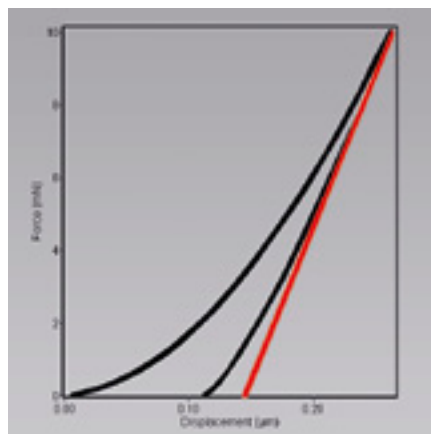
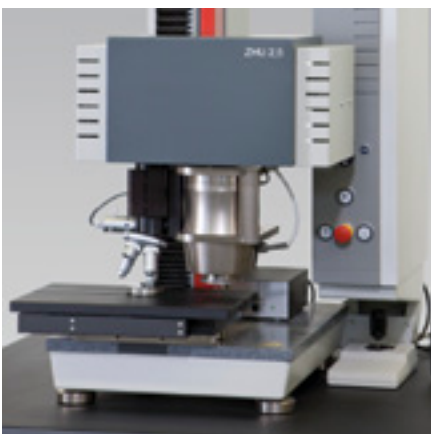
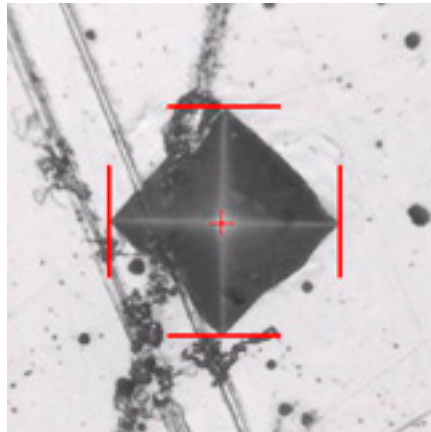
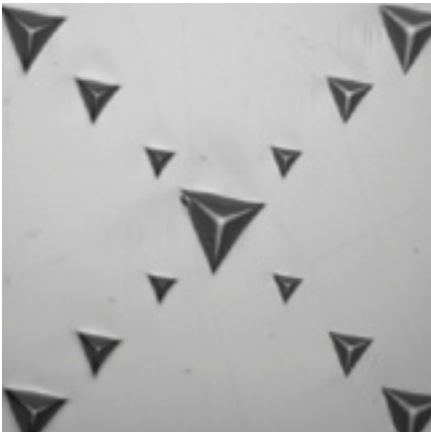
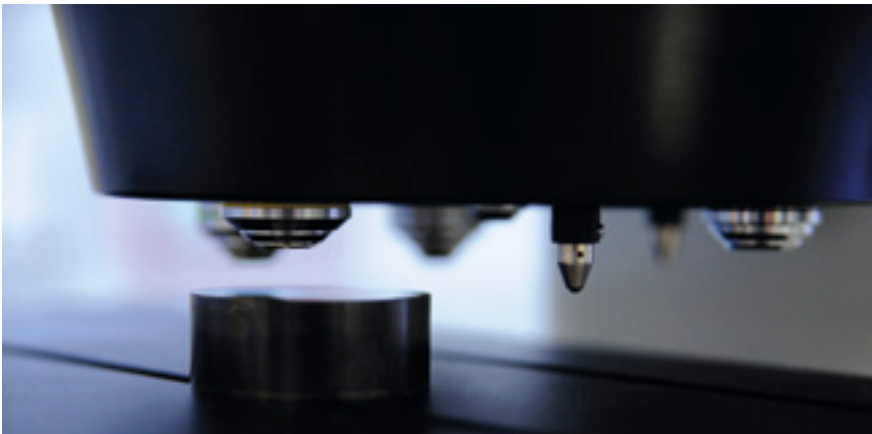


## Hardness Testing with Zwick Roell



## **1 Welcome to Zwick Roell – passionate customer orientation**

For over 150 years the name of Zwick Roell has stood for outstanding technical competence, innovation, quality and reliability in materials and component testing. Our customers' confidence in us is reflected in our position as world-leaders in static testing and the significant growth we are experiencing in fatigue strength testing systems. With innovative product development, a comprehensive range and worldwide service, this family concern supplies tailor-made solutions for the most demanding requirements – in both research and development and quality assurance in over 20 sectors. With more than 1000 employees, a production facility in Ulm, Germany, additional facilities in Europe, USA and Asia plus agencies in 56 countries worldwide, the Zwick brand name guarantees the highest product and service quality.

Customer orientation is the basis of our corporate philosophy. Dependability, straightforwardness and professionalism are the keynotes of our approach. Our aim is to build long-term customer relationships based on mutual trust – we value every customer, from large undertakings to small firms. We always give of our best.

We help our customers to achieve greater success through expert advice, tailor-made solutions, innovative products and comprehensive services.

## **Zwick Roell's comprehensive and innovative hardness testing solutions**

The success of our hardness testing machines and instruments is founded on many years' experience, on our role as a global supplier and on maintaining close contact with our customers. The versatility and high level of 'intelligence' of our testing systems are the product of up-to-date engineering, powerful electronics and application-orientated software.

The Zwick Roell Group has UKAS and DAkkS-accredited ISO 17025 hardness calibration laboratories, traceable to National Metrology Institutes. This guarantees Zwick Roell hardness testers, test blocks and indenters are supplied with traceable certification.



Fig. 1: Headquarters of the Zwick Roell AG and the Zwick GmbH & Co. KG in Ulm, Germany



### Static load application

An indenter with a hard metal ball or a diamond cone/pyramid is pressed into a specimen supported on a firm base. The test load is applied perpendicularly, without shock, and with a defined initial application time and duration.

### Dynamic load application

Large components often require portable devices which normally use dynamic force application.

### Optical indentation measurement

The indentation is measured after removal of the test load. The length measurement values (indentation diagonal, diameter) are used to calculate the hardness value.

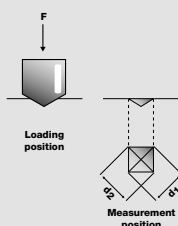
### Depth measurement method

The indentation depth is measured under test load or after removal of additional test load.

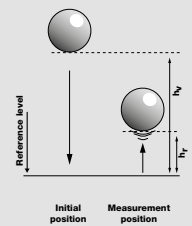
### Energy measurement

Impact velocity and rebound velocity (or height) of impact body are measured.

- Vickers HV
- Brinell HBW
- Knoop HK

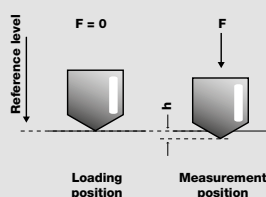


- Leeb HL
- Rebound hardness (e.g. Sclerograph)



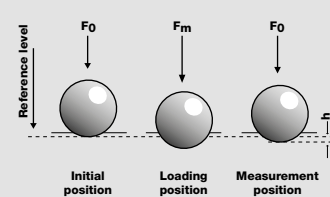
### Measurement under constant test load

- Instrumented indentation test
- Martens HM
- Ball indentation hardness
- Modified method to Vickers HVT



### Measurement under pre-load after removal of the additional load

- Rockwell (A, B, C, D, E, F, G, H, K, N, T, W, X, Y)
- Rockwell (R, L, M, E, K, alpha)
- Modified method to Brinell HBT





## 2 Universal Hardness Testers

### ZHU250CL Universal Hardness Tester

#### ***Combination of the best.***

Today's modern all-purpose hardness testing machines are based on technologies making innovative use of mechatronic components. Their high level of precision gives them a wide range of applications, particularly in quality assurance, production-line checks and in the laboratory environment.

In the ZHU250CL hardness tester the latest close loop technology is used for applying test forces. The closed loop control system is designed to have a much lower signal-to-noise ratio than a traditional load cell, thus providing much greater consistency of test force application. The accuracy on all loads beats the requirements according to the relevant ISO and ASTM standards.

The extremely wide test force range of 1 kg to 250 kg enables testing according to Vickers, Knoop, Rockwell and Brinell to ISO 6507, ISO 4545, ISO 6508, ISO 6506 and the relevant ASTM standards.

The unique "4-plus-4" turret is able to carry up to 4 lenses and up to 4 indenters simultaneously. The turret is also designed to allow testing in hard to reach positions by using a unique vertical rotation mechanism with an adjustable approach velocity. The dwell times is variable from 5 - 60 seconds. A high-resolution 1.3 megapixel USB camera is integrated in the hardness tester.

Operation and control of the hardness tester results from the High Definition software (ZHμ.HD). Motorized x-y tables are available for automated hardness traverse tests. With the USB camera and an objective lens a high-resolution overview image of specimen surface can be created via scan function. Automatic indentation measurement - with illumination and shadow correction - removes operator influence in determining hardness values (see further features of High Definition software on page 16).

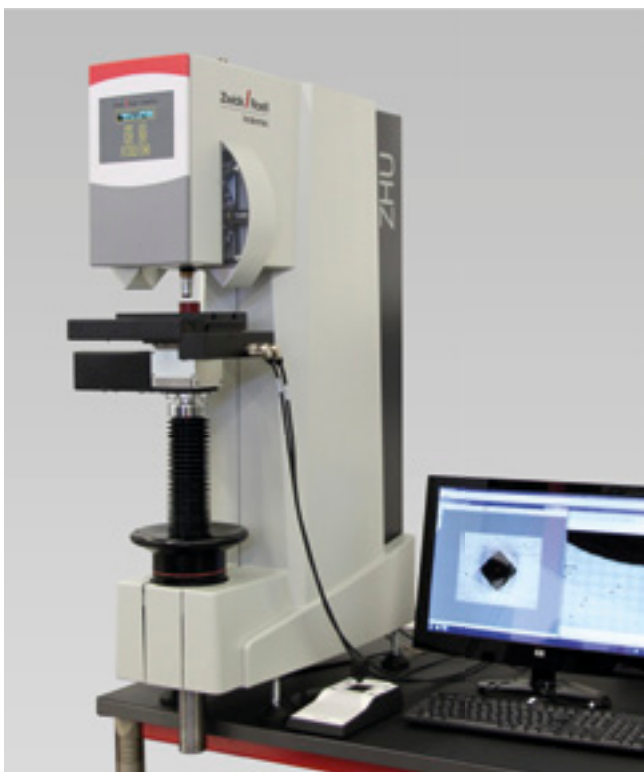


Fig. 1: ZHU250CL universal hardness tester



Fig. 2: ZHU250CL universal hardness tester in zoom

## ZHU250 Universal Tester

### ***Robust Know-How.***

The ZHU250 universal hardness tester is used for the following methods:

- Vickers (HV) ISO 6507, ASTM E 384
- Knoop (HK) ISO 4545, ASTM E 384
- Brinell (HBW) ISO 6506, ASTM E 10
- Rockwell (HR) ISO 6508, ASTM E 18
- Vickers depth measurement HVT VDI/VDE 2616-1
- Brinell depth measurement HBT VDI/VDE 2616-1
- Ball indentation hardness (H) (ISO 2039-1) (plastics)

The ZHU250's robust design guarantees many years of testing in a wide range of applications requiring a test load up to 250 kgf. It features fast, easy handling.

Optical measuring of indentations uses a digital precision measuring system on a highly tempered, non-reflective focusing screen. A comprehensive range of lenses (magnifications from 15x to 520x) and accessories is available to suit any testing situation.



Fig. 1: ZHU250 universal hardness tester

## ZHU187.5 Universal Tester

### ***Flexibility for Everyone.***

The ZHU187.5 is available in versions to suit test loads between 29.4 N and 1839 N (187.5 kgf) for the following methods:

- Vickers hardness (macro)
- Brinell hardness (up to 1839 N)
- Rockwell hardness (classic method)

Features of these instruments include weight-loading, an automatic test cycle and a nose-mounted indenter providing highly flexible test positions. They are available with an LCD line display. Load-change is by means of side-mounted rotary knobs; the test method is selected via the display. The microscope has adjustable graticules to optically measure the indentation. The hardness value is transmitted to the testXpert software at the touch of a button, to appear automatically on the display. Statistical evaluations and conversions can be performed in addition to entering tolerance limits.

An RS-232 interface plus a wide range of accessories (indentors, support tables, hardness test blocks) are included as standard.



Fig. 2: The ZHU187.5 universal hardness tester

## 3 Vickers Hardness Testers

### ZHV $\mu$ / ZHV30 Vickers Tester

#### *Variety to suit.*

The **ZHV $\mu$  Micro Vickers** hardness tester covers Vickers and Knoop hardness tests to ISO 6507, ISO 4545 and ASTM E 384 within the load range from HV0.01 to HV2.

The hardness tester is equipped with an automatic 6-position turret for up to 2 indenters and up to 4 lenses. This enables Vickers and Knoop hardness tests by menu selection without exchanging the indenter. A wide practical application range is ensured with objective lenses covering total magnifications from 25x to 1000x. The front panel display and integrated microscope allow easy operation and timesaving hardness testing. The test cycle is fully automatic and dwell time can be set in the hardness tester electronics. Load change is also automatic and set in the menu. The intensity of the illumination can be stored for each objective lens individually.

For more sophisticated or automated applications, PC controlled versions are available as semi or fully automatic systems based on the High Definition Software (HD). The advantage of this software is that it creates an overview image of the specimen in high resolution to define indentation positions. This allows single or multiple traverses to be configured and carried out accurately on the specimen surface. The customer benefits from the linking of the overview picture and the live image. The indentation is shown on the live image with the measurement lens magnification and the software indicates automatically where this position is in the overview image of the specimen surface.

The system is operated and controlled entirely by the software and is particularly used for automated multiple traverse testing.



Fig. 1: ZHV $\mu$  Vickers hardness testers from manual to fully automatic

The **ZHV30 micro/macro Vickers** hardness tester covers Vickers and Knoop hardness tests to ISO 6507, ISO 4545 and ASTM E 384 within the load range from HV0.2 to HV30.

The hardness tester is equipped with an automatic 5-position turret for 1 indenter and up to 4 lenses. A wide practical application range is ensured with different objective lenses covering magnifications from 25x to 500x. The front panel display and integrated microscope allow easy operation and timesaving hardness testing. The test cycle is fully automatic and dwell time can be set in the hardness tester electronics. Load change is also automatic and set in the menu. The intensity of the illumination and individual adjustment is stored for each lens individually.

For more sophisticated or automated applications, PC controlled versions are available as semi or fully automatic systems based on the High Definition Software (HD). The advantage of this software is that it creates an overview image of the specimen in high resolution to define indentation positions. This allows single or multiple traverses to be configured and carried out accurately on the specimen surface. The customer benefits from the linking of the overview picture and the live image. The indentation is shown on the live image with the measurement lens magnification and the software indicates automatically where this position is in the overview image of the specimen surface.

The system of this hardness tester is operated and controlled entirely by the software. The system is especially used for automated traverse testing.



Fig. 1: ZHV30 manual Vickers hardness tester

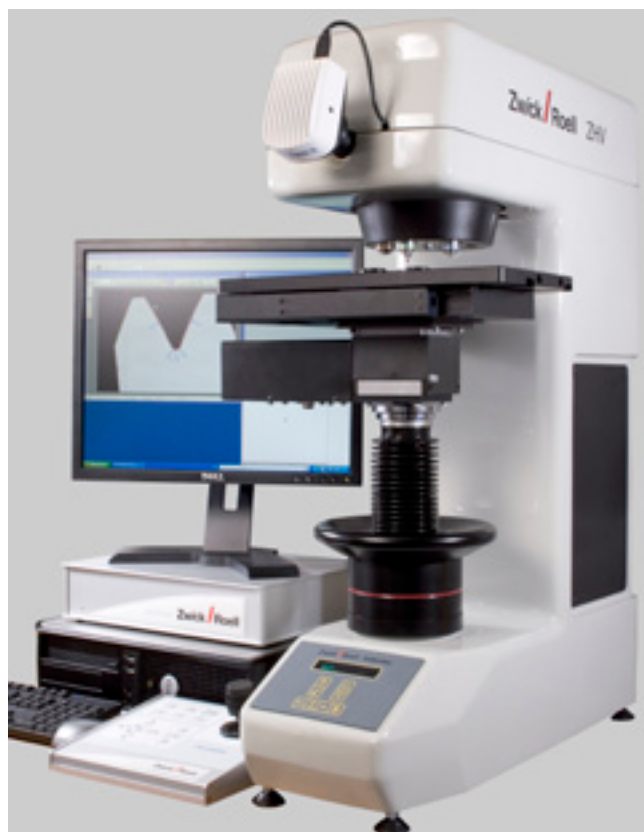


Fig. 2: ZHV30 fully automatic Vickers hardness tester with HD software





Fig. 1: ZHV30/zwickiLine unit for optical hardness test methods



Fig. 2: ZHV30/zwickiLine hardness testing machine

## ZHV30/zwickiLine Vickers Tester

### ***Precise Control.***

The ZHV30/zwickiLine hardness tester covers Vickers hardness tests to ISO 6507 and ASTM E 384 and Brinell hardness tests according to ISO 6506 within the load range from 0.1 kgf to 31.25 kgf.

The ZHV30/zwickiLine is a combination of a zwicki-Line hardness testing machine, a unit for optical hardness test methods and of the testXpert software. The system uses a top-loading concept, in which the specimen is mounted on the support and the unit is automatically lowered to the specimen from above, providing maximum flexibility regarding specimen heights. The unit is also equipped with a high-precision load cell, a GigE camera and a 5-position turret for up to 4 lenses and 1 indenter. A wide practical application range is ensured, with different objective lenses covering total magnifications from 50x to 600x.

The turret is available in manual or motorized form for changing from lens to indenter position. Manual or motorized x-y tables plus controllers can be combined as required to provide a tailored testing solution in line with the customer's requirements. The system is operated and controlled entirely by the software.

The system is used in semi or fully automatic mode, also for multiple traverse testing including automatic focusing and automatic indentation size measurement.

A testXpert master test program contains series tests for the Vickers, Knoop and Brinell methods. Optional add-ons are available for automatic indentation measurement, focusing and for traverse testing (including multiple traverses), with manual or motorized x-y tables.

Alternatively, the fully automatic system of this hardness tester can also be used with the test software High Definition (see page 16).





Fig. 1: ZHV10 analog version



Fig. 2: ZHV10 PC version

## ZHV10 Vickers Tester

### *Progress in Tradition.*

The ZHV10 Vickers hardness tester has a proven track record, especially with:

- Vickers hardness,
- Knoop hardness,
- Brinell hardness,
- Case-depth-hardening, hardening and nitriding depth,
- Scratch hardness (analog unit only).

Loading weights from 0.2 kg to 10 kg (optionally up to 30 kg) and exchangeable lenses for various magnifications and image areas are available for both versions.

Hardness tables are used to evaluate the hardness value when using the **analog unit**.

The **PC version** uses testXpert software. As well as being simple to operate, testXpert adapts to varying test conditions with great flexibility. This equipment includes a video adapter with a high inherent magnification (approx. 40 fold) which is integrated in the measurement microscope in front of the GigE camera (1.4 megapixel). The LED illumination enables a considerably lower heating up of the measuring microscope and a longer life span.

Various x-y table variants are available:

- with manual micrometer screws or
- with digital micrometer screws for data transfer (RS-232) of the measured coordinates to testXpert

Various prisms and clamping devices as well as a parallel vice for fixing the specimens are optional extras.

## 4 Rockwell Hardness Testers

### ZHR Rockwell Tester

#### *Unique Accessibility.*

The ZHR Rockwell hardness testers cover the following methods:

- Classical Rockwell: ZHR 4150 (pre-load: 10 kgf; test load: 60; 100; 150 kgf)
- Super Rockwell: ZHR 4045 (pre-load: 3 kgf; test load: 15, 30, 45 kgf)
- Combined Rockwell and super Rockwell: ZHR 8150 (pre-load: 3, 10 kgf; test load: 15, 30, 45, 60, 100, 150 kgf)
- Jominy hardness traverse testing to Rockwell

The machines are available with various levels of operating convenience:

- Models with one-button operation for straightforward testing situations (Type AK, Type BK)
- Models with line-display and integrated conversion functions for standard applications (Type LK)
- Models with touchscreen, expanded functions and high level of operating convenience for wide-ranging test situations (Type SK/TK).

This range of hardness testing machines features modular design, with a wide variety of equipment, allowing the ideal combination to be produced for each application.

A special feature of our Rockwell hardness testers is a nose-mounted indenter for testing difficult-to-access measuring positions. Operation is straightforward, thanks to:

- Automatic test cycle,
- Automatic loading and unloading,
- Automatic evaluation, including conversion,
- Load-weight selection using rotary knob or via touchscreen (automatic load changing).

These testers are of rugged construction, with a play-free ball-bearing spindle, test areas up to 250 mm as standard and optional 375 mm height for large workpieces and an integrated RS-232 interface for connection to testXpert/testXpert II.

Zwick Roell can provide a standardized solution for the Jominy end quench test (Rockwell traverse testing).



Fig. 1: ZHR 4150AK Rockwell tester



Fig. 2: ZHR 8150SK Rockwell tester with automatic Jominy system

## Zwick 3106 Ball Indentation Tester

### **Speciality Testing.**

The Zwick 3106 hardness tester provides universal application for all depth-measurement tests.

The following can be tested to standards:

- Rockwell hardness (ISO 6508)
- Rockwell hardness for carbon-based materials (DIN 51917)
- Ball indentation hardness for plastics and hard rubber (ISO 2039-1)
- Hardness test: plaster (DIN 1168-2)
- Indentation test: asphalt (DIN 1996-13)
- Indentation test: resilient floor-coverings (ISO 24343-1)

The Zwick 3106 is equipped with an electronic evaluation unit plus suitable test modules. It is employed in research, development, quality control and for goods inwards inspection.

### **Special features:**

- Dead-weight loading
- Electronic display of the indentation depth
- Display of hardness values via an integrated electronic evaluation unit
- Adjustable oil brake clamping for shock-free application of the test load
- Easy to handle, short instruction time
- Manual lead screw



Fig. 1: Zwick 3106 electronic evaluation unit



Fig. 2: Zwick 3106 universal ball indentation tester

## 5 Instrumented Indentation Hardness Testers

### ZHU/zwickiLine Universal Tester

#### *Innovation & Competence.*

The ZHU/zwickiLine universal hardness testing machines can be used for all the classical testing methods, including Rockwell, Vickers, Brinell and ball indentation hardness. They are also well-suited to the innovative instrumented indentation test. This is used to determine hardness plus additional mechanical materials parameters and is known as Martens hardness (ISO 14577). Furthermore cyclic indentation tests with increasing test force or indentation depth and partial load removal are realized in the testing software testXpert.

The ZHU/zwickiLine features a hardness measuring head (resolution 0.02  $\mu\text{m}$ ) with integrated digital depth and depth force measuring system, mounted in a zwickiLine hardness testing machine. Combine our state-of-the-art measuring and control electronics testControl and our intelligent test software testXpert and the result is a well-balanced, high-precision measuring system.

Also available is an add-on optical unit which, when used with the hardness measuring head, allows any current hardness method to be tested. The optical unit consists of a measuring microscope with various lenses and a linear displacement unit. The linear displacement unit allows a change from the hardness measuring head with indenter to the optical unit position without the specimen being moved. The ZHU/zwickiLine can be upgraded to a fully-automated hardness tester using the motorized linear displacement unit (MLDU), actively controlled by testXpert.



Fig. 1: ZHU2.5/Z2.5 universal hardness testing machine with motorized hardness measuring head

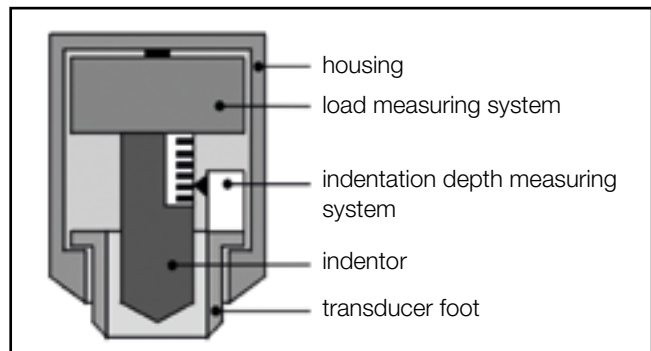


Fig. 2: General layout of the hardness measuring head

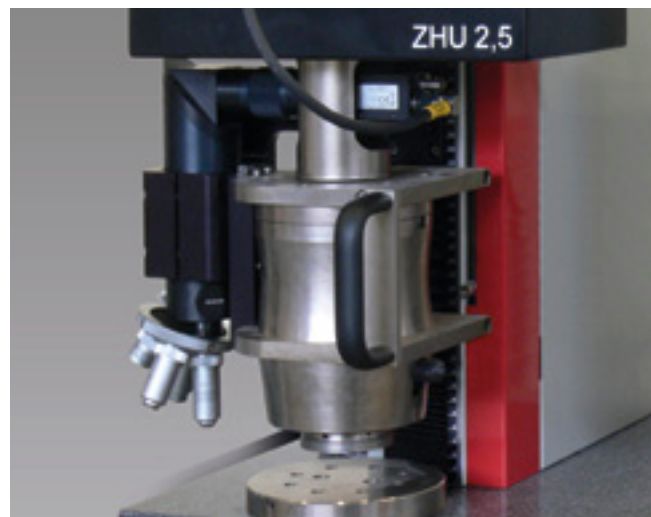


Fig. 3: ZHU2.5/Z2.5 universal hardness testing machine with manual linear displacement unit



## Indentation depth methods:

- Instrumented indentation test (Martens hardness, ISO 14577)
- Rockwell hardness HR - ISO 6508
- Rockwell hardness HR - ISO 2039-2
- Vickers depth measurement HVT
- Brinell depth measurement HBT
- Ball indentation hardness H (for plastics) - ISO 2039-1

## Indentation area methods:

- Vickers hardness HV - ISO 6507
- Brinell hardness HBW - ISO 6506

The ZHU/zwickiLine range is complemented by a comprehensive, standardized range of accessories. This includes a highly varied selection of indenters, hardness test blocks and clamping systems. Additional options include:

- Universal, material-independent application for practically all hardness testing methods with indentation depth measurement
- Fast, automatic approach, including for different specimen heights

- Automatic test sequence and evaluation
- Shortest possible test durations
- Minimum set-up time when changing method or when changing indenter and transducer foot
- High accuracy and reproducibility of test data through high-resolution measurements and constant test conditions
- Determination of additional material characteristics from the force-indentation depth curve
- Versatile result display: single and statistical values, graphics, screen display and print-outs
- Cyclic indentation test with increasing test force or indentation depth and partial load removal

## Options



### Crosshead travel

Two different crosshead travels are available with the ZHU/zwicki-Line: 350 mm or 850 mm maximum.



### Hardness measuring heads

To facilitate high-precision measurements in various application areas, two hardness measuring heads are available: 2 N ... 200 N or 5 N ... 2.5 kN



### Optical unit

The optical unit consists of a measuring microscope with various lenses and a displacement unit for easy changes between indenter and optics positions.



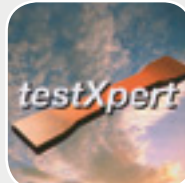
### LED illumination

The frontlight coaxial lamp has LEDs for longer life and greatly reduced heating of the measuring microscope.



### X-y tables

Manual or motorized x-y tables with travel up to 150 mm are available.



### testXpert testing software

The intelligent testing software testXpert supports the innovative testing system in standard testing situations (e.g. quality assurance) as well as in research and development for very sophisticated tasks.

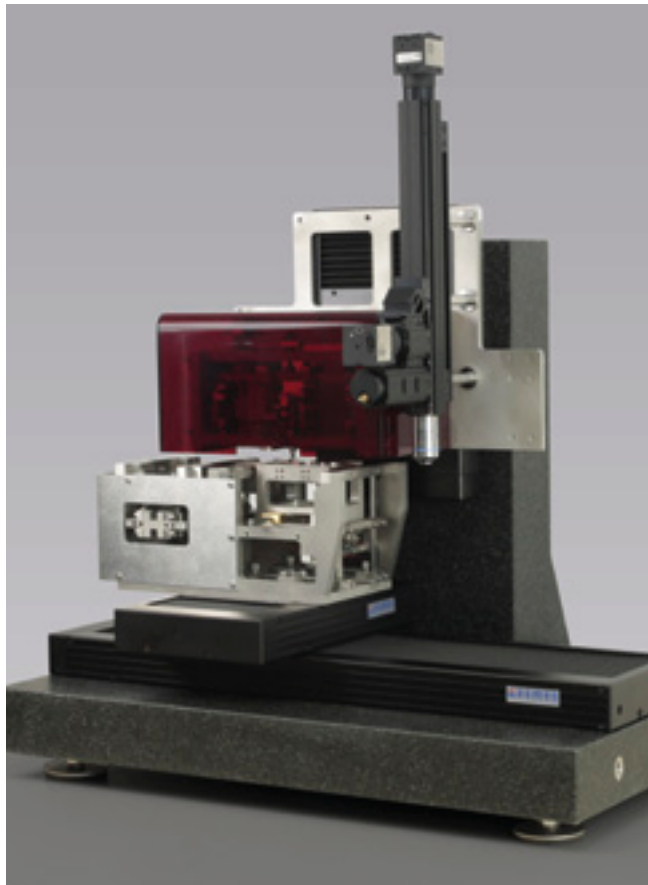


Fig. 1: UNAT universal nanomechanical tester fully equipped with lateral force unit (LFU)

## UNAT Nanomechanical Tester

### A new Dimension.

The Universal Nanomechanical Tester UNAT's unique force and displacement resolution enables comprehensive mechanical characterization of thin films and coatings or small surface areas, including measurement of indentation hardness, indentation modulus and Martens hardness to ISO 14577.

Two patents cover UNAT's measuring heads:

- the Normal Force Unit (NFU)
- the Lateral Force Unit (LFU)

Working with one measuring head (**Normal Force Unit**), UNAT functions as a depth-sensing hardness tester in the micro range, with a maximum force of 2 N. It can also be used in the nano range for indentation depths less than 200 nm.

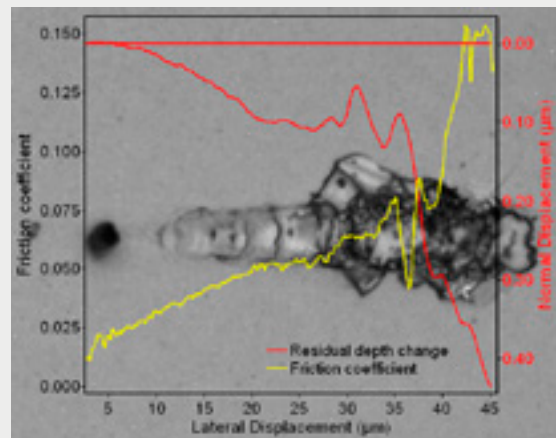


Fig. 2: Scratch of a 300 nm thick layer on silicon

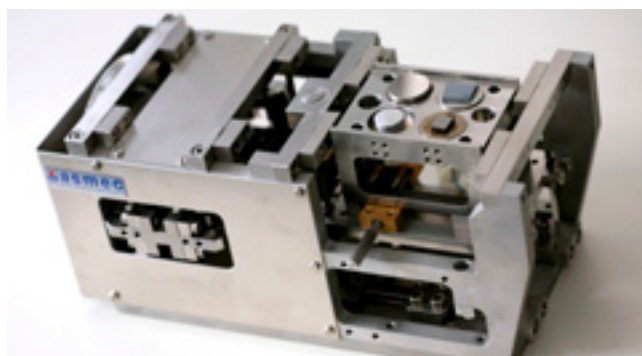


Fig. 3: Second measuring head Lateral Force Unit (LFU) with specimen holder for 4 specimen

A 0.2 N head with ten times higher force resolution is optionally available.

A unique feature of the UNAT is the second independent measuring head with the same excellent resolution for the lateral direction, the **Lateral Force Unit**. The two measuring heads can be combined in any way required - for a greatly increased range of measuring options. The instrument can considerably additionally be used as a micro scratch tester, micro wear tester, fatigue tester or high-resolution profilometer.

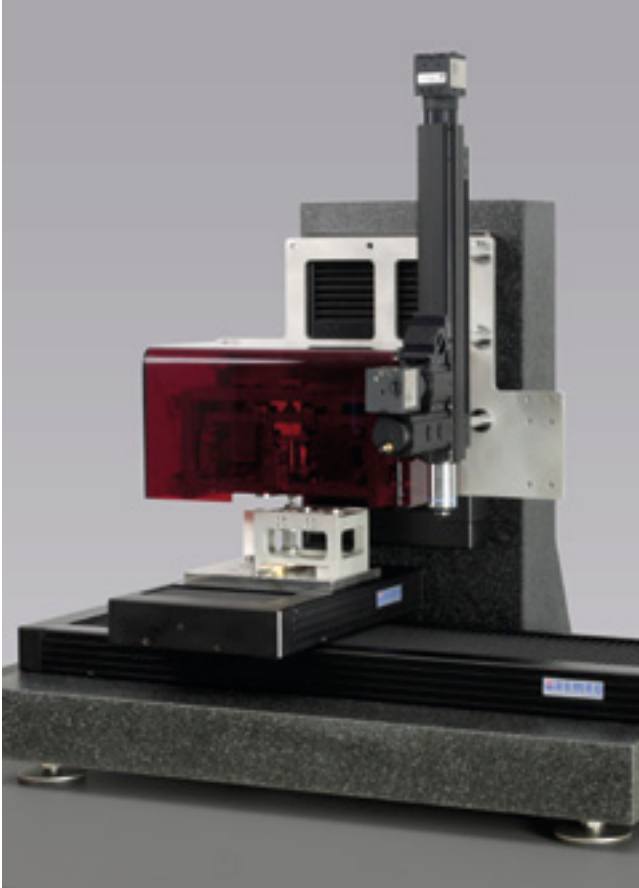


Fig. 1: UNAT universal nanomechanical tester with normal force unit (NFU)

## Other unique features:

- Both measuring heads can work in compression and tensile mode.
- Dynamic measuring modes are available for both heads. Small oscillations with a frequency of up to 100 Hz are added to the force or displacement signal, allowing virtually continuous analysis of contact stiffness.
- Extremely robust construction eliminates any risk of sensor damage and allows easy handling.
- The standard diamond indenter can easily be replaced by other indenters of any shape and material without a substantial loss of accuracy, particularly useful for special wear or adhesion tests.

The instrument is combined with x-y-z tables with travel ranges up to 50 mm and up to 300 mm, with a resolution of 0.5  $\mu\text{m}$  or better. It also includes high-resolution optics, with two cameras and an auto-focus system. Many elements of the instrument can be adapted to suit customers' requirements.

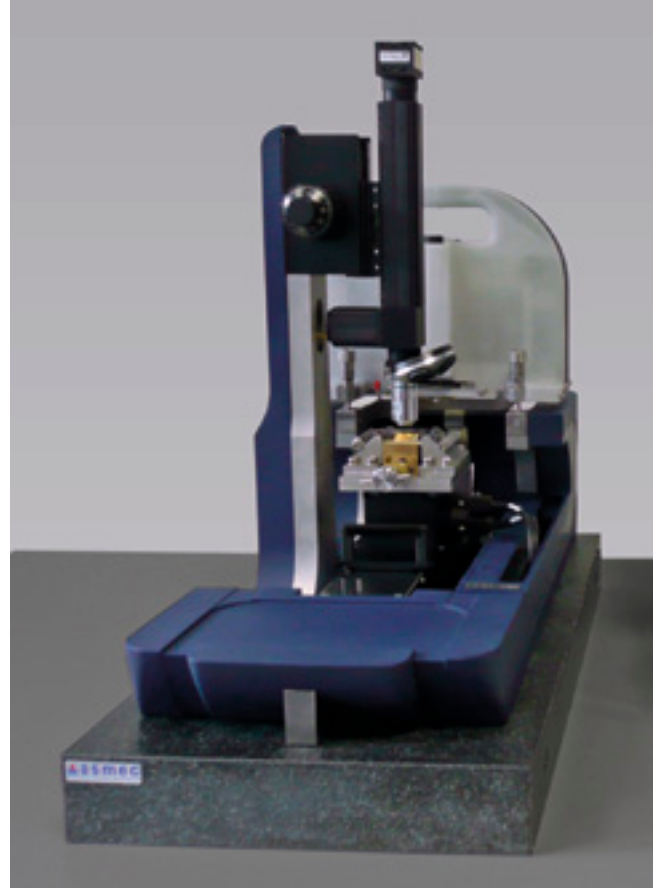


Fig. 2: UNAT-m universal nanomechanical tester with a mobile measuring head

All types of indenters can be delivered, e.g. Vickers, Berkovich, Cube Corner, Knoop, spheres, flat punch or wedge.

## Additional features:

- User-friendly software operation with the software InspectorX
- Fully automatic approach, even with varying specimen heights
- Fully automatic measurements, including image generation of the measurement positions
- Virtually unlimited number of measurement positions can be preset
- Shortest possible testing times
- Multiple curve overlay for direct comparison of all curves in a series
- Configuration of user-specific test sequences (applications)

## 6 Testing Software

### High Definition Testing Software

#### *User-friendly Precision.*

When a hardness testing solution which delivers reliable, accurate and repeatable test results is needed, choose from the HD line of macro and micro hardness testing solutions - field-proven systems, offering beyond comparison capabilities and fully ASTM E 384, ISO 6507 and ISO 4545-compliant.

#### **Precise positioning**

With its image of the entire specimen (Mosaics) and its annotation tools, HD Software enables you to position indents precisely where they are required.

#### **Precise, reproducible measurements**

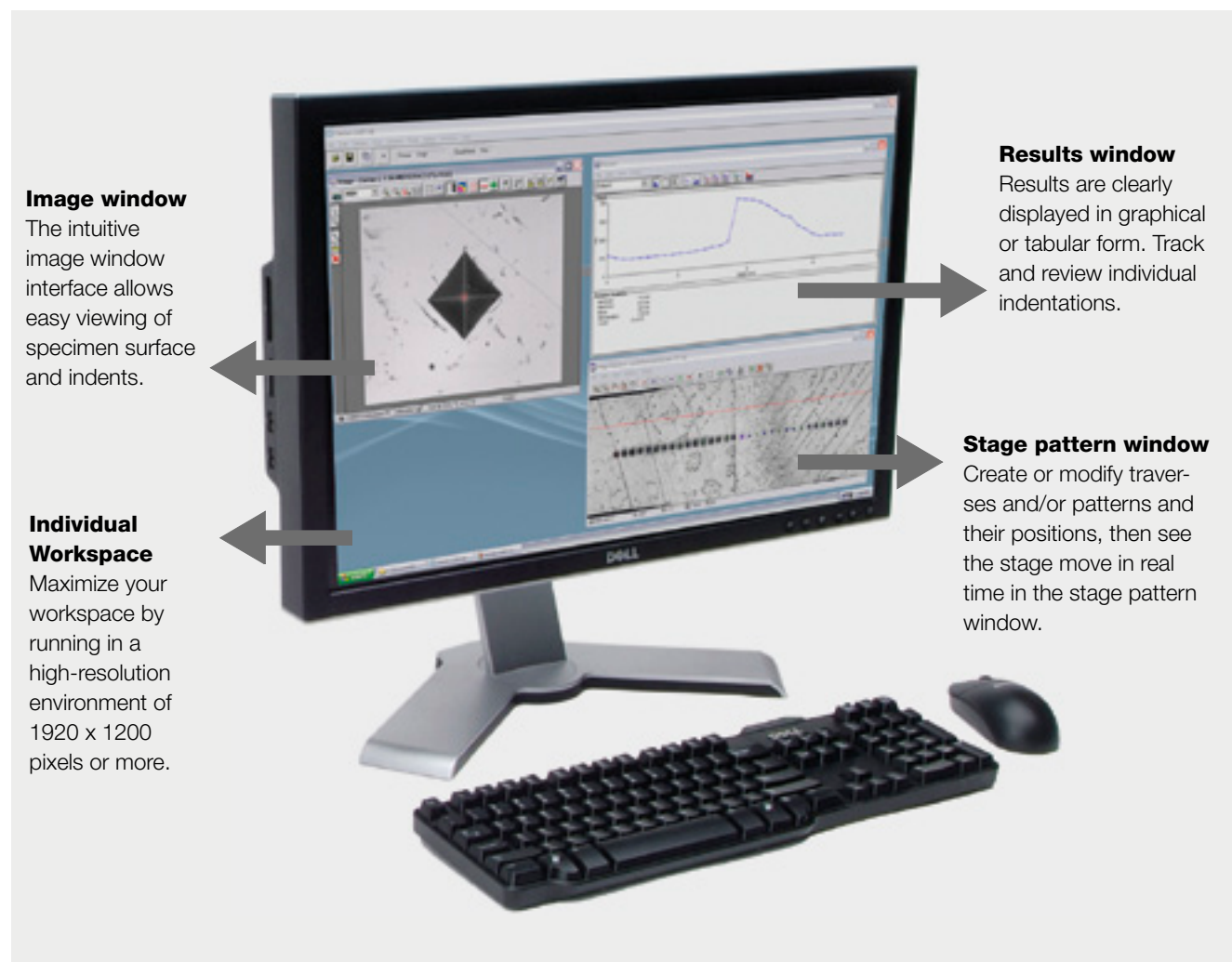
The high image resolution of the HD Software allows measurement of indents to be precise and reproducible.

#### **Enhanced productivity**

The HD Software combines ease of use, reliability and auto-calibration, minimizing the subjectively associated with human intervention. The system can run autonomous for hours without interruption.

#### **Sophisticated reporting**

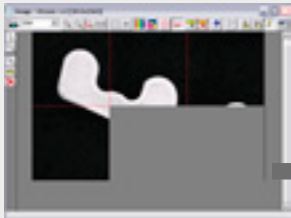
The results are automatically transferred via data interface from HD software to testXpert II - the testing software for all Zwick testing machines and instruments. According to your requirements the reports are now generated.



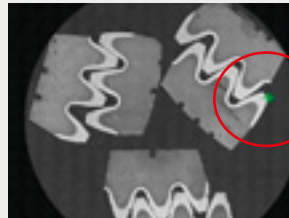


## Step 1: Set the entire specimen

Place the specimen in the specimen holder and - with one click - build a mosaic image of the specimen and set reference points for more traverses using annotated tools.



Building mosaic image to a complete image



Precise positioning at any magnification



## Step 2: Set-up traverses/patterns

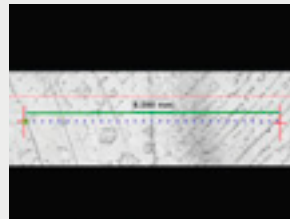
Open, modify, or create new traverses/patterns using reference points or lines. Traverses and patterns can be individually adjusted.



T-Bar rotation tool



Three traverses perpendicular to edge



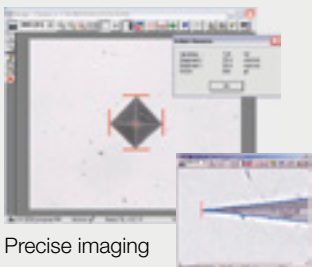
Traverse centred in weld sample



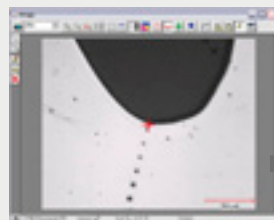
Five traverses perpendicular to the edge of the gear

## Step 3: Click & walk away

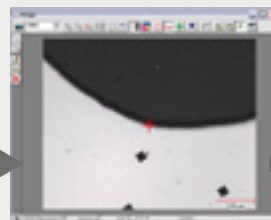
HD Software intelligently follows the predefined patterns, indents the specimen, focuses if needed, measures and generates data dynamically. Everything is automated, freeing users for other tasks.



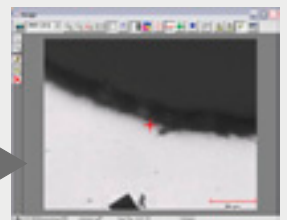
Precise imaging



with 2.5 x objective lens



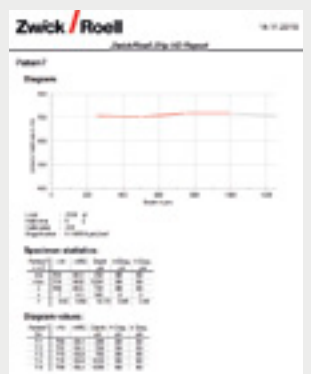
with 10 x objective lens



with 40 x objective lens

## Step 4: Get results

Review results in graphical and/or tabular format. Export results to the spreadsheet application of your choice, or to **testXpert II** for creating and printing standard or customized reports.



## testXpert Testing Software

### *Intelligent & Reliable.*

#### One basic software for all applications

testXpert employs the same basic software system for all hardness applications. It is responsible for data, user and test program management, as well as communication between the hardness testing machine or hardness testing device and other peripheral systems.

#### Master test programs

cover the test categories which are designed for frequently changing or complex test requirements. With a minimum of effort and previous knowledge it is possible to

- create and alter test programs,
- configure screen views according to individual needs and
- create task specific test reports.

Intelligent software wizards guide you rapidly through all menus, running consistency checks at the same time.

Two master programs are available for hardness testing machines and devices:

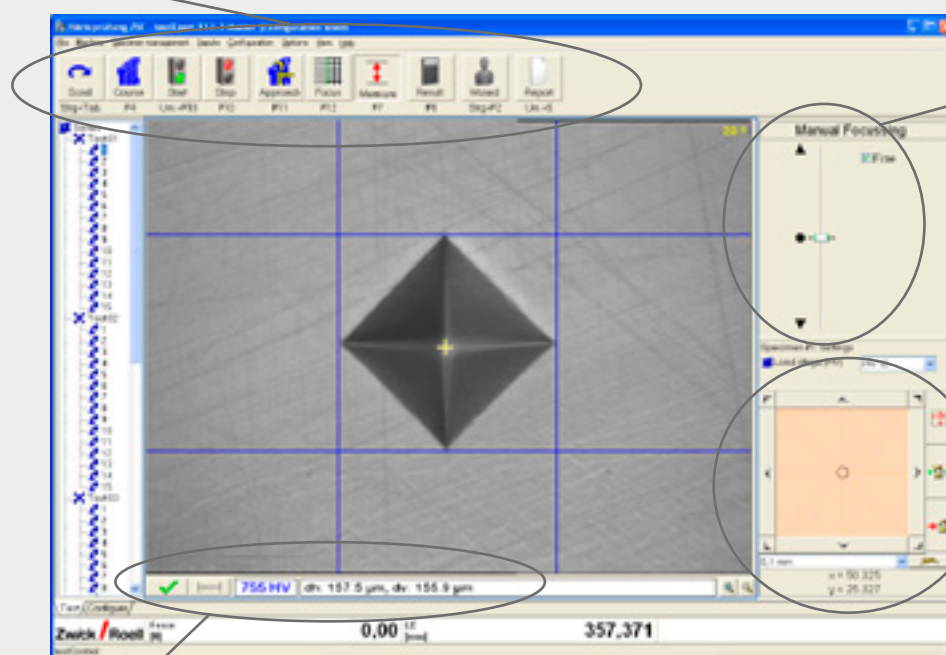
- Optical hardness testing methods (Vickers, Knoop, Brinell)
- Instrumented indentation test and hardness testing method with indentation depth measurement

#### Customized test programs

are solutions for special test situations, the functions and sequences of which have been specified by the user. These programs can be created in either of two ways:

- Zwick supplies the appropriate master test program and the user creates specific test programs, with the aid of a software wizard.
- Zwick creates these test programs in accordance with the customer's specifications.

The **menu bar** appears at the top of the user interface in all layout windows, with the toolbar underneath and the serial tree on the left.




#### Virtual z axis control

The motorized z axis of the hardness tester is moved via the software by means of a virtual slider, using the mouse.

#### Virtual x-y axis control

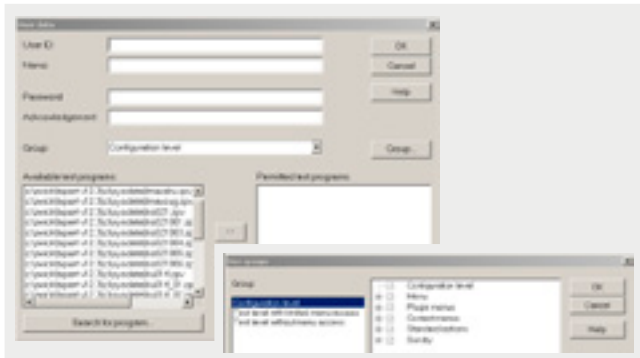
The motorized x-y table is moved in steps by means of the „arrow“ buttons or continuously by displacing the circle (while holding the mouse key). The degree of displacement determines the traversing speed.

#### Video image showing measured values

The status bar of the video image screen incorporates a button for confirming the measured lines. The hardness value and the gage lengths are displayed automatically and accepted as results by pressing the  button.

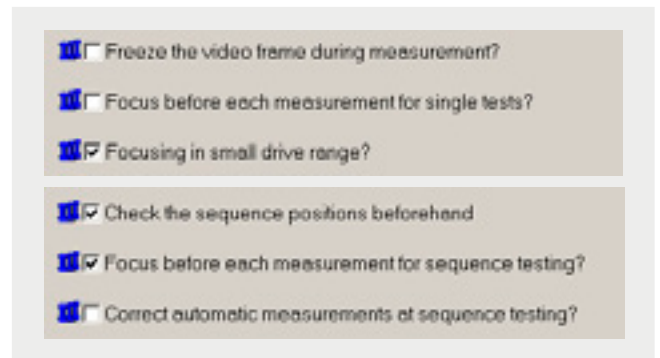
## User management

testXpert includes a user management system with different access options available to defined user groups. New groups are simple to define and configure.



## Configuration of a test sequence

The test sequence is simple to adjust with regard to checking of the indentation position, autofocussing prior to indentation measurement and automatic indentation measurement.



## Definition of traverses

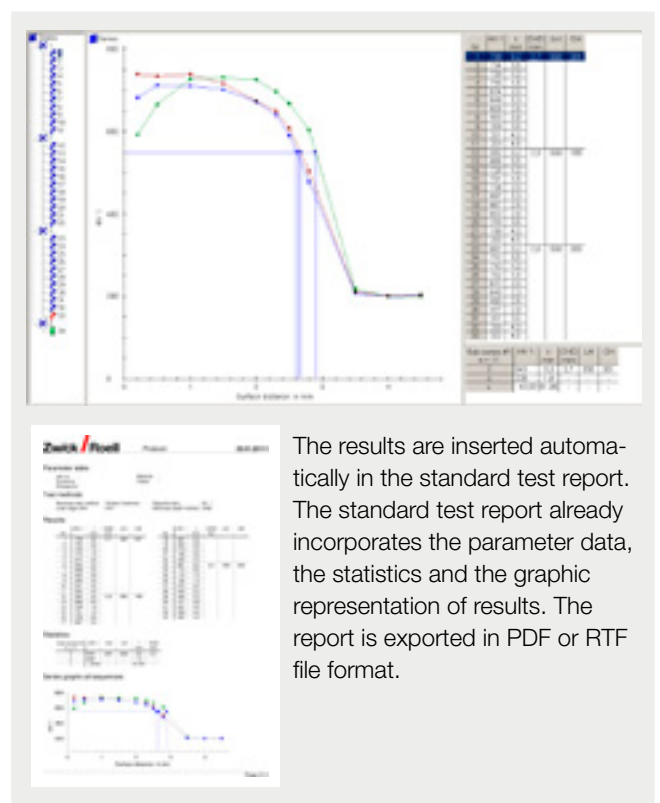
Simple configuration, copying, shifting and modification of hardness traverse tests take place in the „Traverse test definition“ mask. Existing samples can be stored and exported or imported and modified.



Two different lenses can be used in hardness traverse tests: an overview lens for checking the indentation position and a measuring lens for measuring the indentation size.

## Presentation of test results and test reports

In testXpert the test results are displayed automatically in graphic and tabular form and are statistically evaluated. The user interface and the standard report are simple to adapt to the user's requirements.



The results are inserted automatically in the standard test report. The standard test report already incorporates the parameter data, the statistics and the graphic representation of results. The report is exported in PDF or RTF file format.

## 7 Portable Hardness Tester



### Sclerograph – Mechanical Rebound Hardness Tester

The portable Sclerograph is based on the dynamic rebound height method. This analog device can be used to determine the hardness of steel and non-ferrous metals. The rebound height is read off and the hardness value is taken from the comparison chart supplied with the instrument. This contains Shore D, Rockwell B and C plus Brinell hardness.



### HT1000A & HT2000A Hand Held Portable Hardness Tester

The HT1000A and HT2000A have many applications. Their small size and easy to use, one-handed operation, makes them ideal for testing large and heavy forgings or castings, such as steel mill rolls and turbine housings. The testers can be used in any direction, and require only a small surface area to obtain a quick and accurate reading.

### MIC10 Hardness Tester (UCI Method)

The MIC10 provides quick, handy, on-the-spot hardness testing in conformity with the UCI method (Ultrasonic Contact Impedance, standardized to ASTM A 1038 and DIN 50156). With the 'comparative' method the indentation is made by the diamond in the surface of the material and is measured electronically. The hardness value is immediately displayed.



### Zwick BARCOL Hardness Tester

The Zwick Barcol tester is a digital hardness tester that is especially suited for performing tests on level and lightly curved specimen to DIN EN 59 and ASTM D 2583, like glass fibre reinforced plastics, duroplasts, hard thermoplasts, semi-finished and finished parts and aluminium.







## Webster Hardness Testing Pliers

Portable, easy-to-use pliers with built-in indenter and spring. Squeezing the grips together presses the indenter (via the spring) into the material to be tested and the indentation depth is shown on the scale. The value is read off and converted to Rockwell hardness using the chart supplied. These testing pliers are used for aluminium, aluminium alloys, brass, copper alloys and steel in the following range: Rockwell HRE 20...110.



## PZ3 Brinell Testing Clamp

This unique portable hardness tester is suitable for standardized static Brinell ball indentation tests up to 29420 N (3000 kg). Hardness tests can be performed on materials and workpieces unsuitable for testing in the laboratory. Examples include stored steel stocks, finished structures, machines and larger metal components. The ball indentation is measured by the aid of a manual or automatic microscope.



## HiLight Manual Brinell Microscope






The HiLight Series features a high intensity LED light source providing excellent contrast for measuring Brinell indentations. With a 20 x lens and narrow nose-piece, it is ideal for accessing restricted spaces. The "auto-motion" feature helps maximize battery life - the LED light is turned off automatically when the scope is not in use. Compliant with ISO 6506 and ASTM E 10.







## B.O.S.S. Automatic Brinell Microscope

An automatic Brinell Optical Scanning System (B.O.S.S.) includes high resolution video scanning head and imaging software that ensures a fast, accurate and consistent reading of all Brinell indentations. Tolerances can be used and signified audibly or visually (green/yellow/red). Create comprehensive test reports; includes the ability to image-capture the Brinell indentations. Compliant with ISO 6506 and ASTM E 10.

## 8 Portfolio Overview

|                                  |   |   |   |   |   |
|----------------------------------|---|---|---|---|---|
|                                  |  |  |  |  |  |
|                                  | <b>ZHU250CL</b>   | <b>ZHU250</b>   | <b>ZHU187.5</b>   | <b>ZHVμ</b>   | <b>ZHV30</b>  |
| Test loads<br>(all models)       | 9.8...2454 N  | 9.8...2454 N  | 29.4...1839 N   | 0.1...19.6 N  | 1.96...294 N  |
| Application                      | Metals<br>Plastics<br>Ceramics  | Metals<br>Plastics<br>Ceramics  | Metals<br>Plastics <sup>1)</sup><br>Ceramics <sup>1)</sup>                        | Metals<br>Ceramics <sup>1)</sup>  | Metals<br>Plastics<br>Ceramics  |
| Rockwell (A...C)                 | ✓   | ✓   | ✓   | -   | -   |
| Rockwell (N...T)                 | ✓   | ✓   | -   | -   | -   |
| Rockwell (L, M, R)               | ✓   | ✓   | ✓   | -   | -   |
| Ball indentation                 | ✓   | ✓   | -   | -   | -   |
| HVT, HBT                         | ✓   | ✓   | -   | -   | -   |
| Instr. indentation               | -   | -   | -   | -   | -   |
| Martens                          | -   | -   | -   | -   | -   |
| Vickers                          | ✓   | ✓   | ✓   | ✓   | ✓   |
| Knoop                            | ✓ <sup>1)</sup>   | ✓ <sup>1)</sup>   | -   | ✓   | ✓   |
| Brinell                          | ✓   | ✓   | ✓   | -   | ✓ <sup>1)</sup>   |
| Software                         | HD (+ tXpII)  | testXpert<br>testXpert II   | testXpert<br>testXpert II   | testXpert<br>HD (+ tXpII)   | testXpert<br>HD (+ tXpII)   |
| Test area, max.<br>(H x D in mm) | 379 x 150   | 300 x 250   | 250 x 150   | 150 x 150   | 250 x 150   |
| Versions                         | ZHU250CL-s<br>ZHU250CL-a  | -   | ZHU187.5<br>ZHU150  | ZHVμ-m<br>ZHVμ-s<br>ZHVμ-a  | ZHV30-m<br>ZHV30-s<br>ZHV30-a   |

<sup>1)</sup> suitable, however limited load range/material-dependent

|   |   |   |  |   |   |
|---|---|---|--|---|---|
|  |  |  |  |  |  |
| <b>ZHV30/zwicki</b>   | <b>ZHV10</b>  | <b>ZHR</b>  | <b>Zwick 3106</b>  | <b>ZHU/zwicki</b>   | <b>UNAT</b>   |
| 0.98...294 N  | 1.96...294 N  | 147...1471 N  | 196.1...1471 N   | 1.96...2452 N   | 0...2 N   |
| Metals  | Metals<br>Ceramics  | Metals<br>Plastics  | Metals<br>Plastics<br>Asphalt, Plaster   | Metals<br>Plastics <sup>1)</sup>  | Metals<br>Plastics<br>Ceramics  |
| -   | -   | ✓   | ✓  | ✓   | -   |
| -   | -   | ✓   | -  | ✓   | -   |
| -   | -   | ✓   | ✓  | ✓   | -   |
| -   | -   | -   | ✓  | ✓   | -   |
| -   | -   | -   | -  | ✓   | -   |
| -   | -   | -   | -  | ✓   | ✓   |
| ✓   | ✓   | -   | -  | ✓   | ✓ <sup>1)</sup>   |
| -   | ✓   | -   | -  | -   | ✓ <sup>1)</sup>   |
| ✓ <sup>1)</sup>   | ✓ <sup>1)</sup>   | -   | -  | ✓   | -   |
| testXpert<br>HD (+ tXpII)   | testXpert   | testXpert<br>testXpert II   | testXpert  | testXpert   | InspectorX  |
| 670 x 99.5  | 300 x 135   | 250 x 150   | 200 x 120  | 665 x 99.5  | 80 x 50   |
| turret manual/<br>motorized   | ZHV10 analog<br>ZHV10 PC  | AK/BK/LK/SK/TK<br>4045/4150/8150  | loading weights,<br>electronics  | ZHU0.2<br>ZHU2.5<br>manual/motorized<br>linear displacement<br>unit                 | automatic<br>manual<br>0...0.2 N  |

<sup>1)</sup> suitable, however limited load range/material-dependent

## Zwick Roell AG

August-Nagel-Str. 11  
D-89079 Ulm  
Phone +49 7305 10 - 0  
Fax +49 7305 10 - 200  
info@zwickroell.com  
www.zwickroell.com

The Zwick Roell AG Group

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www.zwick.com

Indentec Hardness Testing Machines Ltd.  
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