaces with height adjustment and easy release mechanism.
SFX3C	L20141	Flexible 3-point suction cup mounting for curved surfaces with height adjustment and easy release mechanism.
3SC-Kit2	L20150	Set of suction cups as replacement of magnetic modules in MF3C
TFX3	L20156	Universal towing eye mounting on car's towing eye. Height adjustment with integrated aluminum profile.
TWB-C	L20144	Universal mounting on a tow-bar with 50 mm ball with height adjustment
MPL-1DR	L20155	Mounting plate for LUXACT 1D Rail, Compact & Neo sensors
MAF-1DC	L20145	Simple mounting angles for frontal or under-floor mounting of 1D sensors (4 pcs.)
MAS-1DC	L20146	Simple mounting angles for side mounting of 1D Rail sensors (4 pcs.)
Splash guards		
SGCC	L20140	Splashguard for rough environment, carbon fiber reinforced.
SGCC-H	L20138	Splashguard for rough environment with integrated heating, carbon fiber reinforced.
Triggering tools		
XLAS3	L30103	Optical light trigger, 5000 Hz switching frequency, 0,15...11 m range
BPT	L30105	Pedal trigger, bounce-free, with quick strap system.
Services		
CAL-1D	L40114	Manufacturer calibration of 1 optical axle & firmware upgrade
CAL-ISO-S	L40122	Calibration of speed by an ISO17025 certified laboratory
CAL-ISO-D	L40123	Calibration of distance by an ISO17025 certified laboratory

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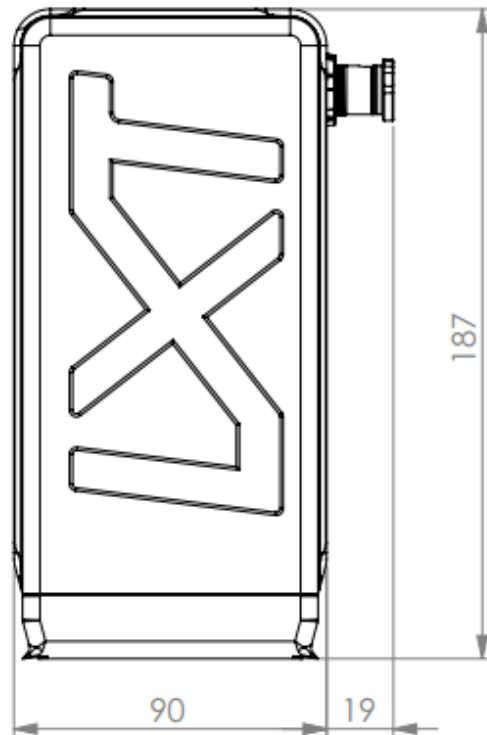
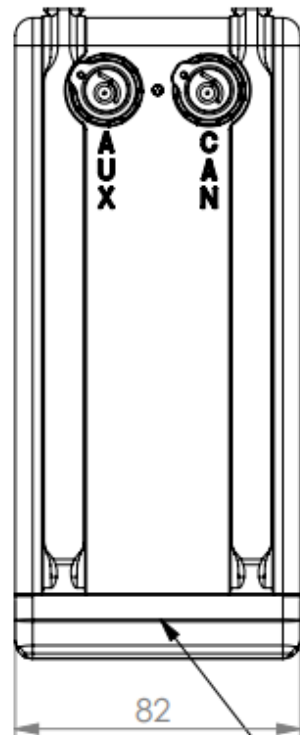
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Ordering product code

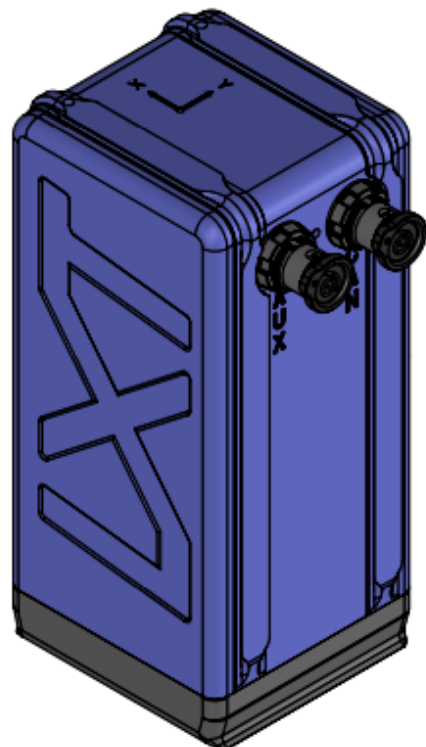
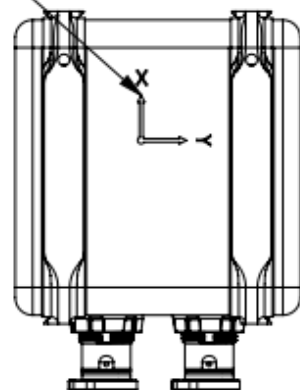
Model	nom. Height [mm]	Max. Speed. [km/h]	Output rate [Hz]	Cable length, other options
LXT - 1DR -	600 -	300 -	250 /	LC10 / LT10
LXT -				LC... / LT

Dimensional drawing



Height reference
Nominal height to ground: 600 mm

positive driving direction



Part number: L10129

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