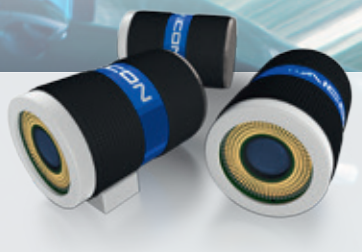
AICON
3D Systems



Vehicle Dynamics

Non-contact high-speed monitoring of wheel and engine motions

MEASURE THE ADVANTAGE

WheelWatch | EngineWatch

In the development of new vehicles, engineers undertake extensive tests to optimize the vehicle dynamics and the engine movement. These include the measurement of the wheel clearance, the determination of the wheel parameters track, camber, spring deflection and steer angle, and the simultaneous measurement of multiple axles within one coordinate system. The engine motion is the one key factor for the optimized configuration of the engine compartment.

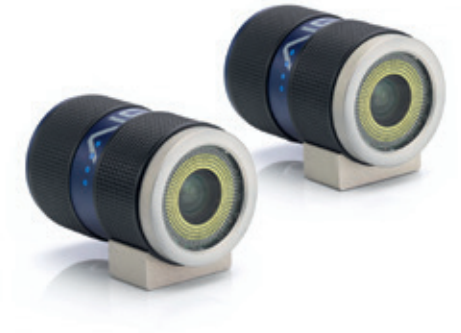
The optical measuring systems **WheelWatch** and **EngineWatch** replace mechanical sensors. Due to the functional principle of this technology, dynamic testing is made more efficient, while the measurements are much more accurate.

APPLICATIONS

- 6D measurement of wheel and engine motions
- Measurement of track and camber changes (e.g. during slalom tests)
- Monitoring of steering and steering wheel angles
- Measurement of absolute wheel positions during various drive maneuvers
- Validation of simulation models
- Wheel clearance measurement
- Spring deflection measurement
- Test station applications (e.g. K & C and axle alignment)
- Camber angle measurement with regard to lateral dynamics and steering return

DYNAMIC TESTING

Optical 3D measuring systems for applications in chassis and engine development



"We have already carried out more than 100 test drives with WheelWatch and we see the data generated by WheelWatch as a valuable complement to other measurement data. It is really easy to combine it with other sensors."

Theo Geluk, LMS International, Leuven/Belgium

The key component of the optical systems **Wheel**Watch and **Engine**Watch is a high-speed camera. The camera has an acquisition frequency of nearly 500 Hz. With its sturdy design and long-term stability, it is particularly suitable for use in test drives.

Workflow

WheelWatch is designed for the measurement of wheel movements, whereby each wheel is monitored by a camera capturing the wheel as well as the surrounding fender. EngineWatch uses one camera focused on the engine block and a reference plate attached to the vehicle body by means of a fixture. The position of the cameras relative to the vehicle does not need to be stable, as WheelWatch and EngineWatch recalculate their positions continuously at the measuring frequency. The measurement results such as positions, angles and trajectories are available for processing shortly after recording.

Excellent accuracy

The wheel and engine motions can be measured up to a vehicle speed of 250 km/h. The system also allows for the monitoring of the relevant parameters during extreme maneuvers. Positions are measured to an accuracy of about ± 0.1 mm, while the accuracy for the measurement of angles is around ± 0.015°.

Synchronization of multiple sensors

Multiple cameras can be synchronized among each other as well as with other measuring devices. For this purpose, the cameras can be controlled by an external synchronization trigger. Alternatively, they can directly generate the master signal for all sensors connected to the system. In addition, every measured value is signed with a digital time stamp. This allows for synchronized operation on multiple axles and in combination with other measuring sensors.

Both systems compute all six degrees of freedom of the wheel and engine motions as absolute values in the vehicle coordinate system. The results can be exported for evaluation through an interface to other software applications (e.g. for motion visualization in CAD).

Short setup time

The high-speed camera can be installed quickly and easily on the vehicle without any special equipment. The installation of a complete WheelWatch system with camera mount, four cameras and wheel adapters, including complete calibration and referencing to the vehicle coordinate system, takes less than two hours. The EngineWatch equipment can be set up in approximately 60 minutes.

Integration into test stations

WheelWatch and EngineWatch can also be integrated into vehicle test stations. The synchronized acquisition of data by all cameras and other connected sensors ensures the cycle-controlled measurement of all wheels and components. All measurements are saved in digital format.

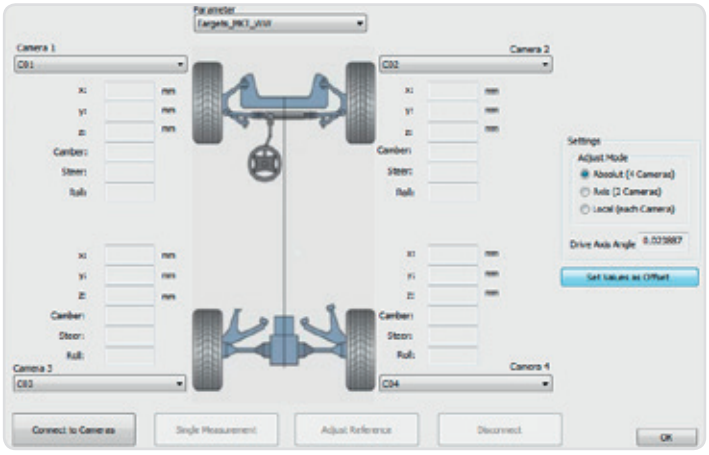
In addition, the data are made available through an analog or digital interface (e.g. TCP/IP) in real time to the master computer. The optional AICON data router enables the control of all functions via TCP/IP from a central test station computer.

No mechanical connection to wheel or engine

The optical WheelWatch and EngineWatch systems have no mechanical connections to the measuring object. The movement of the wheel or engine is thus not in any way influenced by the measuring equipment. In particular, there is no restriction of the steering angle. In contrast to other methods, measuring errors caused by the mechanical connection of the sensors cannot occur.

Low weight

WheelWatch and EngineWatch do not require heavy analysis units, batteries or controllers that might influence the drivability of the vehicle. Additionally, there is no need for high stability of the camera mount. As the mount and the cameras are lightweight components, they do not affect the handling.



One reference system for all wheels and engines

With WheelWatch and EngineWatch, all four wheels and the engine are captured in one global coordinate system. This allows a wheel-to-wheel motion analysis.

Extendable for additional measuring tasks

The high-speed camera of the WheelWatch and EngineWatch systems can also be used for the analysis of other motions, including applications with a large number of measuring points. For 3D analysis, at least two cameras are required, focused at different angles on the measuring object.

Other applications include door slam testing and the testing of locking mechanisms of hatches (e.g. car boot door), convertible tops and windows as well as material tests.

ADVANTAGES

- Suitable for use on test tracks and test stations
- Short setup time
- 6 DOF measurement of motion in real time
- Excellent measuring accuracy (X, Y, Z: ± 0.1mm, angles: ± 0.015°)
- High measuring frequency of up to 490 Hz and unlimited measuring time
- Measuring results shown as absolute values in vehicle coordinate system
- No mechanical connection between sensor and wheel or engine
- Low stability requirements for camera mount
- Adaptable for motion analyses of rigid bodies

Our Philosophy

Efficient and high-precision production monitoring, quality control, inspection and reliable reverse engineering are absolutely essential to be competitive in a global market.

In the field of industrial metrology and beyond, optical and portable non-contact 3D measuring systems become more and more important. We offer optimized solutions around your inspection and digitization tasks to keep the quality of your products always at the maximum level.

MEASURE THE ADVANTAGE

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