Sensoric Solutions

Optic in Motion.

Optical measurement solutions for driving dynamics, motorsports, and railways.

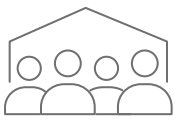
Development and production of optical measurement systems that reliably measure speed, slip angle, height, and motion – wherever performance, safety, and innovation are required.

We make motion measurable.

Sensoric Solutions specializes in optical sensor technology that makes motion and dynamics visible – precisely, contactlessly, and in real time. Our sensors measure speed, wheel slip and slip angle, pitch, roll, and yaw with an accuracy that gives engineers new insights into driving dynamics and handling.

Whether in research, development, motorsports, or railways, our systems deliver reliable data where other methods reach their limits. By combining optical and inertial measurement technology, we combine high dynamics with stable precision – regardless of surface, speed, or GPS signal.

Based in Wetzlar – the center of German optical technology – Sensoric Solutions combines in-depth engineering expertise, a passion for innovation, and the ambition to get the most out of every motion.



Founded
2021 in Wetzlar

Core competence
Optical inertial sensors

Applications
- Automotive
- Motorsports
- Rail
- Research & Development

Customers
worldwide in
- OEMs,
- universities,
- racing teams,
- testing institutes,
- railways

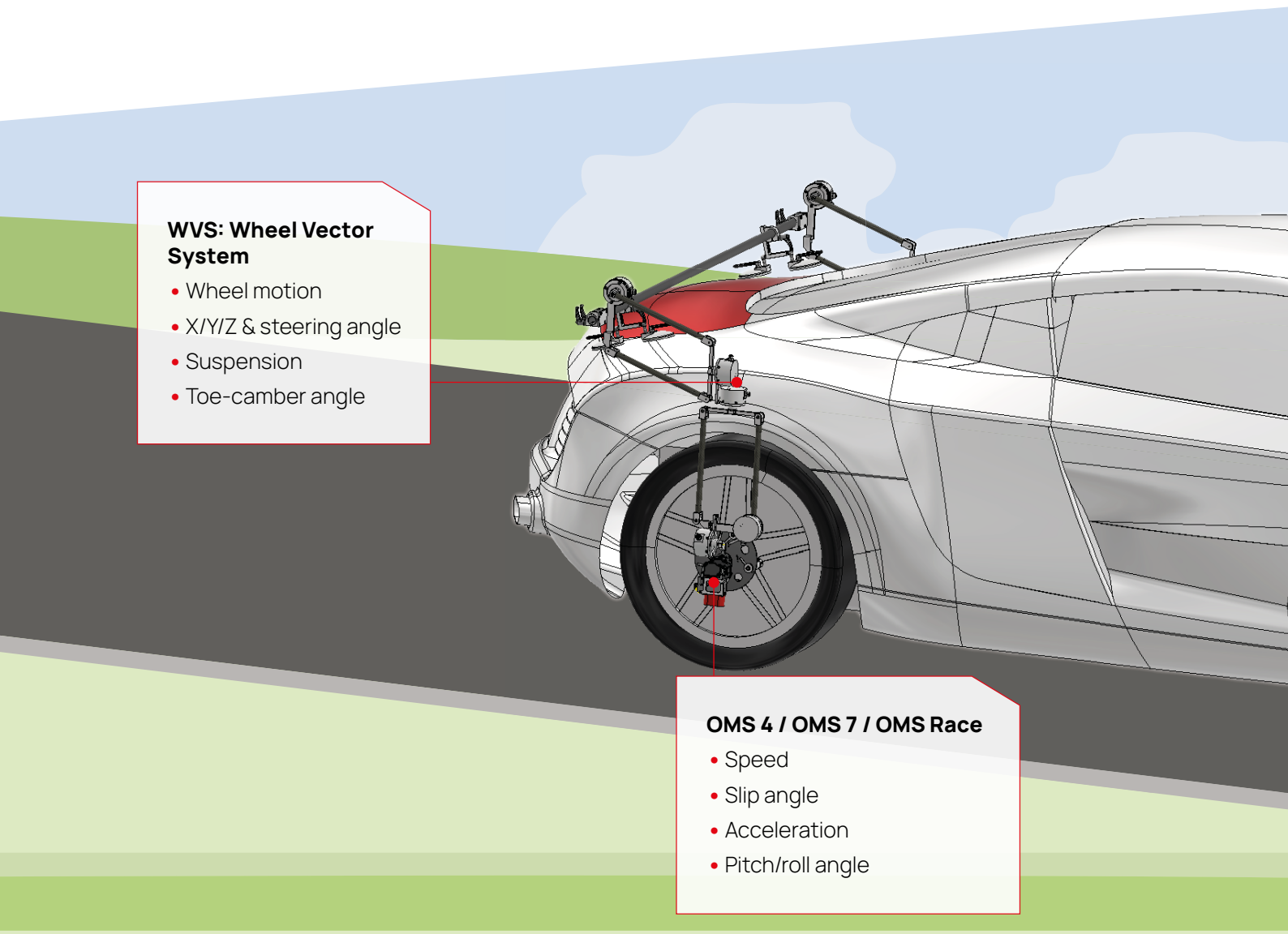
One beam of light – many possibilities.

From speed and angle to vehicle height, Sensoric Solutions offers precise, contactless measurement systems for research, development, motorsports, and railways.

Whether for driving dynamics tests, tire tests, braking distance measurement, or chassis analysis: With Sensoric Solutions' optical-inertial sensors, all relevant measurement variables are available in a consistent, combinable system – whether on the road or on the rail.

One system. All movements. Maximum precision.

Combine OMS, HMS, and WVS into a fully synchronized measurement solution – modularly expandable, easy to integrate, and ready for tomorrow's requirements.



OMS sensors

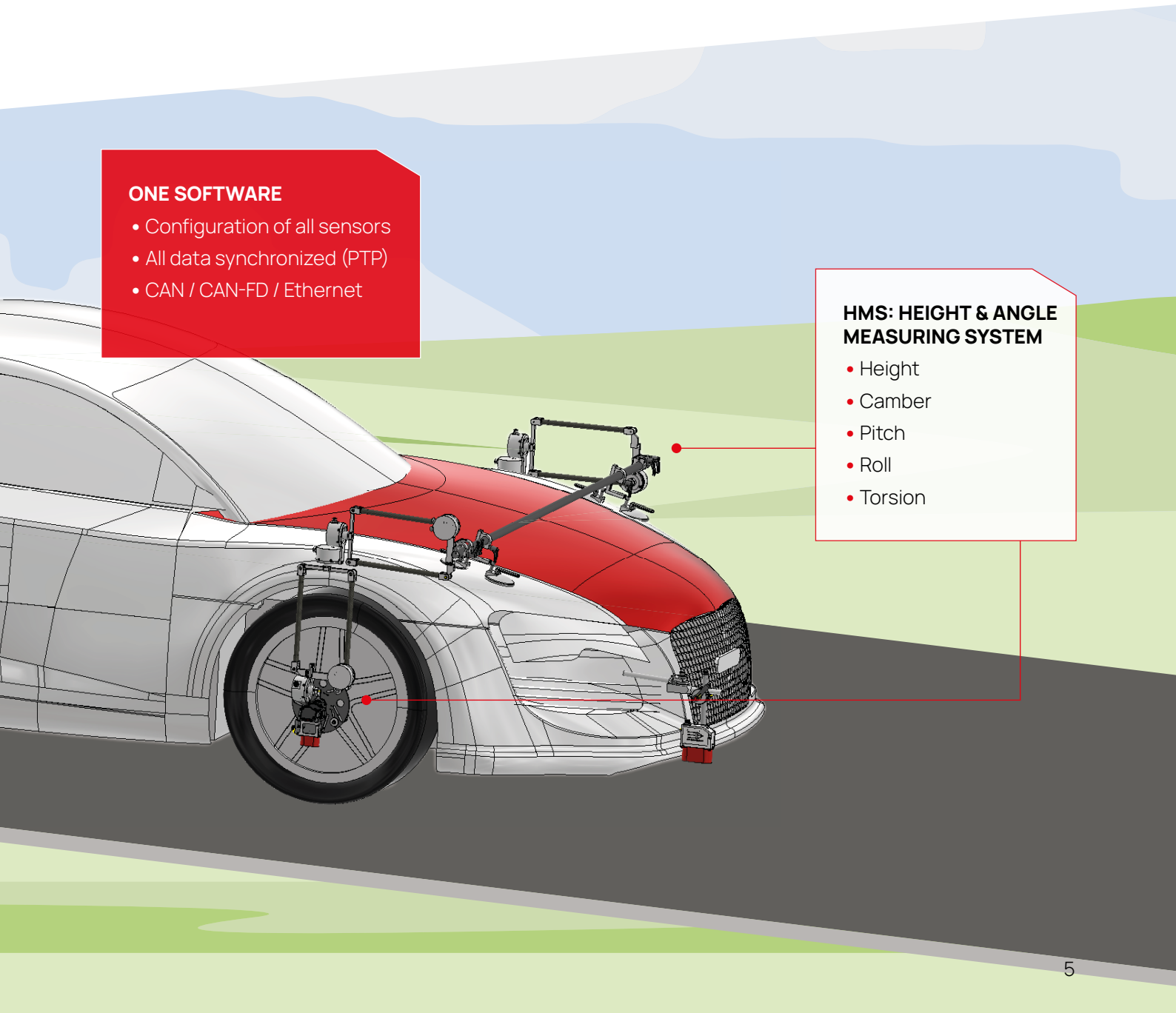
Optical inertial sensors for measuring speed, wheel slip and slip angle, and motion in 1 or 2 axes.

HMS system

Laser-based system for measuring altitude, pitch, roll, and yaw angles directly relative to the road surface.

WVS System

High-precision system for dynamic recording of wheel kinematics in X/Y/Z, including camber, toe and steering angles.



Optical precision for every dynamic.

The OMS sensor family from Sensoric Solutions.

When it comes to accurately detecting vehicle movements, optical inertial sensors are unbeatable. The OMS series from Sensoric Solutions measures speed and distance, wheel slip and slip angle, pitch and roll angle, and yaw movements directly – without GPS, without slip, without contact.

Based on the spatial filtering method, the system continuously analyzes the surface structure of the road. The smallest pattern changes are detected and converted into motion – with an accuracy better than 0.1%.

In combination with an integrated IMU (inertial measurement unit), stable, highly dynamic motion data is generated in real time, regardless of surface, light, or weather conditions.

Key advantages of OMS technology:

- **Direct, optical measurement → no GPS / slip / contact**
- **1 kHz update rate → ideal for highly dynamic maneuvers**
- **Compact design, easy integration via CAN / CAN-FD / Ethernet**
- **Quickly ready for use – no waiting for GPS, no entry procedure**
- **Absolutely reliable – measurements in all weather conditions and on all surfaces (ice, snow, earth, gravel, grass, road markings, etc.)**

OMS 4

Compact and precise

1-Axial optical-inertial sensor for displacement and velocity measurement

As a powerful 1-axis sensor, the OMS 4 accurately records displacement and velocity data. It is particularly suitable for displacement measurements and dynamic velocity tests that require high precision.

Features:

- 1-axis optical measurement
- Speed up to 500 km/h
- Accuracy < 0.1% (FS)
- CAN output
- Long-life IR LED illumination
- Optional brake & acceleration add-on

Typical applications:

- Braking distance measurements
- Acceleration tests
- Mileage measurement for rail vehicles

OMS 7

The standard for driving dynamics measurements

2-Axial optical-inertial sensor for all motion parameters

The OMS 7 enables precise recording of driving dynamics parameters in two axes and is ideal for comprehensive vehicle testing. Its robust design and high measurement accuracy make it the perfect companion for dynamic analyses in the automotive industry.

Features:

- Slip angle measurement < 0.1 °
- 1 kHz sampling rate
- POI conversion
- Robust, vibration-resistant design

Typical applications:

- Driving dynamics tests
- Handling
- Tire tests
- ADAS validation

OMS Race 180/250

Minimal weight and maximum performance

2-axis high-performance sensor for motorsports and autonomous systems

The OMS Race delivers precise data during extreme acceleration and driving maneuvers. Specially developed for motorsports, the OMS Race provides detailed data on slip angle and speed in real time. This sensor helps racing teams to precisely analyze vehicle behavior and develop optimized driving strategies.

Features:

- Low weight
- Ultra-robust (F1-proven)
- Slip angle measurement < 0.1 °
- 1 kHz sampling rate – highly dynamic
- CAN/CAN-FD output

Typical applications:

- Motorsports
- Chassis and control development
- Autonomous driving

OMS 7 Race

Precision with a compact ECU

The OMS 7 Race combines the OMS 7 sensor with its large working distance with the small, lightweight Race ECU (250 g) – the perfect solution for motorsports and harsh, mobile testing.

In addition, the OMS 7 Race allows the integration of up to 4 wheel incremental encoder (WPS1) for measuring wheel speed.

Features:

- Large working distance 300 mm ± 150 mm
- Race ECU has ¼ of the volume and ⅓ of the weight of the standard ECU
- Vibration resistance
- Three operating modes: Purely Visual I Visual Priority Mode I Fusion

Typical applications:

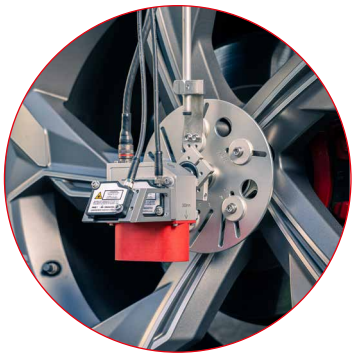
- Motorsports / Rally / Nascar
- Rough vehicle testing
- OEM / Driving dynamics
- Motorcycles

More than just motion – complete vehicle kinematics made measurable.

With HMS and WVS, Sensoric Solutions expands optical driving dynamics measurement to include height, angle, and wheel motion.

HMS System – Laser-based height and angle measurement

The HMS system is the perfect complement to the optical OMS sensors. Based on precise laser triangulation, it measures vehicle height, camber, pitch, and roll angles directly in relation to the ground. This provides realistic, reliable data for driving dynamics, handling, and comfort analyses.



System structure:
The HMS system consists of compact laser sensors (HMS 1) that can be mounted at various locations on the vehicle and an HMS integrator box that captures all signals and outputs them synchronized via CAN / CAN FD / Ethernet.

The integrated web interface makes it easy to configure the entire system and integrate it into existing DAQ environments.

Possible configurations:

Setup	Measurement options
1 × HMS	Height measurement at one point
2 × HMS (on the wheel)	Measurement of wheel camber angle to the road
3 × HMS	Simultaneous measurement of pitch & roll
4 × HMS (H-frame)	Dual roll signals and torsion

Key Features:
- Precise height measurement: measurement frequency 1000 Hz, repeat accuracy < 0.1 mm
- Road inclination or steep curves have no influence
- Can be combined with OMS sensors
- Integrator box ensures synchronous data output via CAN/CAN FD/Ethernet
- Protection class IP67
- Web interface for configuration and real-time monitoring

Typical applications:
- Chassis behavior
- Camber angle analysis
- Torsion measurements
- Pitch/roll angle detection during handling tests

Height measurement & wheel angle

WVS – Wheel Vector System

The WVS measures the position of the wheel in X, Y, and Z, additionally records camber, steering angle, and track and thus provides a complete picture of wheel kinematics. Combined with OMS and HMS, this creates a fully synchronized overall system for complete vehicle and axle dynamics.

The WVS operating principle:
Five optical encoders detect wheel motion relative to the body.
A parallelogram mechanism ensures constant alignment of the sensors in all driving situations. All sensor signals are synchronized via an ECU, calculated, and output via CAN/CAN FD/Ethernet.

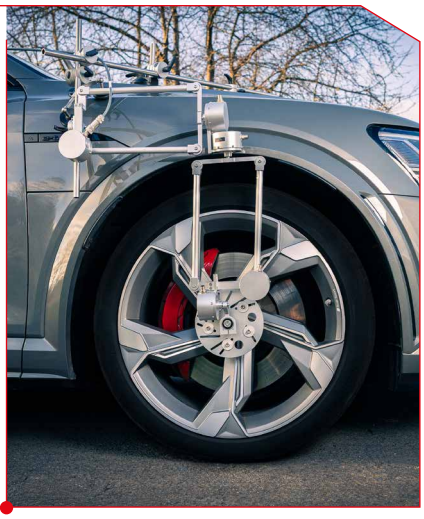
From the wheel to the body – everything in motion, everything measurable.
HMS and WVS complement the optical sensor technology of the OMS series to form a complete, synchronous driving dynamics system for research, development, and testing.

Key Features:

- Dynamic measurement of X/Y/Z, camber and steering angle, suspension travel
- Up to 4 wheels per integrator
- Compatible with OMS 7 and HMS 1
- Robust, lightweight design – suitable for use in vehicles or on test benches
- Easy installation using suction cup mount and collets
- CAN integration with standardized DBC file

Typical applications:

- Wheel kinematics analysis
- Chassis validation
- Ride comfort (in combination with OMS and WFT)
- Simulation & HiL systems
- Tire development



Quick to set up.
Intuitive configuration.

Sensoric Solutions' measurement systems are not only characterized by their high precision, but also by their quick installation thanks to flexible mounts and convenient configuration thanks to a web-based software suite.

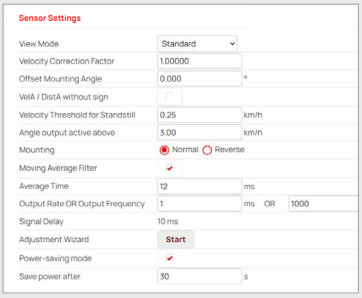
Software

With the Sensoric Software Suite, all OMS, HMS, and WVS sensors can be conveniently configured, monitored, and evaluated – directly via the browser. Simply enter the IP address of the sensor and you will have access to all functions, live data, and diagnostic information.

The basic software is included with every sensor – no additional license required.

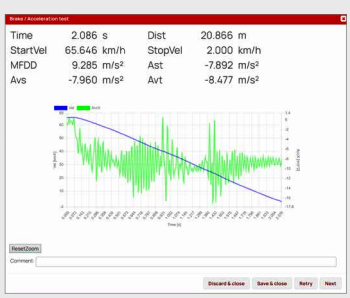
Functional highlights:

- One software for all sensors: No installation, easy operation via any browser
- Parameterization & calibration: intuitive menu navigation, no expert knowledge required
- POI conversion: Conversion of measured values to any vehicle points
- User configurations: Save vehicle profiles for quick switching between vehicles
- Data output: CAN / CAN-FD / Ethernet in standardized data formats
- System diagnostics: Status display, voltage monitoring, and log function



Expansion package: Brake & acceleration measurements

An optional, fully integrated add-on is available for brake and acceleration tests. Guided procedures and automatic report generation make execution and documentation easier and more reliable.



Features:

- Automatic detection of start/stop triggers
- Calculation of all important parameters: MFDD, distance, start/end speed, deceleration
- Output to CAN or Ethernet
- Storage of measurements in a CSV file
- Automatic sequence control (also possible via CAN commands)

The add-on can be activated at any time.

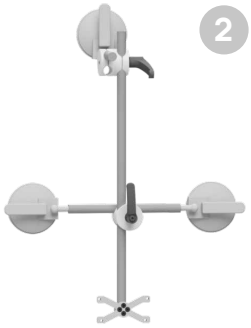
Mounting systems & brackets

Our robust and versatile mounts ensure precise mounting of OMS sensors in every application. Whether for use in dynamic vehicle testing, racing, or demanding track measurements, the mounts offer maximum stability and flexibility to ensure optimal measurement results.

Towing eye mount (1)
The T1 / T2 tow eye mount enables easy and extremely stable mounting on the tow eye of vehicles. Its variable clamp allows mounting on a wide variety of vehicle types. The sensor can be ideally aligned on the vehicle without additional tools.

Side mount (2)
The side mount is available in two versions: Version S1/S2 with Rubber suction cups for smooth surfaces and version M1/M2 with magnetic magnets for metallic surfaces. Thanks to three supported contact surfaces , the holder provides a secure hold even on curved surfaces. The fully rubberized suction cups and magnets reliably protect the vehicle paintwork from damage.

Wheel mount (3)
With the W1 wheel mount and an OMS 7 sensor, the camber angle can be precisely measured directly on the wheel. The mount includes a flexible mounting plate that centers itself and is suitable for different bolt circle sizes and wheel nuts. It is mounted using collets and stabilized by a flexible support to the body, which can be easily adapted to any vehicle and ensures a secure hold.



Key features of all mounts:

- Quick installation & precise alignment of the sensors
- Rotatable and lockable clamp connections
- Quick changeover between vehicles
- Corrosion-resistant materials for long-term use
- Compatible with all OMS, HMS, and WVS systems
- Designed for road, track, and rail

OMS-, HMS- and WVS-Systeme

capture all relevant parameters in a single, synchronized measurement system.

Application Driving dynamics – Capture every motion

Driving dynamics tests form the foundation of modern vehicle development

Whether handling, comfort, tire tests, or control strategies – precise knowledge of speed, slip angle, and vehicle motion is crucial. With the OMS, HMS, and WVS systems, you can record all relevant parameters in a single, synchronized measurement system.

Typical measurement tasks:

- Speed, slip angle, and wheel slip
- Pitch, roll, and camber angles
- Vehicle height and wheel motion
- Steering and suspension
- Longitudinal and lateral acceleration
- Validation of tire model & friction coefficient analysis
- Dynamic compliance measurements

Advantages:

- Synchronized data from all sensors via integrator box
- Slip angles with < 0.1° accuracy
- Angle measurement relative to the road surface (no reference error)
- 1 kHz measurement rate – ideal for highly dynamic maneuvers
- Browser-based configuration
- CAN/CAN FD/Ethernet integration

ESP tuning

Measure, understand, and optimize stability.
The OMS provides precise, reproducible reference data for the development and validation of ESP control strategies – independent of tire or drive influences.

Typical tasks:

- **Precise vehicle speed –** regardless of slip and drive
- **Direct slip measurement of all wheels –** basis for sound ESP calibration
- **Validate ESP algorithms –** comparison of controller target vs. vehicle actual without GPS dependency
- **Recording tire characteristics –** for μ estimation, μ progression, force-slip characteristics, and tire model parameterization (Pacejka, MF-Tyre)
- **Validating state estimation –** highly accurate reference data for slip angle, and observer tuning (EKF, UKF)

Advantages:

- Synchronized Data from all sensors via integrator box
- Slip angle with < 0.1° accuracy
- Angle measurement relative to the track (no reference error)
- 1 kHz measurement rate – ideal for highly dynamic maneuvers
- Browser-based configuration
- CAN/CAN-FD integration

Ride comfort analyses

Comfort begins with precise motion capture.
The optical inertial measurement system provides a low-noise, stable reference for NVH, drive, and suspension analyses.

Typical tasks:

- **Drive and brake comfort:** Detect slip peaks, jolts, and quantify load changes; ideal for e-drive calibration
- **Lateral dynamics comfort:** Directly measured lateral velocity for directional stability and crosswind sensitivity as well as slip angle
- **Chassis and tire comfort:** Analysis of slip and force behavior, objective damper and spring evaluation
- **Transmission and clutch comfort:** Precise measurement of slip during gear changes
- **Electric drives:** Optimizing torque build-up and recuperation

Advantages:

- Precise speed and acceleration reference without IMU drift
- Clear separation between road influence and vehicle response
- Objective, reproducible comfort metrics independent of tire or road surface conditions

Application: Motorsport
Precision at the limit

When every millisecond counts, absolute precision is essential.

In motorsports, the OMS Race, together with the Race ECU, delivers high-frequency, synchronized measurement data for telemetry and performance analysis – even under extreme conditions.

Real tire data under track conditions:

- Direct measurement of longitudinal and lateral slip under real driving dynamics, not on the test bench
- Exact force/slip characteristics under real friction coefficient and temperature conditions
- Recording of complex effects: friction coefficient fluctuations, surface temperature, track rubbering
- Significantly more meaningful than drum test benches or roller test benches
- CAN/CAN FD/Ethernet integration

Advantages:

- Ultra-compact and lightweight design
- Robust, vibration-resistant design
- FIA certified
- Used in F1, NASCAR, IndyCar, GT3 Cup, Formula E, FS, A2RL, etc.
- 1 kHz data rate, low and constant latency
- Ideal for tire testing, setup validation, control development, performance optimization

Heat-up, fade & tire degradation

- Analysis of tire behavior over complete stints
- Real-time recording of grip changes, overheating, grain/blister effects
- Derivation of optimal pit stop windows, tire pressure, and camber strategies

Ground truth for simulation & model development

- High-precision, drift-free speed and lateral motion data
- Validation of driving dynamics and lap time simulations
- Optimized parameterization of tire models (MF-Tyre, FTire, custom models)
- Reliable reference for vehicle models and setup processes

Dynamic compliance analysis with WVS (Wheel Vector System)

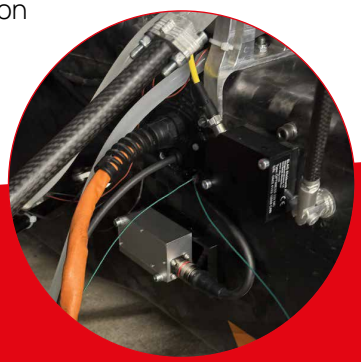
- Detection of dynamic changes in axle geometry and elastokinematics
- Measurement of toe/camber compliance, axle deformation, and roll stiffness
- Comparison between static setup geometry and actual track geometry
- Ideal for high-performance chassis with tight tolerances

Evaluate aerodynamics and vehicle balance

- Real influence of downforce and aero stall effects on grip and balance visible
- Detection of balance shift via speed or load change
- Better representation of aerodynamic changes in telemetry and simulation

Reliable in any environment

- Precise data even on city courses, narrow pit lanes, or with poor satellite reception
- Drift-free optical measuring principle → perfect for long runs, reproducibility, and comparability



“We love the OMS Race 180 – that thing works every time!”

William F1 Team

“With the OMS Race from Sensoric Solutions, even our most experienced driver was able to achieve previously unattainable lateral and longitudinal acceleration, making us faster than ever before.”

Team Leader, DART Racing Darmstadt

Only those who truly know themselves can drive autonomously.

The optical sensors from Sensoric Solutions provide precise motion detection that makes autonomous driving safe – regardless of surface, real-time capability, and reliability.

Application: Autonomous driving and ADAS

Perfect position and motion measurement – independent of GPS.

For precise validation, safe maneuvers, and reliable autonomy.
Automated driving functions require a precise understanding of vehicle motion – not only where the vehicle is located, but also how it is moving. Sensoric Solutions' optical-inertial sensors deliver this information directly to the ground: highly accurate, dynamic, and independent of satellite signals. This enables reproducible, drift-free measurement of vehicle motion, synchronized across all axes, even in "GPS-denied" environments.

Why optical sensor technology is key

Independent of GNSS limitations:

- No interference from shadows, urban canyons, or tunnels – precise data even in urban canyons, parking garages, or test halls.
- No dropouts, no jitter, no multi-path errors
- Works reliably in GPS-denied areas and in poor signal quality conditions

Superior dynamics and precision:

- High-frequency motion data (1 kHz) – delivers dynamics that GNSS systems cannot achieve
- Surface-independent: works on asphalt, pavement, gravel, and even ice and snow
- Captures all rotational movements and angles in real time
- Drift-free optical measurement principle → perfect for long runs, reproducibility, and comparability

Validation of ADAS and AD functions
Secure systems start with secure data. Optical sensors are the benchmark for dynamic testing and automated maneuvers – from sensor fusion to certification.

Result:
Reliable speed and angle measurement in any environment – ideal for the development, calibration, and validation of ADAS and AD functions.

Typical areas of application:

Automated maneuvers and safety functions:

- **AEB/AES tests:** Reproducible reference data for emergency braking and evasive maneuvers
- **ACC/LKA/TJA:** Objective evaluation of longitudinal and lateral dynamics (jerk, directional stability, stability)
- **Low-speed automation (< 10 km/h):** Reliable motion detection even at minimal speeds
- **Driving dynamics analysis:** Precise evaluation of yaw reactions, understeer/oversteer, μ jumps

Algorithm development and sensor fusion:

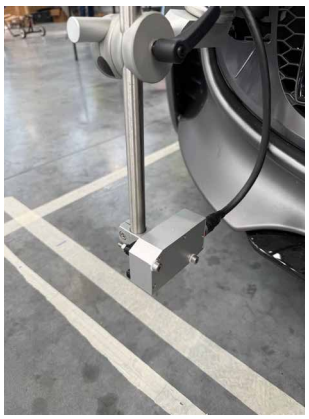
- **Observer validation:** Precise ground truth data for EKF/UKF/SLAM algorithms
- **Perception & localization fusion:** Reliable calibration and uncertainty reduction in sensor data
- **ESP, MPC, and trajectory control:** Highly dynamic speed data for control and path tracking
- Detection of deviations between planned and actual trajectory

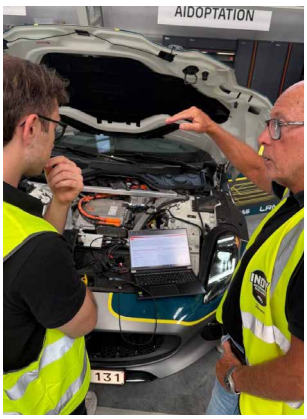
Certification and approval:

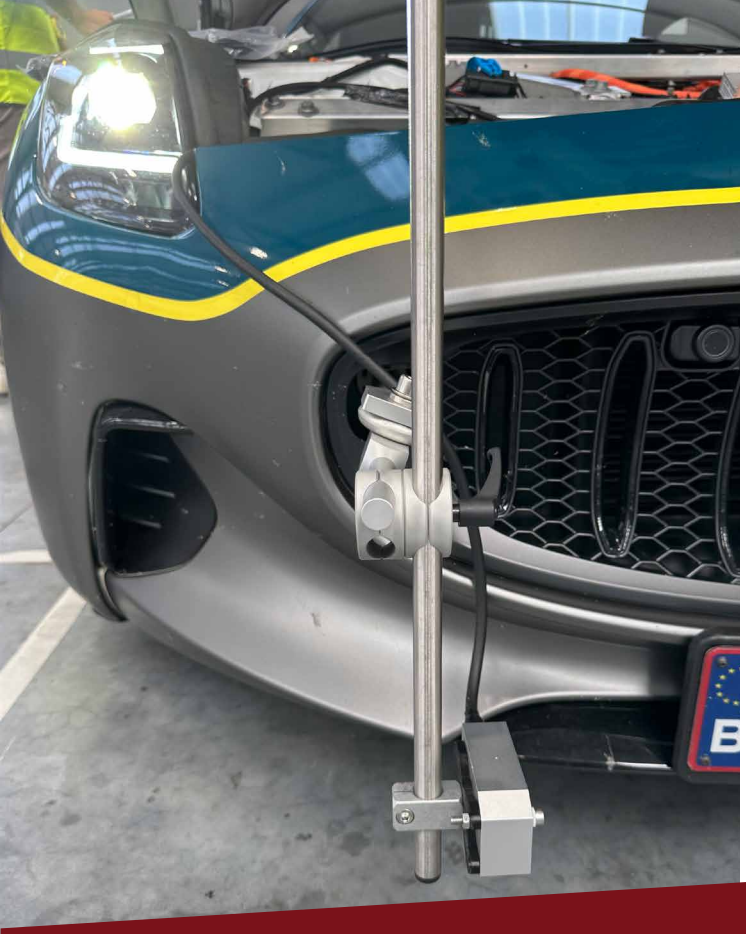
- Reliable motion data for ADAS calibration and approval in accordance with ISO 15622 and Euro NCAP requirements
- Essential for certification and approval criteria of international standards

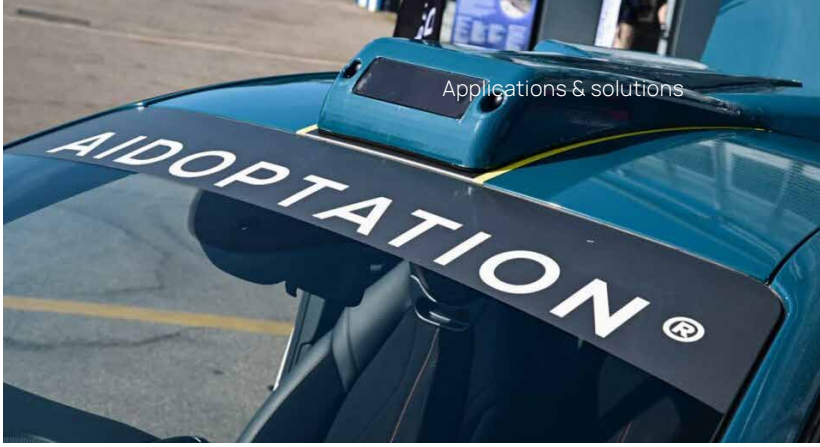
Key benefits for developers and testing institutes:

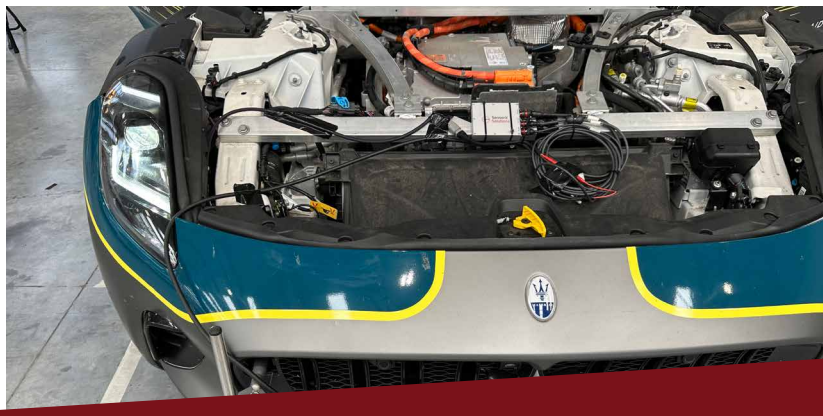
- **Reduced uncertainties** in the validation of perception, localization, and planning algorithms
- **Greater robustness** of autonomous control in GPS-critical test environments
- **Ground truth data** for validating model predictive control strategies











Case study:
AIDOPTATION / Droneport (Belgium)

“We tested the optical sensor on our autonomous Maserati GranTurismo Folgore.

The measured speed (Vx) of our EKF now matches the optical measurements much better, while GNSS data remained unreliable in some sections.

The sideslip measurement compared to GNSS techniques is a real game changer in terms of accuracy. The sensor is indispensable for edge case maneuvers with high lateral forces – it significantly improves the responsiveness and stability of the overall system.”

Rodrigo Senofieni, PhD, Engineering Leader AIDOPTATION

Bildquelle: https://www.linkedin.com/posts/aidoptation_autonomousdriving-ai-vehicledynamics-activity-7362396794263089153-OUra

Application:
Brake distance measurement
for road and rail

Precise, contactless, and efficient

Whether for vehicle development, approval, or operational testing, reliable braking distance measurements are the basis for safe mobility.

However, many measurement methods reach their limits precisely where precision is crucial. Wheel speed sensors provide inaccurate values under slippage and ABS interventions, drag wheels are sensitive to uneven surfaces, GPS loses accuracy when shaded, and inertial systems drift over longer measurement distances. The result: incorrect values, multiple measurements, and delayed testing and approvals.

Optical precision – the new benchmark:

The braking distance measurement system from Sensoric Solutions is based on optical inertial sensor technology (OMS 4/OMS 7), which measures speed and distance directly on the road or rail without contact and without slippage – regardless of GPS, weather, or surface conditions.

- **Precision:** Measurement accuracy better than 0.1%
- **Versatile:** Can be used on asphalt, concrete, gravel, or rail track
- **Robust:** Weather-independent, shock- and vibration-resistant
- **Fast:** Ready for use without calibration or warm-up time
- **Complete:** Includes data acquisition and software

Complete system – configured for practical use
The braking distance measurement system is available as a complete, ready-to-use system– including data acquisition and software. Guided test procedures, live data display, vehicle management, and automatic PDF reports make operation simple and efficient – on a tablet, notebook, or smartphone.

Areas of application

Road:

- Development/testing of passenger cars, commercial vehicles, and buses
- Braking distance measurements according to ISO and NCAP
- Validation of emergency braking assistance systems (AEB)
- Analysis of deceleration, stability, and reproducibility

Areas of application

Rail:

- Braking distance measurements for trams and trains
- Approval/acceptance tests in accordance with BOStrab and EBO
- Documentation of braking performance under real conditions
- Optimization of brake parameters and maintenance

Advantages

- Reliable measurement results under all conditions
- Efficient measurement process thanks to intuitive app
- High productivity thanks to quick installation
- Secure documentation with tamper-proof PDF reports

One sensor – all paths in view.

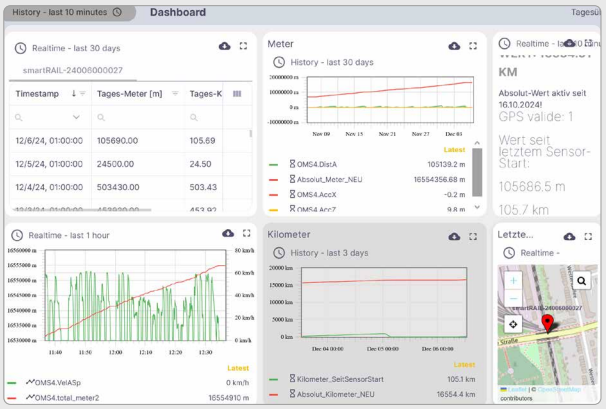
With the optical systems OMS 4 and OMS 7 from Sensoric Solutions, motion is transformed into measurable precision – for reliable data along the entire route.

Railway application
Optical precision for the railway industry

Precise distance and speed measurement

Reliability and precision are key in the railway industry – whether in the development of new vehicles, in approval tests, or in ongoing operational monitoring.

The OMS 4 and OMS 7 optical inertial systems from Sensoric Solutions deliver accurate distance and speed data on all surfaces – from ballast to concrete – enabling completely new levels of accuracy in braking distance measurement, mileage recording, and route referencing.



Optical precision on the rails

The optical measuring principle detects motion and speed directly on tracks, ballast, and sleepers – contactless, drift-free, and independent of wheel slip. This produces highly accurate reference data that can be used not only for brake tests but also for precise position and route determination.

All data at a glance:

- **Cloud-based platform:**
  Access data from anywhere
- **Real-time insights:**
  Live visualization of train data
- **Integrated GPS:**
  Track every train in real time
- **Seamless processes:**
  Integrated workflows and vehicle management tools

Key benefits:

- Accuracy better than 0.1% at any speed
- Stable measurement on all track types: ballast, asphalt, concrete, switch areas
- No dependence on GPS or wheel rotation
- Easy to retrofit on trams, railcars, and measurement trains
- Robust and low-maintenance for continuous operation

Mileage & odometry

Sensoric Solutions' optical sensors enable accurate recording of mileage and running performance – reliably even after weeks of use and under demanding conditions. The data can be transferred directly from the cloud to operational maintenance or fleet management systems and serves as the basis for precise maintenance and planning intervals.

Distance measurement & referencing

The high measurement resolution of the OMS sensors allows events to be accurately assigned to defined points along the route. This means that measurement results, braking processes, or infrastructure data can be precisely referenced to the route geometry.

Practical example:

In a test measurement conducted by ÖBB over a 50 km reference route, the OMS achieved a deviation of only 5 m – corresponding to a total accuracy of 0.01%. This means that even the smallest events, such as the start of braking, can be clearly assigned to a specific point on the route.

Innovation from Wetzlar – for the mobility of tomorrow.

Sensoric Solutions stands for optical precision made in Germany.

Our mission is to offer high-quality products that provide our customers with reliable vehicle motion data with unparalleled precision. Easy to install, ready to use, and equipped with standard interfaces, our solutions enable seamless integration into various systems. They are robust enough to withstand harsh test environments, operate autonomously, and guarantee unmatched reproducibility of measurement results.

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