# WFT-Cx - 6-Component Wheel Force Transducers

In motor vehicle development, 6 component wheel force transducers (WFTs) are used to determine and record forces and torques at the wheels during test drives – in all three dimensions, resulting in 3 forces (Fx, Fy, Fz) and 3 torques (Mx, My, Mz). The measurement results generate the data used for computer simulations or as input parameters for test rig systems. The WFT-C$^x$ is a wheel force transducer which is not only completely waterproof, but furthermore provide a higher thermal and mechanic load to perform even in off road tests of cars in any weather conditions.

The entire signal processing system relies on extremely short signal lead lengths. Each strain gauge signal is digitized individually, all channels are recorded simultaneously.The WFT-C$^x$ can be used on small to large cars (minimum wheel size: 14 inches), but also on SUVs and light trucks (maximum hub diameter: 5.5 inches).

**Highlights**

- Waterproof (IP66, IP67)
- Ideal for brake testing due to excellent heat dissipation
- Removable stator for comfortable wheel mounting and convenient balancing of wheels
- Online zeroing - system is ready to measure after six turns of the wheel
- Automatic balance of the wheel angular
- Incremental angular resolution of 0.072 ° (with up to 5.000 points per turn)

An optimized sensor design, along with the high thermal conductivity of the sensor material, avoids excessive heating of the measurement body even on heavy break tests. The entire signal processing is designed for a temperature range of -40 °C to +105 °C. All this results in a much wider range of applications than before, which now also includes braking tests, ride comfort tests and tire tests with the very same WFT configuration. Along with its waterproof design, its remarkable shock resistance of up to 100 g now enables WFT measurements with speed bumps!

Due to mechanically induced nonlinearities, accurate calibration for each wheel on a specially designed test rig is essential. The inhouse calibration test rig at CAEMAX has been enhanced to be able to offer optimal calibration. There, each wheel force transducer‘s profile containing all calibration and correction values necessary for exact online/real time calculation can be exactly determined.

**Overview of available variants**

| Order Code | | article number |
|---|---|---|
| • H-SEN-CMX-WFT-Cx-AL | Wheel Force Transducer WFT Aluminium without connection unit | 1370001 |
| • H-SEN-CMX-WFT-Cx-TI | Wheel Force Transducer WFT Titanium without connection unit | 1370002 |
| • H-SEN-CMX-WFT-Cx-ST | Wheel Force Transducer WFT Steel without connection unit | 1370031 |
| • H-SEN-CMX-WFT-Cxs-AL | Wheel Force Transducer WFT Aluminium without connection unit | 13700xx |

**Accessories**

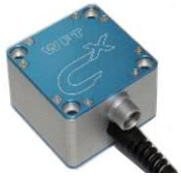
| Order Code | | article number |
|---|---|---|

- H-SEN-CMX-WFT-Cx-STAT — Telemetry unit for WFT rotated application — 1370003

  Connection unit telemetry type for WFT in rotating applications.

- H-SEN-CMX-WFT-Cx-SI — Fixed unit for WFT stationary application — 1370004

  Connection unit fixed-type for WFT in test rack applications.



- H-SEN-CMX-WFT-Cx-HUB — Hub Adapter for WFT — 1370005

  The exact specification / type of the wheel hub is needed.

- H-SEN-CMX-WFT-Cx-RIM — Rim Adapter for WFT — 1370006

  Rim Adapter for WFT (specification of the wheel rim is needed)

- H-SEN-CMX-WFT-Cx-SCR — Bolts for WFT hub & rim adapter — 1370007

  Mounting bolts (set of 32) for mounting WFT to hub adapter and rim adapter

- H-SEN-CMX-WFT-Cx-CASE — Transportation case for WFT-C$^x$ — 1370008
- H-SEN-CMX-WFT-Cx-MK — Torque arm (carbon) with 3 suction cups — 1370010

  Torque arm (carbon) with 3 adjustable suction caps

- H-CAB-LEM-WFT-6m — Connection cable between Wheel Force Transducer and Control Unit, 6 m — 1370012
- H-CAB-LEM-WFT-12m — Connection cable between Wheel Force Transducer and Control Unit, 12 m — 1370013
- M-SEN-CMX-WFT-TTI-BAS — Control Unit incl. WFT telemetry interface — 1370014

  Telemetry Control Unit incl. WFT telemetry interface (TTI) for connecting of two Wheel Force Transducers. 4 slots available for further modules. Larger housings upon request.

- M-VST-CMX-TTI-STD — WFT telemetry interface — 1370015

  Additional WFT telemetry interface (TTI) for connecting two 6-component WFTs occupies 2 slots.

**Optional extension**

- M-KOM-CMX-WFT-CAN CAN output module 1370016
  CAN output module for WFT telemetry control unit, for two WFTs; occupies 1 slot
- M-DAC-CMX-DAC-K16 16-channel analog output module 1370017
  16-channel analog output module; simultaneous or asynchronous output; ± 5 V or ± 10 V; occupies 1 slot.

**Optional service**

- D-SEN-CMX-WFT-Cx-KAL Wheel Force Transducer calibration 1370028
  Calibration of one Wheel Force Transducer WFT incl. crosstalk compensation. Recommended every year.

# WFT-Cx

| Parameter | Value | | | | Remarks |
|---|---|---|---|---|---|
| | WFT-C$^{x}$ | | | WFT-C$^{xs}$ | |
| Material | Aluminium | Titan | Steel | Aluminium | |
| Measurement principle | temperature compensated strain gauge application | | | | |
| Measurement ranges<br>Forces<br><br><br>Torsional moment<br><br> | <br>$F_x$, $F_z$ = ±45 kN<br>$F_y$ = ±25 kN<br>$M_x$, $M_z$ = ±8.75 kNm<br>$M_y$ = ±8.75 kNm | <br>$F_x$, $F_z$ = ±60 kN<br>$F_y$ = ±30 kN<br>$M_x$, $M_z$ = ±10 kNm<br>$M_y$ = ±10 kNm | | <br>$F_x$, $F_z$ = ±25 kN<br>$F_y$ = ±20 kN<br>$M_x$, $M_z$ = ±6 kNm<br>$M_y$ = ±6 kNm | |
| Sampling rate | up to 5 kHz | | | | per channel |
| Angle resolution | 0.072 ° | | | | 5000 increments |
| Accuracy | <0.2 % | | | | of the measured value |
| Hysteresis | <0.2 % | | | | of the measurement range |
| Crosstalk | <0.2 % | | | | of the measured value |
| Temperature drift | 0.005 %/°C | | | | |
| Low pass filter | 6-pol Butterworthfilter | | | | cut-off frequency: 1200 Hz |
| Revolution speed | max. 2300 rpm (approx. 278 km/h) | | | | |
| Weight | approx. 7.5 kg | approx. 10.5 kg | approx. 17.5 kg | approx. 5.9 kg | w/o adapters |
| Dimension (w/o adapter) | 317.5 mm<br>203.0 mm<br>76.0 mm | | | <br><br>61.5 mm | outer diameter (OD)<br>inner diameter (ID)<br>height |
| Rim diameter | min. 14" (356 mm) | | | | |
| Hub diameter | max. 5.5" | | | | with hub adapter |
| Protection class | IP66, IP67 | | | | |
| Operating temperature<br>Sensor<br>Electronics | <br>-40 °C to 150 °C<br>-40 °C to 105 °C | | | | |
| Mechanical load | stress analysis according to BMW QV 36026 | | | | |
| Acceleration | max. 100 g | | | | |
| Security | mechanical breakage protection | | | | |
| Mounting bolts | 32 | | | | |
| Adaption | custom specific adaption for every vehicle possible | | | | |