

# Krautkramer MIC 10

Operating Manual  
084-028-547



[GEInspectionTechnologies.com](http://GEInspectionTechnologies.com)

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# Introduction 1

## 1.1 Krautkrämer MIC 10

The hardness tester MIC 10 from Krautkrämer is handy, easy to operate and can carry out tests quickly without any difficulty.

It mainly is suitable

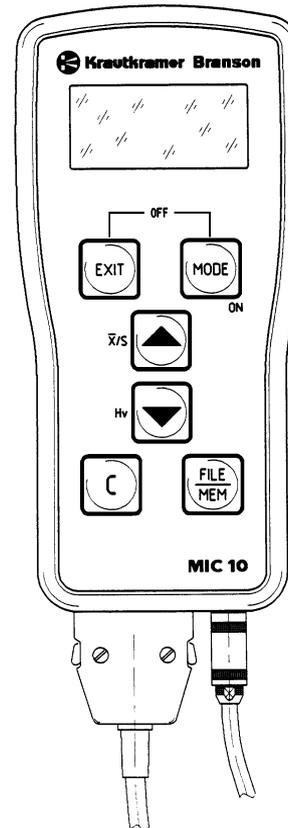
- for hardness measurement of low and non-alloyed steels,
- for hardness measurement of high-alloyed steels,
- for hardness measurement of nonferrous metals.

The MIC 10 can be delivered in two versions:

- the basic version "B"
- the Data Logger version "DL"

As opposed to the B version, the DL version has additional functions for data storage:

You can store readings in the instrument in order to have them printed or, using special software, transfer them to a PC. With the auxiliary Memory Card you have access to almost unlimited storage possibilities and flexible data processing.



Compared to customary Vickers low-load hardness testers, the MICRODUR series from Krautkrämer does not evaluate with a microscope but uses the UCI method electronically. The measured hardness is instantly displayed digitally and high reproducibility of the test results is achieved. The indent in the surface of the material is microscopic.

We are constantly working on further instrument development. Therefore we hope that you appreciate our right to carry out technical changes.

Your nearest Krautkrämer Sales Center is ready to help you concerning service questions. In addition to this, you can contact our Customer Service or Service Center directly at our company. The addresses are shown on pages 12-8 - 12-9 under "Service addresses".

## 1.2 Information on these instructions

In the following you will find information about how to use these instructions.

Please read these instructions carefully in order to operate the MIC 10 functions quickly and effectively.

In doing this you will be able to take full advantage of the function range of the instrument. At the same time, you will also avoid errors and wrong operation which in turn would cause incorrect test results and thus could lead to injury and damage.

### Important information

Even if you have experience in hardness testing you must observe the information given in Chapters 1.4 and 1.5. Chapter 1.4 contains important limitations and conditions for hardness testing (training of the operator, knowledge of the special technical requirements and limitations, selection of the suitable test setup). In Chapter 1.5 you will find special information about hardness testing with the MIC 10. Please pay attention to this information in order to obtain precise measuring results.

Please always look up in **Chapter 13** to see if there are any current changes. This chapter describes corrections which have been added at short notice and which are not yet included in the general manual. If there are no additional corrections, the chapter remains empty.

The operation of the MIC 10 is easy and quick to learn. In order to be able to use the instrument quickly you should become acquainted with preparation as well as the basic functions of the MIC 10. To do this, read the following chapters carefully:

### **Chapter 3 *Preparations for operation***

Here you will find all the steps necessary for application of the instrument.

### **Chapter 4 *Basics of operation***

This gives you an insight into MIC 10 operation as well as a few important steps which always reoccur during operation.

### **Chapter 5.1 *Hardness measurement***

All operation steps are shown which are required during the measurement procedure.

### **Chap. 5.2 *Data storage (only for MIC 10 DL)***

The MIC 10 base instrument does not have these functions. You learn how to store data, to display, change and delete stored data. Using the special Memory Card you can reload stored instrument settings into the MIC 10.

### **Chapter 6 *Configuration***

This gives you information about additional possibilities concerning instrument adjustment.

### **Chapter 7 *Documentation (only for the MIC 10 DL)***

You can document the measurement readings via a printer or transfer them to a computer using special software and evaluate them there. Various possibilities are available for your printouts.

### **Chapter 10 *Interfaces and peripherals (only for MIC 10 DL)***

In this chapter you learn about connecting the MIC 10 to a computer or printer. You can remote control the instrument via a computer.

### **Chapter 12 *Appendix***

The appendix supplies you with information about conversion of hardness values into other scales, the UCI method, the treatment of test materials as well as the statistical evaluation of the measurement results.

## 1.3 The layout and presentation of these instructions

In order to simplify the layout of these instructions, the operation steps, lists, notes etc. are always put in the same form. In this way, you will be able to quickly find individual information.

The individual functions are described in the operation steps so that you are immediately able to work with the function which you require.

### Operation steps

The operation steps are shown in the following way:

- ...
- ...
- ...

### Listing

Listing is made as follows:

- ...
- ...

### Note and attention symbols

You will find the following symbol when there are specialities to be observed concerning instrument operation:



Information to reliable and error-free operation of the instrument is found under the following symbol:



## 1.4 Conditions for hardness testing

You will find all the essential instructions for operation of the MIC 10. In addition to this there are a series of factors which affect the test results. Due to the fact that a description of these factors would extend beyond the scope of this manual, the three most important conditions are as follows:

- training of the operator
- knowledge of the special technical requirements and limits
- selection of the suitable test setup

### Training of the operator

For reliable application of a hardness tester suitable training in the field of material testing is required.

Suitable training means, for example, suitable knowledge about:

- hardness testing on metallic materials.
- effects of material properties, especially the structure, on the hardness test and the selection of a suitable hardness testing setup connected with it.

- the problems of comparability of different hardnesses such Vickers, Rockwell and Brinell. Also refer to the information given in the Appendix.
- the effects of surface treatment on the hardness value.
- the effect of the test load, and the size of the indent connected with it, on the determined hardness value.

Please read also the instructions in chapter 1.5.



#### **Attention:**

**Insufficient knowledge of the above mentioned fields can cause wrong test results and could have unforeseeable consequences.**

## Test requirements

Every hardness test has certain requirements. The most important are:

- determination of the test scope
- selection of a suitable testing technique
- consideration of the material properties
- Determination of the evaluation limits

## Selection of a suitable test setup

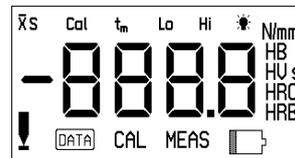
It is the task of the person responsible for the test to inform the operator about the test requirements. In addition to this, a clear and complete interpretation of the corresponding test specifications is urgently required.

Information about the test method and test specifications are, amongst others, obtainable from different institutes, industrial companies and authorities.

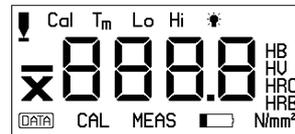
## 1.5 Important notes on MIC 10

### New display

The MIC 10 display has changed as from instrument serial number 1001. Please take into account when retrofitting new software to an instrument having a smaller serial number. This change does not affect the operation in any way.



Old Display



New Display

The average is now indicated with **x** before the reading; the indication **S** for the single value is dropped (no indication=single value). The indication **s** (seconds) for the dwell time is likewise dropped. The indication for the probe contact and the hardness scale **N/mm<sup>2</sup>** are located elsewhere on the display.

In the following you will find a summary of the most important technical test requirements that you always have to comply with to ensure correct measurements.

## Test material

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

- smooth, homogeneous surfaces require low test loads
- rougher, coarse-grained surfaces require as high test loads as possible.

The surfaces must always be free of any impurities (oil, dust, etc.) and rust.

The surfaces roughness should not exceed approx. 30 % of the penetration depth.

Thin metal sheets must have a thickness corresponding to the tenfold indentation depth of the Vickers diamond.

For more details, please also read Chapter 12.3 and especially the tables on page 12-5.

## UCI method

The UCI method is a comparative method (contribution of the Young's modulus to the measurement) with a very high reproducibility of the measurements. The UCI method does not replace the classical testing according to Vickers, but it forms a quick and reliable complement to it.

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

### **Attention:**

It is absolutely necessary that you calibrate your MIC 10 to the material under test.

For this purpose, the calibration only has to be carried out once since you can easily store and recall or set a calibration.

The calibration for low-alloy or unalloyed steel is already preset in the instrument. Check it from time to time (refer to Chapter 9.1 *Check function*)

For more details on the UCI method, please also read Chapter 12.1.

## Conversion of hardness values

The conversion of hardness values into other hardness scales is only possible with certain restrictions. You should only carry out conversions if

- the specified test method cannot be applied (e.g. because there is no suitable test instrument)
- it is not possible to take the required samples for the specified test method.

Please read also Chapter 12.2 for this.



### **Attention:**

**Wrong calibration and unacceptable or illegal conversions can cause grave errors in the interpretation of measurement result.**

## Protection against moisture



### **Attention:**

Only use the MIC 10 DL (Data Logger version with board slot) in a dry environment and only clean it with a dry cloth.



# Scope of delivery and accessories **2**

## **Scope of delivery and accessories**

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This chapter gives information about MIC 10 accessories (for versions B and DL).

It describes:

- accessories in the delivery package
- accessories required for operation
- recommended accessories for instrument and probes including hardness reference blocks

## 2.1 Scope of delivery

Product name	Description	Order no.
MIC 10	Portable Hardness Tester with digital display for hardness tests with Vickers diamond and measurement in HV, HB, HRB, HRC, N/mm <sup>2</sup>	34 101
MIC 10 DL	<p><b>or:</b></p> <p>as above; but with: interface for connection of a printer or computer as well as a Data Logger with card reader and Memory Card</p>	34 103
	2 AIMn batteries (Mignon)	06 563
	Case	14 823
	Operating manual, English	28 547
	Brief operating instructions, English	28 549
	<b>or:</b>	
	Operating manual, German	28 546
	Brief operating instructions, German	28 548

Product name	Description	Order no.
	<b>only for MIC 10 DL:</b>	
MIC 1000	Memory Card (1 pc.)	34 125

## 2.2 Required accessories

TZ 1-2	1 Set (2 pcs.) AIMn cells (Mignon), for single use only	34 107
	<b>or:</b>	
NiMH 1-2	1 Set (2 pcs.) of NiMH cells, rechargeable	34 109
MIC 1050	Probe cable	34 071
	<b>Only for MIC 10 DL:</b>	
TGDL/PC	Data cable	13 647
	<b>Hand-held probes such as:</b>	
MIC 201-A	Hand-held probe	34 104
	<b>consisting of:</b>	
	Probe 10 N (1 kgf)	32 097
	Special grip	33 053
	Probe attachment, cylindrical	33 844

Product name	Description	Order no.
MIC 1050	Probe connection cable	34 071
	Operating instructions (G/E)	28 513
	<b>or:</b>	
MIC 205-A	Hand-held probe	34 105
	<b>consisting of:</b> Probe 50 N (5 kgf) with accessories (as MIC 201-A)	31 991
	<b>or:</b>	
MIC 2010-A	Hand-held probe	34 106
	<b>consisting of:</b> Probe 98 N (10 kgf)	33 766
	Spherical headed grip	33 854
	Probe attachment, cylindrical	33 846
MIC 1050	Probe connection cable	34 071
	Operating instructions (G/E)	28 536
	<b>or:</b>	
MIC 205-AL	Hand-held probe with long oscillation rod	34 282
	<b>consisting of:</b> Probe 50 N	34 155
	Probe grip	33 053
	Screw cap, cylindrical	34 184

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<b>Product name</b>	<b>Description</b>	<b>Order no.</b>
MIC 1050	Probe connection cable	34 071
	Operating instructions (G/E)	28 591
	<b>or:</b>	
MIC 201-AL	Hand-held probe with long oscillation rod	34 392
	<b>consisting of:</b>	
	Probe 10 N	34 390
	and accessories such as MIC 205-AL	

## 2.3 Recommended accessories

Product name	Description	Order no.
MIC 270	Surface attachment for hand-held probes	32 084
MIC 271	Prism attachment for hand-held probes	32 993
MIC 222	Test support for precise probe guiding	33 652
MIC 2221	Magnetic foot for support stand of the MIC 222	33 909
MIC 2220	Support block for flat, thin parts	33 651
MIC 300	Manual for hardness testing	28 837
MIC 1040	Support and positioning device	34 148
MIC 1090	Battery charger unit for NiMH and/or NiCd cells	34 212
MIC 1060	Grinding set for surface finish	34 380
	<b>only for MIC 10 DL:</b>	
MIC 230 W	Software for storage of the Data Logger, creation of a calibration table (Windows)	33 930
	including operating manual (German/English)	28 535

<b>Product name</b>	<b>Description</b>	<b>Order no.</b>
MIC 1000	Memory Card (1 pc.)	34 125
MIC 1001	1 Set (5 pcs.) of Memory Cards	34 126
<b>Hardness reference blocks, such as:</b>		
MIC 25C	Hardness reference block 25 HRC	33 905
MIC 45C	Hardness reference block 45 HRC	33 906
MIC 65C	Hardness reference block 65 HRC	33 907
MIC2V010	Hardness reference block 240 HV1	33 896
MIC5V010	Hardness reference block 540 HV1	33 897
MIC8V010	Hardness reference block 840 HV1	33 898
MIC2V050	Hardness reference block 240 HV5	33 899
MIC5V050	Hardness reference block 540 HV5	33 900
MIC8V050	Hardness reference block 840 HV5	33 901
MIC2V100	Hardness reference block 240 HV10	33 902
MIC5V100	Hardness reference block 540 HV10	33 903
MIC8V100	Hardness reference block 840 HV10	33 904

# Preparations for operation **3**

In order to prepare the MIC 10 for operation you must carry out the following:

- check the battery supply
- connect the probe

### 3.1 Battery supply

The MIC 10 is driven by batteries or accumulators. For this you need two 1.5 V Mignon cells (DIN 40 766):

- dry cells (AlMn) or
- rechargeable (Nickel-Cadmium or Nickel-Metalhydrid).

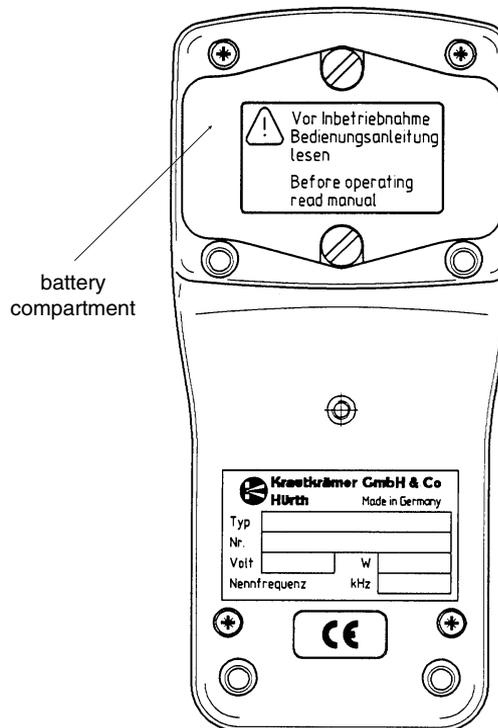
We recommend the use of Nickel-Metalhydrid batteries because the operation time is increased by 60%

### The use of batteries or accumulators

You can insert batteries (AlMn) or accumulators (NiCd, NiMH).

- Loosen the screws on the battery compartment (e.g. with a coin).
- Open the battery compartment.

- Insert the batteries, observing the correct polarity (this is marked in the battery compartment).
- Screw the cover back onto the battery compartment.



 **Note:**

If the instrument is not going to be used for a long period, remove the batteries from the compartment!

When the battery voltage is too low a symbol will appear on the MIC 10 display:



If this symbol appears, the batteries must be immediately changed. The MIC 10 automatically switches off if the batteries are too low in order to guarantee reliable measurement.

When measurements are made at remote locations a spare set of batteries should be present.

Further information with regard to batteries and accumulators can be found in Chapter 8.1.

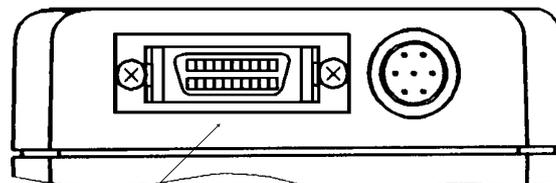
 **Note:**

Used or defective batteries are special refuse and must be disposed of according to the governing laws!

## 3.2 Connection of hand-held probes

In order to prepare the MIC 10 for operation, the probe must be connected. The probes available for the MIC 10 are: MIC 201-A (1 kgf), MIC 205-A (5 kgf) and MIC 2010-A (10 kgf).

- Connect the probe to the probe cable. The red marking points at probe socket and cable connector must be on top of each other.
- Connect the probe cable to the MIC 10 socket.
- Place the probe grip onto the probe.
- Screw on the conical probe attachment for short measurements (refer to Chapter 2.2 *Required accessories*).



socket for  
probe connection

- Screw on the cylindrical probe attachment for measurements with defined measurement times (refer to Chapter 2.2 *Required accessories*).

The MIC 10 is now ready for operation.

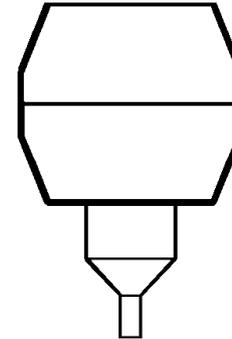
 **Note:**

If you wish to carry out measurements with defined measurement times, use a test support:

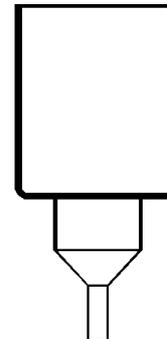
- DH 191 test support for series measurements
- MIC 222 test support for precise probe guiding

By doing this you will avoid measurement inaccuracies.

There are also other accessories available which simplify measurement (refer to Chapter 2.3 *Recommended accessories*).



Conical probe attachment for short measurements



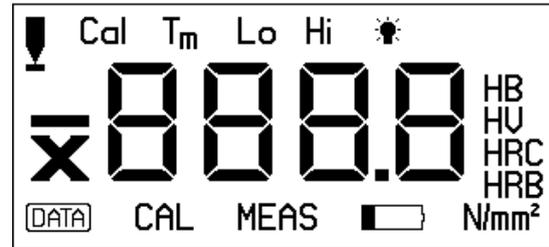
Cylindrical probe attachment for measurements with defined time

# Basics of operation **4**

Read the following chapter before working with the MIC 10. It contains information about:

- display
- keypad
- operation concept with the steps which you will need
- using the probe

## 4.1 Display



The display contains the following fields:

### Measurement reading display

The measured hardness reading is displayed in large digits. This field displays the adjustment values, error codes and text.

### Hardness scales

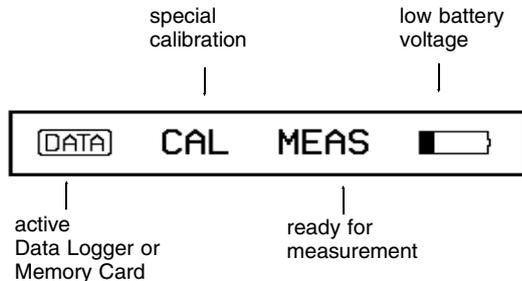
The hardness scales to be selected are displayed on the right of the measurement reading.

HB  
HV  
HRC  
HRB  
N/mm<sup>2</sup>

<b>HB</b>	Brinell
<b>HV</b>	Vickers
<b>HRC</b>	Rockwell C
<b>HRB</b>	Rockwell B
<b>N/mm<sup>2</sup></b>	Tensile strength only when the 10 kgf probe MIC 2010-A is connected

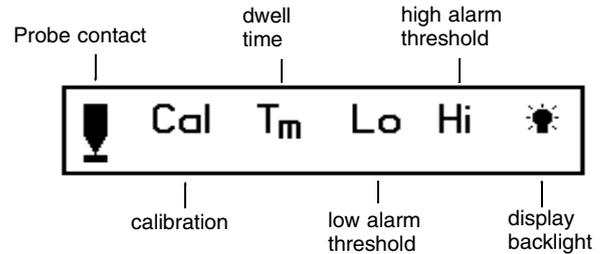
**Status display**

The active status of the MIC 10 is displayed in the field below the measurement reading:



**Settings display**

The active settings of the MIC 10 are displayed in the field above the measurement reading:



Average value



**Note:**

You will find an overview of all display symbols on the foldout page (inside).

## 4.2 Keys

The following table gives a general overlook into keypad operation of the MIC 10. However, please note the description of the individual operation steps in Chapter 5.

Key	Description
	Turn on MIC 10 / Select next level or the next program step
	Adjust settings (increase) / Selection between single measurement value and average value
	Adjust settings (decrease) / Selection of hardness scale
	Delete measurement reading and settings/ Delete error messages / Reset function to default setting
	Close measurement set / Store measurement set (Version MIC 10 DL)/ Return to MEASUREMENT level

Key	Description
	Access to active measurement set / Only MIC 10 DL: Access to stored measurement set / Printout of data / Transfer of data to the PC
 + 	Turn off MIC 10
 + 	Configure MIC 10

## 4.3 Operation concept



### Note:

Unfold the foldout page. There you will find an overview of the operating levels that will always offer you quick orientation help if you have any operating problems.

### The MEASUREMENT level

After turning on, the MIC 10 automatically switches to the **MEASUREMENT** level: the instrument is ready for measurement.

This status is indicated by "MEAS" on the display. The measurement reading immediately appears after a measurement has been made.

### Keys and in the MEASUREMENT level

In this level, with  you can switch between indication of the measured single reading (**S** in the header of the display) and the actual arithmetical average value ( $\bar{X}$  in the header of the display). With  you select the required hardness scale (displayed on the right of the measurement reading).

## Changing between levels

With  you can switch from **MEASUREMENT** to **SET** level. A return to the **MEASUREMENT** level can be made from any function

- by pressing 
- simply by carrying out a measurement.

### SET level

A number of sublevels are used for setting instrument parameters:

Calibration

Calibration value

Dwell time

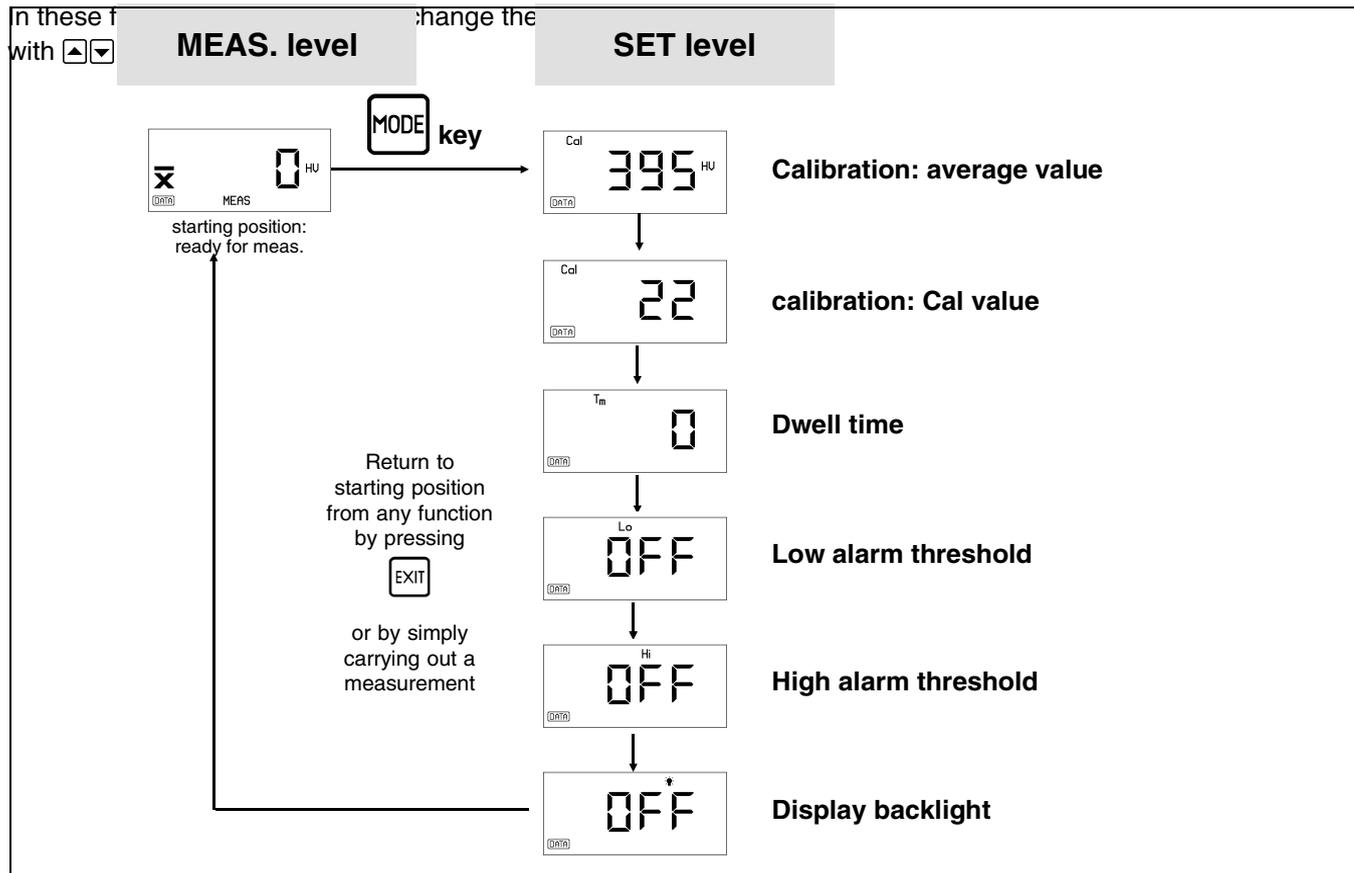
High alarm threshold

Low alarm threshold

Display backlight

You can select these individual functions consecutively with .

### Keys and in the SET level



## Changing the settings

You have the following adjustment possibilities with functions having a large range (e.g. calibration value):

### Changing 1 step at a time

- Shortly press  or .

The setting is increased or decreased by 1.

### Accelerated and decelerated setting

- Keep  or  pressed.

Setting is accelerated.

- If, during the accelerated setting, the opposing arrow key is pressed, i.e. with  pressed the  key is used or vice versa, the setting is decelerated.

- As soon as you release the opposing arrow key, the setting will be accelerated again.

### Setting over a large range

If you wish to bridge larger ranges, you can change the setting into larger steps.

- Keep  or  pressed and simultaneously press .

## Resetting set functions

In the **SET** level you can reset all functions back to their default setting after you have changed them:

- Select the function and press .



### Note:

The functions **Hi and Lo alarm thresholds** are not reset to their default settings but switched off.

## Function blocking

In order to increase MIC 10 operating reliability you can switch off the following functions, resp. inhibit any changes, if you do not require them:

### Switching off

- all hardness scales except the one required
- data storage function (Version MIC 10 DL)
- Memory Card (Version MIC 10 DL)

### Inhibit changes of

- calibration
- dwell time
- Hi and Lo alarm threshold

Please refer to Chapter 7 *Configuration* for operation of this blocking function.

## 4.4 Handling the probe

You will only obtain reliable readings if you handle the probe correctly.

- Screw on the conical probe attachment for short time measurements.
- Turn on the MIC 10 with .
- Press the probe carefully and evenly against the test material.

The contact symbol appears on the display:



An acoustic signal indicates that the measurement has been carried out.



### Note:

The measurement must be made within 3 seconds after probe contact with the material, otherwise an error message will be displayed.

- To carry out a further measurement, the probe must be lifted and placed at another position on the test material.



### Attention:

In order not to damage the probe tip, avoid banging and shifting the probe on the surface of the test material.

### Guiding the probe

- Always hold the probe with both hands to achieve the best possible control when carefully applying pressure onto the material surface.
- Press the probe with one hand vertically from the top. Then guide the probe to the required measurement position with the other hand.
- Make certain that there is a steady and vertical probe guidance.

# Operation **5**

## 5.1 Hardness measurement

The following chapter informs you about how hardness measurements are made with the MIC 10 and how to carry out adjustments.

If you wish to carry out measurements on low-alloy or unalloyed steels then instrument calibration is not necessary because the parameters are already preset into the instrument.

However, you must carry out instrument calibration if you wish to measure high-alloy steels or materials such as non-ferrous metals.

The execution of measurements and adjustments (hardness scale, alarm thresholds) is basically the same in both cases.

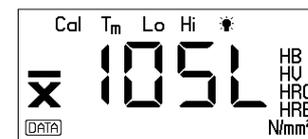
### Turning on the instrument and viewing the software version number

– You turn on the MIC 10 with .

The MIC 10 automatically carries out a system self-check. On the display then appears the following indication for about 2 seconds:



base version



Data Logger version

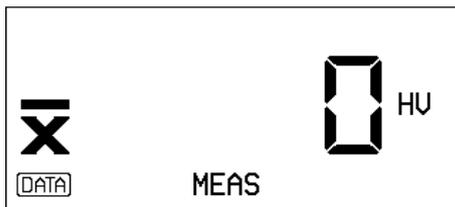
In the middle of the display you can see the software version code of your instrument. The last three digits of the version number are displayed, e.g.: 01.01.05 (the first digits are hardware identifiers that you do not need to identify your instrument).

**L** indicates the Data Logger version as active instrument version. Additionally, you see the hardness scales on the right and the display symbols at the top of the display.

#### Note:

If there is a system error then a code number will be displayed. You will find a breakdown of code numbers in Chapter 9.2.

Finally, the instrument will give a short signal tone indicating that it is ready for measurement:



If a probe is not connected, then the probe symbol on the left of the display will flash:



**Note:**



If the Data Logger is activated (DL version), or the Memory Card is inserted, then the following status symbol will also appear in the display:



The settings of all function values are the same as before the instrument was turned off.



**Note:**

If a Parameter Card is inserted when turning on the MIC 10, then all instrument settings will be automatically loaded from this into the instrument. Refer to Page 5-28.

## Turning the instrument off

The MIC 10 is turned off with a key combination.

- Simultaneously press  and .

The set functions are retained.

## Automatic instrument switch-off

The MIC 10 will automatically switch off after 3 minutes of non-operation.

Because of this, energy is saved and the operation time is increased.

## Setting the display backlight

You can set the display backlight.

- Press **MODE** until the following indication is displayed:



- **▲** or **▼** switch backlighting on
- Press **MODE** or **EXIT** if you wish to return to the **MEASUREMENT** level.

The display backlight switches automatically off after a certain time of non-operation. You can determine this time yourself (5 to 60 seconds). Refer to Chapter 6 *Configuration*.

### **Note:**

The operation time is decreased when the backlight is used!

## Selecting the measurement reading display

With your measurements, you can have single measurement readings displayed or the active arithmetical average value calculated from continuous measurement readings. You can change the display at any time, even during the measurement.

- Select the **MEASUREMENT** level.
- With **▲** switch between the two alternatives.

If you select the setting Average reading, you will see  $\bar{X}$  displayed before the reading.



## Selecting the hardness scale

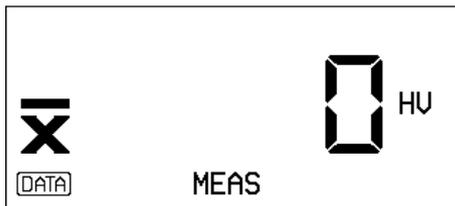
Normally the measurement reading is displayed in **HV** corresponding to the **UCI method**.

In addition to this, you can have the hardness value displayed in the following hardness scales:

- **HB** Brinell
- **HRC** Rockwell C
- **HRB** Rockwell B
- **N/mm<sup>2</sup>** Tensile strength  
(only with the 10 kgf probe MIC 2010 connected)

– Select the **MEASUREMENT** level.

The active hardness scale (e.g. HV) is displayed behind the measurement reading:



You can select the hardness scale in the above sequence (scrolling).

– Press .

The newly selected hardness scale is indicated in the display.

Also during the measurement sequence you can select another hardness scale. The displayed measurement reading is then converted; the set alarm threshold (see following page) is also converted according to the new hardness scale.

### **Note:**

You can select between conversion according to DIN 50150 or ASTM E 140. For this, refer to Chapter 6 *Configuration*.

Observe the limitations in DIN 50150 and ASTM E 140 with regard to conversion. For more information refer to Chapter 12.2 *Conversion of hardness values*.

### **Note:**

When the displayed measurement reading is outside the range of the newly selected hardness scale, the message **OFL** (Overflow) or **UFL** (Underflow) will be displayed and the hardness scale indication will flash.

- Select another hardness scale or press  twice in order to delete the measurement reading.

After the hardness scale has been changed the set threshold is deactivated if its range is exceeded.

## Setting the alarm threshold

This function is useful for identifying measurement readings which are under or over defined limit values. You can set an upper and lower alarm threshold in order to obtain a visual and acoustic alarm signal when these tolerances are exceeded.

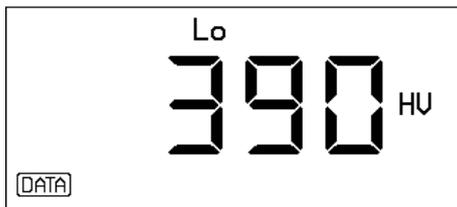
### Lower alarm threshold

Press  until the function **LO** (lower threshold) appears on the display:



-   sets the alarm threshold.

It is displayed in the same hardness scale as selected in **MEASUREMENT** level, for example:



If, during the measurement sequence, a measurement reading is below the set alarm threshold then an additional signal tone is given and a flashing **LO** symbol will appear on the display.



### Upper alarm threshold

- By pressing  one more time you go from the function **LO** to the function **HI** (upper alarm threshold).



- With   set the upper alarm threshold, for example:



The setting is made in the same hardness scale as selected in **MEASUREMENT** level:

If, during the measurement sequence, a measurement reading exceeds the set alarm threshold then an additional signal tone is given and a flashing **HI** symbol will appear on the display.

 **Note:**

You switch the alarm threshold off again by selecting the corresponding function and pressing .

 **Note:**

The set alarm thresholds are automatically converted to the new value when the hardness scale is changed. The alarm is deactivated when the range is exceeded.

## Carrying out the measurement

Measurement on low-alloy and unalloyed steels can be directly made without calibration because the calibration values for these materials are preprogrammed in the instrument.

The measurement is normally made as a short time measurement with a fixed programmed measurement time of 4 ms. Due to this, measurement inaccuracies caused by unsteady holding of the probe are largely excluded.

- Make certain that the probe is connected to the instrument and that the conical probe attachment is screwed on.
- Turn the instrument on.
- When the instrument is already turned on, you are able to carry out the measurement from each function without having to return to the **MEASUREMENT** level.
- Select the required measurement reading display (single or average value) and the hardness scale and set, if necessary, the alarm threshold.

- Position the probe tip vertically onto the surface of the test material. Pay attention to correct probe handling.

The probe symbol on the display indicates that contact has been made.



### Note:

The measurement must be carried out within 3 seconds after the probe has made contact with the test material. If the 3 seconds is exceeded a error message will appear on the display. In this case, press  in order to delete the message or carry out another measurement.

- Press the probe down to the limit for about 1 second.

An acoustic signal indicates the end of the measurement.

The measured hardness value is displayed.

In most cases you will carry out a series of measurements (a set) and not single measurements.

- Position the probe to another point on the test material and carry out a further measurement.

– Using  you can switch between single or average value.

– A measurement set is closed by pressing .

If you are working with the DL version of the MIC 10, the measurement set is now stored and the file name displayed (refer to Chapter 5.2).

– Press  to return to the **MEASUREMENT** level or carry out a new measurement.

## Deleting the last measurement reading

You can delete a critical single reading without interrupting the measurement set.

– Press .

The last reading flashes. It also appears on the display if you have selected the average value display mode.

– Press  again.

The reading is deleted. At the same time, the average value is automatically reevaluated. This is displayed if you have selected the average value mode.

You can repeat this sequence with the last reading until all readings have been deleted.

## Viewing the last average value

You can also recall the last calculated average value after termination of a measurement set.

Due to the fact that the last settings always remain in the instrument, the average value will also remain within the scope of the calibration setting.

– Press .

The average value of the last measurement appears on the display.

## Viewing measurement set and deleting any measurement value

During the measurement you are able to view the active measurement set. However, this only applies if you have not yet closed the set with .

### Note:

With the DL version of the MIC 10 you have access to measurements already stored. Refer to Chapter 5.2 *Data storage*.

Single measurement readings are displayed as well as their total number, over-threshold condition of the reading, absolute/relative standard deviation as well as the active average reading. You have the possibility to directly select and delete a single reading. The average reading is then reevaluated.

### The basic procedure

You obtain this function via ; you select all the individual steps after each other in the order described below using . If you interrupt the function and wish to continue your measurement, press  or carry out another measurement.

The following status indication on the display flashes with all steps of this function in order to indicate that you have interrupted the measurement and can continue:

MEAS

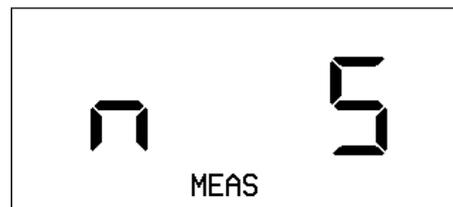
### Viewing the readings

– Press .

### Note:

If MIC 10 DL is used and data storage is active the actual file number is displayed. Press -key.

The previous number of readings appears on the display:



**Example:** 5 previous readings

– Press .

The current absolute standard deviation appears on the display:



You can view the relative standard deviation (in percent) by pressing or :



Using or you can toggle between both displays.

More information on standard deviation you will find in chapter 12.4.

– Press .

The first measurement reading of the active set appears on the display:



You can now view the individual measurement readings in measurement sequence:

- You can scroll through the measurement set with :  
Using you are able to recall the measurement readings consecutively up to the last one.

The end of the measurement set is indicated by a signal tone.

- You can scroll back with .

If you have set alarm thresholds for your measurement then an out of tolerance condition of the recalled measurement reading will either display a flashing **LO** or **HI** symbol.

### Deleting measurement readings

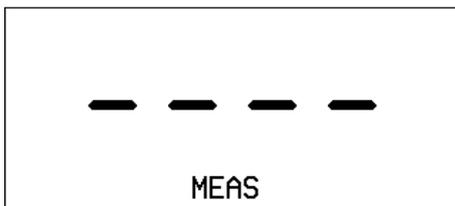
You can delete every displayed measurement reading. The average value will then be reevaluated.

- When the average value, which you wish to delete, is displayed, press .

The displayed measurement reading flashes.

- If you press  once again then the reading is deleted.

This is indicated on the display as follows:

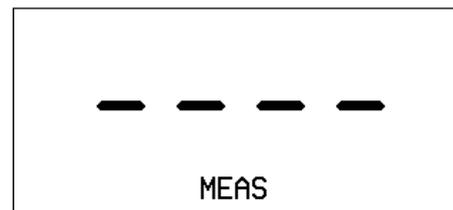


After this, the next measurement reading of the set is displayed.

### Cancelling deletion

You are able to retrieve the deleted measurement reading.

- Scroll through the set with   until the indication for the deleted measurement reading appears on the display:



- Press .

The deleted reading appears on the display and flashes.

Press  once again.

The measurement reading now is retrieved.

### Direct selection of the measurement reading from the set

- If you press **MODE** again, the index (position in the measurement set) of the measurement reading last selected will be display:



- With **▲▼** select the index of the measurement reading which you wish to be displayed.
- After this press **MODE**.

The selected measurement reading appears.

Press **MODE** again.

The index appears of the last measurement reading which was selected.

### Displaying the average reading

- If you press **MODE** again, the active average reading of the measurement set will appear.

If you wish to see the measurement set once again:

- Press **MODE**.

You return to the first step within the function (number of previous measurement readings).

If you wish to exit the function:

- Press **EXIT** or continue your measurement.

## Measuring other material

If you do not wish to carry out measurements on low or non-alloyed steels but on high alloyed steels or materials as nonferrous metals, then you must adjust the MIC 10 to the required material.

For calibration you will need a test piece made of the same material having a known hardness. You determine the calibration value which you will need with further measurements on this material.

The calibration value is an additional value that makes a subsequent change of the calibration setting easier. As the calibration value has no physical relation, it has no designation either.

Due to the fact that you can directly enter this calibration value you only need to carry out the calibration once for a certain material.

- Carry out a measurement set of about 5 single measurements on your test material (corresponding to the above described measurement on low-alloy steel).
- Press  in order to go to the **Set** level and then select the function **Calibration (Cal)**:



### **Note:**

With the DL version (if the Data Logger is active) the measurement set is stored after pressing . After that the above display appears.

The active average value reading of your measurement will be displayed.

This value does not correspond to the known, real hardness value because you have not calibrated the instrument.

You must now match the displayed value to the hardness value of your test material.

- With   you can increase or decrease the displayed value (refer to Chapter 4, page 4-7, *Accelerated Setting*).

When the correct value is set, the instrument is calibrated for the material to be measured.

The calibration value is automatically evaluated according to the set hardness value:

- Press .

The calibration value is displayed:



- Note this calibration value.

If you have to carry out a new calibration for this material you are able to enter the value directly without having to carry out new measurements.



### Note:

With the help of the Memory Card, recalibration with the DL version of the MIC 10 is made easy. All calibration and adjustment parameters can be stored on a Memory Card and loaded at any later time by inserting this card (refer to page 5-29).

The calibration which has been changed is indicated by the status symbol **CAL** in the measurement mode:



The calibration is retained when the instrument is turned off.

After you have adjusted the MIC 10 to the material to be measured you can carry out the measurement as described above.

## Reproducing the calibration

If you wish to recall the calibration parameters for the measurement on low alloyed steels after having calibrated to another material, proceed as follows:

- Press **MODE** until the calibration value is displayed.
- Press **C** to set the calibration value to 0.
- Press **EXIT** if you require to return to **MEASUREMENT** or carry out a measurement.

The instrument is now calibrated for standard measurement; the status symbol **CAL** is no longer displayed.

If you wish to enter the calibration parameters for a material whose calibration value is known, proceed as follows:

- Press **MODE** until the calibration value is displayed.
- Enter the known calibration value with **▲▼**.

The calibration which has been changed is correspondingly displayed in the **MEASUREMENT** level by **CAL**.



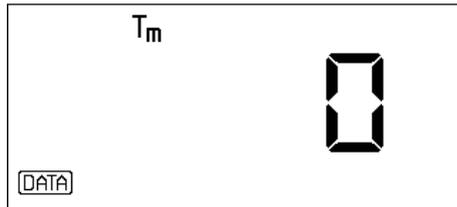
## Measuring with defined measurement times (dwell time)

As opposed to short time measurements, you can carry out measurements whose dwell time you can determine yourself. In order to measure with a steady accuracy you require a cylindrical probe attachment as well as a test support.

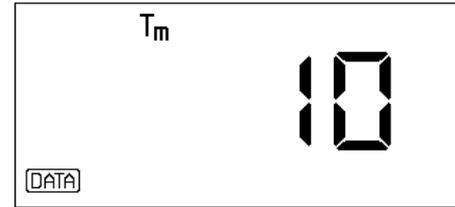
You can set a dwell time between 1-99 seconds.

### Setting the dwell time

- Press **MODE** until the following indication appears in the display:



- Set the required dwell time with **▲▼**, for example:

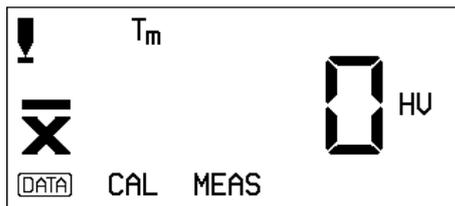


- Press **EXIT** if you wish to return to the measurement mode or simply carry out a measurement.

### Carrying out a measurement

- Screw on the cylindrical attachment tightly down to screw stop on the probe case.
- Clamp the probe into the support (DH 191 or MIC 222). By doing this you will avoid measurement inaccuracies.
- Select the required hardness scale.
- If necessary set the calibration value and the alarm threshold.
- Carry out the measurement.
- Make certain that the tip of the probe attachment is pressed on the material to be measured during the complete measurement time.

The indication for the changed dwell time flashes on the display during the measurement:



An acoustic signal indicates the end of the measurement. The hardness reading appears on the display.

## 5.2 Data storage (only MIC 10 DL)

The MIC 10 has a Data Logger in which you can store measurement values and settings.

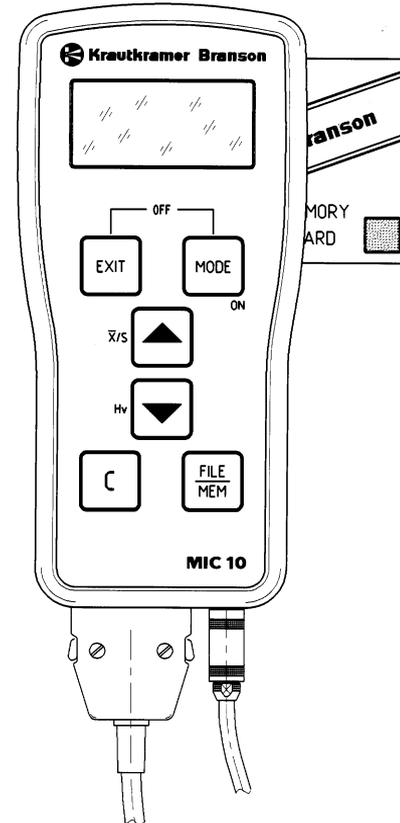
The stored data of a measurement set can be

- viewed on the display
- deleted
- printed
- transferred to a PC with special software.

You also have Memory Cards giving unlimited storage capabilities because you are able to use as many Memory Cards as you require. As opposed to the internal Data Logger, the Memory Card, used as a parameter card, also gives you the possibility to load instrument settings into the MIC 10 without having to carry out recalibration for repetitive tests.

### Note:

The possibilities to print stored data and to transfer them into a PC are described in Chapter 7 *Documentation*.

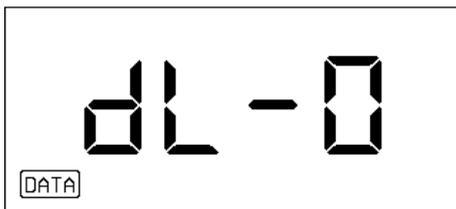


## Switching the Data Logger on

In the default setting of the MIC 10 DL the Data Logger is switched off. In order to store data you must firstly activate it.

- Press 

You will see the following display:



- With  or  you can change the setting:



- With  go back to **MEASUREMENT** level or simply carry out a measurement.

The Data Logger is now activated. This setting is retained even after the instrument has been switched off. When the Data Logger is activated you will see the status indication **DATA** appear in the measurement mode:



If you do not wish to store every measurement set but would like to carry out test measurements, then switch the Data Logger off again:

- Press  and with   set **dl-0** again.

### **Note:**

The MIC 10 DL needs not be activated when working with the Memory Card. Simply insert the card.

Both storage possibilities (Data Logger and Memory Card) can be inhibited if you do not require them. For this refer to Chapter 6 *Configuration*, pages 6-8.

## Storing the measurement in the Data Logger or on the Memory Card

With the MIC 10 DL you can carry out a number of measurements within a measurement set and store them.

- Make certain that the Data Logger is active.

If you wish to work with the Memory Card:

- Insert it into the slot.

The MIC 10 DL automatically stores the data onto the Memory Card. The instrument will store onto the internal Data Logger if there is no Memory Card inserted.

- Carry out your measurement.
- After termination of the measurement set, press .

The measurement set, including the instrument settings are stored into a file. The file number will appear on the display, for example with the first file stored:



The MIC 10 DL always stores the data onto the next free storage space.

You can store 255 measurements in a measurement set. The Data Logger has capacity for up to 1800 measurements and the Memory Card up to 590 measurements (with an average measurement number of 10 per measurement set).



### Note:

Before data are stored, the MIC 10 DL automatically carries out a storage capacity check. An error message will appear if there is insufficient storage capacity. Refer to Chapter 9.2 *Error messages*.



### Attention:

Do not remove the Memory card whilst you have access to data because this could damage the card.

## Viewing a file and deleting single measurement readings

The stored data of a measurement set can be displayed. The following data are shown:

- Average value reading
- Number of single measurement readings
- Single measurement readings
- Index, where you are able to select a certain single reading
- Standard deviation, absolute and relative
- Range, absolute and relative
- Calibration value
- Dwell time
- Lower alarm threshold (LO)
- Upper alarm threshold (HI)
- Probe

You have the possibility to delete single measurement readings out of a set. The average value, standard deviation and range are then recalculated.

## Basic procedure

Access to the stored data is made via . Individual data of the stored measurement set can be selected consecutively with .

The status symbol **DATA** flashes during data viewing.

You can return to **MEASUREMENT** level at any time by making another measurement.

## Selecting a file

– Press .

The card number will appear on the display if the Memory Card is active (e.g. **C001**); **dL - 1** will appear if the Data Logger is active.

– Press .

The last file number which was stored will appear:



- With select the file which you would like to view.

### Displaying the average measurement value

- Press again.

The average value, calculated from all the measurements made in the measurement set, is displayed in the hardness scale which was selected when storing:

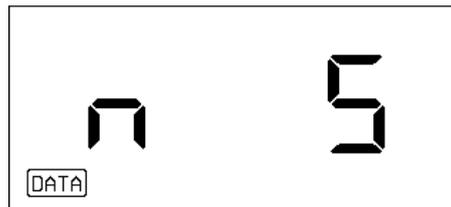


- The hardness scale can be changed with . The new hardness scale is stored.
- With you can reset the hardness scale back to the normal setting.

### Viewing single measurements

- Press again.

The indication for the number of measurements stored in the set appears on the display:



Example: 5 single measurement readings within a measurement set

- Press again.

The first measurement reading of the stored measurement set is stored in the same hardness scale as the average value reading:



- With  and  you can view all the measurement readings of the measurement set:
  -  shows the the next measurement reading in the storage sequence. When you reach the last measurement reading of the set, a signal tone will be generated.
  - With  select the measurement reading in the opposite direction until you reach the first measurement value.

If, by the measurement, alarm thresholds were set, the HI and LO states are displayed with the corresponding measurement reading (top of display).

### Deleting single measurements

You can delete a display measurement reading. The average value is then recalculated.

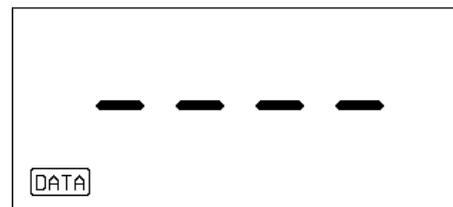
- Press .

The displayed measurement value flashes.

- Press  again.

The measurement value is deleted.

This is indicated by the following display:

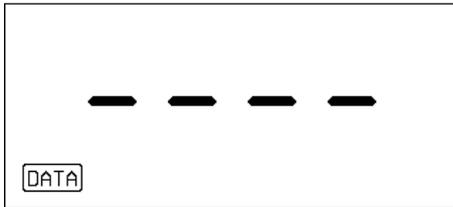


After this, the next measurement reading of the set is displayed.

## Cancelling the deletion

You can retrieve the deleted measurement reading.

- Scroll through the measurement set with   until the indication for the deleted measurement reading appears on the display again:



- Press .

The deleted measurement reading appears on the display and flashes.

- Press  again.

The measurement reading is retrieved.

## Direct selection of the measurement reading from the measurement set

- Press  again.

The index (position of the measurement set) of the measurement reading last selected appears:



- With   select the index of the measurement reading which you wish to display.

- Press .

The selected measurement reading appears.

- Press  again.

The index of the measurement reading selected last will appear.

### Displaying the standard deviation

- Press  again.

The absolute standard deviation is displayed:



- If you press  or , the relative standard deviation is displayed in percent:



- Using  or  you can switch between both displays.

### Displaying the range

- Press  again.

The absolute range is displayed:



- If you press  or , the relative range is displayed in percent:



- Using  or  you can switch between both displays.

Information about standard deviation and range can be found in chapter 12.4.

## Viewing the instrument settings

In the following steps of this function the instrument settings for the measurement are displayed.

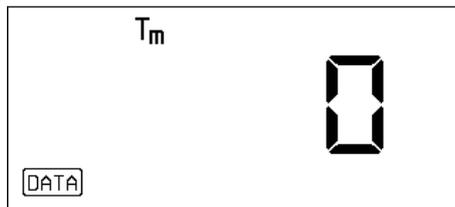
– Press .

The calibration value is displayed, e.g. for the unchanged, preset calibration on non-alloyed and low alloyed steel:



– Press .

The set dwell time is displayed.



– Press .

The lower alarm threshold is displayed, e.g.



– Press .

The upper alarm threshold is displayed, e.g.

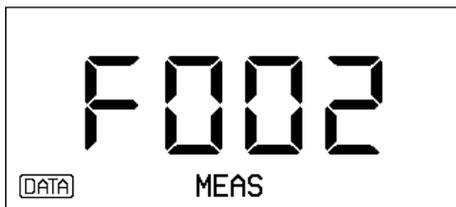


– Press .

The probe load used for the measurement is displayed:



- 1 kgf: Probe MIC 201 (1 kgf)
  - 5 kgf: Probe MIC 205 (50 kgf)
  - 10 kgf: Probe MIC 2010 (10 kgf).
- If you now press  the next file, whose data you wish to see, is displayed:



- If you require to return to the **MEASUREMENT** level, press  or carry out another measurement.

## Deleting a file

- If necessary, close your actual measurement set.
- Press  and then .
- Select with   the file of the measurement set which you wish to delete, e.g.:



- Press .

The display flashes.

- Press  again.

All the data of the selected file are deleted.

## Deleting the whole memory

- If necessary, close your actual measurement set.
- Press .

With an active Data Logger the following display appears:



With an inserted Memory Card e.g. the following display appears:



- Press  and then press the -key until "ALL.F" appears on the display.
- Press .

The display flashes.

- Press  again.

### **Attention:**

All stored data are deleted.

## Changing the number of the Memory Card

The Memory Card has a number which also appears in the report printout (refer to Chapter 7.1, page 7-6).

You can change this number in order to identify different Memory Cards. To do this the Memory Card must be empty, therefore any data remaining on the card must firstly be deleted enabling the number to be changed.

- Insert the empty Memory Card into the card slot.
- Press .

The last card number to be stored will appear on the display, e.g:



- Change the number of the Memory Card using  .

The card now has a new number.

## Using the Memory Card as a Parameter Card

You can use the Memory Card for instrument adjustment. To do this, you require an **empty** Memory Card, on which you will store a certain instrument setting. When storing you identify this card as a Parameter Card. When you insert this parameter card into the MIC 10, the instrument settings will be automatically loaded into the instrument.

You can change a Parameter Card into a Memory Card again by deleting the stored instrument settings.

## Storing parameters

- Make your instrument settings, e.g. calibration on another material, threshold and dwell time adjustment.
- Insert an **empty** Memory Card into the MIC 10.
- Press . You must be in the **SET** level.

The following indication flashes on the display:



- Press .

The Memory Card is now identified as a parameter card. Your active settings are now stored.

- Note the necessary information to your stored settings.

### Loading parameters

The stored settings on a parameter card can be re-loaded into the MIC 10 at any time.

- Close your active measurement set if you want to keep its data.
- Insert the parameter card into the MIC 10.

The following display appears:



The instrument loads the stored settings.

#### Attention:

When the Parameter Card is inserted, the measurement set is closed and the active instrument settings are overwritten. A protection query is not given!

You should therefore always complete your current measurement set before inserting a Parameter Card if you want to retain the data.

### Deleting parameters

You can afterwards delete the stored settings and again use the Parameter Card as a Memory Card to store your measurement sets.

- Complete your current measurement set if you want to retain the data.
- Insert the Parameter Card into the MIC 10.

Your instrument settings are overwritten by the settings stored on the card.

- Press .

The following display appears:



- Press .

The display flashes.

- Press  once more.

All stored parameters are deleted. The MIC 10 returns to the **MEASUREMENT** level.

The Card is now an empty Memory Card again, i.e. you can use it for storing both measurement sets and instrument settings.

## Parallel use of Memory Cards on the MIC 10 and the DynaMIC

You can use Memory Cards parallel to one another on the two instruments without data being lost.

If you insert a card written by the DynaMIC into the MIC 10 or, vice versa, a MIC 10 card into the DynaMIC, the error message E 2.1 is displayed. The card is not recognized by the corresponding instrument; and no data can be stored.

You can delete the data stored on the card if you want to write new data on it:

- Press the  key.

The display flashes.

- Press the  key one more time.

The data are cleared. You can write new data on the card.



# Configuration **6**

## Configuration

---

The MIC 10 offers you various possibilities of instrument configuration using a special mode. You can compile the function range for the instrument if you wish. You can

- select the language for the report printout
- select the type of report to be printed
- inhibit individual scales
- select whether conversion is to be made according to DIN 50150 or ASTM E 140
- inhibit calibration changes
- inhibit setting the dwell time
- inhibit adjustments to the alarm thresholds
- adjust the backlight period
- inhibit the function Data Logger or Memory Card.

### Basic procedure

- Select the **Configuration** level, by simultaneously pressing  and  when the instrument is turned on.
- Select the different functions after each other in the Configuration level with .
- Carry out the function adjustments with .
- You can reset each function back to the last setting which was stored by pressing .

You can exit any function for the Configuration level and return to the **MEASUREMENT** level by pressing .

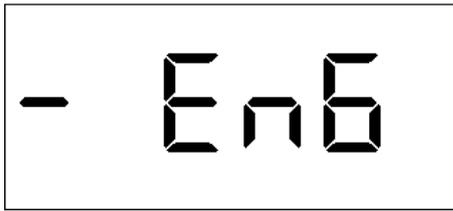
The instrument automatically switches off after 3 minutes if no key is pressed.

When you are in the configuration level the minus symbol flashes in the display.

## Selecting the language for the report print-out (only for MIC 10 DL)

You can select which language the stored data is to be printed.

After you have switched on the configuration mode, this function will be the first to appear in the display:



You have the following selection possibilities:

- **EnG**      English
- **FrA**      French
- **dEU**      German
- **ItAL**     Italian
- **ESP**      Spanish

–   selects the required language, for example:

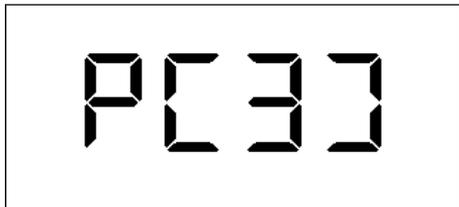
## Configuration

---

### Selecting the report format (only for MIC 10 DL)

The stored data can be printed in six different formats. Refer to Chapter 7, *Documentation*.

- Press  until the following display appears:



- Using   select one of the report formats (1 to 6).

### Inhibiting hardness scales

You can switch off the individual hardness scales.

- Press  until the scale appears which you wish to switch off, for example:



- With   set the selected hardness scale to **OFF**.

In addition to the inhibit function you can select the resolution when using hardness scales **HRC** and **HRB**:

- OFF
- 0.1
- 0.5
- 1



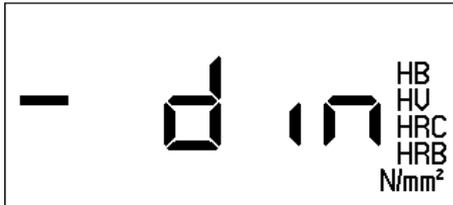
#### Note:

Of course, a hardness scale must remain switched on. If all scales are switched to **OFF** then the MIC 10 will automatically switch the HV scale to **ON**.

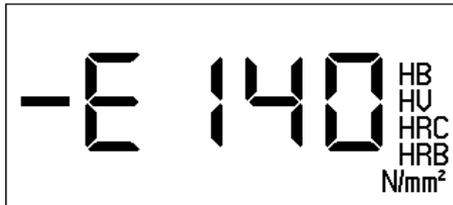
## DIN 50150 or ASTM E 140

You can convert the hardness into other scales according to DIN or ASTM E 140.

- Press  until the following display appears:



- Press   if the evaluation is to be made according to ASTM E 140:

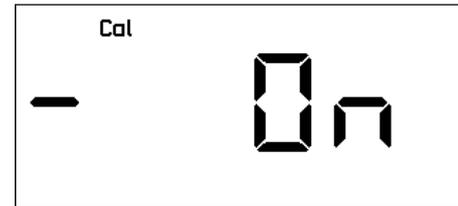


## Inhibiting calibration

You can inhibit calibration changes. This is especially useful

- if you only measure on one type of material
- if you carry out the calibration only using the Parameter Card

- Press  until the following display appears:



-   switches the function **OFF**.

The calibration cannot now be changed.

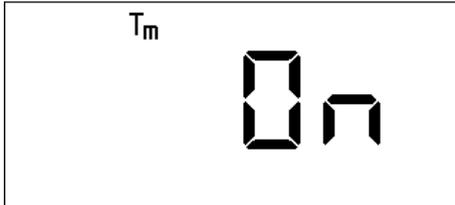
## Configuration

---

### Inhibiting the dwell time

You are able to inhibit adjustment changes to the dwell time.

- Press  until the following display appears:



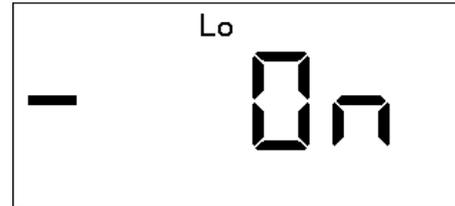
- Using   you switch the function **OFF**.

The dwell time cannot now be changed.

### Inhibiting alarm thresholds

Changes to the upper (Hi) and lower (Lo) alarm thresholds can be inhibited.

- Press  until the required display appears:



- Using   you switch the function **OFF**.

The lower alarm threshold cannot now be changed.

## Adjusting the time period for the display backlight

You can select the switch off time for the backlight, which is activated after a non-operation period. An adjustment from 5 to 60 seconds is possible. You can also set a permanent backlight.

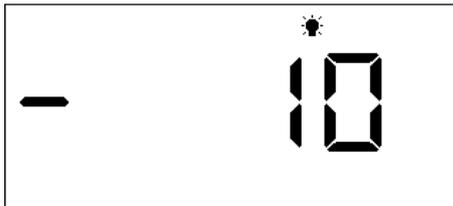
The display backlight is activated and deactivated in **SET** (refer to Chapter 5.1, page 5-4).



### Note:

Operation with the backlight reduces the life of the batteries!

- Press  until the following display appears:



- Using   set the required time.
- Using  you set the function **ON**.

In doing this, the permanent display backlight is set, this means that it does not automatically switch off after a certain time.

### Switching off the Data Logger (only MIC 10 DL)

You can switch off the internal Data Logger of the MIC 10 DL if you do not intend to store measurements.

- Press  until the following display appears:

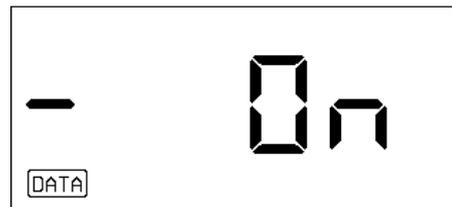


-   switches the Data Logger off.

### Switching the Memory Card off (only MIC 10 DL)

If operation with the Memory Card is not required it can be switched off.

- Press  until the following display appears:



- Using   you can switch off the Data Logger.



#### Note:

You can use Data Logger and Memory Card independently. Therefore it is also possible to switch off only one of both options.

# Documentation (only MIC 10 DL) 7

## 7.1 Printing data

In connection with a printer with serial interface (e.g. EPSON series FX), the MIC 10 DL offers you the possibility to print stored adjustment and measurement data including statistical data.

You can either print all measurement sets, this means the complete contents of the Data Logger or a Memory Card, or an individual measurement set. In doing this, different report formats can be selected as well as various languages.

You require:

- a printer with serial interface RS 232
- a data cable TGD/PC for connection of the MIC 10 DL to the printer

## Preparing the printer

- Connect the printer to the MIC 10 DL via the serial interface.

Data transfer is made in the following fixed data format to which you must set your printer:

• Baud rate	9600
• Number of start bits	1
• Number of stop bits	1
• Number of data bits	8
• Parity	none
• Software handshake	on



### Note:

For setting transfer parameters refer to the operating manual of your printer.

## Printing all files

- Press .

The display for the active Data Logger (dL - 1) or Memory Card (card number), if inserted, appears.

- If the Data Logger is switched off (dL - 0), switch it on with .
- Press  and then use the -key until "ALL.F" appears on the display.
- Press .

The following message appears on the display:



- Press  again.

All data are printed from the Data Logger or Memory Card.

The form and language of the printout are dependent on the setting made in the configuration level of the MIC 10 (see following pages).

## Printing single files

- Press .

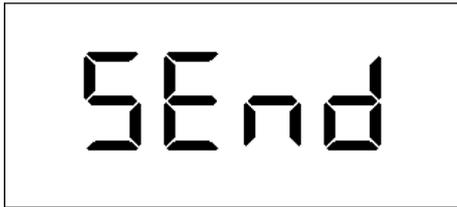
The display for the active Data Logger (dL - 1) or Memory Card (card number), if inserted, appears.

- If the Data Logger is switched off (dL - 0), switch it on with .
- Press  again.

The file number which was last stored will appear.

- With  select the number of the file which you want to print.
- Press .

The following message appears:



– Press  again.

The data of the selected file are printed.

The form and language of the printout are dependent on the setting made in the configuration level of the MIC 10 (see following pages).

## Selection of the report language

You can select the language in which the report is to be printed:

- English (Standard setting)
- French
- German
- Italian
- Spanish

The setting is made in the configuration level. Proceed as described in Chapter 6 *Configuration*, page 6-3.

## Selection of report format

You can select one of five settings for the format in which the report is to be printed.

The following are differentiated:

- complete printout (adjustment data, statistical data, single measurement readings)
- complete printout in DIN A4 format with header data and additional information
- shortened printout (adjustment data, statistical data)
- List (with a printout of the complete memory: measurement set number with average value)

Single measurement sets can be printed completely or in the shortened form, the complete memory as a list with measurement sets in complete or shortened form. A detailed description of the individual print formats is contained on the following pages.

Setting is made in the configuration level of the MIC 10. Proceed as described in Chapter 6 *Configuration*, page 6-4.

You can select the following combination with number 1 - 5:

	Single meas. sets	All meas. sets
1	short printout	list
2	short printout	short printout of measurement set
3	complete printout	list
4	complete printout	short printout of measurement set
5	complete printout	complete printout of measurement set
6	complete printout in DIN A4 format with header data and additional information	

As default the combination 3 is set. This means you receive a complete printout when you print single measurement sets, and a list when you print the complete contents of the memory.

Select the corresponding number if you require another combination.

**Complete printout of a measurement set**

The complete printout contains the following data:

- Header with software version of the MIC 10
- **Date:** entry of date
- **Data Source:** Data Logger (DL-) or Memory Card (number of Memory Card)
- **Instrument SN:** MIC 10 serial number
- **File #:** Number of the stored measurement set
- Adjustment data:
  - Cal Value**
  - Tm** (dwell time)
  - Lo Alarm** (lower alarm threshold)
  - Hi Alarm** (upper alarm threshold)
- **Probe SN:** Serial number of the probe being used
- **Test Load:** Test load of the applied probe
- **# of Readings:** Number of measurement readings in the measurement set
- **Avg. Value:** Arithmetical average value of the measurements in a set
- **Min. Value:** Smallest single value
- **Max. Value:** Greatest single value
- **Range:** Range between minimum and maximum value (absolute and relative)

```

-----
                MIC 10 (01.01.00)
-----
Date:  __. __. __
Instrument SN   500
Data Source    DL-1
File #         F001

Cal Value      0
Tm             0 s
Lo Alarm       OFF
Hi Alarm       OFF
Probe SN       618
Test Load      5 kgf

# of Readings  3
Avg. Value     414 HV
Min. Value     405 HV
Max. Value     424 HV
Range          19 HV
              4.6 %
Standard Dev.  10 HV
              2.3 %
Min.Thickness  0.215 mm

Readings
  1           412 HV
  2           424 HV
  3           405 HV
* deleted readings
+ or - out of tolerance

```

- **Standard Dev.:** Standard deviation (absolute and relative)
- **Min. Thickness:** Minimum material thickness, size necessary for geometrically not influenced measurements
- **Readings:**  
List of all single measurement readings
- **deleted readings:**  
The single measurement readings deleted from the measurement set are marked with "\*". They are not included in the statistical calculation.
- **+ or - out of tolerance:**  
Reading exceeds or is below the set alarm threshold.



**Note:**

Information about calculation of the average value, the range and the standard deviation as well as the minimum thickness can be found in Chapter 12.4 *Information about statistical evaluation*.

### Short printout of a measurement set

The short printout is an extract from the complete printout:

```

-----
                MIC 10 (01.01.00)
-----
Date:  __.__.__
Instrument SN   500
Data Source    DL-1
File #         F001

Cal Value      0
Tm             0 s
Probe SN       618
Test Load      5 kgf

# of Readings  3
Avg. Value     414 HV
Min. Value     405 HV
Max. Value     424 HV
Range          19 HV
              4.6 %
Standard Dev.  10 HV
              2.3 %
    
```

## Printout of all measurement sets as a list

All the measurement sets stored in the Data Logger or on the Memory Card are printed with the following information:

- Header with software version of the MIC 10
- Data source
- File #
- # of readings
- Average value

```

-----
      MIC 10 (01.01.00)
-----
Data source  DL-1
F001      ( 3)  414  HV
F002      ( 5)  407  HV
F003      ( 6)  404  HV
F004      ( 4)  392  HV

```

## Printout in DIN A4 format

The printout in DIN A4 format (refer to the following page) contains all information of the complete printout (page 7-6). Additionally, it has header and foot data which can be filled out by the operator to obtain complete documentation:

### Header data

- Test object
- Order No./Drawing No.
- Party ordering
- Material
- Treatment condition
- Remarks

### Foot data

- Marking possibilities to see if
  - ( ) Set hardness is met
  - ( ) Set hardness exceeded
  - ( ) Set hardness not reached
- Person testing (signature)
- Date

```

Hardness testing

Test object:                Treatment condition:
Order No./Drawing No.      Remarks:
Party ordering:
Material:

MIC 10 (01.01.08)
Instrument SN 1000
Data source DL-1           Readings
File # F001                1          377 HV
                           2          421 HV
                           3          394 HV
                           4          392 HV

Cal Value      0
Tm             0 s
Lo Alarm       OFF      * deleted readings
Hi Alarm       OFF      + or - out of tolerance
Probe SN       618
Test Load     5 kgf

# of Readings  4
Avg. Value     396 HV
Min. Value     377 HV
Max. Value     421 HV
Range          44 HV
              11.1 %
Standard Dev.  18 HV
              4.6 %
Min.Thickness  0.220 mm

( ) Set hardness is met      ( ) Set hardness exceeded
( ) Set hardness not reached

Person testing: _____ Date: _____

```

## 7.2 Data transfer with the user program UltraDOC

Using the user program UltraDOC from Krautkrämer you are able to transfer stored measurement sets to a PC before editing and processing them. In addition to this, you can remote control the MIC 10 from a PC with this program.

The program is multilingual and has a common graphics user interface as well as an internal text editor for various languages.

All files can be processed with commercially available word processing or DTP programs.

You obtain detailed information about effective use of this program in a detailed operating manual.

For data transfer with UltraDOC you require:

- IBM compatible PC with EGA or VGA graphics card and at least one serial interface
- WINDOWS, version 3.0 or higher
- a data cable TGD/PC for connection of the MIC 10 to the printer.



# Care and maintenance **8**

## 8.1 Care

### Care of instrument

Clean the instrument and accessories only with a dry cloth.

 **Warning:**

Never use water for cleaning the MIC 10 DL!  
The MIC 10 DL is not damp/water-proof (board slot).

Never use solvents!  
Plastic parts could become brittle or otherwise damaged.

### Care of batteries

Battery capacity and life depend mainly on correct treatment. Therefore please observe the following tips:

The batteries should be charged in the following cases:

- before operating for the first time
- after a storage time of 3 months or longer
- after frequent partial discharge

### Battery charging

For charging NiMH and/or NiCd cells use the battery charger unit MIC 1090 (refer to Chapter 2.3 *Recommended accessories*). With this charger unit, a charging time of only 1 - 2.5 hours is needed.

 **Warning:**

Only use the batteries recommended by us. Any inexperienced handling of the charger unit and batteries may cause danger of explosion.

 **Note:**

You also can use a commercially available battery charger. Make certain that you use a charger which is suitable for the type of batteries you are using!

## Treatment of AIMn batteries

Due to the fact that incorrect treatment of batteries can lead of damage, please observe the following hints:

- use leakproof batteries!
- remove the batteries from the instrument if you do not use them for a long period!



### **Attention:**

Never try to charge AIMn batteries (danger of explosion)!



### **Note:**

Discharged or defective batteries are classified as special refuse and must be disposed in accordance with statutory provisions!

If possible, use rechargeable batteries for the sake of the environment!

## 8.2 Maintenance

Basically, the MIC 10 and the probes are maintenance-free.

**Warning:**

Repair work must only be carried out by authorized Krautkrämer service personnel.

# Function check and troubleshooting **9**

## 9.1 Check function

### Visual check of the Vickers diamond

Periodically check the Vickers diamond under a microscope.

Make sure that the pyramid-shaped diamond is not damaged.

### Checking the measurement accuracy

All UCI probes are calibrated using hardness reference plates which are certified by the material testing institute "Materialprüfungsanstalt MPA NRW" for the corresponding test load (1 kgf, 5 kgf, 10 kgf). Each hardness reference plate shows natural variations that have an influence on the measured value deviations of the corresponding probe from the plate value.

Under well-defined conditions, as is the case with measurements using the test support MIC 222 on Krautkrämer hardness plates with acoustic coupling (thin oil film or ultrasonic couplant ZG between the reference plate and base), a deviation by  $\pm 3,6$  % of the average from 5 measurements from the plate value is

still permissible (for a max. range of 5 % with reference to the average).

Individual deviations from the plate value may occur in freehand measurements depending on the probe handling. However, they should not go beyond 5 % from the plate value for 10 measurements.

You should carefully study the handling of the probe and train yourself in working with the probe by carrying out measurements on the hardness reference plates until you obtain stable readings.

Repeat these reference measurements from time to time and note down the measured average in order to check the measurement accuracy of your probe.

Any sudden variations indicate a defective diamond or maladjustment of the probe.

## 9.2 Troubleshooting

After the MIC 10 has been turned on it runs an automatic system self-check.

In addition to this, the MIC 10 has a self-monitoring function which is active during operation.

When system or operating errors occur they will be indicated by a corresponding error code in the display (e.g. E 2.0).

 **Note:**

If you don't succeed with the described procedures you can initialize the instrument, i.e. reset it to its default settings.

- Turn the instrument off.
- Keep both  and  pressed at the same time while turning on the instrument with .

 **Attention:**

All settings are deleted.  
Stored data are retained.

Error code	Cause	Remedy
E 0.0	Internal error in the EPROM	Restart the instrument. If the error reoccurs, contact Service.
E 0.1	Batteries are empty.	Change batteries.
E 0.2	Error found during the automatic system check	Restart the instrument. If the error reoccurs, contact Service.
E 1.0	Error in the probe	Contact Service.

<b>Error code</b>	<b>Cause</b>	<b>Remedy</b>
E 1.1	Error in handling the probe during measurement (contact time greater than 3 seconds)	Repeat the measurement. Ensure correct probe handling. Place the probe with the necessary pressure carefully onto the material surface.
E 1.2	Measurement cannot be evaluated (e.g. if used probe is not suitable for test material).	Repeat measurement. If necessary, use another probe.
E 1.3	The probe was coupled before termination of a defined measurement time.	Repeat measurement. Note the symbol in the MIC 10 display.
E 2.0	Error when reading the Memory Card.	Remove the Memory Card and reinsert it again. If the error reoccurs, use another Memory Card.
E 2.1	Memory Card written by the DynaMIC	Delete data or use another Memory Card.
E 3.0	Interface is not ready.	Check to see if your printer or PC is correctly connected.

The MIC 10 gives additional text error messages:

OFL / UFL	Overflow / Underflow Out of range when hardness scale is changed.	Select another hardness scale.
Full	Not enough storage capacity for the data to be stored.	Delete the contents of the Data Logger or Memory Card (if necessary, after previous transfer to a PC) or use another Memory Card.

# Specifications **10**

## Specifications

---

<b>Measurement method</b>	UCI method (Ultrasonic Contact Impedance) with Vickers diamond
<b>Test load</b>	Handheld probes MIC 201-A (10 N), MIC 205-A (50 N), MIC 2010-A (98 N)
<b>Indenter</b>	Diamond pyramid according to Vickers, roof angle 136°
<b>Test materials</b>	Metallic materials Basically, measurements are also possible on glass and ceramics. Please contact your Krautkrämer service agent.
<b>Measurement tolerances</b>	Max 5% tolerance in the Vickers hardness range from 200 HV to 900 HV. Max $\pm 3.6\%$ deviation from the average measurement value to the value of the hardness reference plates. These deviations are determined from 5 single measurements using the test support MIC 222. With handheld measurements greater deviations are possible. Deviations in the measurement result caused by plate vibration can be reduced by coupling. The error data are related to the total error (instrument plus hardness reference plate) For more information refer to chapter 9.1
<b>Measurement/Conversion range</b>	Vickers: 20 - 1740 HV Rockwell B: 41.0 - 105.0 HRB Rockwell C: 20.3 - 68.0 HRC Brinell: 76.0 - 618.0 HB Tensile strength: 255.0 - 2180.0 N/mm <sup>2</sup> (only with the 10 kgf probe connected) The conversion is made according to DIN 50150 or ASTM E 140.

<b>Display resolution</b>	1.0 HV 1.0 HB 1.0 N/mm <sup>2</sup> 1.0/0.5/0.1 HRB 1.0,/0.5/0.1 HRC
<b>Display</b>	4 digit LCD with switchable backlight, adjustable duration (5 to 60 sec. or continuous)
<b>Power</b>	Battery operation, two 1.5V AA cells Batteries:        AlMn (approx. 15 hours operation) Alkaline:         at 20 ° C and max. 500 measurements / 8 hours: NiCd (approx. 15 hours operation) or NiMH (approx. 20 hours operation)
<b>Instrument dimensions</b>	ca. 160 mm x 70 mm x 45 mm (L x W x H)
<b>Weight</b>	ca. 300 g (including batteries)
<b>Permissible operation temperature</b>	Instrument:         -15 °C to +55 °C Instrument with probe:  0 °C to +40 °C
<b>Store/transport temperature</b>	Instrument:         -40 °C to +70 °C Instrument with probe: -20 °C to +60 °C
<b>Data Logger (only MIC 10 DL)</b>	Internal Data Logger: ca. 1800 measurements Memory card:         ca. 590 measurements (dependent on the number of measurements per measurement set)
<b>Interface</b>	RS 232 bidirectional for printer and computer



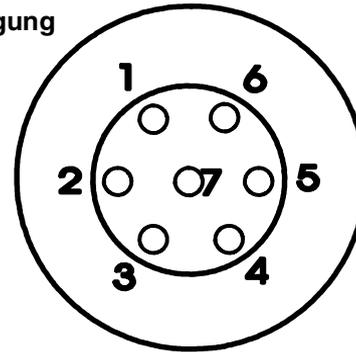
# Interface and peripherals (only MIC 10 DL) 11

## 11.1 Interface RS 232

The MIC 10 has an RS 232 interface (Lemo 0) enabling you to transfer data between peripherals such as a printer or PC.

Complete remote control of the MIC 10 DL from a PC is also possible via the RS 232.

Pinbelegung  
RS 232



### Pin layout

PIN No.	Symb. Name	Description	Elec. Specification	Signal direction	Signal type
1	GND	Ground			supply
2	+5 V	Voltage supply	+5 V $\pm$ 5 %		supply
3	TXD	Serial interface, "transmit"	HCMOS	output	
4	SER_ON	Interface connected, recognition	HCMOS	input	digital, active LOW
5	RXD	Serial interface, "receive"	HCMOS	input	
6	N.C				
7	N.C.				

## Data format

The physical data transfer via the MIC 10's RS 232 interface is made with the following fixed data format:

- Baud rate 9600
- Number of start bits 1
- Number of stop bits 1
- Number of data bits 8
- Parity none
- SW handshake on

Make certain that the transfer parameters of the connected equipment correspond with these settings.



### Note:

As long as data are transferred the automatic instrument cutout is deactivated.

## 11.2 Data transfer with a printer

With the MIC 10 you have the possibility to print adjustment and measurement data including statistical data.

For this you will need:

- a printer with serial interface RS 232
- a data cable TGD/PC for connecting the MIC 10 to a printer

There are various selection possibilities available. Further information about this and the procedure are contained in Chapter 7.1 *Printing data*.

## 11.3 Data transfer with a PC

When you connect the MIC 10 DL to a PC you can

- remote control the instrument from a PC
- transfer the stored measurement sets to the PC, edit and process them there (using the user software UltraDOC, refer to Chapter 7.2 *Data transfer with the user software program UltraDOC*)

You require

- a PC with a standard interface RS 232, e.g. an IBM compatible PC
- a data cable TGD/PC for connecting the MIC 10 to a PC
- the user software UltraDOC if necessary.

## Remote operation of the MIC 10 DL

Data transfer from the PC is made by remote control codes. These codes represent instructions which relate to individual functions of the MIC 10. The codes are entered with a certain syntax via the keyboard of the PC connected.



### Note:

Remote control can be made using the software UltraDOC.

## General information about remote control commands

All remote control commands are initiated with <ESC> and start with a function code which consists of two letters. The commands are terminated with <CR>.

There are two different types of remote control command:

- Enquiring (read) about a value or condition of a MIC 10 DL function with the command structure:

**<ESC><CODE><CR>**

- Entry (set) of a new value or condition for the function with the command structure:

**<ESC><CODE><PARAMETER><CR>**

Function codes and parameters can be separated by a space or an equal sign. The space can be used anywhere within the parameter, e.g. between the numerical value and the unit, between the sign and the numerical value or for structure of the numerical value.

**Example:**

**<ESC>CA = - 2 000<CR>** (setting calibration value)  
**<ESC>HI = 580 HV<CR>** (setting upper threshold)

The command, including <ESC> and <CR>, must not contain more than 16 characters. When the MIC 10 DL operates in the echo mode it will give all characters (unchanged) within the command sequence back. The return values are terminated by <CR> and <LF>. The command initial character <ESC> is returned as "\*" and the command end character <CR> as a space.

With a deactivated echo mode the received characters are not given again.

With an erroneous command the return of the MIC 10 DL is:

"?<CR><LF>".

**Time sequence at the interface (ex.: recall of active cal. value)**

Echo mode on:

<b>Rx (MIC10)</b>	ESC		C		A		CR									
<b>TX (MIC10)</b>		*		C		A		␣	-	2	0	0	0	0	CR	LF

Echo mode off:

<b>Rx (MIC10)</b>	ESC	C	A	CR								
<b>TX (MIC 10)</b>					-	2	0	0	0	0	CR	LF

**Code list for remote operation**

<b>Code</b>	<b>Description</b>	<b>Code</b>	<b>Description</b>
AV	Read / set display mode	MR	Read number of stored measurement sets; Issue measurement set contents
CA	Read / set calibration value	NF	Read active zero frequency
CF	Close data set	OC	Indication of probe contact on/off; Read status of contact indication
CM	Select printed report format	OE	Output of error messages on/off Read status of error message output
CO	Read / set instrument configuration	OH	Output of the measured hardness on/off Read status of measured hardness output
CU	Enable / disable hardness scales	OT	Output of the indentation period on/off Read status of indentation period output
DL	Activate / deactivate Data Logger; Read status of Data Logger	OX	Output of the relative frequency shift on/off; Read status of frequency shift output
DG	Select language for printed report	PN	Read probe serial number
EC	Echo mode on / off	PT	Read probe test load
HI	Read / set upper threshold value	RF	Read probe frequency
IL	Read / set display backlight state	SN	Read MIC 10 serial number
IN	Load default setting		
KB	Keyboard operation		
LO	Read / set lower threshold value		

Code	Description
TL	Read / set time for display backlight switch-off
TM	Read / set dwell time
TP	Read / set time for instrument switch-off
UN	Read / select hardness scale
VE	Read MIC 10 software version

### Description of the individual functions

In the following you will find a detailed description of the individual remote control functions arranged alphabetically.

### Explanation of the characters used

n,m      Decimal numbers  
 <xxx>    ASCII control characters  
 <ESC> = 1B (Hex) - Escape  
 <CR> = 0D (Hex) - Carriage Return  
 <LF> = 0A (Hex) - Line Feed  
 [...]     The contents of the brackets can be entered.  
 (a | b)    a or b

**AV - Read / set display mode**

**Syntax:** <ESC>AV [ (0|1) ]

**Description:**

Toggle between display of single value and average value or read active display mode.

**Examples:**

<ESC>AV<CR>	Read display mode
0<CR><LF>	Result: single value display
<ESC>AV 1<CR>	Set average value display

**CA - Read / set calibration value**

**Syntax:** <ESC>CV [ [ (+ | -) ] n ] <CR>

**Description:**

Set calibration value or read active value.  
Range: **-9999 to +9999**.

**Example:**

<ESC>CA 5000<CR>	Set calibration value to 5000
<ESC>CA -2000<CR>	Set calibration value to -2000
<ESC>CA<CR>	Read calibration value:
-2000<CR>	Result: -2000

 **Warning:**

When you change the calibration value, the active measurement set will be terminated beforehand.

**CF- Close data set**

**Syntax:** <ESC>CF<CR>

**Description:**

Close active data set.

 **Warning:** The actual measurement set is closed!**CM - Select report format**

**Syntax:** <ESC>CM [n]<CR>

**Description:**

Selection of the format for the printed report. Possible settings are:

- 1 = Single report: Short / Complete printout: List
- 2 = Single report: Short / Complete printout: Short
- 3 = Single report: Long / Complete printout: List
- 4 = Single report: Long / Complete printout: Short
- 5 = Single report: Long / Complete printout: Long
- 6 = A4 format

**Example:**

<ESC>CM<CR>      Read report format:  
 3<CR>                Result: 3  
 <ESC>CM 5<CR>      New format: 5

c(Lo) = 0            lower alarm threshold not variable  
 c(Lo) = 1            lower alarm threshold variable

c(Logger) = 0        Data Logger function disabled  
 c(Logger) = 1        Data Logger function enabled  
                           (only MIC 10 DL)

c(Card) = 0          Memory Card function disabled  
 c(Card) = 1          Memory Card function enabled  
                           (only MIC 10 DL)

c(E140) = 0          conversion according to DIN 50 155  
 c(E140) = 1          conversion according to ASTM E 140

**CO - Read / set instrument configuration**

**Syntax:**                    <ESC><CO> [n] <CR>

**Description:**

Reading as well as disabling and enabling of different instrument configurations.

A code number n is given as parameter. It is calculated as follows:

$$n = c(\text{Cal}) + 2 \cdot c(\text{tm}) + 4 \cdot c(\text{Lo}) + 8 \cdot c(\text{Hi}) + 16 \cdot c(\text{Logger}) + 32 \cdot c(\text{Card}) + 128 \cdot c(\text{E140})$$

Meaning of the individual factors:

c(Cal) = 0            calibration value not variable  
 c(Cal) = 1            calibration value variable

c(tm) = 0            dwell time not variable  
 c(tm) = 1            dwell time variable

For example, in order to only make the calibration value variable, to disable the Data Logger and Memory Card functions and to select the conversion according to DIN 50 155, the code is:

$$n = 1 + 2 \cdot 0 + 4 \cdot 0 + 8 \cdot 0 + 16 \cdot 0 + 32 \cdot 0 + 128 \cdot 0 = 1$$

The remote-control command CO without any parameter results in the current instrument configuration with the coding described above.

**Examples:**

<ESC>CO<CR>            Read the current configuration code:

63<CR><LF>              Result: 63

<ESC>CO 1<CR>          Set configuration as shown in the above example

**CU - Disable / enable hardness scales and read status****Syntax:** <ESC>CO [n]<CR>**Description:**

Disabling and enabling of hardness scales; with Rockwell scales, definition of the display resolution.

A code number n is given as parameter. It is calculated as follows:

$$n = c(\text{N/mm}^2) + 4 \cdot c(\text{HB}) + 16 \cdot c(\text{HV}) + 64 \cdot c(\text{HRC}) + 256 \cdot c(\text{HRB})$$

Meaning of the individual factors:

$c(\text{N/mm}^2) = 0$  N/mm<sup>2</sup> scale disabled  
 $c(\text{N/mm}^2) = 1$  N/mm<sup>2</sup> scale enabled

$c(\text{HB}) = 0$  HB scale disabled  
 $c(\text{HB}) = 1$  HB scale enabled

$c(\text{HRC}) = 0$  HRC scale disabled  
 $c(\text{HRC}) = 1$  HRC scale: resolution 1 HRC  
 $c(\text{HRC}) = 2$  HRC scale: resolution 0.5 HRC  
 $c(\text{HRC}) = 3$  HRC scale: resolution 0.1 HRC

$c(\text{HRB}) = 0$  HRB scale disabled  
 $c(\text{HRB}) = 1$  HRB scale: resolution 1 HRB

$c(\text{HRB}) = 2$  HRB scale: resolution 0.5 HRB  
 $c(\text{HRB}) = 3$  HRB scale: resolution 0.1 HRB

If e.g. only HV and HRC should be enabled with a resolution of 0.1 HRC, then:

$$n = 0 + 4 \cdot 0 + 16 \cdot 0 + 64 \cdot 0 + 256 \cdot 0 = 208$$

The remote-control command CU without any parameter results in the currently active code number.

**Examples:**

<ESC>CU<CR>	Read the currently enabled hardness scales:
16<CR><LF>	Result (only HV)
<ESC>CU 208<CR>	Enable also HRC scale (resolution 0.1 HRC)

**DL - Data Logger Status**

**Syntax:** <ESC>DL [ (0 | 1) ] <CR>

**Description:**

Activate and deactivate the Data Logger or read states of the Data Logger. Only the values 0 and 1 are available for setting (default setting: 0), status reading can also result in **2** (Memory Card).

**Example:**

<ESC>DL<CR>	Read Data Logger status:
0<CR><LF>	Result: not active
<ESC>DL 1<CR>	Activate Data Logger

**DG - Select printed report language**

**Syntax:** <ESC>DG [n] <CR>

**Description:**

Selection of the printed report language:

0 = German  
1 = English  
2 = French  
3 = Italian

4 = Spanish

5 = user defined

On recall without parameter, the active selected report language is returned in the same code.

**Example:**

<ESC>DG<CR>	Read printed report language:
1<CR>	Result: English
<ESC>DG 0<CR>	Select German report

**EC - Echo on/off**

**Syntax:** <ESC>EC [ (0 | 1) ] <CR>

**Description:**

Switching the echo mode on or off.

**Example:**

<ESC>EC<CR>	Read echo mode
1<CR><LF>	Result:
	Echo mode switched on
<ESC>EH 0<CR>	Echo mode switched off

**HI - Read / set upper threshold**

**Syntax:** <ESC>HI  
 [ (n [.m] [ (HV | HRC | HRB | HB | N/MM2 ) ] | ON | OFF) ]<CR>

**Description:**

Set upper threshold value or read active setting. If a hardness scale is not given then the active scale will be assumed. The upper threshold is deactivated when set to **OFF**. Subsequent setting to **ON** activates the upper threshold again. The threshold value is the last one which was set.

**Example:**

```
<ESC>HI 420HV<CR> Upper threshold: 420 HV
<ESC>HI<CR>         Read status:
420HV<CR><LF>       Result: 420 HV
<ESC>HI OFF<CR>    Upper threshold not active

<ESC>HI<CR>         Read status:
OFF<CR><LF>         Result: not active
<ESC>HI ON <CR>    Activate upper threshold
                    again
<ESC>HI<CR>         Read status:
420HV<CR><LF>       Result: 420 HV
```

 **Warning:**

When you set the upper threshold, the active measurement set will be terminated beforehand.

**IL - Read / set display backlight status**

**Syntax:** <ESC>IL [ (0 | 1) ]

**Description:**

Read or set the status of the display backlight (see also code TL).

**Example:**

```
<ESC>IL<CR>         Read backlight status:
0<CR><LF>           Result: not active
<ESC>IL 1<CR>      Switch backlight on
```

**IN - Initialization**

**Syntax:** <ESC>IN<CR>

**Description:**

The default setting of the instrument is loaded.

**Default settings**

In the following you will find an overview of the default settings of all functions including the corresponding remote codes.

<b>Function</b>	<b>Default setting</b>	<b>Code</b>
Display mode	Single value	AV 0
Hardness scale	HV	UN HV
Calibration value	0	CA 0
Dwell time	0 s	TM 0
Lower alarm threshold	not active	LO OFF
Upper alarm threshold	not active	HI OFF
Display backlight	off	IL 0
Measured hardness output	not active	OH 0
Indentation period output	not active	OT 0
Relative frequency output	not active	OX 0

<b>Function</b>	<b>Default setting</b>	<b>Code</b>
Error messages output	not active	OE 0
Probe contact output	not active	OC0
Language for printed report	English	DG 1
Printed report format	P(3)	CM 3
Active hardness scales: HV HRC HRB HB N/mm <sup>2</sup>	on resolution: 0.1 resolution: 0.1 on on	CU 1013
Active functions: Cal tm Lo Hi Data Logger Memory Card conversion	on on on on on (MIC 10 DL) on (MIC 10 DL) DIN 50 155	CO 63

Function	Default setting	Code
Time for backlight switch-off	10 s	TL 10
Time for instrument switch-off	180 s	TP 180

## KB - Keyboard operation

**Syntax:** <ESC>KB  
 [ (0 | 1 | EX[IT] | MO[DE] | UP | DO[WN] | C | FI[LE/MEM] | OF[F] ) ] <CR>

### Description:

The remote-control code KB enables the following functions:

- Disable or enable the instrument operation via keyboard
- Enquire whether keyboard operation is disabled or enabled. With disable the reply is **0**, with enable it is **1**.

- Trigger the key functions via remote control. The corresponding key designation is input as parameter for this:

EXIT  key  
 MODE  key  
 UP  key  
 DOWN  key  
 C  key  
 FILE/MEM  key  
 OFF  +  key (instrument switched off)

The first two letters are sufficient for all key designations.

### Examples:

<ESC>KB<CR> Enquire whether keyboard is disabled  
 1<CR><LF> Result: keyboard enabled  
 <ESC>KB 0<CR> Keyboard disable  
 <ESC>KB MODE Trigger  key

**LO - Read / set lower threshold**

**Syntax:**           <ESC>LO  
 [ (n [.m] [ (HV | HRC| HRB | HB | N/MM2 ) ] | ON |  
 OFF) ]<CR>

**Description:**

Set the lower threshold value or read the active setting. If a hardness scale is not given, the active scale will be assumed. The lower threshold is deactivated when set to **OFF**. Subsequent setting to **ON** activates the lower threshold again. The threshold value is the last one which was set.

**Example:**

```
<ESC>LO 380HV<CR> Lower threshold: 380 HV
<ESC>LO<CR>       Read status:
380HV<CR><LF>     Result: 380 HV
<ESC>LO OFF<CR>   Lower threshold not active
<ESC>LO<CR>       Read status:
OFF<CR><LF>       Result: not active
<ESC>LO ON <CR>   Activate lower threshold
                  again
<ESC>LO<CR>       Read status:
380HV<CR><LF>     Result: 380 HV
```

 **Warning:**

When you set the lower threshold, the active measurement set will be terminated beforehand.

**MR - Data Logger access**

**Syntax:**           <ESC>MR [n]<CR>

**Description:**

If a valid file number is given as a parameter, the MIC 10 DL will issue the contents of the measurement set in the selected report printout format. On recall without parameter, the number of the stored measurement set is returned.

**Example:**

```
<ESC>MR<CR>       Read file number:
3<CR><LF>         Result: 3
<ESC>MR 3 <CR>   Request file No. 3
```



**OE - Output of error messages**

**Syntax:** <ESC>OE [ (0 | 1) ] <CR>

**Description:**

Switching the output of error messages on/off via the serial interface or display of the active status of the error message output. When the function is switched on, each error message of the instrument is output via the serial interface, e.g.

E 1.1<CR><LF>

**Example:**

<ESC>OE<CR>	Enquire whether error output is switched on:
0<CR><LF>	Result: not switched on
<ESC>OE 1<CR>	Activate error output

**Note:**

The last setting is retained even when the instrument is switched off.

**OH - Output of measured hardness**

**Syntax:** <ESC>OH [ (0 | 1) ] <CR>

**Description:**

Switching the output of the measured hardness on/off, or display active status of the hardness reading output. When the function is switched on, the measurement reading are transferred in the selected hardness scale, for example:

40.5HRC<CR><LF>

40.7HRC<CR><LF>

**Example:**

<ESC>OH<CR>	Enquire whether hardness output is switched on.
0 <CR><LF>	Result: not switched on
<ESC>OH 1 <CR>	Switch on hardness reading output

**Note:**

The last setting is retained even after the instrument is switched off.

**OT - Output of indentation period****Syntax:** <ESC>OT [ (0 | 1) ] <CR>**Description:**

Switching the output of the indentation period on/off with free-hand measurements (tm=0) or display of the active status of the indentation period. When the function is switched on, the indentation time is output with each measurement, e.g.:

405HV 0.9S&lt;CR&gt;&lt;LF&gt;

398HV 1.2S&lt;CR&gt;&lt;LF&gt;

(also when the measurement reading output is switched off).

**Example:**

```
<ESC>OT<CR>      Enquire whether output of
                    indentation time is switched on:
0<CR><LF>          Result: not switched on
<ESC>OT 1<CR>     Switch on indentation time
                    output
```

 **Note:**

The last setting is retained even after the instrument is switched off.

**OX - Output of the relative frequency shifts****Syntax:** <ESC>OX [ (0 | 1) ] <CR>**Description:**

Switching the output of the relative frequency shifts on/off or display active status of the frequency shift indication. When the function is switched on, the relative frequency shift is displayed with each measurement reading, e.g.:

0.0277612&lt;CR&gt;&lt;LF&gt;

0.0277784&lt;CR&gt;&lt;LF&gt;

**Example:**

```
<ESC>OX<CR>      Enquire whether output
                    of the relative frequency shift
                    is switched on.
                    Result: not switched on
0<CR><LF>          Switch on relative frequency
<ESC>OH 1<CR>     shift output.
```

 **Note:**

The last setting is retained even after the instrument is switched off.

---

**PN - Serial number of the probe****Syntax:** <ESC>PN<CR>**Description:**

Read probe serial number. If there is no probe connected, the result is **0**.

**Example:**

<ESC>PN<CR>      Read probe serial number:  
1618<CR><LF>      Result: 1618

---

**PT - Test load of the probe****Syntax:** <ESC>PT<CR>**Description:**

Reading the probe test load. If there is no probe connected, the result is **0**.

**Example:**

<ESC>PT<CR>      Read probe test load:  
50N<CR><LF>      Result: 50 N

---

**RF - Read active probe frequency****Syntax:** <ESC>RF<CR>**Description:**

Reading the active probe frequency.

**Example:**

<ESC>RF<CR>      Read probe frequency:  
75319.7HZ<CR><LF>      Result: 75319,7 Hz

---

**SN - MIC 10 Serial Number****Syntax:** <ESC>SN<CR>**Description:**

Reading the Serial Number of the instrument.

**Example:**

<ESC>SN<CR>      Read serial number:  
580<CR><LF>      Result: 580

**TL - Read / set time for display backlight**

**Syntax:** <ESC>TL [ (n | ON) ]<CR>

**Description:**

Reading or setting the time after which the instrument backlight is switched off if the instrument is not used. The setting range is from 5 seconds to 60 seconds. If **ON** is given as parameter, the backlight is permanently on if activated.

**Example:**

<ESC>TL<CR>	Read time for backlight switch-off
10S<CR><LF>	Result: 10 s
<ESC>TL 20<CR>	Increase switch-off time to 20 seconds

**TM - Read / set dwell time**

**Syntax:** <ESC>TM [n]<CR>

**Description:**

Set the measurement time in seconds or read active setting  
Range: **0 to 99**.

**Example:**

TM 5<CR>	Set dwell time to 5 seconds
TM<CR>	Read measurement time:
5S<CR><LF>	Result: 5 seconds

**Warning:**

When you change the dwell time, the active measurement set will be terminated beforehand.

**TP - Read / set time for instrument switch-off**

**Syntax:** <ESC>TP [ (n | ON) ]<CR>

**Description:**

Reading or setting the time after which the instrument is switched off if not used. The variation range is from 30 seconds to 600 seconds. If On is given as parameter, the instrument is permanently switched on.

**Example:**

<ESC>TP<CR>	Read switch-off time
180S<CR><LF>	Result: 180 seconds
<ESC>TP 300<CR>	Increase switch-off time to 300 seconds

**UN - Select the hardness scale**

**Syntax:** <ESC>UN [ (HV | HRC | HRB | HB | N/MM2) ] <CR>

**Description:**

Selecting hardness scale resp. display of active scale. The default setting is **HV**.

**Example:**

<ESC>UN<CR>	Read active hardness scale:
HRC<CR><LF>	Result: HRC
<ESC>UN HV <CR>	Set HV scale

**Warning:**

When you change the hardness scale, the active measurement set will be terminated beforehand.

### VE - Software Version

**Syntax:** <ESC>VE<CR>

**Description:**

Reading the software version number of the instrument.

**Example:**

<ESC>VE<CR>	Read Software Version no.:
1.1<CR><LF>	Result: 1.1

# Appendix 12

## 12.1 The UCI method

The following section contains some helpful information about the hardness testing method of the MIC 10.

As opposed to conventional Vickers low load hardness testers, the MIC 10 does not evaluate the Vickers indent microscopically but electronically according to the UCI method.

This has an advantage over the visual evaluation because high repeatability of the test results is ensured even when small indents are measured.

The Vickers diamond is fixed to the tip of a round metal rod. This metal rod is excited, to its resonant frequency of approx. 78 kHz, into longitudinal oscillations.

When the Vickers diamond contacts the material, the resonant frequency changes. This change happens in relation to the size of the indent area from the Vickers diamond. The size, in turn, is a measure for the hardness of the tested material.

Resonant frequencies can be measured very accurately. This is why the UCI method is suited to make the evaluation of Vickers indents, and thus of the complete test procedure, so much easier and quicker.

There are also two additional advantages:

- The measurement is made under load. (no impairment of the measurement due to elastic resilience)
- The hardness measurement is based on the area of the indent and not on the length of the indent diagonals. The measurement is thus less affected by surface roughness; even gunmetal-finished surfaces can be measured.

Concerning the UCI method, the measurement value is also dependent on the Young's modulus of the material.

## 12.2 Conversion of hardness values

The conversion of hardness values into other hardness scales is only possible with certain limitations. Therefore, in the following we give important information which you should take into account.

Hardness values which were measured by different methods cannot be converted to each other on the basis of generally applicable relationships (see DIN 50 150 resp. ASTM E 140).

In one respect, the reasons for this are found in the fact that the penetration behaviour of a material is determined by its stress behaviour and change of form behaviour. On the other hand, the form and material of the indentation diamond, the size of the indent and, therefore, the measured area vary with the hardness testing methods used.

Therefore, please note that the conversion of hardness values either into other hardness units or units of tensile strength may be inaccurate or inadmissible, depending on material, material preparation and surface finish.

Consequently, you should make conversions only in cases where:

- the specified testing method cannot be applied, for instance, because suitable test equipment is not available.
- it is not possible to take the samples required for the specified testing method.

### Special factors of MIC 10

The conversion of the hardness values into other scales, which you can select on the instrument, is made according to DIN 50150 or ASTM E 140. Therefore, all limitations specified in this DIN standard for the conversion are applicable.

Utmost caution is advised when using the Brinell scale. Under no circumstances should the MIC 10 be used for the measurement of materials with coarse grained structure (e.g. gray castings). Particularly materials of this kind call for a Brinell measurement.

## 12.3 Preparation of the test material

In order to achieve reliable and repeatable measurement results it is important that you observe the information on quality and preparation of the material. Therefore, read the following information.

### Surface finish

The surface must be clean and free of oil, grease and dust.

The surface roughness of the material must be small in relation to the penetration depth of the Vickers diamond (ca 14 to 200 micrometers). We recommend a surface roughness of approx. 30 % of the penetration depth..

- Grind rougher surfaces with the grinding device MIC 1060 (refer to chapter 2.3).

### Measuring small test pieces

Distinct reading variations may especially occur with a mass lower than 0.3 kg and a specimen thickness of less than 15 mm if the test material is excited to resonance or sympathetic oscillations. Therefore, such test materials must be fixed to a solid base, e.g. using a viscous paste. The same applies to the hardness reference plates.

Thin plate must have a thickness which corresponds to 10 times the penetration depth of the Vickers diamond (see table on the next page).

#### Note:

As per DIN 50133 (hardness measurement according to Vickers) the center distance between two neighbouring indents in relation to the mean length of the indent diagonal must be

- at least 3 times the amount for steel, copper and copper alloys,
- at least 6 times the amount for light metals, lead, tin and their alloys.

If two neighbouring indents vary in size then the mean indent diagonal of the larger indent must be used for calculation of the minimum distance.

<b>Diagonal lengths and indent depths for a selection of Vickers hardness values and a test load of 1 kgf</b>			
Vickers hardness [HV]	<b>F = 1 kgf</b>		
	Diagonal d [ $\mu\text{m}$ ]	Depth t [ $\mu\text{m}$ ]	min. material thicken. [ $\mu\text{m}$ ]
250	86	12	120
500	61	9	90
750	50	7	70
1000	43	6	60

<b>Diagonal lengths and indent depths for a selection of Vickers hardness values and a test load of 10 kgf</b>			
Vickers hardness [HV]	<b>F = 98 N</b>		
	Diagonal d [ $\mu\text{m}$ ]	Depth t [ $\mu\text{m}$ ]	min. material thicken. [ $\mu\text{m}$ ]
250	272	39	390
500	193	28	280
750	157	22	220
1000	136	19	190

<b>Diagonal lengths and indent depths for a selection of Vickers hardness values and a test load of 5 kgf</b>			
Vickers hardness [HV]	<b>F = 5 kgf</b>		
	Diagonal d [ $\mu\text{m}$ ]	Depth t [ $\mu\text{m}$ ]	min. material thicken. [ $\mu\text{m}$ ]
250	193	28	280
500	136	19	190
750	111	16	160
1000	99	13	130

## 12.4 Notes on statistical evaluation

The MIC 10 offers you the opportunity to print the following statistical data into a report:

- maximum value
- minimum value
- average value (is also displayed)
- absolute and relative range
- absolute and relative standard deviation
- minimum material thickness

How this information is printed has been covered in Chapter 7.1 *Printing data*. The average value can be continuously displayed during the measurement and can also be recalled after termination of the measurement set.

Each measurement has a certain amount of inaccuracy. A measuring error includes the following individual errors:

- The basic measurement inaccuracy of the applied testing method
- The usage of the probes
- The preparation of the test material (surface or heat treatment)
- The homogeneity of the material
- External influences ((dirt accumulation, moisture, temperature)

The statistical evaluation is to support your measurement assessments and help you to make a clear decision about the quality of the tested material. The most decisive information is derived from the standard deviation; it is the best indicator of the quality of a measurement set.

The average value of a measurement set becomes more accurate the more measurements you make. On the other hand, the more single measurements you make the more measurements can go wrong (mis-measurements). This is why the difference between minimum and maximum value is not suited as a reliable indicator for the evaluation of a measurement set which goes beyond 12 measurement points.

## Calculating the statistical data

### Average value

The average (AVG) is calculated as an arithmetical mean:

$$AVG = \frac{(x_1 + x_2 + x_3 + \dots + x_n)}{n}$$

whereby  $x$  = single measurement  
 $n$  = number of measurements

### Relative tolerance range

The relative tolerance range (RNG) is calculated as follows:

$$RNG[\%] = \frac{(MAX - MIN) \cdot 100}{AVG}$$

## Relative standard deviation

The relative standard deviation (STD) is calculated as follows:

$$STD[\%] = \frac{S}{AVG} \cdot 100$$

whereby  $S$  = Standard deviation (mean error of single measurement)

$S$  is calculated as follows:

$$S = \sqrt{\frac{(x_1 - AVG)^2 + (x_2 - AVG)^2 + \dots + (x_n - AVG)^2}{(n - 1)}}$$

## Minimum material thickness

The minimum material thickness required (tenfold indentation depth) is calculated as follows:

$$d[\text{mm}] = 0.62 \times \sqrt{\text{Test load [N]} / \text{Average value [HV]}}$$

## 12.5 EC declaration of conformity

We declare that the MIC 10 / MIC 10 DL conforms to the following European directives:

- 89/336EEC - Electromagnetic compatibility -
- 73/23/EEC, amended by the directive 93/68/EEC - Low-voltage directive -

The conformity of the above-mentioned product with the regulations of the directive 89/336EEC is proven by the observance of the standard specifications

- EN 55011, 12/1998 Class A, Group 2 and
- EN 50082-2, 02/1996.

The conformity of the above-mentioned product with the regulations of the directive 73/23/EEC, amended by the directive 93/68/EEC, is proven by the observance of the standard specifications

- EN 61010 Part 1, 03/1994 and
- EN 61010-1/A2, 05/1996

## 12.6 Service addresses

The MIC 10 is made of high quality components and is produced according to the most modern methods. Stringent intermediate checks and a quality assurance system according to DIN ISO 9001 ensure an optimal quality of the instrument.

Should, nevertheless, any malfunctions occur, contact your Krautkrämer or Krautkramer Inc. Service giving details and a description of the defect.

Retain the instrument packing should it be necessary to send it for any possible repairs which cannot be carried out at the location.

If you have any questions regarding the application, use, operation or specifications of your MIC 10 contact your local Krautkrämer agent.

### Krautkrämer GmbH

Service-Center  
Robert-Bosch-Str. 3  
D - 50354 Hürth

or:

Postfach 1363  
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Lewistown, PA 17044

Phone: 001 - 717 - 242 03 27  
Fax: 001 - 717 - 242 26 06  
E-Mail: infolink@krautkramer.com

# Changes **13**

## Changes

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Existing changes or additions are described in this chapter.

Otherwise this chapter remains empty.

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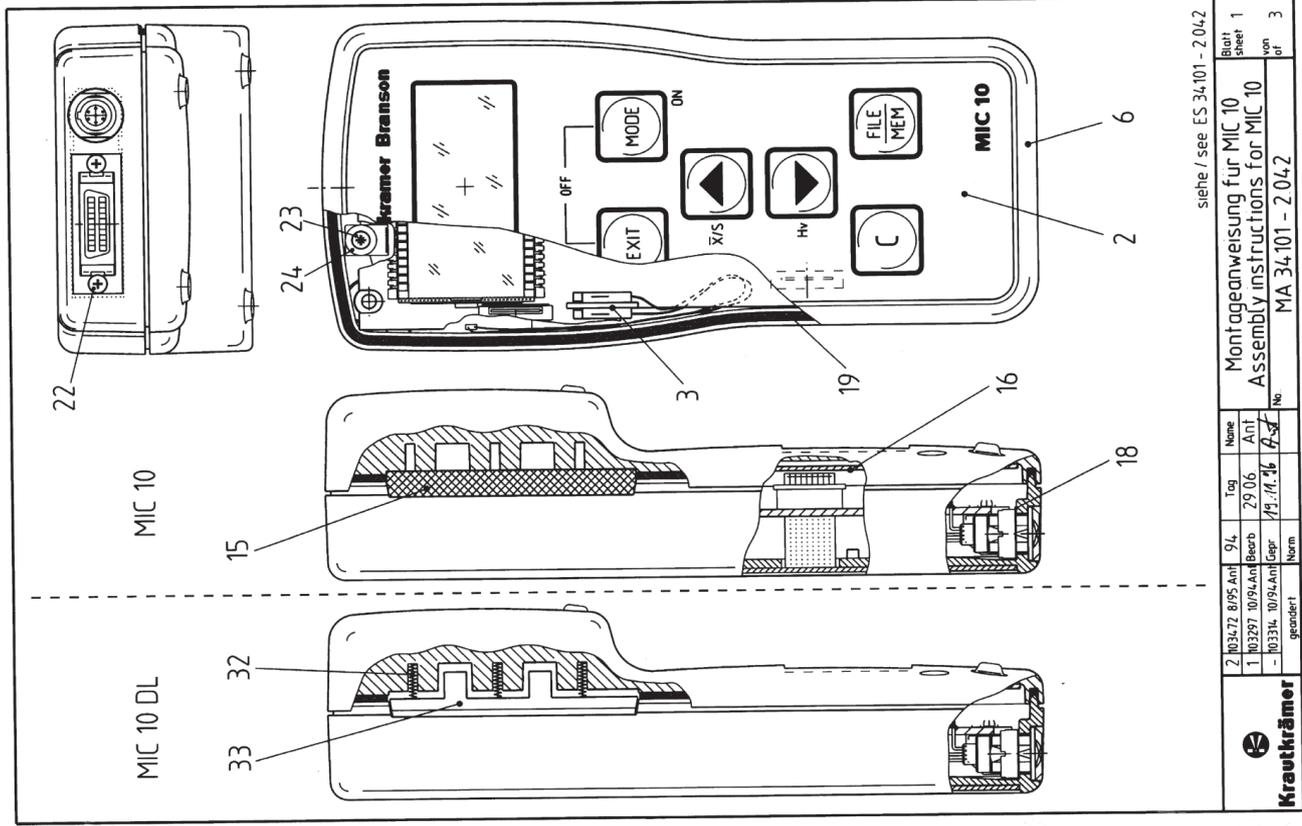
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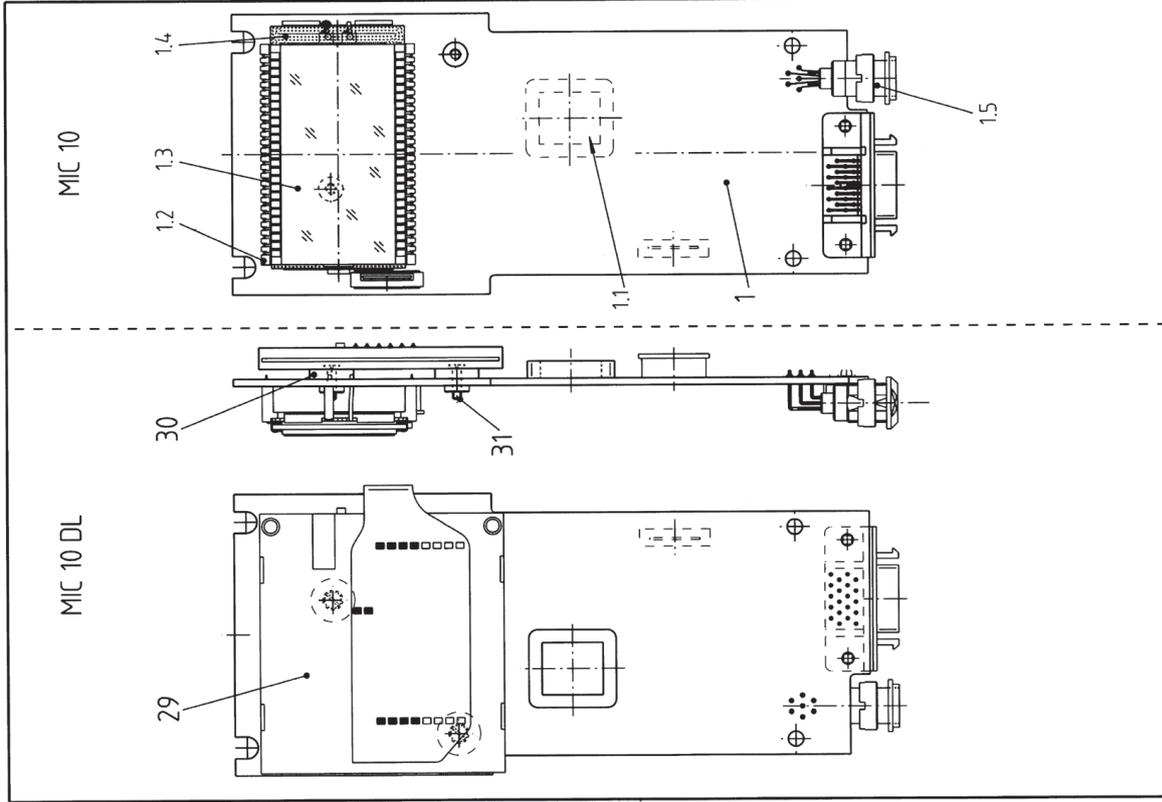


# Assembly Instructions, Spare Parts List



siehe / see ES 34.101 - 2.04.2

Blatt 1  
 von 3  
 Montageanweisung für MIC 10  
 Assembly instructions for MIC 10  
 No. MA 34.101 - 2.04.2



siehe / see ES 34.101 - 2.042

 <b>Krautkrämer</b>	2	103457	11/95	Anl	94	Tag	29.06.	Name	Montageanweisung für MIC 10 Assembly instructions for MIC 10			Blatt	2
	1	103297	10/94	Anl	Bearb	13.11.16	Ant	A	MA 34.101 - 2.042			von	3
												von	
												of	

# Assembly Instructions, Spare Parts List

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Vor Inbetriebnahme lesen  
Before operation read manual

Krautkrämer GmbH & Co  
Merzbach  
Made in Germany

Typ \_\_\_\_\_  
Nr \_\_\_\_\_  
Volt \_\_\_\_\_  
Nennfrequenz \_\_\_\_\_ kHz

CE

A - A

rot/red

schwarz/black

siehe / see ES 34.101 - 2.042

3 10364.8		9196Ant	Exp	19.11.96	Ant	Montageanweisung für MIC 10 Assembly instructions for MIC 10		Blatt sheet	3
geändert		Norm				MA 34.101 - 2.042		von of	3

## Assembly Instructions, Spare Parts List

1	2	3	4	5	6
Nb.	Qty	Designation	Part no.	Remarks	Kind
1		PCB assembly - MC 10	34013-3.220		
1.1		Eprom programmed for MC 10	34221-3.295		
1.2		LCD-support	34086-6.640		
1.3		LC-display	14619-7.232		
1.4		LCD backlight	14117-7.490		
1.5		Instrument socket Lemo 0 7pin	14507-7.137		
2		Membrane keypad	34298-3.120		
3		Battery cable	34211-3.180		
6		Housing, upper part	34035-6.640		
7		Housing, lower part	34036-6.640		
8		Battery cover	34037-6.640		
9		Battery cover sealing	34108-6.600		
10		Screw	34040-6.070		
11		Information sign	33667-6.920		
12		Battery spring, simple	14516-7.180		
14		Rubber foot	14520-7.820		
15		Strip	34111-6.600	Only MC 10	
16		Insulating plate	34238-6.600		
17		Battery tape	34291-6.690		
18		Contact plate	34468-6.600		
19		Round cellular rubber 2 mm	04586-8.560	370mm lg	
20		Screw for plastics 3 x 18	14518-8.070		
21		Screw for plastics 3 x 25	14519-8.070		
22		Screw 2-56 UNC ¼"	11140-8.070		
23		Screw for plastics 2, 2 x 4,5	16872-8.070		
24		Captive washer	00866-8.150		
		<b>Only for DYNA MIC DL</b>			
29		Chipcard reader	14503-7.000		
30		Spacer washer	34276-6.660		
31		Countersunk screw M2x8	00487-8.020		
32		Pressure spring	14824-7.850		
33		Strip	34116-6.600		
		20.11.96 / Berg			

## Assembly Instructions, Spare Parts List

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