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News from the world of industrial measurement technology

Quality …

… the hard currency of global production

Quality counts:
Application reports from Valeo, Promess and APL

Low-emission ship drives:
Torque transducers help optimize efficiency

Editorial

Optimal product quality with HBM measurement technology

Dirk Möller, HBM
Head of Product Marketing
Industrial Measurement Solutions

Quality – the hard currency of

Dear reader,

Quality is a decisive competitive advantage. Even emerging nations increasingly focus on production quality as they say goodbye to the image of cut-price producers. HBM represents quality around the world whether in Asia, Europe or the Americas. This enables our international customers to profit from using reliable HBM measurement technology in their machines and systems.

Quality – a global megatrend

Emerging economies tend to be popular as production locations because they are frequently associated with low wage costs. Previously there was the perception that this also meant a correspondingly low product quality but this is no longer the case. Increased competition means that quality is becoming the main differentiator. Our factories in China, Germany and USA have always produced to HBM internal standards thus ensuring that product quality is identical around the world. The global combination of high quality system solutions and a mature international sales structure makes HBM an attractive partner for global players.

HBM: Guarantee for quality and efficiency

Quality management is aimed at economically realizing specified product properties and thereby reducing overall costs. This actually means that machines must be brought online as rapidly as possible to achieve maximum utilization while maintenance times are kept as low as possible. These requirements are always at the forefront at HBM when it comes to the practical implementation of our customer's metrological tasks.

Optimal measurement technology

Our products are not only precise and robust, they are also optimally suited for applications in demanding production environments.

In this issue

global production

" HBM represents quality in measurement technology – and an impressive price/performance ratio. This is the requirement for the use of our measurement technology in a global market. In addition, HBM also makes a significant contribution to increasing efficiency in the production processes of our customers. "

Dirk Möller

For instance, all our sensors are made of non-corrosive materials and available in various degrees of protection. In order to reduce machine downtimes and optimally monitor production, integrated diagnostic and documentation options are necessary. Evaluation procedures are therefore integrated into many of our measuring amplifiers to log all data and document them in quality reports.

Comprehensive service

In addition to the characteristics of our products our customers appreciate our comprehensive services all the way through to the commissioning of machines and systems.

Our scope of supply includes:

___ Training

___ Specially adapted software

___ Application engineering.

In application engineering, HBM specialists are included in the customer team to integrate HBM measurement technology into existing systems. The earlier we are involved the better, as the avoidance of errors beforehand is far more cost effective than having to solve problems during commissioning.

Make the quality of our products part of your competitive advantage! With HBM as your measurement technology partner, you can rely on globally uniform quality standards because quality pays for itself.

HBM: Active quality

The name HBM has stood for quality in measurement technology for 60 years. Today, HBM is proud to be the global technology and market leader. The high standard of quality is well-documented: HBM was the first company in Germany to be accredited to ISO9001 back in 1986. This was followed in 1996 by the accreditation of our environmental management system to ISO14001. HBM also has its own test laboratories and an in-house German Calibration Service (DKD) facility. Quality is our primary focus and our motivation to continuously develop and optimize our sensor technology, measurement electronics and software. The requirements of our customers are always the focus of our actions.

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HBM technology in action

ADVICE FOR USERS

Piezoelectric force transducers

Piezoelectric force transducers are impressive with their high level of reliability and flexibility, while installation and operation are simple. However, to ensure maximum measurement accuracy with high operating safety, some rules should be taken into account.

A piezoelectric measurement chain consists of a transducer, charge amplifier and a connection cable. All three components influence the measurement result. Here are some useful hints for increasing the quality of output signals:

Tip 1 Select components according to requirements

The use of an analog charge amplifier, e.g. from the HBM CMA series, depends on the maximum force to be measured. In contrast, measurement ranges are freely selectable with digital charge amplifiers, such as the HBM CMD600. The output signal of piezoelectric sensors is independent of the nominal (rated) force. Even small forces can be measured with transducers for higher nominal (rated) forces. The transducer should therefore be selected according to the required overload capacity and the geometric dimensions.

Tip 2 Correctly pre-stress the transducer

It is necessary to pre-stress the transducer for the linearity of the measurement signal. The CFT force transducers are already internally pre-stressed and are delivered calibrated. In contrast, the flat CFW force washers must be pre-stressed and calibrated in the mounting condition. The force washer must therefore be pre-stressed to a minimum of 10 % of its nominal (rated) force and calibrated after mounting.

Tip 3 Note the running-in behavior

Switch on the measuring chain at least one hour before start up.

Piezoelectric force transducers excel through their:

___ independence from the output signal and nominal (rated) force

___ compact design

___ measurement of dynamic signals.

Tip 4 Check cleanliness

The cleanliness of plugs and sockets can influence the insulation resistance of the cable and therefore the measurement result. The following recommendations apply:

___ Do not touch contact surfaces with your hands

___ Only use pure isopropanol to clean contaminated sockets

___ Leave protective caps on any sockets until the connection is needed

___ Replace contaminated or defective plugs and coaxial cables.

Tip 5 Minimize temperature influences

The influence of temperature on the sensitivity of piezoelectric force transducers is negligible. However, if there are high requirements for signal stability, it is recommended to minimize temperature influences by:

___ Storing the transducer at the application temperature for a while before taking measurements

___ Not touching the transducer with your hands shortly before measurement

___ Implementing a reset after every measurement cycle.

■ *Thomas Kleckers, HBM*

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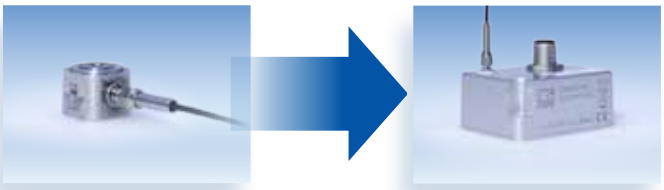
HBM technology in action In-vehicle ergonomics

> "The perfectly matched components in the HBM piezoelectric measurement chain helped us to design our test procedures more efficiently and securely in the shortest possible time."

Valeo uses innovative control concepts and HBM measurement technology

Modern cars are increasingly developing into "multimedia cockpits". However, complex technologies require simple operation. The French automotive supplier Valeo is therefore applying high-level ergonomics to its control elements and information panels – in addition to HBM measurement technology.

Automotive supplier Valeo has successfully positioned itself by targeting vehicle comfort with innovative products. Its main aim is to simplify operation despite the use of complex technological systems. These function via mature man-machine interfaces and the best-possible ergonomics. Quality is therefore obligatory, particularly in the production of the switching and control elements.



20 kN PACEline CFT piezoelectric force sensor

Analog CMA charge amplifier

Ergonomic control elements – tested with HBM measurement technology

Valeo uses the complete HBM measurement chain in the production of control elements for window opening and closing.

Valeo tests all produced switches during and after production. The test uses PACEline CFT 20 kN *(4496 lbf)* piezoelectric force sensors to measure forces produced during the switch actuations. Sensors are characterized by their compact design, high rigidity and high overload capacity.

The force signal is then converted into an analog output signal by CMA-series analog PACEline charge amplifiers and evaluated by the MP85A-S EASYswitch process controller. This contains analysis algorithms that monitor tactile feedback from control elements and the closing function of the electric switches in one test procedure.

All evaluated test processes are stored in a line server and are therefore available for quality data reference. This means that, as a producer, Valeo is able to document the delivered quality for their customers. Valeo also utilizes HBM's "FASTpress Suite" software package. This is a major benefit as it comprises integrated software modules - based on Microsoft.NET - which enable customized views to be developed by the user.

Perceivable quality in the operation of a Valeo electric window

Secure tests for optimal haptics: Test system at Valeo

Michael Guckes, HBM

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WORLD PREMIERE

New products from HBM Top level, cost-effective automation

Network-capable CMD600 charge amplifier with SensorTeach

The SensorTeach function of the HBM CMD600 digital charge amplifier automatically sets the measuring range for the force transducer – ideal for rapid processes where normal calibration is not possible.

In combination with piezoelectric sensors, the CMD600 charge amplifier very rapidly measures force, torque and pressure signals in the frequency range up to 30 kHz. The measuring range is freely scalable and ranges from 50 pC (picocoulomb) to 600,000 pC. The CMD600 can also acquire and evaluate small process values exactly because an internal secondary measuring range acquires low strength signals with high resolution and without quality losses.

SensorTeach for continuous production

Rapid processes, e.g. compressed air blow-molding of PET bottles, do not allow longer hold times for adjusting the measuring range. The SensorTeach function therefore allows automatic parameterization of the analog output signal during a production cycle. The measurement cycle is run through once before the start of measurement and then the CMD600 automatically sets itself using the determined minimum and maximum values.

Well protected for hard use

The CMD600 charge amplifier is fitted with a diecast aluminum enclosure and comes with IP60 degree of protection. All signal inputs and outputs are electrically isolated, ensuring problem-free integration in electrical systems and machines. In addition, the CMD600 has a digital input with Run/Hold trigger and peak value storage-delete function, as well as digital outputs for machine control.

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New products from HBM CFW/20 kN *(4496 lbf)* – New sensor in the HBM PACEline series

Tiny sensor facilitates huge innovative leap in production

With its maximum capacity of 20 kN *(4496 lbf)* and small dimensions – height 8 mm *(5/16 inch)* and external diameter 14.5 mm *(9/16 inch)* – HBM's new 20 kN *(4496 lbf)* CFW piezoelectric force washer is opening up innovative opportunities in production monitoring. In addition, HBM has met the demand for more compact dimensions. The force washer can be easily integrated as a "measurement washer" into existing structures.

Linear and robust up to +120 °C *(+248 °F)*

Like all CFW sensors, the CFW/20 kN *(4496 lbf)* is symmetrical in design and achieves good linearity values. With an operating temperature range of -40 °C *(-40 °F)* to +120 °C *(+248 °F)* combined with its high processing quality, the CFW family provides sensors for use in challenging industrial environments.

Sensitive load-bearing

The CFW series comprises piezoelectric force washers with nominal (rated) forces of 20 kN *(4496 lbf)*, 50 kN *(11240 lbf)* and 140 kN *(31473 lbf)*. All force washers are not pre-stressed and are calibrated in the application. Each piezoelectric force sensor delivers the same output signal for identical forces independent of the nominal (rated) force. Even smaller forces can be precisely measured with CFW sensors whose nominal (rated) forces are higher by powers of ten. Like all PACEline sensors, CFW force washers offer the possibility of over-dimensioning without loss of resolution.

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HBM technology in action Measurement of static and dynamic forces

HBM force transducers at Promess: quality assurance in production

Promess GmbH relies on HBM strain gages and piezoelectric force transducers during the production of electromechanical press components.

Promess is a leading manufacturer of high-quality servo presses for the assembly and automation industry. In addition to supplying standard components, the company develops and sells complete technologies for resolving complex and customized assembly and test tasks. The product range also includes electromechanical presses which are used as an alternative to hydraulic, pneumatic and pneumohydraulic systems in the automation industry. These universal presses are equipped with force/displacement monitoring systems to optimally monitor production quality.

The appropriate force transducer for every application

During production of the presses, positioning feedback is usually provided either by the numerical control unit or by linear measurement systems measuring displacement. The press forces are directly measured in the connection and either acquired by strain gage (SG) sensors or with piezoelectric transducers from the HBM PACEline family. SG sensors are suitable for measuring static forces while the piezoelectric sensors are ideal for processes with smaller forces. Besides being extremely rigid, they have high overload protection and are compact in design.

> "The HBM PACEline family has justified itself in the measurement of smaller forces as the favorable sensitivity value of 7.7 pC/N (picocoulomb/Newton) provides a stable signal for monitoring and evaluation. We can always find the right sensor in the HBM portfolio for the application, regardless of whether it is a strain gage or piezoelectric force transducer."
>
> *Dr.-Ing. Gerhard Lechler, CEO Promess GmbH*

Promess servo-electric press

Piezoelectric force washer from the HBM PACEline family

Thomas Kleckers, HBM

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HBM technology in action Exact measurement results dramatically boost efficiency

Low-emission ship drives. Torque transducers help optimize efficiency

Integration of measurement technology into the drive train provides efficient control of ship engines. HBM torque transducers help to optimize ship propulsion economy and protect the environment.

The worldwide MARPOL Convention requires that limit values for emissions of nitrogen oxides and sulphur oxides be reduced incrementally by 2016 to protect marine environments. Newly developed marine propulsion units have reduced emissions, but this requires precise measurement of drive power.

Three factors influencing efficiency

The efficiency of a ship's drive can be generally characterized by low fuel consumption, minimal exhaust gas values and an output power adapted to voyage conditions. To keep drive power within the optimal working range, even with rapid load changes, all these parameters must be measured with the highest possible accuracy. Load distribution over several drives, running in parallel, also requires exact measured values as a basis for monitoring and control.

Power monitoring with HBM measurement technology

The direct measurement of torque and speed enables the output power to be computed. To achieve this a torque transducer needs to be integrated into the drive train during the design phase. HBM torque transducers are available for an extensive nominal (rated) measuring range of up to 10 MNm *(7375600 ft-lbf)*. They are recommended for use in ship drives due to their long service life as well as their outstanding performance and quality characteristics.

Protecting the environment and reducing costs

The drive system can be precisely controlled on the basis of the measurement results. The combustion engine then operates within the optimal working range. This helps to avoid the occurrence of knocking, misfiring and overloading, and reduces fuel consumption. The load distribution over several parallel operating drives can also be precisely calculated using the measurement results, which has a positive effect on the service life of components. Operating costs are thus substantially reduced by both lower fuel consumption and reduced wear.

Klaus Weissbrodt, HBM

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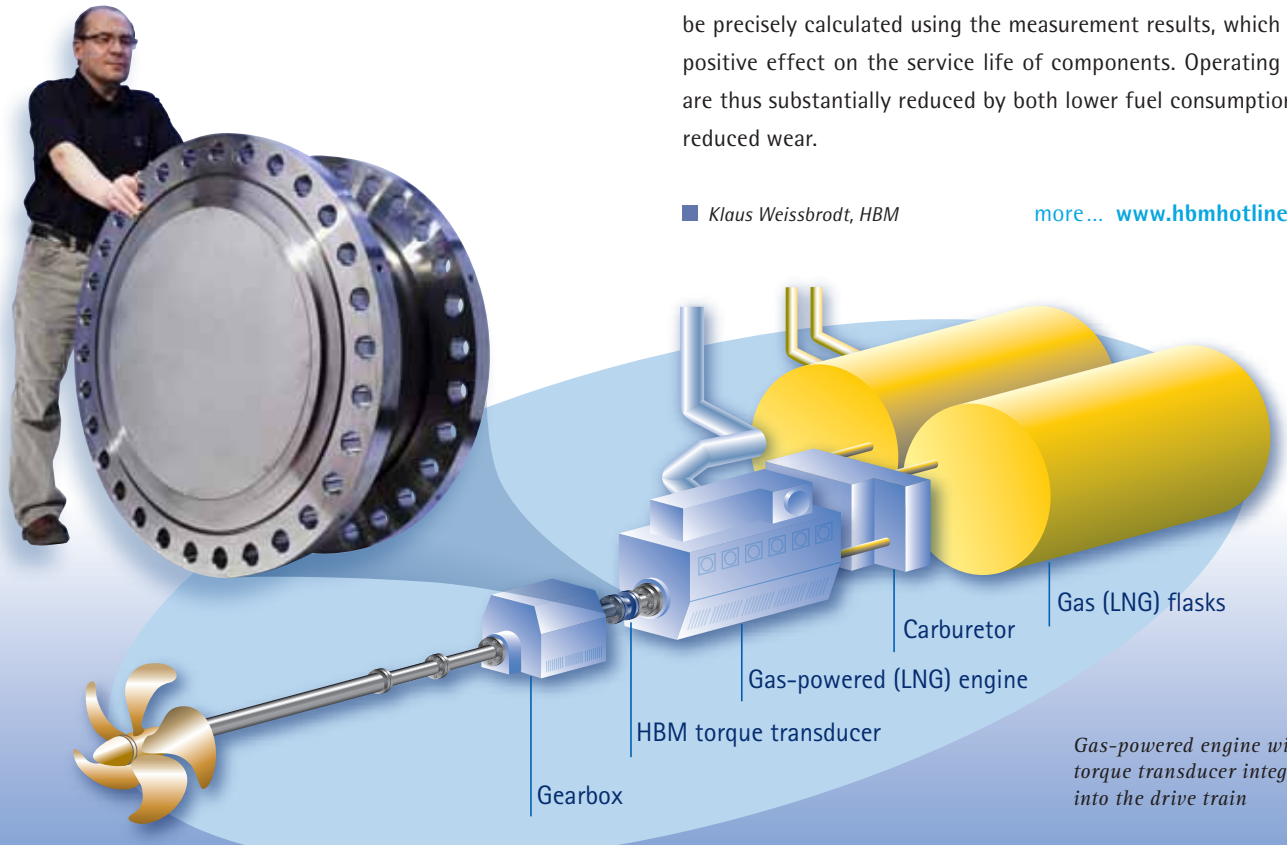

Gas-powered engine with torque transducer integrated into the drive train

HBM technology in action Economic efficiency, accuracy and small dimensions

T40

T40 torque transducer in APL test bench

The independent test bench service provider APL has over 70 state-of-the-art motor and component test benches, and relies on HBM measurement technology.

APL tests motors, drive trains, drive train components and lubricants for customers in the automotive, oil and additives industries. This permits motors to be developed that consume less fuel with the same or even improved performance.

Accuracy and loading capacity

The T40 has an accuracy class of 0.05 for temperature, repeatability and linearity, including hysteresis. In addition, the torque transducer also withstands the limit loads for longitudinal, transverse and bending moments.

T40 – optimal for dynamic applications

A realistic simulation of dynamic loads in vehicles is required for endurance testing or, alternatively, the identification of loss sources during efficiency tests on drive trains. Motor design can be improved with the aid of such test data. However, reliable measurement technology is a prerequisite for obtaining meaningful test data. During the development of the driveline test bench for rear-wheel drives, APL decided to use the HBM T40 torque transducer, impressed by its technology, economic efficiency, accuracy and small dimensions.

Advantages of compact design

Torsional stiffness and mass moment of inertia influence the natural frequency of the overall system, comprising drive train and transducer, thereby affecting the measurable speed. The compact design of the T40 means that the drive train can be designed to be short and with high rigidity, which offers metrological advantages. In addition, small and compact test benches save money as they require less floor space and smaller foundations.

High sampling rate and wide bandwidth

The T40 has an output signal bandwidth of up to 6 kHz and an internal sampling rate of 38 kHz. This high sampling rate in comparison to the bandwidth, also called oversampling, helps to eliminate the effects of aliasing. As the torque transducer is available with bandwidths of 1 kHz, 3 kHz and 6 kHz, high investment security is also achieved. It can be integrated into existing systems, due to the compatibility with 1 kHz-conditioning electronics, as well as in demanding dynamic applications. Last but not least, the good price/performance ratio makes the T40 highly suitable for use in dynamic applications such as the test benches at APL.

Multitalented – even in automated applications

Automation and robotics often require signal conditioning in real time and a direct data exchange with superordinate controllers via fieldbus. The T40 is the first transducer with a Torque Measurement Communication interface (TMC), which can be upgraded with digital interfaces using the TIM40 torque interface module which enables communication with the automation system via CAN, EtherCAT or Profibus.

Markus Haller, HBM

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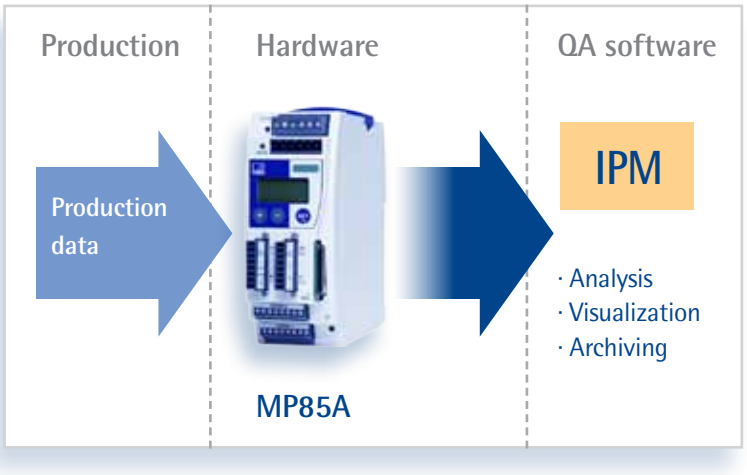
New products from HBM More efficient production control

MP85A measuring amplifier with IPM process data interface

Commercial decisions demand reliable data. Quality management systems collect manufacturer-relevant production data and store it in databases or customized reports. In addition to the Q-DAS interface, an IPM integrated process data interface is now also available for management of QA (quality assurance) data for the MP85A process controller from HBM.

The MP85A now transfers acquired production data to the QA server via the new interface directly in IPM format for database archiving or visualization. Modern, quality-oriented companies use such production information for quality assurance and production monitoring, even in the form of SMS messages. Access to meaningful processed data on productivity, downtime and tooling times, as well as product and production quality, helps to reduce costs. This can be demonstrated in a return-on-investment calculation.



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New products from HBM New S-shaped force transducer

S9M – high accuracy, low price

The new S9M force transducer – with optimized key elements – has replaced its predecessor, the S9. Wide-ranging application options and stringent standards of accuracy characterize this S-shaped force transducer – whether in the experimental research area, in OEM applications or in test machines.

Advantages of the S-shaped force transducer

The S9M has the typical properties of S-shaped force transducers such as double bending beam, high measurement accuracy and an excellent price/performance ratio. Particularly important properties are also the high absorption accuracy and the corresponding categorization of the robust S9M force transducer in the accuracy class 0.02.

Force absorption at the highest technical levels

A wide force measuring range is available from 500 N *(112 lbf)* to 50 kN *(11240 lbf)*. All measuring bodies are manufactured in stainless steel. Force application is either directly via the two central internal threads or via knuckle eyes. In addition, the S9M has a welded and therefore hermetically sealed strain gage installation, providing the force transducer with IP68 protection.

With its versatile application options, the S9M optimally supplements HBM's wide range of force transducers. Together with U10M force transducers for dynamic applications and S2 transducers with smaller nominal (rated) forces, HBM covers the entire range of force sensor applications in test machines.

Multiple application options
- ___ Test benches
- ___ Assembly systems
- ___ Hardness testing
- ___ Experimental research

Safety, precision and wide range
- ___ More security with IP68 – even in the nominal force range of 500 N *(112 lbf)*
- ___ More choice – 500 N *(112 lbf)* to 50 kN *(11240 lbf)*
- ___ Higher precision: Accuracy class 0.02

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HBM services

Volkswagen AG gains 25,000th calibration certificate

Presentation of HBM's 25,000th calibration certificate to Herbert Franke, head of the central department for measuring instruments at Volkswagen AG (center), Lioba Stenner, head of the German Calibration Service (DKD) laboratory at HBM, Andreas Hüllhorst, CEO of HBM.

DKD-calibrated measuring instruments increase the efficiency of measurement chains in production thus providing a direct effect on product quality.

In 1977, HBM was the first calibration laboratory to be accredited by the German Calibration Service (DKD). This year, calibration certificate number 25,000 was issued to Volkswagen AG.

Optimization of the measuring chain to ensure quality

During calibration, a measuring device is checked and deviations from a reference standard are determined and documented. Accreditation through the German Calibration Service (DKD) guarantees traceability to a national standard. No other laboratory can match the HBM equipment range, especially in the sector of torque and force: Nominal (rated) forces of 5 N *(1.12 lbf)* to 5 MN *(1124000 lbf)* and torques of 0.5 Nm *(0.37 ft-lbf)* to 60 kNm *(44250 ft-lbf)* can be calibrated. HBM's customers profit from reliable calibration records that make it possible to optimize measuring chains in production, thus improving production quality. In addition, HBM offers service contracts where customers can, for instance, request a calibrated replacement transducer when sending in their transducer for recalibration. This ensures that production is continued with proven quality.

> "We have a very competent partner in HBM, whose comprehensively equipped DKD calibration laboratory represents an excellent supplement to our own measurement and calibration equipment. HBM is our extended workbench."
>
> *Herbert Franke,*
> *Head of Volkswagen AG's central department for measuring instruments*

Nicole Kohl, HBM

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HBM technology in action

More security and comfort in vehicles

MP85A FASTpress ensures quality in shock absorber manufacturing

A safe and enjoyable driving experience is a prerequisite in modern vehicles where shock absorbers substantially influence the motion dynamics and comfort. Consistently high quality and output rates are essential in their manufacture. This is ensured with HBM's MP85A (DP) FASTpress process controller, which accurately monitors and documents fitting processes. The complete data storage process runs in the background and can be uniquely assigned to the produced workpieces via component identifiers which are read into the MP85A. As both the MP85A and machine PLCs utilize standardized Ethernet interfaces (TCP/IP), the process data acquired from production can also be accessed via the company network by quality assurance personnel.

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Calibration at HBM

HBM – The first stop for piezo calibration

Does your piezoelectric force transducer need recalibrating? For individual sensors or complete measurement chains – HBM is the expert for manufacturer-independent piezo calibration.

Force and torque are measured with sensors that are technologically different in their construction. However, the machine park is identical for all technologies with regards to calibration. Piezoelectric sensors and strain gage-based sensors are calibrated using the same machine; the decisive factor is a comprehensive knowledge of calibration. HBM calibrates according to application, either individual sensors or complete measurement chains. Our services therefore encompass manufacturer-independent calibration of:

___ Piezoelectric sensors and measurement chains

___ Strain gage sensors and measurement chains.

33 years experience.
Fast, economic and standardized

HBM was the first calibration laboratory to be accredited by the German Calibration Service (DKD) in 1977 and is today an acknowledged specialist for the calibration of force and torque sensors. The calibration laboratory is continuously upgraded with investments in personnel and accredited testing machines.

Strict regulations with regard to traceability of measurement tools are constantly increasing calibration demand. HBM's calibration laboratory offers rapid runtimes at attractive prices, thus enabling customers to meet their production specifications and also profit from the good price/performance ratio.

■ Lioba Stenner and Thomas Kleckers, HBM

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measure and predict with confidence

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