

# Duramin



**Duramin  
Microhardness Testers  
-More than just  
hardness testing**



**With its Duramin microhardness testers, Struers has opened a new dimension in hardness testing**

Duramin testers are state-of-the-art microprocessor-controlled devices which enable Vickers and Knoop hardness tests to be performed rapidly, accurately and reliably.

The devices are suitable for applications in both industrial research (metals, sintered materials, ceramic products, integrated circuits, coatings, grain microstructure analyses) and quality control environments (cutting tools, wires, small-scale precision-engineered components, heat-treated surfaces).

The hardness testers in the Duramin series conform with the newest standards, Vickers: DIN EN ISO 6507 part 1-3, ASTM E-384-99; Knoop: ISO 4545

### **Duramin-1 and -2**

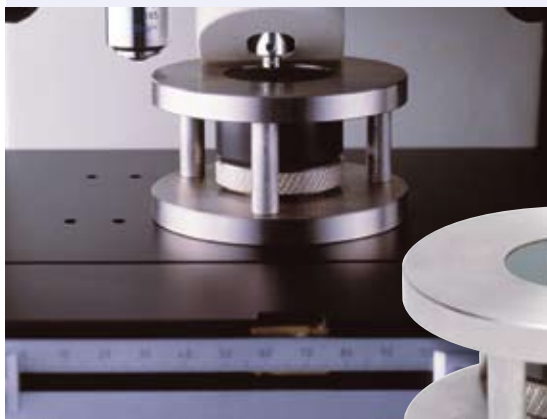
- Excellent reproducibility
- User-friendly design
- Patented automatic load-changing mechanism
- Automatic lens turret (Duramin-2)
- Simple menu-driven operation, values can be entered and displayed (in graphic or text mode) via the LCD touch-display
- High resolution measurement probe. Minimum measurement unit 0.01  $\mu\text{m}$
- High precision mechanical stage with micrometer screw arrangement for exact positioning in the x-y plane
- Standard and rapid testing modes
- Series and one-off measurements possible
- Conversion between hardness scales (HR, HB, MPa, etc.)
- Surface correction for flat, cylindrical and spherical samples
- Measurement statistics (max and min values, mean, standard deviation and bar chart)
- RS 232C interface and printer port

### **Duramin-5**

- Automatic start/stop of test
- Increased repeatability and accuracy
- Computer video interface
- Automatic indent measurement
- 10x eyepiece with integrated dual-line filar
- Automatic case depth measurement
- Automated 3-position turret
- One-button operation to submit and record data
- Load – 9 loads ranging from 10 grams to 2 kg
- Conversions to HRC, HK and Brinell
- LCD touch pad
- Graphing function for results

### **Duramin-10 and -20**

- Simple to operate using the clearly designed user interface
- Ergonomic design for fatigue-free operation
- Modular structure
- High degree of automation
- Automatic mechanical stage with a reproducibility of 1  $\mu\text{m}$  and a resolution of 0.025  $\mu\text{m}$
- Automatic positioning and measurement of indents
- Interactive operator intervention possible at any time
- Auto-focus function with high reproducibility (Duramin-20)
- Increased reproducibility and accuracy of measurements
- Measurement log editor with formatting functions and formula parser
- Menu-driven data transfer for exporting results to Microsoft Excel



*Single specimen holder*



### **Introduction**

Developments in materialographic research and quality assurance have led to increasing demands for reliable and reproducible methods of testing material properties such as hardness.

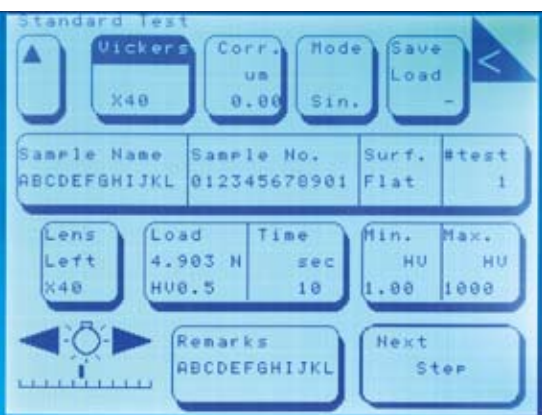
The Duramin series of microhardness testers has been developed by Struers using the very latest in engineering technology with the aim of satisfying these stringent demands. Our experience in microhardness testing has led to a range of test devices that set new standards in the field and are capable of meeting the exact requirements in research and quality control, today and in the future.

The Duramin series comes with a wide selection of accessories designed to help you with your particular hardness testing operations. By connecting an image processing and control computer to the serial interface, incorporating an automatic mechanical stage and a motorized z-axis (auto-focus), the device can be expanded to a fully automatic microhardness tester.

### **Duramin-1 and -2 with manual mechanical stage**

The Duramin microhardness testers from Struers allow you to perform Vickers and Knoop hardness tests reliably, reproducibly and accurately on metallic and non-metallic materials.

The automated test sequence means that testing can be carried out efficiently, saving you valuable time. The tester has a range of nine loads, from 98.07 mN (10 g) to 19.61 N (2 kg), which can be selected by the unique patented load-interchange mechanism. Loading and unloading of the indenter with the chosen weight occurs automatically with the relevant information displayed on the tester's LCD touchpad.



*Touch-sensitive display screen in test parameter mode*



*Touch-sensitive display screen in test mode*

The manually operated mechanical stage is equipped with micrometer screws for accurate positioning of the sample.

Once the test point has been chosen, pressing the START button automatically moves the indenter into position, lowers it onto the specimen and then returns the lens to its original position for analysis of the indent (Duramin-2 only).

This high level of automation not only saves time, but also helps to avoid operator errors. The size of the indent is measured using the incremental probe after carefully positioning the two parallel filars. The maximum resolution of 0.01  $\mu\text{m}$  enables the indent size to be measured very accurately. The measurement data is transferred to a microprocessor that calculates the hardness value and displays the result.

### Display

A touch-sensitive screen is used both for simple user-friendly control of the tester and for displaying the results. All the important device functions are shown on the display and can be activated

by lightly touching the relevant section of the screen.

### **Touch-sensitive display screen in test parameter mode:**

- Process selection, lens, hardness conversion etc.
- Information on test sample
- Selection of sample surface (flat, cylindrical, spherical)
- Number of indents
- Applied load and holding time
- Tolerance range
- Illumination intensity
- Notes

### **Touch-sensitive display screen in test mode:**

- Applied load and dwell time
- Measured length of indent diagonals d1 and d2
- Calculated hardness value
- Tolerance assessment of hardness value (OK = within tolerance/NG = out of tolerance)
- Converted hardness value
- Lens selection
- Repeat measurement

### **Single specimen holder**

The specimen holder, which was specially developed for microhardness testing, ensures that the specimen is held absolutely flat thus helping to make the measurements both accurate and reproducible.

### **Duramin-5**

Duramin-5 is a PC controlled semi-automatic microhardness tester with automatic turret and touch pad or computer control of indent load and time. Duramin-5 is designed specifically for the laboratory or QC station that is looking to eliminate operator influence during indent measurement.

Conventional semi-automatic systems require the operator to manually position the filar lines on the indent. Duramin-5 uses state-of-the-art algorithms to automatically place the filars with the click of a single button. By using Duramin-5 the operator influence is removed thus assuring the highest repeatability.

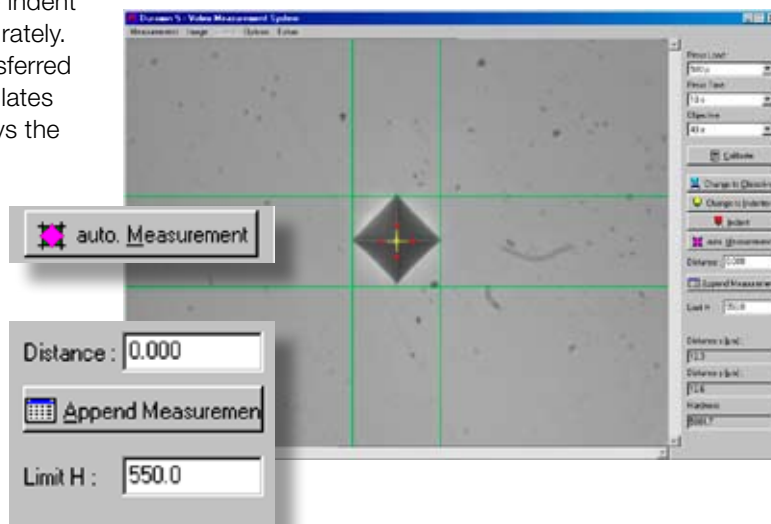
In addition to repeatability, Duramin-5 integrates the PC directly with the tester. This enables the operator to perform the following tasks directly from the PC without touching the tester:

### **Automatic load selection**

The load feature eliminates common miscalculations based on input of the incorrect load.

### **Automatic turret control**

The PC controls all turret movement i.e. exchange between the objective lenses and the indenter. The operator



### **Duramin-5 User Interface**

*A simplified interface allows the user to control all aspects of the hardness test including applied load, dwell time, magnification, indenter/objective exchange and associated case depth functions.*



*Automatic mechanical stage*

rator never touches the turret. This eliminates the number one cause of machine misalignment.

#### **Automatic start/stop of test**

The operator only needs to click the indent button to start a test. The Duramin-5 program automatically sets the desired load, dwell time and objective lenses.

#### **Duramin-5 software provides:**

- Computer video interface
- Computer control of turret changing
- Automated control of load, time and magnification of indent
- Automatic measurement of Knoop or Vickers indent to reduce operator influence on readings
- Spreadsheet reporting of results
- Limited reporting formats with graphs
- Tools for measuring and reporting case depths
- User-friendly computer interface screen

#### **Indentation measurement**

Unlike other testers that require manual filar placement, the Duramin-5 features automatic indent measurement. Automatic measuring with image analysis software significantly improves the reproducibility of the results.

#### **Case depth measurement**

Duramin-5 also features case depth measurement. Simply by entering the limit hardness e.g. 550 HV and displacement values e.g. 0.05 mm, 0.1mm, 0.2 mm etc Duramin-5 will automatically calculate case depth in either mm or inches.

#### **Duramin-10 and -20**

The Duramin-10 /-20 are modular systems for computercontrolled microhardness testing based on the Duramin-1 /-2 and operating under Windows 2000 / XP Pro.

The tester is available as a semi-automatic (Duramin-10) or a fully automatic (Duramin-20) model.

A simply structured, graphical user interface enables the operator to use the control program after only a short period of familiarization.

The sequence of measurement operations to be performed on a particular sample or set of samples can be pre-programmed and stored for future use.

The full range of test functions are available, from simple one-off manual measurement to fully automated positioning onto predefined coordinates. In addition, the Duramin-20 tester has an auto-focus function provided by a servomotor that controls the positioning of the z-axis. All axes (x, y, z) can be driven either manually (joystick control) or automatically.

Measuring the indents using image analysis software significantly improves the reproducibility of the results. Interactive user intervention is possible at any time. All data is stored, ready for immediate logging.

#### **Automatic mechanical stage**

The automatic mechanical stages have a travel of either 50 x 50 mm or 100 x 100 mm and a step size of 1 µm. They are ideal for automatically performing routine hardness tests within a predefined positional grid. This technology enables a complete series of hardness measurements, involving as many individual measurement points as required (e.g. along a welded seam), to be conducted fully automatically either by pre-programming the device or using teach-in mode.

#### **Multiple specimen holder**

The multiple specimen holder guarantees that all specimens are held level during measurement.

It enables several specimens to be measured during a single testing sequence. For example, in a single test run, hardness measurements can

be made on up to six 30 mm diameter specimens.



*Multiple specimen holder*

## Technical data

Subject	Duramin-1/2	Duramin-5	Duramin-10/20
<b>Max. Load</b>	19.61 N (2 kg)	19.61 N (2 kg)	19.61 N (2 kg)
<b>Load</b>	Automatic switching between 9 load types (98.07, 245.2, 490.3, 980.7 mN, 1.96, 2.94, 4.901, 9.81, 19.61 N (HV 0.01, 0.025, 0.05, 0.1, 0.2, 0.3, 0.5, 1, 2))		
<b>Load Duration</b>	5 to 999 secs.	5 to 999 secs.	5 to 999 secs.
<b>Indenter</b>	Vickers (optional: Knoop, Brinell, Triangular)	Automatic measurement of Knoop or Vickers indenter to reduce operator influence on readings	Automatic measurement of Knoop or Vickers indenter to reduce operator influence on readings
<b>Objective Lens</b>	x 40 (Optional: x 10, x 20, x 50, x 100) Max. 2 objectives		
<b>Eyepiece</b>	x 10	x 10	x 10
<b>Effective Measurement Range</b>	250 µm (at x 40)	250 µm (at x 40)	250 µm (at x 40)
<b>Resolution (encoder)</b>	0.01 µm	0.01 µm	0.01 µm
<b>Camera resolution</b>		0.27 µm / pixel (std. version) 0.20 µm / pixel (high res. version)	0.27 µm / pixel (std. version) 0.20 µm / pixel (high res. version)
<b>Electric turret</b>	No (Duramin-1) Yes (Duramin-2)	Yes	No (Duramin-10) Yes (Duramin-20)
<b>X-Y Stage</b>	Surface area: 120 x 120 mm. Stroke: +/- 12.5 mm. Test sample height: max. height above sample stage: approx. 100 mm, max depth: approx. 140 mm. Z-axis: 60 mm Stroke		
<b>Statistical Calculations</b>	256 Pieces of data. Average, standard deviation, coefficient of variation, maximum of data value, minimum value, converted value graph. Display (Scatter Graph, Histogram)	Unlimited pieces	Unlimited pieces
<b>Test Conditions</b>	10 Sets of test conditions can be saved Sample name: 12 alphanumeric characters Sample number: 12 numeric characters Test mode: serial / single testing Test Loads: 9 types Load duration time: 5 to 999 sec. (user selectable in 1 sec. units) No. of tests: User selectable (256 max.) Limit: Upper and lower limit settings for acceptable / not acceptable decision (max. 4 digit integers) Correction (only with Vickers measurement) Correction to compensate for test sample shape Remark: 12 alphanumeric characters	Unlimited          Unlimited          Not available	Unlimited          Unlimited          Not available
<b>Result Display</b>	Data No.; Length of diagonal; Hardness; Converted values *1); Averages; Statistic values, Acceptable / not Acceptable decision, Graph; Histogram		
<b>External Output</b>	Bi-directional RS-232C, Printer Port (ESC/P Code)	Via PC	Via PC
<b>External Dimensions</b>	430 (w) x 590 (d) x 520 (h) mm	430 (w) x 590 (d) x 520 (h) mm	430 (w) x 590 (d) x 520 (h) mm
<b>Weight</b>	55 kg/121 lb	55 kg/121 lb	55 kg/121 lb
<b>Power Requirements</b>	Single Phase AC100 to 240 V +/-10 %, 300 VA 50/60 Hz		
<b>Environmental Conditions</b>	Temperature: 5 to 40°C Humidity: 0 to 80 % (Condensation must not be allowed to form on the tester)		

*Struers' equipment is in conformity with the provisions of the applicable International Directives and their appurtenant Standards. (Please contact you local supplier for details)*

## Specifications

	Code
<b>Duramin-1</b> Microhardness tester with manual X-Y stage, Vickers indenter and 2 micrometer heads. Objective lens x 40, eyepiece x10, automatic switching between 9 load types, load duration 5-999 sec., LCD touch panel. Size of X-Y stage: 120 x 120 mm, 25 mm stroke. 110-250 V / 50-60 Hz	DURA1
<b>Duramin-2</b> Microhardness tester with electric turret, manual X-Y stage, Vickers indenter and 2 micro meter heads. Objective lens x 40, eyepiece x10, automatic switching between 9 load types, load duration 5-999 sec., LCD touch panel. Size of X-Y stage: 120 x 120 mm, 25 mm stroke. 110-250 V / 50-60 Hz	DURA2
<b>Duramin-5</b> Microhardness tester with video camera, video adapter and software package (Windows 2000 / XP Pro compatible). Vickers indenter, objective lens x40, eyepiece x10, automatic switching between 9 load types, load duration 5-999 sec., LCD touch panel. Size of manual X-Y stage 120 x 120mm, 25mm stroke. PC, monitor and printer not included. 110-250V / 50-60 Hz	DURA5
<b>Duramin-10</b> Microhardness tester with video camera, video adapter and software package (Windows 2000 / XP Pro compatible). Vickers indenter, objective lens x40, eyepiece x10, automatic switching between 9 load types, load duration 5-999 sec., LCD touch panel. Electric X-Y scanning stage (HASTA) or (HASTO) is ordered separately. PC, monitor and printer not included. 110-250 V / 50-60 Hz	DUR10
<b>Duramin-20</b> Microhardness tester with video camera, video adapter, autofocus, electric turret and software package (Windows 2000 / XP Pro compatible). Vickers indenter, objective lens x40, eyepiece x10, automatic switching between 9 load types, load duration 5-999 sec., LCD touch panel. Electric X-Y scanning stage (HASTA) or (HASTO) is ordered separately. PC, monitor and printer not included. 110-250 V / 50-60 Hz	DUR20

\*1) From HV into HRA, HRC, HRD, HR15N, HR30N, HR45N, HB, HS, Mpa according to ASTM-E-140



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Accessories	Code
<b>Electric scanning stage</b> 135x135 mm stage. 50 mm stroke in X-Y directions. For Duramin-10 and -20	HASTA
<b>Electric scanning stage</b> 218x265 mm stage. 100 mm stroke in X-Y directions. For Duramin-10 and -20	HASTO
<b>Objective micrometer</b> For adjustment of microscope magnification ratio	HARMI
<b>Electric Turret</b> For automatic switching between indenter and objective lens. For Duramin-1 or Duramin-10.	HARTU
<b>Knoop indenter</b> Longitudinal edge angle 172.30°, 130°.	HAKNO
<b>Brinell indenter</b> Steel ball indenter 1 mm in diameter, for HBS 1/1 measurement.	HABRI
<b>Triangle pyramid indenter</b> Tip angle 115°	HATRI
<b>Standard vice</b> Opening: 36 mm, width: 42 mm.	HARST
<b>Universal vice</b> Opening width: 22 mm. Can be turned and tilted. Leveling stage (HARLE) is required.	HARUN
<b>Leveling stage for Universal vice (HARUN)</b>	HARLE
<b>Thin specimen attachment</b> For specimens with thickness of 0.02 to 0.5 mm	HATHE
<b>Thin specimen attachment</b> For specimens with thickness of 0.02 to 8 mm	HATHO
<b>Slender specimen attachment</b> For specimens with diameter of 0.4 to 3 mm	HASLE
<b>Slender specimen attachment</b> For specimens with diameter of 0.15 to 1.6 mm	HASLO
<b>Objective lens x10</b>	HOL10
<b>Objective lens x20</b>	HOL20
<b>Objective lens x50</b>	HOL50
<b>Objective lens x100</b>	HO100
<b>Digital micrometer head for sample stage</b> For digital display of position. Minimum reading 1 µm. One digital micrometer head is for either X-direction or Y-direction	HARDI
<b>Specimen holder</b> For clamping of 6 specimens of 25 mm / 1" diameter. For plane parallel levelling of specimens for fully automatic micro hardness tester Duramin	HALSI
<b>Specimen holder</b> For clamping of 6 specimens of 30 mm / 1 1/4" diameter. For plane parallel levelling of specimens for fully automatic micro hardness tester Duramin	HALSA
<b>Specimen holder</b> For clamping of 4 specimens of 40 mm / 1 1/2" diameter. For plane parallel levelling of specimens for fully automatic micro hardness tester Duramin	HALFO
<b>Single specimen holder</b> For clamping of one specimen of 25 mm / 1" diameter	HALON
<b>Single specimen holder</b> For clamping of one specimen of 30 mm / 1 1/4" diameter	HALQU
<b>Single specimen holder</b> For clamping of one specimen of 40 mm / 1 1/2" diameter	HALAF
<b>Single specimen holder</b> For clamping of one specimen of 50 mm / 2" diameter	HALTO

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Struers' products are subject to constant product development. Therefore, we reserve ourselves the right to introduce changes in our products without notice

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