ATESTEO

Excellence in drivetrain testing

Innovative Testing Equipment

Torque sensors • Vehicle Applications • Actuators

Custom-made measuring solutions

As a leading drivetrain testing company, ATESTEO specialises in drivetrain and transmission testing combined with additional engineering and testing services. In the equipment sector, we offer products for the measurement, testing and analysis of complete drivetrains. In addition, based on decades of experience and a high level of expertise, we develop custom-made solutions for your measuring tasks.

Broad offer

In an integrated approach, measurement systems, vehicle equipment and actuators are created that are used both on ATESTEO test benches as well as directly at OEMs as well as suppliers of the automotive industry. All test and measurement systems are developed at the highest technological level and can be coupled with the latest automation technology.

ATESTEO Equipment

Whether standardised or individually tailored to your requirements – with a broad technical range of products, we offer ideal torque measurement technology and high-end instruments in the equipment sector.

- **Measurement systems:** High-resolution torque and speed measuring systems with contact-free signal transmission for capturing stationary and highly dynamic processes.
- **Vehicle-installed measuring equipment:** Components for setting up high-quality telemetry systems, measurement technology for rotating transmission parts and complete vehicle equipment kits as GSA (Gearshift analysis system).
- **Actuators:** From clutch and gas pedal controllers to state-of-the-art gearshift robots to automized test benches.

At **http://www.atesteo.com/en/testing-equipment/configurator/,** you can very simply choose the optimum torque sensors for your needs.

ATESTEO is the leading specialist for drivetrain testing combined with automotive product validation and drivetrain testing related engineering & equipment. We are among the top partners in the automotive industry and automotive suppliers internationally. With the high professional expertise of the employees in operational testing and pre/post-processing, transmissions and products are reliably verified in custom tests. ATESTEO is everywhere that drivetrain development takes place in the automotive industry. More than 150 test benches in Germany and China as well as offices in the US and Japan make a smooth solving of measurement, testing as well as analytical problems possible at any time.

Innovative measurement technology from ATESTEO

- Torque measuring shafts from 1 Nm to 150 kNm
- Metrological equipping of transmissions, drivetrains and vehicles: Torque, speed, acceleration, temperature, pressure, force and other
- Analysis systems for manual transmissions with exact measurement of the shifting paths and forces
- Gearshift robots, clutch actuation and other functions

Implementation of highly dynamic tests

With powerful technology, ATESTEO allows for highly dynamic, realistic testing on the test bench and thus reduces your trips in the test vehicles. A wide range of actuators and robots is available for the implementation of highly dynamic tests.

Telemetry systems for contact-free energy and data transmission

The telemetry technology developed by ATESTEO can be used in a variety of ways due to the different design. We can therefore also offer you very complex solutions, especially in the field of vehicle instrumentation.

Torque sensors

All products and services are characterised by the great engineering expertise at ATESTEO. Created by engineers for engineers, our measurement systems are already comprehensively tested in the development phase under test bench conditions. Customised solutions allow for flexible test bench installations, the implementation of test programmes as well as detailed investigations for pre-engineering projects.

With product enhancements and improvements, additional goals can be achieved that are requested with respect to changing ambient and component temperatures and to the benefit of reliable handling. Special newly developed products for vehicle adaptation complete our product range in the field of vehicle measurement technology for you.

Torquemeter Fx iS

The torque measuring flange Fx iS uses infrared high-performance LEDs for data transmission. It is completely EMC-safe due to optical data transmission and also does not emit any electromagnetic waves. Designed as a dual-range measuring shaft, it shortens your setup times considerably. In addition, it covers wide measuring ranges with one and the same flange pattern.

Performance features

- Measurement range from 20 Nm to 150,000 Nm
- Standard measuring precision 0.05 % in the measuring ranges up to 10 kNm
- Multidimensional temperature detection for optimal compensation
- Integrated rotational speed measurement as standard
- High-speed performance up to 25,000 rpm possible
- Optional two torque ranges
- Optional high-resolution magnetic rotation measurement system
- Variation with separate stator electronics is deliverable

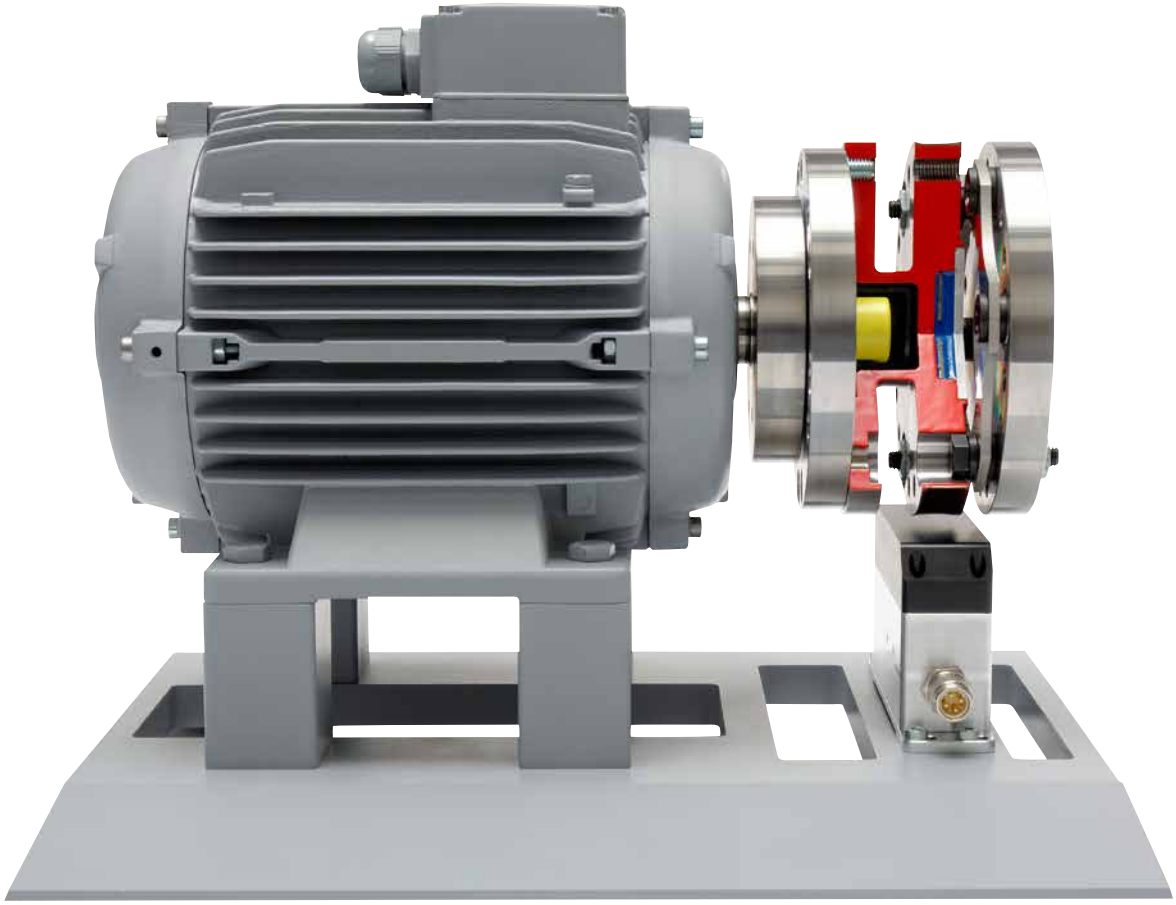
Torquemeter series DF

With the torquemeter DF, an innovative measuring member in combination with the digital multi-channel telemetry allows for an extremely large range of installation and measurement arrangements. The two real DMS amplifiers in the rotors electronics are unique. The additional overload channel transmits up to 300 % of the nominal torque. The rotor temperature is also transmitted. The flange dimensions of the INLINE DF correspond to the DIN standard and are compatible with existing systems.

DF in numbers

- Max. speed up to 25,000 rpm
- Accuracy class: 0.04 % F.S.
- A/D-converter: 24 Bit
- D/A for analogue output: 16 Bit
- Total sampling rate: 25 kHz
- Operating range temperature: 0...85 °C
- Nominal gap distance < 4 mm
- Limit torque: 300 %
- Custom measuring ranges by request

DF1	DF2	DF3	DF4	DF5
50 - 500 Nm	200 - 1 kNm	1 kNm - 3 kNm	4 kNm - 5 kNm	5 kNm - 10 kNm
PCD 84	PCD 101.5	PCD 130	PCD 155.5	PCD 196

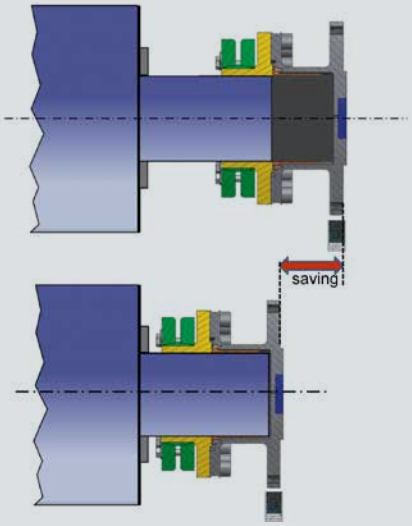


User Interfaces

- Ethernet (10/100 Mbit)
- CAN2.0 (111 Bit, up to 2 kHz)
- Analogue output: 0 - 5 V, 0 - 10 V, ±5 V, ±10 V
- Frequency output: 10±5 kHz, 60±20 kHz, 60±30 kHz, 240±120 kHz
- Optional power output: 4 - 20 mA
- Magnetic speed sensor optional

Your advantage

The unique advantage of the inline torque sensor is its new measuring body. It is produced as a single-sided hollow shaft sensor. This feature allows for the positioning of the entire sensor directly on a cylindrical drive shaft. In this way, critical operating parameters of the dynamometer, such as the radial load and maximum speed, can be greatly improved.



Torque sensors

Torque sensors for special applications

To determine the mechanical performance of rotating components, ATESTEO offers highly specific telemetry systems which can be optimally adapted in form and scope of functions to the conditions of new drive concepts. The optionally available central data acquisition function enables a time-synchronous processing of the measurement channels including the additional measured values read in via the vehicle bus (CAN). The functional reliability of more extensive installations is supported through the installation of an additional battery.

Example: Brake testing

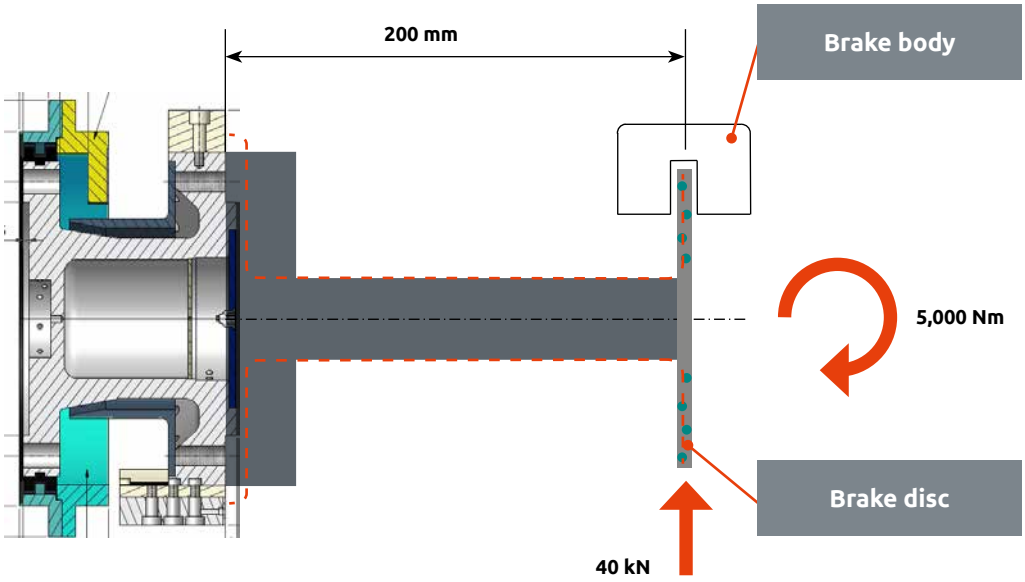
In brake test benches (inertia brake dynamometers) and during the testing of individual brake components, torque measurement technology is subjected to tough requirements. Braking in and of itself generates very high torques. If the brake does not work, it must be possible to measure even very small torques. The measurement of these residual drag (grinding) torques is an important part of judging a braking system, because these parameters have a direct influence on fuel consumption and of course on wear and tear.

Technical characteristics of the torque sensor QKS4

- Nominal torque up to 12 kNm
- Nonlinearity including hysteresis <±0.05%
- Temperature measurement with eight thermocouples of type K -20°C to 1,000°C
- Maximum rotation to 3,000 rpm
- Frequency output 60 ±20 kHz
- Analog output: 0 – 5 V, 0 – 10 V, 5 ± 5 V

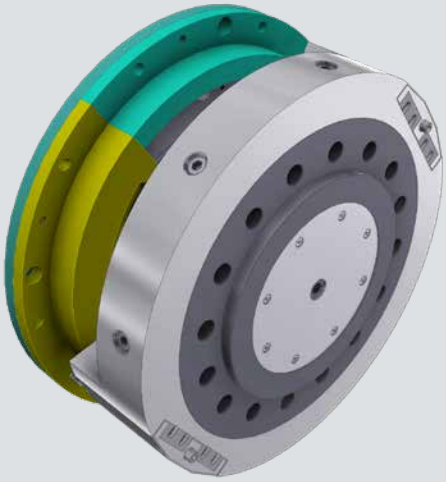
When measuring torque, the test set-up must accurately reflect the installation situation in the vehicle. Through this, parallel to the torque, very high bending moments (side loads) act on the body to be measured. This means that very high bending moments act on the measuring body parallel to the torque. Owing to its short lever arm, the disc brake must deliver a force of 40,000 N to generate a torque of 5,000 Nm. This generates a bending moment of 8,000 Nm on the torque flange.

Especially for this application, ATESTEO has developed a measuring body which measures torque with maximum accuracy, but also withstands the bending moment without major measuring errors: the torque sensor QKS4. The QKS series also offers the possibility of integrating a second, smaller measuring range to measure the residual drag torques. Together with the integrated eight-channel temperature measurement, this measuring system offers the ideal solution for measuring brake systems in the test bench.



Sketch of a brake test bench

If measurements are to be taken on the stationary side instead of the rotating side, forces similar to those of the rotating system are generated. The transverse forces would quickly overload and permanently damage the sensitive measuring body for torque measurement. The measuring body developed by ATESTEO absorbs even very large transverse forces optimally by means of torsionally soft but bend-proof construction elements. This guarantees highly accurate torque measurements even under extreme mechanical conditions. Active temperature compensation in the measuring body ensures that the specially manufactured torque measuring shaft delivers the most accurate results under the environmental conditions required by the customer.



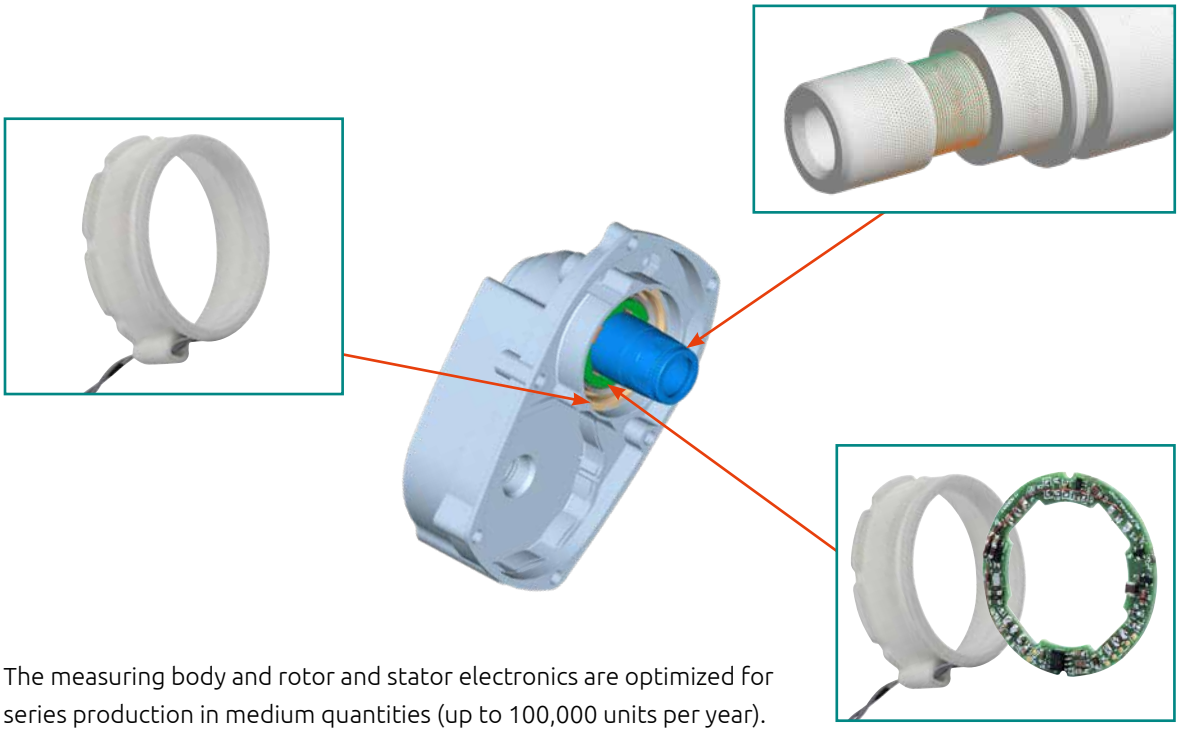
Torque sensors

Torque measurement shafts for custom applications

ATESTEO develops and manufactures both custom torque sensors and sensors in a standard series for the set-up of test benches.

Example: E-bike drive (power unit)

Electromobility is a global trend to improve living conditions in cities and to reduce dependency on fossil fuels. Along with hybrid drives and pure electric motors in motor vehicles, electric driving assistance is becoming increasingly popular with bicycles. The drive in an e-bike requires a torque sensor equipped with non-contact telemetry. What is special about the sensor are its high accuracy and reproducibility of the supplied sensor signal. The result is extremely precise and user-friendly assistance for the rider.



The measuring body and rotor and stator electronics are optimized for series production in medium quantities (up to 100,000 units per year).

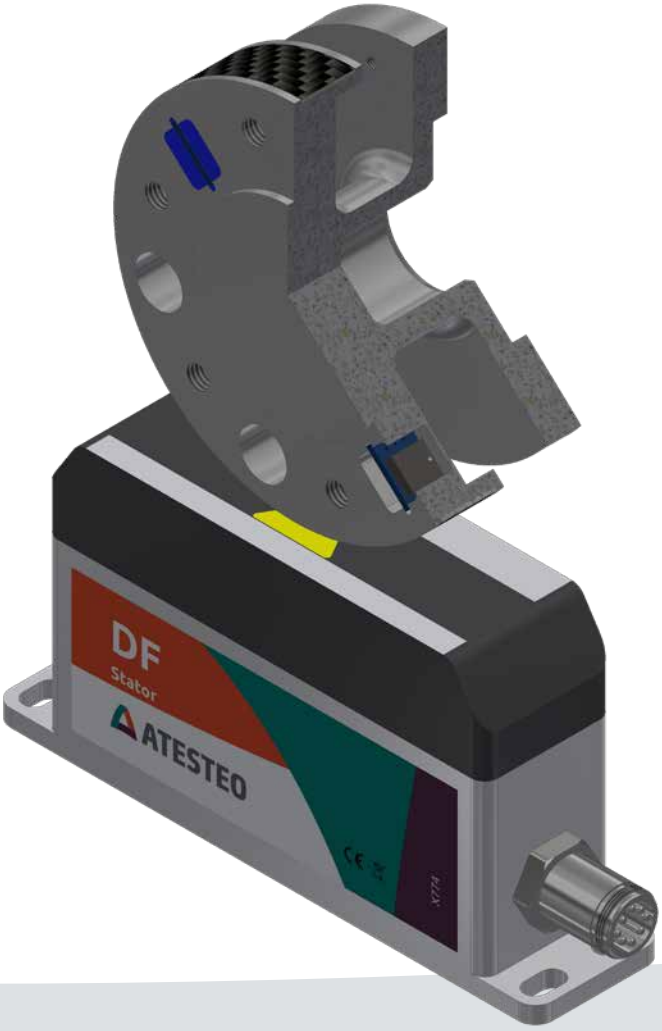
Example: Wind energy

Wind turbines make a significant contribution to reducing dependence on fossil and nuclear power generation. Torque sensors are used in wind turbines to increase efficiency and for continuous monitoring of operations. The development towards ever more efficient and stable energy generation from wind power places special demands on the measurement technology, its dimensions, and its possible applications.

ATESTEO torque sensors support the development of new construction types and the use of modern materials. During operations monitoring, ATESTEO torque sensors contribute to optimising the service life of the wind turbine and to warning of possible damage.

Torque and acceleration

Based on the multi-channel capability of the innovative ATESTEO sensor series, torque and tangential acceleration can be measured simultaneously. Dynamic phenomena can thus be analysed over the entire torque and speed range with high resolution.



Torque

- Very high speed ranges
- Accuracy class: 0.04 % F. S.
- A/D-converter: 24 Bit
- D/A for analogue output: 16 Bit
- Total sampling rate: 25 kHz
- Wide operating temperature range (adapted to the requirements of modern electric machines)
- Nominal gap distance < 4 mm
- Limit torque: 300 %
- Custom measuring ranges by request

Acceleration

- Input range: ±25 g (other areas available)
- Dynamics (3dB): DC - 1.5 kHz
- Non-linearity: ±0.15 % F. S.
- Shear force compensated
- Max. mechanical impact load 5,000 g

Calibration laboratory

As a manufacturer and operator of torque measuring technology, we also provide the service of torque sensor calibration. Our calibration devices cover the range from 10 N·m to 80,000 N·m. We offer in-plant calibration and calibrations compliant to DIN 51309 from 10 to 10 kN·m. In-plant calibrations are offered from 10 kN·m to 80 kN·m. We are also able to calibrate many special applications. Calibration adaptors can be manufactured in-house, allowing for a quick turnaround.

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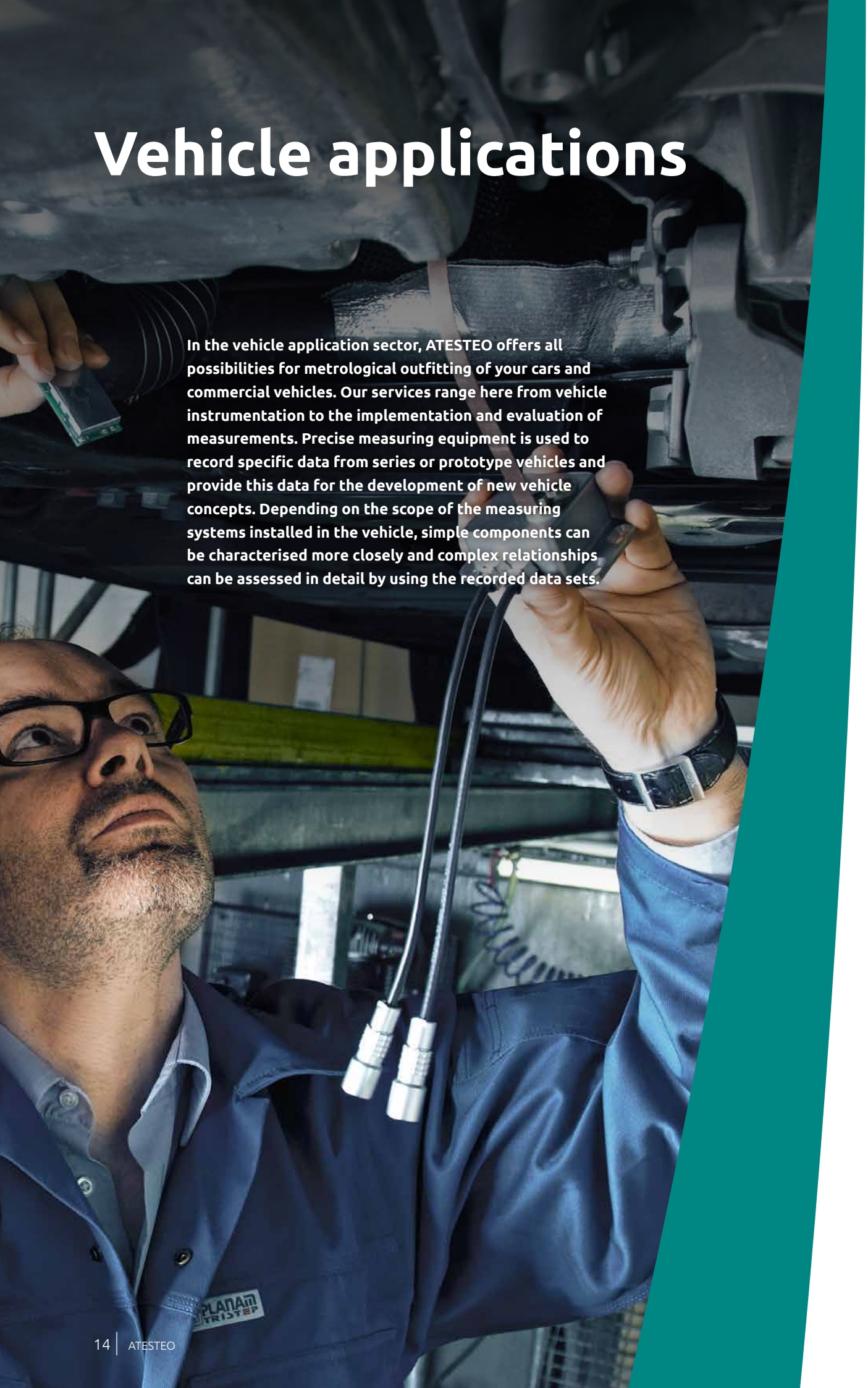
Vehicle applications



In the vehicle application sector, ATESTEO offers all possibilities for metrological outfitting of your cars and commercial vehicles. Our services range here from vehicle instrumentation to the implementation and evaluation of measurements. Precise measuring equipment is used to record specific data from series or prototype vehicles and provide this data for the development of new vehicle concepts. Depending on the scope of the measuring systems installed in the vehicle, simple components can be characterised more closely and complex relationships can be assessed in detail by using the recorded data sets.

Torque

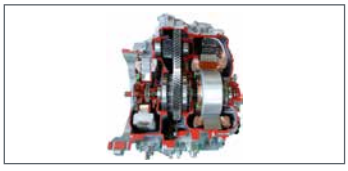
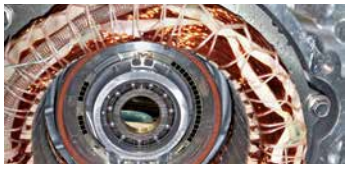
Adaptable telemetry systems

To determine the mechanical performance of rotating components, highly-specified telemetry systems are available to you at ATESTEO, which can be optimally adapted in form and functionality to the conditions, including new types of drive concepts. The optionally available central data recording provides for a time-synchronous processing of the measurement channels, including the measurement variables additionally read in via the vehicle bus (CAN). More extensive installations are supported in their functional reliability by the installation of an additional battery.

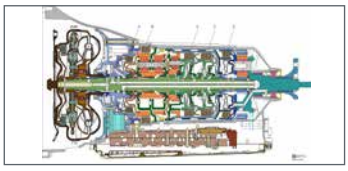
General reasons for vehicle tests

- Data validation
- Benchmark
- Performance testing of components
- General vehicle testing
- ECU/TCU calibration
- NVH
- Efficiency
- Component load
- Alignment controls (tumbling)
- RLD (road load data)

HYBRID EV


AT RWD



AT FWD



MT RWD



MT FWD



DCT



RFTS-1 TELEMETRY

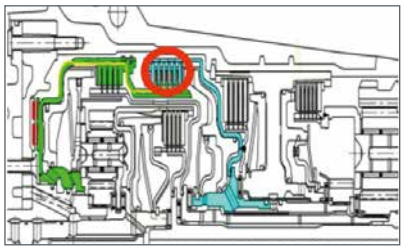
With the telemetric RFTS-1 set, ATESTEO implements basic torque and temperature measurements in vehicle drivetrains. It contains all of the components for assembly on site.

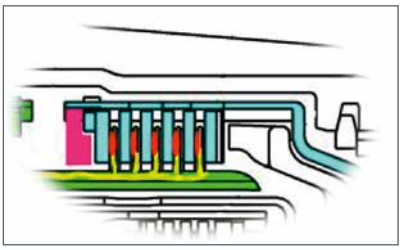
General data

- Easy to assemble and user-friendly
- Can be used for strain gauges or thermocouples
- Wireless data and energy transmission with only one coil
- Up to 70 mm distance between the transmitting coils
- Signal bandwidth 0...1 kHz (-3 dB)
- Power supply 9 - 36 V DC
- Low power consumption

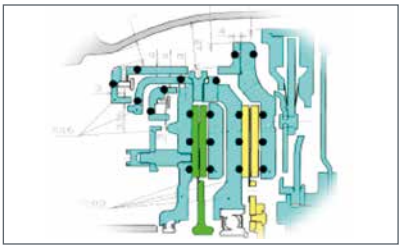
Temperature

Clutch wet
friction elements



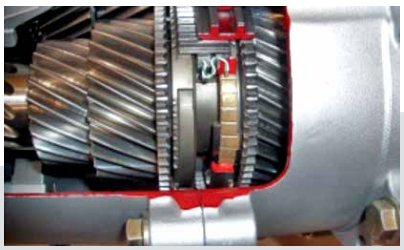


Clutch dry
elements

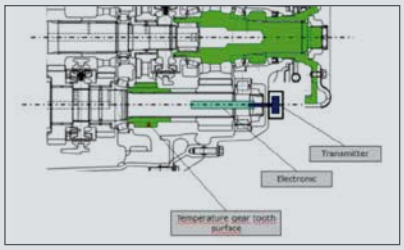


Planetary gear
pinion

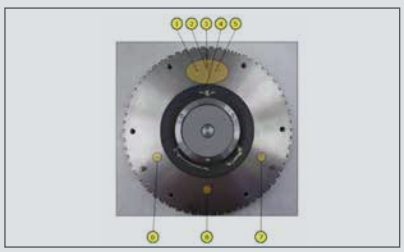
MT
synchroniser

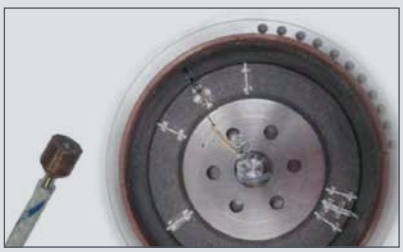


Gear wheel
temperature



Flywheel
surface





Actuators

GSE4 transmission shifting unit

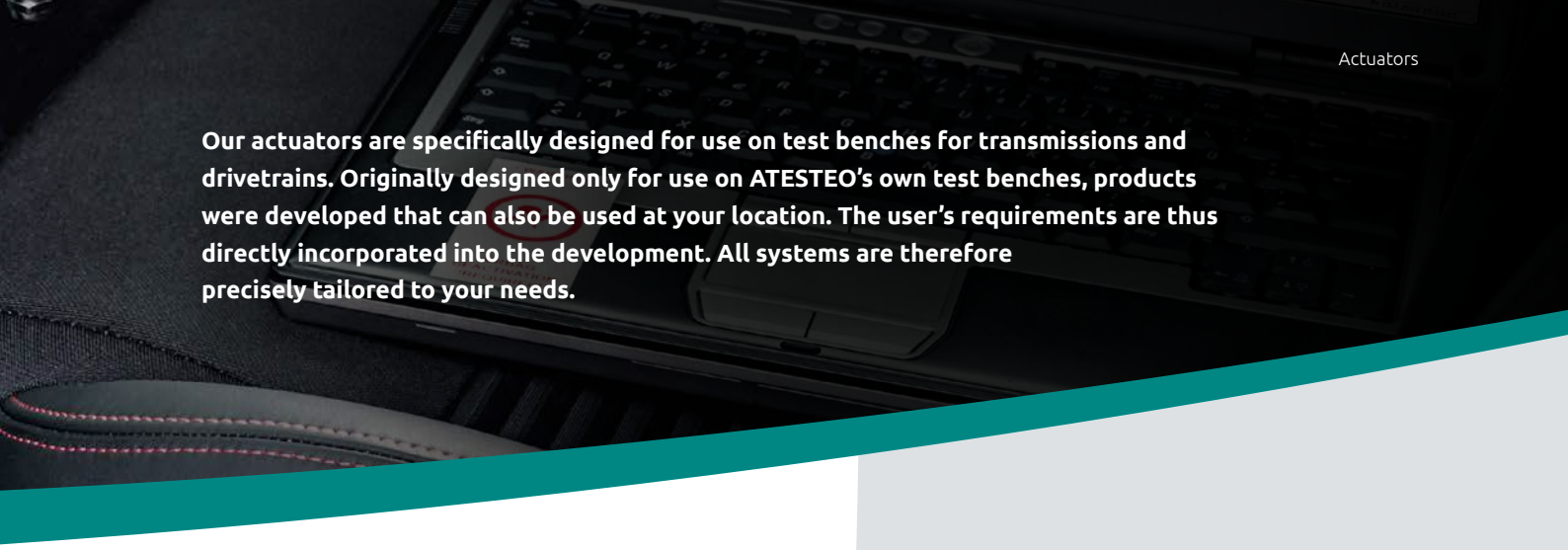
The GSE4$_{HDC}$ from ATESTEO is a highly dynamic gear shift robot for drivetrain and transmission test benches. Its high-frequency control of force, position, and speed enables the fully automated and realistic shifting of all kinds of vehicle transmissions. Its adaption uses the original gear lever and state-of-the-art interfaces (EtherCAT, CAN), therefore it can be seamlessly integrated into your testing environment. High availability is ensured by using solely components suitable for industrial use, ensuring fail-safe operation at numerous ATESTEO and customers' test benches around the globe.

GSE4 App

The intuitive user interface of GSE4 APP makes all necessary parameters available, clearly arranged. All characteristic values such as the shifting forces and speeds can be set gear by gear and stored as projects in any required number. Besides the numerical representation of current measurement values and parameters, the software also makes additional graphics windows available. Displaying the gear lever positions "learned" by the robot enables the visual control of the learning phase, while presenting the shifting force over the shifting travel serves the rapid analysis of the individual phases of the shifting event. Optionally, the GSE4 APP can additionally be executed on a connected Windows® PC.

Properties

- Rapid adaptation to the original shift lever (MT, AMT, AT, DCT, CVT)
- Integrated force measuring device for the direction of shifting and selection
- Vibration resistant stiff mechanism
- Shaft with low inertia and low friction
- Dynamic synchronous force control
- Realistic simulation of how human drivers shift gears
- Reproducible gear shifting behaviour
- Release of the gear lever after the shift process
- Learning procedure on the robot via touchscreen control
- CAN bus, digital and analogue interfaces to the test bench control system (master host system)
- Interface for objective evaluation of the gear shift quality (GSA system)



Our actuators are specifically designed for use on test benches for transmissions and drivetrains. Originally designed only for use on ATESTEO's own test benches, products were developed that can also be used at your location. The user's requirements are thus directly incorporated into the development. All systems are therefore precisely tailored to your needs.

GSA gearshift analysis

The GSA system from ATESTEO is a tool for the optimisation of synchronised manual transmissions. The measured data is analysed to yield objective key values for evaluating the quality of gear shifts. The system delivers the hardware to collect, process, and visualise the relevant data in the vehicle or at the test bench.

- It measures the forces and travel at the gear stick. Optionally, the force and travel at the clutch along with further analogue and CAN signals may also be measured
- It supports users in conducting measurement tests
- It analyses and sorts the specific values in an easy-to-read form with the aid of a variety of filters
- It displays the analysed values in user-friendly tables and typical diagrams
- It offers the possibility of comparing the results of different analyses across different projects

The experience of our specialists coupled with that of many customers in Germany and abroad has made the GSA system a tool recognised around the globe for improving the quality of gear shifting.

Performance features

- Quick and easy installation of measurement equipment
- Low inertia and friction minimise the influence of the measurement equipment on measurement results
- User-friendly navigation through any number of measurement tasks during dynamic and static measurements (for instance: free play, stiffness, speed lift and detent mechanism tests)
- Automatic determination of gear changes and shifting phases; The results can then be reviewed graphically and, if necessary, be adjusted
- Calculation of important parameters, for instance, shifting speed, momentum, and energy
- Display of the calculated values as a function of shifting type, shifting phase, relative time, and travel
- Statistical values, such as minimum and maximum values, time values, and force ratios, are determined as a function of shifting events and shift phases, and are listed in the table form as the user defines
- By exporting the specific values to Excel®, further parameters can be determined and processed into the desired form
- A comparison function supports loading several measurement projects. The simultaneous display of project parameters shows the existing differences in a clearly structured form
- With the help of measured GPS data, the shift events can be displayed and evaluated in relation to the given locations (OpenStreetMap®)

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Would you like to learn more about our products, solutions and services from the areas of measurement systems, vehicle applications and actuators? Then simply give us a call at +49 2404 9870-570 or e-mail us at equipment@atesteo.com. Your personal ATESTEO contact partner is happy to help you.

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