Bedienungsanleitung
Instruction manual
Istruzioni per l uso
Instructions d emploi
Instrucciones para el uso

EMCO TEST

Instruction manual

Original instruction manual

DuraJet G5

A2015-05 EN

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Contents

1 Introduction

1.1 Preface

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

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

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

1.2 Safety notes

Safety regulations

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

Operating instructions

Read all operating instructions before you start the machine.
Keep the operating instructions in the vicinity of the machine. Order a new copy if you lose it.

Moving the machine

To avoid personal injury while moving the machine, never try to move it unassisted. The machine's weight is approximately 110 kg.

Transportation safety devices

Remove all transportation safety devices before starting the machine.

Installation

- Position the machine on a secure and stable working surface.
- Ensure that its working height is in accordance with ergonomic principles and will not result in unnecessary physical strain.
- Ensure that there is sufficient space available to access the machine and that an adequate escape route is kept clear to provide for unforeseen incidents.
- Ensure that the work station has adequate lighting.
- The hardness testing machine must be protected against shocks and vibrations that can influence the test result.

Fire and explosion protection

Please bear in mind that the machine must not be used in explosive environments.

Workwear and protective equipment

Ensure that workwear is close-fitting and cannot become entangled in the machine's moving parts. Make sure you use your personal protective equipment.

Electrical power supply

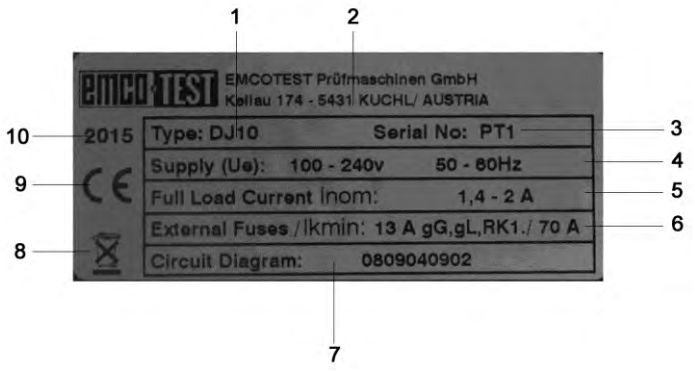
The machine must be connected to a grounded electrical outlet (a protective conductor contact is required).

Work time	Do not work with the machine for too long or when you are unable to concentrate properly.
Protection from splashing	The machine must not come into contact with water. Protect the machine from splashing.
Startup	Before each startup, ensure that the machine is in a flawless condition and that none of the safety features have been removed and are all functional. Any damaged cables must be replaced immediately by authorized personnel.
Operation by authorized personnel	Ensure that the machine is only operated by authorized and properly trained persons. Ensure that the machine cannot be started or operated by unauthorized persons.
Single-person machine	Ensure that the machine is only operated by one person at all times.
Unauthorized changes	Do not make any unauthorized changes to the machine's safety features. Bridging of control features and any interference with the electrical/electronic components of the machine are not permitted and will nullify the warranty in all cases.
EMERGENCY-OFF	In case of emergency, shut down the machine immediately with the EMERGENCY-OFF button.
Securing workpieces	Before testing, check that the testing tools are securely clamped. Do NOT attempt to touch the internal parts of the machine while it is operating. Use appropriate fixings to secure any workpieces that do not stay in place without support. Never hold workpieces in place by hand! Wear protective gloves when handling heavy or sharp workpieces or removing chips.
Resetting the machine	Use the main switch to turn the machine off before resetting.
Supervision	Never leave the machine unsupervised while it is operating. Always switch the machine off before leaving the work station.
Work station	Keep your work station clean and tidy. A cluttered work station increases the risk of injury.
Maintenance	Use the main switch to turn the machine off. Remove the power plug to disconnect the machine from the power supply before you carry out any maintenance or readjustments. Any work on the machine's electrical parts unit should only be carried out by skilled electricians or service technicians.
	Comply with the stipulated inspection and maintenance intervals (see standards EN ISO 6507, EN ISO 6505, EN ISO 6508, EN ISO 4545, EN ISO 2039).
Claims	Contact your supplier in the event of collision or damage. Always specify the unit number and software version of your machine in cases of complaint or damage or when making inquiries or ordering replacement parts.

1.3 Manufacturer's notes

Rating plate

The rating plate sits at the right-hand side on the base. It shows the information that is required to identify the machine.



1 Manufacturer information
2 Type name
3 Serial number
4 Mains voltage
5 Nominal motor voltage
6 External fuse
7 Number of the circuit diagram
8 Disposal information
9 CE sign
10 Year of manufacture

Manufacturer information

Address	EMCOTEST Prüfmaschinen GmbH Kellau 174 5431 Kuchl Austria
Phone	+43 6244 20438
Fax	+43 6244 20438-8
E-mail	office@emcotest.com
Internet	www.emcotest.com

Intended use

The machine is intended to be used to test hardness in accordance with the following methods:

Metals, plastic material and carbon material

- Rockwell EN ISO 6508, ASTM E18
- Plastics EN ISO 2039-1
- Brinell and Vickers, depth hardness only, not standardized
- Testing carbon material DIN 51917

Conversion standards: DIN EN 50150, EN ISO 18265, ASTM E140-05.
Testing other material is not permitted or, in exceptional cases, only after agreement with your contact person. Never use poisonous or harmful materials. Intended use also includes observing the specified operating and maintenance instructions.
The machine must be installed in a clean location. It is particularly important that this location is free of metal chips, dust, smoke and other contaminants. If the ambient air at

the installation location is contaminated, the machine must be operated in a separate closed test cell.
The machine may only be operated by persons who have been properly trained in the operation, maintenance and repair of the machine, and are aware of the risks involved. All accident prevention and safety instructions for operating the machine must be observed. The manufacturer does not accept any liability in cases where the machine is used for purposes other than those for which it is intended. In these cases, liability is transferred to the user.

Ambient temperature

The machine is adjusted for the ambient temperature specified in the technical data.

Unauthorized uses of the machine

The machine must not be used to test workpieces with low mechanical stability, which may become distorted or may break when clamped.
Workpieces that are stable but do not have the required structural integrity may only be clamped if they are secured using appropriate fixings.
The machine should not be used for workpieces which are toxic or harmful to health.

EC conformity

CE

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

Disposal

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

Warranty conditions for new machines

The warranty period for new machines is 24 months from the date of delivery by the manufacturer with unlimited operating hours.
If a defect is detected, inform your sales partner or nearest service center of the manufacturer immediately, providing a detailed description of the defect in written form, over the phone or in person.
Defects that are properly reported and are covered by the manufacturer's warranty will be corrected free of charge either by repair or replacement delivery. If requested, defective parts are to be returned to the manufacturer at the customer's expense and risk.
The manufacturer's warranty does not apply to defects that are caused by one or more of the following:

- failure to fully comply with the operating instructions, safety and licensing regulations or other instructions relating to the delivery, installation, startup or use of the machine
- incorrect assembly or startup of the machine
- unauthorized, unapproved interference with or modifications to the machine by the customer or a third party
- improper or inappropriate use of the machine for purposes other than those for which it is intended
- normal wear and tear
- negligent or incorrect handling
- chemical, electrochemical or electrical exposure
- an insufficient or incorrect power supply
- force majeure

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

1.4 Icons and Typographic Conventions

Safety instructions

The following safety instructions are used in this document. The sequence starts with the most important information, and shows the importance of the messages.
A safety instruction always begins with the hazard sign, the signal word, and a text box that explains the hazard point and gives handling instructions.

DANGER

The safety instruction DANGER stands for an extremely dangerous situation. Nonobservance will lead to severe and even fatal injuries (burns, for example).
Observe the danger warning, and take greatest care (using protective equipment, for example) to face the danger. Persons must work very carefully in this area.

WARNING

The safety instruction WARNING stands for a very dangerous situation. Nonobservance can lead to severe, irreversible and even fatal injuries, and loss of limbs.
Observe the danger warning, and take greatest care (using protective equipment, for example) to face the danger.

CAUTION

The safety instruction CAUTION stands for a dangerous situation. Nonobservance can lead to injuries or material damage.
Observe the danger warning, and take greatest care (using protective equipment, for example) to face the danger.

NOTE

The safety instruction NOTE refers to situations that can lead to material damage. They show how damage can be avoided.

Icons

The following icons and typographic conventions are used in this instruction manual:

Crushing hazard
indicates a risk of crushing, threatening life and limb of persons.

Electric current
indicates a risk of electric current, threatening life and limb of persons.

Danger
indicates a risk that threatens life and limb of persons.

Note
indicates a risk of damage to property, or the need to proceed with special care.

Information
indicates additional information and tips

Typographic conventions

Bold	indicates menu options and button labels
Italics	indicate names, software programs or figure titles
`Monospace`	indicates system output
"Inverted commas"	indicate chapter titles and terms of particular importance
➢	indicates a necessary work step

1.5 Technical Data

Technical data

Test loads	
[N]	9.8-2450N
[kgf]	1-250kg
Test anvil/nose cone/test unit	
Test unit drive [1]	DC motor
Standard support [mm]	Diameter 25
Nose cone support [mm]	Diameter 15
Nose cone drilling [mm]	Diameter 8
Test anvil dimensions	
Width x depth [mm]	180 x 185
Throat depth [mm]	175
Test height [mm]	260
Max. weight of workpiece [kg]	100
Power supply [V]	110 V / 230 V
Max. voltage fluctuations [%]	+6/-10
Frequency [Hz]	50/60
Max. power consumption [W]	max. 120 W
Main fuse rating at 230 V [A/T]	T 6.3 A
Main fuse rating at 110 V [A/T]	T 6.3 A
Touch screen [inches]	7 in.
Dimensions	
Basic unit (WxHxD) [mm]	300x740x562
Footprint (WxD) [mm]	700x900
Weight of basic unit [kg]	approx. 110
Ambient conditions	
Room temperature [°C]	5-40
Rel. humidity (non-condensing) [%]	up to 90
Protection category EN60529 [1]	IP20

Electrical power supply

The machine adjusts automatically to the voltage variant.

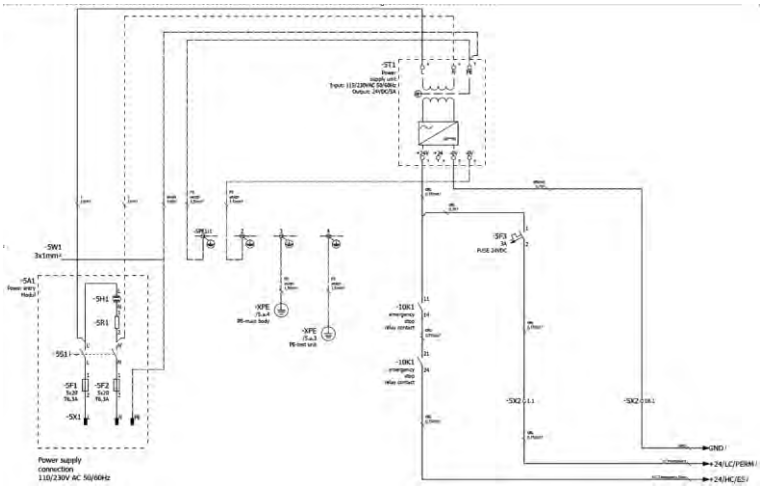
Voltage	230V~1/N/PE 50/60 Hz 110V~1/N/PE 50/60 Hz
Max. voltage fluctuations	+6%/-10%
Power consumption	120 W
Fuses	T 6.3 A

Circuit diagram

DANGER

Electric current

- Connect the machine only to a grounded electrical outlet with a protective earth conductor contact.
- Any intervention in the electrical/electronic part of the unit is prohibited.



2 Startup

2.1 Transporting the Machine

Unpacking the machine

The machine is delivered on a pallet. Its outer packaging varies depending on the country of delivery and the delivery agreements.

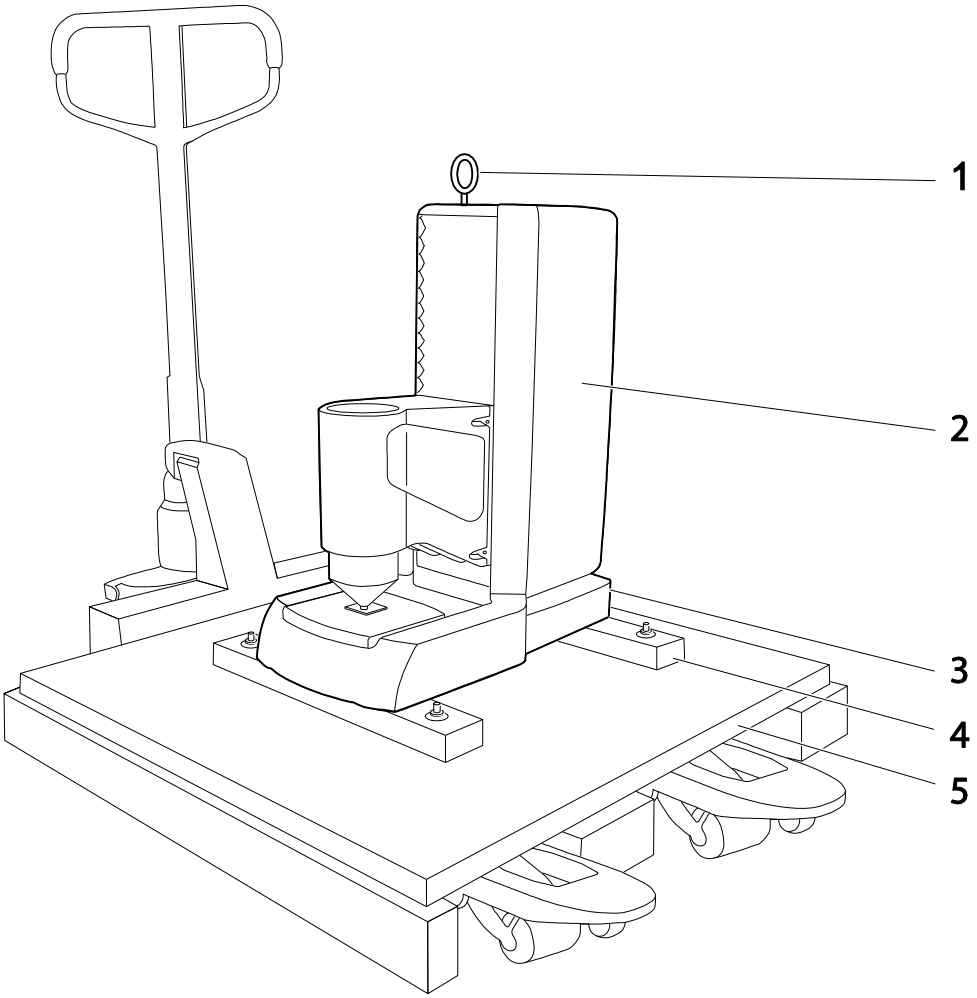
- Remove the packaging.
- Use a lifting vehicle to move the machine on the pallet.

WARNING

Overturning parts with improper transport.

Severe injuries from overturning parts.

- Secure the unit with bolts on the pallet.
- Transport the unit only on the pallet and with a lifting vehicle.

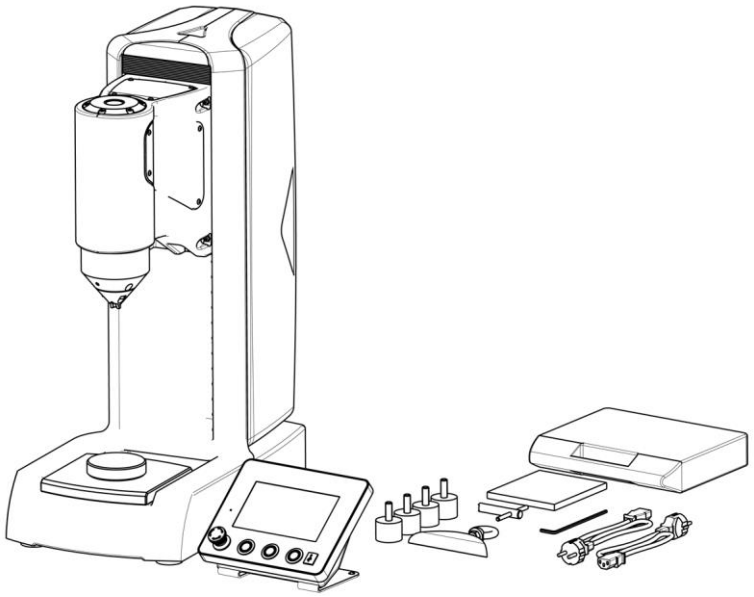


1 Ring bolt with 10 mm thread for transportation by crane
2 Hardness testing machine
3 Serial number of the unit
4 Transportation rails
5 Pallet for transporting with lifting vehicle

2.2 Scope of Supply

Inspecting the delivery

- Inspect the machine for any damage that may have occurred during transportation, and check the delivery for completeness.
- If you detect any defects or discrepancies, contact your supplier or insurance provider immediately.
- Please specify the serial number of the machine when you make a complaint. You can find this serial number on the rating plate at the rear of the machine.



- Hardness tester with mounted nose cone
- Standard XY table DM 90mm
- Control part with 7-in touch screen
- 4x feet
- Cover for ring-bolt hole
- 2 power cables (EU/US plugs)
- 2 replacement fuses (slow-blow 6.3 A)
- 1 socket head wrench (Allen wrench)
- 1 socket wrench for changing the indenter
- CD-ROM with machine data, certificate and documentation
- Ring bolt

Optional accessories

- Indenter
- Nose cone
- Test anvils

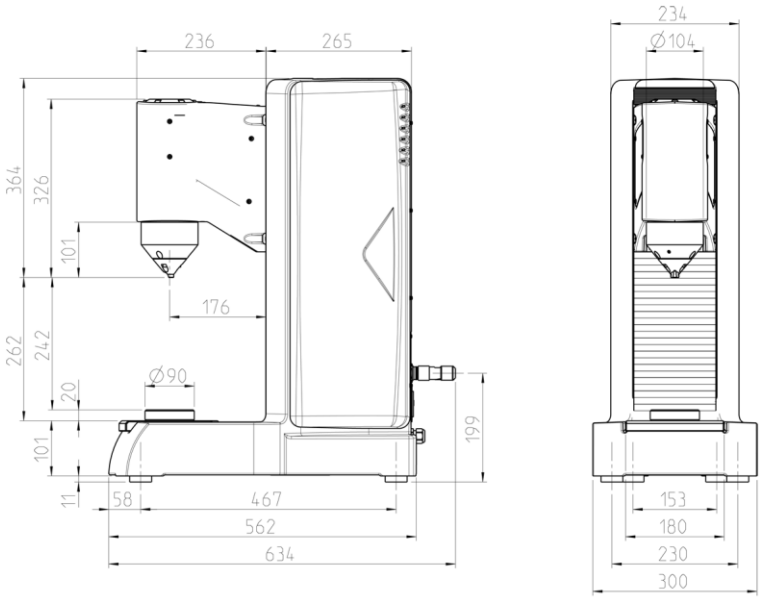
If you ordered an indenter, it is included in the delivery and must be mounted.
To order additional accessories and replacement parts, contact your supplier. Only approved products have been tested for use with this machine.

- Calibrated test blocks
- Test anvils
- Nose cones
- USB printer
- USB hub
- USB flash disk (USB stick)

2.3 Weight and Dimensions

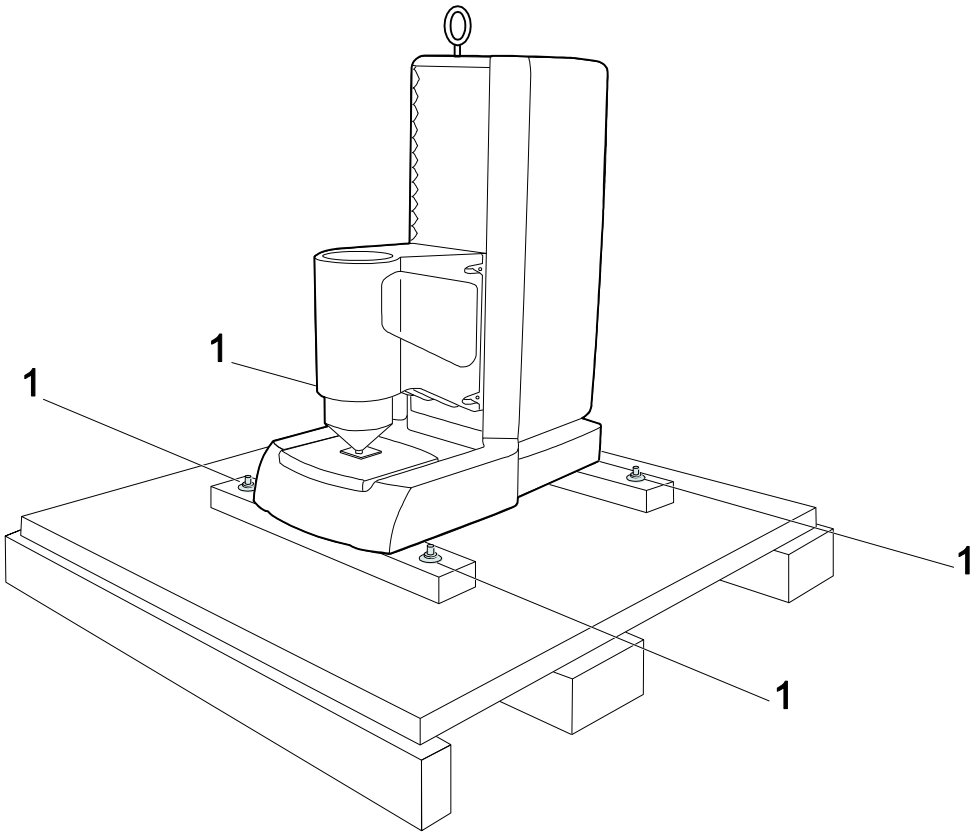
Weight and dimensions

excluding pallet and transportation rails: approx. 110 kg
including pallet and transportation rails: approx. 150 kg



2.4 Installing the Machine

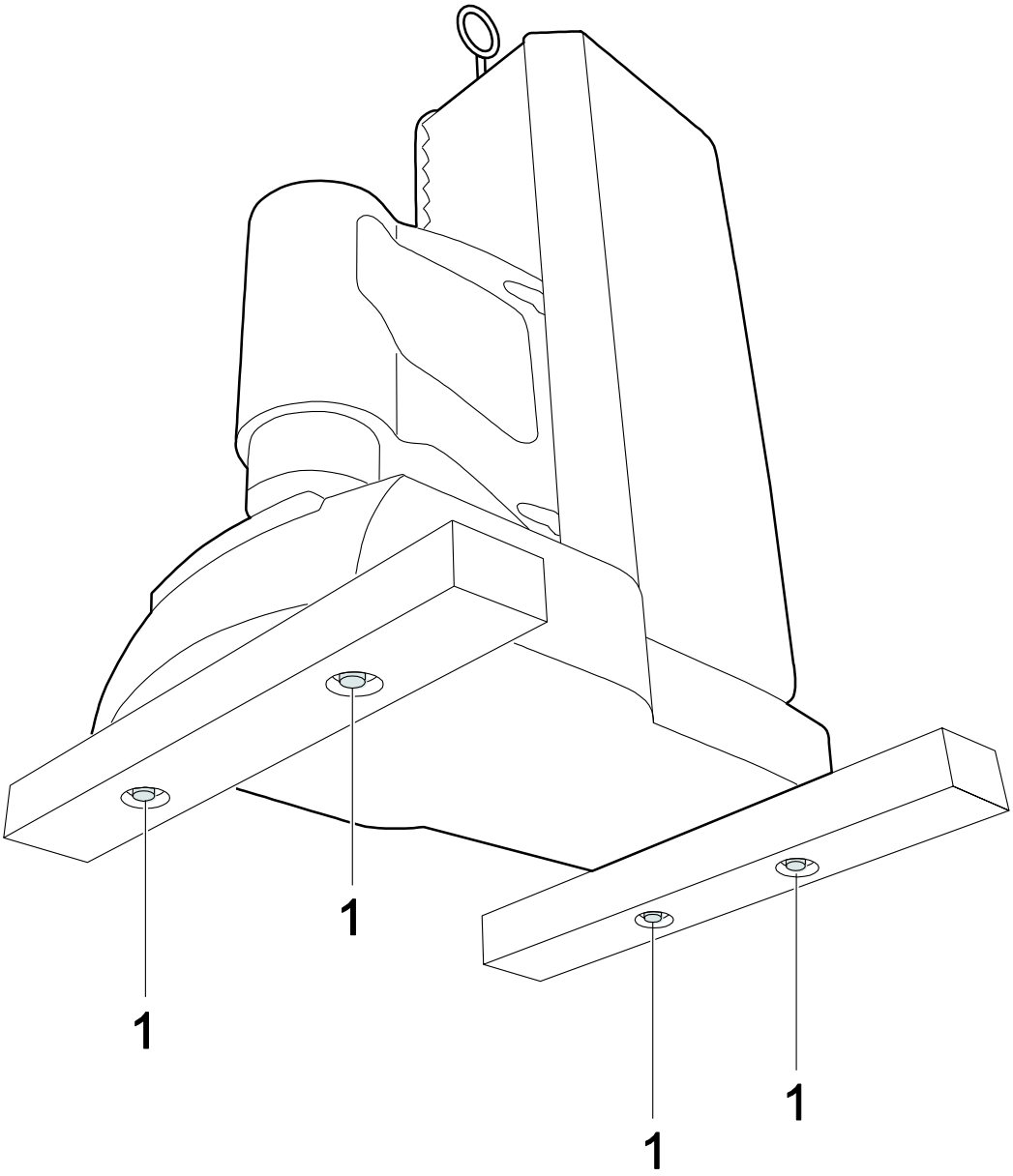
Lifting the machine off the pallet



- Loosen the four fastening screws (1).
- Use a crane to lift the machine off the pallet by the ring screw.

Removing the transportation rails

Two transportation rails are screwed onto the machine in place of the feet.



- Use a crane to lift the machine.

WARNING

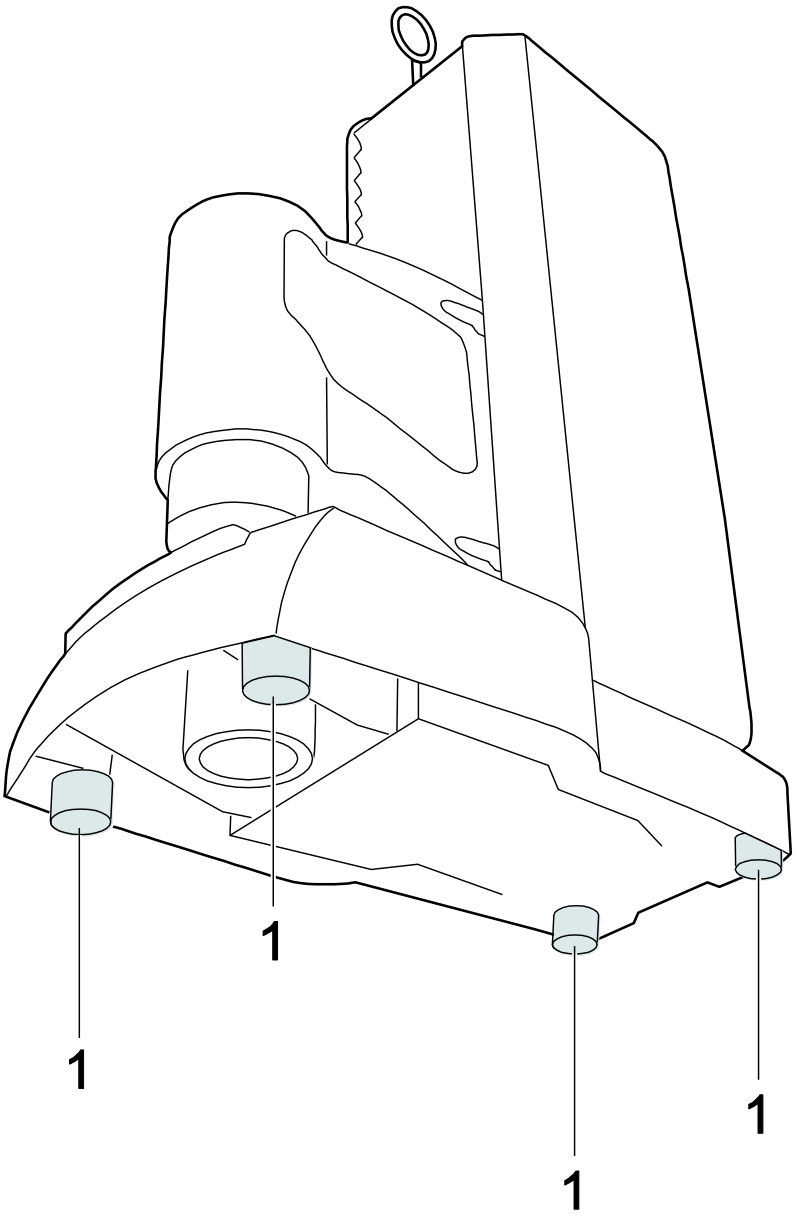
Dropping parts.

Severe injuries of head and limbs.

- When using a crane for lifting, never exceed the maximum lifting capacity of the rope or chain.
- Ensure that nobody stays under the suspended load.

- Put down the unit on 2 assembly stands.
- Remove the screws (1) fastening the transportation rails and remove the rails.

Attaching the feet



➢ Screw the feet provided (1) to the unit while the unit is still suspended from the crane and is supported by the assembly stands.

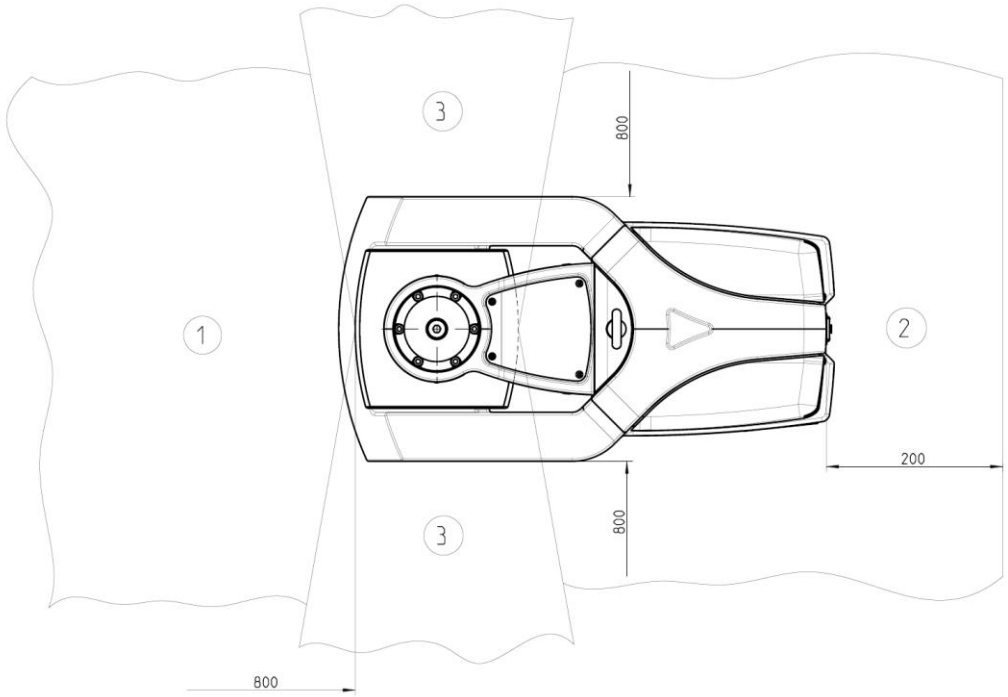
Otherwise, it is difficult to attach the feet because the unit weighs 110 kg and lies flat on any surface when the feet are not attached.

Installing the machine

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

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

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



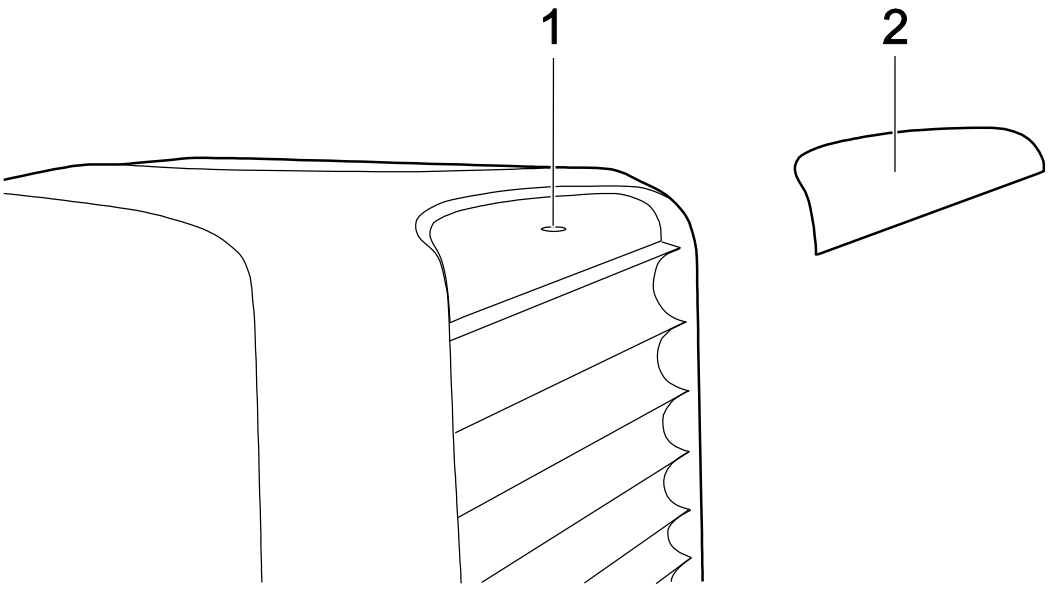
1 Space required for operation
2 Space required for maintenance
3 Space required for workpiece feed

The machine's ergonomic design is intended to optimize operation.

- During installation, ensure that the work station has adequate lighting.
- Avoid direct glare (dazzling light sources within the operator's line of vision) and reflected glare (reflections and light reflexes) on the touch screen.

Attaching the cover

➢ Remove the ring bolt.

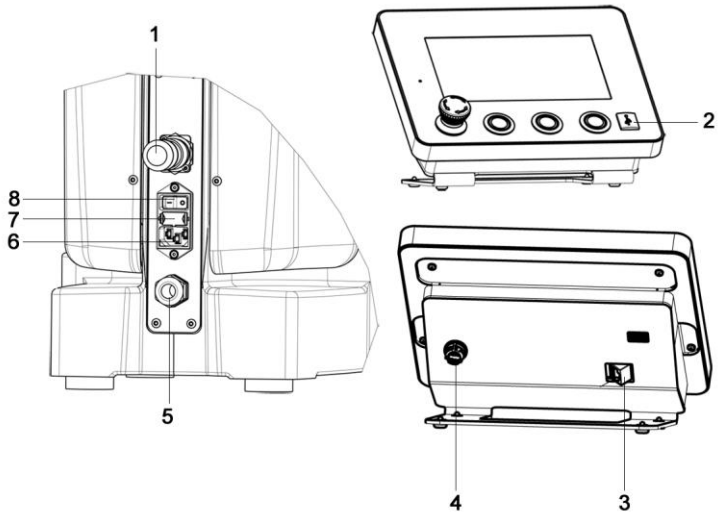


➢ Secure the cover (2) over the ring bolt (1).

The cover is supplied with a Velcro fastener.

2.5 Initial Startup

Connecting the unit



Connections on the units

1 Hardware interface (option)
2 USB connection
3 Ethernet interface
4 Control unit connection
5 Control unit connection
6 Mains connection
7 Fuses
8 Main ON/OFF switch with indicator lamp

- Turn the main switch to OFF.
- Plug the connector of the fixed control unit cable into the connection on the control unit.

Ensure that the control unit cable is firmly screwed into place.

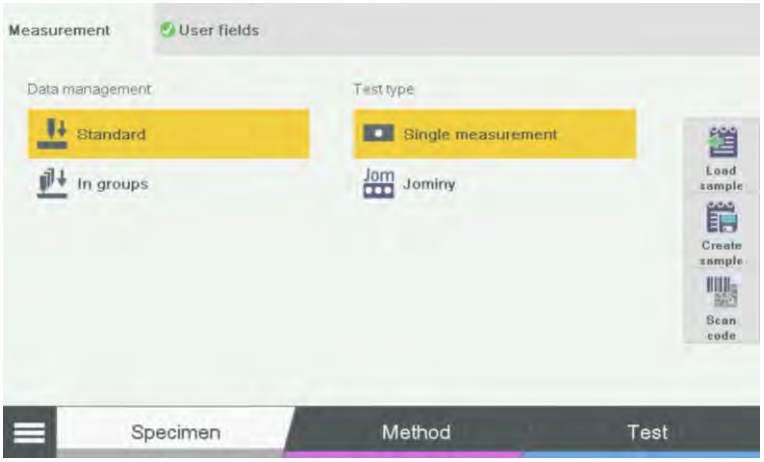
- Plug the power cable into the mains connection.
- Plug the opposite end of the power cable into a grounded electrical outlet with a protective earth conductor contact.

Switching on the unit

- Turn the main switch to ON.
- To release the EMERGENCY OFF button on the control unit, turn it clockwise.

The software starts the initialization process.

After one to two minutes, the initial screen appears on the touch screen monitor of the control unit, followed shortly afterwards by the main menu.

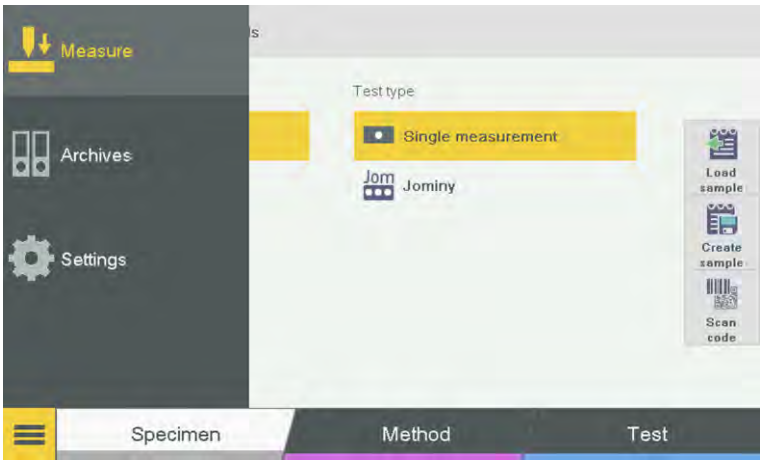


Selecting language - units

The default language of the software is English. If you want to use the software in a language other than English, you must configure this first.

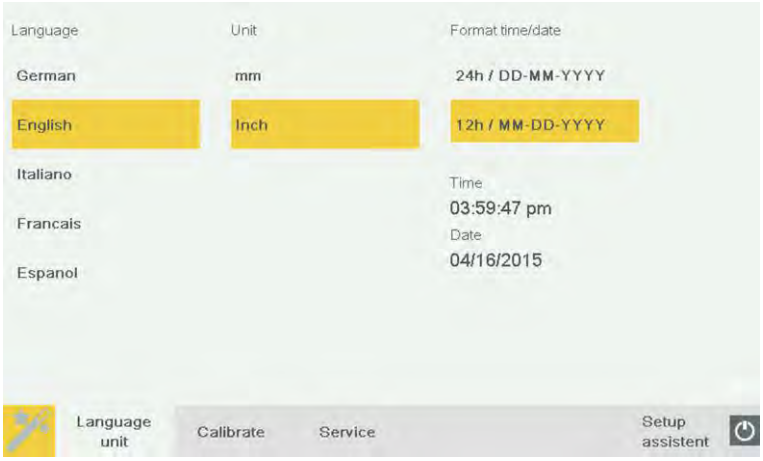
➢ Select the button with your finger or with the touch pen.

The following screen appears on the touch screen monitor:

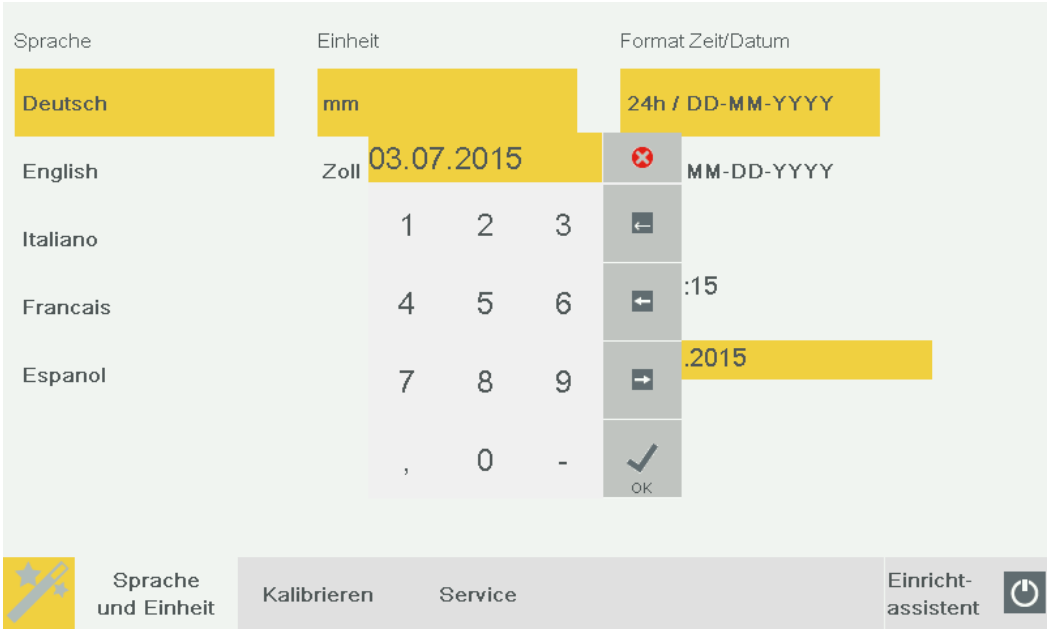


➢ Select the button **Settings**.

- Select the button **Open**.
- Select the language **German**.



- Select the unit **mm**.
  - Language and unit have been selected.
- Select data and time in the right column.
- Select **Time** or **Date**.



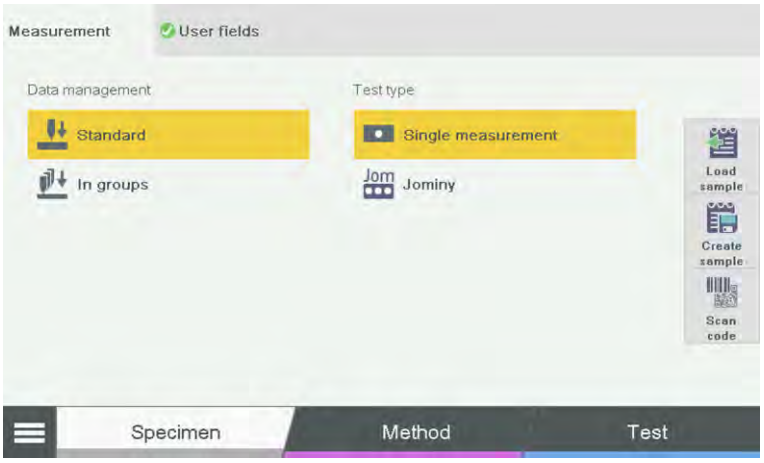
- Enter the current data and time in the numeric box. Touch the button to abort the input. Touch the button to confirm the input. Touch the and buttons to move the cursor. Touch the button to delete the number to the left of the cursor.
  - Date and time are selected and the settings are completed.
- Touch the button back to configuration.
- Touch back to measuring.

Activating the measuring mode

The three buttons **Nose Cone Up**, **Nose Cone Down**, and **Start Testing** on the control unit are only active when measuring mode is activated.

➢ Select the **Testing** button with your finger or with the touch pen.

The unit is now operating in a measuring mode and you can use the **Nose Cone Up**, **Nose Cone Down** buttons on the control unit to move the test unit up or down.



*Touch the **Test** button*

DANGER

Risk of crushing from dropping test unit.
Crushed hands, arm, or fingers.
➢ Keep your hands away from the area around the moving test unit.

➢ Use the **Nose Cone Up** button on the control unit to move the test unit upwards until you can easily reach the nose cone.
➢ Remove the transportation safety device (cardboard padding) from the test anvil.

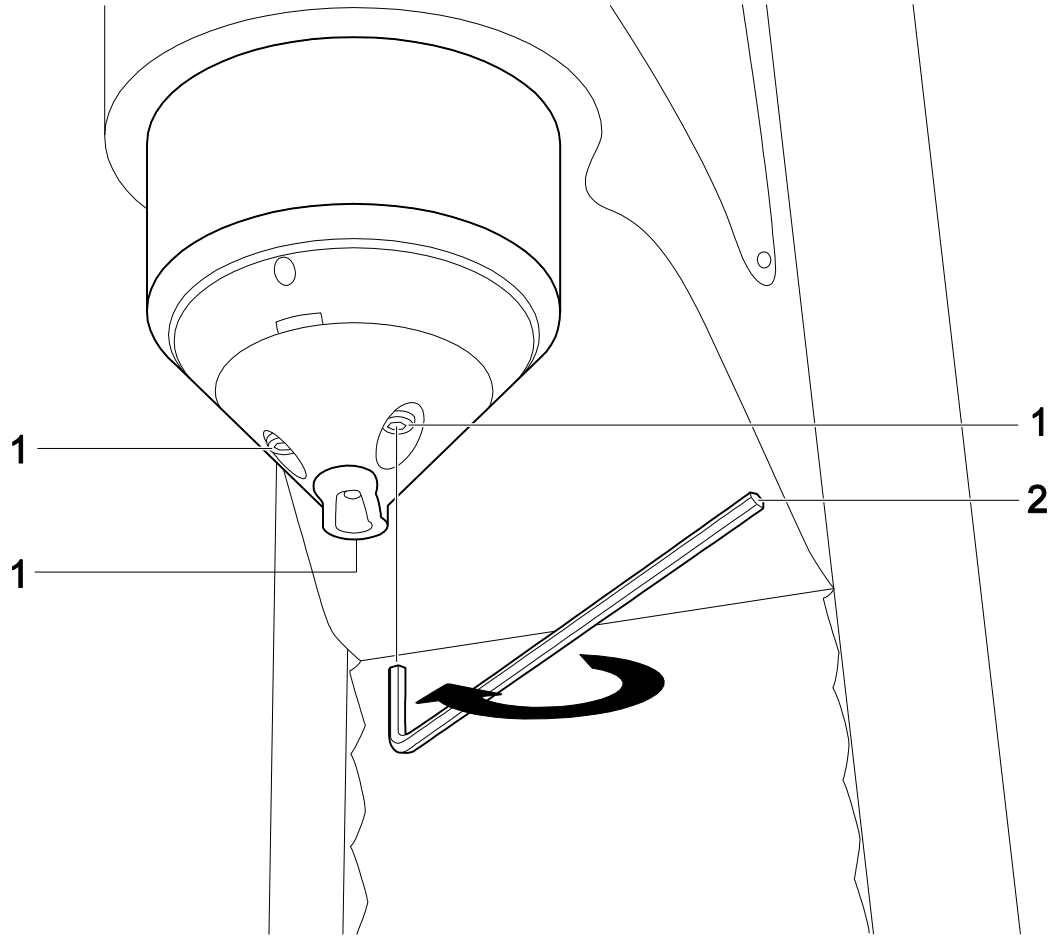
Mounting the indenter

If you ordered an indenter, it is included in the delivery and must be mounted.

Caution

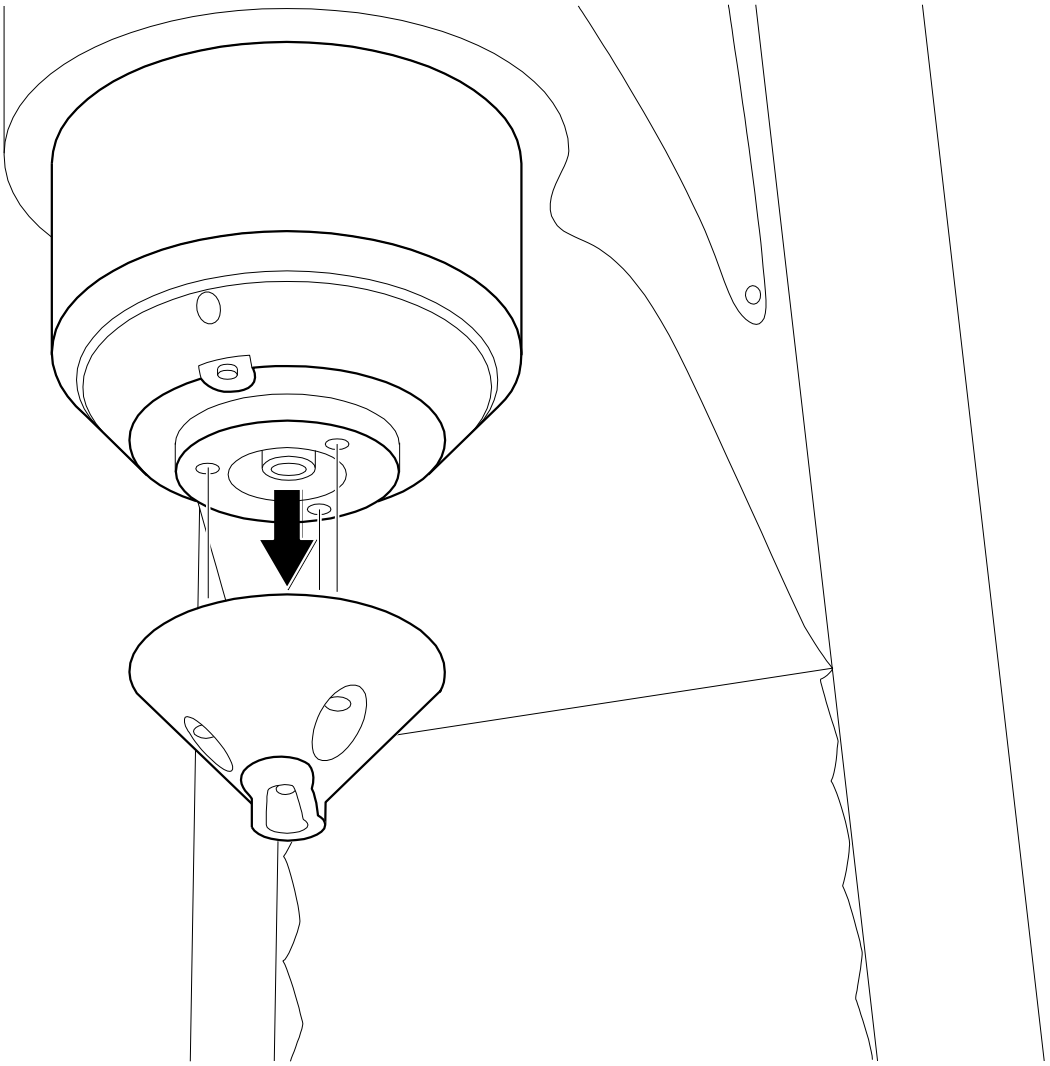
Use the main switch to turn the tester off before mounting or dismounting the indenter.
➢ Turn the main switch to the OFF position.

Removing the nose cone



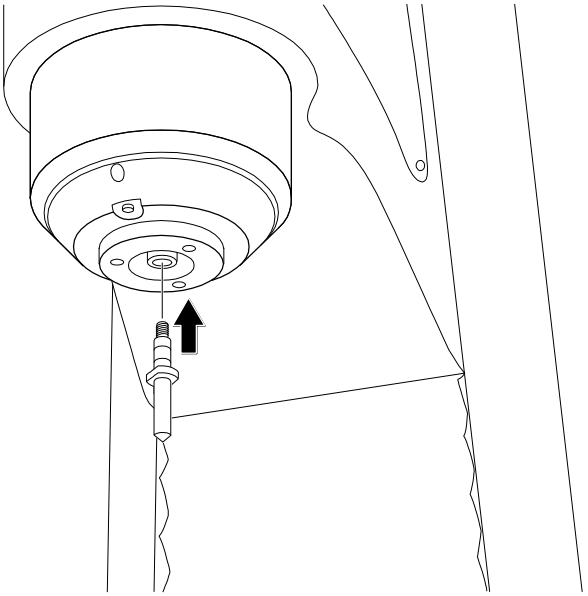
1 Screws
2 Allen wrench (socket head wrench)

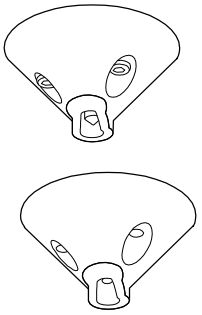
➢ Use the allen wrench supplied to loosen the three screws.



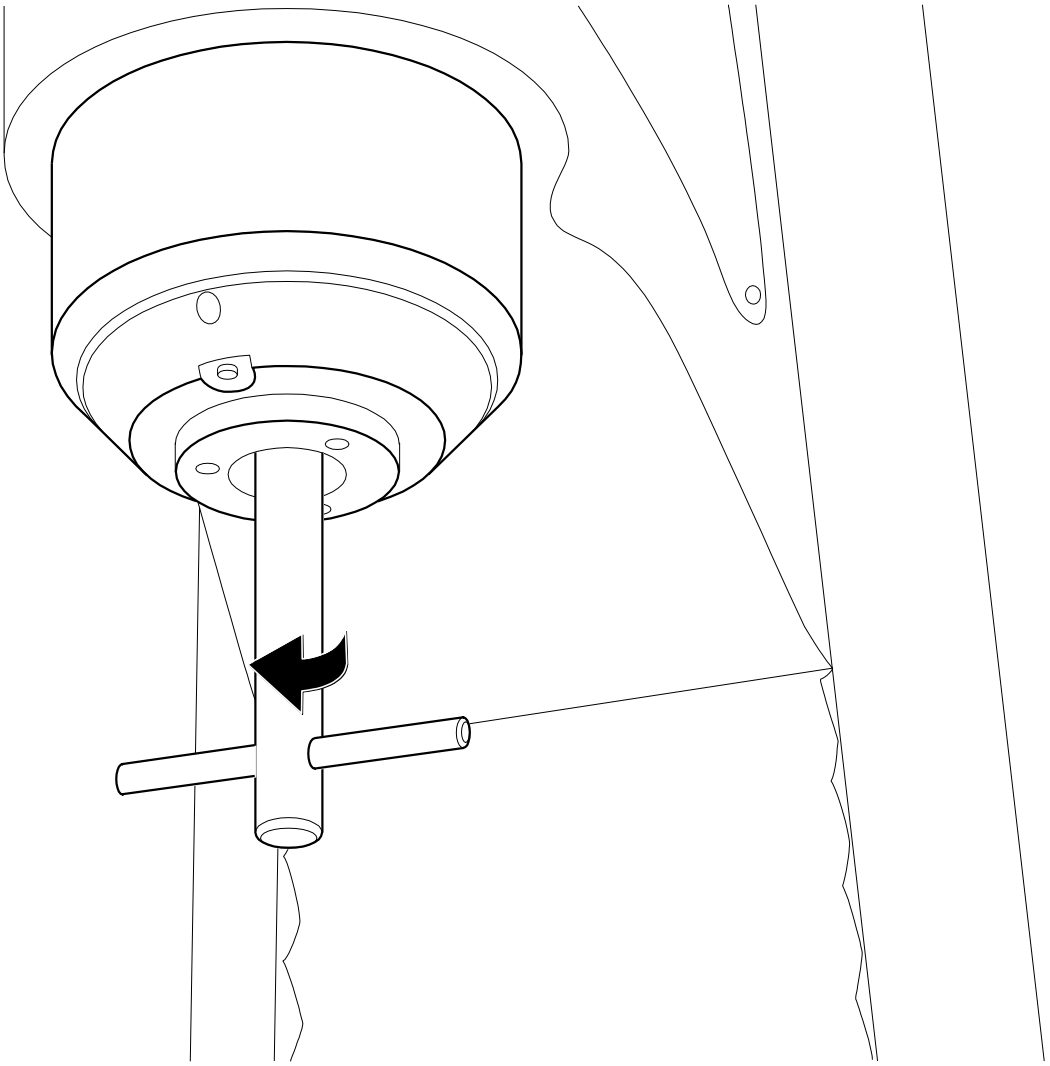
➢ Remove the nose cone.

Inserting the indenter





➢ Insert the indenter.



➢ Use the socket wrench provided to secure the indenter.

NOTE

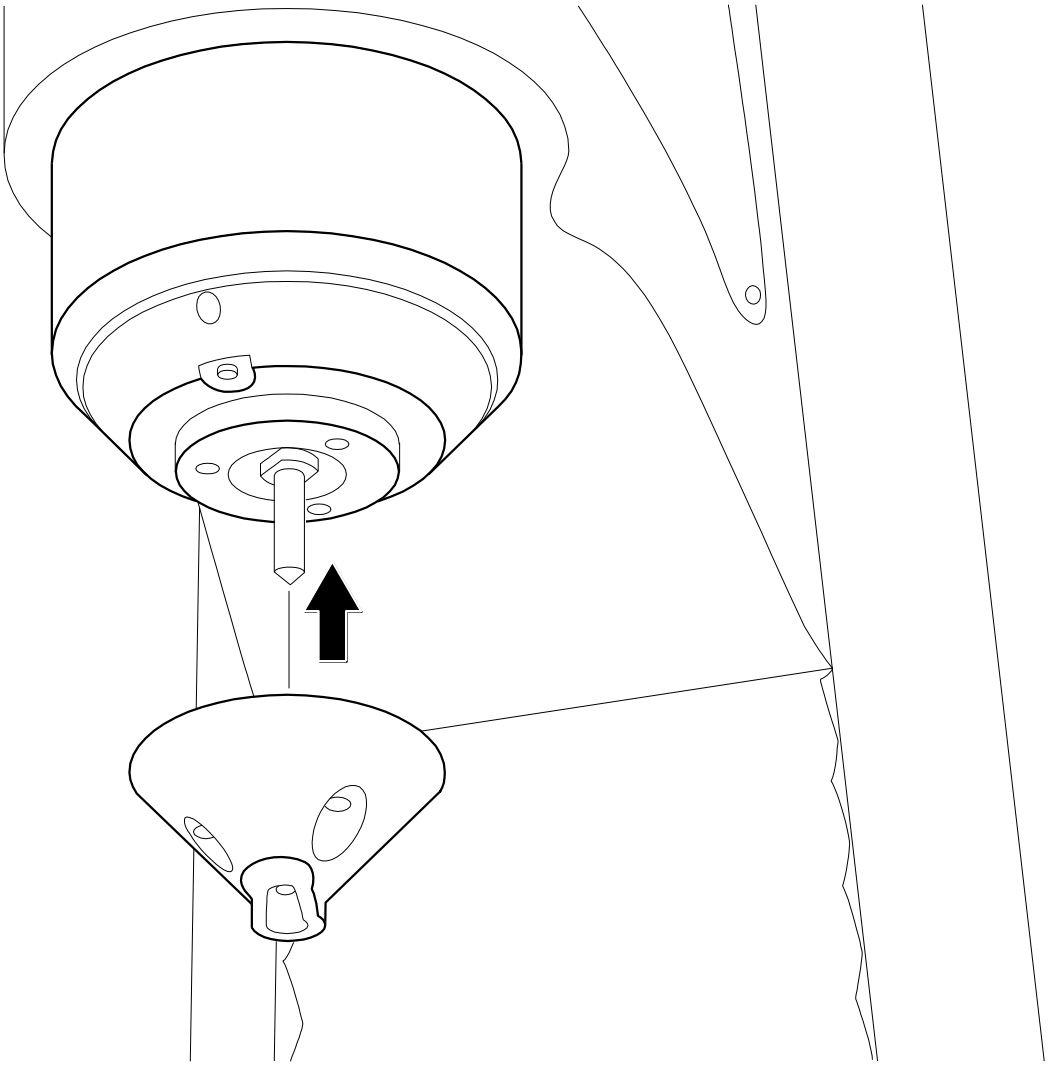
Risk of damage.

Risk of damaging the unit or the indenter.

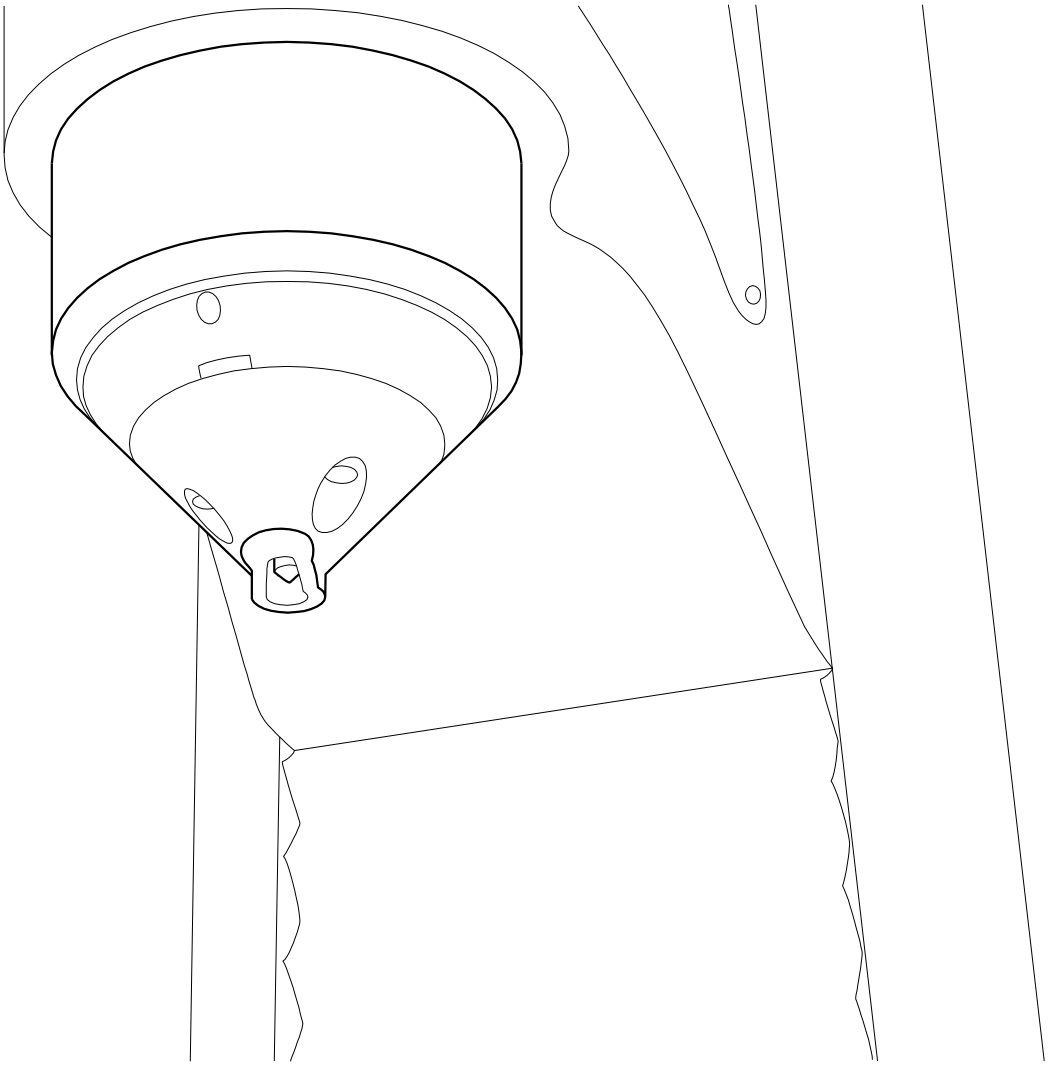
➢ Do not overtighten the indenter.

➢ Do not tighten the indenter too firmly.

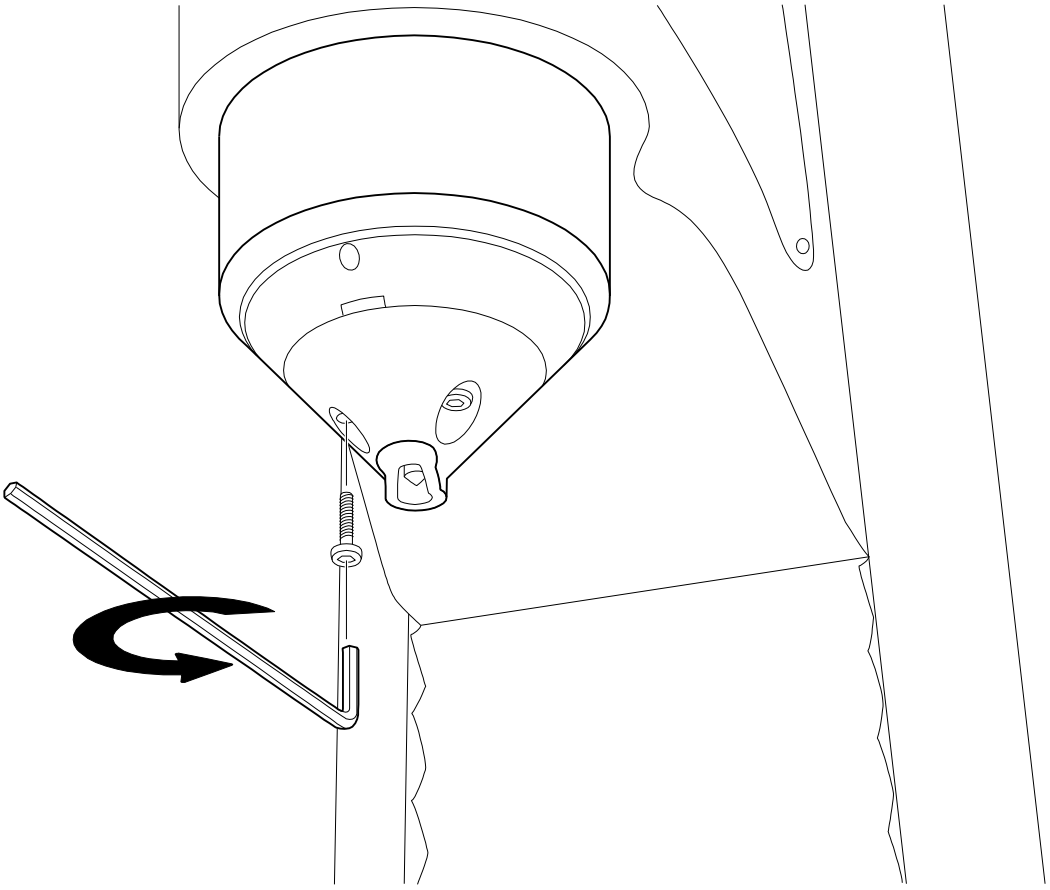
Mounting the nose cone



➢ Place the nose cone over the indenter so that the indenter is visible from the front.



Correct positioning of the indenter and nose cone ensures precision testing.



- Use the allen wrench supplied to tighten the three screws.
- Turn the main switch to the ON position.

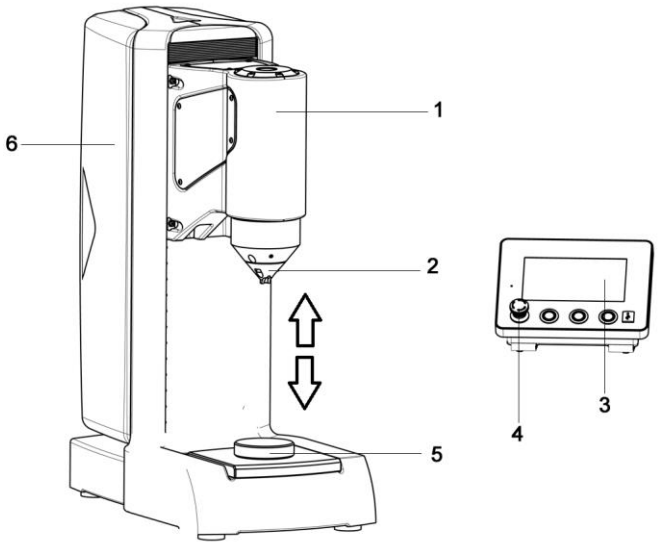
The hardness tester is supplied with calibrated factory settings. To ensure correct testing, you should have your machine calibrated by an authorized institute, manufacturer or distributor before you use it for the first time.

After successful calibration, the machine is ready for operation.

3 Design and Functions

3.1 Design, Methods and Data Interfaces

Design of the unit

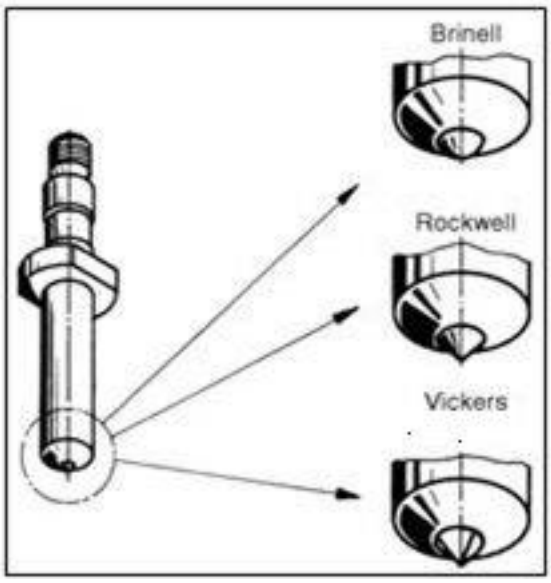


1 Test unit
2 Nose cone with indenter
3 Control unit with touch display
4 EMERGENCY OFF button
5 Test anvil
6 Machine stand

The essential components of the hardness tester are the machine stand, the test unit with nose cone, the indenter and the test anvil. Operation is controlled via the control unit. The control unit is equipped with an EMERGENCY OFF button for shutdown.
The machine stand is made from grey cast iron. The stand contains all electrical and electronic components of the unit, and all drive units.
The test unit is powered by a DC motor. The test unit can move up and down at a speed of 6 mm/s. It is capable of measuring workpieces with a maximum height of 260 mm.
The test anvil is 180 mm wide x 185 mm deep and can support workpieces with a maximum weight of 100 kg.

Indenters and methods

Various indenters can be supplied for the different test methods.
A Rockwell indenter is the standard indenter for the machine.



NOTE

Risk of damage

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

Ports

The machine has the following ports:

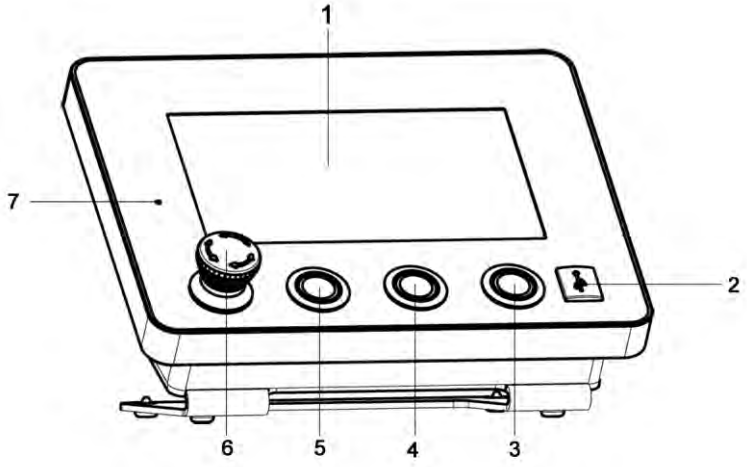
- 2 x USB
- 1 x control unit socket connection
- 1 x serial RS232 (USB-RS232 adapter)
- 1 x Ethernet interface
- 1 x hardware interface (option)

3.2 Control Unit

A control unit with a 7" touch screen allows you to control and program the machine. The software is menu-based and offers a range of options for test methods, conversions and statistical analysis.

Controls

The control unit has the following controls:



1 Touch screen
2 USB connection
3 "Start Testing" button
4 "Nose Cone Down" button
5 "Nose Cone Up" button
6 EMERGENCY OFF button
7 LED indicator lamp

To operate the touch screen, you can touch the buttons with your finger or with a suitable touch pen.

NOTE

Risk of damage

Risk of damaging the touch screen when using sharp objects.

➢ Use your finger or a touch pen for data input.

Input

Use your finger or a touch pen for input. Use only genuine EMCO-TEST accessories.

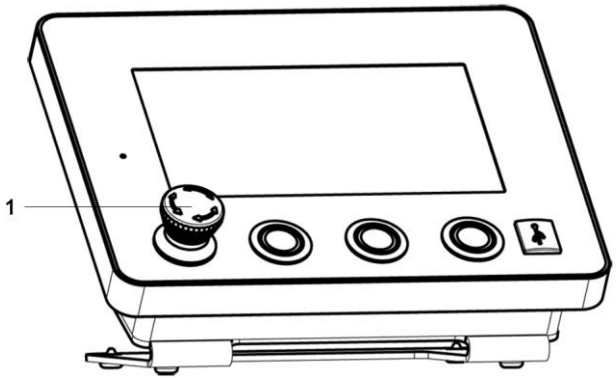
The three buttons **Nose cone up, Nose cone down** and **Start testing** on the control unit are active in measuring mode and in measuring mode.

To activate one of these measuring modes, use your finger or the touch pen to touch the **Measuring** or **Testing** button.
If the unit is in the selected measuring mode, you can move the test unit with the buttons **Nose cone up, Nose cone down** on the control unit up or down, and carry out a measurement.

Safety equipment

WARNING

Risk of crushing by the nose cone.
Severe injuries.
- In an emergency, press the EMERGENCY OFF button to stop the unit immediately.
- Never modify the safety equipment of the unit without authorization.



An EMERGENCY OFF button (1) sits on the left side of the control unit as a safety device. If you press this button, the current operation is cancelled and the machine is switched off.
The test unit stops moving and the touch screen light is dimmed. The DANGER pictogram appears.
To release the EMERGENCY OFF button, turn it clockwise.

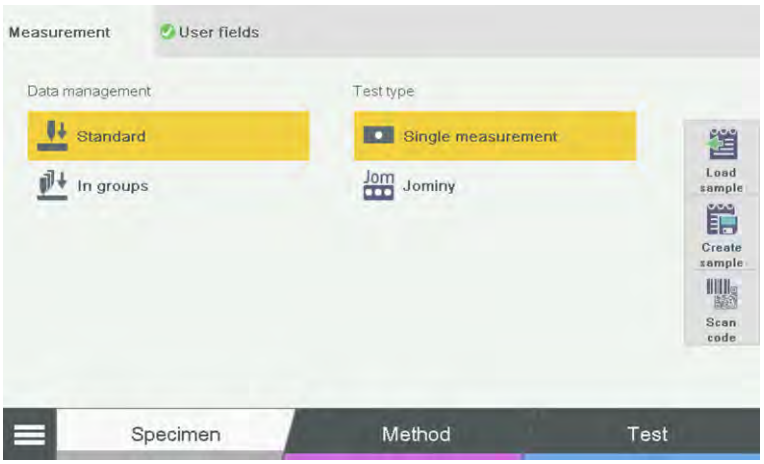
4 Basic Operation

4.1 Switching the Machine On and Off

Switching the tester on

- Use the main switch to turn the machine on.
  - The white LED indicator lamp is ON and the software starts.
- If necessary, release the EMERGENCY-OFF button on the control unit by turning it clockwise.

After 1...2 minutes, the main menu automatically appears on the touch screen of the control unit.



Switching the tester off

- Use the main switch to turn the machine off.

The white LED indicator lamp is OFF.
The test unit stops moving and the touch screen light is dimmed.

4.2 Touch Screen

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

NOTE

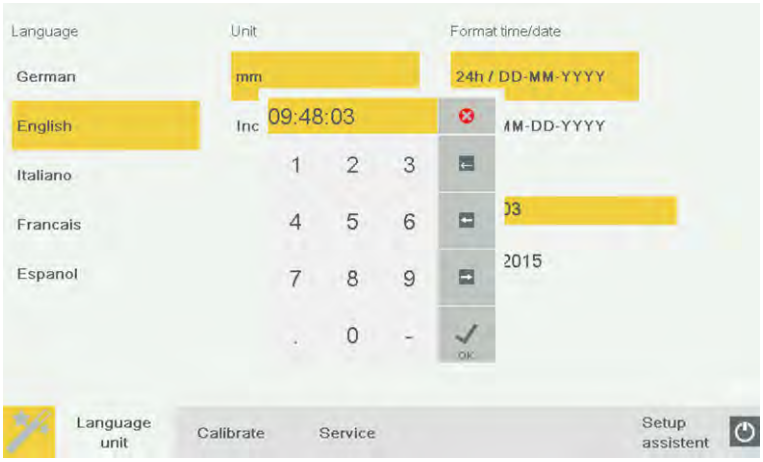
Risk of damage.
Risk of damaging the touch screen when using sharp objects.

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

4.3 Virtual Keyboard

Numeric keyboard

If you need to enter text or numbers, a virtual keyboard (similar to a standard computer keyboard) automatically appears when you select the relevant input field.



You can enter or change numbers with the numeric keyboard.

cancels the entry

deletes the character to the left

moves one character to the left

moves one character to the right

completes the entry

Alphanumeric keyboard

You can enter or edit text with the alphanumeric keyboard.

< moves one character to the left

> moves one character to the right

switches between lower and upper case

deletes the character to the left

END moves the cursor to the end of the input

INS inserts characters at the cursor position in the text

cancels the entry (escape)

ENTER completes the entry

4.4 Symbols and Buttons

Buttons - general		Cancel
		Apply button
		Edit
		Scroll in list (alternatively swyping is possible)
		Clear input
Icons - general		Emergency OFF is active, no operation or movement of the machine possible.
		Shows that selections are active in a menu (tab page)
Buttons - menu		Opens the main menu
		Measuring: Opens the measuring sequence (start screen) "Workflow"
		Archive: All performed tests and measured data groups are combined here.
		Opens the Settings menu

Buttons - sample


Test data management "Standard". All data items are archived in a standard list.


Test data management "Grouped". The test data items are stored in a user-defined list.


Creates a new test data group / opens the "New test data group" menu


To load an existing test data group / opens a list of all existing groups.


Single test method (for individual measuring points)

Jominy test method (for measuring sequences to Jominy standard)


Loading a template: Opens a list of all created templates for selection


Saving a template: Opens the "Save template"" menu. All settings (including "Group" if test data management "Grouped" was selected) are accepted.


Code scanning: Opens a request for input. If you read a code via a connected bar code or QR code scanner that is linked with an existing template, this code is loaded and you get to "Testing".

Buttons - methods


Icons for the individual test methods


Geometric correction of spheric surfaces


Geometric correction of cylindrical surfaces

Buttons - testing


Shows, if conversion is active, the test method and the converted method


Shows warnings (for example: Conversion boxes or values below and above the selected hardness line).


Start measurement: Starts a test when the workpiece is clamped. With unclamped measurement, the indenter must be positioned as closely as possible to the sample.


Next sample: (Only available with test data management "Grouped") Opens an input request for the designation of the next sample. All subsequent measuring points have this designation assigned until the function is used again.


Closing a group: (Only available with test data management "Grouped") Terminates the test sequence and opens a selection of further actions (to the archive to view the results, or to the sample step to start with another sample).


Opens controller and switch for the working position lighting

Buttons - archive


Continue group: Change to the workflow step "Test". All measurements are appended to the list.


Editing test point information: To rename the "Test point information" box in the list of measured values


Select: To select several lines in the list of measured values


Deletes the selected lines

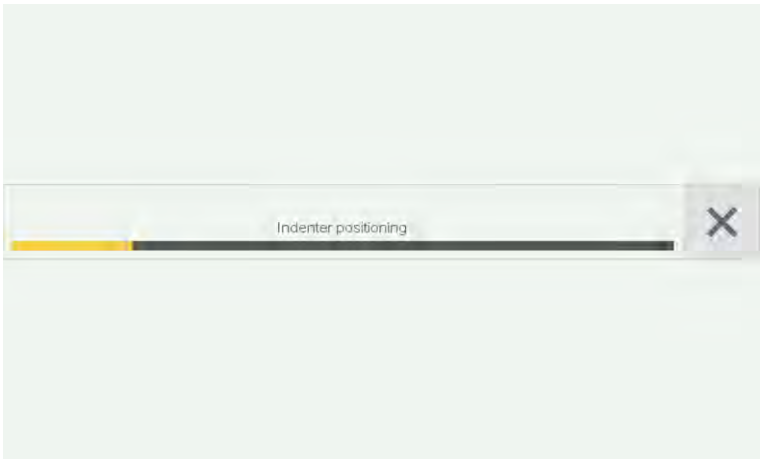

Deletes the entire list

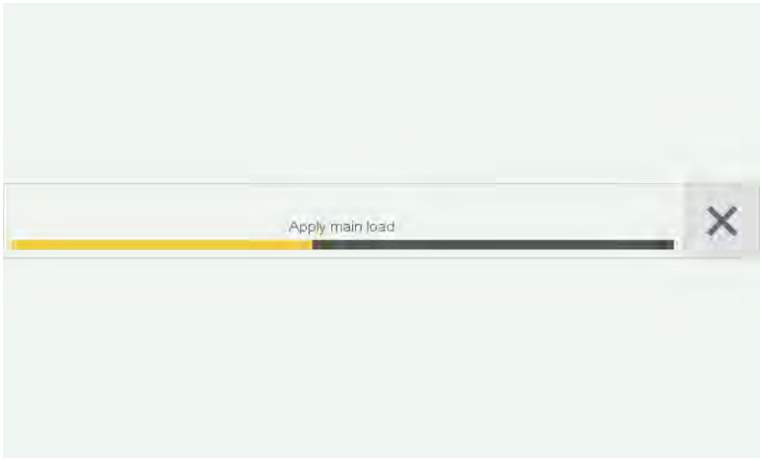
Adapting the list: Opens the menu to adjust the columns that are to be displayed.

List output: Opens the menu to output the list as csv file or pdf report at the selected drive (define the drive at settings), at a connected USB flash drive or to print it on a connected printer.

Progress bar

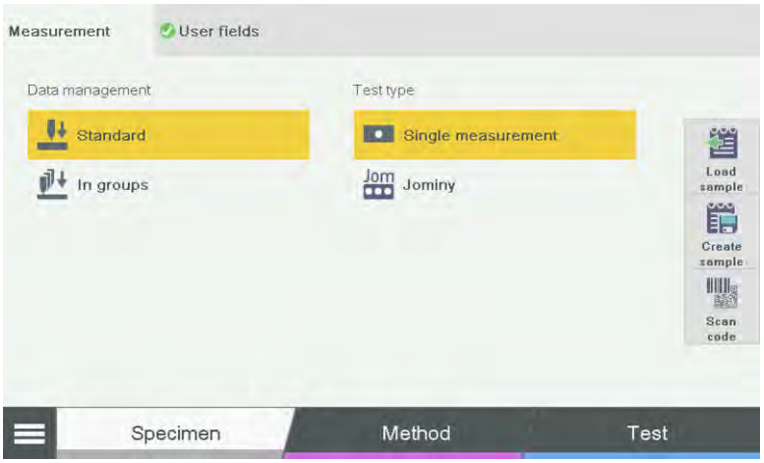
The progress bar indicates how long it will take for the triggered action to be completed and how much time has already elapsed since it was triggered.



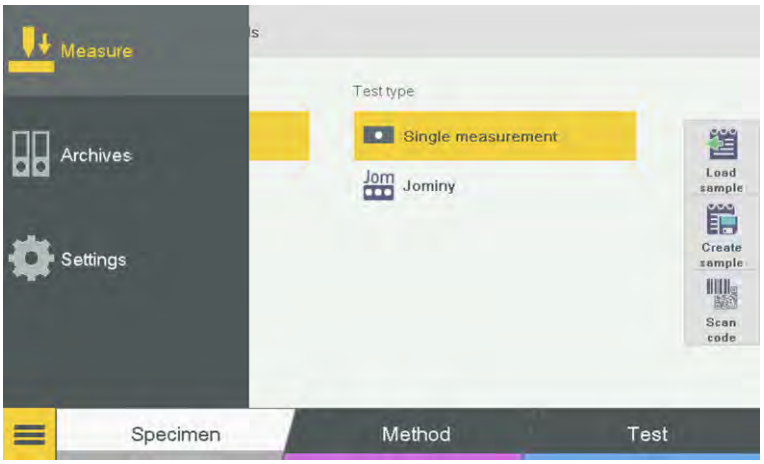


Menu types

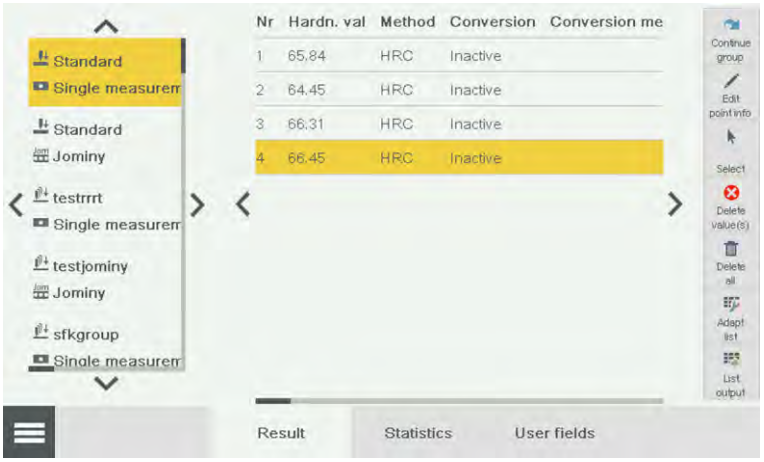
The buttons take you to the following menus:



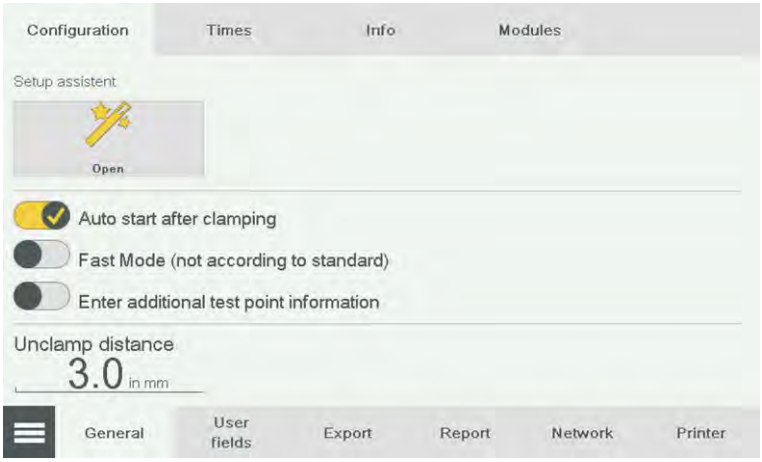
Measuring sequence menu



Main menu



Archive menu



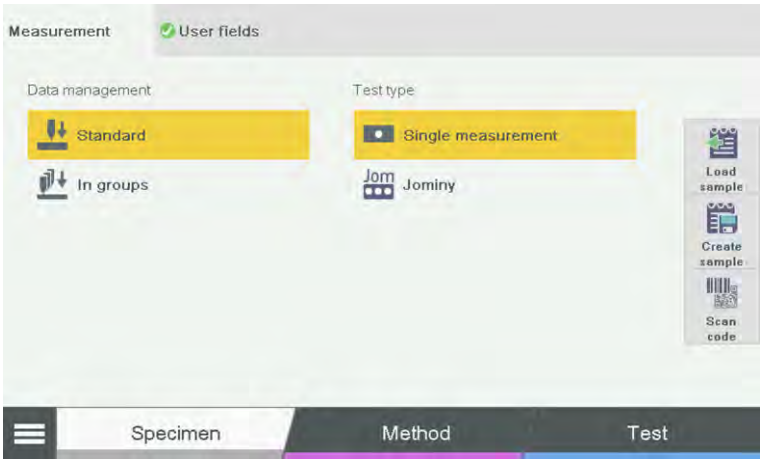
Settings menu

4.5 Test Sequence

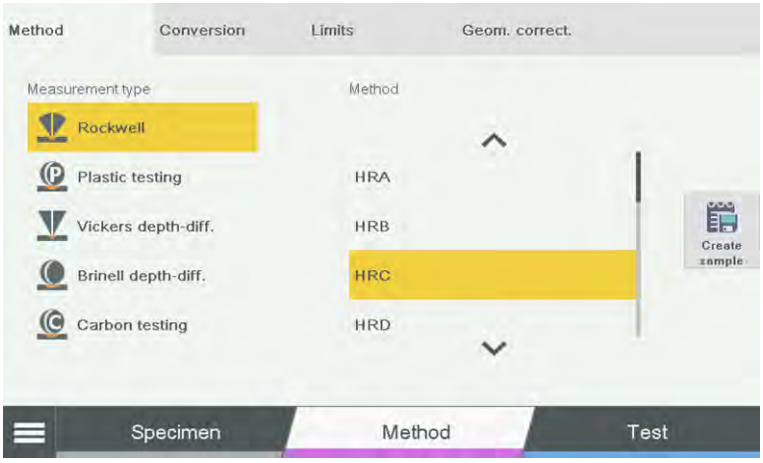
The "Test sequence" chapter describes a typical simple measurement. The "Enhanced operation" chapter gives a further description of the setting options.

Start testing

- In the **Sample** menu, select the **Standard** option from test data management.
- In the **Test method** menu, select **Single measurement**.

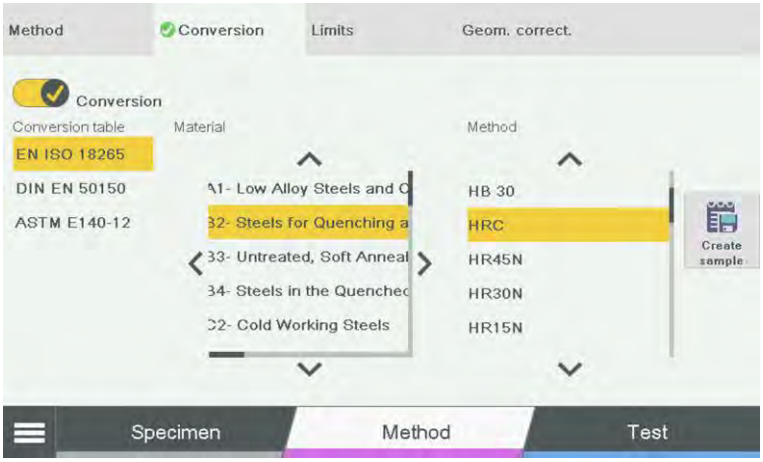


- Change to the **Method** menu.
- From the **Test method** menu, select the required test method.
- From the **Method** menu, select the required test method.



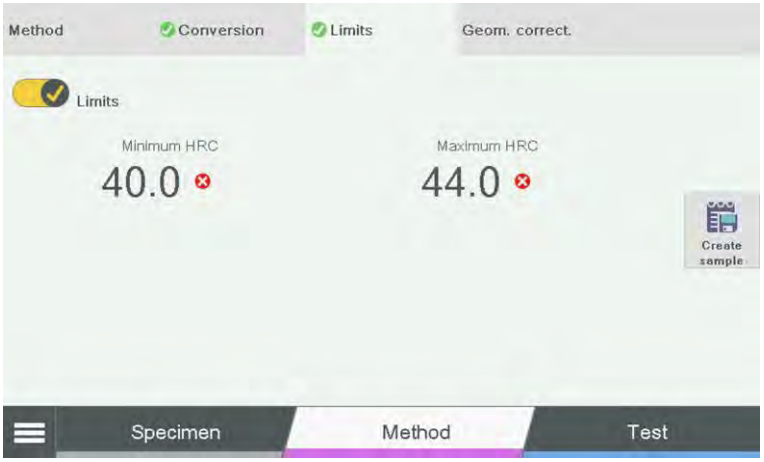
Conversion

- ➢ Select the **Conversion** menu.
- ➢ Select the **Conversion table** e.g. EN ISO 18265.
- ➢ Select the **Material** e.g. B2 heat-treated steel.
- ➢ Select the **Method** e.g. HRC.
  - ✓ Conversion is selected.



Limits

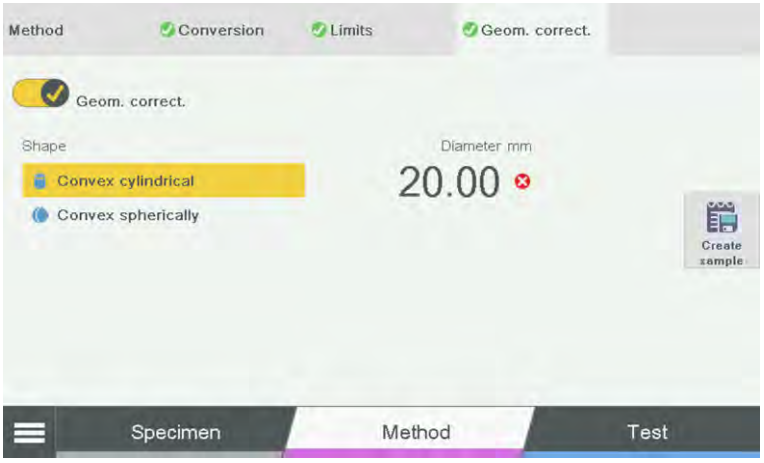
- ➢ Select the **Limits** menu.
- ➢ Actuate the slide switch at **Limits**
  - ➢ Touch the value. The numeric keypad opens for input.
- ➢ Enter the required value at **Minimum**.
- ➢ Enter the required value at **Maximum**.
  - ✓ If a result is within the limits, OK is displayed when the measurement is taken. If a result is outside the limit values, the display reads Result too high or Result too low.



Component correction

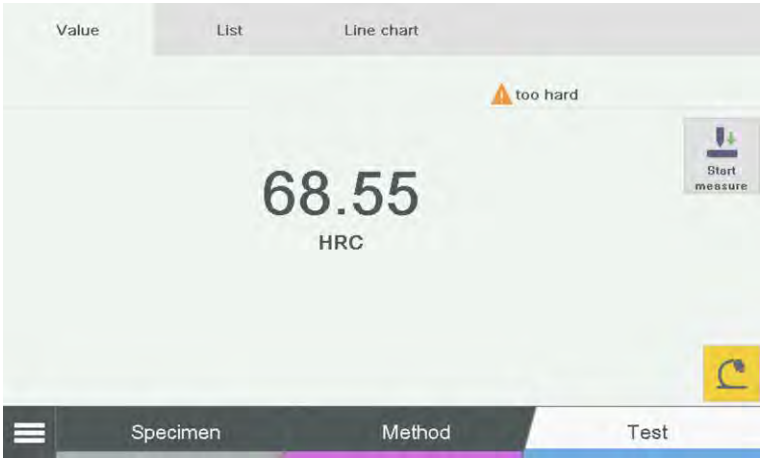
The specified component corrections depend on the selected method.

1. Select the **Component correction** menu.
2. Actuate the slide switch at **Component correction**.
3. Select the shape Convex cylindrical or Convex spheric.
   - ➢ Touch the value at **Diameter in mm**. The numeric keypad opens for input.
4. Enter the required value.
   - ✓ Enter the values in accordance with the test method.

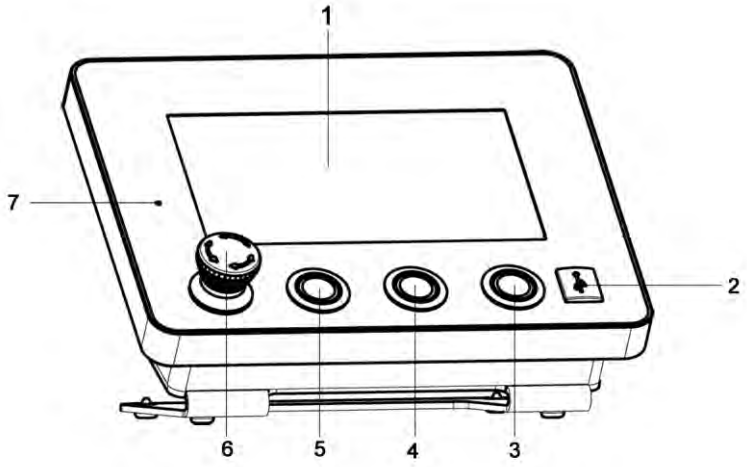


Start testing

- ➢ Select the **Test** menu.
- ➢ Place the workpiece on the test anvil.



➢ Press the **Nose cone down** button (4) until the workpiece is clamped and the test unit stops automatically.



1 Touch screen
2 USB connection
3 "Start Testing" button
4 "Nose Cone Down" button
5 "Nose Cone Up" button
6 EMERGENCY OFF button
7 LED indicator lamp

➢ Select the **Start measurement** button in the software, or press the button (3) to **start the measurement**.

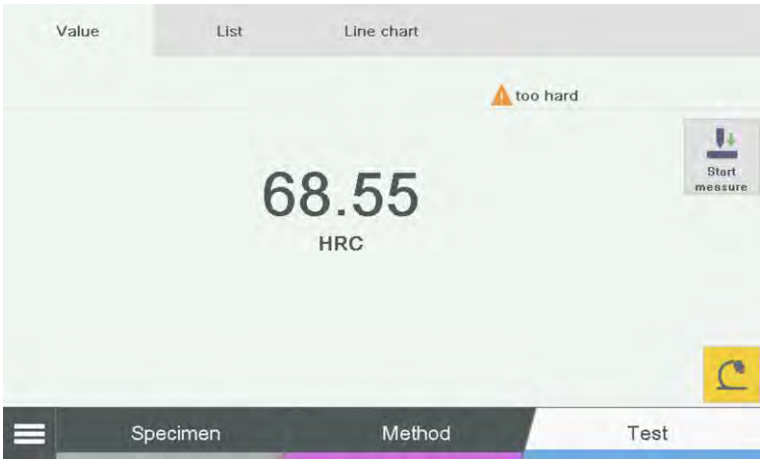
➢ The measurement runs automatically.

Measurement starts automatically if the **Auto Start** function is activated after clamping! The function can be found at **Settings**.

WARNING

Risk of crushing by the nose cone moving downward.
Severe injuries of arms and hands.
- Keep your hands away from the area around the moving test unit.
- In an emergency, press the EMERGENCY OFF button to stop the unit immediately.

The software automatically analyzes and displays the impression made by the test specimen.



Press the **List** button to change to list view (all measured values of the current group / all values measured as standard are displayed).
Press the **Measuring profile** button to change to the measuring profile view (shows a line diagram of all previously measured values).
In addition, all results are saved to the result lists and statistically analyzed. More information about measured value table, statistics and printing can be found in the chapter "Advanced operation".

4.6 Testing Without the Nose Cone

Some workpieces cannot be properly clamped because of their geometric dimensions. It is possible to test the hardness of such workpieces without the nose cone.

Use appropriate fixings to secure any workpieces that do not stay in place without support.

The function **Auto start after clamping** can not be used in a measurement without nose cone. You must therefore lower the test unit with the **Nose cone down** button. The test unit moves slower in this method. This protects the diamond in the indenter.

WARNING

Risk of crushing by the nose cone moving downward.
Severe injuries of arms and hands.
- Keep your hands away from the area around the moving test unit.
- In an emergency, press the EMERGENCY OFF button to stop the unit immediately.

- Approach the test unit with the **Nose cone down** button as closely as possible to the workpiece.
- Start the measurement manually with the **Start testing** button.

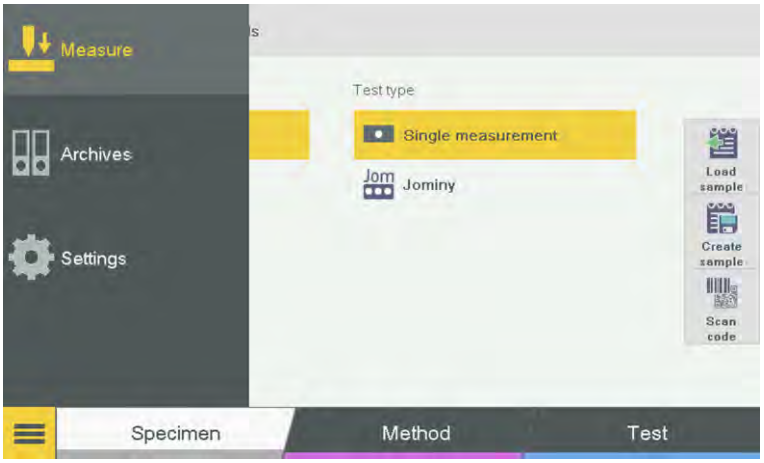
The message `Indenter positioning` appears on the touch screen before the measurement starts.

5 Advanced Options

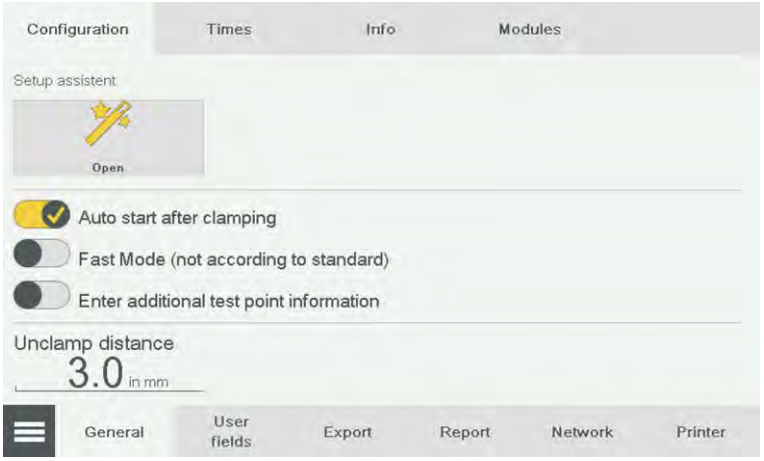
This chapter introduces you to the additional options offered by the testing machine.

5.1 Opening the setting menu

➢ Select the button with your finger or with the touch pen.
  ➢ The following screen appears on the touch screen monitor:



➢ Select the button **Settings**.
  ➢ The following screen appears on the touch screen monitor:



You are now in the settings and can choose between different menus. These menus can be found next to the button .

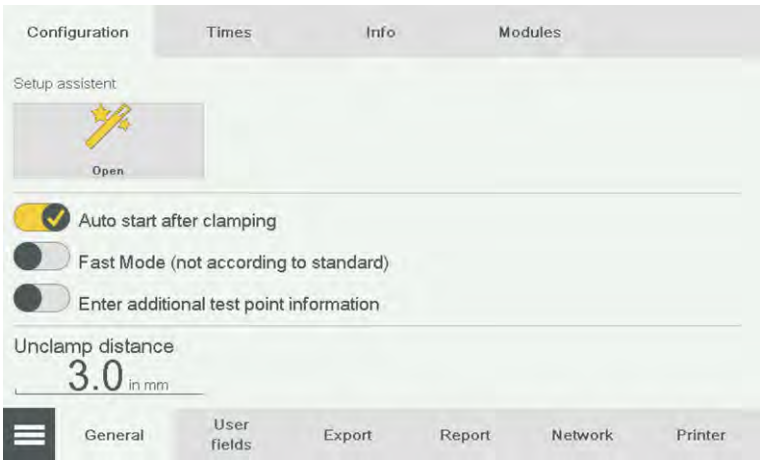
5.2 General settings

The **General** menu has the following submenus:

- Configuration
- Times
- Info
- Modules

Configuration

In the **Configuration** submenu you can select the following settings:

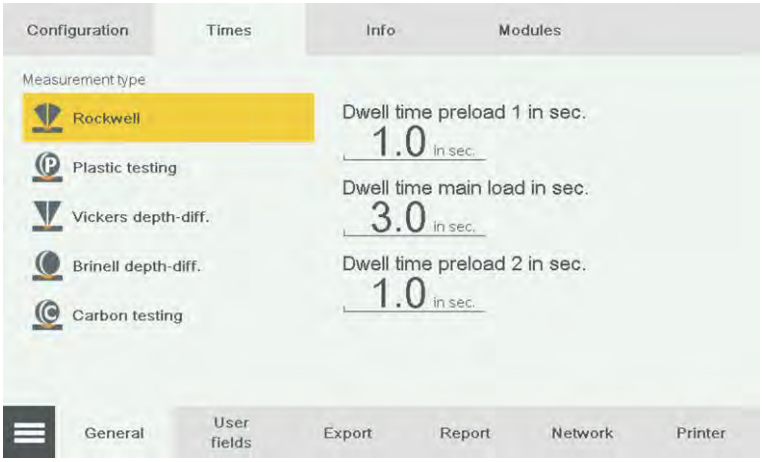


Configuration submenu

Opening setup wizard	Here you can select the basic settings, such as language, unit, and time.
Auto start of measurement after clamping	Measurement is triggered automatically after the workpiece has been clamped.
Fast mode (not corresponding to standard)	Permits faster test cycles (the times can be reduced to 0.1 seconds, the forces are applied faster). Caution: Not corresponding to standard!
Enter measuring point information before the measurement	An input mask opens before each measurement that permits up to three boxes to be filled as required. This information is also stored in the list of measured values.
Unclamp distance	Retract stroke of the nose cone after each measurement.

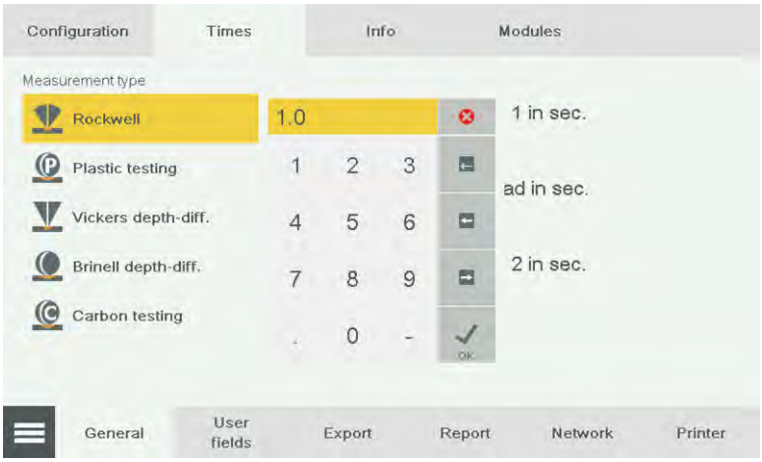
Times

In the **Times** submenu you can set different holding times for the individual test procedures.



Times submenu

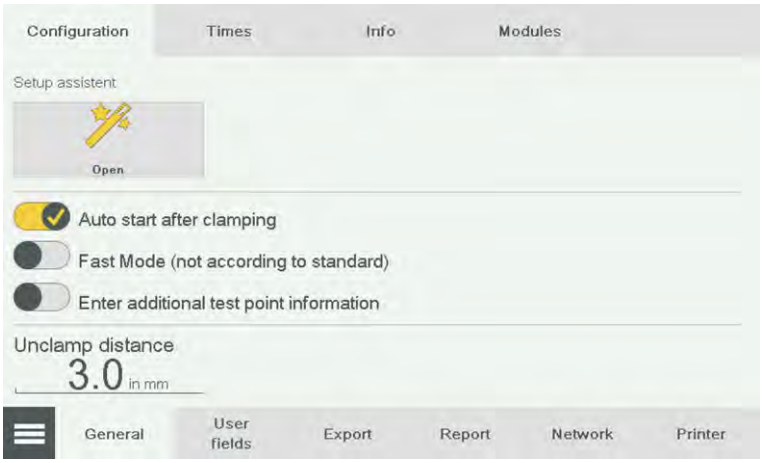
- Select the test procedure, for example the **Rockwell** button.
  - Preload 1, main load, and preload 2 of the test procedure are displayed.
- Touch the numeric value; for example **Holding time preload 1 in sec**.
  - The numeric keypad opens and permits the holding time to be entered.



- Enter the numeric value in seconds.
- Touch **OK** to save.
  - ✓ A new holding time for the test procedure is defined.

Info

The **Info** submenu shows the following information:

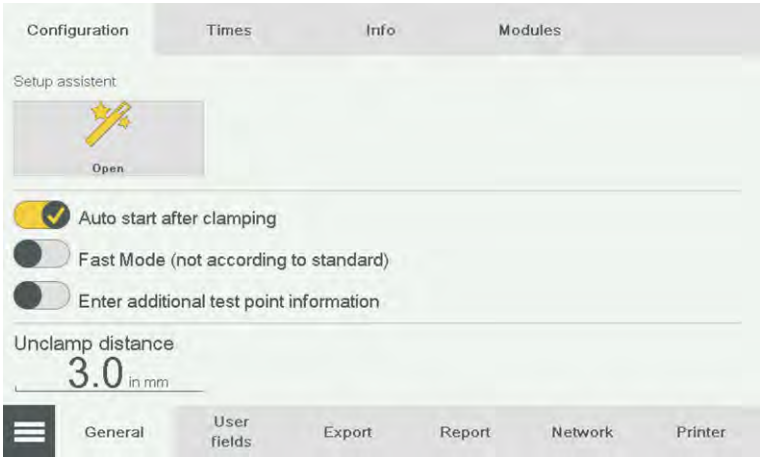


Info submenu

Software version	The software version is shown here.
Number of measurements	The number of measurements performed with the unit is shown here.
Error list	All system errors are listed here.

Modules

The **Modules** submenu shows the following information:

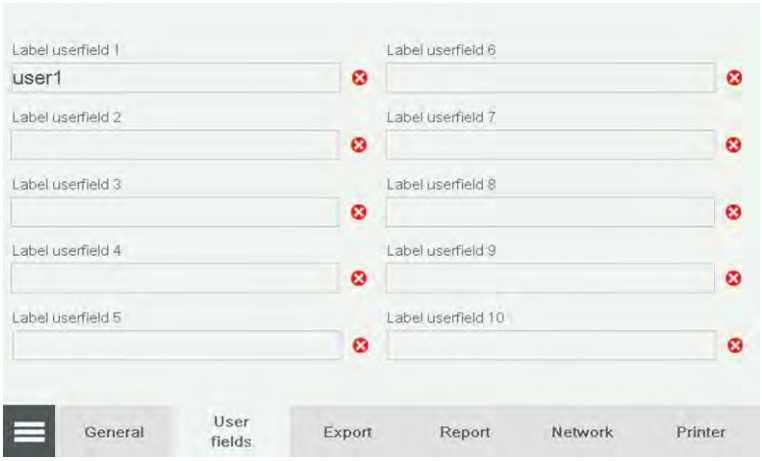


Modules submenu

Software modules	This menu shows the installed auxiliary modules. The release codes for purchased modules can be entered here.

5.3 User boxes

The **User boxes** menu permits up to 10 user boxes to be specified. These boxes can be filled for each measurement data group in the workflow step "Sample", and be output with the test report. Touch the button to clear the boxes.



User boxes menu

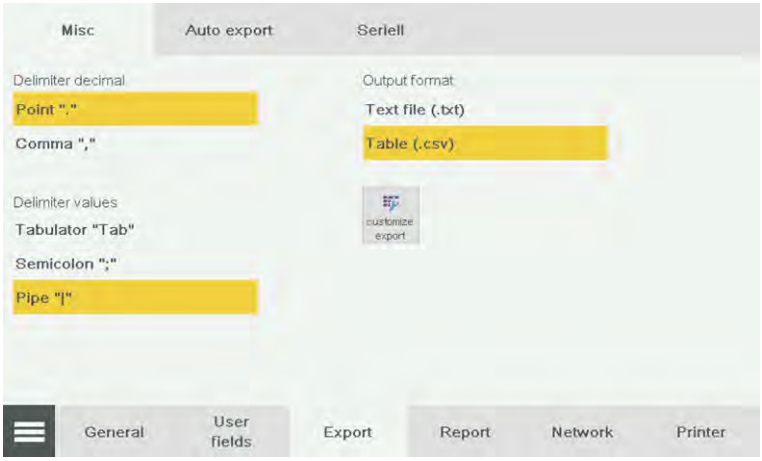
➢ Press the blank box below one of the 10 user boxes
  ➢ The alphanumeric keypad opens.

➢ Enter the required name.

➢ Press the button ENTER to accept the name.
  ✓ The new name is defined and can be used.

5.4 Export

In the **Export** menu you can select how the list of measured values is output. Specify delimiter and output format. Touch "Adapt export" to select the columns you want to export.



Export menu

5.5 Report

In the **Report** menu you can select the information you want to show in the reports.

Report menu

Use the **Report header line** boxes to define the header line.

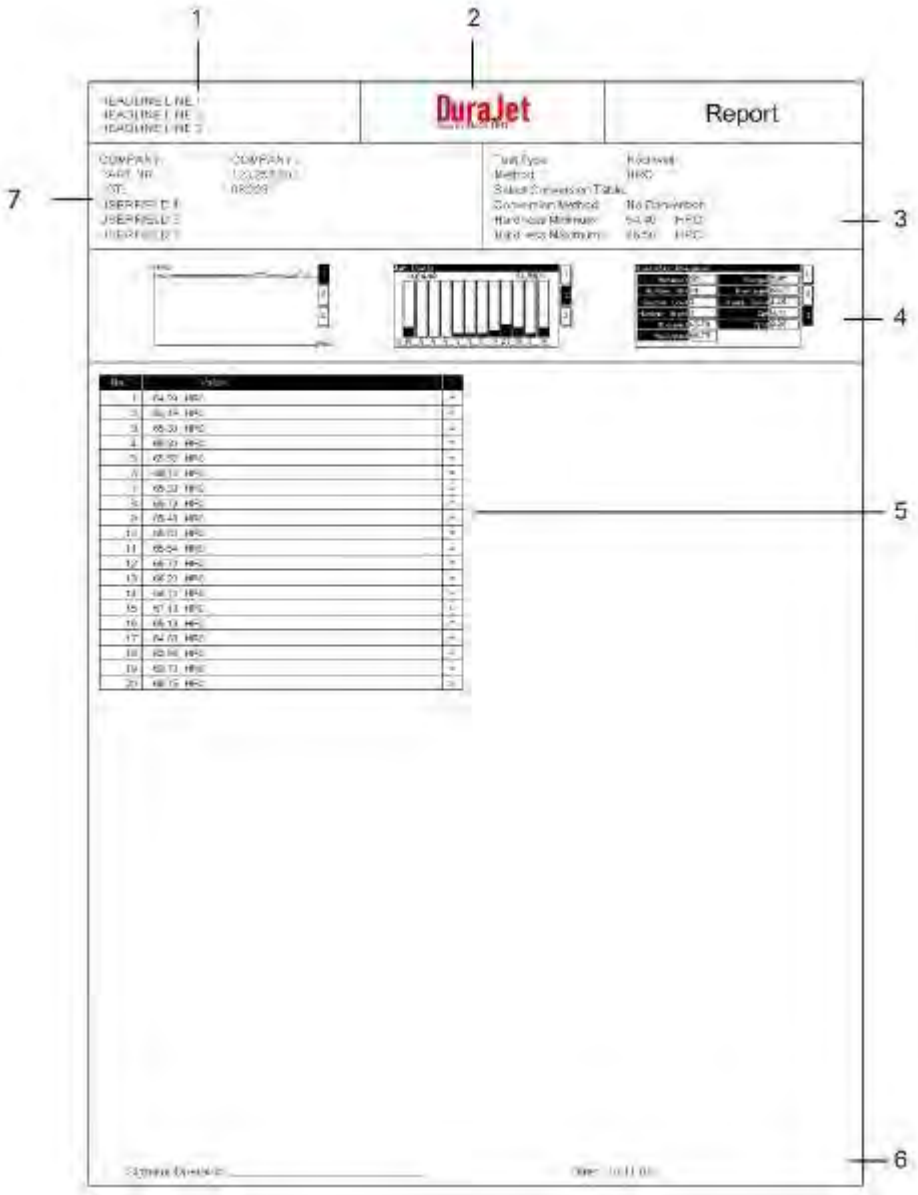
➢ Touch the box you want to edit.
  ➢ The alphanumeric keypad opens.

- Enter the required name.
- Press the button ENTER to accept the name.
  - ✓ The new name is defined and is used.

You can enter a logo in your report. The logo must exist as a bitmap file in a USB flash drive in the root directory, and have the file name logo.bmp. The maximum size of the logo is: 315x70pix.

Report printout

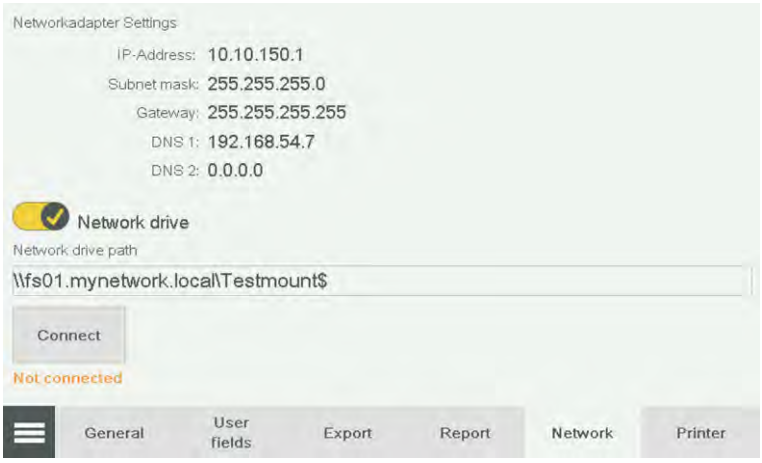
An example of a report printout is provided below:



1 Headlines
2 Company logo
3 Test method, conversion, limits
4 Statistical trend line, bar chart, statistical analysis
5 Result list
6 Footer with signature field and date
7 User fields

5.6 Network

Here, you can define an available network drive that can be connected with the hardness tester. The network drive can be used for data export or for saving reports. Contact your network administrator for information.



Network menu

5.7 Printer

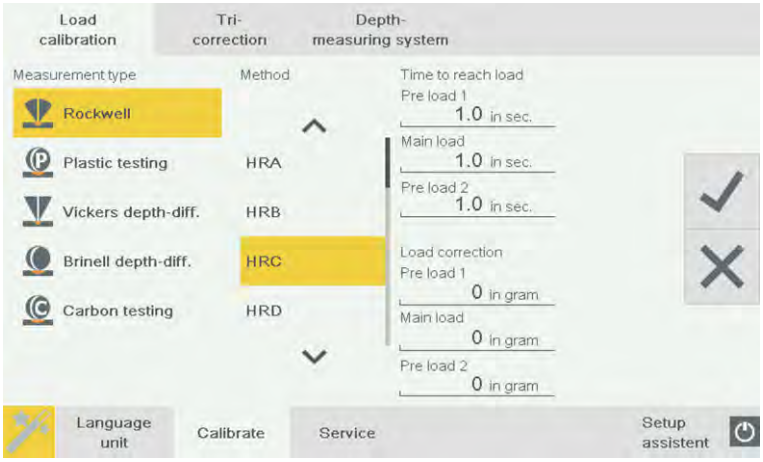
A printer can either be connected directly to the hardness testes via USB or - if the printer has a fixed IP address - via a network. Please contact your service partner for compatible printer models.

Printer menu

5.8 Checking Load Calibration

To check load calibration, you need a digital calibration device.

➢ Select the **Load calibration** menu via the Settings menu in the Calibration menu.



Load calibration menu

- In the boxes **Test procedure** and **Test method**, select the test procedure and the test method for which you want to check load calibration.
- Place the load cell of the calibration equipment under the test unit on the test anvil of your support.

In load calibration, the tip of the indenter touches the load cell of the calibration equipment. For this reason, it is advisable to place a workpiece on the load cell as an intermediate layer.

NOTE

Risk of damage

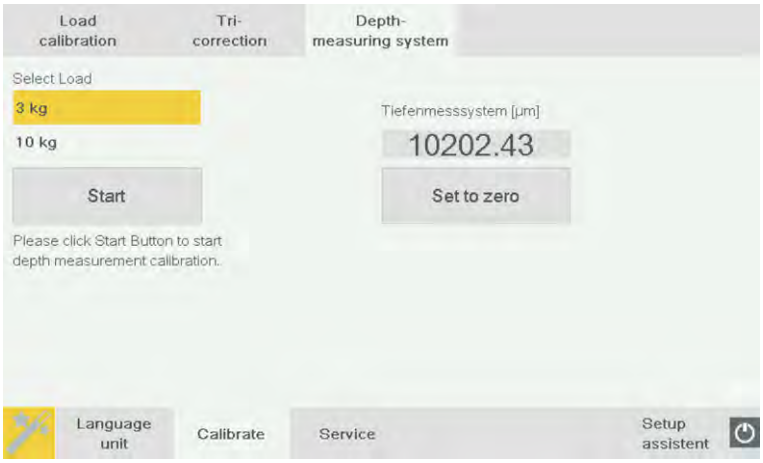
- Always perform calibration in unclamped state; otherwise there is already a force that acts on the load cell.

- Place a workpiece on the load cell as an intermediate layer, and set the display of the calibration equipment to zero.
- Press the **nose cone** button on the control unit to move the nose cone until it stands just above the load cell with the workpiece (do not clamp!).
- Select the **Start** button.
- Read the measured value on the calibration equipment, and enter the difference as correction value in the boxes provided.

5.9 Calibrating the Depth Gauge System

You need an external depth meter to calibrate the depth probe. To calibrate the depth probe, the machine must always be unclamped and without nose cone.

- Remove the nose cone.
- Remove the indenter. In its position, install the special indenter that is usually delivered together with the depth meter (for turret option, install at position 1).
- Select the **Depth probe** menu.
- In the **Select preload** box, select the preload for which you wish to calibrate.
- Place the measuring device of the depth meter on an appropriate support under the test unit. During the calibration of the depth probe, the tip of the indenter touches the measuring device of the depth meter.
- Move either the measuring device or the test unit until the indenter is located just above the measuring device (approximately 0.5 mm).
- Select the **Start** menu.



Depth probe menu

After the set load has been reached, a text message appears below the progress bar prompting you to perform a test.

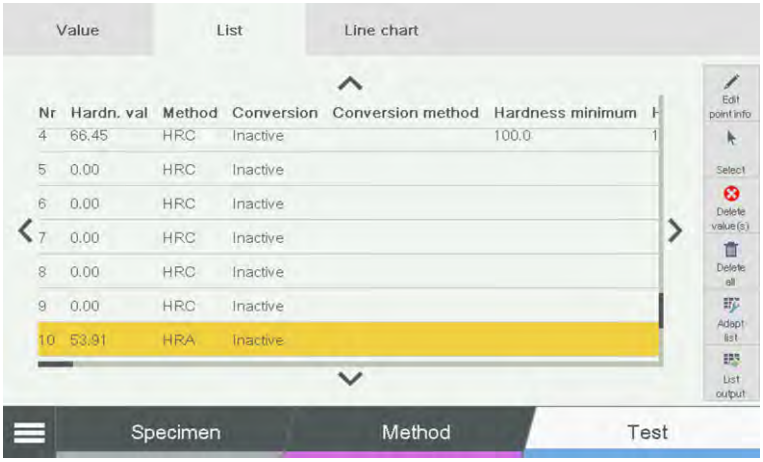
- Touch the **Reset** button to set the value of the depth probe to zero and start your calibration as specified in the standard.
- As soon as you have completed your calibration, press the **Exit** button, and the test of the depth probe is terminated.

5.10 Documenting and Evaluating Results

5.10.1 Displaying, Printing and Exporting Results

Results

After you have carried out the measurements, you can view them in the archive or directly during the test in the List tab.
Each list of measured values can accommodate a maximum of 500 measured values. The oldest measured value is overwritten automatically when the list is full.



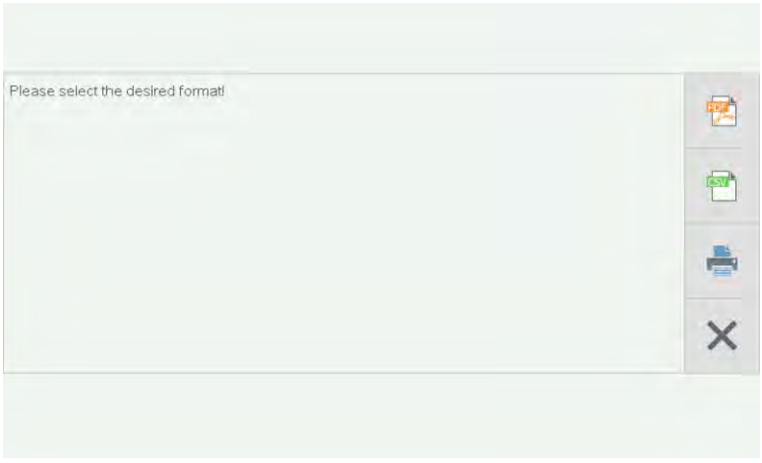
Use the buttons ◀ and ▶ to scroll horizontally. If you have configured a conversion, this is automatically displayed. Scroll to the left to view the results for the test method. The buttons are explained in the Chapter "Symbols and Buttons", page 4-3.

Data output

Touch the button to export the results.

➢ Touch the button.

The following text appears on the touch screen (example):



➢ Select the required output format. The list of measured values can be output as a csv file or be generated as a report, and subsequently be saved as a PDF file or be printed. The contents of the report can be defined in the **Settings** menu at **Report**. Next, assign a file name and the storage location. The USB flash disk may have a single partition only.

5.10.2 Deleting Results

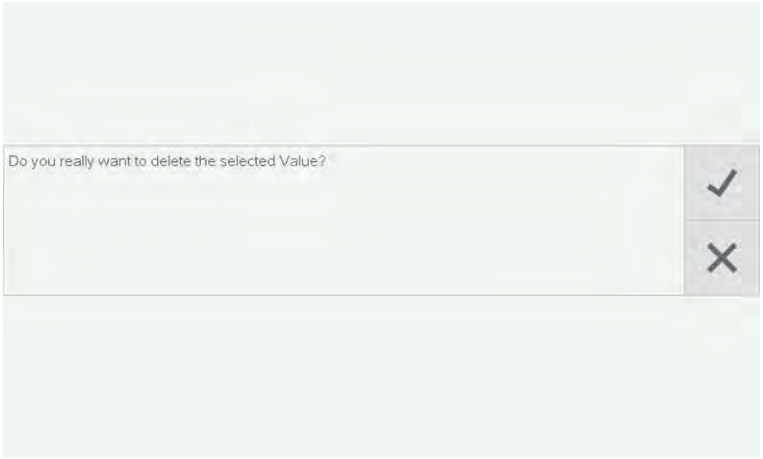
Deleting a value

Use the button to delete a measured value from the list of measured values. You can, for example, delete a value that was measured with a different test method. This ensures a correct statistical analysis because a combination of different test methods is not permitted.

➢ Touch a value to select it.

➢ Touch the button.

The following message appears on the touch screen:



➢ Touch ✓ to delete the measured value.

After you have deleted a value, all subsequent values are re-numbered.

Deleting the result list

Touch the 🗑 button to delete the entire list of measured values.

➢ Touch the 🗑 button.

The following message appears on the touch screen:

➢ Touch ✓ to delete the list of measured values.

6 Cleaning and Maintenance

Cleaning the machine

Regular cleaning is not required.
If the machine is left idle for a long period of time, ensure that it is protected from dust and dirt, and lightly oil the anvil before moving the test unit down the next time it is used.

Cleaning the touch screen

NOTE

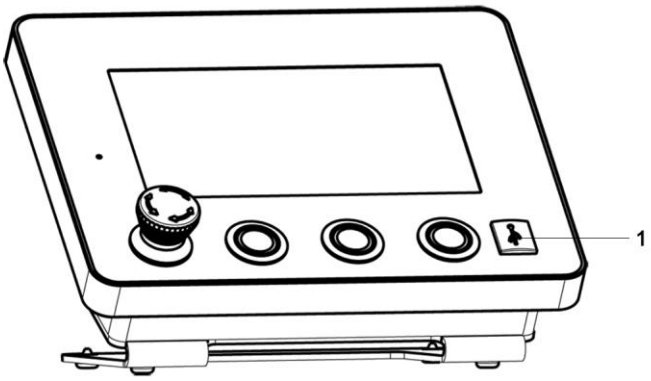
Risk of damage.
Damaging the touch screen.
- Use only special cleaning products for TFT/LCD screens to clean the touch screen.

7 Startup and Retooling with Optional Accessories

7.1 USB

USB connection

The USB port (1) sits on the front of the control unit.

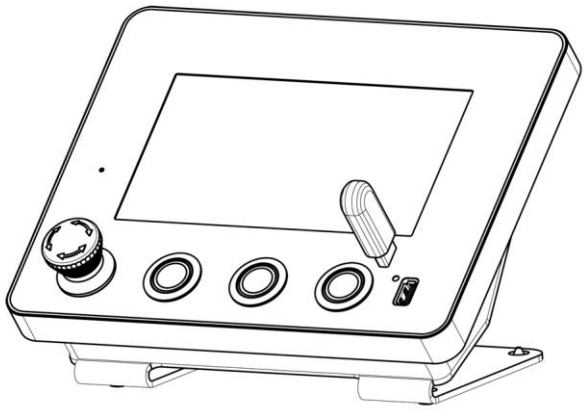


Various USB devices can be connected to the USB port (1):

- USB flash disk (USB stick)
- USB printer
- USB hub
- USB-RS232 adapter
- Bar code/ QR code scanner with USB connection (accessory)

Contact your supplier for detailed product descriptions. Only approved products have been tested for use with this machine.

Connecting USB flash disk



➢ Insert the USB flash disk (USB stick) into the USB port.

The USB flash disk (USB stick) may have only a single partition.

7.2 External machine control via hardware interface

For this option the DuraJet G5 is equipped with an additional interface at the rear of the machine stand.
Via this interface it is possible to control the DuraJet G5 via signals for "Start measurement", "Clamp test unit", "Unclamp test unit" and "Emergency stop".
Likewise, the outputs "Classification OK", "Classification High", "Classification Low", "Cycle active" and "Nose cone clamped" are provided.
The intended field of application for this option is, for example, the integration of a DuraJet G5 into a production plant.
If this option is ordered, the shipment additionally includes 1 activation plug and 1 blank plug.
The activation plug is needed to use the machine as a stand-alone unit. This means that the hardness tester works only when the activation plug is inserted, or when the machine is, with the blank plug provided, integrated in an external controller with a proper safety structure. If a plug is not connected to the interface, the hardness tester is not functional, since the safety circuit is interrupted.
Only the customer is allowed to integrate the unit with a blank plug into a customer system.

Activation plug or blank plug

Signals - interface:

Inputs:

- Measurement start
- Clamping test unit
- Unclamping test unit
- Emergency OFF

Outputs:

- Classification OK
- Classification high
- Classification low
- Cycle active
- Nose cone is clamped

Scope of supply:
In addition the the standard scope of supply of a DuraJet G5, the following parts are enclosed:

- 1x activation plug
- 1x blank plug

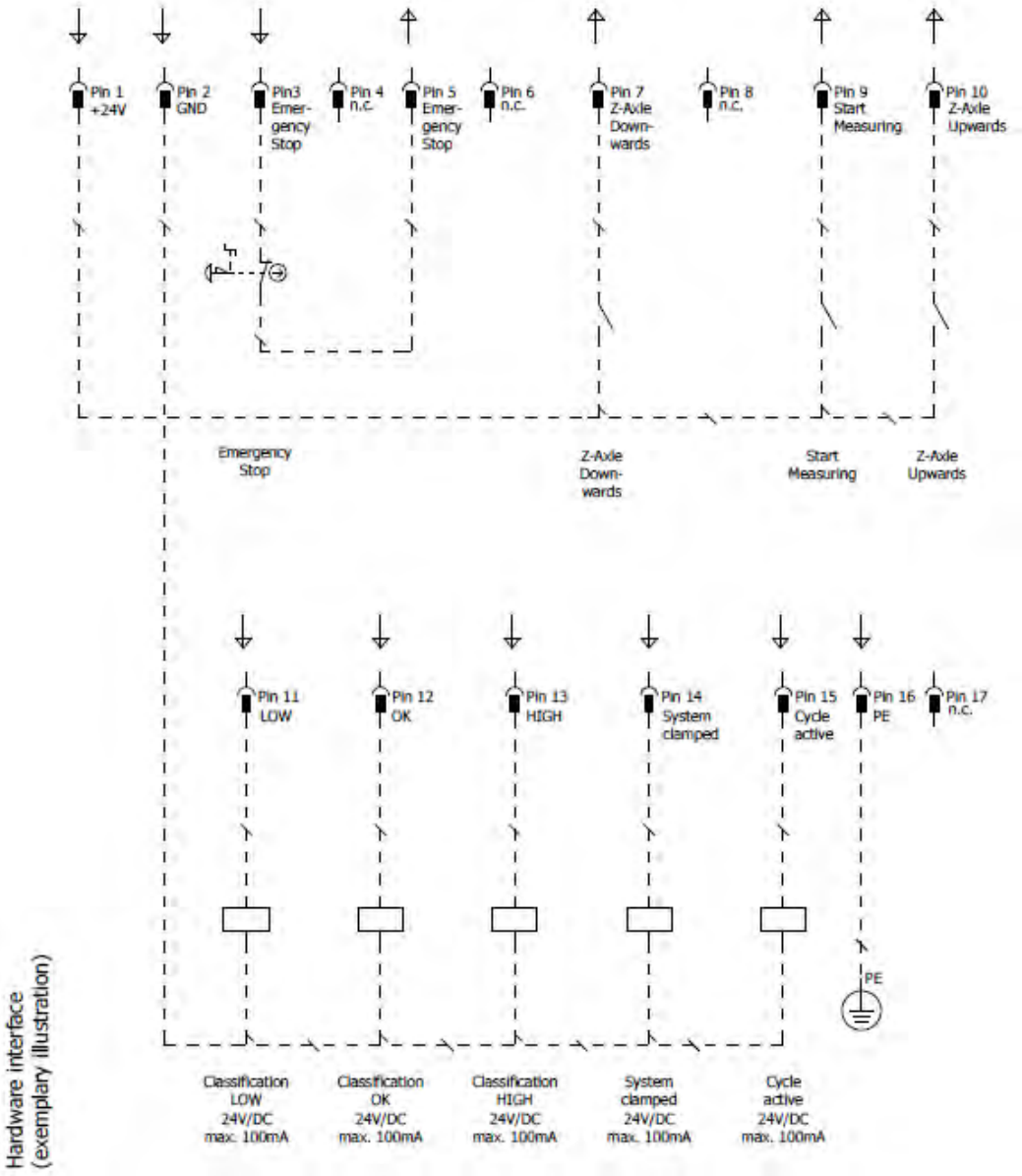
Instructions for wiring and cable routing:

The +24VDC power supply line (pin 1) is protected with a 3-A fuse that is installed in the DuraJet G5 unit. The safety lines should be routed such that they are protected and separate from the other lines. Perform cable routing, cable selection and dimensioning in compliance with the regulations applicable on site. All interconnections must be via floating connections.

With a minimum cross-section of 1.5mm², the maximum length of the cable is 100m. Cable length of more than 100m are not permitted.
The power applied at the interface connector must never be used to feed other components, sensors, or actuators.

Connector pin assignments:

Circuit diagram



General safety instructions:

DANGER

Electric shock

Prior to starting up the machine, you must make a safety compliance assessment in accordance with Machinery Directive 2006/42/EC. Comply with all the labour safety and accident prevention rules and regulations that are applicable at the location where the machine is operated. The external machine control system (EMERGENCY STOP and Z-axis downward or clamping) must satisfy at least PL [d] to EN 13849-1. Safely de-energize the entire system before you install, disassemble, or wire the external machine control system. Only qualified technical personnel are allowed to install, assemble, start up, maintain, and shut down safety components.

Startup:

Validation to DIN EN ISO 13849-2 must be performed. Startup must be documented. There must be proof of the safety functions.

WARNING

Risk of injuries
If the DuraJet unit is controlled via an external machine control system, a safety compliance assessment in accordance with the Machinery Directive 2006/42/EC must be made. Please contact the manufacturer if you have any questions.

7.3 Foot button

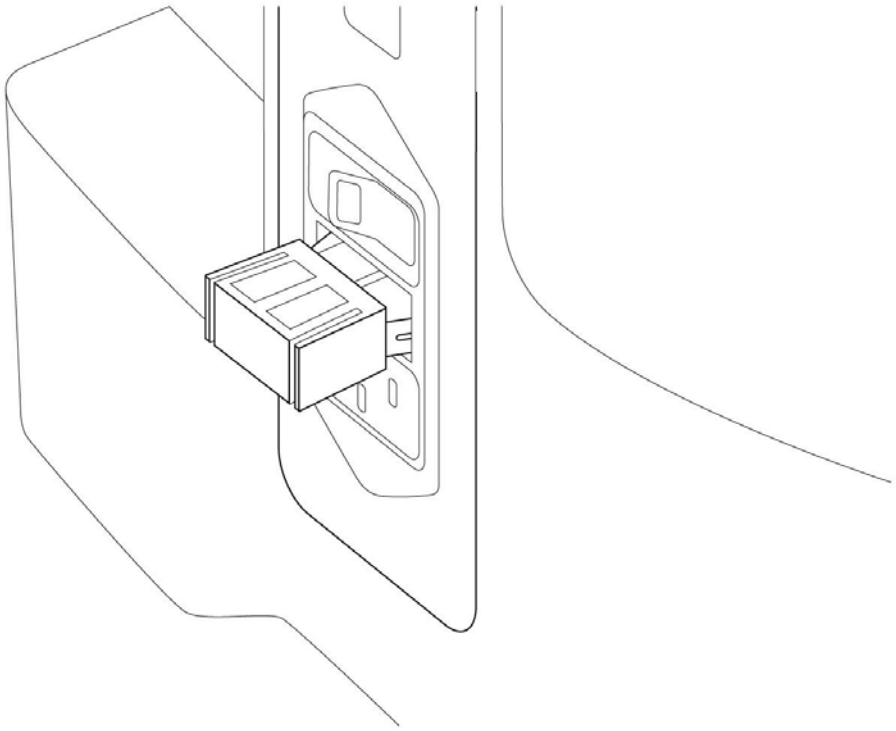
This option is used to clamp a work piece via a foot switch when components are extremely large and there is a risk of injury in the area of the two-hand control.

To be able to use the foot switch, the option "External machine control via hardware interface" must be installed in the machine. For this option the DuraJet G5 is equipped with an additional interface at the rear of the machine stand. The foot switch can be connected via this interface.
The foot switch is equipped with a safety locking device. The safety circuit is interrupted when the switch is fully depressed. In order to re-activate the safety circuit, the black unlocking switch at the upper side of the foot switch must be turned anticlockwise. If the foot switch option is ordered, the scope of supply includes the foot switch and 2.5 m connection cable.

7.4 Replacing the Fuses

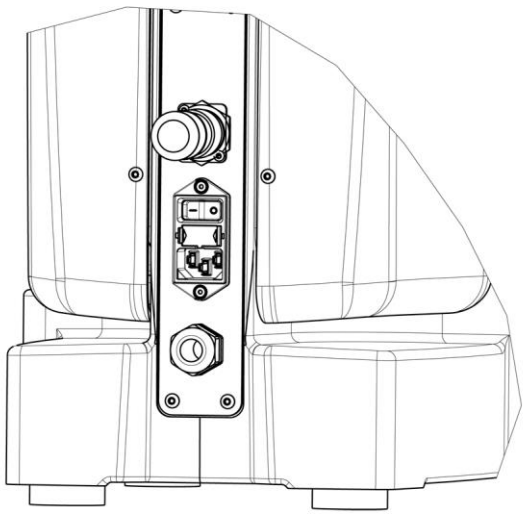
DANGER

Electric current
- Only trained personnel are permitted to replace fuses.
- Switch off the machine at the main switch before you replace a fuse.
- Pull the mains plug before you start any maintenance work.

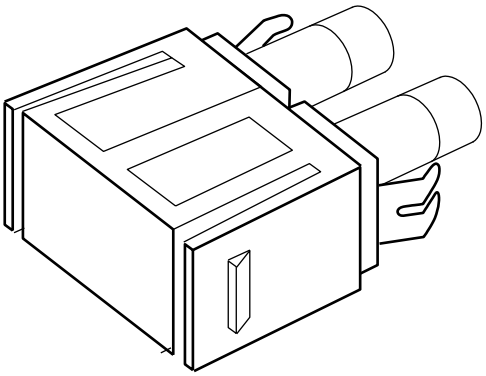


The fuse cover (1) sits between the main switch (with the green indicator lamp) and the mains connection.

- Turn the main switch to OFF.
- Unplug the power cable.
- Carefully pry out the fuse cover on both sides. Use a screwdriver as a lever if necessary.



- Remove the cover with the fuses.



- Carefully remove both fuses from their holders.
- Insert the replacement fuses provided into the fuse holders.
- Insert the fuses in their holders back into the machine.

Install the fuses in the reverse sequence of the removal.

Ensure that the two fuse clips are slightly pressed together when you insert them into the housing.

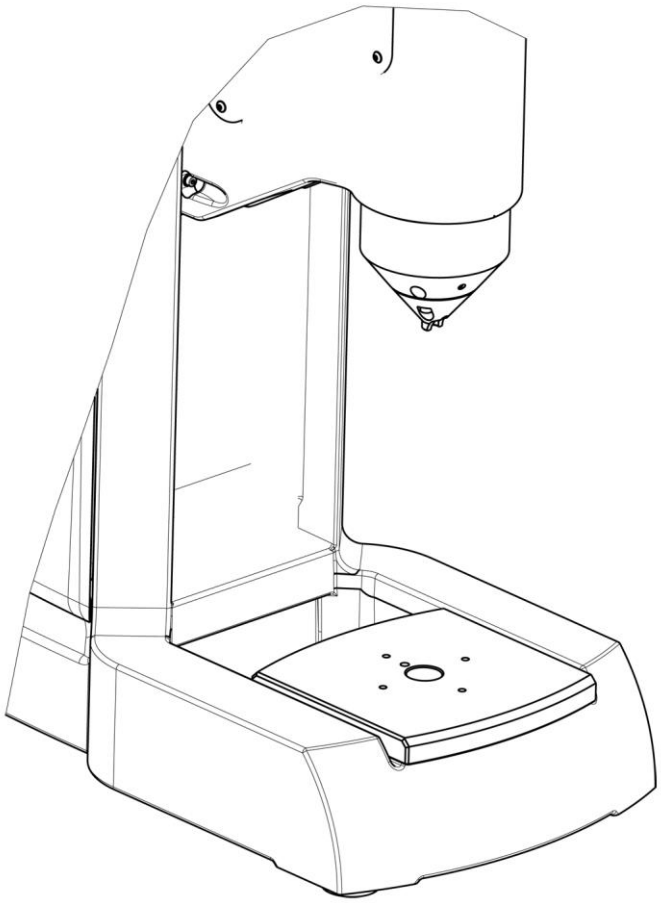
- Plug the power cable into the mains connection.
- Turn the main switch to ON.

7.5 Replacing the Test Anvil

Removing the test anvil

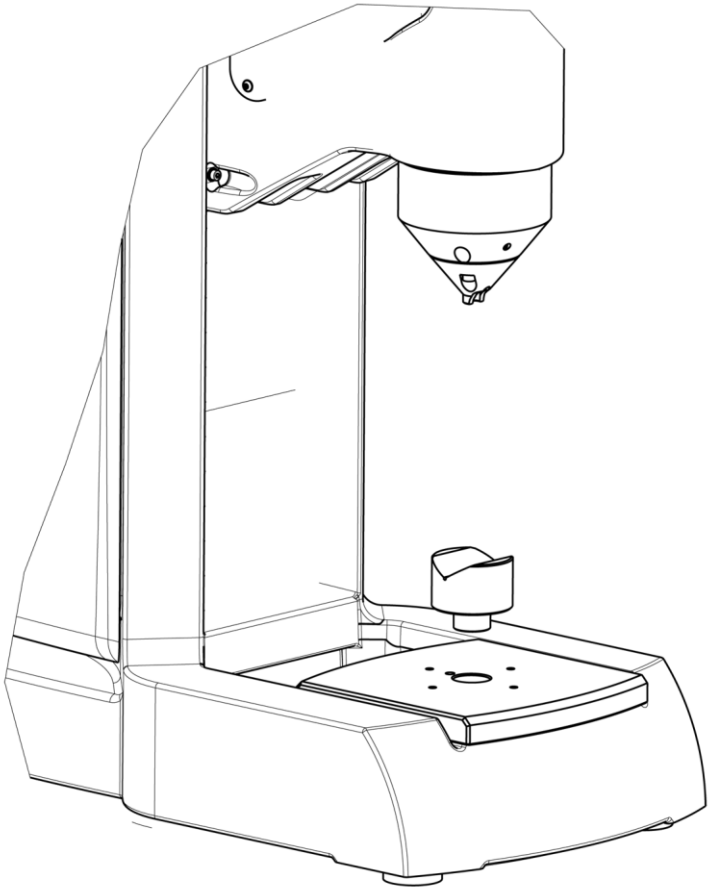
You can remove the DM 90mm XY table provided. The 25-mm bore can then be used to accommodate other test anvils and sample supports. The 4 M6 bores are used to secure special accessories.

- Raise the test anvil provided and remove it from the machine.

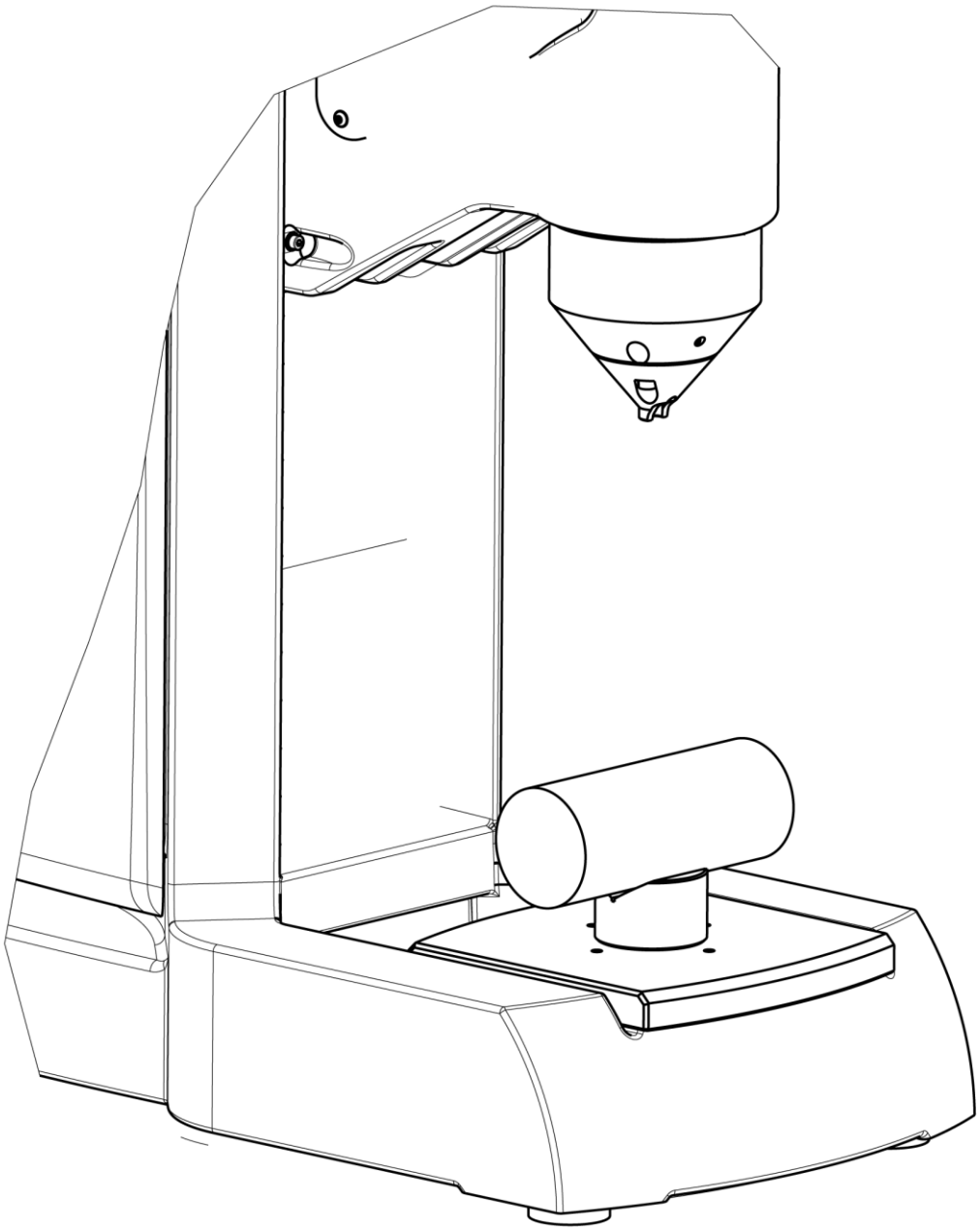


Tester without the test anvil provided.

Mounting a new test anvil



➢ Insert the new test anvil into the space provided on the machine.



Unit with new test anvil and round component.

7.6 Test Methods and Indenters

Test methods Rockwell

HRA	120° V	HR15N	120° V
HRB	1/16" O	HR30N	120° V
HRC	120° V	HR45N	120 ° V
HRD	120° V	HR15T	1/16" O
HRE	1/8" O	HR30T	1/16" O
HRF	1/16" O	HR45T	1/16" O
HRG	1/16" O	HR15W	1/8" O
HRH	1/8" O	HR30W	1/8" O

HRK	1/8" O	HR45W	1/8" O
HRL	1/4" O	HR15X	1/4" O
HRM	1/4" O	HR30X	1/4" O
HRP	1/2" O	HR45X	1/4" O
HRR	1/4" O	HR15Y	1/2" O
HRS	1/2" O	HR30Y	1/2" O
HRV	1/2" O	HR45Y	1/2" O

Vickers methods for depth hardness

HVT5, HVT 10, HVT 20
HVT 30, HVT 50, HVT 60, HVT 100

Brinell methods for depth hardness

HBT 1/5, HBT 1/10, HBT 1/30
HBT 2,5/31,25, HBT 2,5/62,5
HBT 2,5/187.5, HBT 5/125

Rockwell methods not standardized

HRZ, HR 2/10, HR 2/20
HRY, HR 2/40, HR 2/120
HRX

Test methods for plastic

1	49N	5 mm O
2	132N	5 mm O
3	358N	5 mm O
4	961N	5 mm O

The results are displayed in N/mm^2.
Explanation of symbols used
V Diamond cone indenter
O Ball indenter

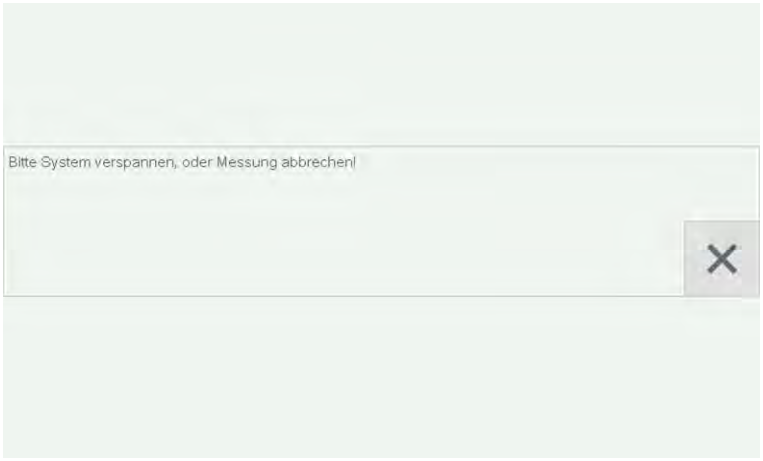
Test methods carbon test:

2,5/7, 5/7, 5/15, 5/20, 5/40, 5/60, 5/100, 5/150, 10/20, 10/40, 10/60, 10/100, 10/150

8 Messages and Problems

Error list

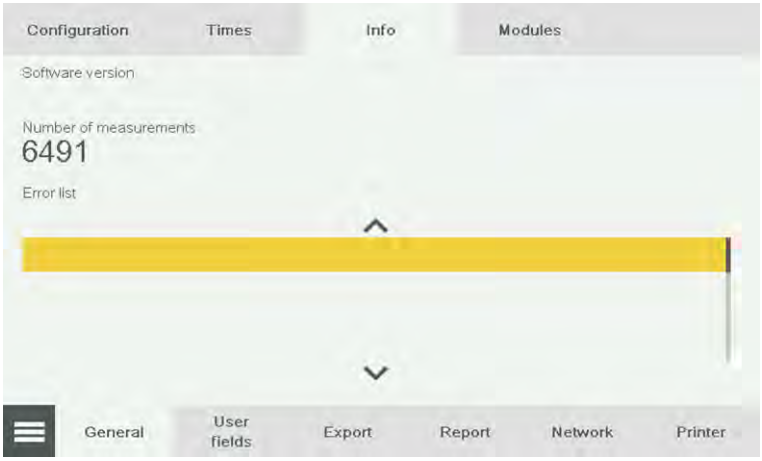
If a problem occurs, send the last three entries of the error list, the software version and the measured value count to your service partner.



➢ Touch **OK** to open the error list.

Alternatively, you can open the error list in the settings via the **General** menu in the **Info** submenu.

The error list appears on the touch screen:

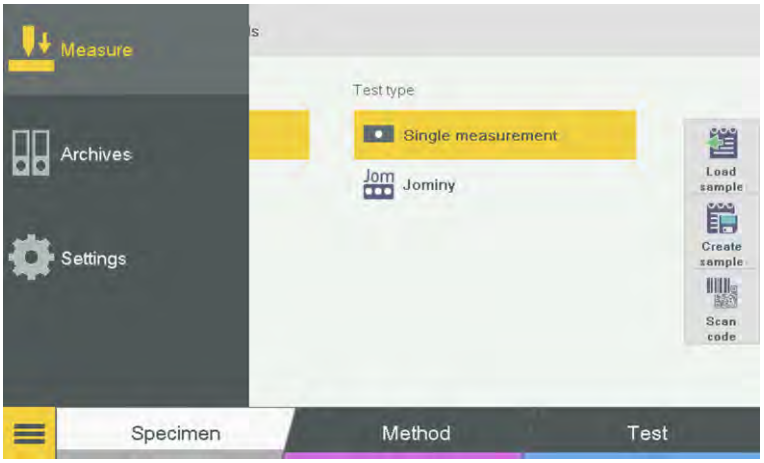


1 Date and time
2 Error number
3 Error description

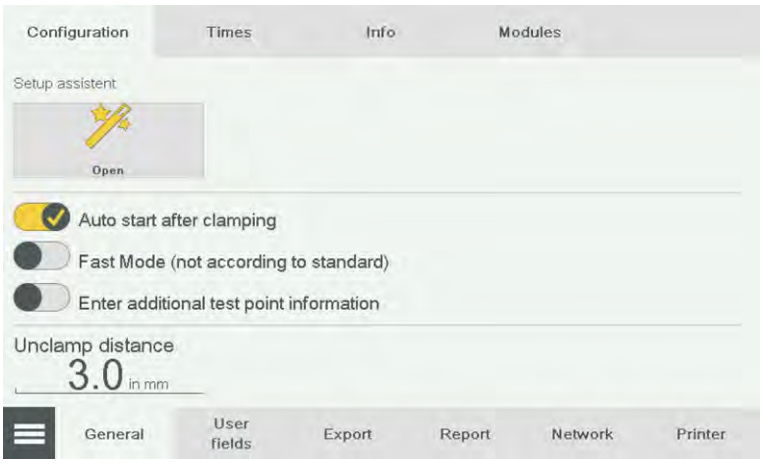
Many error messages can be eliminated by restarting the machine. Contact your supplier if the error persists after you have restarted the machine.

Software version

➢ In the main menu, touch **Settings**.

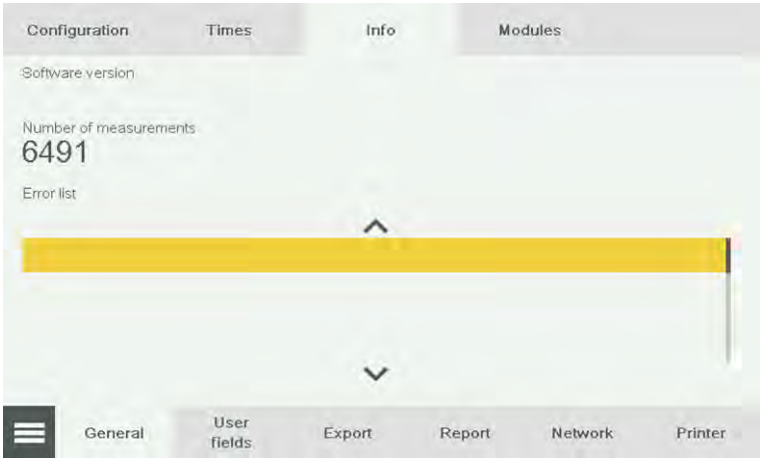


The following screen appears on the touch screen monitor:



➢ Touch **Info**.

The current software version and the serial number are shown here.



Restart

➢ Use the main switch to turn the machine off.

The green pilot light switches off.

➢ Wait at least five seconds before turning the machine back on with the main switch.

The green pilot light lights up.

Contact your supplier if the error persists after you restart the machine.

Error description	Troubleshooting	Correction
No information is displayed on the touch screen; the machine is not working.	▪ Check the power supply, power cable and plug. ▪ Unlock the EMERGENCY OFF button ▪ Replace the fuses. ▪ Check the functioning of the main switch: Does the green pilot light come on when the switch is turned to the ON position?	If none of these measures are effective, there can be a defect in the electronics of the machine. Contact your supplier in this case.
No response when you press the **Nose cone up** and **Nose cone down button**	▪ The unit is not in the workflow step "Testing" ▪ Upper end position reached (if the **Nose cone up** does not work)	▪ Change to the workflow step ""Testing" to activate the measuring mode ▪ Lower the test unit with the **Nose cone down** button
The software fails to start.	The screen message `Wait for start` remains on the screen	Switch the unit off and back on, and access Setup within five seconds.

If you contact our Service team, please have the following information ready:

- Model
- Serial number
- Firmware version
- Error number and error description

You can communicate the error number and error description to our Service team by sending the error list by e-mail.
Otherwise, note down the most recent error number and error description so that you can communicate these by phone.

Service messages

Message	What to do
`Method has been Changed! Please Replace the Indenter!`	You require a different indenter because you have changed the test method (see "Messages and Problems", page 8-1). To

		replace the indenter, refer to "Initial Startup" on page 2-9.
	`Entered Value outside Allowed Range!`	Change the value.
	`Timeout, Indenter has not Touched Sample in Time!`	Before you start testing, move the test unit down for the next measurement.
	`Timeout, Target Force not Reached in Time!`	Take the measurement again. If the same message appears, contact your supplier.
	`Preset Position not Reached!`	The precise unclamp distance was not reached. If the same message appears, contact your supplier.
	`USB Flash Disk not Available or Full!`	Check that the USB flash disk (USB stick) is compatible. If necessary, check the USB flash disk on a PC to determine whether it is full.
	`Error Occured, Print Process Canceled!`	Check that a printer is correctly connected.

Self-explanatory service messages

Message	**What to do**
`Caution! Warning! Indenter has touched Surface. Move up Test Unit.`	Use the **Nose Cone Up** button on the control unit to move the test unit up.
`Upper Position reached. Move Down Test Unit.`	Use the **Nose Cone Down** button on the control unit to move the test unit down.
`No Results in Measurement List. Data Export not possible!`	Proceed with testing.
`Template Name is already existing. Please enter a new Template Name!`	Select **OK** to access the screen where you can assign a new template name or change an existing template name.
`File is already existing. Do you want to overwrite the File?`	Change the file name or choose **OK** to confirm.
`Caution! Warning! The Hardn. Minimum Value is greater or equal than the Hardn. Maximum Value.`	Change the values.
`Please Connect USB Flash Disk on the Back of the Machine.`	Insert a USB flash disk (USB stick) into the USB port provided.
`No Printer Connected, or Printer not available!`	Check that a printer is correctly connected and is ready for use.
`Error Occured! Detailed Information in the Error List!`	The error list is described under "Messages and Problems" on page 8-1.
`Logo was Successfully Loaded!`	The company logo was downloaded and will be inserted into the correct position in the test report (see "Report", page 5-6).