Bedienungsanleitung
Instruction manual
Istruzioni per l'uso
Instructions d'emploi
Instrucciones para el uso
Instruction manual
Translation of the original instructions.

DuraScan 10, 20
# Hardness Tester Introduction

## DuraScan 10/20

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1 Introduction

1.1 Preface

Our hardness testing machines represent state-of-the-art technology and comply with current norms and standards. Both the hardware and software in our machines can be upgraded on an ongoing basis. As a result, you can ensure that the technology in your machine is always up-to-date.

The machines are equipped with a measuring system and electronic power control. They are also distinguished by their ergonomic design and user-friendly software, which complies with DIN standards.

Take time to read this instruction manual closely. You will be amazed by the many application options available.

1.2 Safety instructions

Safety regulations
Familiarity with the applicable safety regulations is a prerequisite for safe, error-free operation of this machine.
Refer to the instructions in this manual, and, in particular, to the safety instructions, when operating the machine. It is also essential that you observe all rules and regulations for accident prevention that apply in the location where the machine is operated.
The design of this machine and its equipment is state-of-the-art and complies with recognized safety regulations. Nevertheless, risk of injury or death to the user or third parties may arise in certain cases, and the machine or other property may be damaged. Icons are used to highlight these risks in the relevant chapters.
Read all of the operating instructions before starting the machine.

Operating instructions
To avoid personal injury while moving the machine, never try to move it unassisted.
Remove all transportation safety devices before starting the machine.
Please bear in mind that the machine must not be used in explosive environments.
- Position the machine on a secure and stable working surface.
- Ensure that its working height is in accordance with ergonomic principles and will not result in unnecessary physical strain.
- Ensure that there is sufficient space available to access the machine and that an adequate emergency route is kept clear in case of unforeseen incidents.
- Ensure that the work station has adequate lighting.
- The hardness tester must be protected against shocks and vibrations which could influence the test result

Workwear and protective equipment
Ensure that workwear is close-fitting and cannot become entangled in the machine's moving parts. Make sure you use your personal protective equipment.
The machine should only be connected to a grounded electrical outlet.

Electrical power supply
Do not work with the machine for too long or when you are unable to concentrate properly.

Work time
The machine must not come into contact with water. Protect the machine from splashing.

Startup
Before each startup, ensure that the machine is in a flawless condition and that none of the safety features have been removed and are all functional. Any damaged cables must be replaced immediately by authorized personnel.

**Operation by authorized personnel**

- Ensure that the machine is only operated by authorized and properly trained persons.
- Ensure that the machine cannot be started or operated by unauthorized persons.

**Single-person machine**

- Ensure that the machine is only operated by one person at all times.

**Unauthorized changes**

- Do not make any unauthorized changes to the machine's safety features. Bridging of control features and any interference with the electrical/electronic components of the machine are not permitted and will nullify the warranty in all cases.

**EMERGENCY-OFF**

- In case of emergency, shut down the machine immediately with the EMERGENCY-OFF button.

**Securing workpieces**

- Before testing, check that the testing tools are securely clamped.
- Do NOT attempt to touch the internal parts of the machine while it is operating.
- Use appropriate fixings to secure any workpieces that do not stay in place without support.
- Never hold workpieces in place by hand!
- Wear protective gloves when handling heavy or sharp workpieces or removing chips.

**Resetting the machine**

- Use the main switch to turn the machine off before resetting.

**Supervision**

- Never leave the machine unsupervised while it is operating. Always switch the machine off before leaving the work station.

**Work station**

- Keep your work station clean and tidy. A cluttered work station increases the risk of injury.

**Maintenance**

- Use the main switch to turn the machine off. Remove the power plug to disconnect the machine from the power supply before you carry out any maintenance or readjustments.
- Any work on the machine's electrical parts unit should only be carried out by skilled electricians or service technicians.
- Make sure you comply with the inspection and maintenance intervals specified (see standard EN ISO 6507).

**Claims**

- Contact your supplier in the event of collision or damage. Always specify the unit number and software version of your machine in cases of complaint or damage or when making inquiries or ordering replacement parts.

### 1.3 Manufacturer's notes

**Intended use**

The machine is intended to be used to test the hardness of metals according to the following methods:

- Vickers EN ISO 6507, ASTM E384
- Knoop EN ISO 4545, ASTM E384

Workpieces must not exceed the following dimensions and weights:

- Maximum height from support surface: 260 mm
- Maximum depth from test point: 150 mm
- Weight: 10 kg

Workpieces must either be sufficiently stable or secured with appropriate fixings. Workpieces should only be positioned/removed by hand.
Testing of other materials is not permitted or, in exceptional cases, may only proceed following consultation with your supplier. Do not, under any circumstances, use materials which are toxic or harmful to health. To use this machine as intended, it is also essential that you comply with the specified operating and maintenance instructions.

Do not expose the machine to extreme, short-term fluctuations in temperature, as otherwise a stable autofocus function cannot be guaranteed.

The machine is designed for an ambient temperature of 23°C.

The machine must be installed in a clean location. It is particularly important that this location is free of metal chips, dust, smoke and other contaminants. If the ambient air in the installation location is contaminated, the machine must be operated within a closed test cell.

The machine may only be operated by persons who have been properly trained in the operation, maintenance and repair of the machine and are aware of the risks involved. All accident prevention and safety instructions for operating the machine must be observed. The manufacturer accepts no liability in cases where the machine is used for purposes other than those for which it is intended. In these cases, liability is transferred to the user.

The machine is adjusted for the ambient temperature specified in the technical data. Avoid major fluctuations in temperature at the installation area, or no stable Autofocus function can be guaranteed.

The machine must not be used to test workpieces with low mechanical stability, which may become distorted or may break when clamped.

Workpieces that are stable but do not have the required structural integrity may only be clamped if they are secured using appropriate fixings.

The CE mark and the EC conformity declaration certify that the machine and this manual comply with the stipulations of the directives that apply to the product.

The WEEE symbol on your unit indicates that it is a WEEE-relevant machine containing electrical/electronic components and must not be disposed of as general waste. For more information about recycling this product, contact your relevant local authority.

The warranty period for new machines is 24 months from the date of delivery by the manufacturer with unlimited operating hours.

If a defect is detected, inform your sales partner or nearest service center of the manufacturer immediately, providing a detailed description of the defect in written form, over the phone or in person.

Defects that are properly reported and are covered by the manufacturer's warranty will be corrected free of charge either by repair or replacement delivery. If requested, defective parts are to be returned to the manufacturer at the customer's expense and risk.

The manufacturer's warranty does not apply to defects that are caused by one or more of the following:
• failure to fully comply with the operating instructions, safety and licensing regulations or other instructions relating to the delivery, installation, startup or use of the machine
• incorrect assembly or startup of the machine
• unauthorized, unapproved interference with or modifications to the machine by the customer or a third party
• improper or inappropriate use of the machine for purposes other than those for which it is intended
• normal wear and tear
• negligent or incorrect handling
• chemical, electrochemical or electrical exposure
• an insufficient or incorrect power supply
• force majeure

The cost of services not covered by warranty are to be borne by the customer.

1.4 Icons and typographic conventions

Icons

**Danger**
indicates a risk of personal injury or death

**Caution**
indicates a risk of functional damage to your machine

indicates that particular attention is required

indicates additional information and tips

<table>
<thead>
<tr>
<th><strong>Typographic conventions</strong></th>
<th><strong>Bold</strong></th>
<th>indicates menu options and button labels</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Italics</strong></td>
<td></td>
<td>indicate names, software programs or figure titles</td>
</tr>
<tr>
<td><strong>Monospace</strong></td>
<td></td>
<td>indicates system output</td>
</tr>
<tr>
<td>&quot;Inverted commas&quot;</td>
<td></td>
<td>indicate chapter titles and terms of particular importance</td>
</tr>
<tr>
<td>➔</td>
<td></td>
<td>indicates a necessary work step</td>
</tr>
</tbody>
</table>

1.5 Technical data

<table>
<thead>
<tr>
<th>Technical data</th>
<th><strong>DuraScan 10</strong></th>
<th><strong>DuraScan 20</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>XY table / cross slide</td>
<td>Ø 90 mm</td>
<td>135 x 135 mm</td>
</tr>
<tr>
<td>Traverse path</td>
<td>- -</td>
<td>25 x 25 mm</td>
</tr>
</tbody>
</table>
Hardness Tester
DuraScan 10/20

Turret                  DuraScan 10                  DuraScan 20
(optionally motorized)
Max. workpiece weight  50 kg                 50 kg
Dimensions (WxHxD)     505 x 670 x 420 mm   505 x 670 x 420 mm
Footprint (WxD)        650 x 500 mm          800 x 650 mm
Touch screen [inches]  8,4”                  8,4”
Weight of basic unit   68 kg                 68 kg
Base plate             Aluminum              Aluminum
Positioning accuracy   - -                   0.01 mm

Ambient conditions
Room temperature (as per ISO/ASTM) [°C] 23 (±5)°C
Rel. humidity (non-condensing) [%] 40 – 70 %

Please take note of the information about the ambient temperature in chapter "Manufacturer's notes", page 5.

General technical data
Test loads              0.098 – 98 N (0.01 – 10 kg)
Test area height        260 mm
Resolution of test unit: 5 nm
Z-axis
Feed speed of test unit 0.03 nm/s to 2mm/s
Ports                   2 x USB 2.0, 1 x RS232, 1 x Ethernet (RJ45), VGA
port
Measuring camera        CMOS, 1.3 mpix, USB 2.0

The machine adjusts automatically to the voltage variant.

<table>
<thead>
<tr>
<th>Electrical power supply</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply (V)</td>
<td>110/230 V~1/N/PE, 50-60 Hz</td>
</tr>
<tr>
<td>Max. voltage fluctuations</td>
<td>+10 %/-10 %</td>
</tr>
<tr>
<td>Max. power consumption</td>
<td>120 W</td>
</tr>
<tr>
<td>Main fuse rating (110 / 230 V)</td>
<td>T6,3 A</td>
</tr>
<tr>
<td>Protection category EN 60529</td>
<td>IP20</td>
</tr>
</tbody>
</table>
2 Initial startup

2.1 Unpacking the machine

Unpacking the machine

- Remove the plastic and paper packaging.

1. Machine stand
2. Test unit
3. Transportation safety device
4. Control unit
5. Accessory case

The serial number can be found on the rear of the tester.

2.2 Inspecting the delivery

Inspecting the delivery

- Inspect the machine for any damage that may have occurred during transportation and check that the delivery is complete.
- If you detect any defects, contact your supplier or insurance provider immediately.
- Please specify the machine's serial number when making a complaint. You will find this serial number on the rating plate at the rear of the machine.
1 Machine stand
2 Test unit
3 Turret with indenter and lenses
   (indenter and lenses not yet fitted on delivery.)
4 Test anvil
5 Control unit
6 EMERGENCY-OFF button

Accessories
Accessories case
2 Allen wrench 0.9 mm
3 Allen wrench 1.3 mm
4 Allen wrench 1.5 mm
5 Flat wrench
6 Two spare fuses (T6, 3A)
7 Cable 3-pole EU
8 Cable 3-pole US
9 Ring bolt
10 Cover
11 CD-ROM 01 with machine data and documentation and conformity test
   CD-ROM 02 with machine-specific data and certificate

**Accessories required**
- Indenter
- Objective Lenses
- Micrometer spindles

Indenters and lenses are not included in the machine shipment and must be ordered separately. If you ordered lenses or indenters at the same time, they will be included in the delivery and must be mounted.

**Optional accessories**
- Calibrated test blocks
- Additional indenter
- Standard USB printer
- Sample holders

To order additional accessories and replacement parts, contact your supplier. Only approved products have been tested for use with this machine.
2.3 Weight and dimensions

**DuraScan 10**

- **Weight and dimensions**
  - without pallet: approx. 68 kg
  - with pallet: approx. 78 kg

**DuraScan 20**

- without pallet: approx. 68 kg
- with pallet: approx. 78 kg

2.4 Transporting the machine

- Use a forklift or hand lift truck to transport the machine to its installation location, on a pallet if wished.
- Screw the ring bolt supplied into the machine and place on the prepared worktable using a crane.

**Attaching the cover**

- Remove the ring bolt.
Secure the cover (2) over the hole for the ring bolt (1).
The cover is supplied with a Velcro fastener.

2.5 Installing the machine

The bench on which the machine is installed must meet the following requirements:

- The bench must be level and have a height of approx. 700 mm.
- It must be capable of supporting at least 220 kg.
- The bench must be solid and resistant to oscillation.

The machine must be professionally installed.
During installation, allow sufficient space for operating the machine and for carrying out possible maintenance work.

Please take note of the information about the ambient temperature in chapter "Manufacturer’s notes", page 5.
2.6 Starting up the machine

Overview

To start up the tester, it is not only necessary to fit the standard accessories, but also calibrate and adjust the individual lenses and indenter. Here the *ecos* Workflow offers assistance with the menu item *Settings*.

The following table shows an overview of the operations necessary:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching the power on</td>
<td>Initial startup</td>
</tr>
<tr>
<td>Switching the machine on for the first time</td>
<td>Initial startup</td>
</tr>
<tr>
<td>Removing transportation safety device(s)</td>
<td>Initial startup</td>
</tr>
<tr>
<td>Selecting <em>ecos</em> Workflow language</td>
<td>Initial startup</td>
</tr>
<tr>
<td>Installing indenter in adapter</td>
<td>Fitting standard accessories</td>
</tr>
</tbody>
</table>
Adjusting indenter  Fitting standard accessories
Screwing lenses into turret  Fitting standard accessories
Mounting micrometer spindles  Fitting standard accessories

Other settings which can then only be made in the ecos Workflow software are to be found in the chapter "Configuration and Calibration", page 74.

**Switching the power on**

1. Main ON/OFF switch with pilot light
2. Mains connection

- If necessary: Turn the main switch to the OFF position (1).
- Plug the power cable into the mains connection (2).
- Plug the opposite end of the power cable into a grounded electrical outlet with a protective conductor contact.

**Connections on the rear of the machine**

1. Ethernet port (RJ45)
2. Keyboard connection
3. USB ports (e.g. USB mouse, USB stick)
4. RS232 port
5. VGA port

- Insert an Ethernet cable in the Ethernet interface (RJ45) if you wish to address the machine via a network.

**Connections on the left of the machine**
Contact the network administrator to set the network functions of Windows XP Embedded accordingly.

The test unit is secured by a transport lock (block of foam).

- Remove the transportation safety device.
- Turn the main switch to the ON position.
- If necessary: To release the EMERGENCY-OFF button on the machine turn it in a clockwise direction.
- Switch the machine on using the Standby button on the left of the touch screen.

The green pilot light in the Standby button lights up.

The operating system will start. The **ecos** Workflow starts automatically.

You will see the following screen after a few moments:

![The software starts the initialization process and opens the login screen. On delivery the machine is set to English.](image-url)
Accept the preconfigured user name "Cal" and select **Login** without entering a password.

If you are unable to log in without a password, contact your administrator or Service team to ask for your login data.

**The ecos Workflow opens with the first screen.**

**Selecting language**

- In the Workflow bar (bottom of screen) select **Settings**.
- Under **General – Region** in the field **Select Language** select the language of your choice.
The screen is immediately displayed in the language selected.

You can now fit the standard accessories.

2.6.1 Mounting the accessories required

2.6.1.1 Indenter and lenses

**Manual turret**

Three positions are available with the manual turret: Position 1 is for the indenter (Vickers or Knoop). Positions 2 and 6 are used for the lenses.

**Motorized turret**

Six positions are available with the motorized turret: max. two indenters and four lenses or one indenter and five lenses. Position 1 is for the indenter (Vickers or Knoop). Positions 2 to 6 are available to fit an optional second indenter and the lenses.

**Installing indenter in adapter**

- Remove the transport lock of the indenter with an Allan wrench.
Insert the indenter into the adapter. When doing so, the flat wrench must be parallel with the bench.

Hold the indenter in position (2) with the flat wrench until you have secured the indenter with the socket head wrench (1).

In order to swivel lenses as quickly as possible, it is recommended fitting the lenses you use most often on the right and left of the indenter (positions 2 and 6). The position numbers are marked on the turret.
Set the lens in the right position on the turret and secure.
Repeat the process for other lenses as necessary.
The procedure for adjusting lenses can be found in chapter Adjusting lenses (Assistant - Objective Lenses)” page 88.

Calibration

The machine has already been calibrated and adjusted by the manufacturer or stockist. After transportation and fitting the indenter / lenses, new settings however have to be made with the so-called "configuration assistant". Calibration should only be carried out by trained technicians. Further information can be found under "Configuration and Calibration", page 74.

2.6.1.2 Micrometer spindles

Mounting micrometer spindles

Only the DuraScan 20 is equipped with a cross slide and the required micrometer spindles.
The micrometer spindles are not mounted on the cross slide on delivery.
Insert the micrometer spindle in the opening in the cross slide. When doing so, make sure that the scale faces upwards and is plainly visible.

Secure the micrometer spindle by tightening the screw with a socket head wrench.
3 Design and Functions

3.1 Design of machine

Design of machine

1 Machine stand
2 Test unit
3 Turret with indenter and lenses
4 Test anvil (here: DuraScan 10 with XY table)
5 Control unit
6 EMERGENCY-OFF button

The essential components of the hardness tester are the machine stand, the test unit plus turret including the indenter/lenses, and the test anvil. The control unit is used to control operation of the tester.

If wished, you can also connect a screen, keyboard and mouse.

The machine stand is made of cast aluminum. The stand contains all of the machine’s electrical and electronic components, as well as all drive mechanisms.

The test unit is powered by a DC motor. It can move at max. 2 mm/s and is capable of measuring workpieces with a maximum height of 260 mm.

The DuraScan 10 and DuraScan 20 are normally equipped with a manual 3-fold turret, although a motorized 6-fold turret is optionally available.

The test anvil can be designed as an XY table (DuraScan 10) or a cross slide (DuraScan 20).

Table of lenses

With the optical Vickers and Knoop test methods lenses are required to see the indent.

The following rule applies: The lower the test force, the greater the optical magnification.

The following table shows the allocation of the 5 lenses.
Test load range [kg]

<table>
<thead>
<tr>
<th>Load</th>
<th>0.01</th>
<th>0.025</th>
<th>0.2</th>
<th>0.5</th>
<th>1.0</th>
<th>3.0</th>
<th>5.0</th>
<th>10.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 x</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 x</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>100 x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table of lenses

3.2 Control unit

A control unit with touch screen allows you to control and configure the machine. The software is menu-based and offers a range of options for test methods and conversion as well as exporting data and reporting.

The control unit has the following controls:

1. Touch screen
2. Touch pen
3. Standby button with green pilot light

You can operate the touch screen by selecting the buttons with your finger or with a suitable touch pen.

Caution

Never use sharp tools or conventional pens or pencils to enter data on the touch screen as they may damage it.

The touch pen (2) can be easily removed from the control unit.

Safety feature

An EMERGENCY-OFF button is located on the front of the machine as a safety device. If you press this button, the current operation is cancelled and the machine is switched off.

The test unit stops moving and the touch screen light dims. To release the EMERGENCY-OFF button, turn it in a clockwise direction.
Danger
In case of emergency, shut down the machine immediately with the EMERGENCY-OFF button. Do not make any unauthorized changes to the machine's safety features.
4 Basic Operation

4.1 Switching the machine on and off

Switching the machine on

➢ Switch the machine on using the Standby button on the left of the touch screen. The green pilot light in the Standby button lights up.

If the machine does not switch on:

● If necessary: Release the EMERGENCY-OFF button by turning it in a clockwise direction.
● Check that the main switch is turned on.

The ecos Workflow starts with the login screen, see „User login“, page 94.

➢ Enter your login data.

The ecos Workflow opens the screen Specimen.

Switching the machine off

➢ Switch the machine off with the Standby button. The green pilot light in the Standby button switches off. The test unit stops moving and the touch screen light dims.

4.2 Touch screen

The control unit display is a so-called touch screen. You can operate the touch screen by selecting the buttons with your finger or with a suitable touch pen. Your finger or the touch pen assumes the role of a "mouse" as used with a standard computer.

Caution

Never use sharp tools or conventional pens or pencils to enter data on the touch screen as they may damage it.
4.3 **Turret**

Depending on the type, operation of the turret with the indenter and lenses is either manual or motorized (optional).

**Manual operation**

If you are prompted in the *ecos* Workflow to swivel in the indenter, then proceed as follows:
- Grasp the hand lever with one hand.
- Turn the turret so that the indenter is above the workpiece and catches in place.

When swivelling in the indenter, pay attention to the catch point of the indenter.

- Use ✅ to confirm when the indenter has caught in the right position.

Use the same procedure when swiveling in lenses.

If you wish to swivel in a lens without being prompted, then proceed as follows:
- Select the menu item **Turret**.

![Turret screen](image)

The tool which has been swiveled in is marked with a red arrow.
- Select the 10x lens for example.
- Comply with the prompt and swivel in the 10x lens until it catches in place as described above under "Manual operation".

- Confirm with ✅.

The *ecos* Workflow automatically returns to the **Image** screen.

**Motorized operation**

With a motorized turret the electronic control system is responsible for moving the turret. Wait until the turret has moved the indenter or lens over the workpiece. You can then continue with operation in the *ecos* Workflow.
If you wish to swivel in a lens without being prompted, then proceed as follows:

- Select the menu item **Turret**.

  The tool which has been swiveled in is marked with a red arrow.

- Select the lens you require.

  The lens is swiveled in automatically.

  The **ecos** Workflow automatically returns to the **Image** screen.

  Use the same procedure when swivelling in the indenter.

### 4.4 Graphical interface

#### Basic elements

The **ecos** Workflow includes a graphical interface which is easy to use.

The number of basic elements depends on the configuration level of the machine and the software modules released.

The following figure shows the basic elements of the graphical interface.
1 Menu items
2 Slider for moving test unit
3 Workflow bar
4 Menu bar
5 Submenus

**Progress bar**

The progress bar indicates how long it will take for the triggered action to be completed and how much time has already elapsed since it was triggered.

**Slider**
The slider at the right-hand edge can be used to move the test unit up and down. This allows you to:

- focus the image
- raise or lower the indenter.

With the bar in the middle the test unit is moved continuously up or down.

The two arrows at the top and bottom end of the slider move the test unit up or down in steps.

### 4.5 Buttons

**General**

- ![Deactivate Function](image)
  - The specified function is deactivated

- ![Activate Function](image)
  - The specified function is activated

- ![Print Data](image)
  - Printing of various data

- ![Display Information](image)
  - Displaying various information

- ![Save Data](image)
  - Saving various data

- ![Delete Data](image)
  - Deleting various data

- ![Create File Location](image)
  - Creating a file location

- ![Cancel Procedure](image)
  - Cancelling of a procedure

- ![Confirm Procedure](image)
  - Confirming a procedure

**Specimen**

**Single Measurement**

- ![Select Test Type](image)
  - Select test type Single Measurement

**Series Measurement**

- ![Optional Module](image)
  - Only with DuraScan 20 or as an optional software module for DuraScan 10!
  - Select test type Series Measurement
<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHD</td>
<td>Only with DuraScan 20 or as an optional software module for DuraScan 10!</td>
</tr>
<tr>
<td></td>
<td>Measures the case hardness depth (CHD)</td>
</tr>
<tr>
<td>Nht</td>
<td>Only with DuraScan 20 or as an optional software module for DuraScan 10!</td>
</tr>
<tr>
<td></td>
<td>Measures the nitride hardening depth</td>
</tr>
<tr>
<td>Rht</td>
<td>Only with DuraScan 20 or as an optional software module for DuraScan 10!</td>
</tr>
<tr>
<td></td>
<td>Measures the surface hardness</td>
</tr>
<tr>
<td>Load sample</td>
<td>Enables you to load a saved sample</td>
</tr>
<tr>
<td>Read QR-code</td>
<td>Enables you to read a QR-code</td>
</tr>
<tr>
<td>Method and</td>
<td>Defines indenter, lens and test method</td>
</tr>
<tr>
<td>Objective Lens</td>
<td></td>
</tr>
<tr>
<td>Indenter</td>
<td>Makes the indenters installed available for selection</td>
</tr>
<tr>
<td>Lenses</td>
<td>Makes the lenses installed available for selection</td>
</tr>
<tr>
<td>Method</td>
<td>Makes the possible test methods available for selection</td>
</tr>
<tr>
<td></td>
<td>Opens additional lines</td>
</tr>
<tr>
<td>Create Sample</td>
<td>Enables the creation of a sample for hardness testings</td>
</tr>
<tr>
<td>Create QR-Code</td>
<td>Enables the creation of a QR-Code for hardness testings</td>
</tr>
<tr>
<td>Conversion</td>
<td>Makes the existing conversion tables available for selection</td>
</tr>
<tr>
<td>Limits</td>
<td>Permits the entry of limits</td>
</tr>
<tr>
<td>Sample Correction</td>
<td>Permits the entry of sample correction data with round workpieces</td>
</tr>
</tbody>
</table>
### Position

- **Test Point Pattern**
  - Only with series measurement on DuraScan 20!
  - Defines the test point pattern for series measurement

- **Image**
  - Shows the current view in the magnification selected

- **Turret**
  - Shows the tool currently active (either indenter or lens)

- **AF Camera**
  - Automatically creates an optimum image without the user's involvement
  - See "Autofocus function (AF Camera)”, page 33

- **AF Indentation**
  - For automatically locating and identifying the surface of a specimen
  - See "AF Indentation function", page 33

### Result

- **Value**
  - Shows the hardness value and the test method applied

- **Auto**
  - Automatically remeasures a test point

- **Manual**
  - Permits manual remeasurement of a test point

### History

- **List**
  - Opens the result list

- **Statistics**
  - Opens statistics for the values measured. These values can be displayed in text form or as a histogram or trend line.

- **Values**
  - Shows a statistical analysis in table form

- **Trend line**
  - Shows a sequence of measurements as a trend line

- **Histogram**
  - Shows a statistical analysis as a histogram

- **Report**
  - Opens the Report screen
<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excel</td>
<td>Exports the measured data as a csv file</td>
</tr>
<tr>
<td>Export</td>
<td>Exports the measured date in the currently set format (only with option export editor)</td>
</tr>
<tr>
<td>Delete Value</td>
<td>Deletes a value from the result list</td>
</tr>
<tr>
<td>Delete all</td>
<td>Deletes all values from the result list</td>
</tr>
<tr>
<td>Load List</td>
<td>Loads an existing result list</td>
</tr>
<tr>
<td>Save List</td>
<td>Saves the current result list in a file</td>
</tr>
<tr>
<td>Load Value</td>
<td>Loads the image and value for a measurement from the result list to the current memory. The value can be seen under Result and can, for example, be re-measured.</td>
</tr>
<tr>
<td>General Settings</td>
<td>Opens the screen for general settings</td>
</tr>
<tr>
<td>General</td>
<td>Opens the screen General</td>
</tr>
<tr>
<td>User fields</td>
<td>Opens the screen User fields</td>
</tr>
<tr>
<td>Times</td>
<td>Displays set dwell times of the test forces</td>
</tr>
<tr>
<td>Setting the export</td>
<td>Opens the screen for setting the individual export data (only with option export editor)</td>
</tr>
<tr>
<td>User Rights</td>
<td>Opens the screen User Rights</td>
</tr>
<tr>
<td>File Locations</td>
<td>Opens the screen File Locations</td>
</tr>
<tr>
<td>Service</td>
<td>Is only for the service team and requires at least the user rights &quot;User&quot;</td>
</tr>
<tr>
<td>Change User</td>
<td>Opens the login screen</td>
</tr>
</tbody>
</table>
4.6 Virtual keyboard

Alphanumeric keyboard

The virtual keyboard opens automatically when you select a field which requires an alphanumeric input.

You can enter or edit text with the alphanumeric keyboard. You must finish inputting by pressing **Enter**.

- **Moves the virtual keyboard on the screen**
- **Deletes the old value or with a current input, the character to the left**
- **Completes inputting**
- **Cancels inputting (Escape)**
- **Switches between lower and upper-case**

4.7 Autofocus function (AF Camera)

The **AF Camera** function automatically creates an optimum image without the user’s involvement:

- Image is focused
- Brightness is optimized.

Select the **AF Camera** function where possible to ensure values that are objectively comparable.

The perception of focus by the human eye varies widely, so possibly resulting in different test evaluations depending on the user.

4.8 AF Indentation function

The **AF Indentation** function is used for automatically locating and identifying the surface of a specimen.

The indenter is automatically moved to the workpiece, where it leaves a little indentation with a test load of approx. 10 g and a diagonal of 10 - 15 µ. The indenter is then raised slightly.

The lens with the lowest magnification is swiveled in and automatically adjusted for an optimum image.
The optimum working height is then approx. 0.3 mm above the workpiece.
5 Examples of ecos Workflow

The following examples will teach you how to use the ecos Workflow.
The ecos Workflow reliably guides you through the hardness test procedure in five steps.

- The first example describes single measurement with the DuraScan 10.
- The second example deals with CHD measurement (series measurement) with the DuraScan 20.

5.1 Single measurement

Example

In this example single measurement is carried out using the HV5 test method.

- Machine: DuraScan 10 with manual 3-fold turret
- Test anvil: XY table
- Test type: Single measurement
- Test method: HV5
- Indenter: Vickers
- Lens: 10x

Login

After switching on, the ecos Workflow starts with the login screen, see "User login", page 94.

- Enter your login data.
  You can ask the administrator for your login data!

- Comply with the prompt and swivel in the indenter.
- Confirm with ![checkmark].

The ecos Workflow opens the Specimen screen.

5.1.1 Specifying test type

Specify the test type in the Specimen screen.
5.1.2 Specifying test method and lens

In the Method screen select the lens and specify the test method. If a second indenter is installed, it can also be selected here.

- Select the 10x lens in Objective Lenses.
- Select the test method HV5 in Method.
- In the Workflow bar select Position to open the Position screen.
5.1.3 Specifying position

In the **Position** screen position the indenter in relation to the workpiece and specify the test point.

- Select the menu item **Turret**.

- Select the 10x lens.

- Comply with the prompt and swivel in the 10x lens until it catches in place.

- Confirm with ☑.

The **ecos** Workflow automatically returns to the **Image** screen.

- Place the workpiece under the lens on the test anvil.
Move the workpiece to a position without any indentation.

If necessary, focus the image using the slider on the right of the screen.

Or:

Select the menu item **AF Indentation**. Focusing and adjustment of the indenter to the optimum working height is carried out here automatically.

Comply with the prompt and swivel in the indenter until it catches in place.

Confirm with ✓.

The **AF Indentation** function is used to move the indenter automatically to the workpiece, where it leaves a little indentation with a test load of approx. 10 g and a diagonal of 10 - 15 µ.

In certain cases the indent left by the **AF Indentation** function is not desirable. In this case you must lower the indenter manually using the slider until it is close to the workpiece.

Comply with the prompt and swivel in the 10x lens until it catches in place.

Confirm with ✓.

Move the workpiece to the position at which measurement is to take place.

Select the menu item **Measure**. Then comply with the prompt and swivel in the indenter until it catches in place.

Confirm with ✓.

**Danger**

Keep your hands away from the area around the moving test unit.

After measurement has started, several messages are displayed on the touch screen.
5.1.4 Viewing result

The result is displayed in the Result screen and is available for further processing.

The indent is automatically set to optimum brightness, focused, subjected to optical analysis and displayed by the ecos Workflow.

The measurement result is displayed in the top right of the touch screen, where it can be read off.

All values measured are saved in a list.

- In the Workflow bar select **History** to open the **History** screen.

5.1.5 Viewing entry in History

All results are permanently stored in the **History** screen with a clear structure.
Further processing of the values generated (e.g. remeasurement) is described in chapter "Advanced Settings and Functions", page 48. Evaluation and editing of your values is described in chapter "Documentation and evaluation", page 63.

5.2 CHD measurement (series measurement)

In this example CHD measurement is carried out using the HV1 test method.

- Machine: DuraScan 20 with optional motorized 6-fold turret
- Test anvil: Cross slide with micrometer spindles
- Test type: CHD measurement
- Test method: HV1
- Indenter: Vickers
- Lens: 20x

Login

After switching on, the ecos Workflow starts with the login screen, see "User login", page 94.

➢ Enter your login data.

You can ask the administrator for your login data!

The ecos Workflow opens the Specimen screen. The indenter is swiveled in.

5.2.1 Specifying test type

Specify the test type in the Specimen screen.
5.2.2 Specifying test method and lens

In the Method screen select the lens, specify the test method and define the test point pattern. See "Test Point Pattern", page 56, section "Test point pattern". If a second indenter is installed, it can also be selected here.

- Select the 20x lens in Objective Lenses.
- Select the test method HV1 in Method.
- Select the Test Point Pattern menu to specify the pattern you wish to test.
Enter the required values for the parameters a, b and c. In this example: a=0.1, b=0.2, c=0.

In the Workflow bar select **Position** to open the **Position** screen.

### 5.2.3 Specifying position

**Positioning indenter**

In the **Position** screen position the indenter in relation to the workpiece and specify the start point for the measurement series.

Select the menu item **Turret**.
Select the 20x lens.
The lens is swiveled in automatically.
The ecos Workflow automatically returns to the image screen.

Place the workpiece under the lens on the test anvil.

If necessary, focus the image using the slider on the right of the screen.
Or:

Select the menu item AF Indentation. Focusing and adjustment of the indenter to the optimum working height is carried out here automatically.

The AF Indentation function is used to move the indenter automatically to the workpiece, where it leaves a little indentation with a test load of approx. 10 g and a diagonal of 10 - 15 µ.
In certain cases the indent left by the **AF Indentation** function is not desirable. In this case you must lower the indenter manually using the slider until it is close to the workpiece.

**Specifying the start point**

- Wait until the image is optimized.
- Set both micrometer spindles (analogue or optionally also digital) to "0".
- Position the workpiece so that its vertical edge lines up with the crossline as far as possible.

The test direction is always from left to right.

**Recording values**

- Comply with the prompt and move the workpiece with the micrometer spindles to the values specified in the X- and in Y-axis.
- Select the menu item **Measure**.
Danger
Keep your hands away from the area around the moving test unit.

After measurement has started, several messages are displayed on the touch screen. The Result screen is displayed automatically.

The measurement value and an image of the indent are displayed in the Result.

➢ In the Workflow bar select Position to return to the Position screen.

When you have carried out at least two measurements, you can perform another measurement or end the series.

➢ If necessary: Perform another measurement as described above.
Completing series

- Select the **Complete Series** function to end the series.

The **History** screen is displayed automatically.

5.2.4 Viewing result

The result is displayed in the **Result** screen and is available for further processing.

The indent is automatically set to optimum brightness, focused, subjected to optical analysis and displayed by the **ecos** Workflow.

The measurement result is displayed in the top right of the touch screen, where it can be read off.

All measurement series are saved in a list.

- In the Workflow bar select **History** to open the **History** screen.

5.2.5 Viewing entry in History

All results are permanently stored in the **History** screen with a clear structure. The series measurements are displayed. You can read off the values measured for each series and are informed about the status of the series (**Series complete** or **Series not complete**).

Series not complete is displayed:

- with program abort
- when the CHD value is not attained.

**Caution**

It is not possible to finish measuring the series later on!

Double-clicking on the measurement series will display the associated result list.
Further processing of the values generated (e.g. remeasurement) is described in chapter "Advanced Settings and Functions", page 48. Evaluation and editing of your values is described in chapter "Documentation and evaluation", page 63.
6 Advanced Settings and Functions

6.1 Advanced settings with measurements

6.1.1 Specimen screen

The screen **Specimen** opens automatically after login.

![Specimen screen image]

You can choose between single measurement and series measurement depending on the configuration level of the machine and the available software modules. With series measurement several options are available: CHD, Nht and Rht.

**CHD**

The **CHD** case hardness depth is defined by determining the effective depth of the carburized and case-hardened layer. With the HV1 test method the typical CHD limit is 550 HV.

**Nht**

The **Nht** nitride hardening depth is defined by determining the effective hardness depth after nitriding. The typical Nht limit corresponds to the current core hardness of +50 HV with test method HV0.5.

**Rht**

The **Rht** surface hardness depth is defined by determining the effective hardness depth after flame or induction hardening. The typical Rht limit is 80% of the surface hardness of test method HV1.

**Load sample**

Here you can load and use the previously saved settings for the hardness testing.

- Press the load sample button
Select the required sample from the list.

If necessary, select the button in order to display the deposited settings of the sample.

Press the button in order to use the sample for the hardness testing.

After the sample has been loaded, the ecos Workflow directly changes to **Position**.

Read Here you can read a QR-code in order to use the settings for the hardness testing it contains. Note, an additional hand-held scanner is necessary. It is not included in the shipment!

Press the read QR-code button

Now scan the desired QR-code with a hand-held scanner (not included in the shipment).
After the QR-code has been scanned the ecos Workflow directly changes to **Position**.

### 6.1.2 Method screen

In the screen **Method** you can determine the settings for your metering. Depending on your settings, you can adjust further settings in the following menus:

- In the menu **Method and Objective Lens**
- In the menu **Conversion**
- In the menu **Limits**
- In the menu **Sample Correction**
- In the menu **Test Point Pattern**

#### 6.1.2.1 Method and Objective Lens

In the screen **Method and Objective Lens** select the test type, the lens, the (test) method, and the zoom level.

**Example view for method > method and lens with standard zoom**

<table>
<thead>
<tr>
<th>Measurement Type</th>
<th>By default a test type can be selected. With the optional turret additional indenters can be installed and configured and therefore several test types may be available.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective Lenses</td>
<td>By default, one lens can be selected. With the optional turret additional lenses can be installed and configured and may therefore be available.</td>
</tr>
<tr>
<td>Method</td>
<td>Here you can choose between the test methods listed.</td>
</tr>
<tr>
<td>Zoom level</td>
<td>By default, you can choose between two zoom levels. When the optional zoom lens is installed, the additional zoom levels are displayed here. With depth difference methods the lenses and the zoom level are deactivated.</td>
</tr>
<tr>
<td>Create</td>
<td>All settings for the hardness testing that were made under</td>
</tr>
</tbody>
</table>
**Sample**

“Specimen”, “Method” and “User fields” can be saved here as a sample.

- Press the create sample button
- Enter the desired name for the sample.
- If necessary, select the button in order to display the deposited settings of the sample.
- Press the button to save the sample. The sample is filed under the set file location for templates Specifying file locations (File Locations), page 83.

After the saving process the ecos Workflow changes back to **Method**.

**Create QR-code**

All settings for the hardness testing that were made under “Specimen”, “Method” and “User fields” can be created as QR-code here.

- Press the create QR code button
If necessary, select the button in order to display the deposited settings of the QR-code.

Select the button to print out the QR-code directly.

Select the button to save the QR-code.

When you press , the following screen opens:

Select the button to select the desired directory.

Enter the desired name for the QR-code into the name field.

Select the button to save the sample.
After the saving process the ecos Workflow changes back to **Method**.

### 6.1.2.2 Conversion

When dealing with different hardness test methods, it is often necessary to convert the hardness value measured with one method to that of another method. For this reason empirical values have been established based on numerous comparative measurements, conversion tables drawn up and standardized in the relevant norm. Different tables apply to different materials. The appropriate norm should be consulted for conversion according to the standards.

For example, the conversion tables also state the tensile strength of steel in N/mm².

When you select the **Conversion** the following screen will open:

With the ![on-off](image) buttons you can activate or deactivate the conversion.

- Use the ![on-off](image) button to activate Conversion so you can select a conversion table.
The following conversion tables are available for selection:

- DIN EN 50150
- ASTM E140
- DIN EN ISO 18265

**Conversion Table** lists the test methods offered by the machine as well as its norm-based conversion options.

- After selecting a conversion table, choose the test method and test unit.
- If you have selected the conversion tables ASTM or DIN EN ISO 18265, you can choose between several materials.
- Leave Conversion by directly calling **Position** up.

### 6.1.2.3 Limits

If you have selected **Limits** the following screen will open:

With the [ ] or [ ] buttons you can activate or deactivate the entering of limit values.
Select the button to enter limits.

Enter the limits for the test method.

If a result is within the set limits, OK is displayed when the measurement is taken. If a result is outside the set limits, the display reads Result too High or Result too Low.

With evaluation of the results in the History screen, the limits are displayed as a trend line in red. Further information can be found in the chapter "Documentation and evaluation", page 63.

Statistical analysis can only be performed with activated limits.

The limits are specified in the same unit of hardness as for the test method selected, e.g. HV for the Vickers test method.

Leave limits by directly calling Position up.

6.1.2.4 Sample Correction,

If you have selected Sample Correction, the following screen will open:

With the or buttons you can activate or deactivate the entering of limit values.
Here you can enter a correction for a sample type based on the test method. A sample correction is required in order to produce correct measurements in the case of round (cylindrical, spherical) samples.

- Use the button to activate Sample Correction so you can specify the sample correction.
- Select the form (spherical or cylindrical).
- Specify whether the curvature is concave (inwards) or convex (outwards).
- Specify the angle at which the measurement series is positioned on the workpiece.
- Measure the diameter of the workpiece and enter it in the Diameter field.
- Leave sample correction by directly calling Position up.

### 6.1.2.5 Test Point Pattern

If you are performing series measurement, you will see the Test Point Pattern menu in the menu bar on the top right.

If you select Test Point Pattern, the following screen will open:
Here you can specify the distances between the individual test points as well as the distance to the edge from which the first of several test points is to be set.

- Switch to the **Method** screen and select the **Test Point Pattern** menu.
- Enter the required value in the **Edge Distance** field.
- Enter the required values in the fields **X-distance between Test Points** and **Y-distance between Test Points**.

If you are performing series measurement with a linear arrangement for all test points (only X-axis), you should not enter a value for **Y-distance between Test Points**. If you require an offset in the X- and the Y-axis, you must enter values in both fields.

Once you have entered all values and switched to the **Position** screen, a message will immediately appear, prompting you to move the specimen.

- Switch to the **Position** screen.
- Set both micrometer spindles to "0".
- Place the workpiece under the lens on the test anvil.
- If necessary, focus the image using the slider on the right of the screen.
- Position the workpiece so that its vertical edge lines up with the crossline.
- Perform at least two measurements, complying with the instructions shown on the screen.
- After each measurement select **Position** again to carry out the next measurement.

Once you have carried out all measurements, you must complete the measurement series. After the very first measurement the **Position** screen will display the **Complete Series** button on the bottom right.

- **Complete Series** should however not be selected until you have performed at least two measurements.
This completes the measurement series, and you can then view and analyze the values as required.

In the result list shown in the History screen incomplete series are shown in the column Series Status as Measurement series not complete.

**Caution**

It is not possible to finish measuring the series later on!

**6.1.3 Position screen**

If you select **Position**, the following screen appears:

You can perform measurement here as well as optical analysis and viewing.

**Image** Shows an image of the workpiece.
Turret
If you select this menu item, you can either select a lens or the indenter (depending on equipment) and then bring it into position in response to a prompt on the screen. After measurement you will either be prompted to swivel in the lens, or the turret will automatically move to the right position.

AF Camera
This function automatically focuses the image of the indent without the user's involvement. If it is not sharp enough and refocusing is required, use the slider on the right of the screen to refocus.

AF Indentation
The AF Indentation function is used for automatically locating and identifying the surface of a specimen.

The indenter is automatically moved to the workpiece, where it leaves a little indentation with a test load of approx. 10 g and a diagonal of 10 - 15 µ. The indenter is then raised slightly. The lens with the lowest magnification is swiveled in and automatically adjusted for an optimum image. The optimum working height is then approx. 0.3 mm above the workpiece.

In certain cases the indent left by the AF Indentation function is not desirable. In this case you must advance the indenter manually using the slider until it is close to the workpiece.

Measure
Measurement is carried out. The value measured is shown in the Result screen.

Danger
Keep your hands away from the area around the moving test unit.

If automatic image processing is enabled, you can swivel in the lens after measurement, or this will take place automatically and the indent measured. On the top right you will see the hardness value with the test method.

If automatic image processing is disabled, the machine will automatically offer the Manual Remeasurement function.

Automatic image processing can be enabled or disabled under General Settings – Image, see "Settings", page 75.
If the hardness value measured seems incorrect (e.g. cavities at indent tip), you can either have it remeasured automatically or remeasure it manually.

Before applying one of the two methods, make a (mental) note of the value, as remeasurement results in a new value, which will be then displayed and also saved as appropriate.

6.1.3.1 Automatic remeasurement

- Select **Auto** and center the indent under the crossline.
- Confirm with ✅.

The value will be automatically remeasured and the new value shown on the top right.

6.1.3.2 Manual remeasurement

If you select **Manual**, the following screen appears:
The measured value is shown on the top right.
The two curved arrows on the bottom left can be used to move all lines at once to attain the optimum measuring position.

Depending on which green line you have selected, you will see two vertical arrows to move the line up or down or two horizontal arrows to move it to the right or left.
Depending on which green line you have selected, you will see two vertical arrows to move the line up or down or two horizontal arrows to move it to the right or left.

- When the four corners of the indentation are exactly between the green lines, confirm the result of remeasurement with 

The remeasured value is displayed and saved.

You can cancel remeasurement with .

The List in the History screen shows whether the value was remeasured (Remeasured) or not (Measured). Further information can be found in the chapter "Documentation and evaluation", page 63.
6.2 Documentation and evaluation

6.2.1 List of measurements

- Select History in the Workflow bar.

The List screen with buttons on the right-hand side is displayed.

You can use the scroll bars on the right and at the bottom of the screen to view the contents of the current list. Measurements are numbered consecutively. The following information is saved in the list as documentation for every measurement performed: method, lens, indenter and hardness value measured. The set hardness limits are displayed.

Status indicates whether the result is the first value measured or whether remeasurement was carried out. The Diagonal is the mean calculated from the first and second diagonal. It is indicated whether conversion was selected and which conversion method.

Classification shows a brief evaluation of the measurement, whether the value was "OK" or too high/low and whether conversion was successful.

6.2.1.1 Delete Value

You can use the button to delete a value from the result list. You can, for example, delete a value that was measured using a different test method. This ensures that statistical analysis is performed correctly.

- Select a value to highlight it.

- Select the button.

The following hint appears on the touch screen:
Do you want to Delete Value?

- Select Yes to delete the value.
After you delete a value, all subsequent values are re-numbered.

6.2.1.2 Deleting the result list

You can use the \( \times \) button to delete the entire result list.

- Select the \( \times \) button.
  The following hint appears on the touch screen:
  Do you want to Delete all Values ??
- Select **Yes** to delete the entire result list.

6.2.1.3 Loading result list

Your results, images, Excel files and export lists are stored in standard directories. With the appropriate user rights you can specify the file locations (see "Specifying file locations (File Locations)" page 83). The standard directory for measured results is \( C:\Data\Export \). The list is saved in XML format with the file extension \( .spe \).

- Select the \( \times \) button.
- Select the list you require.

6.2.1.4 Saving result list

You can save the current list under any name in any directory.
The **Directory** field can be used to specify the location where the file is to be saved. The default directory can be changed.

The **File Name** field can be used to specify a file name for the result list export. The file name you specify here is automatically used to save the list but can be changed at any point.

### 6.2.1.5 Loading value

The **Load Value** button can be used to load the image for a measured result you have selected. If no image is available, the following message will appear: **No image available for chosen Test Point.**

You can then remeasure the value loaded, see chapter "Automatic remeasurement", page 60.

### 6.2.1.6 Adjust result list

By default, all kinds of data of a hardness testing is displayed in the result list. In order to show only specific data in a certain order, it is possible to individually adjust the result list.

- Double click on one of the names of the columns in the result list (e.g. hardness value).

The following screen opens:
Under **Displayed columns** set the data that should be contained in the result list.

In order to consider values for the result list they must be selected previously. In order to do so, the fields displayed in the list **Not displayed columns** must be marked and by means of the arrow key moved to the list on the right hand side **Displayed columns**. If the values should not be considered, they can be moved back by means of the arrow key – left.

If required, the values in the list **Displayed columns** can be arranged by means of the up and down arrow keys.

For confirmation of the settings press ✔️.

### 6.2.1.7 Additional information for hardness testings

The result list has 3 additional information fields for each hardness testing. These can be filled with customer specific data (e.g. batch no., etc.) prior to every measurement or subsequently in the result list. Moreover, it is possible to adjust the names of the columns of the information fields.
Double click on one of the names of the columns in the result list (e.g. hardness value).

Change to the Additional test point information button

The following screen opens:
➢ If required, enter the desired column name for each additional information.
➢ Should you wish to use the additional information for your measurement, activate the respective additional information by means of the respective "Apply" button.
➢ If required, activate the "Enter additional information prior to each measurement" button. If this button is activated, additional information can be entered prior to each hardness testing. After pressing the Start Measurement button a screen for filling in the additional data appears for every activated additional information. This data is automatically applied to the result list after the hardness testing.
➢ If you only wish to fill the additional information into the result list, deactivate the "Enter additional information prior to each measurement" button.

➢ For confirmation of the settings press 

➢ In order to fill the additional fields of the result list with data, double click on the respective additional field.

The following screen opens:
After you filled in the fields and pressed "next" the entered data is automatically applied to the result list.

6.2.2 Statistical analysis

6.2.2.1 Trend line

If you select Statistic in the menu bar in the History screen, all values included in the list will be displayed as a Trend line. Limits are shown as red lines. If you wish to map certain measured values, these values must be incorporated in a new list before selecting Statistic.
6.2.2.2 Histogram

You can also display the values as a histogram by selecting the **Histogram** button. The values will be displayed as follows:

The distribution of the values in percent over the hardness range is shown as a histogram.

6.2.2.3 Statistics for values

Under **Values** you can perform statistical analysis of the values selected.
To ensure a correct statistical analysis, note the following points:

- Delete the result list after saving it.
- Make the following settings: test methods, test parameters, hardness limits.

Statistical analysis can only be carried out if you have specified hardness limits.

These settings must not be changed during the statistical analysis. If they are changed, you must delete the relevant value from the result list before the analysis, see “Delete Value”, page 63).

The results then undergo a statistical analysis.

**Number**  
Total number of measurements taken

**Number OK**  
The number of values that lie between the **Hardness Minimum** and **Hardness Maximum** limits

**Number too Soft**  
The number of values that lie below the **Hardness Minimum** limit

**Number too Hard**  
The number of values that lie above the **Hardness Maximum** limit

**Minimum**  
The lowest value recorded

**Maximum**  
The highest value recorded

**Range**  
The difference between the minimum and maximum values

**Mean**  
The arithmetical mean of all values

**Stand. Dev.**  
Standard deviation

**Cp**  
Process conductivity  
\[ Cp = \frac{(\text{Hardness Max} – \text{Hardness Min})}{6 \times \text{Standard Deviation}} \]

**Cpk**  
Process conductivity index  
\[ Cpk = \frac{(\text{Mean} – \text{Hardness Min})}{3 \times \text{Standard Deviation}} \]
\[ Cpk = \frac{(\text{Hardness Max} – \text{Mean})}{3 \times \text{Standard Deviation}} \]
The lower of the two Cpk values is used for the statistical analysis.

6.2.3 Printing report

The report contains ten user fields, which you can define in accordance with your requirements. Further information about definition of the user fields can be found in the chapter "Defining user fields (User Fields)", page 80.

You can select a sample under Pattern.
The sample selected should correspond to your test method, e.g. CHD.

You can only print the report if a USB printer is connected and installed.

- Select Print to print the report.

6.2.4 Exporting to Excel

You can save the result list as an Excel file.
The **Directory** field can be used to specify the location where the file is to be saved. The default directory can be changed.

The **File Name** field can be used to specify a file name for the result list export. The file name you specify here is automatically used in the result list export but can be changed at any point.

The output format for the data export is an Excel-compatible file (csv). csv format is a format for text files, which can be processed in Excel, for example. The file extension csv is short for "comma separated values".

### 6.2.5 Export (optional)

By default, only one manual export to Excel in a .csv format is possible. However, if the option export editor is available "Export Editor", page 100, the result list can be saved in different file formats with user-defined data. Possible file formats are csv/txt/xls/xlsx.
6.3 Configuration and Calibration

Different options are available for configuration and calibration of the machine. The various selections available can be found in the Workflow bar under **Settings**. As special skills are required for certain settings, they will only be displayed if the logged-in user has the appropriate rights. Further information about user rights can be found under "User administration (rights)" page 81.

The **General Settings** menu includes functions that are mainly used for administration of the machine. The **Service** menu includes all functions you require to calibrate the machine. With **Change User** you can open the login screen to log in (possibly with other user rights). **Exit** can be used to close the **ecos** Workflow program and switch to the operating system (Windows XP Embedded).

6.3.1 General Settings

- Select **Settings** in the Workflow bar.

The **General Settings** screen opens. The menu item **General** with the first tab **Region** is active.

To make selections in the menu item **General** you must at least have the user rights "User".

6.3.1.1 Regional settings (General - Region)

On delivery of the machine the unit of measure is set to mm.

- Under **General – Region** select the required unit of measure (mm or inch) in the **Unit** field.

All measurements of length – e.g. coordinates with series measurement – will appear in the unit of measure selected.
Selecting language

On delivery the machine is set to English.

- Select the required language in the **Language** field under **General – Region**.

The screen is immediately displayed in the language selected.

6.3.1.2 Settings

**Automatic image processing (General – Image)**

Automatic image processing is enabled as standard. With automatic image processing measurement is followed by automatic measurement of the indent using the digitized image of the indentation and display of the result. Manual remeasurement is however possible at any time. You can disable the automatic image processing for special applications (e.g. for work pieces with a very rough surface).

**Analysis according to ASTM**

By default, the image processing according to EN ISO standard is performed for Vickers and Knoop measurements. In order to perform the image processing according to ASTM standard, it can be enabled here.
Select **General – image**

With the or buttons you can activate or deactivate the parameter *Automatic image processing*.

If automatic image processing is disabled, you have to measure the indent manually (see chapter "Manual remeasurement" page 60).

**6.3.1.3 Setting dwell time (General - Times)**

Setting the dwell time allows you to specify the length of time during which the test force is to be applied. The value selected here is a "global" parameter for all test methods. Please take note of the relevant norms when adjusting the dwell time.
Under **General – Times** select the dwell time for the test force (in seconds).

### 6.3.1.4 Advanced settings (General – Advanced)

You can set additional parameters here.

**Automatic change to “Position” after measurement in**

If you select this parameter, the Position screen is displayed again automatically following a measurement once the period of time set here has elapsed.

- Select the **button** to activate this parameter.
- Enter the required time in seconds.

**Use-QR codes**

If this parameter is enabled, it is possible to create QR-codes in the "Method" screen or to read them by means of a hand-held scanner in the "Specimen" screen.

- Select the **button** to activate this parameter.

### 6.3.1.5 Displaying information (General - Info)

This screen is only displayed for your information. The measurement counter automatically counts the number of measurements performed on the machine. Here you can also find information about the machine equipment and program versions possibly of interest to the Service team.

- Select **General – Info** to display this information.
6.3.1.6 Viewing and printing error list (General - Error List)

The error list contains hints for the Service team should problems occur when performing measurement on your machine. You can view and print the error list. The error list can only be deleted by the Service team.

- Select **General – error list** to display the error list.
- Select the **Print** button to print the error list.
- Select the **Save as** button to save the error list to a desired path (e.g. USB stick)

6.3.1.7 Serial export

Via the serial interface (RS232) at the back of the machine data can be output in ASCII format after every testing. You can individually adjust this serial output.

- Select **General – Serial export**
Select the Export button to enable the serial output.

Select the button to individually adjust the serial export.

Under General set the required settings for port, baud rate, stop bits, decimal mark and value separator.
Select the Export List button to set up which data should be output.

In order to consider values for the serial output, they must be selected previously. In order to do so, the fields displayed in the list **Not exported values** must be marked and by means of the arrow key moved to the list on the right hand side **Exported values**. If the values should not be considered, they can be moved back by means of the arrow key – left.

If required, the values in the list **Exported values** can be arranged by means of the up and down arrow keys.

For confirmation of the settings press 

6.3.1.8 Export editor (option)

The export editor enables you to automatically or manually export measured data from the program to various file formats (.csv, .txt, .xls, .xlsx). The export editor is described under "Export Editor" on page 100

6.3.1.9 Defining user fields (User Fields)

You can freely define ten user fields to bring the test reports provided into line with your requirements.

To make selections in the menu item **User Fields** you must at least have the user rights "User".

Select the menu item **User Fields** to define the user fields.
Enter your data in the fields **Userfield 1 to Userfield 10**.

Further information about test reports can be found under "Printing report", page 72.

### 6.3.1.10 User administration (rights)

After the machine has been switched on or after a change in user, the ecos Workflow displays the login screen. All users have to log in here with their name and password. Configuring users is generally the responsibility of an administrator, who not only allocates passwords, but also assigns users various user rights. The menu item **User Rights** is used to configure users.

To make selections in the menu item **User Rights** you must at least have the user rights "User".

The **ecos** Workflow is characterized by a role-based utilization concept with three different user levels. The table shows the main user rights per level:

<table>
<thead>
<tr>
<th>Level</th>
<th>User rights</th>
</tr>
</thead>
<tbody>
<tr>
<td>View</td>
<td>View results</td>
</tr>
<tr>
<td>User</td>
<td>All rights as for &quot;View&quot;, perform additional measurements, change general settings (e. g. user administration) and carry out simple calibration</td>
</tr>
<tr>
<td>Cal</td>
<td>All rights as for &quot;User&quot;, additionally perform load calibration</td>
</tr>
</tbody>
</table>

To avoid operating errors due to incorrect machine settings, you should be very careful when assigning user rights. Users with "Cal" rights should be given appropriate training without fail.

Select the menu item **User Rights** to open User Administration.
Add User

- Select the Add User button.
- Enter the name under User Name.
- Select the user level with the rights to be assigned to the user.
- Enter a password for the user.
- Select the OK button.

The new user will be added to the list.

If you are the administrator, pass the login data on to the user. When entering the password, pay attention to the use of lower and upper-case letters. Users can only log in if they enter exactly the same password as you.

Change User
Select the user whose name, user level or password you wish to change.
Select the Change User button.
Amend the relevant data.
Select the OK button.

The data are amended.

Delete User

One user with the relevant name (View, User, Cal) is preconfigured per level. These preconfigured users and the user currently logged in cannot be deleted.

Caution
Delete will be carried out at once without any confirmation prompt!

Select the user you wish to delete.
Select the Delete User button.

The user is deleted immediately.

6.3.1.11 Specifying file locations (File Locations)

To make settings in the menu item File Locations, you must have "User" rights as a minimum.

Your results (XML files), indent images, export files, export lists, QR-codes, samples and autoexport files (optional) are filed in standard directories. In the menu item File Locations you can change the default settings.

Select the menu item File Locations to determine the file locations.
➢ Select the file type whose file location you wish to change.

➢ Select the corresponding button.

➢ Select the file location you require.

The data will in future be stored in the new directory.

6.3.2 Calibration with Configuration Assistant

The machine has already been calibrated and adjusted by the manufacturer or stockist. After transportation and fitting the indenter / lenses, new settings however have to be made with the so-called "configuration assistant". Calibration should only be carried out by trained technicians.

➢ Select Settings in the Workflow bar.

➢ In the menu bar select Service.

The Service screen opens. The menu item Assistant with the first tab Turret is active.

With this button you can show the slider for moving the test unit in the configuration assistant.

With this button you can hide the slider for moving the test unit in the configuration assistant.

To make all selections in the menu item Assistant which are necessary for proper and accurate functioning of the machine you require "Cal" rights. If users have not yet been configured (initial startup), you can log in as user "Cal" (without password). If you have the rights "User", you can adjust the position and focus of lenses and the turret equipment.

6.3.2.1 Equipping turret (Assistant - Turret)

The Turret tab is used to allocate the mechanically inserted indenters and lenses to the turret positions and to inform the machine accordingly. The position numbers are marked on the turret.

➢ Select the Turret tab (if not already active).

The possible positions are displayed depending on the type of turret – manual or motorized turret (optional).

Manual turret
Three positions are available with the manual turret: Position 1 is for the indenter (Vickers or Knoop). Positions 2 and 6 are used for the lenses.

Motorized turret
Six positions are available with the motorized turret: max. two indenters and four lenses or one indenter and five lenses. Position 1 is for the indenter (Vickers or Knoop). Positions 2 to 6 are available to fit an optional second indenter and the lenses.
Advanced Settings and Functions

Example of view with motorized turret

- Select the equipped positions of the turret one by one and use the list to specify which indenter / lens is mechanically inserted in the position.
- Check that what is shown on screen corresponds to the actual allocation of equipment.

Take great care to allocate indenters and lenses correctly or the machine will not otherwise function properly.

6.3.2.2 Checking load calibration (Assistant - Load Calibration)

To check load calibration you will need digital calibration equipment.

- Select the **Load Calibration tab**.

The first sub-menu **Manual** is enabled.
In the fields **Measurement Type** and **Test Method**, select the measurement type and the test method for which you wish to check load calibration.

- Select the button to show the slider for the operation with the test unit.
- Use the slider to move the test unit up.
- Place the load cell of the calibration equipment on the test anvil.

With load calibration, the tip of the indenter touches the load cell of the calibration equipment. You should therefore preferably place a workpiece on the load cell as an intermediate layer and set the display of the calibration equipment to zero.

- Select the **Start**.
- Read off the measured value from the calibration equipment and enter it in the field provided for this purpose (using the unit "g").

- Select the **Apply** button.

The machine will perform measurement with the corrected value. If no error message is displayed, the value is confirmed. Repeat the process if an error message is displayed.

- Repeat these steps for the other measurement types and test methods for which you wish to check load calibration.

The difference in values is calculated automatically and load correction carried out. All load corrections are listed in a table.

**Table**

- Select the sub-menu **Table**.

The table lists all possible loads for the machine and the load corrections applied.
You can change individual values in the table.

- Select the value you wish to correct.
- Select the Change button.

Another screen will open.

Example view for Vickers testings

- Use the virtual keyboard to change the values in the input fields and finish inputting with the Enter key.
- Confirm your change with the OK or with the Apply button.

OK will apply the new value and close the view. Cancel will close the view without the changes. Apply button will apply the new value and leave the display open for further corrections.
6.3.2.3 Adjusting lenses (Assistant - Objective Lenses)

It is necessary to adjust the position, focus and magnification factor for the lenses.

- Select the **Objective Lenses** tab.

On the right-hand side you will see three submenus: **Position**, **Focus** and **Magnification**.

**Adjusting position**

The set screws should be used to adjust the lenses so that they are positioned right above the indentation of the indenter.

- Select the sub-menu **Position** subtab (if not already enabled).
- In the field **Test Method**, select the test method (e.g. HV 1) for which you wish to adjust the setting
- Place a workpiece suitable for the test method on the test anvil.
- Select the **Start Measurement button**.

Measurement will start with the indenter fitted at position 1 of the turret. With a manual turret you are prompted to swivel in the relevant indenters and lenses. With a motorized turret they are swivelled in automatically. The image is shown by the lens with the lowest magnification.

- When prompted, use the set screws on the lens to adjust the position so that the crossline is centered in the indent.
Adjusting focus

- Repeat these steps for the other lenses.

For all lenses it is necessary to adjust the position on the Z-axis at which a sharp image is displayed. This calibration operation has to be carried out by eye.

- Select the sub-menu **Focus subtab**.

- Place a workpiece suitable for the test method on the test anvil.
- Select the **Start Measurement button**.
Measurement will start with the indenter fitted at position 1 of the turret. The image is shown by the lens with the greatest magnification.

- Select the button to show the slider for the operation with the Z-axis.
- Use the slider to focus the image.
- Select the **Save Focus** button.
- Select the **Next Lens** button if you wish to adjust further lenses.

To adjust the magnification factor you require a calibrated test block (micrometer objective).

- Select the **Magnification** submenu.
- Place the test block on the test anvil and align so that the scale is visible.
- In the field **Required Value** enter the required value of the test block for the scale distance you are remeasuring.
The upper buttons and can be used to move the green lines to the right and left. The lower buttons and can be used to rotate the image slightly if required.

- Use these buttons to align the green lines to the scale so you can measure the scale distance entered.

Make sure that the green lines are precisely aligned, e.g. to the left-hand edge of a scale marking.

- Select the Save Magnification Factor button when the green lines are precisely positioned.

The actual dimension is displayed and the magnification factor calculated automatically.

- Select the Next Lens button if you wish to adjust other lenses.

6.3.2.4 Calibrating a second indenter (Assistant – 2. Indenter)

If your machine is fitted with a second indenter (optional with motorized turret), an additional tab appears 2. Indenter.

In the tab 2. Indenter you can adjust the focus of the lenses for the second indenter.

**Adjusting position**

The position of the second indenter must also be adjusted so that the indentation is centered in the image with all lenses. This adjustment calls for a certain amount of experience and should be preferably carried out by the Service team.

To adjust the position you have to create an indentation with the second indenter and use the set screws 1 and 2 to perform alignment to the lenses already adjusted. Here the lenses already adjusted should not be readjusted again.
In the tab **2. Indenter** select the sub-menu **Position**

- Place a workpiece suitable for the test method on the test anvil.
- Select the **Start Measurement button**.

Measurement is performed with the second indenter.

- If necessary: Swivel in the relevant lens. The lens with the lowest magnification is swivelled in automatically.
- Use the set screws 1 and 2 to adjust the second indenter so that the indentation is centered in the image.
- Repeat calibration until you have a precise result.
- If necessary, check the result with the other lenses.

**Adjusting focus**

- Select the **2. Indenter**.
- In the tab **2. Indenter** select the sub-menu **Focus subtab**
Place a workpiece suitable for the test method on the test anvil.
Select the **Start Measurement button**.
Measurement is performed with the second indenter. The image is shown by the lens with the lowest magnification.

Select the **button to show the slider for the operation with the Z-axis.**
Use the slider to focus the image.
Select the **Save Focus button.**

### 6.3.2.5 Releasing optional software modules
You can use the menu item **Program** to release optional software modules without any major effort in terms of subsequent installation.
Further information about optional software modules is available from your authorized dealer or service partner.

Select **Settings** in the Workflow bar.
In the menu bar select **Service**.
The **Service** screen opens.
Select the menu item **Program**.
Enter the product key provided by your dealer on purchase.
Select the **Apply** button.
The login screen opens.

### 6.3.3 User login

The login data are generally available from the administrator. For further information about user administration and user rights see "User administration (rights)", page 81.

- Select **Settings** in the Workflow bar.
- In the menu bar select **Change User**.
The login screen with the current login data opens.

- Enter your user name and password.
During entry, pay attention to the use of lower and upper-case letters.

- Select the **Login** button.

Different user rights are linked to the login data. Further information about user administration and user rights can be found under "User administration (rights)", page 81.

### 6.3.4 Exiting application (Exit)

This function is only available if you are logged in with the user rights "Cal". Further information about user rights can be found under "User administration (rights)", page 81.

- Select **Settings** in the Workflow bar.
- In the menu bar select **Exit**.

You will then access the operating system.
7 Maintenance and Care

Cleaning the machine
Regular cleaning is not required.
If the machine is left idle for a long period of time, ensure that it is protected from dust and dirt, and lightly oil the anvil.

Cleaning the touch screen
Caution
The control unit touch screen must only be cleaned using cleaning products specially designed for TFT/LCD screens.

7.1 Replacing fuses

Caution
Only trained personnel are permitted to replace the fuses.

The fuse cover (1) is located between the main switch (with the green pilot light) and the mains connection.

Caution
Use the main switch to turn the machine off before replacing the fuses.

- Turn the main switch to the OFF position.
- Unplug the power cable.
- Carefully raise the fuse cover on both sides. Use a screwdriver as a lever if necessary.
- Remove the cover and the fuses.
- Carefully remove both fuses from their holders.
- Insert the replacement fuses provided into the fuse holders.
- Slot the fuses in their holders back into the machine.

Replace the fuses using the same steps used to remove them but in reverse.
Ensure that the two fuse clips are pressed together slightly when mounting them in the housing.

- Plug the power cable into the mains connection.
- Turn the main switch to the ON position.

7.2 Circuit diagram

Danger
The machine must be connected to a grounded electrical outlet with a protective conductor contact. Do NOT touch any of the machine's electrical/electronic components.
8 Startup and Fitting with Optional Accessories

Look at the home page of your sales partner if you are interested in additional accessories.

8.1 USB ports

The USB ports (1) are located on the rear of the machine.

Various USB devices can be connected to the USB ports (1):
- USB stick
- USB printer

8.2 Digital micrometer spindles

Instead of the analog micrometer spindles you can also order and install digital micrometer spindles for the cross slide.

Operation is described in the operating instructions for bought-in digital micrometer spindles.
Digital micrometer spindles are installed in exactly the same way as the analogue micrometer spindles, see chapter “Micrometer spindles” page 20.
8.3 Indenters and test methods

Indenters and methods Various indenters can be supplied for the different test methods. The machine can be equipped with a Vickers or a Knoop indenter.

If you wish to fit two indenters, you require a motorized 6-fold turret.

Vickers indenter  
Knoop indenter

Vickers indent  
Knoop indent

Caution Indenters should always be stored in their plastic case when not in use in order to avoid damage.

8.4 Indenter adapter

The additional indenter adapter is intended for operation with 2 indenters on the 6-fold turret.

Caution: The indenter is delivered with a transport lock. This may not be removed prior to installation of the adapter on the turret!
Fasten the adapter with 4 Allen head screws in any desired position of the turret.

After installation of the indenter adapter remove the transport lock by means of an Allen wrench.

### 8.5 Export Editor

The export editor enables you to automatically or manually export measured data from the program to various file formats (.csv, .txt, .xls, .xlsx). In the process data can be individually adjusted for the export.

- Select General – Export editor
If required, select the Create file after each measurement to automatically create a separate file for every value. These are saved in the set file location for autoexport files. The file name is composed of Date/time/file type.

- If required, select the save measured values in common file button to automatically save all values in a common file.
- In order to save the values in a common file, the file name field must be additionally filled in. The file is saved in the set file location for autoexport files. The file name is composed of file name/file type.
- If you do not select any of the two buttons, no automatic data export is performed. The manual data export, however, can be performed as before.

- Select the button to individually adjust the export.
Under General, adjust the required settings for output format, decimal marks and value separators.

Select the Add user fields to manual export button if the user fields should be contained in the manual export.

Select the Export List button to set up which data should be contained in the export. The settings are used both for the manual and the automatic export.

In order to consider values for the export, they must be selected previously. In order to do so, the fields displayed in the list Not exported values must be marked and by means of the arrow key moved to the list on the right hand side Exported values. If the values should not be considered, they can be moved back by means of the arrow key – left.

If required, the values in the list Exported values can be arranged by means of the up and down arrow keys.

For confirmation of the settings press

8.6 Hand-held scanner

The available hand-held scanner serves for the reading of hardness testing data via QR-code.
Connect the hand-held scanner with the machine via USB interface.
9 Messages and Problems

Errors are listed in the error list, see "Viewing and printing error list (General - Error List)", page 78.