Struers
Ensuring Certainty

DuraVigo-150

Instruction Manual

Original Instructions

CE

Doc. no.: 16687026_A_en
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1 About this manual

CAUTION
Struers equipment must only be used in connection with and as described in the Instruction Manual supplied with the equipment.

Note
Read the Instruction Manual carefully before use.

Note
If you want to view specific information in detail, see the online version of this manual.

1.1 Accessories and consumables

Accessories

For information about the available range, see the DuraVigo-150 brochure:

- The Struers Website (http://www.struers.com)

Consumables

The machine is designed to be used only with Struers consumables specifically designed for this purpose and this type of machine.

Other products may contain aggressive solvents, which dissolve e.g. rubber seals. The warranty may not cover damaged machine parts (e.g. seals and tubes), where the damage can be directly related to the use of consumables not supplied by Struers.

For information about the available range, see: The Struers Website (http://www.struers.com).

2 Safety

2.1 Intended use

Automatic Macro hardness tester for Automatic Macro hardness testing of solid materials.

The machine is designed to be used with indenters specially designed for this purpose and fixed in the test head. Samples are secured on a fixed anvil or optional manual XY-stage.

For load ranges 3 - 250 kgf.

The hardness tester meets the applicable DIN, ISO-EN, ASTM and JIS standards.

The machine is for use in a professional working environment (e.g. a materialography laboratory).

Model	DuraVigo-150

2.2 DuraVigo-150 safety precautions

2.2.1  Read carefully before use

1. Ignoring this information and mishandling of the equipment can lead to severe bodily injuries and material damage.
2. Struers equipment must only be used in connection with and as described in the Instruction Manual supplied with the equipment.
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. Any defects observed must be repaired before using the machine.
5. The operator must read the safety precautions and Instruction Manual, as well as relevant sections of the manuals for any connected equipment and accessories.
6. This machine must be operated and maintained only by skilled/trained personnel.
7. The machine must be placed on a safe and stable table with an adequate working height.
8. If two persons work together, make sure they communicate clearly to avoid injuries.
9. Safety devices, such as protective covers/safety switches, must never be removed or bridged during normal use of the machine.
10. If disassembly of safety devices during installation, inspection, maintenance or repair is necessary, the reassembly and inspection of the safety devices must be done immediately after the completion of these activities.
11. When handling oils, greases and other chemical substances, the safety regulations applicable to that product must be observed! Contact with chemicals should be avoided as much as possible. Before working with these materials, the instructions on the package must be read and followed.
12. When handling electric motors, be aware these can get warm during use. Let the motors cool down before you work on them. If this is not possible, appropriate safety measures should be taken, for example the use of gloves.
13. Untrained persons or persons present during a general training, may only perform work under the permanent supervision of a trained operator.
14. All safety and hazard warnings on the machine must always be kept in a legible condition.
15. 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.
16. Dismantling of any part of the equipment, during service or repair, should always be performed by a qualified technician (electromechanical, electronic, mechanical, pneumatic, etc.).
17. Hot parts should not come into contact with explosive or highly fammable chemicals.

2.3 Safety messages

Struers uses the following signs to indicate potential hazards.

ELECTRICAL HAZARD
This sign indicates an electrical hazard which, if not avoided, will result in death or serious injury.

DANGER
This sign indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

WARNING
This sign indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

CRUSHING HAZARD
This sign indicates a crushing hazard which, if not avoided, could result in minor, moderate or serious injury.

HEAT HAZARD
This sign indicates a heat hazard which, if not avoided, can result in minor, moderate or serious injury.

CAUTION
This sign indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

Emergency stop
Emergency stop

General messages

Note
This sign indicates that there is a risk of damage to property, or a need to proceed with special care.

Hint
This sign indicates that additional information and hints are available.

2.4 Safety messages in this manual

ELECTRICAL HAZARD
Switch off the electrical power supply before installing electrical equipment.
The machine must be earthed (grounded).
Incorrect voltage can damage the electrical circuit.Make sure that the actual electrical power supply voltage corresponds to the voltage stated on the type plate of the machine.

WARNING
Do not remove the fixed guards.
Do not operate the machine without the fixed guards.

WARNING
Any defects observed must be repaired before using the machine.

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

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

WARNING
Safety critical components must be replaced after a maximum lifetime of 20 years.
Contact Struers Service.

CRUSHING HAZARD
Take care of your fingers when handling the machine.
Wear safety shoes when handling heavy machinery.

CRUSHING HAZARD
Do not place your hand between the specimen and the indenter.

CAUTION
Struers equipment must only be used in connection with and as described in the Instruction Manual supplied with the equipment.

2.5 Fixed guards

WARNING
Do not remove the fixed guards.
Do not operate the machine without the fixed guards.

The fixed guards on drives such as a belt drive, chain drive and gear drive are fitted with fasteners. These safety features prevent contact with these moving parts and therefore protect against severe injuries.

3 Get started

3.1 Device description

DuraVigo-150 is an entry-level hardness tester, specifically developed for Rockwell testing for all types of stable and non-explosive metals.

The test operator starts the procedure by positioning – and possibly securing - the sample/specimen to the anvil or stage. A wide range of clamping tools and vices are available to fit your needs.

Via the included software, the operator selects the test type on the touch-screen. When the operator tightens up the sample against the indenter, the test starts.

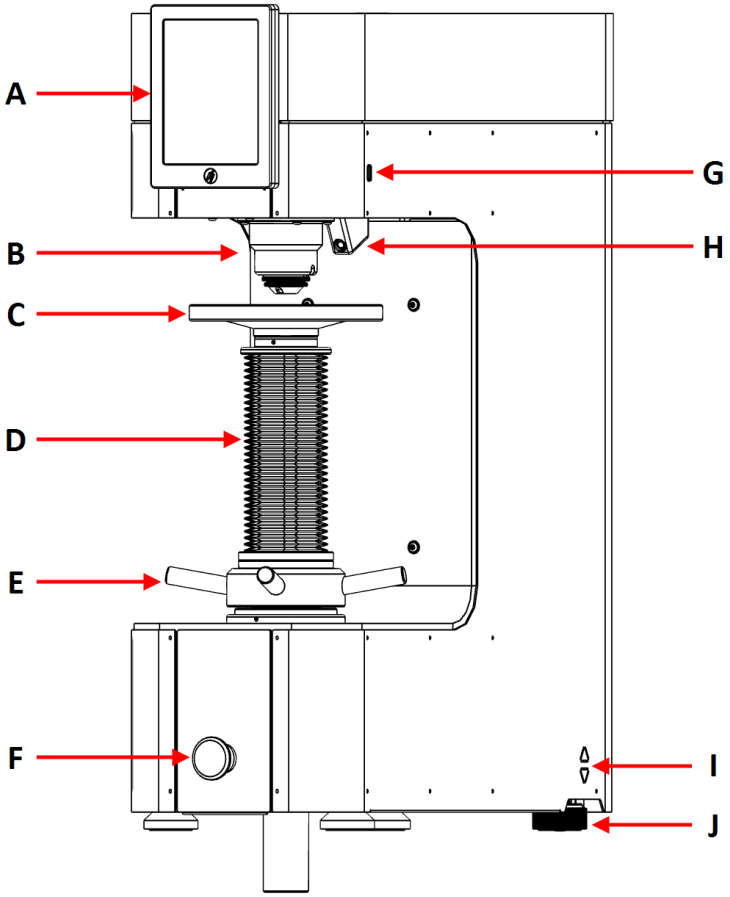
The software calculates the values instantly and stores them on the internal hard drive. Afterward, the data can be moved to a memory stick.

In the unlikely situation of an accident or unforeseen incident, the operator can hit the Emergency stop to power off the machine.

3.2 Overview

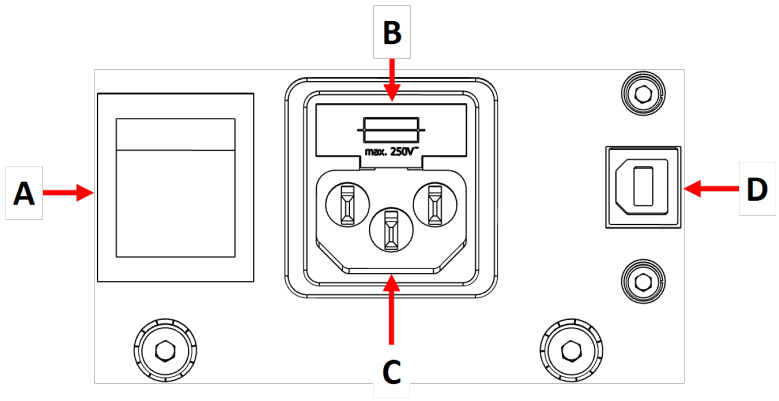
Note
Do not use force or pointed / sharp objects on the touchscreen.

Overview



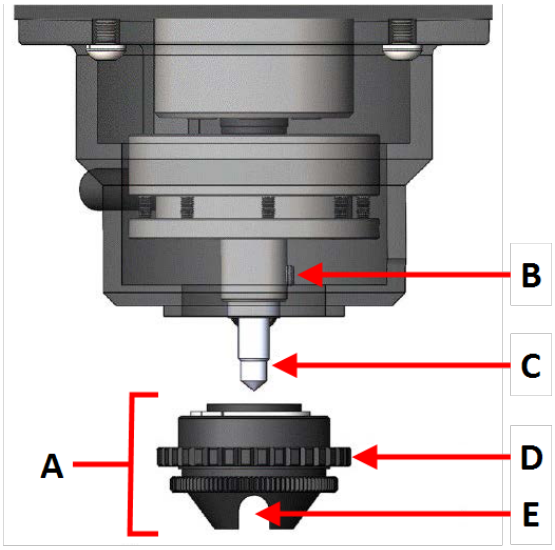
A	Touchscreen	**F**	Emergency stop
B	Nose cone	**G**	USB port
C	Anvil	**H**	Object light
D	Spindle	**I**	Leveling buttons
E	Spindle screw	**J**	Adjustable foot

Rear view



A	Main switch	**C**	Power socket
B	Fuse holder	**D**	USB-B port

Head



A	Nose cone	**D**	Counter nut
B	Fixation screw	**E**	Inspection window
C	Indenter		

- The head holds the indenter.
- The fixation screw holds the indenter in place.
- The nose cone fixates the specimen against the anvil.

3.3 Emergency stop

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

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

- To activate the emergency stop, press the red emergency stop button.
- To release the emergency stop, turn the red emergency stop button clockwise.

4 Transport and storage

If, at any time after the installation, you have to move the unit or place it in storage, there is a number of guidelines we recommend that you follow.

- Package the unit securely before transportation. Insufficient packaging could cause damage to the unit and will void the warranty. Contact Struers Service.
- We recommend that you use the original packaging and fittings.

Note
The straps must be approved for at least twice the weight of the machine.

Note
Always transport the machine in an upright position.

Note
Do not ship or transport the machine without the correct packing materials.

Transport

1. Familiarize yourself with points 1-14 in the DuraVigo-150: How To Unpack document.
2. Disconnect the machine from the power supply.
3. Place a foam block between the indenter and the anvil to prevent it from moving.
4. Place the lifting straps securely around the lifting bar (see point 9 and 10).

5. Lift the machine and (while lifted) remove the feet.
6. Move the machine to its new position.

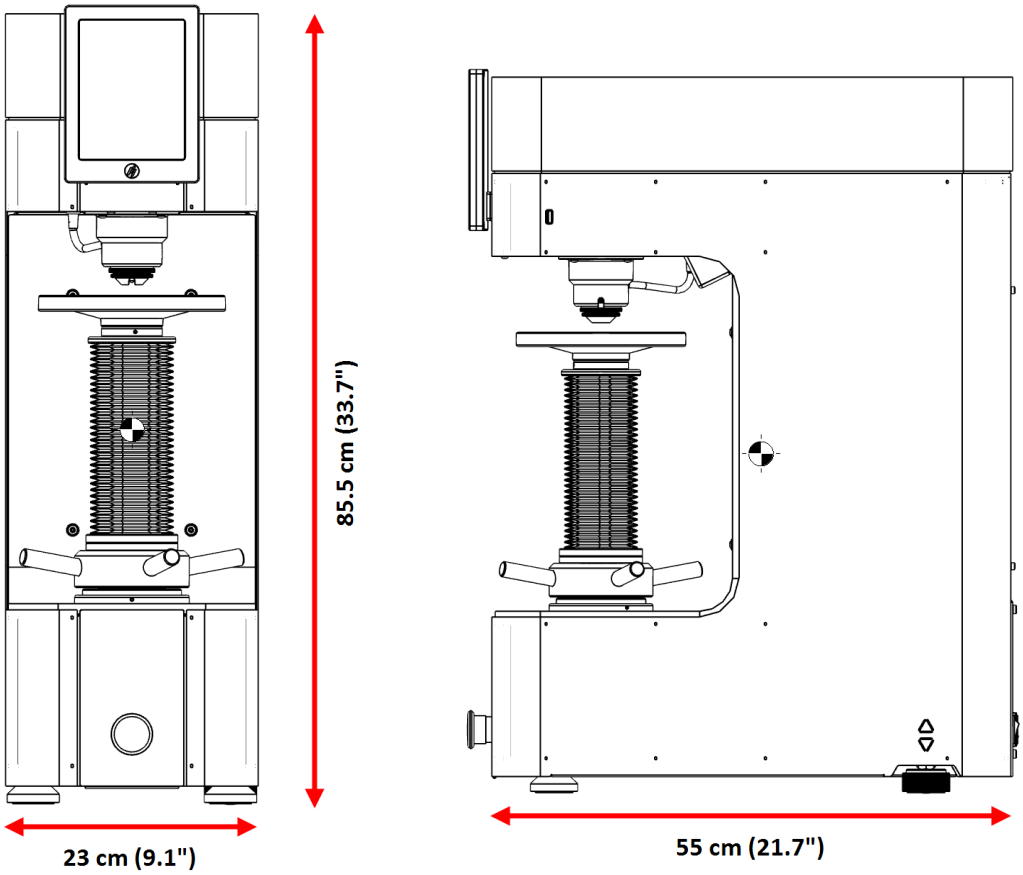
Long-term storage and shipping

7. Place the machine on the pallet. Remember to line up the holes on the pallet with the holes in the machine.
8. Mount the transport bolts.
9. Secure the actuator with a plastic strip (see point 13).
10. Mount the sides of the crate.
11. Place the accessory case and other loose items in the crate.
12. To keep the machine dry, place a desiccant (silica gel) in the crate.
13. Mount the lid of the crate.

5 Installation

5.1 Dimensions

Front view	Side view



5.2 Unpack the machine

Refer to the DuraVigo-150: How To Unpack instructions delivered with the machine.

Note
Take care while unpacking and handling the machine.

- Do not expose to external impact.
- Do not tilt over 30 degrees.
- Do not touch the turret.

1. Carefully open and remove the top of the packing crate.
2. Remove the sides of the packing crate.
3. Remove the accessory case(s).

4. Carefully lift the foam pieces to access the machine.

Note
We recommend that you keep all original packaging and fittings for future use.

5.3 Check the packing list

The packing box contains the following items:

Pcs.	Description
1	DuraVigo-150
1	Accessory case
1	Instruction Manual set

Accessory case

The actual packaging and accessories may differ from those shown in the picture. Check your order confirmation to make sure that all the accessories ordered are included in the delivery.

Note
Some components or parts may be packaged separately and may not be included in the accessory case or may have been installed on the machine.

Pcs.	Description
As ordered	Indenter(s)
1	Hex key driver 2.0 mm
2	Power supply cables
2	Spare fuses
4	Vibration dampers (feet)

5.4 Lift the machine

CRUSHING HAZARD
Take care of your fingers when handling the machine.
Wear safety shoes when handling heavy machinery.

Note
Take care while unpacking and handling the machine.
- Do not expose to external impact.
- Do not tilt over 30 degrees.
- Do not touch the turret.

A crane and lifting straps are required to lift the machine from the packing crate.

Note
The straps must be approved for at least twice the weight of the machine.

1. Check that the crane has a free pathway from the lifting point to the final location.
2. Place the lifting straps securely around the neck of the machine.
3. Remove the bolts securing the machine to the pallet.
4. Carefully lift the machine out of the packing crate.
5. While hanging, install the 4 adjustable vibration dampers and adjust the height of the dampers until they are of equal height.
6. Lift the machine into its final location.

5.5 Location

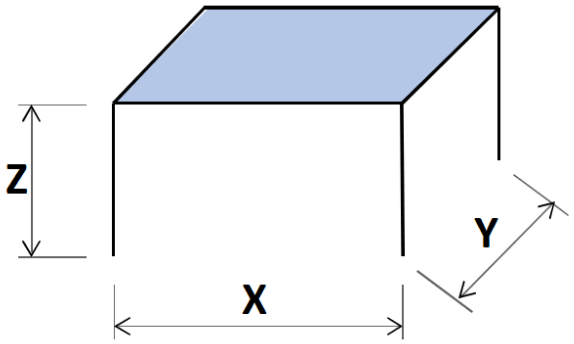
CRUSHING HAZARD
Take care of your fingers when handling the machine.
Wear safety shoes when handling heavy machinery.

Make sure that the following facilities are available:

– Power supply

The machine must be placed on a safe and stable table with an adequate working height.The table must be able to carry at least the weight of the machine and the accessories.

Recommended workbench dimensions	
X:	60 cm (23.5")
Y:	60 cm (23.5")
Z:	70 cm (27.6")



- The machine must be placed close to the electrical power supply.

Vibration

Note
Vibrations can lead to inaccurate measurements and must be avoided.

Hint
A simple way to detect vibrations is to set up a tray of water and watch for ripples on the surface.

- Install the machine in a vibration-free location.
- If possible, install the machine on the ground floor of a building and away from exits or doorways.

Sources of vibration can include:

- Passers-by
- A road with heavy traffic
- Cranes
- Equipment generating vibrations
- Equipment generating sound (acoustic vibration)
- Exposure to wind or air conditioning fans

Illumination

- Make sure that the work station has adequate lighting. Avoid direct glare (dazzling light sources within the operator's line of vision) and reflected glare (reflections of light sources).

  A minimum of 300 Lumen is recommended to illuminate the controls and other work areas.

Ambient conditions		
Operating environment	Surrounding temperature	10 - 35°C (50 - 95°F)
	Humidity	10% - 90% RH non-condensing

5.6 Level the machine

To eliminate possible wear and tear of the machine’s mechanical structure, the machine should be leveled once it is in its final location.

Check that the anvil / stage is level. If not:

1. Turn the vibration damper in the rear right hand corner to level the machine.
2. Remove the top of the machine and cut the plastic strip that prevents the actuator from moving.

Note
Refer to the DuraVigo-150: How To Unpack instructions delivered with the machine.

3. Mount the top again.

Note
Remember to secure the actuator with a plastic strip before moving or transporting the machine. Failure to do so can cause damage to the machine.

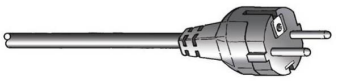
5.7 Power supply

ELECTRICAL HAZARD
Switch off the electrical power supply before installing electrical equipment.
The machine must be earthed (grounded).
Incorrect voltage can damage the electrical circuit.Make sure that the actual electrical power supply voltage corresponds to the voltage stated on the type plate of the machine.

Note
Local standards can override the recommendations for the main electrical power supply cable.Always contact a qualified electrician to verify which option is suitable for the local installation setup.

Single-phase supply

The 2-pin plug (European Schuko) is for use on single-phase electrical power connections.

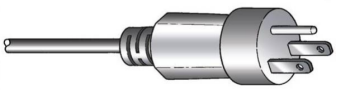


The leads must be connected as follows:

Yellow/Green	Earth (ground)
Black/Brown	Line (live)
Blue	Neutral

2-phase supply

The 3-pin plug (North American NEMA) is for use on 2-phase electrical power connections.

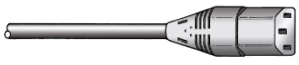


The leads must be connected as follows:

Green	Earth (ground)
Black	Line (live)
White	Line (live)

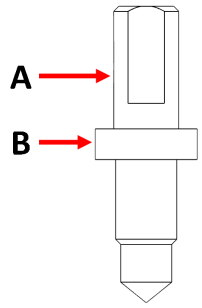
Power the machine

1. Connect the electrical power cable to the machine (IEC 320 connector).
2. Connect the other end of the cable to the electrical power supply socket.



5.8 Install an indenter

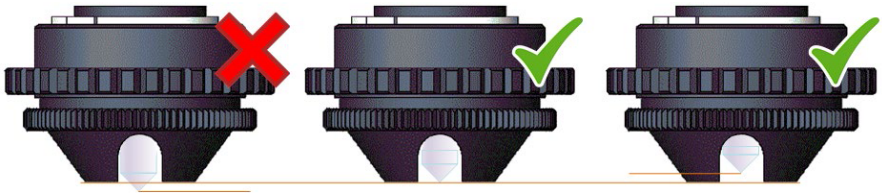
The machine is delivered with a preinstalled indenter as ordered.



A	Indenter shaft	**B**	Impact

To replace the indenter:

1. Remove the nose cone.
2. Loosen the fixation screw and let the indenter slide out.
3. Wipe the old indenter clean with a soft cloth and store it in its plastic container.
4. Mount the new indenter. Make sure that the impact sits firmly against the head.
5. Fasten the fixation screw.
6. Mount the nose cone. The inspection window does not always point forwards.
7. The distance from the bottom of the nose cone up to the pinnacle of the indenter must be approximately 1 mm. Adjust the distance with the counter nut.

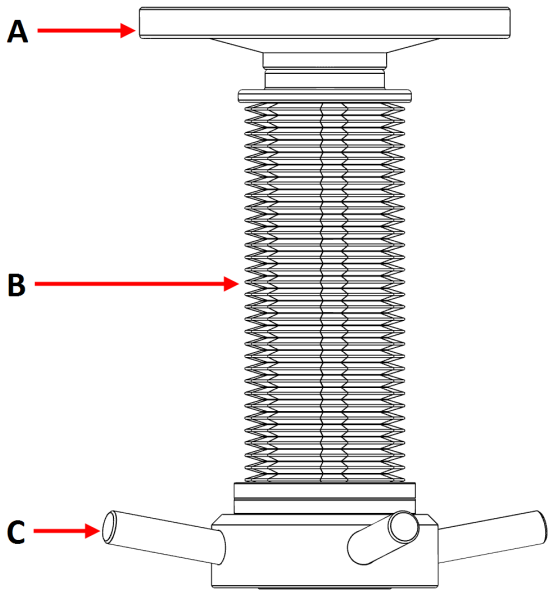


Adjust the nose cone in relation to the indenter. The indenter point must not protrude.

8. Perform a few hardness tests on a test block to securely seat the indenter.

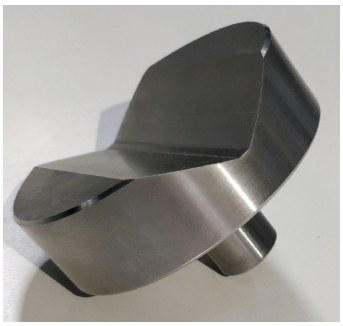
Note
Use Struers accessories to ensure proper function.

5.9 Install an anvil



A	Anvil	**C**	Spindle screw
B	Spindle		

Use the appropriate anvil for the application:



V-type anvil for cylindrical samples (optional).

Flat anvil for even specimens.

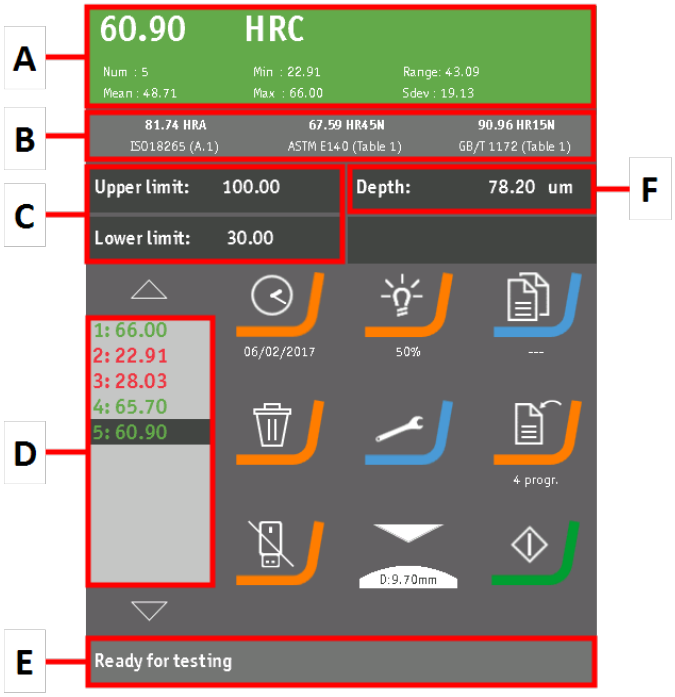
1. Check that there is enough room between the indenter and the spindle to install the anvil.
2. Use a soft cloth to wipe any dirt from the mat surfaces of the anvil and spindle.
3. Carefully place the anvil into the spindle.

Hint
To place the anvil, move the spindle sufficiently down.

4. Perform a few hardness tests on a test block to securely seat the anvil.

6 Operate the device

6.1 Overview screen



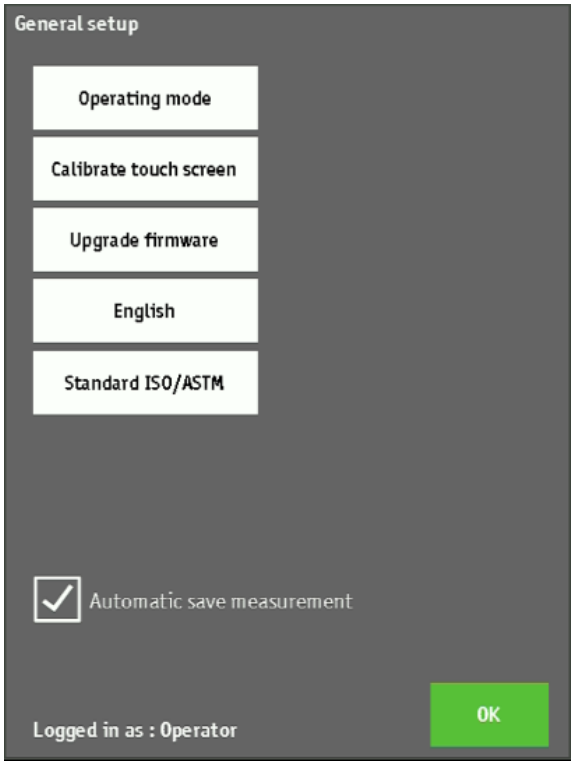
Field	Main function	Tap and hold
A	**Test results**	Save measurement
B	**Conversions**	
C	**Limits**	Enable / disable limit
D	**Batch list**	
E	**Status bar**	
F	**Depth**	

Button	Main function	Tap and hold
	**Date/time**	Date and time notation
	**Light control**	
	**Load program**	
	**Delete measurement**	Delete all measurements
	**Settings**	Information screen
	**Save program**	
	**Export measurement**	
	**USB flash drive not detected**	
	**Dwell time and progress**	Shape correction

Button	Main function	Tap and hold
	**Start**	
	**Stop**	

6.2 General setup

Tap **Settings** to access **General setup**.



Functions

You can access the following functions from the **General setup** menu:

Function	Description
Operating mode	Change the operating mode. This function is used by service technicians.
Calibrate touch screen	Recalibrate the touchscreen.
Upgrade firmware	Install new firmware using a USB flash drive.
Language selection	Change the language of the operating system.
Standard ISO/ASTM	Change the standard you want to apply to the tables used for the shape correction.
Automatic save measurement	Enable or disable the automatic save function.

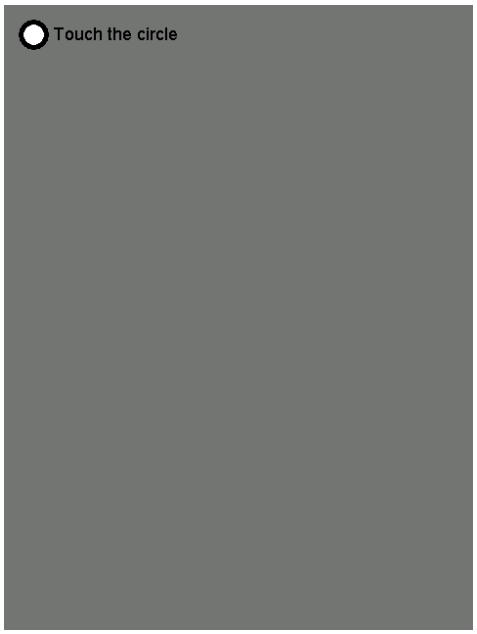
6.2.1 Operating mode

This options is for service technicians only.

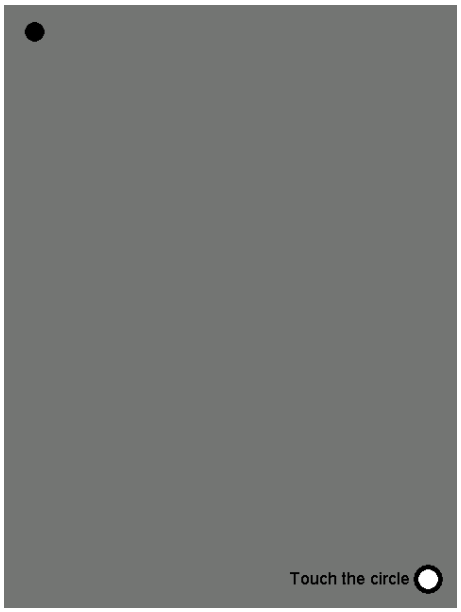
6.2.2 Calibrate the touch screen

To recalibrate the touch screen:

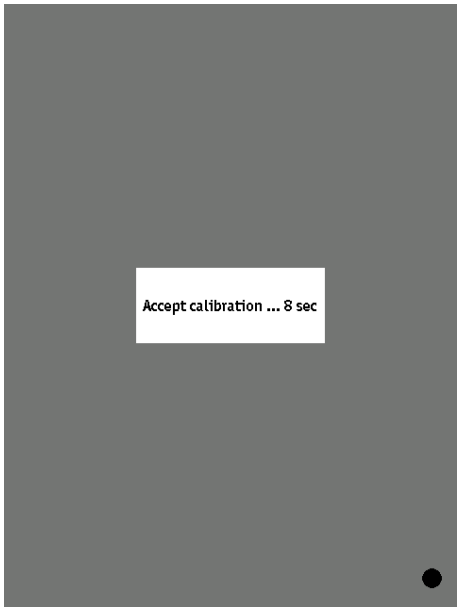
1. Tap **Calibrate touch screen** in the **General setup** menu.



2. Tap the circle in the upper-left corner.



3. Tap the circle in the lower-right corner.



4. Tap **Accept calibration** or wait for the countdown to finish.

6.2.3 Upgrade the firmware

New firmware is installed using a USB flash drive. The .hex file with the new firmware must be located in a folder named **Firmware** in the root directory of the flash drive.

Note
Make sure that the .hex file with the new firmware is the only .hex file in this folder.

Note
The flash drive must be formatted using the FAT(32) file system. The NTFS and exFAT file systems cannot be used.

To install the new firmware:

1. Tap **Upgrade firmware** in the **General setup** menu.
2. Plug the flash drive into the USB port on the machine.

Note
If the upgrade process does not start, unplug the flash drive and plug it back in.

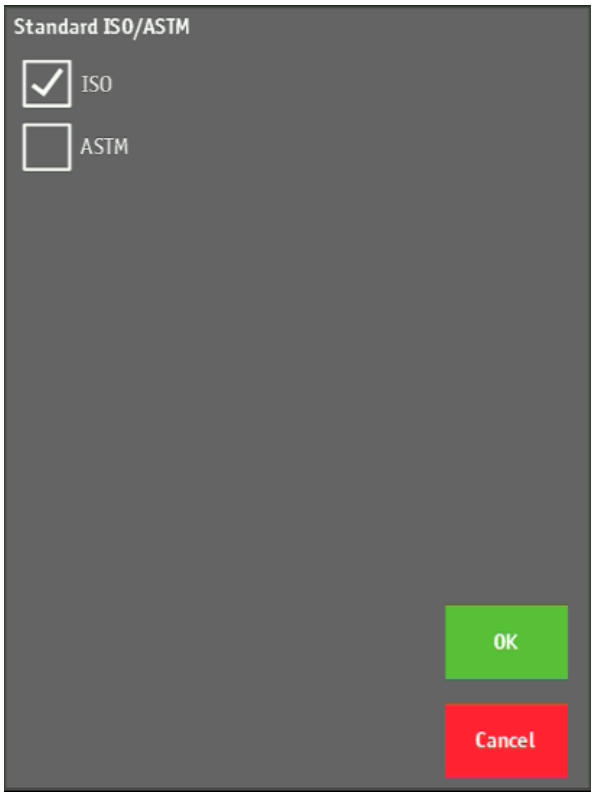
When the firmware upgrade process is completed, the machine will restart with the new firmware.

3. Check the firmware version on the splash screen at start-up or on the **Information** screen. See Information screen ►27.

6.2.4 Standard ISO / ASTM

To change the standard you want to apply to the tables used for the shape correction:

1. Tap **Standard ISO/ASTM** in the **General setup** menu.



2. Tap the box of the standard you want to use.
3. Tap **OK**.

6.3 Information screen

Tap and hold the **Settings** button to access the **Information** screen.

The **Information** screen displays the following information:

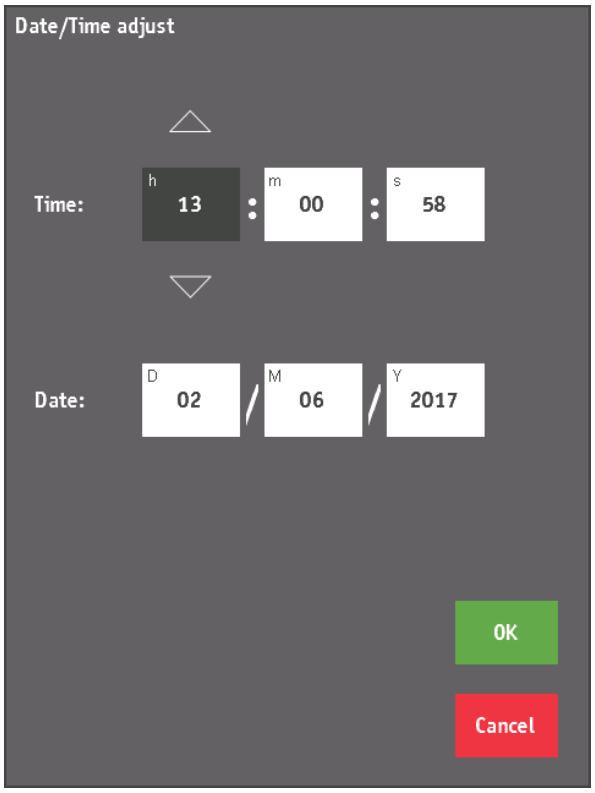
- **Tester type**
- **Software version**
- **Hardware version**
- **License code**

6.4 Time and date setup

The **Date / Time** button shows the current time and date.

Set the time and date

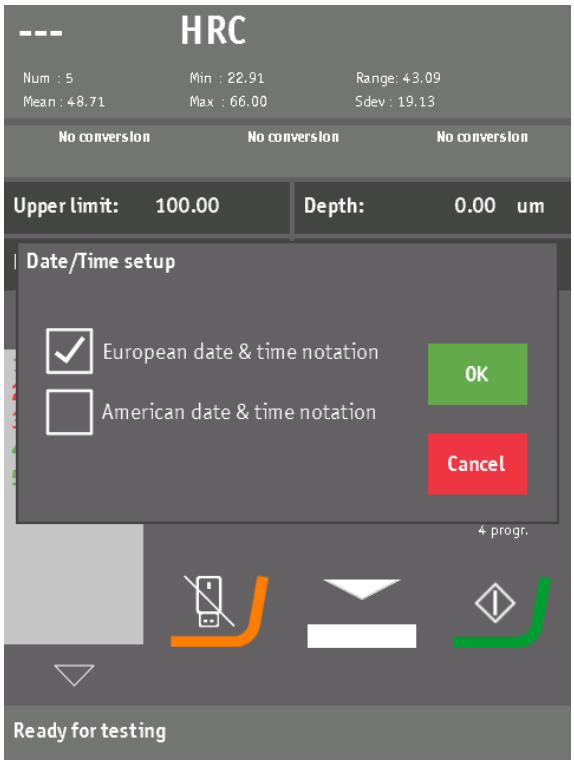
1. Tap the **Date / Time** button.
2. Tap the individual parameters.



3. Tap or hold the **Up** and **Down** buttons to set the value.
4. Tap **OK** to save the settings.

Change the date and time format

1. Tap and hold the **Date / Time** button.

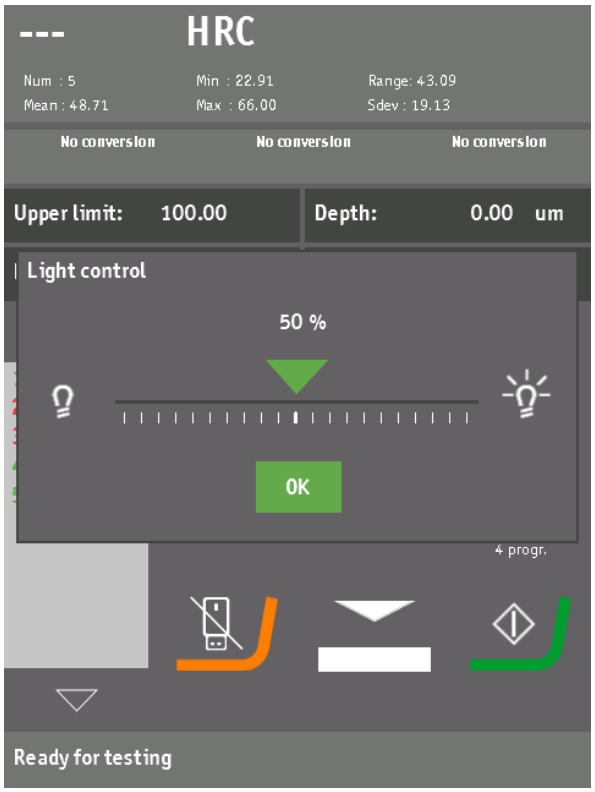


2. Choose a format:
   - **European date & time notation** format: dd/mm/yyyy
   - **American date & time notation** format: mm/dd/yyyy

6.5 Light control

Use the **Light control** button to set the object light level:

1. Tap the **Light control** button.



2. Swipe the slider to set the light level.
3. Tap **OK**.

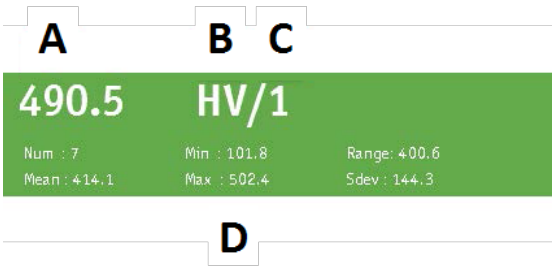
The light level is displayed in the **Light control** button.

6.6 Test results

The **Test results** field shows the result of a hardness test or the hardness value of a saved test results from the batch list.

When the limits are active, the color of the **Test results** field indicates whether the hardness value is within the set limits or not.

The statistic data calculated over all saved test results is also shown.

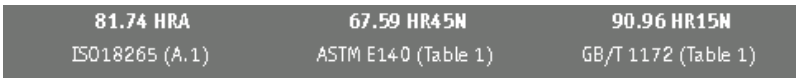


A	Hardness value	**C**	Hardness load
B	Hardness scale	**D**	Statistics

Statistics	
Num	Number of saved test results.
Min	Minimum value of the saved test results.
Max	Maximum value of the saved test results.
Range	Difference between the minimum and maximum value.
Mean	Mean value calculated over the saved test results.
Sdev	Standard deviation calculated over the saved test results.

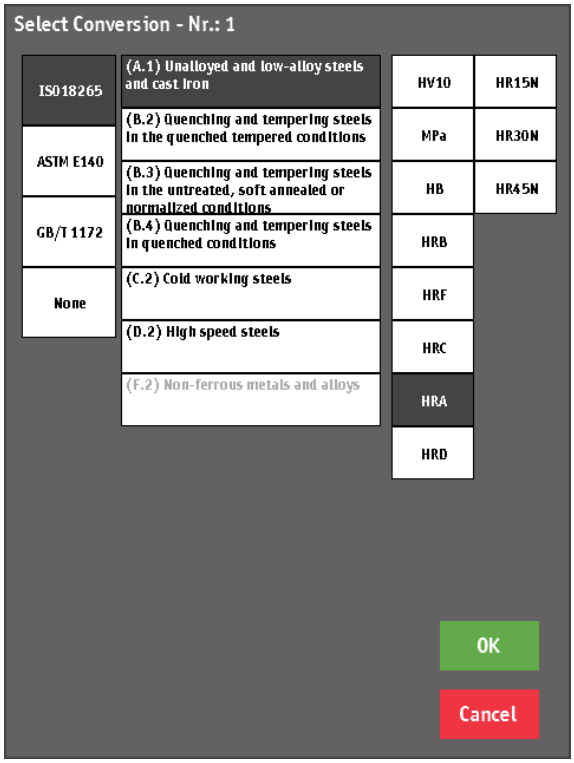
6.7 Conversions

You can store and show 3 user-selectable conversions of the current hardness value into 3 other hardness scales. The current conversions are shown in the **Conversions** field.



To change one of the 3 conversions, tap the corresponding area in the **Conversions** field.

Example - Conversion 1



1. Select the first conversion value.

   The **Select conversion** screen is shown.

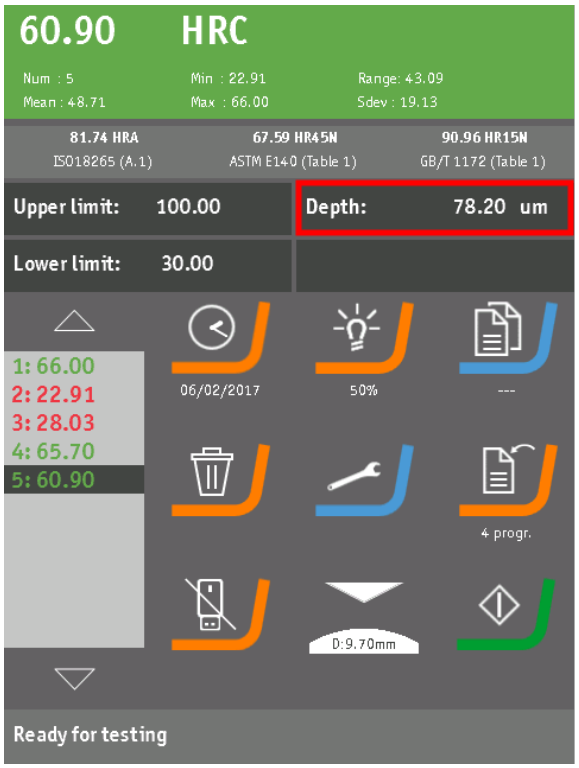
The screen shows the current conversion data.

2. To change the conversion, select a standard from the left column.
3. Select a metal type from the second column.
4. Select a conversion scale from the last column.
5. Tap **OK** to save the settings.

   The conversion selection screen closes and the new conversion is shown in the **Conversions** field.

Note
When the hardness value cannot be converted into the selected conversion scale, the converted hardness value is displayed as **---**.
This happens when the hardness value is outside the range of the chosen conversion scale or when a new measurement is not finished yet.

6.8 Depth information



The **Indenter displacement** value is the distance the indenter moved relative to the zero position of the depth sensor.

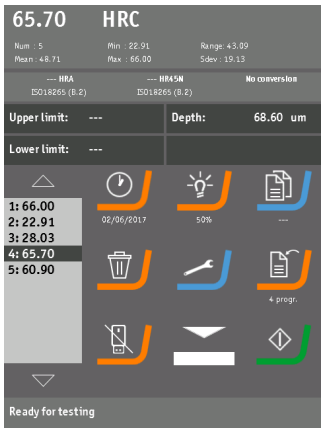
The zero position is reached when the indenter stops being in contact with the specimen.

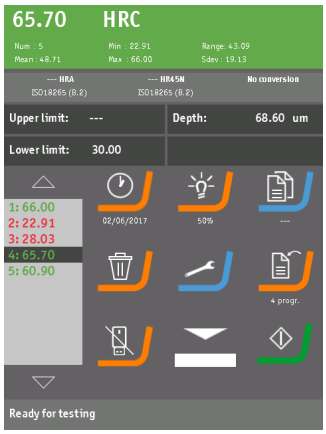
Note
The indenter displacement value is not shown for saved measurements from the batch list.

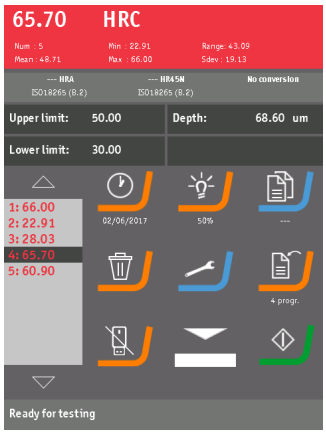
The **Depth** value is the difference between the indenter displacement value during preload dwelling and the indenter displacement value during recovery dwelling. This is the actual Rockwell depth used to calculate the Rockwell hardness value.

6.9 Limit setup

When a hardness test is complete, the color of the **Measurement and statistics** field reflects the relation between the test results and the defined limits:

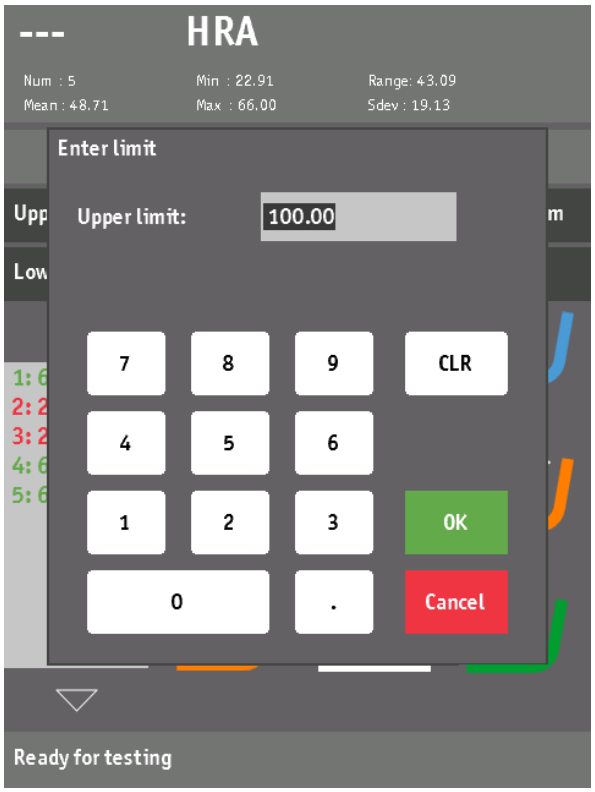






Grey	Green	Red
No set limits	Hardness value within limits	Hardness value outside limits

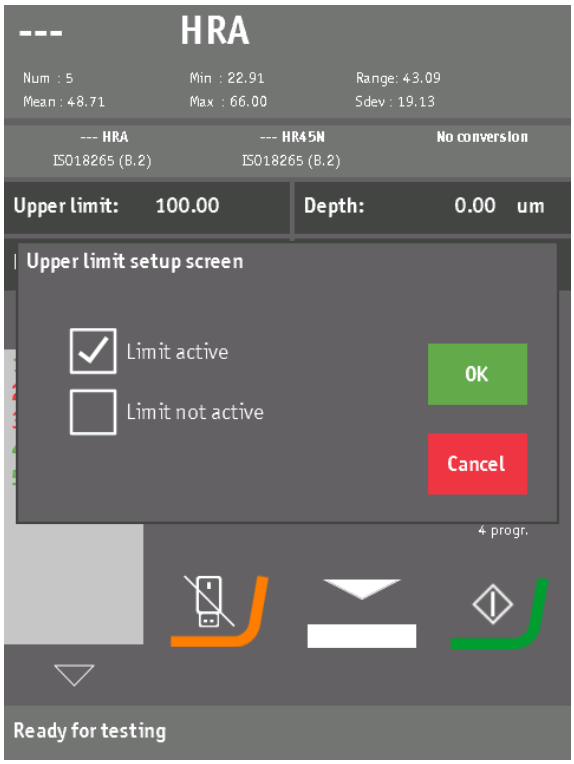
Hint
The same color is used in the batch list.



- Tap the **Upper limit** or **Lower limit** fields to set the limit values.

Enable and disable the limits

1. Tap and hold the **Upper limit** or **Lower limit** fields to enable or disable the limits.



2. Tap one of the boxes:
   - Tap **Limit active** to enable the limit.
   - Tap **Limit not active** to disable the limit.
3. Tap **OK**.

6.10 Save programs

You can store settings in custom programs for frequently used testing tasks to reduce the setup time.

Note
You can save up to 50 programs.

To save the current settings as a program:

1. Tap the **Save program** button.
2. To change the program name, tap the **Program name** field.
3. Enter a name for the new program.

4. Tap **OK** to save the changed name.
5. Tap **OK** again to save the program.

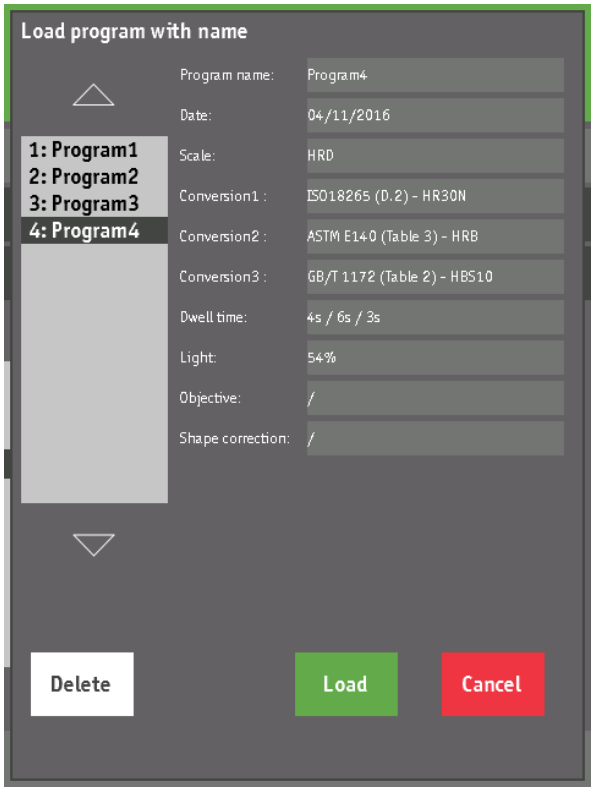
   The current settings are saved under the new name.

Hint
The **Save program** button shows the number of saved programs.

6.11 Load programs

To load a saved program:

1. Tap the **Load program** button.



2. Tap a program from the list.

   You can also use the **Up** and **Down** buttons to browse the list and then tap **Load**.

Delete a program

1. Tap the program you want to delete.
2. Tap **Delete**.

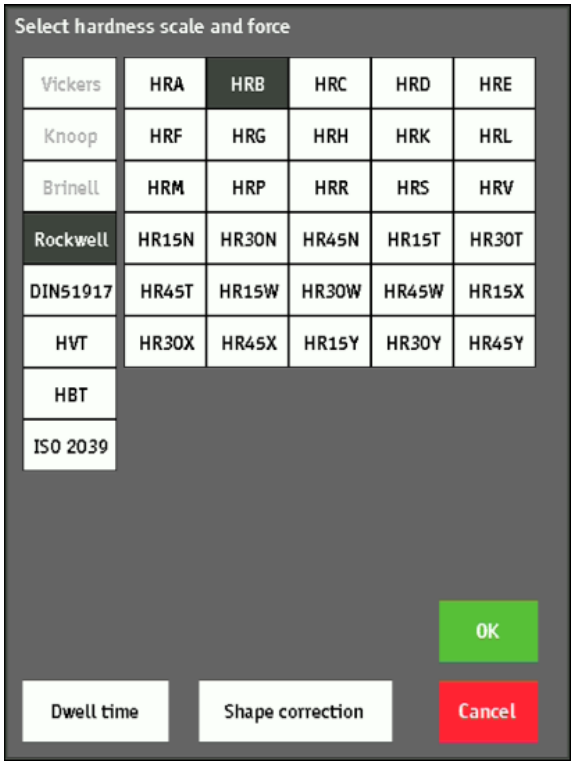
Delete all programs

- Tap and hold the **Delete** button.

6.12 Select a scale

Note
Some hardness scales and forces are disabled depending on the type of hardness tester.

1. Tap the **Measurement and statistics** field to open the **Select hardness scale and force** menu.



2. Select a hardness scale from the left column.
3. Select the force from the right table.
4. Tap **OK**.

Dwell time

To set the **Dwell time** and the **Shape correction**, see Dwell time and progress ►42.

Shape correction

1. Tap **Shape correction**.
2. Tap **Convex** to enable the shape correction.
3. Swipe the slider or use the **+** and **-** buttons to set the diameter (in millimeters).
4. Tap **OK**.

To disable the limit:

- Tap **Off**.

Regular Rockwell scales

Hardness unit	Type of indenter	Preliminary force	Total force	Scaling constant	Full range constant	Applicable range
HRA	Diamond cone	98.07 N	588.4 N	0.002 mm	100	20 - 95
HRBW	Ball 1.587 5 mm	98.07 N	980.7 N	0.002 mm	130	10 - 100
HRC	Diamond cone	98.07 N	1471 N	0.002 mm	100	20 - 70
HRD	Diamond cone	98.07 N	980.7 N	0.002 mm	100	40 - 77
HREW	Ball 3.175 mm	98.07 N	980.7 N	0.002 mm	130	70 - 100
HRFW	Ball 1.587 5 mm	98.07 N	588.4 N	0.002 mm	130	60 - 100
HRGW	Ball 1.587 5 mm	98.07 N	1471 N	0.002 mm	130	30 - 94
HRHW	Ball 3.175 mm	98.07 N	588.4 N	0.002 mm	130	80 - 100
HRKW	Ball 3.175 mm	98.07 N	1471 N	0.002 mm	130	40 - 100

Superficial Rockwell scales

Hardness unit	Type of indenter	Preliminary force	Total force	Scaling constant	Full range constant	Applicable range
HR15N	Diamond cone	29.42 N	147.1 N	0.001 mm	100	70 - 94
HR30N	Diamond cone	29.42 N	294.2 N	0.001 mm	100	42 - 86
HR45N	Diamond cone	29.42 N	441.3 N	0.001 mm	100	20 - 77

Hardness unit	Type of indenter	Preliminary force	Total force	Scaling constant	Full range constant	Applicable range
HR15TW	Ball 1.587 5 mm	29.42 N	147.1 N	0.001 mm	100	67 - 93
HR30TW	Ball 1.587 5 mm	29.42 N	294.2 N	0.001 mm	100	29 - 82
HR45TW	Ball 1.587 5 mm	29.42 N	441.3 N	0.001 mm	100	10 - 72

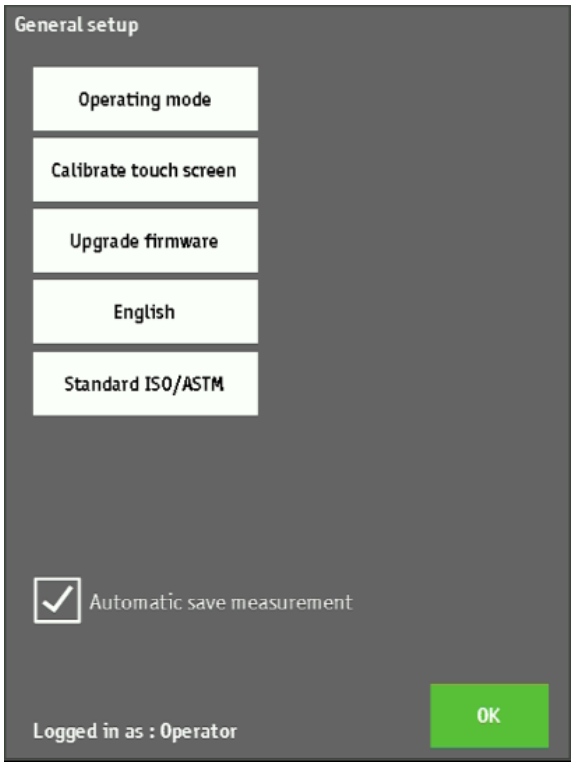
6.13 Save measurements

You can save a measurement automatically or manually.

To set the saving mode:

1. Tap the **Settings** button.

   The **General setup** screen is shown.



2. Tap the **Automatic save measurement** check box to enable or disable the automatic saving mode.
   – Automatic mode: The hardness value will be saved automatically to the **Batch list**.

– Manual mode: The hardness value is saved by the user.

Add measurements manually

1. Tap and hold the **Measurement and statistics** field.

   A pop-up will appear: **Add measurement to the list?**.

2. Tap **Yes** to save the measurement.

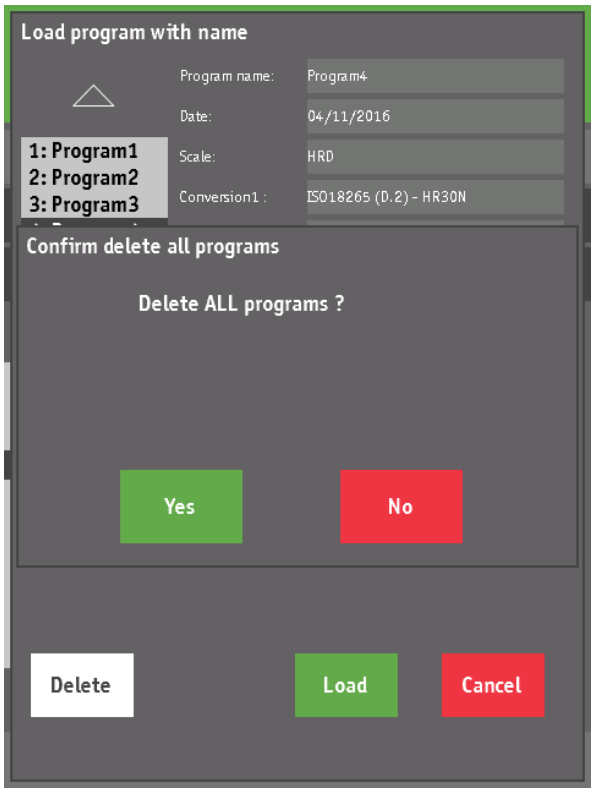
6.14 Delete measurements

To delete a measurement:

1. Select a measurement from the **Batch list**.

2. Tap the **Delete measurement** button.

Delete all measurements



Tap and hold the **Delete measurement** button.

6.15 Export measurements

To export a measurement from the **Batch list** to a USB flash drive:

1. Plug the flash drive into the USB port on the machine.

   The **Export measurements** button indicates whether a flash drive is available or not:

Available

Not available

   If the flash drive is not detected, unplug the flash drive and plug it back in.

> **Note**
> The flash drive must be formatted using the FAT(32) file system.

2. Tap the **Export measurements** button.

```
STRUERS

Duramin-150 G2

TEST RESULT LIST

OPERATOR     : .................

PART NR.     : .................

DATE             : 18/03/2024
TIME             : 13:10:32

Program name     : ---

HARDNESS SCALE   : HRC

CONVERSION 1     : None
                 :

CONVERSION 2     : None
                 :

CONVERSION 3     : None
                 :

FORCE            : 150000.000g
DWELL TIME       : 2s - 3s - 4s

MEASUREMENTS     : 14
AVG              : 104.3
MAX              : 456.6
MIN              : 41.30
S.DEV            : 102.7
RANGE            : 415.3

SINGLE VALUES

Upper limit: :  50.00
Lower limit: : ---
```

The test reports are saved in the root directory of the flash drive.

6.16 Dwell time and progress

This button displays both the dwell time and the progress when you run a test.

Dwell time

During a hardness test, the machine applies the preload force, then the main load force and finally the recovery load.

Each force application is followed by a corresponding dwell time, where the force is maintained.

When an indentation cycle starts and the desired force for the indentation phase is reached, the corresponding dwell time value will start counting down to zero. Once the value reaches zero, the next phase of the indentation cycle starts.

When the indentation cycle is completed, the dwell time values reset back to their start values.

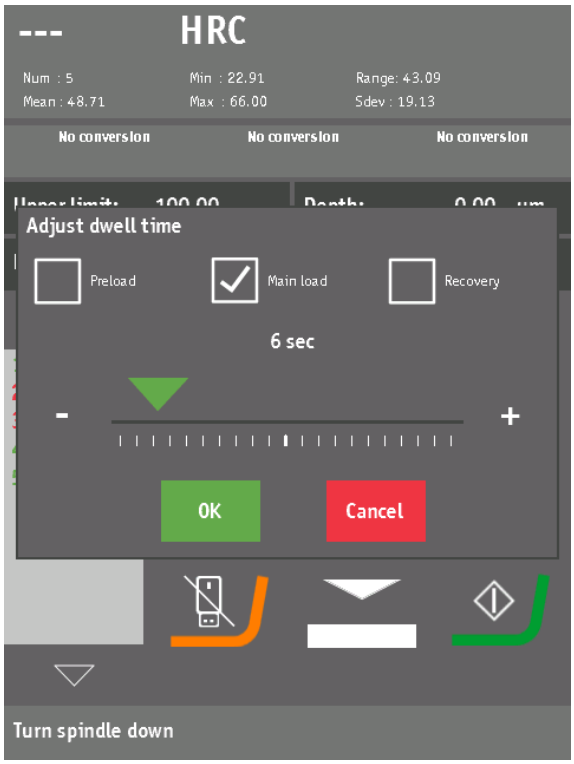
The lower part of the button shows a triangle or circle representing the indenter and a rectangular concave or convex shape that represents the specimen surface.

When an indentation starts, the progress field shows the position of the indenter while moving towards the specimen surface.

When the specimen surface is reached, the progress field changes to a bar graph that represents the measured force until the selected force is reached.

Set the dwell time

1. Tap the **Dwell time and progress** button.



2. Tap one of the boxes. You can set the dwell time for the following steps:
   - **Preload**
   - **Main load**
   - **Recovery**
3. Swipe the slider or use the **+** and **-** buttons to set the dwell time (in seconds).
4. Tap **OK**.

Hint
You can also set the dwell time from the **Select hardness scale and force** menu. See Select a scale ►37.

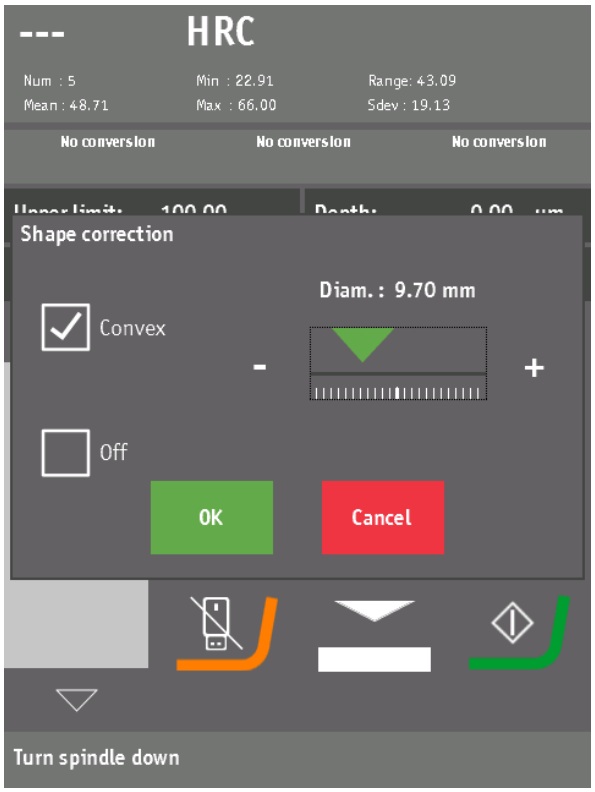
Shape correction

The **Dwell time and progress** button indicates the current shape correction:æ

Convex shape correction	No shape correction

To set the shape correction:

1. Tap and hold the **Dwell time and progress** button.



2. Tap **Convex** to enable the shape correction.
3. Swipe the slider or use the **+** and **-** buttons to set the diameter (in millimeters).
4. Tap **OK**.

To disable the shape correction:

- Tap **Off**.

Hint
You can also set the shape correction from the **Select hardness scale and force** menu. SeeSelect a scale ►37.

6.17 Perform a Rockwell test

CRUSHING HAZARD
Do not place your hand between the specimen and the indenter.

Preload

When the test starts, the indenter automatically moves downwards until it reaches the preload position.

The machine then applies the preload (3 kgf for superficial scales and 10 kgf for regular Rockwell scales).

This process is represented visually on the display. See Overview screen ►21.

Main load

After the preload has been applied the machine will automatically apply the main load.

Once the main load has been applied, the machine will pause for the selected dwell time.

When the dwell time has passed, the machine will automatically release the main load and return to the preload position.

Carry out a Rockwell test

1. Make sure that the specimen surface is smooth and even.
2. Make sure that the specimen surface is free from oxide scale, foreign matter and completely free of lubricants.
3. Set up the machine with the required Rockwell scale and the required indenter.
4. Place the specimen on the anvil.
5. Turn the spindle clockwise until the specimen is at a distance of 1 mm from the indenter.

Note
The specimen can be firmly in contact with the clamp , but it must not have contact with the indenter.

6. Tap **Start**. The **Stop** icon becomes available to stop the process.

Note
Do not use the emergency stop to stop the test.

7. Remove the specimen. If you are using a clamp, first move the spindle down to release the specimen.

Once the indentation cycle is complete, the Rockwell depth and the calculated hardness value are displayed and saved in the batch list.

Note
The first Rockwell reading on the specimen should not be considered in the statistics.

Note
If you test twice in the same spot, the result will be not be valid.

7 Maintenance and service

Proper maintenance is required to achieve the maximum up-time and operating lifetime of the machine. Maintenance is important in ensuring continued safe operation of your machine.

The maintenance procedures described in this section must be carried out by skilled or trained personnel.

Safety Related Parts of the Control System (SRP/CS)

For specific safety related parts, see the section "Safety Related Parts of the Control System (SRP/CS)" in the section "Technical data" in this manual.

Technical questions and spare parts

If you have technical questions or when you order spare parts, state serial number and voltage/frequency. The serial number and the voltage are stated on the type plate of the machine.

7.1 General cleaning

WARNING
Any defects observed must be repaired before using the machine.

To ensure a longer lifetime for your machine, we strongly recommend regular cleaning.

Note
Do not use a dry cloth as the surfaces are not scratch resistant.
Grease and oil can be removed with ethanol or isopropanol.

Note
Do not use acetone, benzol or similar solvents.

If the machine is not to be used for a longer period of time

- Clean the machine and all accessories thoroughly.

7.2 Daily

- Clean all accessible surfaces with a soft, damp cloth.

7.3 Weekly

- Clean all painted surfaces and the control panel with a soft damp cloth and common household detergents.

Weekly inspection

Part	Attention	Action	Precaution
Indenter	The tip is dirty.	Wipe the indenter.	Do not bend the indenter shaft.
Anvil	Rust.	Remove rust.	Do not bring the stage into contact with the turret.
Test block	Rust.	Replace the test block.	Do not use rusted test blocks.

Part	Attention	Action	Precaution
Spindle cover	The cover may be dislocated.	Fasten the cover.	Without the spindle cover, you can access the spindle freely.

7.4 Annually

Lubricate the spindle

Note
Do not lubricate the spindle with motor oil.

1. Power off the machine.
2. Carefully lift the spindle cover.
3. Clean the elevator spindle.
4. Lightly oil the spindle with a universal household oil.
5. Wipe the spindle thoroughly after lubrication so that as little as possible oil is left on the spindle.
6. Wipe the spindle again after a few days to ensure no oil residue is left on the spindle surface.

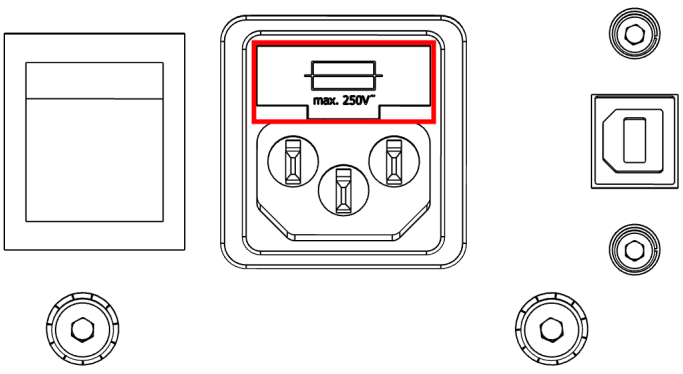
Test the emergency stop

1. Switch on the machine.
2. Activate the emergency stop.

   If the machine does not stop, contact Struers Service.

7.5 Replace the fuse

Fuse dimensions	Fuse rating
5 x 20 mm	3.15 AT, 250 V.



The fuse holder is located directly over the power socket at the rear of the machine.

1. Turn the machine off.
2. Disconnect the power supply cable.
3. Pull out the fuse holder.
4. Remove the blown fuse and replace it with the new fuse.
5. Reinstall the fuse holder.
6. Reconnect the electric power cable.

Hint
Remember to order a new spare fuse.

7.6 Calibration

The highly sensitive and accurate load cell of the machine is calibrated prior to shipping.

Contact Struers Service if the load cell or objectives require recalibration.

8 Service and repair

WARNING
Safety critical components must be replaced after a maximum lifetime of 20 years.
Contact Struers Service.

Note
Service must only be performed by a qualified technician (electromechanical, electronic, mechanical, pneumatic, etc.).
Contact Struers Service.

We recommend that a regular service check be carried out on a yearly basis.

9 Disposal

Equipment marked with a WEEE symbol contains electrical and electronic components and must not be disposed of as general waste.

Contact your local authorities for information on the correct method of disposal in accordance with national legislation.

For disposal of consumables and recirculation fluid, follow local regulations.

10 Troubleshooting

Hint
Most of the minor malfunctions can be resolved by restarting the machine.

Problem	Possible cause	Action
Indenter not present	No indenter selected	Select the installed indenter using the turret configuration menu.
Start-up failure	The emergency stop is activated.	Release the emergency stop and restart the machine.
Motor failure	Failure of force application motor.	Restart the machine. If the error remains, contact Struers Service.
User interface LCD does not light up.	No power supply.	Check the power supply.
	The fuse is burnt out.	Replace the fuse.
	The power supply cable is not connected or damaged.	Connect the power supply cable or replace it.
	The user interface LCD is defective.	Contact Struers Service.
The status bar turns red and one or more error messages are shown.	The power has been switched off and on too fast, without waiting in-between.	Switch the power off, wait for a few seconds, then switch the power on again.
	A technical problem causes the device to go into the error state. This can be caused by a bad connection, a malfunctioning sensor or an electronic problem.	Write down the error message(s) and contact Struers Service.

Problem	Possible cause	Action
The USB flash drive is not detected.	The flash drive is not detected properly.	Unplug the flash drive and plug it back in.
	The flash drive is not formatted for use with the FAT(32) file system.	Format the flash drive for use with the FAT(32) file system.
	The flash drive is defective.	Try a different flash drive.
When the USB flash drive is inserted, the machine does not respond anymore, until the flash drive is removed again.	The flash drive is defective or not compatible with the machine.	Try a different flash drive.
When trying to enter a limit, the machine does not respond.	The specific limit is not enabled.	Enable the limit. See Limit setup ►33.
Nothing happens when tapping areas where a button or touch sensitive area is displayed.	The touch screen is not calibrated properly.	Calibrate the touch screen. See Calibrate the touch screen ►24.
The object light lamp does not switch on.	No power supply.	Check the power supply.
	The fuse is burnt out.	Replace the fuse.
	The lamp is defective.	Replace the lamp.
No indentation is made.	The indenter tip is chipped off.	Replace the indenter.
	The machine is faulty.	Contact Struers Service.
	The indenter shaft is curved.	Contact Struers Service.
	Abnormal position of indentation.	Adjust the indentation position.
Abnormal hardness value.	The tip of the indenter is dirty.	Wipe the indenter.
	Installed in bad conditions.	Improve the installation conditions. See Location ►16.

Problem	Possible cause	Action
Irregular indentation shape.	The tip of the indenter is dirty.	Wipe the indenter.
	The indenter tip is chipped off.	Replace the indenter.
	The surface of the specimen is coarse or dirty.	Polish the surface of the specimen.
	The specimen is not level.	Level the specimen, so that its surface is perpedicular to the indenter.
	The specimen surface is curved.	Make an indentation at the highest point.
	The indenter shaft is broken.	Contact Struers Service.

11 Technical data

11.1 Technical data

Hardness methods	Rockwell & Superficial Rockwell	ISO 6508 ASTM E18 JIS Z 2245
	Brinell Depth (HBT)	Not standardized. Calibration table required.
	Carbon hardness	DIN 51917
	Ball indentation hardness	ISO 2039
Force range		29.4 - 2452 N (3-250 kgf)
Test force	Force application	Fully automatic, closed loop, force feedback, loading, dwell, unloading
	Test force tolerance	< 0.5 %
	Dwell time settings	Adjustable 1 to 99 s

Conversion		Conversions to other hardness methods according to ASTM E140,, ISO 18265, GB/T 1172
Turret	1 Position	1
Electrical data	Power supply	100 V AC - 240 V AC, 50/60Hz, single phase
	Power consumption max. work load	100 W
	Power consumption idle	13 W
	Power consumption max. load	100 W
	Power inlet	1-phase (N+L1+PE) or 2-phase (L1+L2+PE) The electrical installation must comply with Installation Category II
Residual Current Circuit Breaker (RCCB)		Type A, 30 mA is required depending on local regulations.
Dimensions	Width	230 mm (9.1")
	Depth	550 mm (21.7")
	Height	855 mm (33.7")
Weight		115 kg (252 lbs)
Read method		Automated
Meassurement camera resolution		NA
Positions in nosepiece		1
Position in nosepiece for overview camera		
Max no. of indenters		1
Max no. of objectives		NA
Indenter Shaft	Diameter	6.35
Standard objectives included		NA
Z-Axis		Manual

Anti-colission protection		
XY Stage / Anvil		Anvil, Ø60 mm (2.4"), other sizes and shapes optional
Stage Illumination		Yes
Software	Operating software	Embedded
	Integrated PC	No
	Monitor	6.5" portrait mode capacitive touch screen
	Dual view	No
	Possibility to connect printer	No
	Ethernet Connection	No
	Data Export	USB
System	Data output	TXT
Software modules		Total test, max, min, average, range, standard deviation, all in real time after each test
Sample height		240 mm (9.4")
Throat depth		150 mm (5.9")
Safety standards		CE labeled according to EU directives
REACH		For information about REACH. contact your local Struers office
Operating environment	Surrounding temperature	10 - 35°C (50 - 95°F)
	Humidity	10% - 90% RH non-condensing
Safety Circuit Categories/Performance Level	Emergency stop	EN ISO 13849-1 PL c, Category 1 Stop category 0
Noise level	A-weighted sound emission pressure level at workstations	< 70 dB(A)
Vibration level	During operation	Total vibration exposure to upper parts of the body does not exceed 2.5 m/s^2.

11.2 Safety Related Parts of the Control System (SRP/CS)

WARNING
Safety critical components must be replaced after a maximum lifetime of 20 years.
Contact Struers Service.

Note
SRP/CS (safety-related parts of a control system) are parts that have an influence on safe operation of the machine.

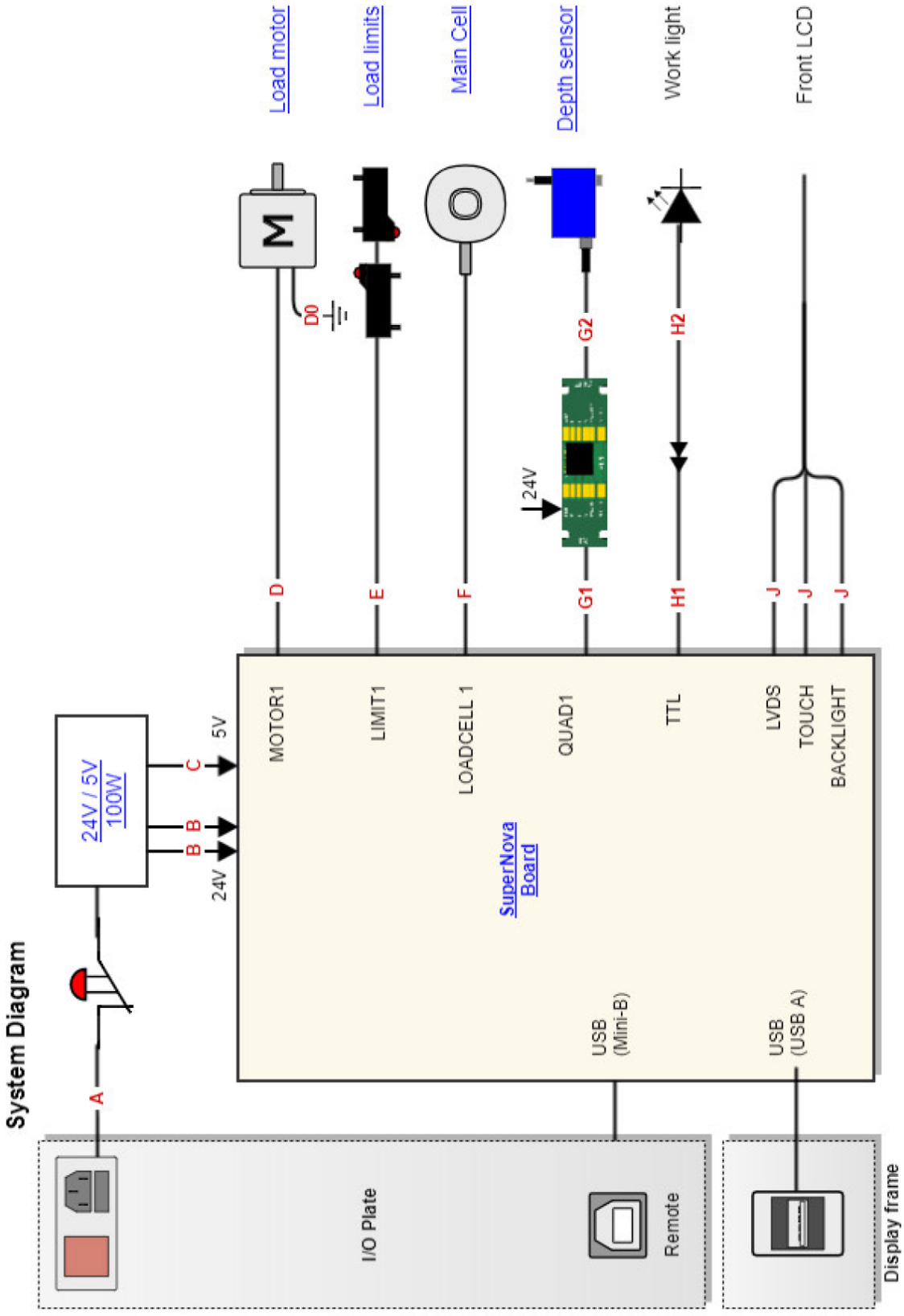
Note
Replacement of safety critical components must only be performed by a Struers engineer or a qualified technician (electromechanical, electronic, mechanical, pneumatic, etc.).
Safety critical components must only be replaced by components with at least the same safety level.
Contact Struers Service.

Safety Circuit Categories/Performance Level	
Emergency stop	EN ISO 13849-1 PL c, Category 1 Stop category 0

Safety related part	Manufacturer/Manufacturer description	Manufacturer catalog no.
Emergency stop button	Schneider Electric	XB2BS542C

11.3 Diagrams

Title	Version
DuraVigo-150, System diagram	1


System Diagram
Load motor
Load limits
Main Cell
Depth sensor
Work light
Front LCD
D0
G2
H2
24V
D
E
F
G1
H1
J
J
J
24V / 5V
100W
C
5V
B
B
24V
MOTOR1
LIMIT1
LOADCELL 1
QUAD1
TTL
LVDS
TOUCH
BACKLIGHT
SuperNova
Board
USB
(Mini-B)
USB
(USB A)
A
I/O Plate
Remote
Display frame

12 Manufacturer

Struers ApS
Pederstrupvej 84
DK-2750 Ballerup, Denmark
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www.struers.com

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.

Struers
Ensuring Certainty

Based on: 16687902 A

Declaration of Conformity

Manufacturer	Struers ApS • Pederstrupvej 84 • DK-2750 Ballerup • Denmark
Name	DuraVigo-150
Model	N/A
Function	Hardness tester
Type	668
Cat. no.	06686111
Serial no.	

CE Module A, according to global approach **EU**

We declare that the product mentioned is in conformity with the following legislation, directives and standards:

2006/42/EC	EN ISO 12100:2010, EN ISO 13850:2015, EN ISO 13849-1:2015, EN ISO 13849-2:2012, EN 60204-1:2018
2011/65/EU	EN IEC 63000:2018
2012/19/EU	EN 50419:2022
2014/30/EU	EN 55011:2016/A1:2017/A11:2020, EN 61326-1:2021, EN IEC 61000-3-2:2019/A1:2021, EN IEC 61000-3-3:2013/A1:2019/A2:2021/C1:2022, EN IEC 61000-4-2:2009, EN IEC 61000-4-3:2020, EN IEC 61000-4-4:2012, EN IEC 61000-4-5:2014/A1:2018, EN IEC 61000-4-6:2023, EN IEC 61000-4-8:2010, EN IEC 61000-4-11:2020/C1:2020

Authorized to compile technical file/
Authorized signatory

Date: [Release date]

Struers
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en	For translations see
bg	За преводи вижте
cs	Překlady viz
da	Se oversættelser på
de	Übersetzungen finden Sie unter
el	Για μεταφράσεις, ανατρέξτε στη διεύθυνση
es	Para ver las traducciones consulte
et	Tõlked leiate aadressilt
fi	Katso käännökset osoitteesta
fr	Pour les traductions, voir
hr	Za prijevode idite na
hu	A fordítások itt érhetők el
it	Per le traduzioni consultare
ja	翻訳については、
lt	Vertimai patalpinti
lv	Tulkojumus skatīt
nl	Voor vertalingen zie
no	For oversettelser se
pl	Aby znaleźć tłumaczenia, sprawdź
pt	Consulte as traduções disponíveis em
ro	Pentru traduceri, consultați
se	För översättningar besök
sk	Preklady sú dostupné na stránke
sl	Za prevode si oglejte
tr	Çeviriler için bkz
zh	翻译见

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