caemax
imc group

Wheel Torque Transducer WTT-D^{x}

compact • robust • wireless

Waterproof wheel torque transducer with telemetric signal transmission

productive testing

Wheel torque transducer WTT-D^x – at a glance

- Precise measuring of drive and braking torque directly at the wheel
- Cable-free data transmission via D^x telemetry to D^x receiver unit in the vehicle
- Synchronous data acquisition from up to four WTTs with a single receiver unit
- Replaceable battery with up to 80 h running time
- Operating temperature -10 °C to +60 °C, with optional special battery -30 °C to +60 °C
- Waterproof according to IP67 protection rating
- Software-controlled zero calibration and measurement start
- Analog and CAN interface

Driving in all weather conditions

Increase productivity with CAEMAX wheel torque transducers

In automotive development, it is important to know the exact torques acting on the vehicle – especially under acceleration and braking maneuvers. With the WTT-D^x wheel torque transducer from CAEMAX, a high-precision tool is available for such measurements. The sensor detects the mechanical load directly where it is produced: at the wheels that form the interface between the vehicle and the road.

The WTT-D^x, which is waterproof according to an IP67 protection rating, acquires the torque in the axial direction (M_y) by means of integrated strain gauge sensors. The fully differential design of the strain gauge amplifier, including the bridge feed, ensures maximum interference suppression.

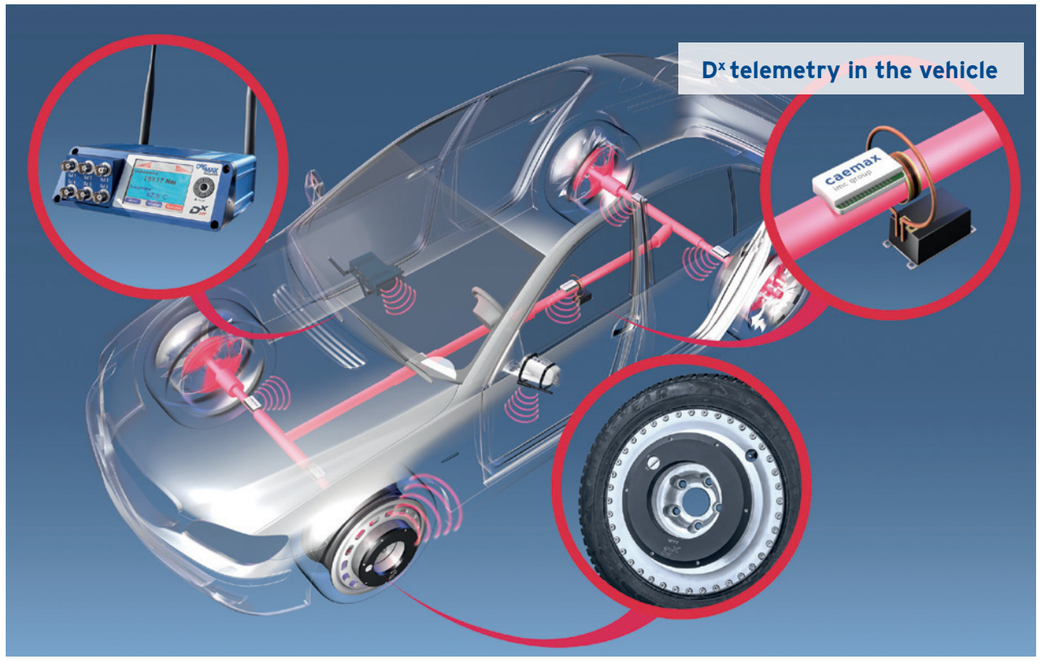
Via integrated D^x telemetry, up to four wheel torque transducers can send their measured values to a receiver unit synchronously – interference-free and wireless thanks to digital radio technology.

A further advantage is the modularity of the WTT-D^x: the sensor housing and adapter can be reconfigured for each vehicle. Exchanging components is simple and fast.

Each CAEMAX wheel torque transducer is calibrated on a specially developed test stand before delivery.

Suitable for all weather conditions: the WTT-D^x wheel torque transducer

Wirelessly measure torque on wheels and drive shafts

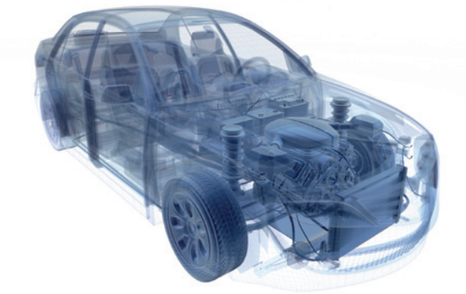


The wheel torque transducer is equipped with a modular Dˣ telemetry digital transmitter unit. This allows for absolutely synchronous data acquisition from several transmitters in a single frequency band (868 MHz, or alternatively 2.4 GHz).

In addition to the WTT torque signals, further measurement points can also be integrated via additional Dˣ transmitter units. For example, drive or output torques can be synchronously acquired by means of strain gauges that are applied to the vehicle shafts. Likewise, wireless temperature measurements on brake discs, for example, or measurements of the brake pressure are also possible. Up to four transmitters can synchronously transmit data to a single Dˣ receiver. In addition, several receivers can be synchronously operated in parallel.

In Practice

Drivetrain efficiency optimization
In order to reduce energy consumption and CO_2 emissions of vehicles, drivetrain efficiency is investigated during automotive development and continuously improved. For measurements on the drivetrain, the WTT-Dˣ precisely acquires the torques directly acting upon the wheels. Additional measurement variables are acquired parallel, and these combined data are used to quantify and model efficiency and friction losses along the drivetrain.



Testing ride & handling in winter
During winter testing, the vehicle, test engineer and measurement equipment are not only exposed to snow and ice but also to high temperature fluctuations and melt water. The waterproof (IP67) and robust WTT-Dˣ proves its worth in these harsh environmental conditions: replaceable cold-climate batteries enable the system to be used at ambient temperatures down to -30 °C. The resistive sensor body is designed for mechanical loads up to ± 6 kNm. The simple assembly and operation enable a fast and uncomplicated exchange of components.

Evaluation of driver assistance systems
In order to optimize traction, maneuverability and directional stability, modern all-wheel-drive vehicles regulate the distribution of drive torque to the wheels within milliseconds. Thus, wheel torque transducers that are used for the evaluation of driving assistance systems must record measurements with high temporal precision. With the WTT-Dˣ, all four wheel torque transducers are sampled synchronously and in high temporal resolution. The interference-free transmission (diversity-mode) minimizes signal failures.

Test-ready in just an hour

Four WTT-D^x can be installed in just one hour

"With our wheel torque transducers, we provide our customers with high-precision tools for measuring the torque at the wheel. We have consistently paid attention to short set-up times and easy, convenient handling during assembly. The synchronous, cable-free acquisition of measurement data is made with standard components of the D^x telemetry, thus ensuring optimum transmission quality."

Florian Sailer, Senior Engineer (QMB) at CAEMAX

Modular design – universal application

Suitable for many different vehicle types

With the CAEMAX adapter system, the wheel torque transducers can be mounted with minimal effort on different vehicle types. A quick system set-up and convenient software functions, such as zero calibration, allow the system to be test-ready within a very short time. Three components form the vehicle-specific wheel.

(1) **Rim adapter:** As with a conventional rim, the rim adapter serves as a mount for the tire. The rim adapter is not directly specific to the vehicle, but depends on the tire. This allows it to be used on different vehicles with the same tire size.

(2) **Hub adapter:** The hub adapter is used to connect the WTT-Dx to the vehicle. It can be used for different types of vehicles, as long as the bolt circle and the wheel offset are the same. With just a few hub adapters, an entire fleet of vehicles can be covered.

(3) **WTT-D^x sensor housing:** The sensor housing connects the hub adapter and the rim adapter to each other. Thus, based on a modular design, a WTT-D^x wheel torque transducer can be adapted to the vehicle in a time-saving, space-saving and cost-effective manner.

The complete testing solution: with imc

In the case of holistic vehicle testing, many different physical quantities need to be acquired. In addition to wheel forces, information on acceleration, force, frequencies, suspension displacement, strain or ECUs are also of interest. imc measurement devices ensure synchronous data acquisition of all signals – to which the CAEMAX WTT-D^x wheel torque transducer can be integrated directly. The imc software then offers a wide range of possibilities for measurement data analysis, visualization and further processing.

Modular, spatially-distributable measurement system

imc CRONOS*flex*

- Flexible modularity through frameless expansion
- Ideal for frequently changing measurement tasks – distributed or centrally located
- Aggregate sampling rate of 2 MHz
- Synchronous acquisition from one up to thousands of channels

Universal & flexible: on the test stand, in the lab or mobile applications

imc CRONOS*compact*

- Measurement, control and simulation in one system
- Large selection of measurement amplifiers & modules
- Integration of MATLAB/Simulink models for HiL
- Ideal for mid- to high channel counts

Measurement systems for extreme environments

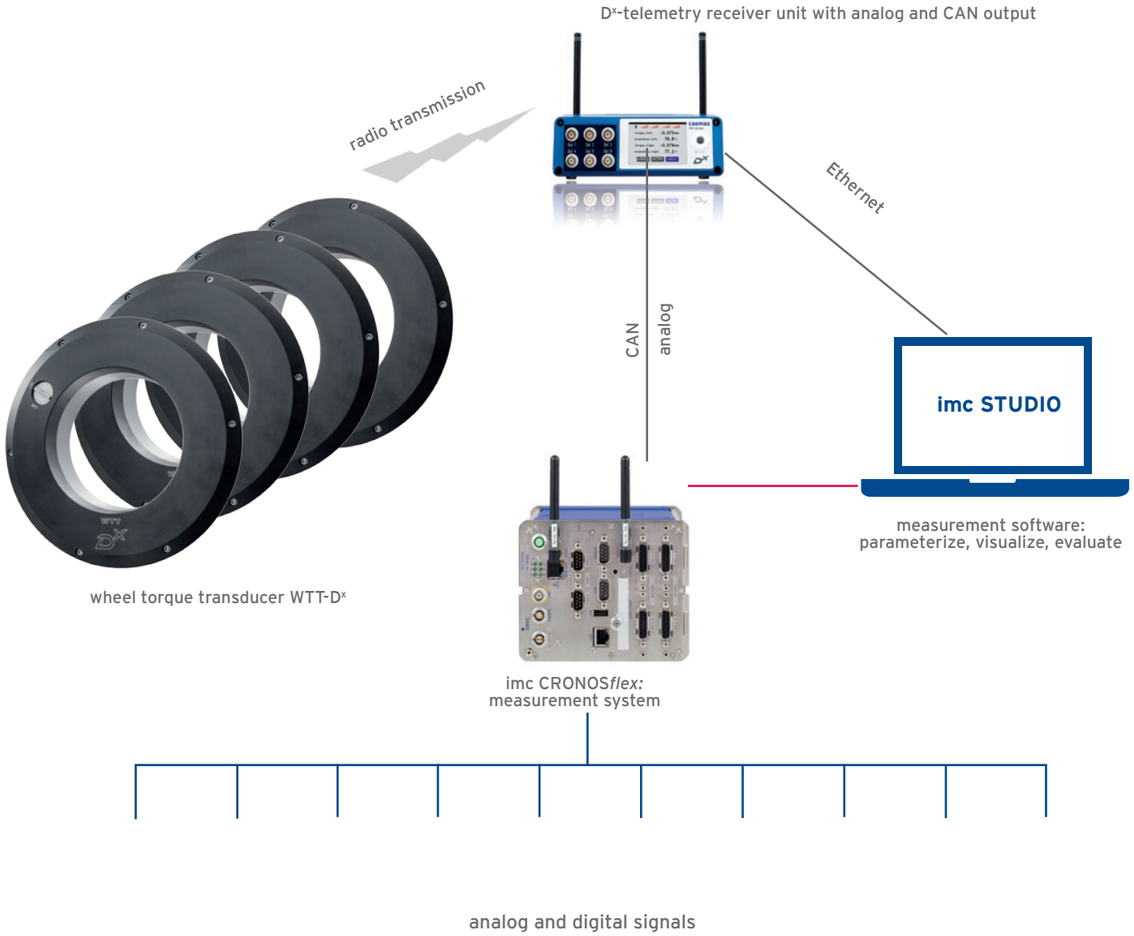
imc CRONOS-SL

- Extremely robust
- Meets MIL STD810F standard for temperature and shock resistance
- IP65 protection rating
- Extended operating temperature from -40 °C to +85 °C
- Condensation allowed

All-in-one data acquisition & control

imc C-SERIES

- Ideal for changing test stands and mobile applications
- Cost-effective solution for measurement tasks with 8 to 24 channels



Technical Data

WTT-D^x wheel torque transducer

Parameter	Value
Measurement value	torque in axial direction M_y
Signal transmission	digital-telemetric
Measurement range	My = ±6000 Nm, optional, My = ±3000 Nm
Bandwidth	max. 1 kHz
Linearity	< 0.5 %
Hysteresis	< 0.5 %
Crosstalk	< 0.5 %
Sensor diameter	300 mm
Sensor weight	ca. 4.75 kg (incl. telemetry unit) ca. 6.3 kg (with battery)
Sensor housing material	aluminum
Mechanical load	stress analysis according to AK-LH-08 4.34
Rim diameter	min. 13“
Hub diameter with adapter	max. 6“
Operating temperature	-10 °C up to +60 °C (standard battery) -30 °C up to +60 °C (special battery)
max. driving speed	250 km/h
max. rpm	2300 rpm
Shock proof	100 g
Protection rating	IP67 (waterproof)
Mounting and balancing	Yes (wheel bolts accessible)
Power supply	standard battery: up to 80 h special battery: up to 40 h

Telemetry receiver RCI

Telemetry properties	Value
Power supply	9 to 36 V DC
Power consumption	< 0.5 W
Frequency	freely configurable in the 868 MHz band (optional 2.4 GHz)
Synchronization	synchronized sampling of up to 4 WTTs
CAN output (connection according to ISO 11898, galvanically isolated)	CAN 2.0b, standard- & extended-identifier, freely programmable up to max. 1 MBaud
Analog output	6 x BNC sockets, (freely assignable, output signal max. ±10
Ethernet	10/100 Mbit
Auto-zero	remote-controllable
Temperature range	-20 °C up to +65 °C
Dimensions	ca. 170 mm x 130 mm x 53 mm
Weight	0.8 kg

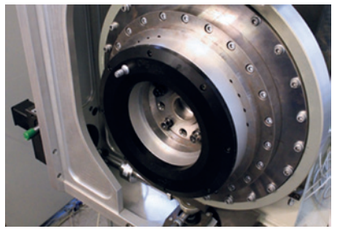
Accessories

Control unit as a central receiver in the vehicle

The D^x receiver unit RCI is used for the parameterization and synchronous signal acquisition of up to four WTT wheel torque transducers. The measurement data is output via six freely programmable analog outputs or the integrated CAN interface. The configuration of all parameters is carried out comfortably via Ethernet and web browser or directly at the RCI and allows auto-zero and shunt calibration at the push of a button.

Vehicle mirror antennas for acquiring telemetry data

Thanks to the specially developed receiver antennas, it is possible to ensure optimal data transmission in both the 868 MHz and 2.4 GHz ranges. The outside mirror antennas can be quickly and easily assembled using an elastic cord and have 5 meters of cable.



Calibration

CAEMAX calibrates each WTT-D^x on its own specifically developed test bench. Each force and torque is measured separately. Interactions (crosstalk) between the measured variables can thus be detected and compensated for. This results in an unprecedented precision of measurement values.

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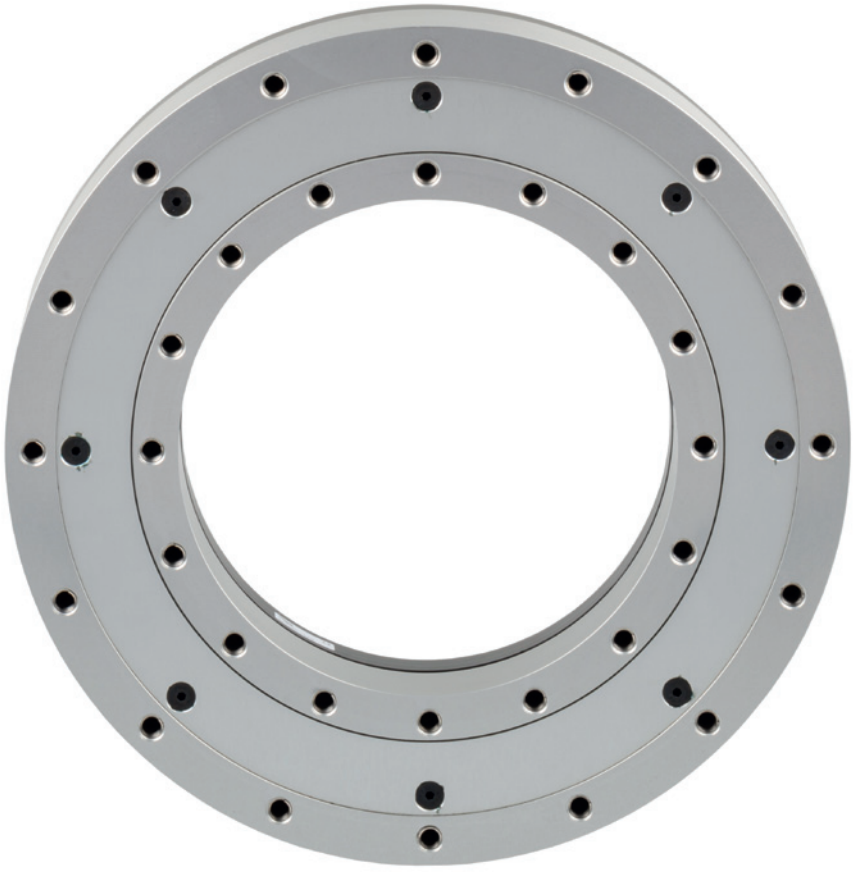

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