

Dynamic and fatigue testing systems



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1 Zwick – passion and expertise

For over 160 years the family-owned company Zwick Roell has stood for outstanding technical achievement, innovation, quality and reliability in materials and component testing. Zwick is the world leader in static materials testing; Zwick testing machines are used in R&D and quality assurance in more than 20 different industries.

Zwick also has a long tradition in the field of dynamic testing technology. It is hard to imagine a laboratory engaged in fatigue testing of metallic specimens and components without resonance testing machines. Our servo-hydraulic product portfolio is also being expanded over time, and it has been completed by the new LTM testing machines with patented linear drive.

At Zwick we use various physical drive principles for our dynamic testing machines. Each has its own special

Dynamic testing machines by Zwick



Electromechanical testing actuator



LTM electrodynamic testing machine



HA series servo-hydraulic testing machines



Vibrophore

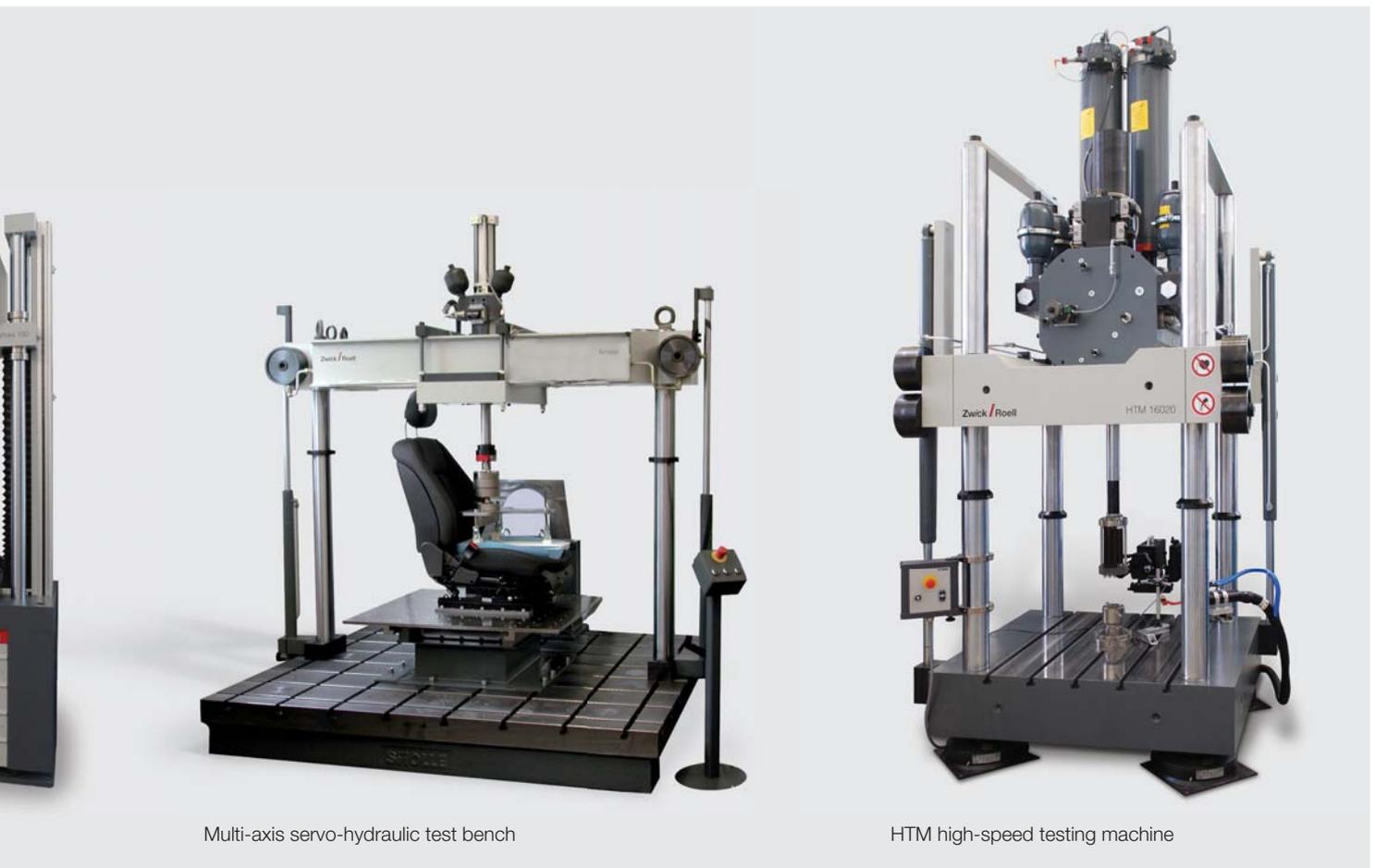
advantages and areas of application, allowing us to find the optimum solution for your testing situation.

The strength of servo-hydraulic testing machines lies in the various applications for which they are suitable. In terms of force, amplitude and frequency they are true all-rounders, enabling multi-axis fatigue tests or crash investigations with speeds of up to 20 m/s. Their modular design includes testing systems up to 2,500 kN (even higher in special versions).

Vibrohores use an electromagnetic resonance drive to generate dynamic loads, which enables very high testing frequencies, and results in short testing times with minimal energy use. The additional screw drive enables the Vibrophore to also be used as true static testing machines. Vibrophore resonance testing machines are available for test loads up to 1,000 kN and are the preferred choice for tests on metallic specimens and components.

The LTM is an electrodynamic testing machine with a drive based on linear motor technology. Zwick's patented oil-free drive makes these machines suitable for a wide range of static and dynamic tests up to 10 kN. Quasi-static tests at only 0.016 mm/s can also be performed just as easily as dynamic tests at a frequency of up to 100 Hz.

Our all-purpose electromechanical testing actuators (EPZ) can also be used for fatigue tests under defined conditions, for example for testing flexible foams as used in car seats.



Multi-axis servo-hydraulic test bench

HTM high-speed testing machine

2.1 Servo-hydraulic testing machines up to 2,500 kN

The load frames of Zwick servo-hydraulic testing machines have been specially designed to cope with the particular demands of fatigue testing; an example of this is their high level of frame stiffness. Depending on testing requirements and the need for ergonomic working conditions in everyday testing, the testing actuator is mounted either above or below the test area.

With the testing actuator mounted in the lower cross-head, the HA range represents the classical servo-hydraulic testing machine as used for determining material properties under cyclic loading. It is particularly suitable for tests requiring the use of high-temperature furnaces.

The HB range has the actuator located above the test area. These machines are especially versatile; the version with integrated T-slotted platform allows flexure tests and component testing to be performed in addition to standard fatigue tests.

Features

- Convenient working height
- Hydrostatic-bearing sealless axial actuator - no sliding friction and therefore no wear or stiction
- Only hydrostatic-bearing actuators can absorb considerable transverse forces; this is of particular importance in compression and flexure tests and in component testing.
- Hydraulic clamping and adjustment for easy positioning of upper crosshead
- Hard-chromed columns for precise guidance of upper crosshead for tests in corrosive media
- Wide range of dynamic load forms, including sinusoidal, rectangular, triangular and trapezoidal
- Also suitable for quasi-static tests due to Zwick's "two in one" function.



Fig. 1: HA 100 for low-cycle fatigue (LCF) tests at high temperature (up to 1,000°C)



Fig. 2: Fatigue test on metal specimens using an HB 100

Typical applications for servo-hydraulic testing machines



Air springs



Flat specimens



CT specimens



Testing engine bearings



Testing rail tie fastenings



Tests in saline bath



Rubber-metal dampers



Testing implants



Tests on asphalt specimens



4-point flexure test



3-point flexure test



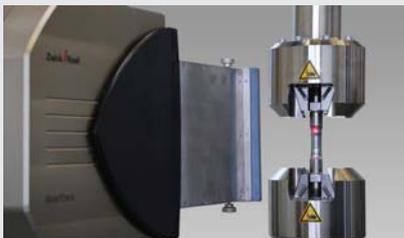
Compression tests



High-temperature tests



Tests in temperature chambers



Test with optical strain measurement

HC Series and HC Compact: 10 to 25 kN

While the HA and HB models are floor-standing, allowing equipment assembly at an optimum operating height, the HC models (10 to 25 kN) are table-top models and can also be positioned on a workbench, for example. A concrete base can optionally be supplied as a support. With all HC models the actuator is positioned above the test area, which is equipped with a T-slotted platform. A special feature of the HC series is the HC Compact. In this model the hydraulic power-pack acts as the machine table, reducing the system footprint to a minimum. With a flow rate of 12 liters/min, special sound insulation for the hydraulic power-pack and a minimal footprint, the HC Compact is ideal for laboratory operation.

Features

- 2-column frame for dynamic tests up to 25 kN

- Testing actuator located in upper crosshead
- Suitable for axial actuator (10 kN and 25 kN)
- Suitable for combined tensile and compression-torsion
 - actuator with a maximum torque of 250 Nm
- Hard-chromed T-slotted platform and columns for tests in corrosive media
- Wide accessory range: temperature chamber, compression platens, specimen grips, flexure test kit etc.
- Optional hydraulic adjustment for easy positioning of upper crosshead



Fig. 1: HC 25 servo-hydraulic testing machine



Fig. 2: HC Compact servo-hydraulic testing machine with integrated hydraulic power pack and temperature chamber

HCT and HBT series for combined tensile, compression and torsion loading

HCT/HBT are variations of the proven HC/HB series, equipped with a combined servo-hydraulic linear drive for superimposed tensile-compression-torsion loading on standardized specimens or components. In addition to axial stiffness, the frames feature high torsional stiffness. The set values for the linear and rotary drives can be configured independently of each other with freely adjustable phasing.

The drive unit is mounted on the upper crosshead and the frame is equipped with an integral T-slotted platform, enabling tests on components also.

HCT series up to 10 kN or 25 kN

The HCT series is designed as a compact, space-saving, table-top model and is available in the following combinations: 10 kN/100 Nm or 25 kN/250 Nm. The actuator stroke in both cases is 100 mm and the angle of rotation is 100° (optionally 280°). The HCT series table-top model covers test loads up to 10 kN or 25 kN and 250 Nm for servo-hydraulic oscillating torsion.

- Testing actuator stroke 100 mm
- Loads up to 25 kN
- Torque 250 Nm
- Angle of rotation 100° (280° optional)



Fig. 1: HCT 25 servo-hydraulic testing machine with integrated torsion drive

HBT series up to 250 kN

The HBT series makes tensile-compression-torsion machines with forces up to 1000 kN and torques up to 5 kNm a practical reality. For special applications and high torques 4-column frames are also used. An example of a standard version which is suitable for many testing situations is the HBT 100/1000 (100 kN and 1000 Nm). The floor-standing HBT series covers the load ranges up to 500 kN and 5,000 Nm for testing with superimposed loads.

- Testing actuator stroke 100 mm
- Loads up to 500 kN
- Torque 5,000 Nm
- Angle 100°

Advantages and features

- Hydrostatic-bearing, sealless linear and rotary actuators
- Torsionally stiff, backlash-free length-compensating coupling
- Hydraulic adjustment of upper crosshead with lifts and locks
- Hard-chromed T-slotted platform and columns for tests in corrosive media



Fig. 2: HBT 100 servo-hydraulic testing machine with integrated torsion drive

Special solutions

In addition to standardized systems, Zwick also designs and produces special dynamic testing systems. multi-axis systems, combined tension-torsion systems, testing systems with various media environments and large-scale testing systems all form part of our product portfolio.

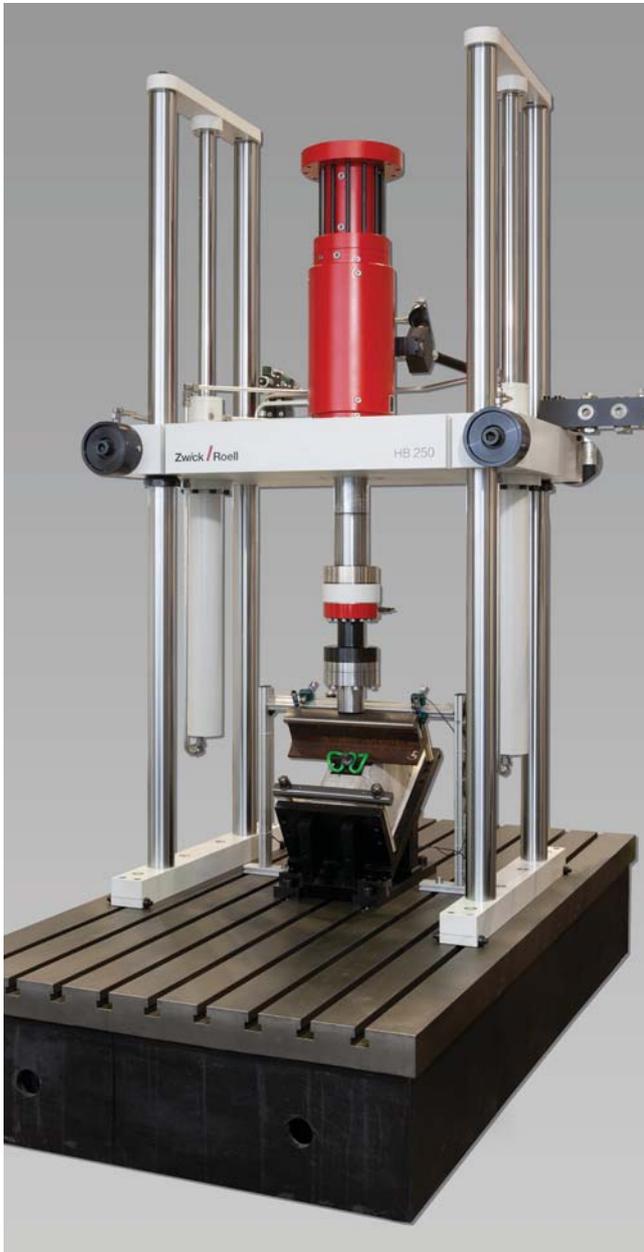


Fig. 1: Movable servo-hydraulic portal frame for component testing



Fig. 2: Four-column HB250 for materials and component testing



Fig. 3: Servo-hydraulic portal frame for testing aircraft components

Accessories for servo-hydraulic testing machines

The final element in our dynamic testing product range is the manufacture of all the necessary accessories. Our portfolio is constantly being expanded through a program of continuous development and the inclusion of new products, allowing us to satisfy our customers' most demanding quality requirements while continually improving the quality of our products.



Fig. 1: Servo-hydraulic testing actuators up to 5,000 kN from Zwick

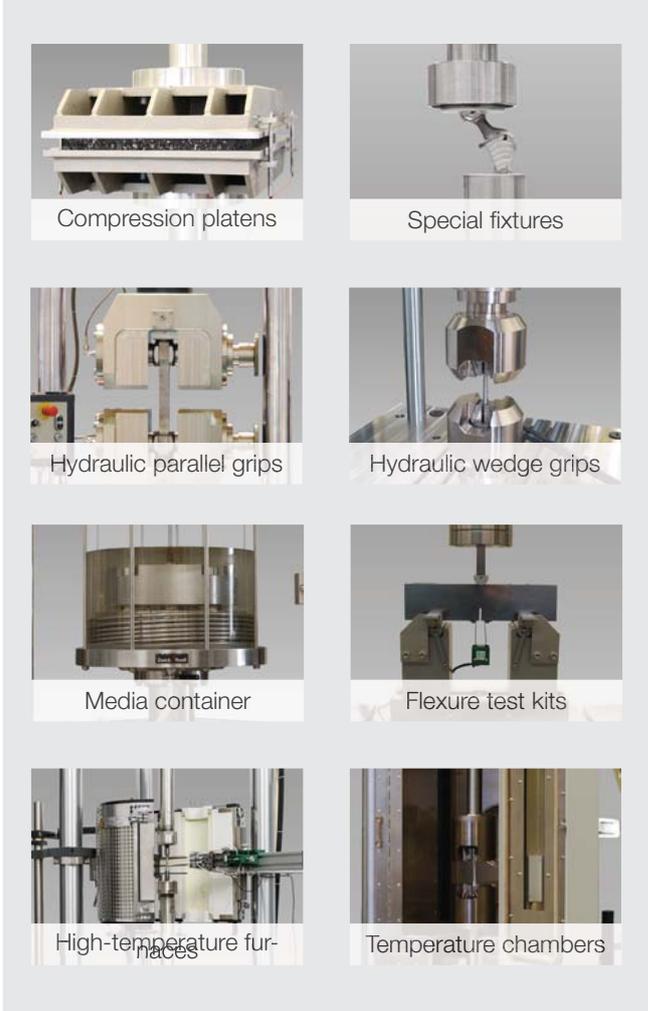


Fig. 2: Comprehensive accessory packages for all sectors and applications



Fig. 2: Zwick supplies the complete servo-hydraulic infrastructure (connector units, valves, hydraulic power-packs)

2.2 Vibrophores

Due to their design, Vibrophores have, in the past, been used exclusively as dynamic materials testing machines for determining the fatigue strength of materials and components with regard to fatigue life and fatigue limit, for example in fatigue tests to DIN 50100 (S-N curve), in the tensile, compression, pulsating load and alternating load ranges.

Modern laboratories and institutes, whether in research, training or industry, are increasingly confronted with frequently changing testing requirements. The latest generation of Vibrophores (high-frequency pulsators) from Zwick can be used as both dynamic and static materials testing machines—a first for this type of machine—with test loads up to 1000 kN. This makes them an attractive proposition for laboratories which mainly perform static tests, as well as for those which mainly carry out dynamic tests, with only the occasional static test.

The intelligent testControl II measurement and control electronics have a measurement and control frequency of 10 kHz, providing rapid response to events during tests as well as a high measured-value acquisition rate. With a resolution of 24 bits, measurement is extremely accurate.

Another new feature is the remote control with display unit that shows measurement channels and the machine and test status. It simplifies the set-up procedure and enables accurate positioning of the oscillating crosshead without direct use of the PC. The result is enhanced operator convenience, particularly when for example, the machine is installed in an acoustic booth and the PC is external.

Dynamic tests using the Zwick Vibrophore

The operating principle of the Zwick Vibrophore is based on the concept of a mechanical resonator with electromagnetic drive. The mean force is applied by moving the upper crosshead with the lead screw drive. The dynamic load is generated by an oscillation system that works when the system operates at full resonance. In this way test frequencies of up to 285Hz are possible, provided the specimens are sufficiently stiff. The dynamic and static drives are controlled separately, so that stress ratios (R-ratios) of any kind are possible. Tests can be force-, displacement- or strain-controlled. Because testing occurs in the resonance range, the Vibrophore can detect developing and growing cracks in the specimen at an early stage through minimal changes in the test frequency. The signal form of the dynamic load applied always corresponds to a sine wave.



Fig. 1: Vibrophores from 100 to 1,000 kN

The testXpert Research software provides intuitive test definition, performance and evaluation. Typical applications include fatigue tests on standard specimens, fatigue tests on components, fracture mechanics investigations on CT and SEB specimens (e.g. connecting rods, crankshafts and threaded connectors). The Vibrophore can also perform production monitoring and quality control of testing components which are subjected to oscillating loads in service, such as concrete-reinforcing steel and rebars.

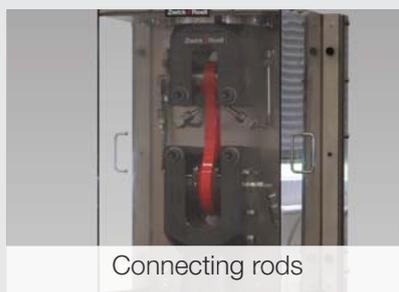
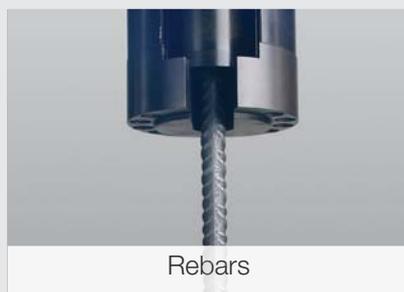
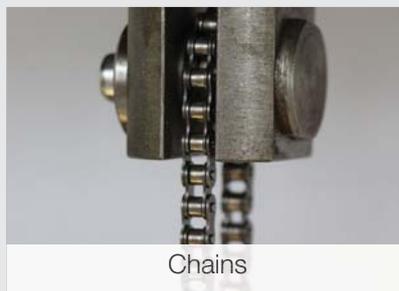
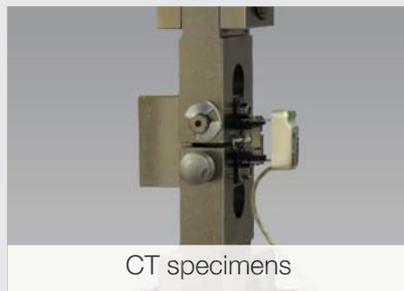
Static tests using the Zwick Vibrophore

Mechanical clamping of the oscillating crosshead and the deployment of testXpert II software transform the Vibrophore into a true static materials testing machine. Generous connecting surfaces and robust components ensure high machine stiffness.



Fig. 1: Examples of typical Vibrophore applications

Typical Vibrophore applications



In combination with precision crosshead guidance, the Vibrophore minimizes unacceptable mechanical influences on the specimen.

By using suitable accessories, both static and dynamic tests can be performed under various environmental conditions (temperature, aggressive media). The Vibrophore can also be configured for torsion and flexure tests. The absence of a central lead screw allows maximum test-area variability on the new Vibrophore, enabling testing of both very short and very large components.



Fig. 1: Vibrophore 100

Fig. 2: Installation of makroXtens extensometer (top) and clip-on extensometer (bottom) for static tensile tests



Fig. 1: Vibrophore 100

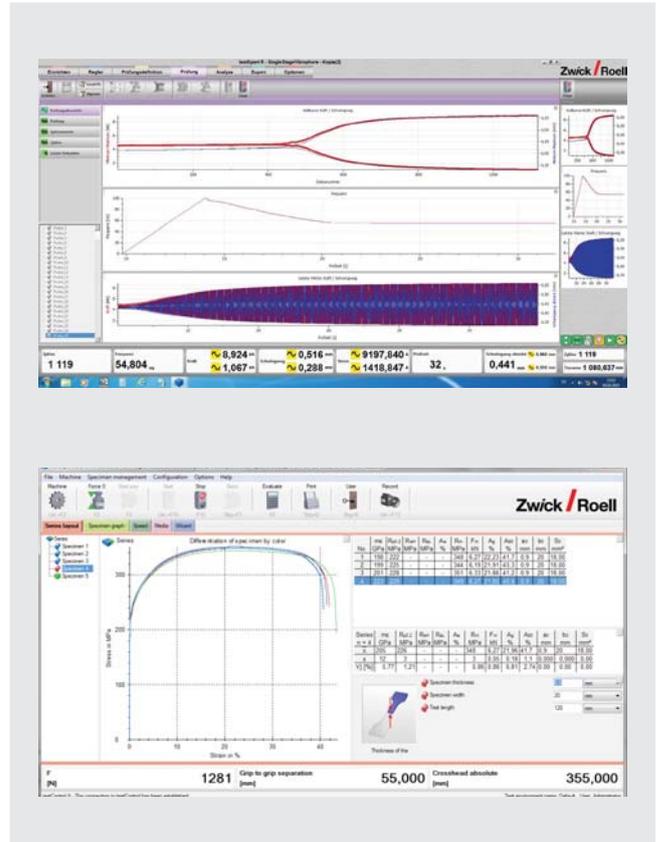


Fig. 2: The Vibrophore can be used for dynamic (top) and static (bottom) tests

Additional advantages and features

- Can be used as both static and dynamic materials testing machine
- High test-frequencies deliver short test times and high specimen throughput
- Resonance drive has very low energy consumption (approx. 2 % of that of servo-hydraulic testing machines)
- Stiff 4-column load frame, providing excellent guidance properties
- Ergonomic clamping table; with ample working area
- Easy to install; no ancillary units or systems (e.g. hydraulics, coolant) required
- No additional structural vibration damping required

- Maintenance-free system; wear-free components
- Safe, reliable operating concept that is ideal for research and training
- Continuously controlled servo motor for fast, accurate mean force control
- High pulse width modulation resolution (120MHz) for high control stability and low failure liability
- testXpert II and testXpert Research test programs matched exactly to the testing situation provide ease of operation
- Easy 8-step test frequency change by means of varying weights.

2.3 LTM electrodynamic testing machine

The LTM linear motor testing system is based on a patented electrodynamic drive system (developed in-house by Zwick), which ideally satisfies the demands placed on testing technology and makes no compromises when it comes to reliable test results. During the design stage, particular attention was paid to the positioning of the travel measurement system—close to the specimen and in the center of the test axis. The avoidance of tilting and bending moments, which lead to travel measurement errors, has enabled extraordinary positioning and repeat accuracy to be achieved, while the LTM's wide speed range allows it to be used both for dynamic fatigue tests and for quasi-static tests. An oil-free drive and closed-loop cooling circuit enable the LTM to excel as a stand-alone solution, as do its extremely simple installation requirements—a power supply is all that is required. Due to their electrodynamic drive system, LTMs require little maintenance, keeping servicing costs low, while demonstrating flexibility and ease of operation in day-to-day testing. Our linear motor testing systems are available in force levels of 5 and 10 kN.



Fig. 2: LTM 5 linear motor testing system



Fig. 1: LTM 10 linear testing system

Typical medical applications are tests on hip joint, knee and dental implants. Other applications include tests on components, standard plastics and composites specimens, together with CT and SEB specimens made of aluminum and plastics.

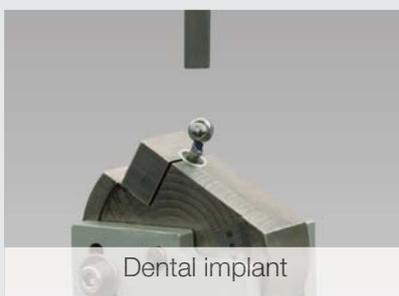
Features:

- Speed range from 0.016 mm/s to 1.5 m/s gives a wide range of application for static and dynamic tests
- Wide range of dynamic load forms, e.g. sinusoidal, rectangular, triangular, and trapezoidal
- High dynamic performance (up to 100 Hz)
- High transverse force stability
- Long piston stroke (60 mm) enables wide variety of tests
- No additional pneumatic, coolant, oil etc. supply feeds required
- Motor-driven crosshead adjustment and electrically monitored crosshead clamping ensure safety and convenience



Fig. 1: LTM 10 linear motor testing system

Typical LTM testing applications



2.4 High-speed testing machines

With a strain rate of up to $1,000 \text{ s}^{-1}$, the HTM range of high-speed testing machines are ideal for determining material behavior under crash loading. Their maximum piston speed of 20 m/s (72 km/h) is faster than the 64 km/h test speed used in the Euro NCAP frontal impact crash test. The strain rate can easily be varied by means of the piston speed, from quasi-static up to maximum speed. However, it can also be adjusted via the specimen length. The relationship as a function of specimen length l_0 and piston speed v is as follows: Rated at 25 kN and 12 m/s , the HTM 2512 is the smallest machine in the portfolio. The testing actuator is in-

$$\dot{\varepsilon} = \frac{\Delta\varepsilon}{\Delta t} = \frac{dl}{l_0} \times \frac{1}{\Delta t} = \frac{v}{l_0}$$

stalled below the machine table. It is particularly suitable for tests requiring the use of high-temperature furnaces. As well as high-speed tensile tests to ISO 18872, puncture tests to ISO 6603-2 are frequently performed using this machine.

The HTM 5020 is the most versatile machine in the portfolio. Rated at 50 kN and with a maximum piston

speed of 20 m/s , it can be used for testing both plastics and metallic specimens, e.g. sheet metal for automobile bodywork and fiber-reinforced composites. The actuator is mounted on the upper crosshead, enabling component testing in conjunction with the optional T-slotted platform. The machine is also available in an 80 kN version designated HTM 8020.

The HTM 16020 is the largest machine in the portfolio with a static nominal force of 160 kN . The actuator is mounted on the upper crosshead of the 4-column frame and the baseplate is provided with T-slots, making the machine ideal for component testing. However, tensile tests on larger-dimensioned specimens or belts are also possible. The maximum tensile force at 20 m/s is 100 kN .



Fig. 1: HTM 5020 high-speed testing machine

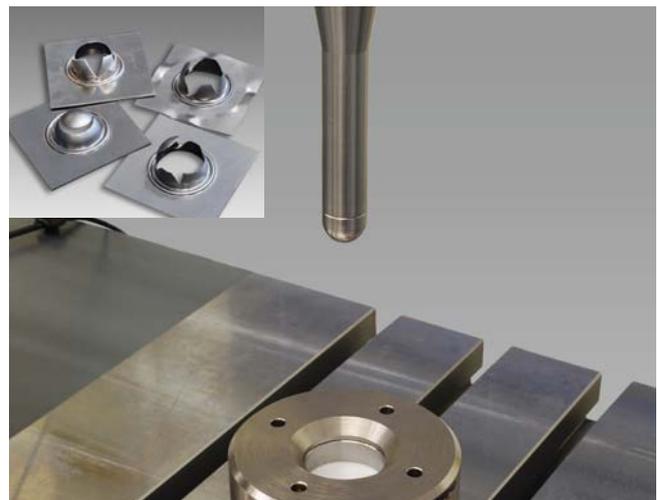


Fig. 2: Test device for puncture tests



Fig. 2: High-speed tensile test with optical measurement system

2.5 Electromechanical servo testing actuator

Electromechanical testing actuators are all-purpose screw drive machines. They are suitable for tensile and compression tests and can be integrated into testing devices in various configurations.

Areas of use range from materials and component testing to testing finished end products. They also enable testing of production steps (e.g. assembling/joining, force-fitting and assembly) and are equally ideal for long-stroke cyclic tests, such as fatigue tests on flexible foams to ISO 3385. A typical test sequence is described below.

1. Indentation hardness and specimen thickness are first measured on an unloaded seat cushion.
2. In the second step the foam is loaded several tens of thousands of times. This loading can take place in a standard climate or under specified humidity and temperature conditions.
3. After continuous loading and waiting time expiration the specimen thickness and compression stress value are measured again.
4. The results obtained are hardness loss and thickness loss.



Fig. 1: Electromechanical servo testing actuator for fatigue tests on foam materials

The electromechanical testing actuator range is available from 1-100 kN and can be supplied with the new display-equipped remote control upon request.

Features

- Variable mounting via head or foot flange or via side trunnion
- testControl II measurement and control electronics are located in a separate housing and can be positioned as required
- Free test sequence configuration via various programming interfaces
- Force or displacement control with smooth switching between operating modes
- Easy to install and no additional infrastructure required (e.g. hydraulic power pack, compressed air supply)
- Ideal for use in clean rooms
- Low maintenance costs combined with high life-expectancy

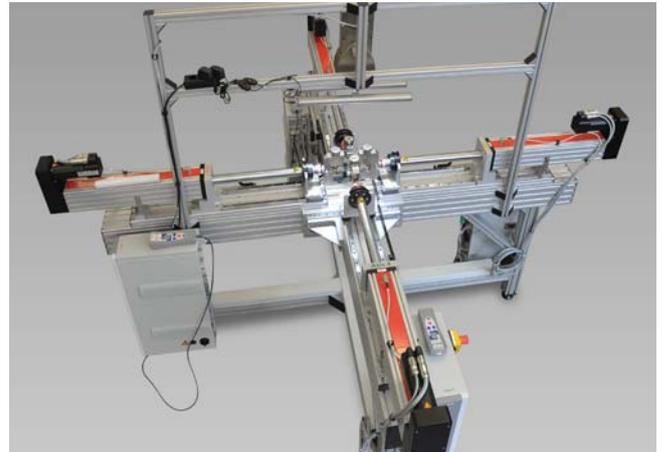


Fig. 2: Biaxial testing machine consisting of 4 servo testing actuators

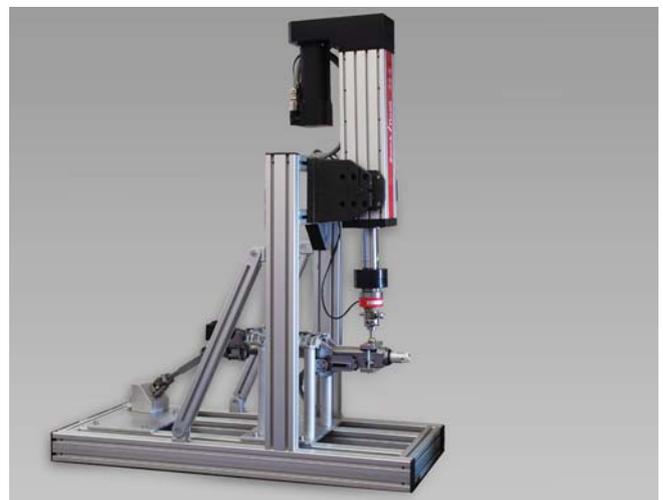


Fig. 3: Electromechanical servo testing actuator for fatigue tests on steering linkage

3.1 testControl II control electronics and testXpert® R testing software

The first choice for standard single-axis applications

Due to their design, servo-hydraulic testing machines and Vibrophores have been used exclusively as dynamic materials testing machines for determining the fatigue strength of materials and components with regard to fatigue life and fatigue limit in the tensile, compression, pulsating load and alternating load ranges.

Switching from testXpert R to testXpert II allows Zwick servo-hydraulic standard testing machines and the new generation of Vibrophores to now be used for both dynamic and static applications. These Vibrophores have therefore also been designated "two in one". The key advantage is that both types of machines can be utilized as static and dynamic materials testing machines capable of exploiting the full scope of Zwick's well-proven testXpert II testing software and application-specific testXpert Research dynamic testing software.

testControl II measurement and control electronics

The first Zwick measurement and control electronics for dynamic testing machines to be developed entirely in-house, testControl II provides a new hardware and software platform for all Zwick testing machines. Users now have access to a uniform testing environment for both static and dynamic testing machines. The intelligent testControl II measurement and control electronics have a control frequency of 10 kHz, providing rapid response to events during tests combined with a high measured value acquisition rate. With a resolution of 24 bits, measurement is extremely accurate.

testXpert® R testing software

testXpert Research intelligent testing software for fatigue and component testing provides the user with a uniform operating concept, from sensor calibration, setting PID parameters and specifying set values, right through to the evaluation and report stages. The software's modular design allows easy addition of test programs for specific tests or standardized test sequences as per ISO/DIN or ASTM.



Fig. 1: testControl II and testXpert Research - the first choice for single-axis standardized dynamic applications

testControl II – powerful modular electronics with state-of-the-art hardware architecture



- 24-bit measurement signal resolution over the entire measurement range for maximum data accuracy
- Synchronous 10 kHz measured-value acquisition rate delivers accurate measurement regardless of number of measurement channels
- 10kHz control frequency for accurate control , e.g. rapid reaction to spontaneous events
- Proven industry-standard Gigabit Ethernet interface enables very high data throughput to test bench computer



A single testing system for both dynamic and quasi-static tests



testXpert® R - A convenient and user-friendly interface

Workflow

Process-oriented structuring of test definition and performance.

Sidebar

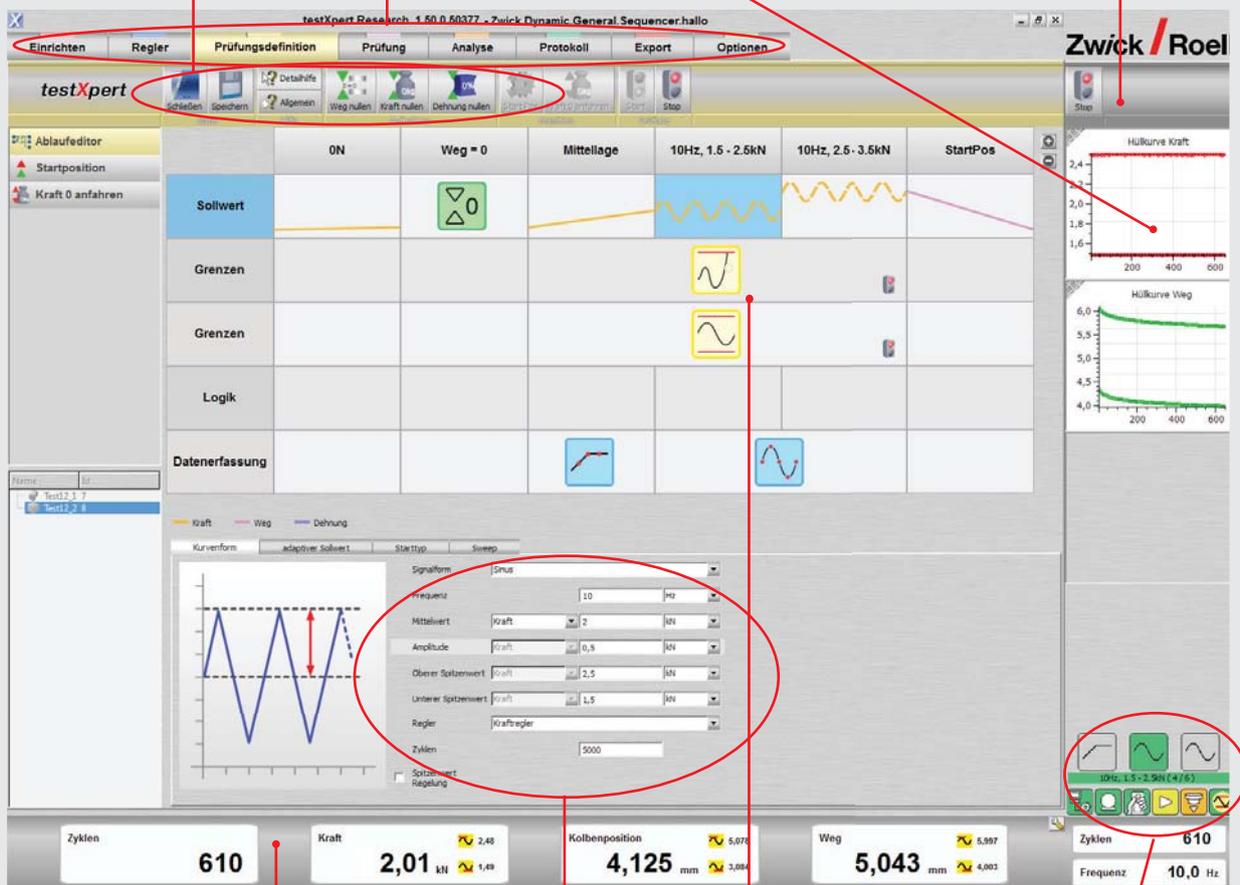
Central control panel showing all key machine status information. The sidebar is always active and cannot be hidden by other desktop applications.

Toolbar

Key functions at a glance.

Online graphics

Synchronous display of the curve graph



Input field

Inputs for all test parameters can be made directly in the test layout.

Status display

The status display provides the operator with detailed information on the current test sequence.

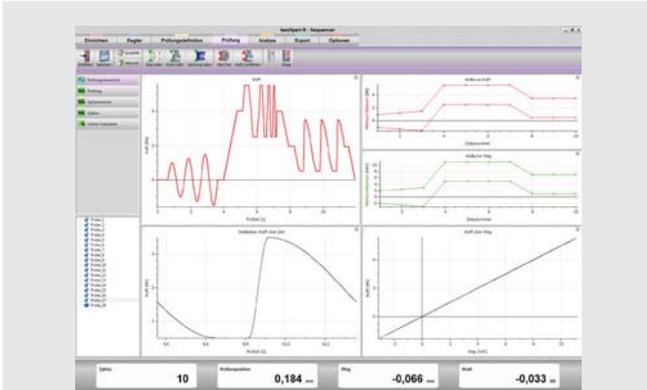
Digital display

All key measurement channels are displayed clearly. The display is freely configurable.

Sequencer

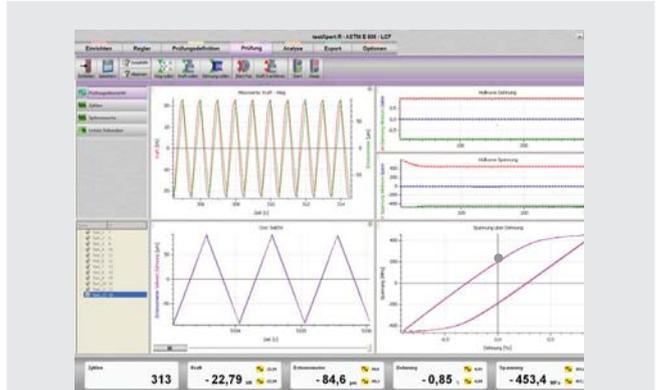
Individually tailored configuration of a block program.

testXpert® R - Modern design for simple operation and support at each step.



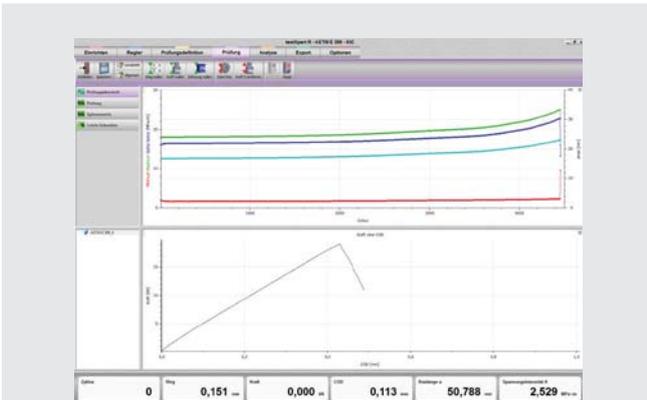
testXpert® R - Sequencer

The freely programmable block program for generating freely definable loading cycles



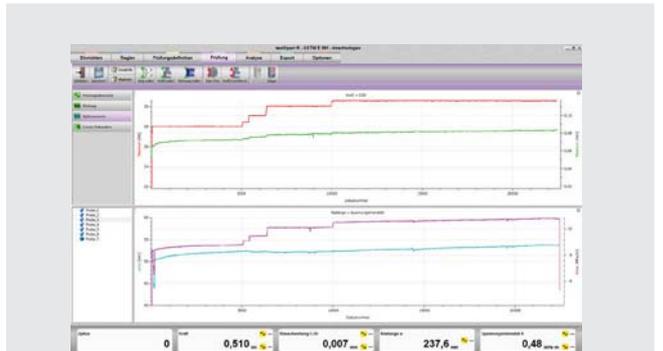
testXpert® R - Low Cycle Fatigue (LCF)

For strain-controlled determination of low cycle fatigue as per ASTM E606



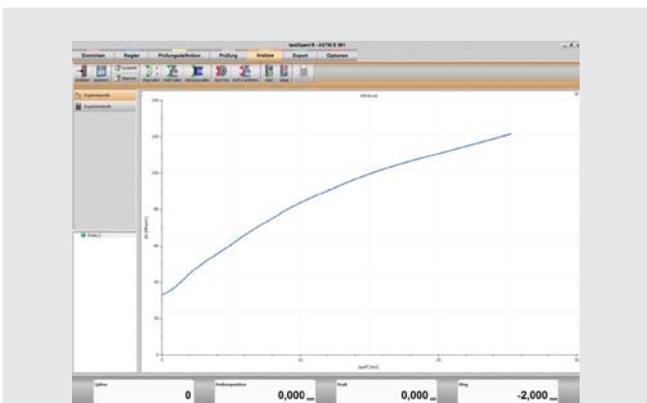
testXpert® R - Fracture mechanics

Determination of K1C value as per ASTM E399



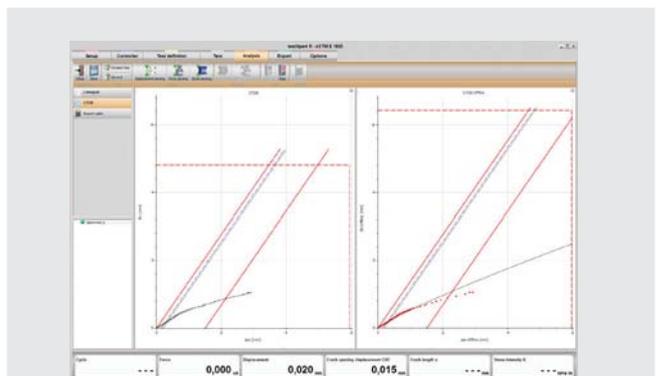
testXpert® R - Fracture mechanics

Pre-cracking for determination of crack progress (K-R curve) as per ASTM E561



testXpert® R - Fracture mechanics

K-R curve as per ASTM E561



testXpert® R - testXpert II

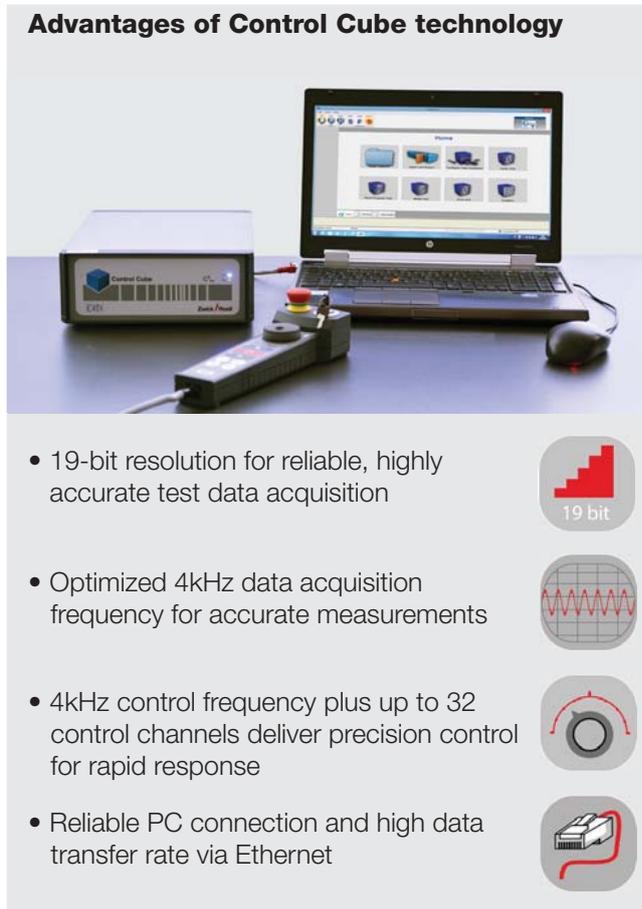
Determination of J1C and CTOD as per ASTM E1820. Display of CTOD curve

3.2 ControlCube control electronics and Cubus testing software

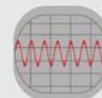
The Control Cube servo controller and Cubus testing software are employed with multi-channel and/or complex testing systems. The Control Cube servo controller is also the optimum solution where frequent test arrangement changes are involved. As well as established standard tests, Control Cube is also used in conjunction with component and assembly testing. The system's modularity and flexibility make it ideal for multi-channel applications and simulation tests.

Added to this is a multitude of helpful functions to simplify everyday use of the testing system. These include automatic optimization of control parameters, together with adaptive control, which allows control parameters to adapt automatically to changing requirements during the course of the test. There is also a wide range of useful options for data acquisition, measured-value display and data export. To enable interface with the testing environment, connections for servo valves, hydraulic supply, remote control and Emergency STOP are available. These are complemented by universal measurement amplifiers and analog and digital inputs and outputs. These can naturally also be retrofitted.

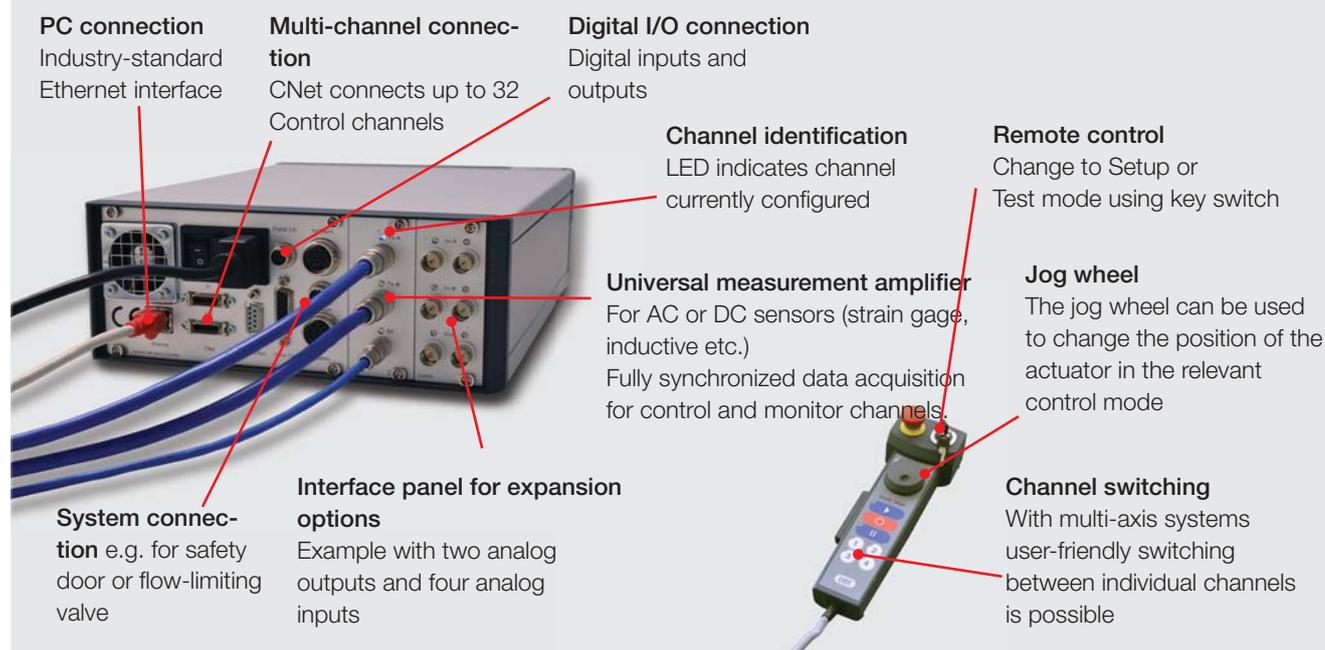
Advantages of Control Cube technology



- 19-bit resolution for reliable, highly accurate test data acquisition
- Optimized 4kHz data acquisition frequency for accurate measurements
- 4kHz control frequency plus up to 32 control channels deliver precision control for rapid response
- Reliable PC connection and high data transfer rate via Ethernet



Control Cube interfaces and functions



PC connection
Industry-standard Ethernet interface

Multi-channel connection
CNet connects up to 32 Control channels

Digital I/O connection
Digital inputs and outputs

Channel identification
LED indicates channel currently configured

Remote control
Change to Setup or Test mode using key switch

Universal measurement amplifier
For AC or DC sensors (strain gage, inductive etc.)
Fully synchronized data acquisition for control and monitor channels

Jog wheel
The jog wheel can be used to change the position of the actuator in the relevant control mode

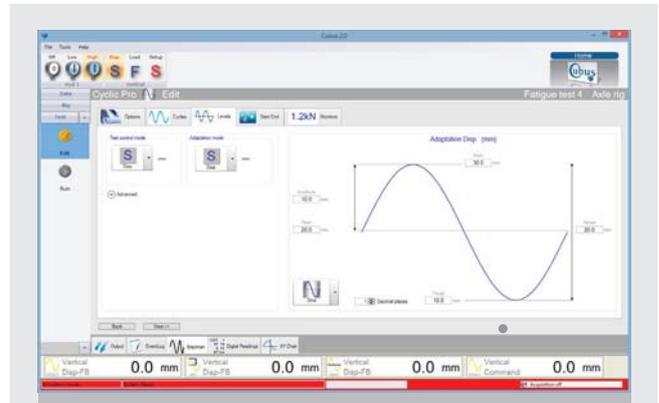
System connection e.g. for safety door or flow-limiting valve

Interface panel for expansion options
Example with two analog outputs and four analog inputs

Channel switching
With multi-axis systems user-friendly switching between individual channels is possible

Cubus testing software and test options

Whether you wish to test a complete product, a component or a single material specimen, Cubus testing software provides professional, highly efficient support. Cubus is a modular software environment specifically developed for single and multi-channel servo-hydraulic testing situations. It is available in two versions: Cubus-light basic software for routine cyclic tests and Cubus testing software for a wide variety of customized testing situations. Thanks to the simple, intuitive, well-structured user interface, only a short familiarization period is required. In a single integrated application, Cubus enables full configuration of the testing environment, at the same time meeting all the demands placed on modern test-bench control systems.



Cyclic Pro

- Cyclic constant amplitude fatigue tests
- Peak-value control, acquisition, trend monitor



Block program

- Graphical editor for creating test sequences
- Cycles, ramps, hold time, I/O, acquisition



Durability test

- Playback of iteration data
- Dynamic and quasi-static trend monitoring

Testing applications with Control Cube



Fig. 1: Multi-axis test stand for follow-up tests (Image: © IABG)



Fig. 2: Multi-axis test stand (Image: © Ford)

4 Modernization of dynamic testing machines

Advantages of modernizing with Zwick:

- Warranty for newly installed components
- Renewed long-term service reliability
- tC II measurement and control electronics satisfy the most demanding safety requirements
- Enables validation of the testing machine in accordance with the latest quality standards
- Expert, long-term service partner with over 20 years' experience of manufacturer-independent modernization of materials testing machines

4.1 RetroLine modernization packages for resonance pulsators

The standardized RetroLine modernization packages for resonance pulsators are manufacturer-independent and can easily be tailored to individual needs and testing requirements. Modernization includes renewal of the static drive motor, new testControl II measurement and control electronics plus installation of current testXpert Research testing software. Modernization is generally carried out directly on-site at the customer's premises and is undertaken by our service technicians.

4.2 RetroLine modernization packages for servo-hydraulic testing systems

Modernization with testControl II measurement and control electronics is ideal for single-channel testing machines. Our modular, manufacturer-independent modernization packages include new testControl II measurement and control electronics plus the latest



Fig. 2: Modernization of a Vibrophore with testControl II

version of our testXpert Research testing software. If necessary, modernization can involve a complete solution with replacement and modification of the hydraulic components.

Additional sensors, specimen grips and test fixtures from our comprehensive accessory portfolio can be retrofitted.



Fig. 1: Modernization of a servo-hydraulic testing machine with testControl II plus testXpert Research testing software

5 Zwick Services

5.1 Contract Testing Laboratory

If you have a testing requirement but no suitable testing option, our contract testing service is ready to provide expert assistance.

We can also help you out in the event of capacity bottlenecks or perform cross-validation tests. It makes no difference whether just a single test is involved or an entire test series.

With the latest technology and modern testing machines, we guarantee fast, standard-compliant testing. Naturally we can also perform tests in accordance with your factory standards.

Our contract testing laboratories perform testing services of all kinds, on all static and dynamic materials testing machines. Our testing is individually tailored to each industry and material, whether metals, plastics, rubber, composites, automotive, medical—you're in good hands with us!



Fig. 2: Static testing machines and instruments in the Zwick testing laboratory



Fig. 1: Some of the dynamic testing machines in the Zwick Contract Testing Laboratory

5.2 Applications technology

Our technical advisors and experienced applications engineers are here to provide expert advice.

Whatever your needs, our qualified engineers will draw on their solid expertise to provide support during the planning and implementation of all or any test sequences and projects.

Our Applications Test Laboratories possess a full-time array of materials testing machines and instruments, together with a comprehensive assortment of accessories including specimen grips, test fixtures, sensors and temperature chambers.

Contact us: 011 49 7305 10 440 or e-mail auftragspruefung@zwick.de

5.3 Overview of services

Our service technicians guarantee successful, trouble-free commissioning—from pre-acceptance and installation, to initial calibration, to instruction on hardware and software, including full safety briefing.

Inspection and calibration

Naturally, we will also carry out the required annual inspection and calibration. Our checklist-based inspections and calibrations provide a sound basis for reliable test results. They also extend the life of your materials testing machines and instruments, saving operating costs in the long term.

Customer support

We are always ready to help whenever our customers need additional support. Our Hotline staff will assist you in questions relating to hardware and software malfunctions, while our Support Desk guarantees individually tailored advice or rapid assistance, including via remote access.



Fig. 2: Experienced applications engineers will advise you on individually tailored testing options



Fig. 1: Zwick operates a DAkkS-accredited calibration laboratory. With over 10,000 calibrations performed annually, this is the largest calibration laboratory in Germany.

Software services

Once you have purchased your testing software we are ready to provide additional software services upon your request—software trials, updates, upgrades, training—whatever you need!

Training courses in the ZwickAcademy

Our ZwickAcademy offers a comprehensive, modular training program, at Zwick's headquarters in Ulm, at a Zwick location near you, or directly on-site at your premises. Course topics range from our testing software to applications training and workshops, to courses customized to your company's specific requirements.

Other services

Particularly for testing systems in the medical and pharmaceutical industries, Zwick provides assistance with DQ/IQ/OQ qualification in the form of comprehensive qualification documentation (individually tailored if required) and through on-site performance of qualification.

If you need to move your materials testing machine to a different location, Zwick's removal and relocation service will assist with technical and organizational planning, together with transport and full recommissioning.



Fig. 2: The ZwickAcademy offers an interesting and wide-ranging training program, for new students and advanced learners alike.

Professional verification of the alignment of your testing machine using standardized alignment transducers is a fundamental component of our service portfolio. The alignment of the test axis is documented, ensuring reliable test results. We can also produce a customized alignment transducer for individual geometry data.

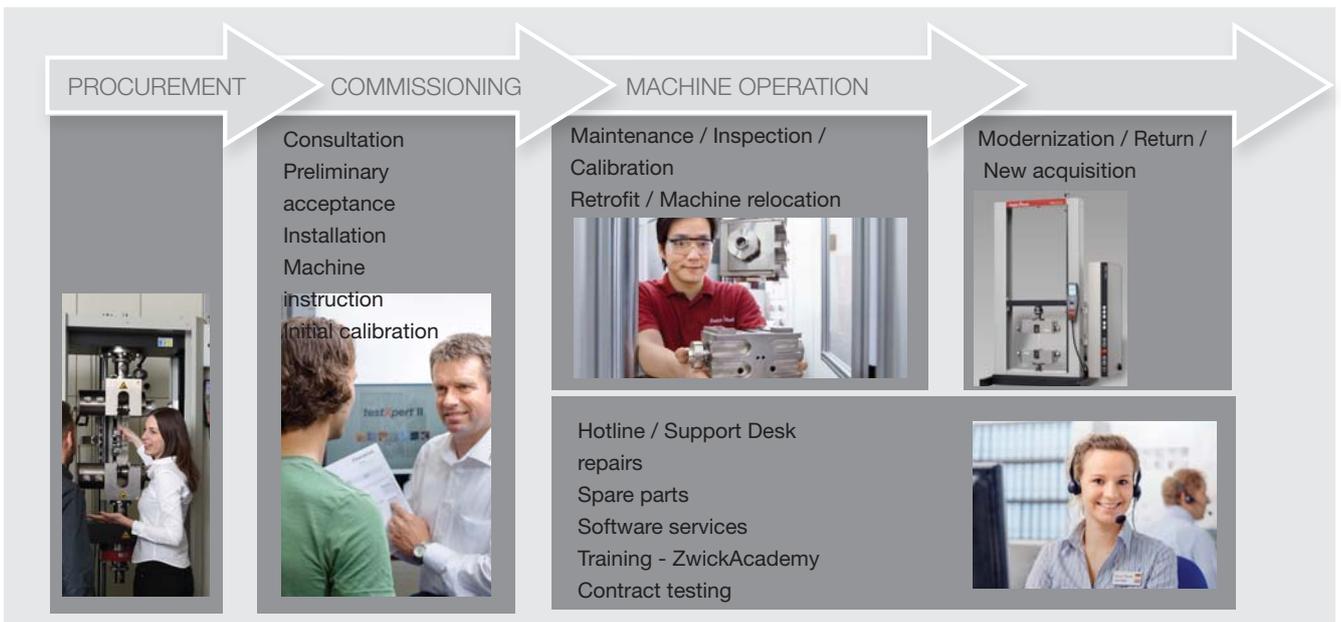


Fig. 1: Zwick provides continuous support throughout the entire life-cycle of materials testing systems.

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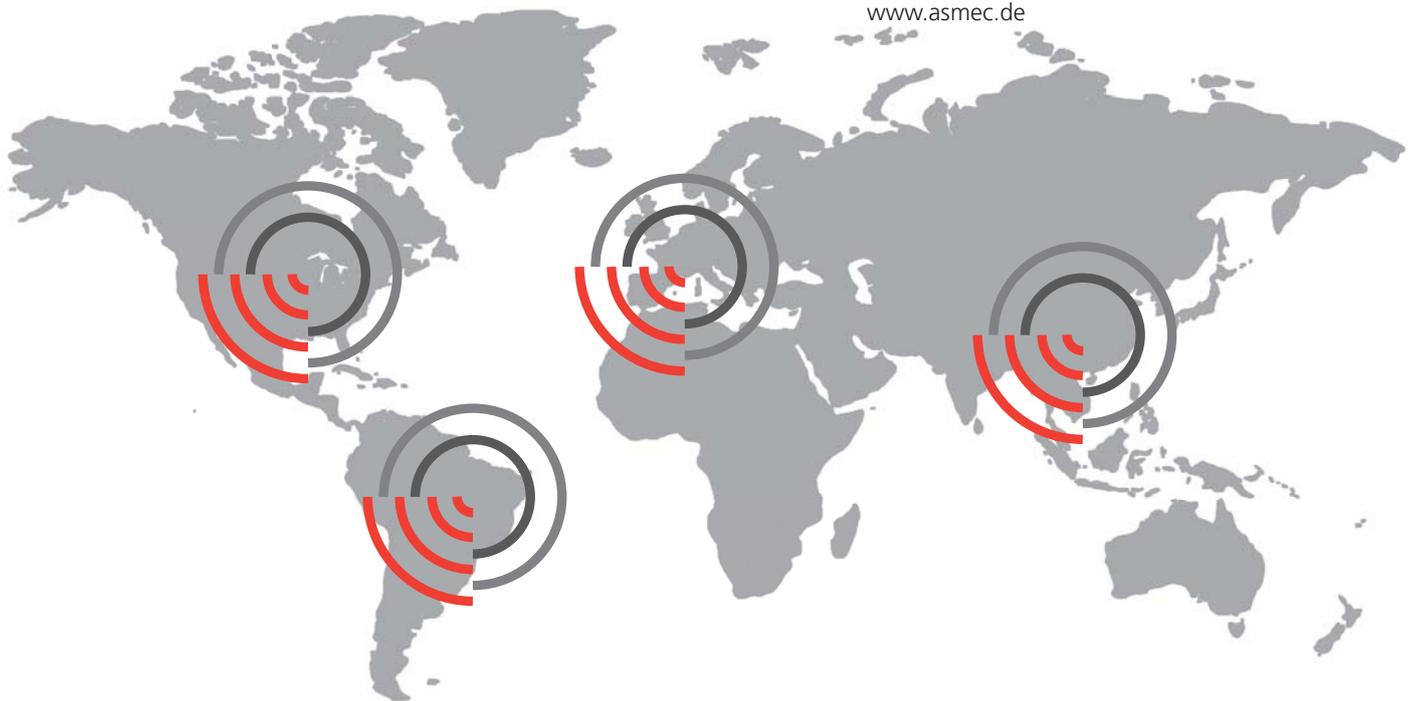
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