Struers
Ensuring Certainty

Duramin Software

Duramin-40 - Duramin-100
Duramin-170 - Duramin-600
Duramin-650

Instruction Manual

Original Instructions

CE

Doc. no.: 16607026-01_A_en
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Table of Contents

1 About this manual

Instruction Manuals

This manual contains an outline of the basic functionality in the Duramin Software. This software manual is to be read together with the instruction manual for the machine, as both contain important information concerning your safety and how to use the machine.

Note
Read the instruction manual carefully before use.

The software can change due to continuous development. We reserve the right to make any necessary modifications in the software without prior notice.

For a more advanced use of the software, visit the **Struers' YouTube channel**: Struers' YouTube channel, or contact your local Struers application representative.

2 Safety

2.1 Intended use

The intended use is the hardness testing of specimens. The machine is to be used in a professional working environment (e.g. a materialographic laboratory or industrial setting). The machine is intended to be used by adult qualified personnel.

The machine must only be operated as described in this manual.

Struers is not responsible for the damage caused by incompetent use (unintentional use).

Only use the machine when it is technically in good working order, and use it according to the intended use, paying attention to the safety and potential hazards referred to in this manual.

Do not use the machine for the following	Testing of materials other than hardness testing of solid materials suitable for materialographic studies. In particular, the machine must not be used for any type of explosive and/or flammable material, or materials which are not stable during heating or pressure.
Model	Duramin Software.

2.2 Safety in the software

When you press the emergency stop

Note
Do not use the emergency stop for operational stop of the machine during normal operation.

- In case of an emergency, press the emergency stop. See the Instruction Manual for the machine you are using.

  When you press the emergency stop, it is detected by the machine. The software shows an emergency stop message:

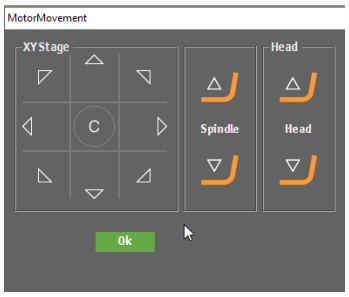
  Emergency stop pressed, release switch for further action

When you release the emergency stop

CAUTION
Before you release the emergency stop, investigate the reason for activating the emergency stop and take any necessary corrective action.

- When you release the emergency stop, the software goes into an emergency state where you can control the machine movements manually.

  If needed, use the controls to bring the machine into a safe state.
- When you click **OK**, the application exits and shuts down.
- To restart the software: See also Starting and exiting the software ►11



2.2.1 Duramin Software safety precautions

Read carefully before use

1. Ignoring this information and mishandling of the equipment can lead to severe bodily injuries and material damage.
2. The operator must read the safety precautions and Instruction Manual, as well as relevant sections of the manuals for any connected equipment and accessories.
3. The machine must be installed in compliance with local safety regulations. All functions on the machine and any connected equipment must be in working order.

4. The machine must be placed on a safe and stable table with an adequate working height. Failure to do so can affect how the machine works and cause the equipment to drop from the table and/or cause accidents and injuries.
5. All safety functions must be intact and in working order. If they are not, they must be replaced or repaired before the machine can be used.
6. Make sure that the actual electrical power supply voltage corresponds to the voltage stated on the type plate of the machine. Failure to do so can result in the machine catching fire.
7. Do not twist or damage the power cables. Damaged power cables can cause fire and/or electric shock.
8. Never block the ventilation. The machine can overheat and it can cause fire.
9. Never try to modify this equipment, as doing so can result in fire and/or electric shock.
10. Never try to disassemble this equipment. Doing so can result in electric shock.
11. Never open any panel on the machine while it is turned on. Doing so can result in electric shock.
12. Do not allow the machine to come into contact with any liquid. The equipment can catch fire if water or any liquid gets inside it. If water or any other liquid gets inside the machine, turn off the power, disconnect the power supply and call technical service.
13. Do not connect or disconnect power with wet hands. Doing so can result in electric shock.
14. If you observe malfunctions or hear unusual noises, stop the machine and call technical service.
15. If two persons work together, make sure they communicate clearly to avoid injuries.
16. Disconnect the machine from the power supply before cleaning it. Failure to do so can result in electric shock.
17. Struers equipment must only be used in connection with and as described in the instruction manual supplied with the equipment.
18. If the equipment is subjected to misuse, incorrect installation, alteration, neglect, accident or incorrect repair, Struers will accept no responsibility for damage to the user or the equipment.
19. Dismantling of any part of the equipment, during service or repair, should always be performed by a qualified technician (electromechanical, electronic, mechanical, pneumatic, etc.).

3 Getting started

3.1 Description

The Duramin software is a tool for setting up and performing manual and automatic hardness testing for common hardness methods, and for handling image detection, manual and automatic focusing, file storing, image storing, report print-outs, turret operation, and a range of advanced functions.

The Duramin software combined with an XY-stage make it possible to run case depth hardness programs, pre-defined testing patterns, and a range of user-defined tasks.

The Duramin software can convert hardness values to 5 different hardness scales complying with international standards (ISO/ASTM).

Test data can be stored and exported as CSV and Q-DAS® formats. Test data can be accessed via USB or network connections.

For detailed information about the Duramin machines, see the Instruction Manual for the specific machine.

3.2 Network connection

To share results and reports, you can connect the hardness tester to a network. Duramin supports both wired and wireless network connections.

If you require network access for results and reports, Struers recommends that you map the **Saved Measurements** folder or the entire D: drive to the network.

- Use the Wi-Fi dongle supplied with your machine to connect to a wireless network.
- Use the Ethernet port on the rear of the machine for a wired network connection.
- If a network connection is available, Struers can provide technical support via remote machine access using the pre-installed TeamViewer QuickSupport.
- If you have a network connection, remote control of test execution can be implemented. This requires a Remote Control Module (Item number 06703007). Contact your Struers representative for further information. See Adding software modules ►9.

3.3 Operating system

The internal PC of the hardness testers is delivered with Microsoft Windows pre-installed.

The Microsoft Windows installation is based on a single-purpose license. This means that you are not allowed to install any other application on the PC.

The Microsoft Windows installation (located on the C: drive) is protected by UWF (Unified Write Filter). This means that all changes made to the C: drive, including the desktop, will be removed every time you restart the system.

Your test results, reports, etc. are as default saved on the D: drive on the PC.

If you have any questions regarding the software, contact Struers Service.

3.4 Adding software modules

Adding an additional software module to the software of your machine may require an additional license.

When ordering a license for a software module, you must provide information about the machine. To find this information, follow these steps:

1. In the **Top menu**, select **Tester** > **Info**. See The Top menu ►12.
2. Select **Export info** to export the info file to the desktop on the hardness tester.
3. Include the info file (info.tar) when you order new software modules.

Available software modules

The following software modules are available. Depending on the type or model of the hardness tester, some of these modules are installed by default. Contact your Struers representative for further information.

Item no.	Name	Description
06703001	**Weld Measurement Module**	Dedicated Weld Hardness measurement module for defining patterns according to base material, HAZ and Weld zone.
06703002	**Fracture Toughness (Kc) Module**	Module for measuring Fracture Toughness Kic using Nihara's formulation.
06703003	**Cartridge Testing Module**	Module for testing shells/casings according to ammunition industry demands.
06703004	**CHD Testing Module**	CHD test module for machines with automatic stages. Enables CHD, SHD and NHD testing patterns.
06703005	**Test Point Editor**	Module for defining and setting up basic test patterns (line, square, zigzag, triangle) on testers with a motorized stage.
06703006	**(De)-carb test acc.to ISO898-1**	Module for detection and analysis of fastener threads in order to find appropriate test locations for a three-point ISO 898-1 pattern.
06703007	**Remote control module**	Module for enabling remote control of the hardness tester using TCP/IP.
06703008	**Automatic edge detection**	Module for edge recognition for creating test pattern parallel to the specimen edge.
06703009	**Automatic contour scanning**	Module for scanning the full contour of the specimen.
06703010	**Automatic mapping module**	Module for 2D or 3D hardness mapping over areas or scanned contours.
06703012	**Q-DAS certif. Connect.Protocol**	Module for exporting test results in QDAS format (Aq def or Dfd/Dfx).
06703013	**Duramin utility software**	Module for exporting test results, scale and time stamp directly into Microsoft Excel on an external PC.
06703015	**CHD Test.Module, Man. XY-stage**	Module for enabling CHD, SHD, NHD patterns on manual stages.
06703016	**Test Point Editor, Duramin-40M**	Module for creating test point patterns (includes +CHD, SHD, NHD) on manual stages.
06703017	**Drawing and Measurement Module**	Module for annotations and manual measurements for simple non-hardness measurements (distances and angles).
06703018	**Image Stitching Module**	Module for scanning and stitching for a full stage overview or detailed images of larger areas of a test specimen.

Item no.	Name	Description
06703019	**Force/Depth/Time Diagram**	Module for showing the force/depth/time diagram for an indentation (only for testers with Rockwell capabilities).
06703021	**Tap screw meas. (ISO2702)**	Module for fully automatic testing according to ISO 2702 for screw thread measurement of (de)-carbonized parts.

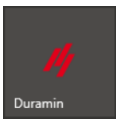
4 Setting up the software the first time

4.1 Starting and exiting the software

When you switch on the machine, the software starts up automatically.

Starting the software manually

1. To start up the software, click the Duramin software icon located in the Windows task bar, or in the Windows **Start** menu.



2. Enter **Username** and **Password**. See (**A**).

> **Note**
> The default credentials are:
> **Username**: admin (not case-sensitive)
> **Password**: Leave this field empty.

3. Click **OK**.

   The following message is shown:

   Tester starts initializing, keep hands away

4. Click **OK** to start the initialization process. The machine starts moving to find its reference positions.

Exiting the software

1. In the **Top** menu, select **System** > **Exit**. See The Top menu ▶12.
2. Wait for the software to exit.

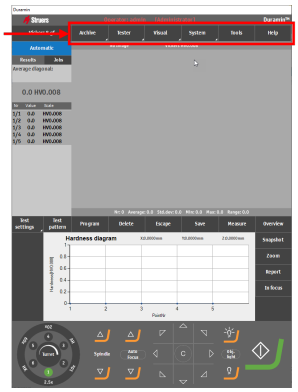
Switching off the machine

1. Exit the software.
2. To shut down the PC, click the **Shut down** icon on the Windows task bar, or select **Shut down** from the Windows **Start** menu.

3. Wait for the PC to power off. When the PC is powered off, **No Signal** is shown on the display.
4. Switch off the machine using the power switch on the machine.

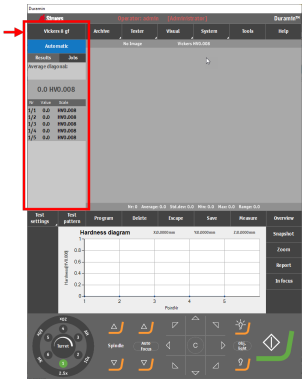
4.2 Navigating the software

4.2.1 The Top menu



Function	Description
Archive	Open and save archives.
Tester	Hardness tester settings.
Visual	Visual settings of the hardness tester.
System	General system settings.
Tools	Distance and angle measurement tools. (Licensed option).
Help	Instruction manual and access to Service mode.

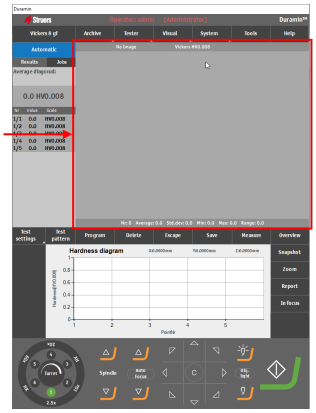
4.2.2 Test method



Function	Description
Method selection	Select the desired method, scale and load for the test.
Automatic/Manual	Select automatic or manual testing.
Results	Show test results.
Jobs	Show a list of jobs. See Jobs ►24

4.2.3 The main view area

The main view area shows either an objective view or an overview view.



Objective view

This area shows the surface of the specimen as seen through the objective selected on the dashboard.

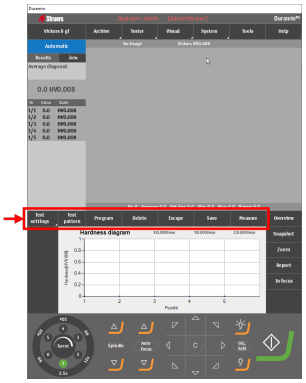
Use this view to bring the specimen into focus, i.e. to bring the specimen into the correct distance and position from the indenter.

Overview view

In the Overview view, the workpiece is visible through the overview camera (Licensed option).

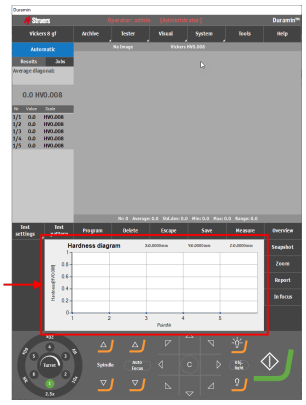
Use this option for a macro view of the specimen.

4.2.4 Test tools



Function	Description
Test settings	Adjust the test settings.
Test pattern	Select and edit test patterns.
Program	View and save Programs (testing templates). See Programs ►23
Delete	Delete measurements.
Escape	Close measurement controls/zoom controls.
Save	Save a measurement.
Measure	Start an optical measurement.

4.2.5 Diagram

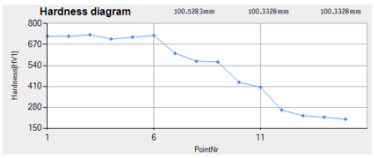


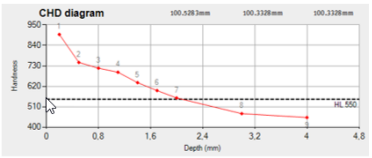
The diagram area shows a visual representation of the test results.

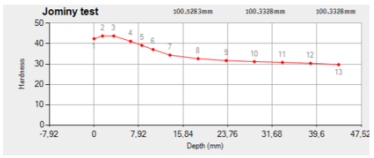
You can select from a series of predefined diagrams:

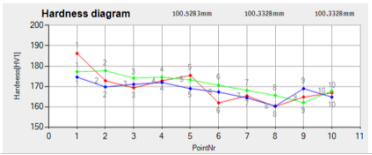
- Hardness diagram
- Case depth diagram
- Jominy diagram
- Multiple lines diagram
- Force-depth diagram
- Color mapping diagram

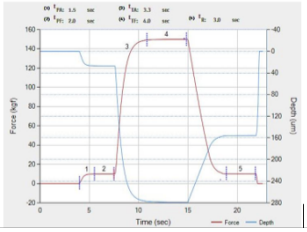
Diagram examples

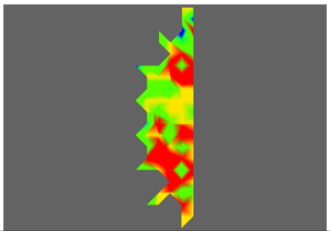




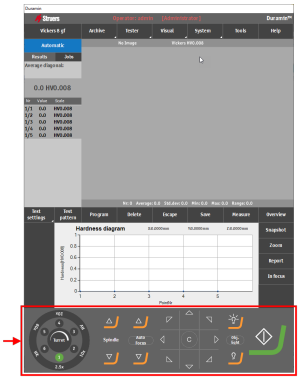








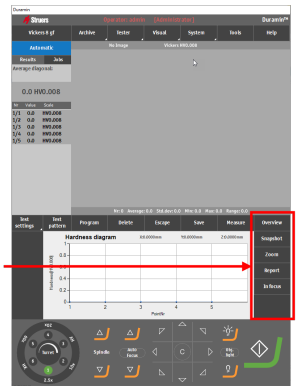
4.2.6 Dashboard



Use the dashboard to select the active turret position (indenter/objective), control spindle movement, motorized stage movement, light settings and to start and stop a test.

See Dashboard ▶22

4.2.7 Optical controls and reporting menu



Function	Description
Overview	Switch the active camera view from objective camera to overview camera and back again.
Snapshot	Take a picture of the live view or captured image.
Zoom	Open the zoom controls.
Report	Create a report, edit report templates, or export results.
In focus	Manual **In focus** button.

4.2.8 Shortcuts

You can use a range of shortcuts to access several functions.

Focus

Shortcut	Function	Application
Shift + **Autofocus**	• Only visual auto-focus (no touch focus). Applies only to machines with a descending turret.	GUI
Mouse scroll wheel	• Fine adjustment of focus for the objective camera.	Place the mouse cursor over the overview camera view.
Mouse scroll wheel	• Fine adjustment of focus for the overview camera.	Place the mouse cursor over the overview camera view.

Pattern

Shortcut	Functionality	Application
Ctrl + left-click	• Add point to a custom point pattern. Add points directly in the editor or in the live view (Objective, Overview).	Pattern editor/Live view
Ctrl + Left-click on blue line	• Add a point between existing custom points. Add points directly in the editor or in the live view (Objective, Overview).	Pattern editor/Live view
Right-click	• Delete a custom point. Delete points directly in the editor or on the live view (Objective, Overview).	Pattern editor/Live view
Shift + Left-click + Drag	• Move the entire pattern. Click anywhere on the pattern itself.	Pattern editor/Live view
Left-click on point + drag	• Move point within custom points pattern. Applies to custom points only.	Pattern editor/ Live view
Shift + Ctrl + drag	• Zoom to selected area. Zoom will be applied for the area contained in the created box.	Pattern editor
Left-click + scroll wheel	• Zoom to a specific point. Zoom will be centered around the selected point.	Pattern editor

Settings

Shortcut	Functionality	Application
F12	• Hide/show the mouse cursor.	GUI
Click the mouse scroll wheel	• Toggle between the red dot/green crosshairs measuring point. The red dot/green crosshairs is shown in the zoom window of the measuring window.	GUI

4.3 The System menu

Use the **System** menu to configure the software.

Function	Description
Language	Select the language you wish to use. See Setting the language ▶17
User levels	Manage user levels. See also Managing user levels ▶17
Users	Manage users. See also Managing users ▶19.
Password	Create or change passwords.
Logout	Log out of the software.
Settings	Customize selected settings.
Exit	Exit the software and return to Windows.

4.3.1 Setting the language

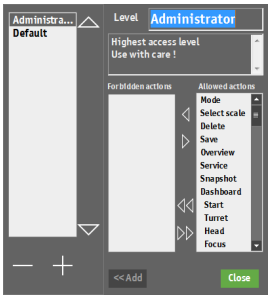
1. In the **Top menu**, select **System** > **Language**.
2. Select the language you wish to use in the software. The following languages are available as default:
   - English
   - French
   - German
   - Spanish
   - Chinese
   - Japanese
3. Click **Select** to close the dialog box.

Hint
The on-screen keyboard changes according to the selected language.

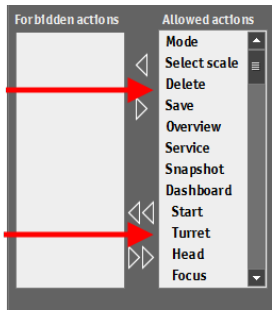
4.3.2 Managing user levels

Creating user levels

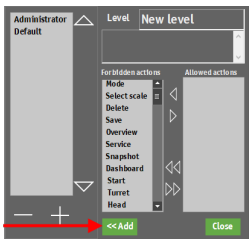
1. In the **Top menu**, select **System** > **User levels**



2. Click the + (Plus) button.
3. Enter the name of the user level.
4. Select allowed actions and forbidden actions:
   – Click the single arrows to move single actions as needed to and from the **Forbidden actions** and **Allowed actions** columns.
   – Click the double arrows to move all actions to the other column.

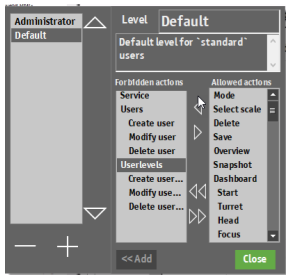


5. Add the new user to the list: Click **Add**.
6. Click **Close** to save changes and exit the dialog.



Editing user levels

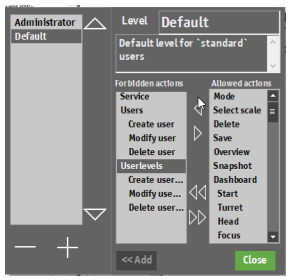
1. In the **Top menu**, select **System** > **User levels**.
2. Select the user level you wish to edit.
3. Select allowed actions and forbidden actions:
   – Click the single arrows to move single actions as needed to and from the **Forbidden actions** and **Allowed actions** columns.
   – Click the double arrows to move all actions to the other column.
4. Click **Close** to save changes and exit the dialog



Deleting user levels

Hint
You can only delete unused user levels.

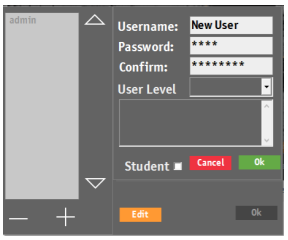
1. In the **Top menu**, select **System** > **User levels**.
2. Select the user level you wish to delete.
3. Click the - (Minus) button.
4. Click **Yes** to delete the selected user level.
5. Click **Close** to save changes and exit the dialog.



4.3.3 Managing users

Creating users

1. In the **Top menu**, select **System** > **Users**.Click the + (Plus) button.
2. Enter the user name and password for the new user.
3. Select the user level from the drop-down menu.
4. Add the new user to the list: Click **OK**.
5. Click **OK** to save changes and exit the dialog.



Editing users

1. In the **Top menu**, select **System** > **Users**.
2. Select the user you wish to edit and click **Edit**.
3. Click **OK** when you have edited the user information.
4. Click **OK** to save changes and exit the dialog.

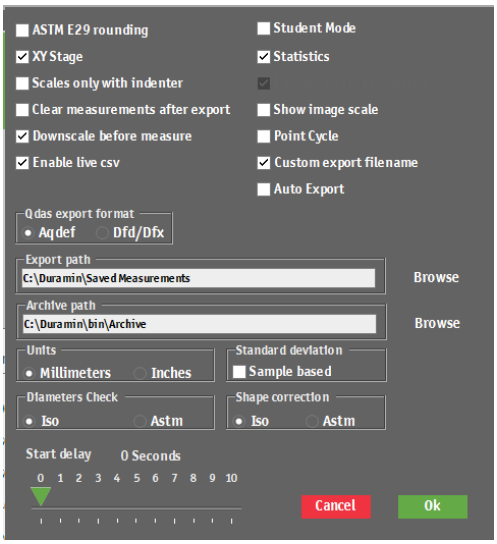
Deleting users

Note
You cannot delete the **Admin** user.

1. In the **Top menu**, select **System** > **Users**.
2. Select the user you wish to delete.
3. Click the - (Minus) button.
4. Click **Yes** in the pop-up to delete the selected user.
5. Click **OK** to save changes and exit the dialog.

4.3.4 Settings

- In the **Top menu**, select **System** > **Settings**.



Setting	Description
ASTM E29 rounding	The hardness values are rounded based on the method described in ASTM E29.
XY-stage	Enable this item, if the machine is equipped with a motorized XY-stage.
Scales only with indenter	Only methods using the installed indenters will be shown in the **Method selection** menu.
Clear measurements after export	Measurements are automatically cleared after export.
Enable live CSV	Export measurements to the file **LiveExport** as soon as the individual measurement is completed. The file is located in the specified export path.
Student mode	No hardness results are shown, only the measured diagonals. For educational purposes.
Statistics	Display the measurement statistics on the objective camera view.
Show image scale	Add an image scale on both the live image and on the measurement image.
Point cycle	Enable the use of the keyboard arrow keys to quickly jump from one point to another in a pattern.
Custom export filename	Enable the selection of a custom file name when test results are exported.
Auto export	Export the results automatically to the export path when the test is completed.
QDAS export format	Select the QDAS formats you wish to use.
Export path	Define the path where you wish to save exported data.

Setting	Description
Archive path	Define the path where you wish to save archived files.
Units	Select the unit of measurement you wish to use.
Diameters check	Diameters are checked according to ISO or ASTM standards.
Standard deviation	A standard deviation is calculated as specimen standard deviation.
Shape correction	Shapes are corrected according to ISO or ASTM standards.
Start delay	Define how many seconds the start must be delayed before testing starts.

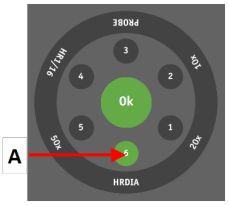
4.4 Mounting an indenter

For detailed instructions on how to mount an indenter, see the Instruction Manual for the specific machine.

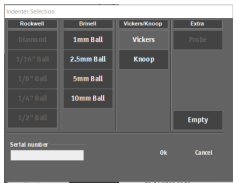
When you have mounted the indenter, follow these steps:

Checking the indenter length

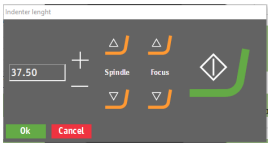
1. Start the Duramin software.
2. Focus on a smooth test specimen using the highest magnification available.
3. Select **Tester** > **Turret configuration**.
4. In the **Turret animation** dialog, select the desired indenter position, for instance (**A**).



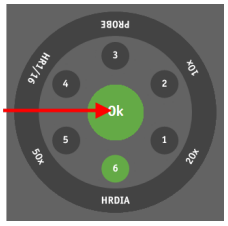
5. Select the new indenter type in the **Indenter selection** menu.
6. Click **OK**.



7. Click the **Start** button and wait until the procedure is finished.
8. In the **Indenter length** dialog, click **OK**.



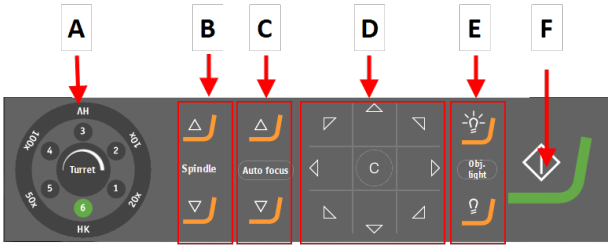
9. Click **OK** to finalize the procedure.



5 Basic concepts

5.1 Dashboard

Use the controls on the dashboard to control the movements and lighting of the hardness tester.



A Turret controls
Select the objective and indenter.
B Spindle up/spindle down
Move the spindle up or down in large steps.
C Spindle up/spindle down
Move the spindle up or down in small steps.
Autofocus
Make the machine focus automatically on the specimen.
D Arrow buttons
Move the stage in all directions.
C: Click and hold this button to return to the center position.
E Select the light source and intensity.
F Click the **Start** button to start the test. This button changes to **Stop** when the test is running.

5.2 Camera sources and views

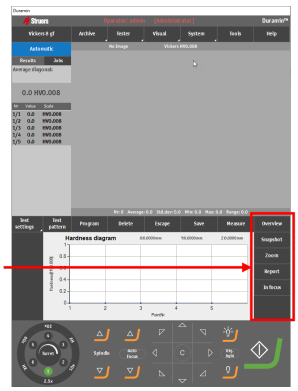
Struers hardness testers are equipped with an objective camera. Some hardness testers are also equipped with an overview camera.

- **Objective view**: The specimen is visible through the selected objective. Select the objective camera view for both live and captured measurement images.
- **Overview view** (option): The specimen is visible through the overview camera. This is a macro view which, in most cases, shows the entire specimen, or a large part of it. Select this view to easily find the correct position to perform the measurements.

Switching between camera views

1. Make sure that the specimen is in focus in the objective view.
2. In the **Optical controls and reporting** menu, select **Overview** to change from the objective camera to the overview camera.
3. If needed, select **Overview** to return to the objective camera.

See Optical controls and reporting menu ►15



5.3 Programs

A program is a template for testing that contains all test settings (objective settings, patterns, light settings, etc.) A job is an instance of a program.

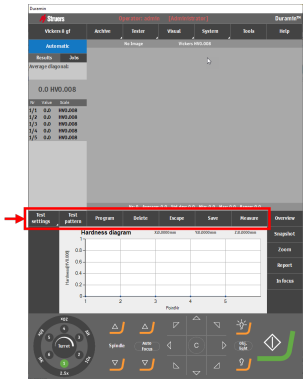
Note
You can save up to 70 programs in a folder.

Creating a program

If you perform a series of tests frequently, you can save those tests and their settings as programs.

If there are already jobs active in the software, you can use the program to create a new job. If not, the active job is overwritten.

Struers recommends that you start by creating a job, and then save it as a program. See Jobs ►24.



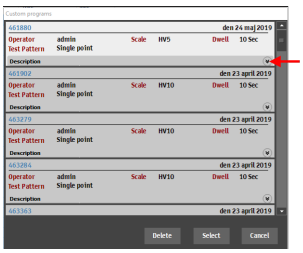
1. Enable the check box indicating the job you wish to use to create a program.
2. In the **Test tools** menu, select **Program** menu > **Save**.
3. Select **OK** to save the program.

   If the program already exists, you will be prompted to overwrite or cancel.

Loading a program

1. In the **Test tools** menu, select **Program** > **View** to open the program list.
2. Use the scroll bar on the right side of the dialog box to navigate the list.
3. Click the double arrow on the program to see default objective and descriptions.
4. Select the program you wish to load and click **Select**.
5. Click **Yes** in the dialog to create a job based on the selected program.

   The job is added to the job list.



Deleting a program

1. In the **Test tools** menu, select **Program**.
2. Select **View** to view the program list.

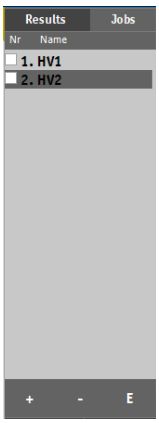
3. Use the scroll bar on the right side of the dialog box to navigate the list.
4. Select the program you wish to delete and click **Delete**.
5. Select **Yes** to delete the program.

5.4 Jobs

A job contains all settings needed to perform the measurements. You can create a job from a program, or create a completely new job. See Programs ►23.

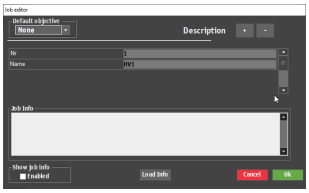
Creating a job

1. In the **Test method** panel, select the test method you wish to use. See Method selection ►26.
2. In the **Test method** panel, select the **Jobs** tab. The job list is shown.



3. In the job list, click the + (Plus) button.

4. In the **Default objective** drop-down menu, enter the objective you wish to use.
5. If needed, change the job name and add descriptions.



   – Click the + (Plus) button to add a description.

   – Click the - (Minus) button to delete the selected description.

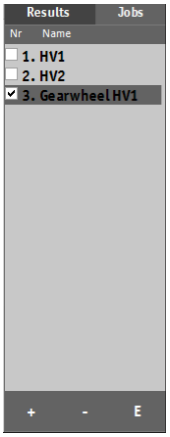
6. If needed, add additional information in the text field **Job Info**.
7. Select **Load Info** to load the contents of a text file to the **Job Info** field.
8. Enable **Show job info** to show all job descriptions before the job is started.
9. Click **OK** to save the changes.
10. The job is now created, and you can continue defining the test settings (objective settings, patterns, light settings, etc.) which will be saved in the job. See Testing ►34.
11. If you use the job frequently, save it as a program. See Programs ►23.

Deleting a job

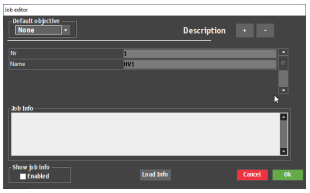
1. In the job list, enable the check boxes of the jobs you wish to delete.
2. Click the - (Minus) button. 
3. Click **Yes** to confirm that you wish to delete the selected jobs.

Editing a job

1. In the job list, check mark the job you wish to edit.
2. Click **E** to edit the job.



3. Edit the job, as needed.



4. Click the + (Plus) button to add a description. 
5. Click the - (Minus) button to delete the selected description. 
6. If needed, add additional information in the text field **Job Info**.
7. Select **Load Info** to load the contents of a text file to the **Job Info** field.
8. Enable **Show job info** to show all job descriptions before the job is started.
9. Click **OK** to save the changes and exit the dialog.

5.5 Snapshots

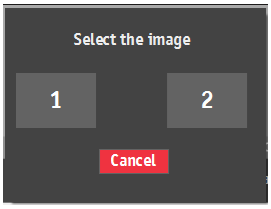
Use the **Snapshot** function to capture an image from the objective camera or the overview camera. A snapshot is a picture from a live or captured image.

Snapshots are saved within the active Job.

- In the **Optical controls and reporting** menu, select **Snapshot**. See Optical controls and reporting menu ►15.

Creating a snapshot

1. In the **Optical controls and reporting** menu, select **Report** > **Snapshot**.
   - If you are working with a single monitor, the snapshot of the live view is automatically captured
   - If you are working with two monitors, you can select which view to capture. 1 = objective view, 2 = overview view



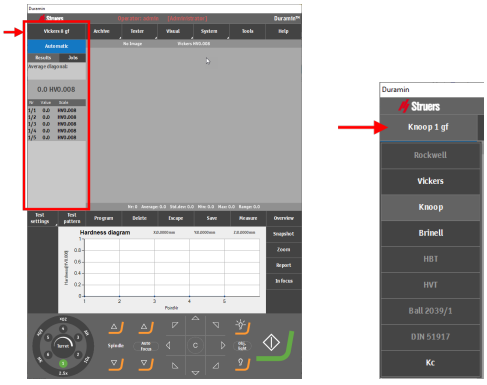
Managing snapshots

1. In the **Optical controls and reporting** menu, select **Report** > **Snapshot**.
2. To select snapshots to be included in the report and delete unwanted snapshots, select **Snapshot**.

5.6 Method selection

Note
The available methods depend on the machine, model, indenters and the software modules installed.

1. In the **Test method** panel, click on the method field. The method list is shown.
2. Select the method you wish to use.
3. In the selected method window, select the scale you wish to use.



5.7 Archives

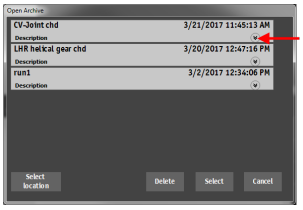
Use the **Archive** function to save test results, snapshots and test settings for later review.

You can view, save and delete an archive.

Note
You can save up to 70 Archives in one folder.

Opening an archive

Note
You cannot perform a test while an archive is open.



1. In the **Archive** menu, select **View**.

   The archive list is shown.
2. If needed, click the double arrow on the archive entry to see more details (operator, method, number of measurements, etc.).
3. Click **Select** to open the archive.

   The **Archive** button flashes to indicate that an archive is open.
4. You can manually review the results from the archive, and export and report them as needed.

Saving an archive

You can save measurements in an archive.

Note
You cannot save a changed archive under the same name.

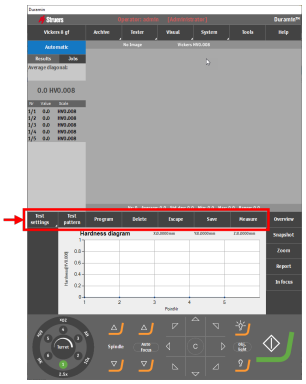
1. In the **Archive** menu, select **Save**.
2. Enter a name and, if needed, a description for the archive.
3. If needed, browse to select another folder.
4. Click **OK** to save the archive.

5.8 Test patterns

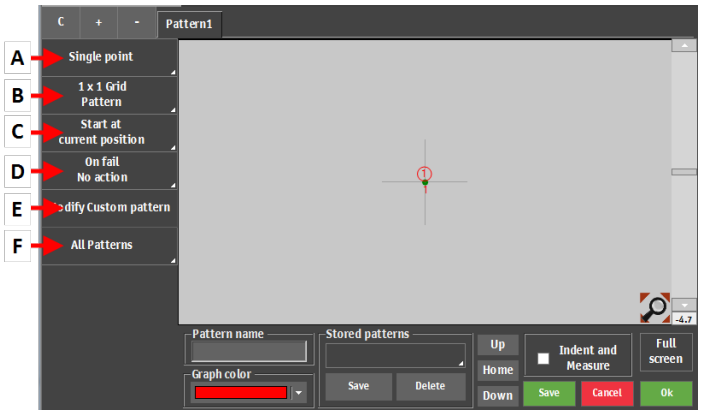
Note
The **Test pattern** feature (option) is available if it is supported by the hardness tester, and if the module has been added to the software.

From the **Test pattern** menu you can access the **Test pattern** editor where you can create test patterns from a range of predefined patterns.

1. In the **Test tools** menu, select **Test pattern**.



The **Test pattern** editor is shown.



	Function	Description
A	**Pattern type**	Select the required type of pattern.
B	**Point settings**	Define the number of points in a pattern.
C	**Starting point settings**	Select the starting point for the pattern.
D	**On fail settings**	Define what should happen if a measurement is outside the set limits.
E	**Custom pattern settings**	Create a custom pattern. You can configure the position of the points more freely.
F	**General settings**	Adjust settings that apply to all patterns.

Pattern types

You can select several pattern types. For more information on how to work with each pattern type, see Testing ▶34.

5.8.1 General pattern settings

Managing patterns

- To add another pattern, click the + (Plus) button.

- To delete the selected description, click the - (Minus) button.

- To create a copy of the selected pattern, click the **C** button.

Naming a pattern

- Click the pattern name field and enter the name of the pattern.

Saving a pattern

1. Highlight the pattern you wish to save.
2. Click **Save** in the **Stored patterns** menu.
3. Enter a name for the pattern.
4. Select **OK**.

Loading a pattern

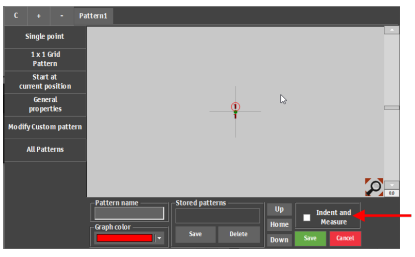
1. Click **Test patterns** in the **Stored patterns** menu.
2. Select the pattern you wish to load.
3. Click **Select**.

Deleting a pattern

1. Click **Test patterns** in the **Stored patterns** menu.
2. Select the pattern you wish to delete.
3. Click **Delete**.
4. Click **OK**.

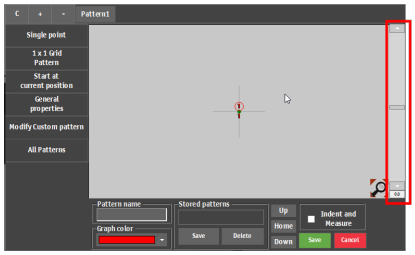
Indent and measure

- If the **Indent and Measure** check box is disabled, all indents are created, and subsequently measured.
- If the **Indent and Measure** check box is enabled, each indentation will be made and measured before proceeding to the next. This option slows down the process, since the machine switches between the objective and the indenter between each test point.



Rotating a pattern

You can rotate a pattern using the scroll bar on the left side of the **Pattern** editor. To obtain a specific rotation angle, enter the value directly in the field under the scroll bar.



- To add another pattern, click the + (Plus) button.

- To delete the selected description, click the - (Minus) button.

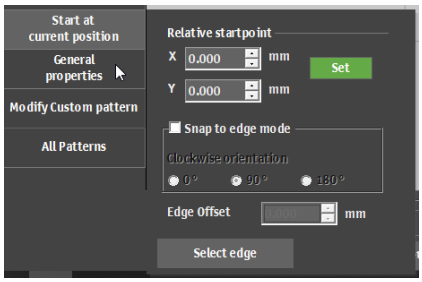
- To create a copy of the selected pattern, click the **C** button.

5.8.2 Common settings

Some settings apply to most pattern types.

Defining the starting point

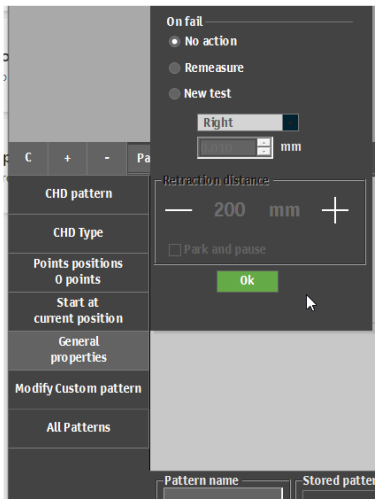
1. Select **Start at current position**.
2. Define the starting point for the pattern.
   – Start at the specific **X** and **Y** coordinates, or select an edge as the starting point.



   – If needed, configure a starting point offset from the selected edge.

> **Note**
> Set the offset before selecting the edge.

Defining general properties



1. Select **General properties**.
2. In the **On fail** dialog, select the action to be taken, if a measurement fails, i.e. exceeds the defined limits.
   - **No action**
   - **Remeasure**
     The machine moves the XY-stage slightly to create another camera angle, and performs a new measurement.
   - **New test**
     Make a new indent on a different location. Select position and distance.

Modifying custom patterns

1. Select **Modify Custom pattern**.
2. Save the created pattern as a custom pattern. This allows you to move freely move around the test points, and add additional test points without the constraints of predefined patterns, such as CHD.

> **Note**
> If you convert a pattern to custom points, the specific calculation of the pattern will be lost, i.e. CHD Depth limit.

Defining general properties for all patterns

1. Select **All patterns**.
2. To define the general properties and the shape of all patterns, select **General properties**.
3. Set the values for the following:
   - Global starting point
   - Retraction distance
   - Working distance
4. To define the shape of all patterns, select **Shape**.
5. Scan a contour and use it across multiple patterns (Licensed option).

5.9 Adjusting light and contrast

Use the light source buttons on the dashboard to select the light source and adjust the light intensity.

Selecting the light source

1. Click the **Obj. light** button to toggle between the following types of light source:

   – **Obj. light**

     Direct light aims at the specimen through the objective.

   – **Ring light**

     Ambient light lights up the specimen.

   – **Overview**

     Ambient light lights up the stage (only available when the overview camera is active.)

Adjusting the light intensity

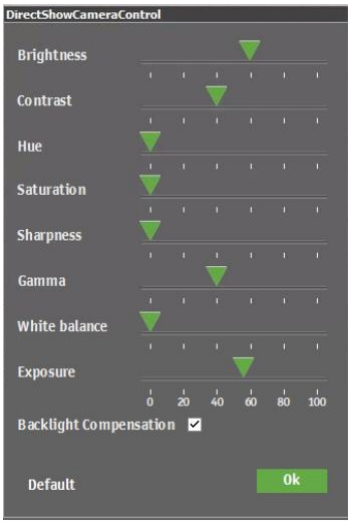
1. Click the buttons to increase or decrease the intensity of the light for the selected light source.

Adjusting the contrast and brightness for the objective view

1. In the **Top menu**, select **Visual** > **Contrast**.
2. Use the green slider to set the desired contrast and brightness.
3. Select **Automatic** to adjust contrast and brightness automatically.
4. Click **OK** to save changes and exit the dialog.
   – If needed, select **Reset** to return to the default settings.

Adjusting the contrast for the overview view

1. In the **Top menu**, select **Visual** > **Contrast**.
2. Use the green slider to adjust the desired contrast and other camera settings.
3. Click **Close** to save changes and exit the dialog.
   – If needed, select **Reset** to return to the default settings.



5.10 Autofocus

Optical autofocus

Optical autofocus uses the camera image to find the optimal focus. The optical autofocus only works when you are close to the focus plane.

Touch focus

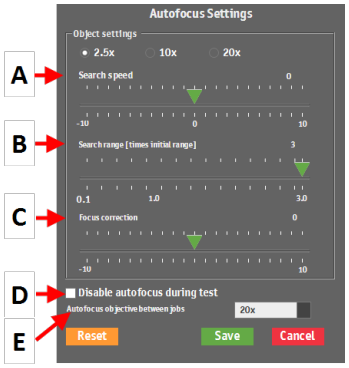
Machines with a descending turret can perform touch focus. This function uses the 10x objective or a probe to touch the surface, and automatically calculates the focus distance. Touch focus is automatically followed by optical autofocus.

Autofocus Settings

Each objective has its own autofocus settings.

- Select the objective you wish to configure in the turret control.

  The machine applies autofocus by moving the table up and down in steps over a certain range. If the machine has a descending turret, the focus is adjusted by moving the turret up and down.



	Function	Description
A	**Search speed**	Define the size of the step the z-axis moves to find focus. Lower values increase accuracy, but increase time to find focus.
B	**Search range**	Limit the focus search range of the **z**-axis. If the best focus is found before the end of the range, the search stops.
C	**Focus correction**	Use this setting if there is a static offset between the actual focus and the focus defined by the **Autofocus** function.
D	**Disable autofocus during test**	Disable autofocus. Only recommended for single indents and low magnification objectives.
E	**Autofocus objective between jobs**	Select the objective to be used for an initial autofocus between each job that is executed.

6 Testing

6.1 Performing simple tests

You can carry out single indents with simple, geometrical patterns.

1. Place the specimen on the stage.
2. Select the test method and the scale you wish to use
3. Select the objective.
4. Focus on the specimen surface.
5. To apply a pattern to the hardness test, select **Test pattern**.
6. If needed, select the pattern type. See Test patterns ►27.
7. Select the settings for the selected pattern type. SeeCommon settings ►30
8. When the test setup is completed, select **Start**.

   When the test is finished, the hardness values are shown in the result list.

9. Save or export the test results. See Working with test results ►59

6.2 CHD (Case Hardening Depth) tests

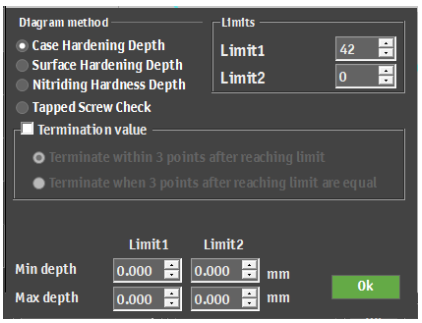
Preparing for testing

1. Create a job. See Jobs ►24.

Creating the pattern

1. In the **Test tools** menu, select **Test pattern** > **CHD pattern**.
2. Select a CHD type: **Case Hardening Depth**, **Surface Hardening Depth**, or **Nitriding Hardness Depth**.

   In this example, **Case Hardening Depth** is used.

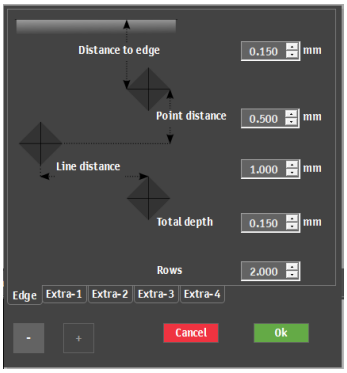


3. In the **Limit** drop-down list, select the desired hardness limit.
4. In the **Termination values** field, select termination values to define when the hardness tester stops.
   - **Terminate within 3 points after reaching limit**

     The hardness tester stops after a maximum of 3 indents, when the limit that was set in **Limit1** has been reached.
   - **Terminate when 3 points after reaching limit are equal**

     The hardness tester stops when the hardness values no longer change (+/- 3%) within a range of 3 indents.
5. Set the desired depth limits (**Min depth**/**Max depth**).
6. Select **OK**

Customizing the pattern



1. In the **Test pattern** editor, select **Points positions**.

   In the **Points positions** dialog, the pattern is created based on a number of parameters.

   – **Distance to edge**
   The distance from the starting point to the first indent.

   – **Point distance**
   The vertical distance between each point.

   – **Line distance**
   The horizontal distance between each line in the pattern.

   – **Total depth**
   Determines the total depth of the pattern, and accordingly how many points the pattern contains.

   – **Rows**
   Select the number of rows the pattern should consist of.

   These settings are applied to each section of the pattern.

2. If needed, click the + (Plus) button to add more sections to the pattern.

3. Click **OK** to create the pattern.

   The pattern is shown in the Pattern editor and on the live camera view.

   Hint
   Select the magnifier icon to see all points in the pattern.

4. Select **Save** to save the settings.

Selecting the starting point

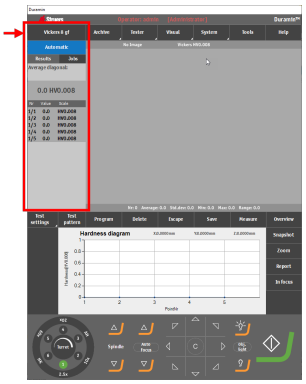
1. In the **Test pattern** menu, click **Start at current position**.
2. To select the starting position, click **Select edge**.
3. Click the desired starting point on the objective view or the overview view. This places the pattern starting point at the selected location.

6.2.1 Performing the test

To start the test, select **Start**.

The test results are shown in the **Diagram** area. See Diagram ►14.

6.2.2 Viewing the results



1. In the **Test method** panel, select **Results**.
2. Click once on each result to see a captured image of each indent.
3. Hover with the cursor over each corner of the indent to make sure that all corners have been detected correctly.
4. If a corner has not been detected correctly, click on it and manually reposition the measuring line. You can use the magnified view in the upper left corner to precisely place the measuring line.
5. To save the results, click **Save**.
6. In the **Test method** panel, click the **Results** tab to see results.
   - Click a result to see the captured image.
   - Double-click a results to see a live view of the selected measurement.

Hint
Use the left and right arrow keys on the keyboard to toggle from one indent to the next (live view only).

7. Save the test results: In the **Test tools** panel, select **Archive** > **Save**.

6.2.3 Reporting test results

The test results can be included in a report.

1. To include snapshots in the report, select **Report** > **SnapshotsSnapshot**. See Snapshots ►25.
2. To print the report, select **Report** > **Print**.
3. To export measurement results into CSV-format, select **Report** > Export.
4. To customize report templates, select **Report** > **Template Editor**. See Report templates ►59

6.3 Welding tests

Note
Before starting the test, make sure that the welded specimen is correctly polished and etched.

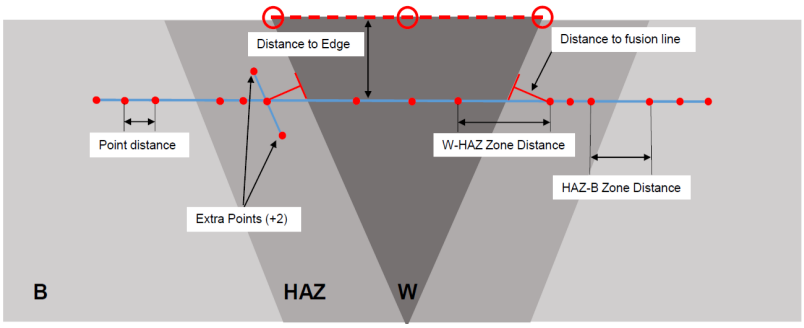
Preparing for testing

1. Create a job.See Jobs ►24.

Note
Struers recommends that you select the lowest magnification available in order to clearly see the fusion lines and the Heat Affected Zone (HAZ) on the specimen.

Creating the pattern

1. In the **Test tools** menu, select **Test pattern**.
2. Select **Welding**.



The indentation pattern is divided in two zones.

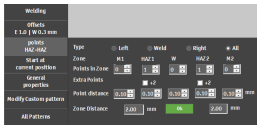
The indentations placed in **M1** and **M2** are placed on the left and the right base materials.

The indentations placed in **HAZ1** and **HAZ2** are placed on the left and right heat affected zones.

The indentations in the weld zone will be placed in the welded zone on the specimen.

3. In the **Test pattern** editor, select **Offset**.

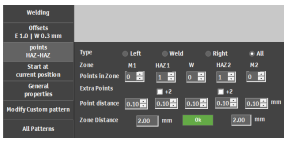
4. Adjust the distance to the edge and fusion line.
5. In the **Test pattern** editor, select **Points HAZ-HAZ**.



6. If needed, adjust the settings.
7. Drag the three dashed segments to the edge of the specimen.
8. Place the first line (to the left on the image) to the edge on the left side of the base material and heat affected zone.
9. Place the second line on top of the welded area.
10. Place the third line on the right side of the specimen.
11. Click the magnifier icon to get a full view of the pattern.

12. Drag the **HAZ1** and **HAZ2** indentations inside the two heat affected zones.
13. To adjust the position of the red dashed lines, double-click on any point on the line.
14. To align the fusion point, double-click on it and place it on the fusion line.
15. Repeat on both right and left sides.

16. If needed, add two extra points. In the **Test pattern** editor, select **Points HAZ-HAZ**.



17. In the **Extra points** setting, enable **+2**.
18. To reposition the points, drag them so that they have the same distance to the fusion line.
19. Click **Save**.
20. To continue, see Performing the test ▶56.

6.3.1 Performing the test

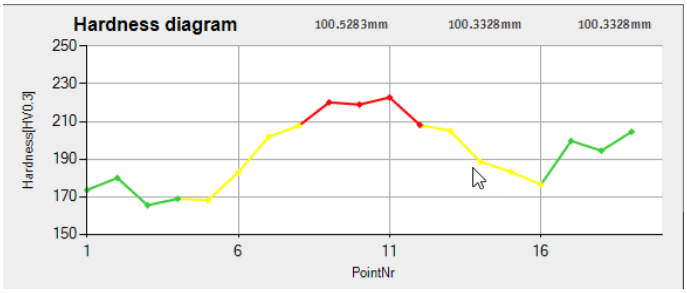
To start the test, select **Start**.

The test results are shown in the **Diagram** area. See Diagram ▶14.

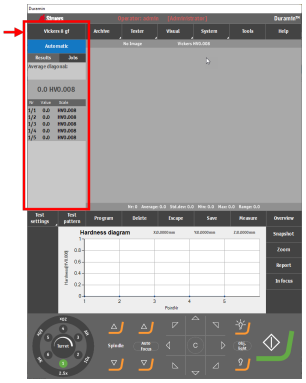
6.3.2 Viewing the results

The test results are shown in the **Diagram** area. See Diagram ▶14.

- Each zone is represented by a different color:
  - Green: Base materials
  - Yellow: HAZ
  - Red: Welded zones

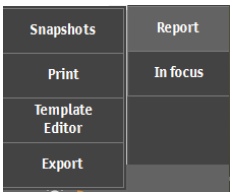


1. In the **Test method** panel, select **Results**.
2. Save the test results: In the **Test tools** panel, select **Archive**Archive > **Save**.



6.3.3 Reporting test results

The test results can be included in a report.



1. To include snapshots in the report, select **Report** > **SnapshotsSnapshot**. See Snapshots ►25.
2. To print the report, select **Report** > **Print**.
3. To export measurement results into CSV-format, select **Report** > Export.
4. To customize report templates, select **Report** > **Template Editor**. See Report templates ►59

6.4 Edge tests

Preparing for testing

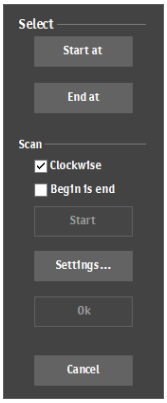
1. Create a job.See Jobs ►24.

Creating the pattern

1. In the **Test tools** menu, select **Test pattern** > **Edge**.
2. To adjust the distance to the edge for the pattern, select **Edge offset**.
3. To set the desired number of points, or the distance between the points, select **Points per line**.
4. To access the scanning dialog, select **Scan**.

Hint
Scanning functions best with low magnification objectives (2.5x, 5x, 10x).

5. To set the starting point for the scan, select **Start at**.
6. Click the edge of the specimen to define where the scan must start. To select the end point for the scan, select **End at**.
7. Click the edge of the specimen to define where the scan must end.
8. To scan the full circumference of the specimen, select **Begin is end**.



9. To start scanning the contour, select **Start**.

10. To accept the scan contour when the scan is finished, select **OK**.

    The scanned contour is shown in the **Pattern** editor.

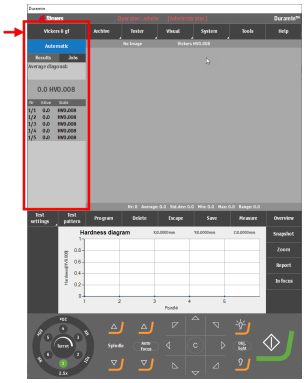
11. If needed, adjust the **Edge offset** and **Points per line**.
12. To exit the pattern settings, select **Save** > **OK**.
13. To continue, see Performing the test ▶56.

6.4.1 Performing the test

To start the test, select **Start**.

The test results are shown in the **Diagram** area. See Diagram ▶14.

6.4.2 Viewing the results



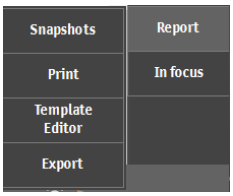
1. In the **Test method** panel, select **Results**.
2. Click once on each result to see a captured image of each indent.
3. Hover with the cursor over each corner of the indent to make sure that all corners have been detected correctly.
4. If a corner has not been detected correctly, click on it and manually reposition the measuring line. You can use the magnified view in the upper left corner to precisely place the measuring line.
5. To save the results, click **Save**.
6. In the **Test method** panel, click the **Results** tab to see results.
   - Click a result to see the captured image.
   - Double-click a results to see a live view of the selected measurement.

Hint
Use the left and right arrow keys on the keyboard to toggle from one indent to the next (live view only).

7. Save the test results: In the **Test tools** panel, select **Archive** > **Save**.

6.4.3 Reporting test results

The test results can be included in a report.



1. To include snapshots in the report, select **Report** > **SnapshotsSnapshot**. See Snapshots ►25.
2. To print the report, select **Report** > **Print**.
3. To export measurement results into CSV-format, select **Report** > Export.
4. To customize report templates, select **Report** > **Template Editor**. See Report templates ►59

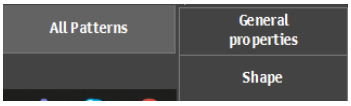
6.5 Area tests

Preparing for testing

1. Create a job.See Jobs ►24.

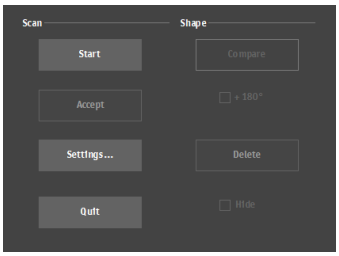
Creating the pattern

1. In the **Test tools** menu, select **Test pattern** > **Area**.
2. Select **All patterns** > **Shape** to access **Contour scanning options**.

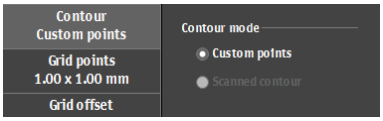


3. Click the **Start** button.

   When the scan is finished, the contour line is shown in the **Test pattern** editor, and you can create the indentation pattern.

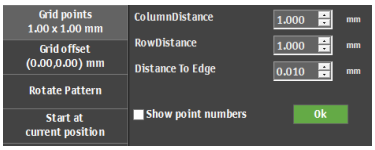


4. Use the mouse to place the corners of the mask where you wish to place the indentations.
5. If needed, press Ctrl and left-click to add additional corners.
6. To place the points inside the scanned contour, select **Contour custom points** > **Scanned contour**.

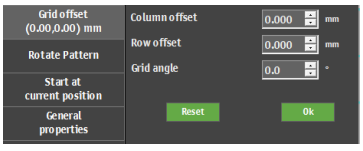


7. To change the horizontal and vertical distance between indentations, and the distance from the edge, select **Grid points**.

   You can also select whether you wish to show the number of points.



8. To change the offset of columns and rows, or to rotate the grid of an angle, select **Grid offset**.



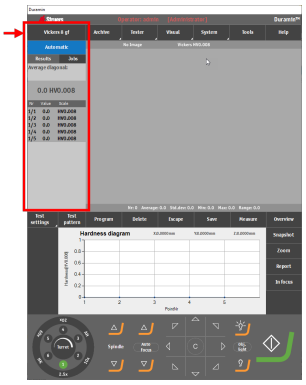
9. To rotate the pattern or the grid, select **Rotate pattern**.
10. To exit the pattern settings, select **Save** > **OK**.
11. To continue, see Performing the test ►56.

6.5.1 Performing the test

To start the test, select **Start**.

The test results are shown in the **Diagram** area. See Diagram ►14.

6.5.2 Viewing the results



1. In the **Test method** panel, select **Results**.
2. Click once on each result to see a captured image of each indent.
3. Hover with the cursor over each corner of the indent to make sure that all corners have been detected correctly.
4. If a corner has not been detected correctly, click on it and manually reposition the measuring line. You can use the magnified view in the upper left corner to precisely place the measuring line.
5. To save the results, click **Save**.
6. In the **Test method** panel, click the **Results** tab to see results.
   - Click a result to see the captured image.
   - Double-click a results to see a live view of the selected measurement.

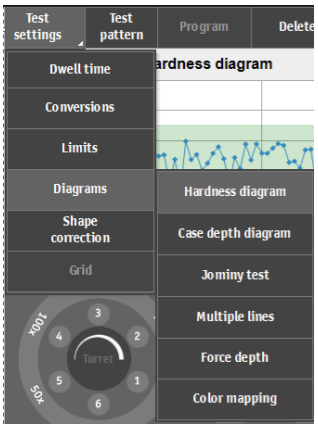
Hint
Use the left and right arrow keys on the keyboard to toggle from one indent to the next (live view only).

7. Save the test results: In the **Test tools** panel, select **Archive** > **Save**.

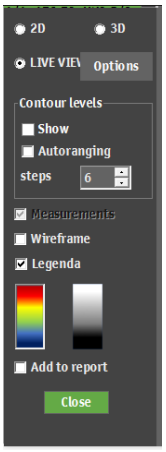
6.5.3 Color mapping

Use this module to visualize the results in a heat map (color map). Color mapping can be shown in a live view and in the report.

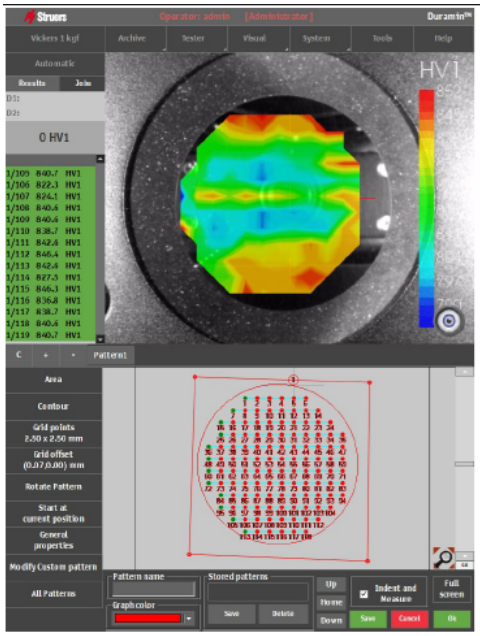
1. In the **Test settings** menu, select **Diagrams** > **Color mapping**.

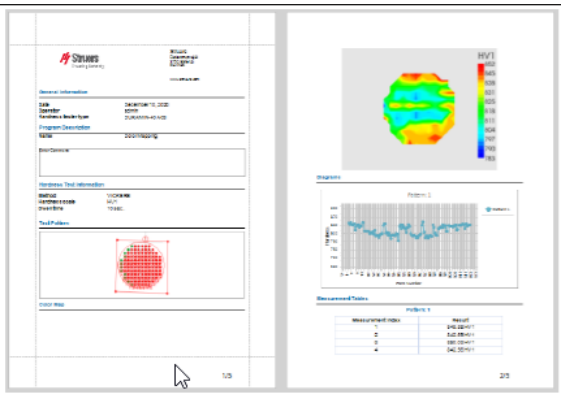


2. Select how you wish to visualize the color map. Select from the following options:
   - Show the color map in **2D**, **3D** or as an overlay in .
   - Enable or disable **Contour levels** and set the number of contour levels.
   - Enable or disable visual elements on the color map (measurements, wireframe, legends).
   - Select if the color map is to be shown in color or gray tones.
   - Select if you wish to add the color map to the report.



Example - a color map of an area pattern





6.5.4 Reporting test results

The test results can be included in a report.

1. To include snapshots in the report, select **Report** > **SnapshotsSnapshot**. See Snapshots ►25.
2. To print the report, select **Report** > **Print**.
3. To export measurement results into CSV-format, select **Report** > Export.
4. To customize report templates, select **Report** > **Template Editor**. See Report templates ►59

6.6 Fracture Toughness tests

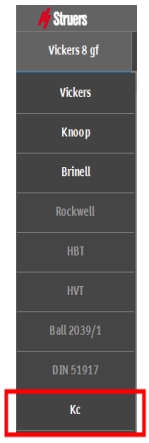
A Fracture Toughness test is a manually executed test. A Fracture Toughness test always consists of single measurements.

Preparing for testingPreparing for testing

1. Create a job.See Jobs ►24.

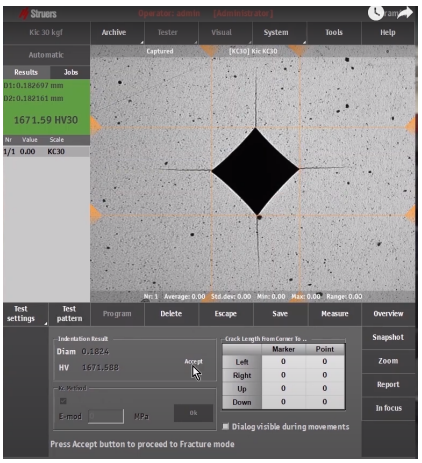
6.6.1 Performing the test

1. In the **Test method** panel, select **Kc**. See Test method ►13
2. On the dashboard, select an objective, and focus on the surface of the specimen.

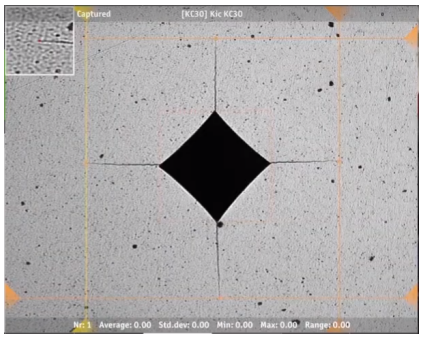


3. Select **Start**.

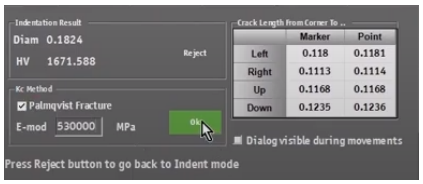
4. Make sure that there are visible cracks on all four corners of the indentation.
5. To accept the results, select **Accept**.



6. Four markers appear in the Objective view.
7. In the Objective view, use the mouse to position each of the yellow lines at the tip of each crack on the indentation.



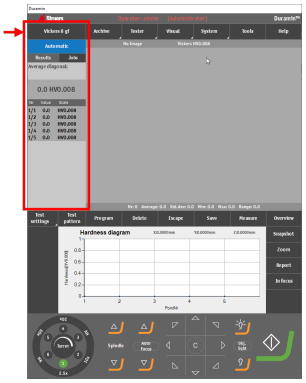
8. Enter the Young modulus in MPa.
9. If the fracture follows the Palmqvist model, enable the **Palmqvist Fracture** check box. Do not enable the check box if the Median crack model is used.



10. To generate the fracture toughness result (expressed in MPa/m²), select **OK**.

6.6.2 Viewing the results

1. In the **Test method** panel, select **Results**.
2. Click once on each result to see a captured image of each indent.
3. Hover with the cursor over each corner of the indent to make sure that all corners have been detected correctly.
4. If a corner has not been detected correctly, click on it and manually reposition the measuring line. You can use the magnified view in the upper left corner to precisely place the measuring line.



5. To save the results, click **Save**.
6. In the **Test method** panel, click the **Results** tab to see results.
   - Click a result to see the captured image.
   - Double-click a results to see a live view of the selected measurement.

Hint
Use the left and right arrow keys on the keyboard to toggle from one indent to the next (live view only).

7. Save the test results: In the **Test tools** panel, select **Archive** > **Save**.

6.6.3 Reporting test results

The test results can be included in a report.

1. To include snapshots in the report, select **Report** > **SnapshotsSnapshot**. See Snapshots ►25.
2. To print the report, select **Report** > **Print**.
3. To export measurement results into CSV-format, select **Report** > Export.
4. To customize report templates, select **Report** > **Template Editor**. See Report templates ►59

6.7 Custom points tests

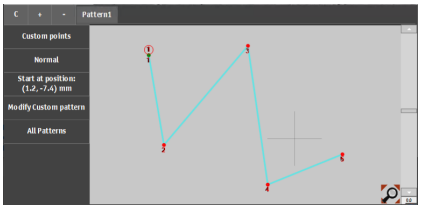
Preparing for testing

1. Create a job.See Jobs ►24.

Creating the pattern

1. In the **Test tools** menu, select **Test pattern** > **Custom points**.

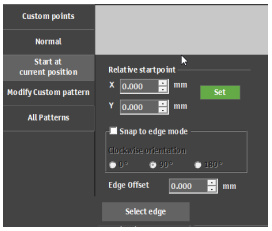
> **Note**
> You can convert any pattern type in the **Pattern** editor to a custom points pattern by selecting **Modify Custom pattern**.



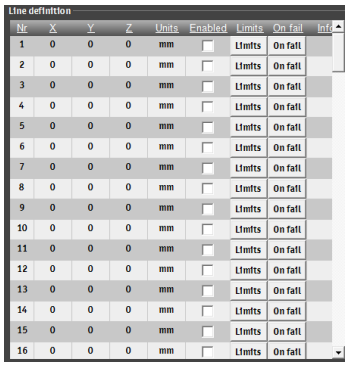
2. Press Ctrl + left-click to freely distribute points on the surface of the specimen.

   To delete points, press Ctrl + right-click on the point you wish to delete.

   Adding and deleting points can be done directly in the objective view, the overview view, or in the **Pattern** editor.
3. To flip the orientation of the axes on the pattern, select **Mirror** and enable the check box of the axis you wish to flip.
4. To define the start position for the pattern, select **Start at current position**.



5. To manually enter values for any of the three axes on the pattern, select **Modify Custom pattern**.
6. To make adjustments, if needed, select **Limits** and **On fail**.



7. To continue, see Performing the test ►56.

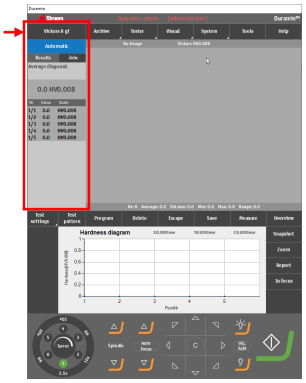
6.7.1 Performing the test

To start the test, select **Start**.

The test results are shown in the **Diagram** area. See Diagram ►14.

6.7.2 Viewing the results

1. In the **Test method** panel, select **Results**.
2. Click once on each result to see a captured image of each indent.
3. Hover with the cursor over each corner of the indent to make sure that all corners have been detected correctly.
4. If a corner has not been detected correctly, click on it and manually reposition the measuring line. You can use the magnified view in the upper left corner to precisely place the measuring line.
5. To save the results, click **Save**.
6. In the **Test method** panel, click the **Results** tab to see results.
   - Click a result to see the captured image.
   - Double-click a results to see a live view of the selected measurement.



Hint
Use the left and right arrow keys on the keyboard to toggle from one indent to the next (live view only).

7. Save the test results: In the **Test tools** panel, select **Archive** > **Save**.

6.7.3 Reporting test results

The test results can be included in a report.

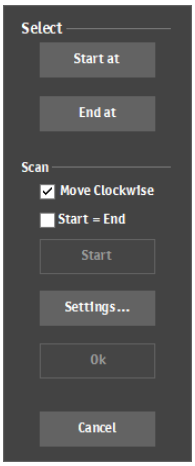
1. To include snapshots in the report, select **Report** > **SnapshotsSnapshot**. See Snapshots ►25.
2. To print the report, select **Report** > **Print**.
3. To export measurement results into CSV-format, select **Report** > Export.
4. To customize report templates, select **Report** > **Template Editor**. See Report templates ►59

6.8 Performing an ISO 898-1 test

Preparing for testing

1. Create a job.See Jobs ►24.

6.8.1 Scanning the thread of the specimen



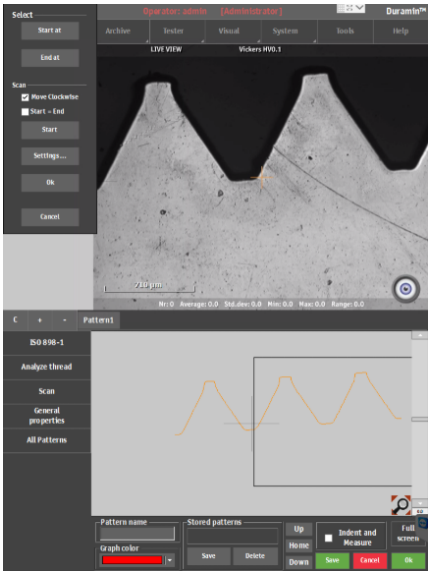
1. In the **Test pattern** editor, select ISO 898-1.
2. In the ISO 898-1 menu, select **Scan** to open the scanning dialog.

> **Hint**
> Make sure to scan at least three threads in order to get an accurate analysis.

3. To set the starting point for the scan, select **Start at**.
4. Click the edge of the specimen where you want the scan to start.
5. To select the end point for the scan, select **End at**.
6. Click the edge of the specimen where you want the scan to end.
7. To scan the full circumference of the specimen, select **Start at** > **Begin is end**.
8. To start scanning the contour, select **Start**.

> **Hint**
> Make sure that the threads are evenly distributed and uniform. If this is not the case, adjust the lighting and rescan the specimen.

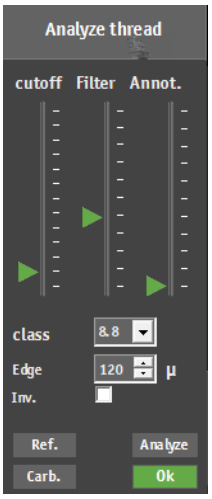
9. To accept the scan when the scan is finished, select **OK**.



The scanned contour is shown in the **Pattern** editor.

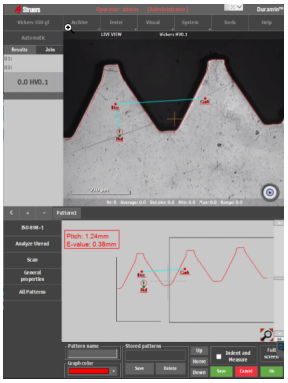
6.8.2 Analyzing the thread

1. In the ISO 898-1 menu, select **Analyze thread**.
2. Select the material property class, as defined by ISO 898-1.
3. Select the **Edge distance** of the carburization point from the edge of the thread.



> **Note**
> ISO 898-1 specifies an edge distance of 0.12 mm. You can change this value, but this will result in non-compliance with ISO 898-1.

4. Select **Analyze**. If the test fails, a dialog is shown. See If the analysis fails ►51.
5. To shift the reference point (decarburization point) to another thread, click **Ref.**.
6. To shift the carburization point to another thread, click **Carb.**.
7. To confirm the analysis and to include it in the test pattern, select **OK**.



If the analysis fails

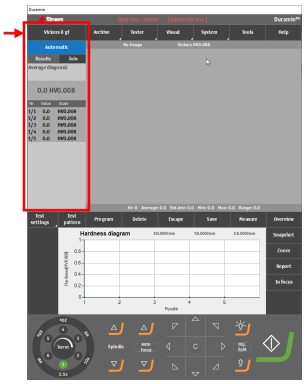
1. Use the **Annot.** slider to check the settings in the algorithm. You can change the following settings:
   - **Cutoff**: Increases or decreases the detection line for a new thread.
   - **Filter**: Increases or decreases the determination levels for main and sub lines, as well as nodes for the algorithm.
2. To repeat the test, select **Analyze**.
3. To confirm the analysis and to include it in the test pattern, select **OK**.

6.8.3 Performing the test

To start the test, select **Start**.

The test results are shown in the **Diagram** area. See Diagram ►14.

6.8.4 Viewing the results



1. In the **Test method** panel, select **Results**.
2. Click once on each result to see a captured image of each indent.
3. Hover with the cursor over each corner of the indent to make sure that all corners have been detected correctly.
4. If a corner has not been detected correctly, click on it and manually reposition the measuring line. You can use the magnified view in the upper left corner to precisely place the measuring line.
5. To save the results, click **Save**.
6. In the **Test method** panel, click the **Results** tab to see results.
   - Click a result to see the captured image.
   - Double-click a results to see a live view of the selected measurement.

Hint
Use the left and right arrow keys on the keyboard to toggle from one indent to the next (live view only).

7. Save the test results: In the **Test tools** panel, select **Archive** > **Save**.

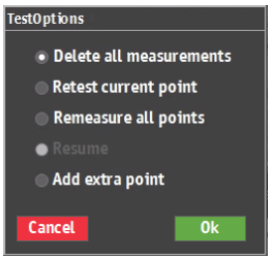
6.8.5 Reporting test results

The test results can be included in a report.

1. To include snapshots in the report, select **Report** > **SnapshotsSnapshot**. See Snapshots ►25.
2. To print the report, select **Report** > **Print**.
3. To export measurement results into CSV-format, select **Report** > Export.
4. To customize report templates, select **Report** > **Template Editor**. See Report templates ►59

6.9 Reindenting a point in a pattern

1. Select the point in the results list and double-click it to move to the point.
2. Make sure that the specimen is in focus.
3. Move to the position where you wish to place the new indent.
4. To open the **Test options** menu, select **Start**.
5. Select **Retest current point**.
6. To start the measurement, select **OK**.



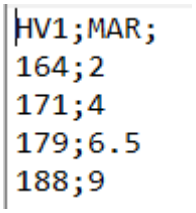
6.10 Making custom conversions

1. Locate the file **Conversions.txt** in the Duramin folder, on the D: drive of the hardness tester.
2. Enter the conversions you wish to add.

   Conversion values must be formatted as follows:

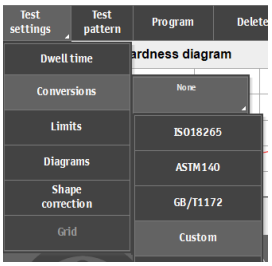
   – A headline describing the scale (HV, HB, HR, HK) to be applied followed by a semicolon.

   – The values you wish to add. Each value in a column must be separated by a semicolon.



Accessing custom conversions

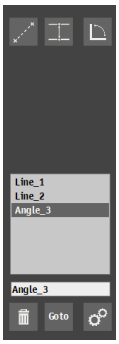
1. Select **Test settings** > **Conversions**.
2. Select one of the empty conversion fields (**None**).
3. Select a conversion to assign it to custom conversions.



6.11 Working with tools

Note
This module is a licensed option.

Use the **Tools** features to make distance and angle measurements, and annotations on the image. See The Top menu ►12



1. In the **Top menu**, select **Tools**.
2. From the menu icons, you can select the following items:

   – **Distance measurement tool** 

   – **Line to line measurement tool** 

   – **Angle measurement tool** 

   – **Delete selected measurement tool** 

   – **Go to selected measurement in the Objective view/Test pattern editor** 

   – **Settings** 

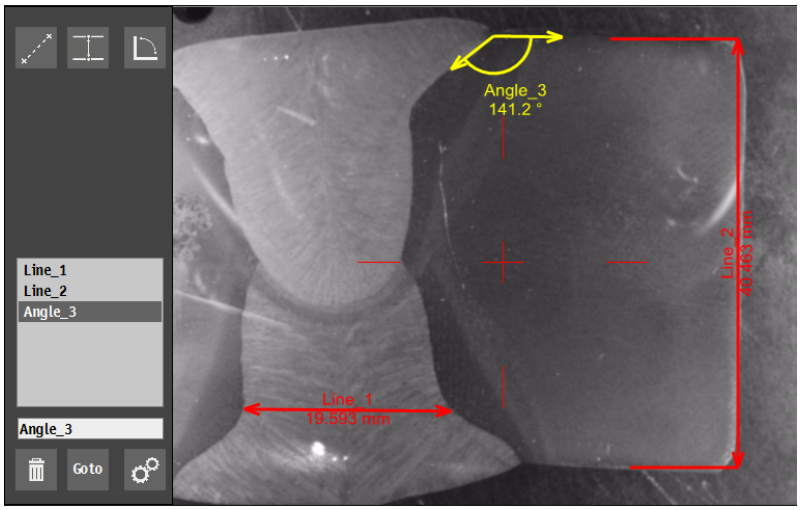
3. Select the tool you wish to use.
4. Place the cursor on the end of the line. A red-dotted circle is shown on the end of the line.
5. Drag the line to the desired position.

   The distance or angle measurements are shown in the objective view.

The Settings menu

Settings	Description
Minimum distance	• Set the minimum distance to be measured.
Precision distance	• Set the number of decimals you wish to use.
Precision angle	• Set the number of decimals you wish to use.
Selection color	• Set the color you wish to use for the selected measurement.
Highlight diameter	• Set the diameter for the selected measurement point.
Normal line	• Configure the normal line.
Highlighted line	• Configure the highlighted line.

Example of how it can look like when working with tools



6.12 Image stitching

With image stitching you can combine several images to create a larger view of the specimen.

> **Note**
> This module is a licensed option.

1. In the **Top menu**, select **Visual** > **Stitching**.

Image stitching using the overview camera

1. To create an image of the full motorized stage, select **Stitch overview**. The machine uses the overview camera to create the image.
2. To see the latest stitched overview image, select **Last Overview Stitch**.

Image stitching using the objective camera

1. To create an image of part of the specimen, select **Stitch selection**. The machine uses the objective camera to create the image.
2. Select the objective you wish to use.
3. To select the desired range to be stitched, click and drag on the objective view.
4. To start stitching the desired area of the specimen, select **OK**.
5. To see the latest stitched image, select **Last Detail Stitch**.

Note
Only the latest stitched image is saved. Snapshot the stitches if you wish to save it or include it in a report. SeeSnapshots ►25

6.13 Working with multiple specimens

If you work with multiple specimens, for instance if you are using a multiple-position specimen holder, Struers recommends that you create a job for each specimen.

Preparing for testing

1. Create a job for each specimen. See Jobs ►24.
2. Enable the check boxes for the jobs in the order in which they should be executed.

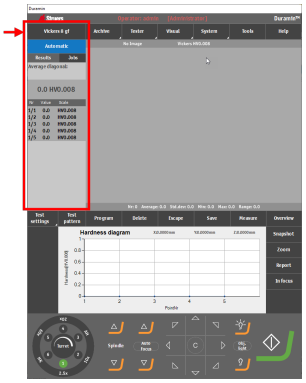
Hint
In the **Top menu**, select **Visual** < **Autofocus**. Select an objective to use for autofocus between execution of the jobs.
If the specimens are not in the same focus plane, select a lower magnification objective to increase the autofocus search range.

6.13.1 Performing the test

To start the test, select **Start**.

The test results are shown in the **Diagram** area. See Diagram ►14.

6.13.2 Viewing the results



1. In the **Test method** panel, select the **Jobs** tab.
2. Select the job for which you wish to see results.
3. Click the **Results** tab.
4. Click once on each result to see a captured image of each indent.
5. Hover with the cursor over each corner of the indent to make sure that all corners have been detected correctly.
6. If a corner has not been detected correctly, click on it and manually reposition the measuring line.
7. To save the results, click **Save**.
8. In the **Test method** panel, double-click the results to show a live view.
9. Use the left and right arrow keys on the keyboard to toggle from one indent to the next.
10. Save the test results: In the **Test tools** panel, select **Archive**Archive > **Save**.

6.13.3 Reporting test results

1. In the **Test method** panel, select **Job**. The job list is shown.
2. Check mark the jobs you wish to report.
3. Select **Report** > **Snapshot** f you wish to include snapshots in the report. See Snapshots ►25.
4. Select **Report** > **Print** if you want to print your report.
5. Select **Report** > **Export** to export measurement results into the CSV-format.
6. Select **Report** > **Template Editor** if you wish to customize your report templates. See Report templates ►59

6.14 Executing test patterns with a manual stage

You can execute test patterns when you work with a manual stage. The following patterns are supported:

- **CHD**
- **Line**
- **Triangle**
- **Circle**
- **Square**
- **Zig-zag**
- **Custom points**
- **Area**

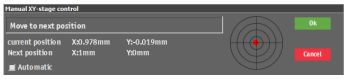
Preparing for testing

1. Create a job. See Jobs ►24.
2. Set up a pattern. See Testing ►34.

Performing a test

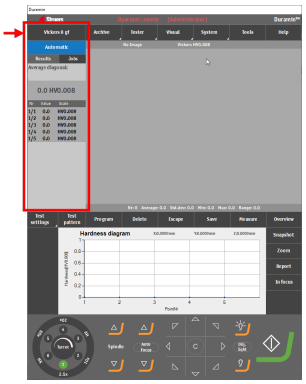
1. To start the test, select **Start**.

The **Manual XY-stage control** dialog is shown.



2. Follow the instructions in the dialog, and move to the next test point.
3. If you enable the check box **Automatic**, the test starts automatically when the correct XY-position is reached.
4. To start testing the next point manually, click **OK**.

6.14.1 Viewing the results



1. In the **Test method** panel, select **Results**.
2. Click once on each result to see a captured image of each indent.
3. Hover with the cursor over each corner of the indent to make sure that all corners have been detected correctly.
4. If a corner has not been detected correctly, click on it and manually reposition the measuring line. You can use the magnified view in the upper left corner to precisely place the measuring line.
5. Save the test results: In the **Test tools** panel, select Archive > **Save**..

6.14.2 Reporting test results

The test results can be included in a report.

1. To include snapshots in the report, select **Report** > **SnapshotsSnapshot**. See Snapshots ►25.
2. To print the report, select **Report** > **Print**.
3. To export measurement results into CSV-format, select **Report** > Export.
4. To customize report templates, select **Report** > **Template Editor**. See Report templates ►59

7 Working with test results

7.1 Viewing test results

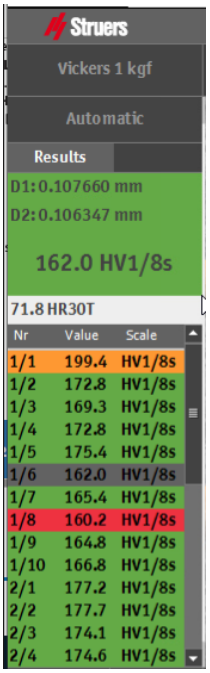
1. In the **Test method** panel, select the **Results** tab.

   The **Results** tab shows the details of the selected result.

   – Diagonals D1, D2

   – Hardness result

   – Conversions



> **Hint**
> To see the average diagonal, click D1 or D2.

Color codes

– Green: the result is within the set limits and the diagonal ratio complies with the standards.

– Orange: the diagonal ratio is outside the standards.

– Red: the result is outside the set limits.

Viewing indents

– Click on a result to see the captured measurement image.

– Double-click to get a live view of the indent.

7.2 Saving test results

1. To save the test results, in the **Test tools** panel, select **Archive**Archive > **Save**.

7.3 Reporting test results

The test results can be included in a report.

1. To include snapshots in the report, select **Report** > **SnapshotsSnapshot**. See Snapshots ►25.
2. To print the report, select **Report** > **Print**.
3. To export measurement results into CSV-format, select **Report** > Export.
4. To customize report templates, select **Report** > **Template Editor**. See Report templates ►59

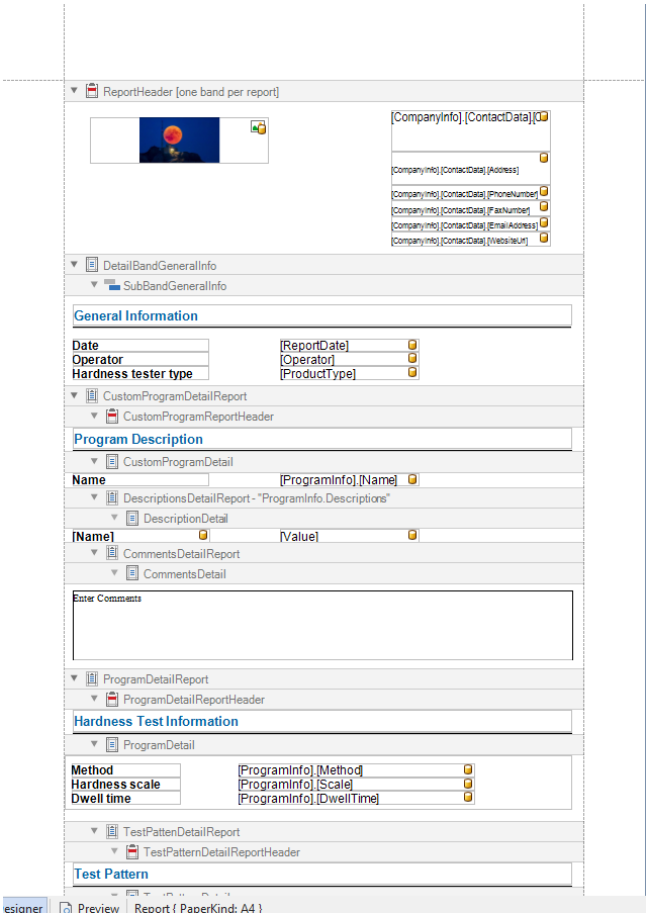
7.3.1 Report templates

You can customize a report template to suit your requirements.

Hint
Struers can help you customize your reports. Contact your Struers representative for further information.

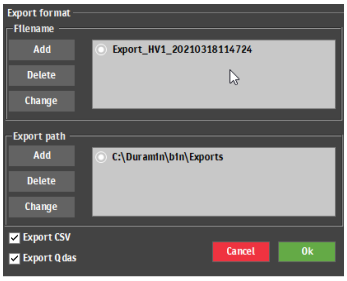
Hint
The two default templates [**Main**] and [**Basic**] cannot be deleted.

1. In the **Optical controls and reporting menu**, select **Report**.
2. Select **Template Editor**.
3. Edit the fields as needed.



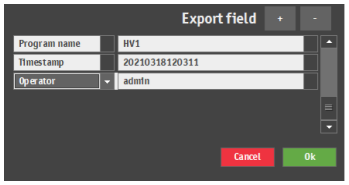
7.4 Exporting test results

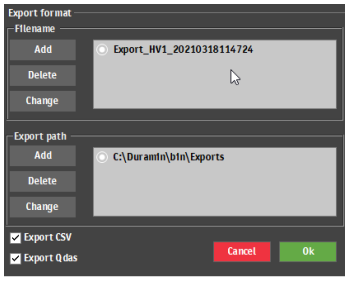
1. Enable the check box of the job for which you wish to export test results.
2. In the **Optical controls and reporting** menu, select **Report**.
3. Select **Export**.
4. Select a file name and export path. Templates for both file locations and file naming can be customized.
5. Enable the check box for the export format (CSV/Q das) you wish to use.
6. Click **OK** to finish.



Setting up templates for file name and export path

1. In the **Optical controls and reporting** menu, select **Report**.
2. Select **Export**.
3. To set up a new file name or export path template, click **Add**.
   - **Filename**: the template is set up using a combination of predefined fields.
   - **Export path**: browse to the desired location.
4. To delete or change templates, select the template and click **Delete** or **Change**.





8 Maintenance and service

8.1 Regular testing

Struers recommends that you use a certified test block to verify the performance of the machine on a regular basis.

Clearing the memory

Shut down the machine on a regular basis to clear the software memory.

8.2 Calibration

Struers recommends a yearly calibration to ensure the performance of the machine.

Calibration can be customized to specific needs and requirements. Contact Struers Service.

9 Troubleshooting - Duramin Software

9.1 Troubleshooting - Duramin Software

If you experience issues, see the table below for basic troubleshooting. If the issues persist, contact Struers Service.

No.	Issue	Action
1	The Overview camera is lagging/freezing.	If the settings for active image correction have been set to **High**, the camera cannot process the live video feed. Select **Visuals** -> **Contrast** while the Overview camera is active. Select **Default**.
2	The Objective image flickers.	Select **Visuals** > **Contrast**, and deselect **Automatic**.
3	Most or all buttons are grayed out when the software is started up.	The machine settings file is corrupted due to incorrect shutdown.
4	The message **Force too high** is shown when an indent is started.	Perform an indenter length calibration.
5	The message **Object detected** is shown when an indent is being made	Make sure that the specimen is in focus before you start a measurement. If the error remains, calibrate the indenter length.
6	The message **COM port x does not exist** is shown.	A digital micrometer connected to the tester has been moved to another USB port. Move the connected device back to its original port. Restart the software.
7	A method is missing in the software. Vickers, Knoop, Brinell, KIC, or HVT cannot be selected in the scale selection dialog.	Make sure that the indenter for the method you are looking for is installed on the turret. If you want to see the method without the indenter installed, select **System** -> **Settings**. Make sure that the setting **Scales only with indenter** is disabled. If the error remains, the method has not been enabled for you tester.
8	The motorized XY-stage stalls during reference search or movements during normal operation.	Make sure that there is nothing obstructing or preventing the stage from moving (transport safety bracket, dirt, etc.)

No.	Issue	Action
9	A **Timeout** message is shown. • **Trinamic timeout** • **Timeout Depthmeter Readout** • **LCA Timeout**	Restart the software. The problem could be caused by the removal of a USB device, or by a faulty USB drive. Use a different USB port for the USB drive or use a different USB drive.
10	Comet tails or indenter scratches are visible.	1. Make sure that the specimen surface is plane. 2. Clean the indenter. 3. Rotate the indenter 180 degrees to see if the tail/scratch follows the indenter orientation.
11	There is oil residue on the stage or specimen.	Clean the specimen and the stage.
12	**Autofocus** cannot find the correct focus plane.	If **Autofocus** settings uses a combination of a high search range and a high search speed, the steps of the autofocus search may be too large to find the actual focus plane. Lower the search range and the search speed for the specific objective: Select **Visual** > **Autofocus**.
13	The Vickers or Knoop indents are not symmetrical.	Make sure the specimen surface is plane. Make an indent on a testblock to verify the asymmetrical indent.
14	The measurement cursor changes from a green crosshair to a red dot.	Use the mouse scrollwheel click function to toggle between the crosshairs and the red dot.
15	The user interface is shown in Landscape, not Portrait mode.	Make sure that the monitor is connected according to the marking on the rear of the hardness tester. Restart the machine.
16	The touch function on the monitor does not work.	Make sure that the USB cable between the monitor and the machine is connected correctly. Press and hold the **Menu** and the **Enter** buttons on the side of the monitor to enable/disable the touch function.
17	Opening the connection to AUX or LCA failed.	Restart the software. If the error remains, contact Struers Service.
18	There is no image on the objective camera.	Make sure the objective light level is not set to 0.

9.2 Messages and errors

Errors must be corrected before operation can be continued.

Messages provide information about the machine's status and minor errors.

- Press **OK** to acknowledge the error/message.

If the error remains, contact Struers Service.

Example: Error message

Error Message	Explanation	Action
Collision switch active	The turret has hit an object. The spindle is too far up, or the head is too far down.	Make sure that there is no obstacle to the turret movement. Make sure that the spindle is positioned correctly.
Corrupt database!	The settings file of the machine has been corrupted. This is normally caused by a sudden loss of the power supply or a wrongful shutdown procedure.	Clicking OK will retrieve a backup of the settings files.
Emergency switch pressed, application will exit now	Correct the cause of the emergency stop. Release the emergency switch. See the Instruction Manual for the machine you are using.	If the error remains or if the message occurs without activating the emergency switch, contact Struers Service.
Emergency switch pressed, release switch for further action	Correct the cause of the emergency stop. Release the emergency switch. See the Instruction Manual for the machine you are using.	If the error remains or if the message occurs without activating the emergency switch, contact Struers Service.

Error Message	Explanation	Action
Failed moving to home position	For machines with a load motor. During initialization, the home switch near the load motor has not been activated, and the motor has failed to move to its home position.	Make sure that there is no visible obstruction in the Z-axis. Restart the machine.
Failed moving to safe position	For machines with a motorized head. During initialization, the motorized head failed to retract approx. 1 cm from the current position.	Make sure that there is no visible obstruction in the motorized head.
Failed to find upper limit	For machines with a motorized head. For a special protocol (e.g. the crank shaft), the motorized head must be in the highest position.	If the error remains, contact Struers Service.
Failed to initialize turret	During initialization, the home switch in the turret was not found within the specified time.	Make sure that there is no visible obstruction in the turret.
Failed to initialize xy-stage	For machines with a motorized XY-stage. During initialization of the XY-stage, the limits for the X and Y axes cannot be found.	Make sure there is no visible obstruction. Shut down the machine and reconnect the cable to the XY-stage.
Failed to move spindle down	For machines with a motorized head and spindle. During initialization, the spindle failed to move lower .	Make sure that there is no visible obstruction in the motorized head.
Failed to open connection to Com[nr] : Comport name	Communication to the indicated port has failed. The port is present but cannot be opened by the operating system.	Restart the machine.
Force too high!	The measured force is not equal in both loadcells.	Make sure that there is no visible damage on the machine.

Error Message	Explanation	Action
Indenter not present	A hardness method is selected which is not suitable for the selected indenter.	Select **System** > **Settings** > **Scales only with indenter**. Alternatively, replace the indenter.
Loadcell not configured	Configuration of the loadcell or loadcells is incorrect.	Restart the machine.
Missing connection for Com [nr] : Comport name	Communication to the indicated port has failed. The port is present but cannot be opened by the operating system.	Restart the machine.
Motor timeout reading position	Internal communication failure.	Restart the machine.
Object detected	The loadcell detects an unwanted force in the turret.	Make sure that there is no visible obstruction in the turret.
Running low on diskspace	The D: drive hard disk is running out of disk space.	Carry out file housekeeping and delete redundant files.
System not initialized	The user interface is released by the software before initialization has ended.	Contact Struers Service.
This position cannot be changed!	The specific turret position is fixed and cannot be changed.	The turret position must be changed. Contact Struers Service.
Timeout depthmeter readout	Internal communication failure between depthmeter and PC.	Restart the machine.
Unsupported scale	You have selected a hardness method scale that is out of range for the selected indenter.	Select **System** > **Settings** > **Scales only with indenter**. Alternatively, replace the indenter.
Unsupported tester	The dongle that is being used is not supported by the software.	Contact Struers Service.
Upper limit not reached	For machines with a motorized head. When the motorized head is in the highest position, but the upper limit has not been activated.	Contact Struers Service.

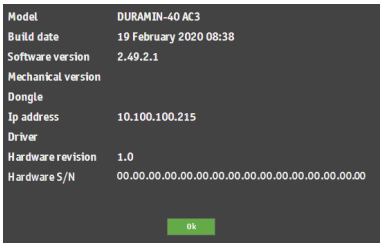
9.3 Contacting Struers Service

When you contact Struers Service, please provide the following information:

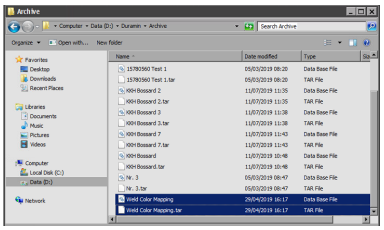
- Serial number of the machine
- Firmware versions (LCA/AUX)
- Software version
- Headline with a clear description of the issue
- Can the issue be reproduced? If this is the case, describe the steps in detail
- If the issue is related to measurements, include files that show the issue (both TAR and DB file)
- If the issue is related to the software, include the exception and debug file
- If possible, attach images and/or videos showing the problem
- Is a **TeamViewer** connection available? This allows Struers to carry out remote troubleshooting on your machine.

Finding the required information

1. From the **Top menu**, select **Tester** > **Info**.
2. Send this information to Struers Service.



3. Save any measurement to an archive. Select **Archive** > **Save**.
4. Name the archive and select the location where you wish to save it.
5. Copy the **.tar** and database files.



6. If needed, exception and debug files are located in the Duramin folder, on the D: drive of the hardness tester. The file names are:
   - **exceptions.txt**
   - **debug.txt**

9.4 Software updates

Struers continuously improves the Duramin software. Contact your Struers representative for further information.

If you have a preventive maintenance agreement with Struers, the software is updated at every service call.

10 Manufacturer

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Responsibility of the manufacturer

The following restrictions should be observed, as violation of the restrictions may cause cancellation of Struers legal obligations.

The manufacturer assumes no responsibility for errors in the text and/or illustrations in this manual. The information in this manual is subject to change without notice. The manual may mention accessories or parts not included in the supplied version of the equipment.

The manufacturer is to be considered responsible for effects on safety, reliability, and performance of the equipment only if the equipment is used, serviced, and maintained in accordance with the instructions for use.

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