

Krautkramer MIC 20

Technical Reference and Operating Manual

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The version number of the software is displayed in the menu bar line on the screen or in the menu **Config – Info** (ref. chapter 4.7).

Subject to change without notice.

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Introduction 1

1.1 Safety information

The Krautkramer MIC 20 is designed and tested according to DIN EN 61 010 Part 1, March 1994, "Safety requirements for electric measuring, control, and laboratory devices", and was technically in a perfectly safe and faultless condition when leaving the manufacturing works.

In order to maintain this condition and to ensure a safe operation, it is absolutely necessary that you read the following safety information before putting the instrument into operation.

**Attention:**

The Krautkramer MIC 20 is an instrument meant for materials testing. Any use in medical or other applications is not allowed!

The instrument may only be used in industrial environments.

Power supply

Battery pack and power supply unit

The Krautkramer MIC 20 can be operated using the battery pack MIC 20-BAT, or a power supply unit. You can charge the battery pack MIC 20-BAT in the instrument itself while the instrument is supplied with power via the power supply unit and turned off. As soon as you turn the instrument on, the power supply to the battery compartment is interrupted.

NiCd or NiMH single cells

The operation using NiCd or NiMH single cells is likewise possible but is not recommended because of the clearly reduced operating time.

**Attention:**

You cannot charge NiCd or NiMH single cells in the instrument itself but only by means of an external battery charger approved for this purpose.

If you are only using the power supply unit for a longer period of time, you should remove the batteries from the instrument.

Note:

Alkaline cells are not suitable due to their high internal impedance.

Software

According to the current state of the art, software is never completely free from errors or defects.

For this reason, before using any software-controlled test equipment, it should be ensured that the required functions operate perfectly in the intended combination.

If you have any questions regarding the use of the instrument, please contact your nearest GE Inspection Technologies representative.

1.2 About this manual

This manual describes the operation of the hardness tester Krautkramer MIC 20.

Please read carefully through this manual in order to be able to operate all functions of your instrument quickly and reliably. You'll be able to use the complete range of instrument functions and, at the same time, to avoid faults and operating errors which may lead to incorrect test results.

Important information

Even if you might be familiar with hardness testing methods, please always observe the information in chapters 1.4 and 1.5. In chapter 1.4, you will find important limitations and prerequisites for hardness testing in general (training, knowledge of the specific technical test requirements and limits of testing, choice of the appropriate test device).

In chapter 1.5, you will find concrete information about hardness testing using the MIC 20 that you always have to follow in order to ensure correct test results.

1.3 Layout and presentation in this manual

To make it easier for you to use the manual, the operating steps, notes, etc. are always presented in the same way. This will help you find individual pieces of information quickly.

Attention and note symbols



Attention:

You will find the **Attention** symbol in the case of any peculiarities or special aspects in the operation which could affect the correctness of the results.



Note:

At **Note**, you will find e.g. references to other chapters or special recommendations for a function.

Listings

Listings are presented in the following form:

- Variant A
- Variant B
- ...

Operating steps

Operating steps appear as shown in the following example:

- Place the handheld probe vertically to the surface to be tested.
- Hold the probe tight with one hand so that the foot stays perpendicular to the surface during the measurement.

1.4 Prerequisites for hardness testing

In this operating manual you will find all essential information on how to operate the Krautkramer MIC 20. In addition, there are a number of factors which affect the test results. As a description of these factors would go beyond the scope of an operating manual, only the three most important conditions are therefore described here:

- operator training
- knowledge of special technical test requirements and limits
- choice of the appropriate test equipment



Attention:

Lack of knowledge of the above-mentioned subjects may lead to incorrect test results with unforeseeable consequences.

GE Inspection Technologies organizes training courses in the field of hardness testing. You will receive information on the scheduled dates on request.

Operator training

The reliable and safe operation of a hardness testing device requires a proper training in materials testing.

A proper training comprises for example adequate knowledge of:

- hardness testing on metallic materials
- effects due to material properties, especially due to the microstructure, on hardness testing and on the corresponding choice of the appropriate hardness tester
- problems relating to the comparability of different hardness values, such as Vickers, Rockwell, and Brinell
- effects due to surface finish on the hardness value
- effects of the test load on the determined hardness value

Technical test requirements

Every hardness test is subject to specific technical test requirements. The most important ones are:

- definition of the scope of testing
- choice of the appropriate test method
- consideration of material properties
- determination of limits for evaluation

Choice of the appropriate test equipment

It is the task of those responsible for the test to fully inform the operator about the technical test requirements. Moreover, a clear and thorough interpretation of the corresponding test specifications is absolutely necessary.

Information about test methods and test specifications may be obtained, for example, from various institutions, industrial companies, and authorities.

1.5 Important information about hardness testing using the Krautkramer MIC 20

Please find in the following a summary of the most important technical test requirements that you always have to observe in order to obtain reliable and reproducible test results.



Attention:

Do not carry out the hardness test twice at the same test position, otherwise measuring errors may occur due to the hardness increase of the surface. The distance between the test positions should be at least 3 mm.

Test material

The surfaces must be free from any impurities (oil, dust, etc.) and rust. The peak-to-valley height should not exceed approx. 30 % of the penetration depth. Rough surfaces lead to a higher variation range of the single readings. If necessary, polish rougher surfaces, for example using our grinding set MIC 1060 (ref. chapter 2).

Test method

The MIC 20 supports both quasi-static hardness testing according to the UCI method and dynamic hardness testing according to the rebound method.

All Krautkramer UCI probes and the rebound impact devices D, G, and E are supported in these processes.

The UCI method

The UCI method is a comparative method (contribution of the Young's modulus to the measurement) with a very high reproducibility of measurements. The UCI method does not replace the classical Vickers hardness testing method but constitutes a fast and reliable addition to it.

The direct comparison with the results of the standardized Vickers measurement according to the material samples is therefore indispensable for the assessment of the measuring accuracy of the UCI method. This means:

The test forces (probes) must match the surface quality of the material:

- Smooth, homogeneous surfaces require low test forces.
- Rougher, coarse-grained surfaces require as high test forces as possible.

 **Attention:**

It is absolutely necessary that you calibrate your MIC 20 to the material to be tested.

The calibration is required only once for this since you can save calibrations and recall them again as required without any problem (ref. chapter 4.4).

The calibration for low-alloy or unalloyed steel is already predefined in the instrument. You should check them from time to time (ref. chapter 4.9 Functional tests).

Please also read the notes on the UCI method in chapter 7.

The Rebound method

The rebound method is a dynamic method with a very high reproducibility of measurements. The rebound method does not replace the classical Brinell hardness testing method or other standardized methods but constitutes a fast and reliable addition to them.

The still existing energy of an impact body after the rebound from the material surface is measured. It should be kept in mind in this regard that the loss of energy suffered in this process also depends on the mechanical properties of the material, i.e. mainly on its Young's modulus or modulus of elasticity.

The direct comparison with the results of the standardized Vickers measurement according to the material samples is therefore indispensable for the assessment of the measuring accuracy of the method. This means:

⚠ Attention:

It is absolutely necessary that you set your MIC 20 to the suitable material group before carrying out the test and that you additionally calibrate it if necessary.

The calibration is necessary only once in this process since you can save the calibrations and recall them again as required without any problem (ref. chapter 4.4).

The material group for low-alloy or unalloyed steel is predefined in the instrument as a default setting.

You should check this from time to time (ref. chapter 4.9 Functional tests).

Test objects having a mass of at least 5 kg can be tested without any additional supports; more lightweight objects require a support to which they have to be rigidly coupled. You should use large metal supports that do not give way for this purpose.

The test objects should have a minimum wall thickness of 20 mm. We recommend the UCI method, or the use of a suitable UCI probe in combination with the MIC 20 for test objects having smaller wall thicknesses.

⚠ Attention:

Should the test objects give way or spring, the result may be measuring errors!

Please read also chapter 7 on the rebound method.

Conversion of hardness values

The conversion of hardness values into other hardness scales is only possibly with restrictions.

Hardness values determined according to different methods cannot be converted into each other by means of generally applicable relations. The restrictions regarding the conversion, stated in the DIN 50 150, ASTM E140 specifications, must therefore always be taken into account!

The indentation behavior of the material is determined by its stress-strain behavior. Shape and material of the indenter, the size of indentation, and consequently the measured area vary, depending on the test method used.

The conversion of hardness values both into one another and into tensile strength values can be inaccurate

or unacceptable depending on the material, treatment condition, and surface quality.



Attention:

Any illegal or unacceptable conversions may lead to serious errors in the interpretation of test results.

1.6 The Krautkramer MIC 20

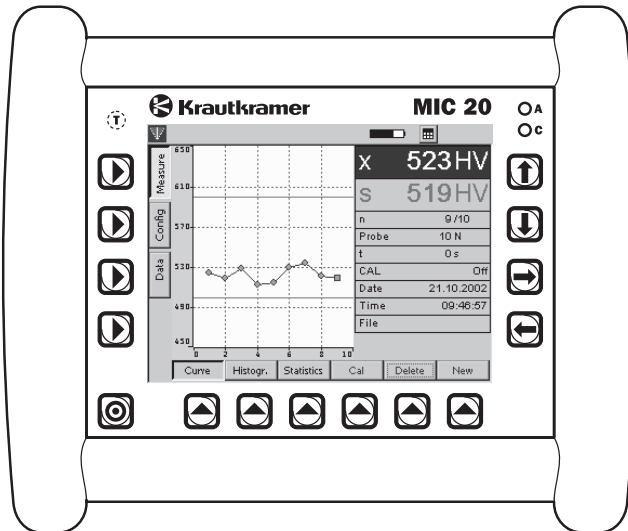
The Krautkramer MIC 20 is a mobile and easy-to-use hardness tester which can be equally used for tests according to the UCI method and for tests according to the rebound method.

After connecting the probe, the instrument is automatically set to the corresponding test method; tests can be carried out quickly and without any problem.

The fact that both methods are supported leads to a large variety of application possibilities with only one single instrument. Additional probes extend the range of applications if required.

The operation of the Krautkramer MIC 20 (calibration, setup, evaluation, data memory) is carried out by means of the graphic user interface presented on the display and adapted to the known Windows standard. The mouse is replaced by the touch screen for this purpose.

As an alternative, conventional buttons are available for most operating functions.



Special features of the MIC 20

- Measurements on castings and forgings, hardened surfaces and welds
- Automatic adaptation of the test method and of the test parameters to the connected probe
- Color LCD 5.7" for displays and operating functions (TFT or CSTN)
- Support of all Krautkramer UCI probes
- Support of the Krautkramer rebound impact devices D, G, and E
- Non-directional measurement (patented signal processing with the rebound method)
- Storage of measurement data and clear representation of measurement series as a diagram and histogram
- Simple and fast calibration, saving and recalling of calibration data at the press of a button
- Output of measurement data directly to a printer or transfer to a computer

- Operation using the battery pack or power supply unit

Large variety of application possibilities

You can use the Krautkramer MIC 20 to measure anywhere and in any direction; the direction must not be set beforehand.

The MIC 20 is mainly suitable

- for measuring hardness of low-alloy or unalloyed steels,
- for measuring hardness of high-alloy steels,
- for measuring hardness of nonferrous metals.

The MIC 20 is available in two versions:

- Basic version MIC 20 with color CSTN screen
- MIC 20 TFT with color TFT display screen

Standard package and accessories **2**

This chapter informs you about the standard package and the accessories available for the Krautkramer MIC 20.

It describes

- component parts of the product
- required and recommended accessories
- spare parts requirements

2.1 Standard package

Product code	Description	Order no.
MIC 20	Portable Hardness Tester according to the quasi-static UCI principle and the dynamic Rebound principle. Display of the hardness values in HV, HB, HRC, HRB, N/mm ² and additional for the Rebound principle in HL and HS.	35 468
	including:	
	Instrument MIC 20	35 493
	Mains adapter	101 075
	Transport case	101 554
	Operating manual German	28 701
	or	
	Operating manual English	28 702

Product code	Description	Order no.
MIC 20 TFT	Portable Hardness Tester according to the quasi-static UCI principle and the dynamic Rebound principle. Display of the hardness values in HV, HB, HRC, HRB, N/mm ² and additional for the Rebound principle in HL and HS.	35 479
	including:	
	Instrument MIC 20 TFT	35 492
	Mains adapter	101 075
	Transport case	101 554
	Operating manual German	28 701
	or	
	Operating manual English	28 702

2.2 Required accessories

Product code	Description	Order no.
	Handheld Probes (UCI method) (each probe complete with cable)	
MIC 201-A	Handheld probe 10 N	34 104
MIC 205-A	Handheld probe 50 N	34 105
MIC 2010-A	Handheld probe 98 N	34 106
MIC 201-AL	Extended handheld probe 10 N	34 392
MIC 205-AL	Extended handheld probe 50 N	34 282
MIC 201-AS	Short handheld probe 10 N	34 711
MIC 205-AS	Short handheld probe 50 N	34 712

Product code	Description	Order no.
	Motorized Probes (UCI method) (each probe complete with cable)	
MIC 211-A	Motor probe 8.6 N	34 381
MIC 2103-A	Motor probe 3 N	34 382
MIC 2101-A	Motor probe 1 N	35 577
	Impact Devices (rebound method) (each without connecting cable for impact device)	
Dyna D	Impact device with 3 mm tungsten-carbide	34 248
Dyna G	Impact device with 5 mm tungsten-carbide	34 549
Dyna E	Impact device with diamond-tipped body	34 588
Dyna 50	Connecting cable for impact device	34 329

2.3 Recommended accessories (general)

Product code	Description	Order no.
MIC 20-BAT	NiMH accumulator pack, 4.5 Ah, internal charging	35 452
MIC 1060	Battery grinding set	34 380
MIC 300	Technical book on hardness testing (only in German)	28 837
	Printer cable (serial/parallel) for connection to Hewlett Packard Printers of the hpdeskjet 9xx series	101 761
UDAT	UltraDAT data management program for transfer and documentation of hardness measurement data	35 549
	Data transfer cable from the instrument to a PC	101 785
ZG-F	Couplant	54 558

2.4 Recommended accessories (UCI method)

Product code	Description	Order no.
Guiding devices and test supports		
MIC 270	Surface attachment for MIC 201-A, MIC 205-A, MIC 2010-A	32 084
MIC 271	Prism adapter for MIC 201-A, MIC 205-A	32 993
MIC 220	Test specimen holder for MIC 2101-A, MIC 2103-A and MIC 211-A	30 766
MIC 221	Universal test support with instrument holder	33 541
MIC 227	Test support for determination of hardness progression	35 264
MIC 222-A	Precision test support	35 546
MIC 2221	Magnetic foot for support MIC 222-A	33 909
MIC 2220	Support block for flat, thin parts	33 651
MIC 225	Camshaft test stand	34 869

Product code	Description	Order no.
Guiding devices for motor probes		
MIC 100	Probe attachment set	29 929
MIC 100-1	Prism attachment	29 920
MIC 120	Magnetic probe shoe for curved surfaces	31 854
MIC 223	Quick test support with magnetic foot	34 020
Hardness reference plates with MPA certificate		
MIC 25C	Hardness Reference Plate 25 HRC	33 905
MIC 45C	Hardness Reference Plate 45 HRC	33 906
MIC 65C	Hardness Reference Plate 65 HRC	33 907
MIC 1V100	Hardness Reference Plate 150 HV10	34 279
MIC 2V010	Hardness Reference Plate 240 HV1	33 896
MIC 2V050	Hardness Reference Plate 240 HV5	33 899

Product code	Description	Order no.
MIC 2V100	Hardness Reference Plate 240 HV10	33 902
MIC 5V010	Hardness Reference Plate 540 HV1	33 897
MIC 5V050	Hardness Reference Plate 540 HV5	33 900
MIC 5V100	Hardness Reference Plate 540 HV10	33 903
MIC 8V010	Hardness Reference Plate 840 HV1	33 898
MIC 8V050	Hardness Reference Plate 840 HV5	33 901
MIC 8V100	Hardness Reference Plate 840 HV10	33 904

2.5 Recommended accessories (rebound method)

Product code	Description	Order no.
Hardness reference blocks (rebound method)		
MIC D62	Hardness reference block 620 HV100	34 393
MIC D62MPA	Hardness reference block 620 HV100, certified by MPA, Germany	34 573
MIC G38	Hardness reference block 380 HV100	34 631
MIC G38MPA	Hardness reference block 380 HV100, certified by MPA, Germany	34 657
Test attachments for Dyna D and E (rebound method)		
Dyna 41	Set (5 pcs.) of test attachments for cylindrical and hollow-cylindrical surfaces	34 536
Dyna 42	Set (5 pcs.) of test attachments for spherical and hollow-spherical surfaces	34 539

2.6 Spare parts requirements (UCI method)

Product code	Description	Order no.
MIC 1050	Probe cable for handheld probes	34 071
MIC 1051	Probe cable for motor probes	34 378
MIC 1052	Probe cable for shortened handheld probes for MIC 201-AS and MIC 205-AS	34 713
	Ball headed probe grip	33 854

2.7 Spare parts requirements (rebound method)

Product code	Description	Order no.
	Impact body D, new	34 443
	Impact body G, new	34 596
	Impact body E, new	34 593
	Impact body D, replacement in exchange by Krautkramer Service Department	34 572
	Impact body G, replacement in exchange by Krautkramer Service Department	35 265
Dyna 50	Connecting cable for impact device	34 329
	Cleaning brush for Dyna D or Dyna E	34 420
	Cleaning brush for Dyna G	34 618
	Standard test attachment for impact device D or E	34 312
	Test attachment for impact devices D or E, Ø = 13.5 mm	34 656

Product code	Description	Order no.
	Standard test attachment for impact device G	34 569
	Test attachment for impact device G, diameter = 50 mm	34 634
	Replacement grinder for battery grinding set MIC 1060	18 115

Initial start-up **3**

3.1 Power supply

You can operate the Krautkramer MIC 20 either with the battery pack MIC 20-BAT or with the power supply unit. The operation with the power supply unit is possible even if the battery pack MIC 20-BAT is in the instrument. The power supply to the battery compartment is then automatically interrupted.

Operation using the power supply unit

The Krautkramer MIC 20 is supplied either with a desktop power supply unit or with a plug-in power supply unit. The power supply unit is automatically set to any a.c. voltage between 100 and 240 V (nominal voltage).

Operation using the desktop power supply unit

The desktop power supply unit is provided with a cable equipped with a Euro plug connector and inlet connector for non-heating appliances.

Plug the cable's inlet connector for non-heating appliances in the socket for non-heating appliances of the power supply unit.

Operation using the plug-in power supply unit

The plug-in power supply unit is delivered with two different socket-outlet adapters – for Euro and U.S. standard. If the adapter plug on your power supply unit does not correspond to your socket-outlet standard, you can exchange it.

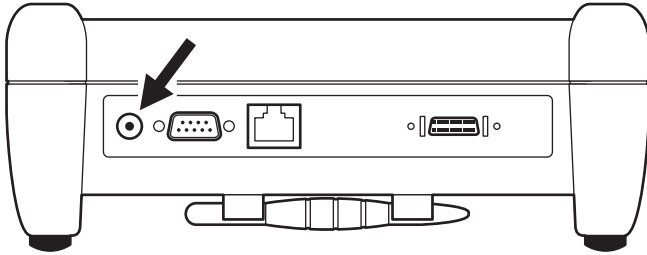
Just pull off the attached adapter, and replace it with the required one.

Note:

You should exchange the socket-outlet adapter only once; the plug-in power supply unit is not meant for frequent exchanges.

Connecting

Use the corresponding power supply unit to connect the Krautkramer MIC 20 to a suitable mains socket-outlet. The socket-contact for the power supply unit cable is located at the back of the instrument.



Operation using the battery pack MIC 20-BAT

You can operate the Krautkramer MIC 20 with the NiMH battery pack MIC 20-BAT (ref. chapter 2).

The operation is likewise possible with 6 NiCd or NiMH single C-cells each, however, it is not recommended because of the clearly reduced operating time.

Inserting batteries

The battery compartment is located in the instrument bottom.

- Move the fastener towards the lid center in order to open the lid, and remove the lid.
- Insert the plug of the battery pack into the socket-contact in the battery compartment until it snaps into place. When inserting the battery pack, make sure that no squeezing or kinking of the cables is possible.
- If you use single cells, insert the individual cells into the battery compartment one by one. Follow the instructions regarding alignment and polarity in the battery compartment.
- Place the lid back on, move the fastener back and close the battery compartment so that the fastener locks home perceptibly.

Notes:

Remove the batteries from the instrument if you're not going to use it for a longer period of time!

Used or defective batteries are special waste and have to be disposed of as provided by the law!

When using the battery pack MIC 20-BAT (unless NiMH or NiCd single cells are used), the current status of the battery is indicated on the display of the MIC 20 by an icon:



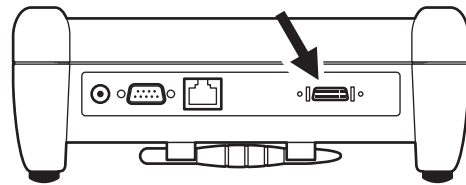
An alarm is output with low voltage. In such a case, exchange the batteries at once. The Krautkramer MIC 20 is automatically turned off if the voltage gets too low in order to ensure a reliable mode of functioning.

You will find more details on the care and charging of batteries in chapter 5.

3.2 Connecting a probe or an impact device

You can connect probes for the quasi-static hardness testing according to the UCI method as well as impact devices for the dynamic hardness testing according to the rebound method to the MIC 20.

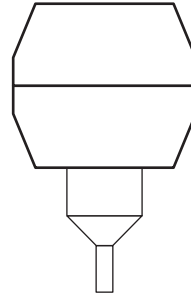
Probes and impact devices are connected to the MIC 20 via corresponding connecting cables. The connecting cables are equipped with a round plug for the connection to the probe or to the impact device, and with a square plug for the connection to the instrument.

**Note:**

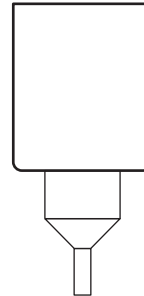
You should only change the probe or the impact device when the MIC 20 is switched off.

Connecting a UCI probe

- Align the round plug of the cable correctly with the socket of the probe by means of the markings, and push it carefully into the socket until it locks into place.
- Plug the square plug of the connecting cable in the socket at the back of the instrument.
- Check that both plugs fit tightly.
- Attach the probe handle to the probe if necessary.
- Screw on the conical test attachment for short-time measurements using the UCI handheld probes MIC 201-A, MIC 205-A, or MIC 2010-A. Use the cylindrical test attachment for measurements with defined dwell times.
- Switch the MIC 20 on. An icon in the top left corner of the screen shows that a probe has been correctly connected:



Conical probe attachment for short-time measurements



Cylindrical probe attachment for measurements with a defined dwell time

 **Note:**

If you want to carry out measurements with defined dwell times, please use the support

MIC 222-A (support with precise probe guidance).

This will help you to avoid measuring inaccuracies to a large degree.

In addition, other accessories are available to make the measurements easier for you to carry out (ref. chapter 2).

Connecting an impact device

The following impact devices are available for use in combination with the MIC 20:

- **Dyna D**
Standard impact device for all materials that can be tested
- **Dyna G**
Impact device for solid test objects, e.g. castings or forgings
- **Dyna E**
Impact device for the hardness range over 650 HV

 **Attention:**

The impact device Dyna G must only be used up to a hardness to be tested of max. 650 HB, otherwise the impact body may be destroyed.

 **Note:**

A larger test attachment (diameter 50 mm) is available for the impact device Dyna G for a more stable measurement on large, flat workpieces.

For measurements on test objects having curved surfaces, you have special test attachments at your disposal in order to achieve a better positioning with the impact devices Dyna D and Dyna E (ref. chapter 2).

- Align the round plug of the cable correctly with the socket of the probe by means of the markings, and push it carefully into the socket until it locks into place.
- Plug the square plug of the connecting cable in the socket at the back of the instrument.
- Check that both plugs fit tightly.
- Screw on the suitable test attachment for measurements on curved surfaces if necessary.
- Switch the MIC 20 on. An icon in the top left corner of the screen shows that a probe has been correctly connected:



Disconnecting the connecting cable

The round plug is provided with a bayonet lock, the square plug has two locking clips.

- Carefully pull the outer ring of the round plug on the probe or on the impact device in order to release the lock, and pull off the plug.
- Press the two lateral clips of the square plug on the instrument in order to release the lock, and pull off the plug.

Exchanging the test attachment

You can use special test attachments for testing on small parts and on uneven surfaces in order to achieve a better positioning of the probe or of the impact device.

- Slowly unscrew the currently used test attachment counter-clockwise by hand.
- Place the required test attachment on carefully. Make sure that the threads are not damaged by tilting.
- Carefully screw on the test attachment clockwise and by only using manual force all the way to the limit stop.

3.3 Turning on/off

Turning on

- Briefly press the button  to turn the instrument on.


The operating system will start, and some information, e.g. about the software, is briefly displayed on the screen. When the instrument is ready, you will see the graphic user interface.

Turning off

- Briefly press the button  to turn the instrument off.




Attention:

You should always use the button  in order to properly turn the instrument off. In the case of an interruption of the power supply (battery removal, unplugging of power plug), the instrument is not turned off properly, and data may be lost.

Emergency-stop

If the instrument no longer shows any reaction, you can turn it off without saving the current data. Afterwards, you can turn it back on as usual.

- To turn off, keep the button  pressed down until the screen is blanked, and the instrument is turned off.



Cold start

If the instrument no longer reacts and cannot be started properly, you can reset the settings with a cold start.



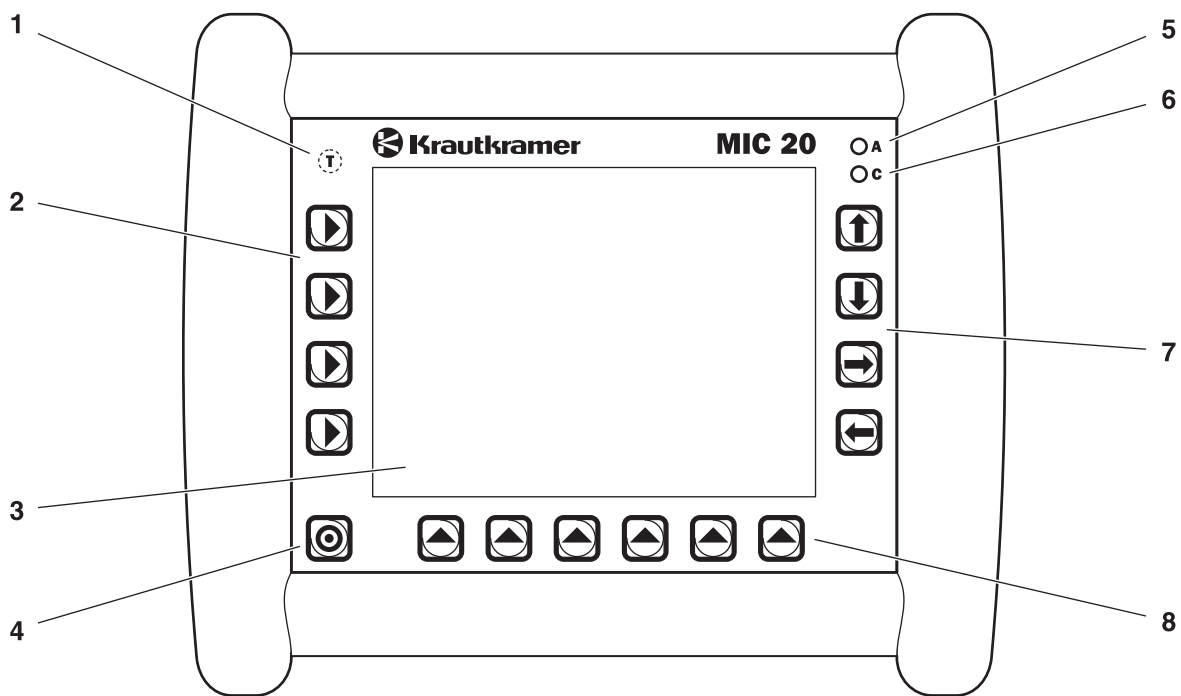
Attention:

In a cold start, the files LastMeasure.mes and last.set are deleted so that the last measurement series and the saved calibration data may be lost.

- To switch on the instrument, briefly press the button .
- As soon as the start screen (blue background) appears, press the button .

Operation 4

4.1 Fundamental principles of operation



Operator's controls and displays

- 1 Temperature sensor (no operating function)
- 2 Select keys to select the main menus
- 3 Touch-sensitive screen (touch screen), for direct operation of the graphic interface
- 4 Key to turn on and off
- 5 Red LED,
is lit in the case of alarms and if the preset threshold values for hardness measurements are exceeded
- 6 Green LED,
is lit with an active charging process,
flashes quickly with a finished charging process,
flashes slowly if the battery voltage or the temperature are out of tolerances
- 7 Arrow keys for navigation in the menus, and for activation of functions
- 8 Select keys for submenus and functions

Display screen

The Krautkramer MIC 20 is equipped with a touch screen enabling a direct operation of the menus appearing on the screen.

The graphic user interface is adapted to the known Windows standards. The operation by means of a mouse (selecting and clicking) is in this case replaced with direct touch on the screen. A mouse pointer is therefore not necessary.

To select or to mark an element of the user interface, just touch the corresponding point of the screen briefly with your finger or with the pen provided for the instrument.

The pen is located in the holder at the instrument bottom.



Attention:

Do not touch the touch screen with any hard or sharp-edged objects (e.g. ball-point pen or screw driver). The touch-sensitive surface may be severely damaged by them.

Do not apply any high pressure to the screen, the touch screen needs only slight pressure to react.

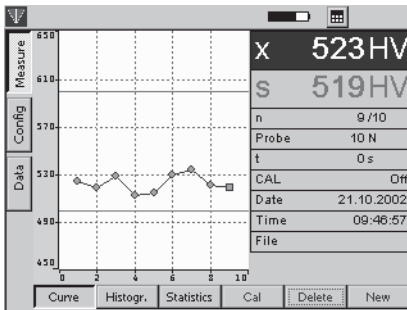
Note:

The contents of the menu differ in some details, depending on the fact whether a probe or an impact device is connected to the MIC 20.

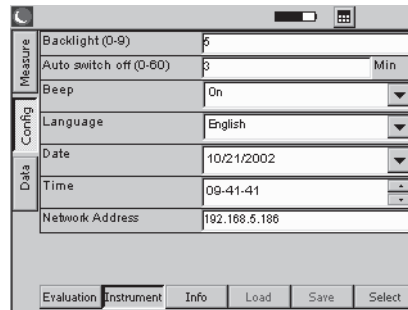
User interface

The 3 main menus **Data**, **Config**, and **Measure** are displayed on the screen. The 3 main menus have different user interfaces.

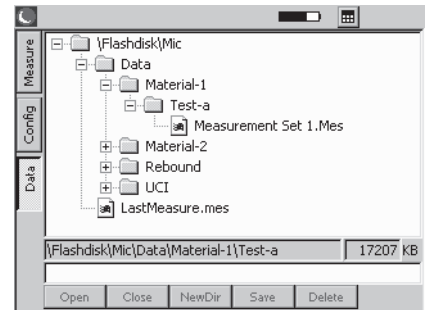
The buttons as well as the option and other boxes shown on the user interface can be operated by directly touching the touch screen, or by pressing the corresponding key next to the screen.



Main menu **Measure**



Main menu **Config**



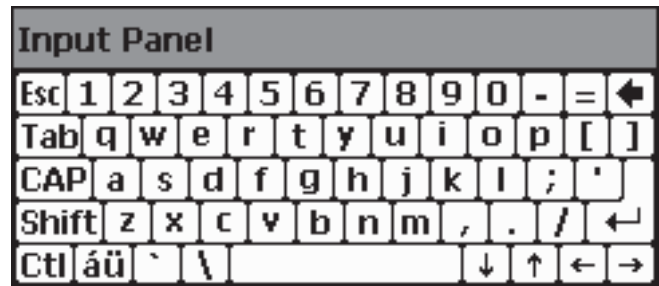
Main menu **Data**

Virtual keyboard

A virtual keyboard is available for text and value inputs and is automatically displayed if the corresponding input fields are activated.

The virtual keyboard can also be turned on and off by hand.

- Touch the button with the keyboard icon on it, next to the battery icon. The virtual keyboard is displayed.
- Touch the broad bar above the displayed keys, keep the pen pressed down, and move the keyboard with the pen pressed down.
- Touch the button with the keyboard icon on it once again. The virtual keyboard is turned off again.



Operation using the keypad or touch screen

You can use either the keys arranged around the screen to operate all menus and functions or, as an alternative, directly the touch screen.

At the beginning, use both alternatives in order to test the advantages of either one in practice.

In general, this manual only describes the direct operation by means of the touch screen. If the operation alternative using the keyboard presents a special advantage, it is additionally mentioned at that point.

The keys and menus or functions are arranged in such a way that a clear assignment can always be seen.

Consequently, you'll always have the following two alternatives:

- Touch the button of a function.
- or
- Press the key next to (or below) the function.

Installing the instrument

The instrument has a prop-up lever stand at its bottom enabling you to install the instrument at varying angles.

You should always ensure that you have a good view of the screen in order to work as ergonomically as possible and to avoid overstraining yourself unnecessarily.

- Fold out the lever stand, and let it lock into the required position.
- Install the instrument in such a way that you have a good and non-dazzling view of it.

4.2 Probe and impact device

Guiding the probe

**Attention:**

Make sure that the probe is connected before switching the MIC 20 on so that the instrument is automatically set to the UCI method.

Reliable measurement results can only be obtained if you know how to handle the probe correctly and safely.

Please always observe the following rules:

- Avoid any rough placing of the probe on the test surface in order not to damage the diamond.
- Do not move the probe under load on the test material.
- Pay attention to guiding the probe smoothly and steadily using your both hands.
- Do not carry out measurements twice at the same test position. The distance between the test positions should be at least 3 mm.

 **Note:**

After placing the probe on the test surface, the measurement must be carried out within 3 seconds. Otherwise an error message will be given and you have to start the process again.

- Select the main menu **Measure**.
- If necessary, remove the rubber protection cap from the probe.
- Screw on the conical test attachment for short-time measurements.
- Hold the probe with your both hands in order to have the best possible control during guidance and during impressing in the material surface.
- Place the probe vertically on the surface to be tested. An icon at the top edge on the screen shows the contact of the probe with the test material:



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