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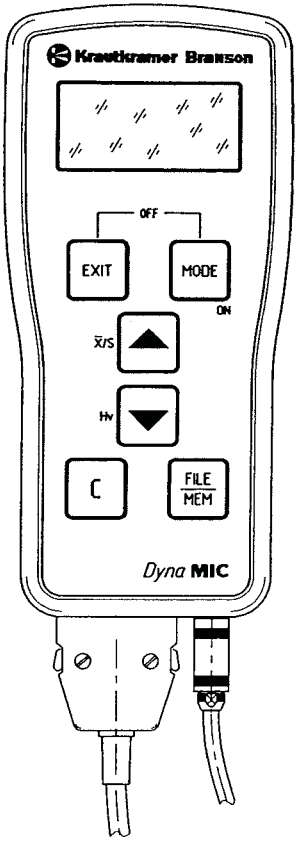
Introduction 1

1.1 Krautkrämer DynaMIC



The DynaMIC from Krautkrämer is a handy and easy-to-operate rebound hardness tester which enables to carry out tests quickly and without any difficulty. The DynaMIC can be used for measurements anywhere and in any direction: the impact direction does not have to be set beforehand.

The DynaMIC is mainly suitable

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

The DynaMIC is available in two versions:

- Basic version
- Data Logger version

As opposed to the Basic version, the Data Logger version has additional functions for data storage:

You can store readings in the instrument in order to subsequently print them out via a connected printer or, using special software, transfer them to a PC. With the additional Memory Card you have access to almost un-

limited storage possibilities and flexible data processing.

The DynaMIC is a hardness tester that operates according to the rebound method. In this method, an impact body is impelled against the test surface by spring force; impact and rebound phase velocities are measured in a non-contact mode, and the hardness value is calculated from these two readings. The measured hardness value is instantly digitally displayed; moreover, a high reproducibility of the test results is ensured.

We are constantly working on further development of our instruments. 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 After-Sales Service or Service Center at our company direct. You will find the addresses in Chapter 13.2.

1.2 Information on this manual

In the following you will find information about how to use this manual.

Attention:

Please read these instructions through carefully in order to be able to operate all DynaMIC functions quickly and reliably.

This will enable you to take full advantage of the instrument's function range. At the same time, you will also avoid malfunction and operating errors which, in turn, would cause incorrect test results. In the long run, these errors could lead to injuries to persons or material damages.

Important information

Even if you have experience in hardness testing, you must always 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 limits of testing, selection of the suitable test setup). In Chapter 1.5 you will find detailed information about hardness testing with the DynaMIC.

It is absolutely necessary that you pay attention to this information in order to ensure correct measuring results.

Please always look up in Chapter 14 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 DynaMIC is easy and quick to learn. In order to be able to use the instrument as quickly as possible, you should familiarize yourself with the preparation as well as the basic functions of the DynaMIC. To do this, read through the following chapters carefully:

Chapter 3 *Preparations for operation*

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

Chapter 4 *Basics of operation*

This gives you a survey of the DynaMIC's operational concept and an overview of a few important steps which occur again and again during operation.

Chapter 5.1 *Hardness measurement*

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

Chapter 5.2 *Data storage* (only for DynaMIC DL)

The Basic version DynaMIC does not have these functions. You learn how to store data, and how to view, edit and delete stored data. Using the special Memory Card you can also reload stored instrument settings into the DynaMIC DL.

Chapter 6 *Configuration*

This gives you information about additional possibilities concerning instrument adjustment.

Chapter 7 *Documentation* (only for DynaMIC DL)

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

Chapter 11 *Interfaces and peripherals* (only for DynaMIC DL)

In this chapter you learn everything you need to know about connecting the DynaMIC to a computer or printer. You can remote control the instrument via a computer.

Chapter 12 *The rebound hardness testing method*

The appendix supplies you with information that goes beyond the actual operating instructions and deals with facts about conversion of hardness values into other scales, rebound method, treatment of the test material as well as statistical evaluation of the measurement results. In addition to this you will find a procedure description for producing your own specific conversion tables for materials.

1.3 Layout and presentation of this manual

In order to make it easier for you to use this manual, the operation steps, listings, notes etc. are always put in the same form. In this way you will be able to quickly find individual information.

The operation steps of the individual functions are always completely described so that you are immediately able to work with the function that you require.

Operation steps

The operation steps are shown in the following way:

– ...

– ...

Listing

Listing is marked as follows:

• ...

• ...

Note and attention symbols

You will find the following symbol when there is something special to be observed concerning instrument operation:

 **Note: ...**

Any information required for a reliable and error-free operation of the instrument is found under the following symbol:

 **Attention: ...**

1.4 Conditions for hardness testing

The present operating manual provides you with all the essential instructions for the operation of the DynaMIC. In addition to this, there are a series of factors which affect the test results. As a description of these factors would extend beyond the scope of this manual, let us only describe the three most important conditions as follows:

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

Training of the operator

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

Adequate training means, for example, sufficient knowledge about:

- Hardness testing on metallic materials.
- Effects of material properties, especially of the material structure, on the hardness test and the selection of a suitable hardness test setup connected with it.
- The problems of comparability of different hardnesses such as Vickers, Rockwell and Brinell.
- Effects of surface finish on the hardness value.
- Effects of the test load on the determined hardness value.

Please don't forget to also read the instructions in Chapter 1.5.

⚠ **Attention:**

Insufficient knowledge of the above mentioned factors can cause incorrect test results and could thus have unforseeable consequences.

☞ **Note:**

Krautkrämer also offers training courses for hardness testing. To obtain more information about these training courses, please call us at: (49)-2233 - 601 344.

Technical test requirements

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

- determination of the scope of testing
- 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 fully inform the operator about the technical 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 hardness testing with the DynaMIC

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 surfaces must always be free of any impurities (oil, dust, etc.) and rust.
The surface roughness (peak-to-valley-height) should not exceed 10 micrometers. Polish all rougher surfaces, for example using our grinding set MIC 1060 (please refer to Chapter 2.2 Recommended accessories).
Test objects weighing at least 5 kg can be tested without any additional supports; test objects weighing less need a base support onto which they have to be fixed. Please use large, unyielding metal supports for this purpose.

The test objects should have a wall thickness of at least 20 mm. The UCI instrument MIC 10 is recommended for test objects with a thinner wall thickness.

⚠ **Attention:**

Any yielding or springiness of the test objects can cause measurement errors! Please also refer to Chapter 12.3.

Rebound method

The rebound method is a dynamic method with a very high reproducibility of the measurements. The rebound method does not replace the classical hardness testing according to Brinell or any other standardized methods, but it forms a quick and reliable complement to it.

In this method, the remaining energy of an impact body after the rebound from the material surface is measured. Please note that the loss of energy occurred also depends on the mechanical properties of the material in question, i.e. mainly on its Young's modulus of elasticity.

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

⚠ **Attention:**

It is absolutely necessary that you calibrate your DynaMIC to the material under test on the basis of the internal material groups.

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

The material group for low-alloy or unalloyed steel is preset in the instrument as a default setting. You should check this calibration from time to time (please refer to Chapter 9.1 *Check function*)

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

⚠ **Attention:**

You should not carry out a hardness measurement twice at the same test position, otherwise measurement errors could occur due to surface hardening. The distance between the test positions should be at least 3 mm.

Conversion of hardness values

The conversion of the HL value into standard hardness scales is carried out, depending on the material group, on the basis of defined conversion tables. The conversion into tensile strength values is made according to DIN 50 150.

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 observe the restrictions for conversion in DIN 50 150. For more details, please read Chapter 12.2.

⚠ **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 DynaMIC DL (Data Logger version with board slot) in a dry environment and only clean it with a dry cloth.

Parallel use of the Memory Card on the MIC 10 and DynaMIC

⚠ **Attention:**

If you are working both with the DynaMIC and with our UCI hardness tester, MIC 10, please pay attention to the following when using the Memory Card:

Up to software version 01.01.05 of the MIC 10, a Memory Card that you have written using the DynaMIC will be overwritten by the MIC 10 without any warning. All stored data are lost.

As of software version 01.01.06 of the MIC 10, an error message is displayed when using a DynaMIC Memory Card: the data cannot be read or overwritten. You can decide whether or not you want to delete the data. This also applies in the reverse case when working with the DynaMIC and using a Memory Card written by the MIC 10.

Scope of supply and accessories 2

Scope of supply and accessories

This chapter informs you about the available accessories for the DynaMIC (basic and DL version).

It describes

- accessories included in the standard package
- recommended accessories
- spare parts requirements

2.1 Scope of supply

Product code symbol	Description	Order no.
DynaMIC D	Portable rebound hardness tester with digital display including impact device **Dyna D** and hardness reference block MIC G38 with indication of measured value in HL, HV, HS, HB, HRB, HRC, N/mm^2	34 658
	or:	
DynaMIC D-DL	as above; in addition: Standard equipment includes interface for the connection to a printer or computer as well as a data logger with card reader and memory card	34 659
	or:	
DynaMIC E	Portable rebound hardness tester with digital display including impact device **Dyna E** and hardness reference block MIC D 62 with indication of measured value in HL, HV, HS, HB, HRB, HRC, N/mm^2	34 662
	or:	
DynaMIC E-DL	as above; in addition: Standard equipment includes interface for the connection to a printer or computer as well as a data logger with card reader and memory card	34 663

Product code symbol	Description	Order no.
DynaMIC G	Portable rebound hardness tester with digital display including impact device **Dyna G** and hardness reference block MIC G38 with indication of measured value in HL, HV, HS, HB, HRB, HRC, N/mm^2	34 660
	or:	
DynaMIC G-DL	as above; in addition: Standard equipment includes interface for the connection to a printer or computer as well as a data logger with card reader and memory card	34 661
	each including:	
DynaMIC	Basic instrument	34 247
	or:	
DynaMIC DL	Basic instrument with data logger	34 358
Dyna D	Impact device with 3mm (0.1") tungsten-carbide spherical test tip	34 248
	or:	
Dyna G	Impact device with 5mm (0.2") tungsten-carbide spherical test tip	34 549

Product code symbol	Description	Order no.
	or:	
Dyna E	Impact device with diamond test tip	34 588
Dyna 50	Connecting cable for impact device	34 329
	Test attachment ∅ 13.5 mm (0.5") for Dyna D and Dyna E	34 656
	or:	
	Test attachment ∅ 50mm (2.0") for Dyna G	34 656
	Cleaning brush for Dyna D and Dyna E	34 634
	or	
	Cleaning brush for Dyna G	34 618
MIC D 62	Hardness reference block 620 HV100 for Dyna D and Dyna E	34 393
	or:	
MIC G 38	Hardness reference block 380 HV100 for Dyna G	34 631

Product code symbol	Description	Order no.
TZ 1-2	1 set (2 pieces) of dry cells	34 107
	Transport case	17 424
ZG	Bottle of couplant (100 cm^3)	29 017
	Operating instructions in German	28 595
	Brief operating instructions in German	28 599
	or as an alternative:	
	Operating instructions in English	28 597
	Brief operating instructions in English	28 600
	only for DynaMIC DL:	
MIC 1000	Memory card (1 piece)	34 125

2.2 Recommended accessories

Product code symbol	Description	Order no.
Dyna 40	Instrument carrier and prop-up stand	34 526
TZ 1-2	1 set (2 pieces) of AlMn batteries	34 107
NiMH 1-2	1 set (2 pieces) of NiMH cells, rechargeable	34 109
MIC 1090	Quick charger for NiMH and/or NiCd batteries	34 212
MIC 300	Technical book on hardness testing	28 837
MIC 1060	Grinding set for surface treatment	34 380
Dyna 41	1 set (5 pieces) of test attachments for cylindrical surfaces	34 536
Dyna 42	1 set (5 pieces) of test attachments for spherical surfaces	34 539
	Only for DynaMIC DL:	
TGDL/PC	Data transfer cable	13 647
GCH 1	Adapter (Gender Changer) for the connection of the TGDL/PC cable to a serial printer	13 648
GCH 2	Adapter (Gender Changer) for the connection of the TGDL/PC cable to a serial printer Seiko DPU 411	17 776

Product code symbol	Description	Order no.
DynaSoft	Software for generation and storage of conversion tables for material groups	34 897
MIC 230 W	Software for data logger storage, generation of a calibration table (Windows)	33 930
	each including operating instructions (German/English)	28 535
MIC 1000	Memory card (1 piece)	34 125
MIC 1001	1 set (5 pieces) of memory cards	34 126

2.3 Spare parts requirements

	Impact body D, new	34 443
	Impact body G, new	34 596
	Impact body E, new	34 593
	Impact body D or impact body E, replacement in exchange by Service Department	34 572
MIC D 62	Hardness reference block 620 HV100	34 393

Product code symbol	Description	Order no.
MIC D 62-MPA	Hardness reference block 620 HV100, MPA certified	34 573
MIC G 38	Hardness reference block 380 HV100	34 631
MIC G 38-MPA	Hardness reference block 380 HV100, MPA certified	34 657
Dyna 50	Connecting cable for impact device	34 329
	Cleaning brush for Dyna D or Dyna E	34 420
	Cleaning brush for Dyna G	34 618
	Standard test attachment for impact devices D and E	34 312
	Test attachment for impact devices D and E, ∅ 13.5 mm (0.5")	34 656
	Test attachment for impact device G	34 569
	Test attachment for impact device G, ∅ 50 mm (2.0")	34 634
ZG	Bottle of couplant (100 cm^3)	29 017

Preparations for operation 3

In order to prepare the DynaMIC for operation, you must carry out the following:

- check the battery supply
- connect the impact device

3.1 Battery supply

The DynaMIC is operated with batteries or accumulators. For this you need two 1.5V AA (Mignon) batteries:

- non-rechargeable (AlMn) or
- rechargeable (Nickel-Cadmium or Nickel-Metal-Hydride).

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

The use of batteries or accumulators

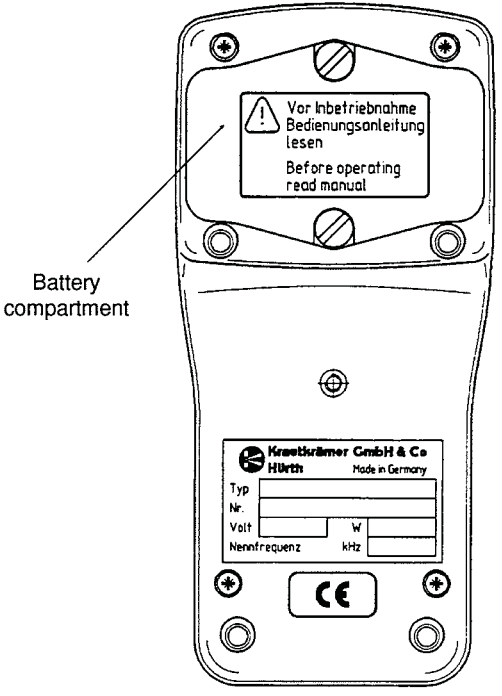
You can insert batteries (AlMn) or accumulators (NiCd, NiMH) into the battery compartment.

– 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 you are not going to use the instrument for a longer period of time, remove the batteries from the compartment!

When the battery voltage is too low, the following symbol will appear on the DynaMIC display as soon as you switch on the instrument:

If this symbol appears, you should immediately exchange the batteries. The DynaMIC is automatically switched off if the batteries are too low in order to guarantee reliable measurement operation.

When measurements are made at remote locations, a spare set of batteries should always be kept available.

For further information regarding batteries and accumulators, please read Chapter 8.1.

Note:

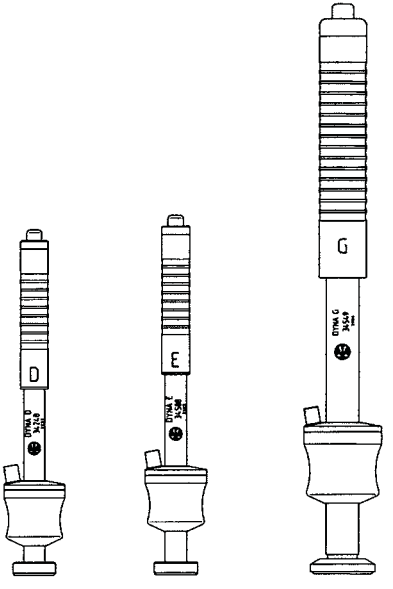
Used or defective batteries are special refuse and must be disposed of as provided by the law!

3.2 Connecting the impact devices

In order to prepare the DynaMIC for operation, you have to connect the suitable impact device.

The following impact devices are currently available:

- **Dyna D**
  Standard impact device for most materials
- **Dyna G**
  Impact device for solid test objects, e.g. castings, forgings
- **Dyna E**
  Impact device for the hardness ränge over 650 HV



⚠ **Attention:**

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

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

If you are measuring test objects with curved surfaces, you can use different test attachments - for radii ranging from 10 to 30 mm each - in order to improve the positioning of the impact devices Dyna D and Dyna E:

- **Dyna 41** Test attachment set for cylindrical and hollow-cylindrical surfaces
- **Dyna 42** Test attachment set for spherical and hollow-spherical surfaces

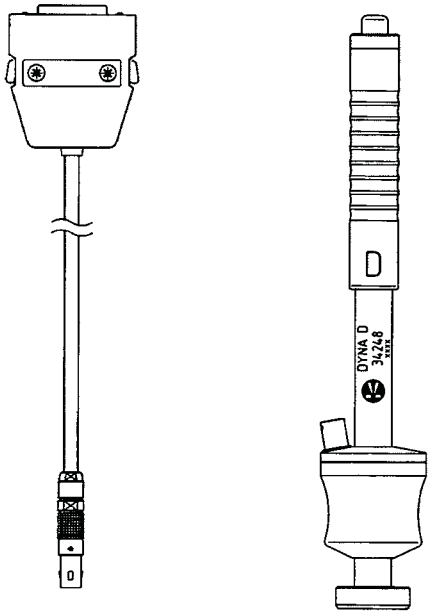
⚠ **Attention:**

When using attachments with the diameters R 10-15 and R 14,5-30 please note the following in order to load the impact device: Do not tension the impact device by pressing the loading tube "in the air" but by pressing it against your finger for example or by placing the impact device on the surface of the test object.

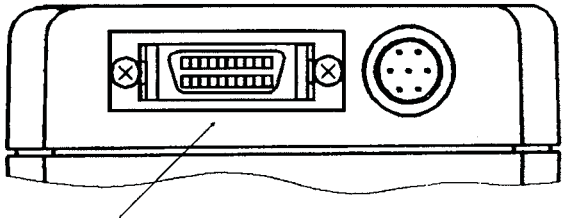
Make certain that you position the impact device at another point when intending to measure (surface hardening).

The DynaMIC is switched off.

– Connect the cable to the impact device socket by observing the red markers.



– Srew on the suitable test attachment if necessary, e.g. when measuring curved surfaces.
– Connect the plug of the impact device to the connector socket on the DynaMIC.



Connector socket
for the impact device

– Switch on the instrument.

The DynaMIC is now ready for operation.

Note:

Always switch off the DynaMIC when plugging-in or replacing the impact device.

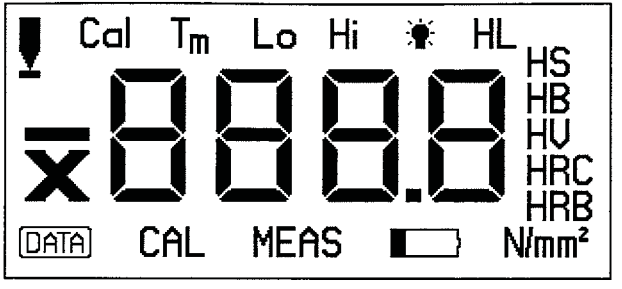
You will find all key functions (e.g. switching on and off) in chapter 4.2.

Basics of operation 4

It is absolutely necessary that you read through the following chapter before working with the DynaMIC. It contains information about:

- display
- keypad
- operational concept with the operating steps which you will need time after time
- using the impact device

4.1 Display



The display consists of the following fields:

Measured value display

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

Hardness scales

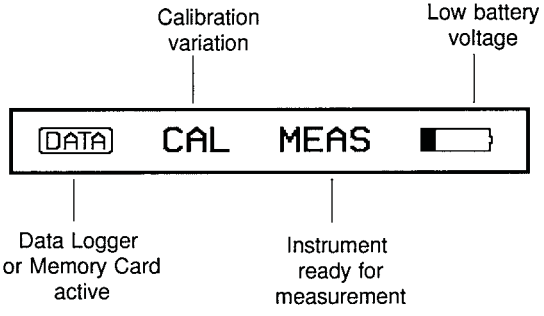
The hardness scales to be selected are displayed to the right of the measured value.

HL
HS
HB
HV
HRC
HRB
N/mm2

HL	Leeb
HS	Shore
HB	Brinell
HV	Vickers
HRC	Rockwell C
HRB	Rockwell B
N/mm²	Tensile strength

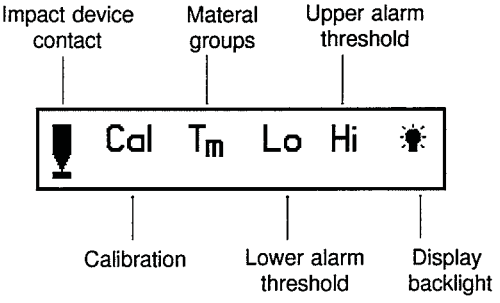
Status displays

The current status of the DynaMIC is displayed in the field below the measured value:



Display of settings

The currently active settings of the DynaMIC are displayed in the field above the measured value:



On the left next to the measurement value:

Average reading

Note:

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

4.2 Keys

The following table gives a general survey of keypad operation of the DynaMIC. However, you should also read the description of the individual operation steps in Chapter 5.

Key	Description
MODE	Turn on DynaMIC / Select next level or next program step
▲	Set (increase) values / Selection between display of single reading and average reading
▼	Set (decrease) values / Selection of required hardness scale
C	Delete readings and settings/ Delete error messages / Reset function to default setting
EXIT	Close measurement set / Store measurement set (Version DynaMIC DL)/ Return to MEASUREMENT level
FILE MEM	Access to active measurement set / Only DynaMIC DL: Access to stored measurement sets / Printout of data / Transfer of data to the PC
MODE + EXIT	Turn off DynaMIC
C + MODE	Configure DynaMIC

4.3 Operational concept

Note:

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

The MEASUREMENT level

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

This status is indicated by "MEAS" on the display. The measured value is immediately displayed after a measurement has been made.

Keys ▲ and ▼ in the MEASUREMENT level

In this level, you can alternately switch between indication of the measured single value and the current arithmetic mean ($\overline{X}$ before the reading) with ▲.

Use ▼ to select the required hardness scale (displayed to the right of the reading).

Changing between levels

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

– by pressing EXIT

– by simply carrying out a measurement.

SET level

A number of sublevels are used for setting instrument parameters:

- calibration
- calibration value
- material groups
- lower (Lo) alarm threshold
- upper (Hi) alarm threshold
- display backlight

You can select these individual functions one by one with MODE.

Keys ▲ and ▼ in the SET level

In these functions you are able to change the settings with ▲▼.

Variation of settings

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

Variation by 1 step

– Shortly press ▲ or ▼.
  The setting is increased or decreased by 1.

Accelerated or decelerated setting

– Keep ▲ or ▼ pressed.
  The setting is accelerated.
– If, during the accelerated setting, the opposite 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 opposite arrow key, the setting will be accelerated again.

Setting over a large range

If you have to bridge large ranges, you can also change the setting in large steps.

– Keep ▲ or ▼ pressed and simultaneously press MODE.

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 C.

Note:

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

Function blocking

In order to increase the operational reliability of the DynaMIC, you can switch off certain functions or inhibit their variability if you do not usually require them for your measurements:

Switching off

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

Inhibit variation of

- calibration

- material groups
- upper (Hi) and lower (Lo) alarm threshold

Please refer to Chapter 6 *Configuration* for operation of this blocking function.

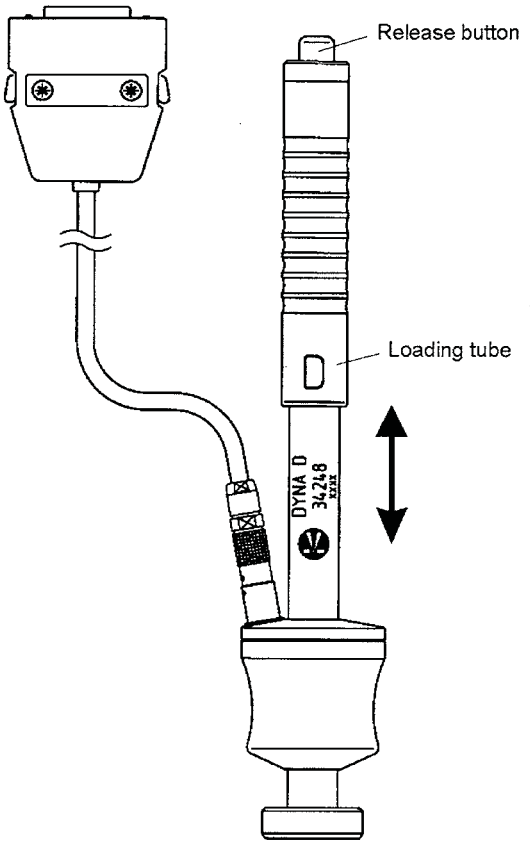
4.4 Handling the impact device

Make sure that you are using the suitable impact device with the appropriate test attachment for your application (please also refer to chapter 3.2).

⚠ **Attention:**

The impact device Dyna G may only be used up to a test material hardness of max. 650 HB. Otherwise the impact device may be destroyed.

– Turn on the DynaMIC with MODE.
– Load the impact device by pushing the loading tube all the way through to the limit stop and by moving it then slowly back to the start position again.
– Place the impact device vertically onto the test surface an press it slightly against the surface with one hand.
– Press the release button on top of the impact device with the index finger of your other hand.



As soon as the impact body touches the test surface, the contact symbol appears on the display:

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

The impact device can be lifted off. Please do not load the impact device at the actual test position but at another point (e.g. table or another position on the test object). Having done this, place the impact device at the measurement position for a further measurement.

⚠ Attention:

Do not place the impact body twice at the same test position, otherwise measurement errors may occur due to surface hardening. The distance between the test positions should be at least 3 mm.

Attachments Dyna 41 and Dyna 42

The attachements Dyna 41 and Dyna 42 enable better positioning of the impact devices Dyna D and Dyna E on curved surfaces. The test attachments have a special geometry due to the direction independance of

the DynaMIC. When using attachments for cylindrical surfaces R10-15 and R14.5-30 as well as for spherical surfaces R10-15 and R14.5 -30 please note the following:

Do not tension the impact device by pressing the loading tube "in the air" but by pressing against your finger for example or by placing the impact device on the surface of the test object. Make certain that you position the impact device at another point when intending to measure (surface hardening).

This applies only to the attachments with the above diameters.

Operation 5

5.1 Hardness measurement

The following chapter tells you how to make hardness measurements with the DynaMIC and informs you about the major adjustments that you can carry out.

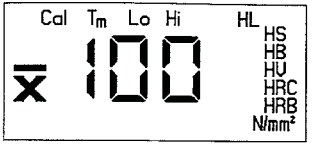
If you wish to carry out measurements on low-alloy or unalloyed steels, there is no need to adjust the instrument because the DynaMIC is adjusted to this material group as default setting.

However, you must select the corresponding material group in each case or carry out an instrument calibration if you wish to measure high-alloy steels or materials such as non-ferrous metals. In this respect, please refer to Measuring other materials, page 5-15. The actual measurement and adjustment (hardness scale, alarm thresholds) processes are basically the same in both cases.

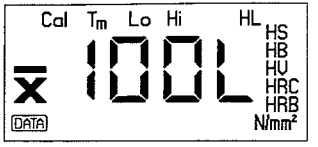
Turning on the instrument and reading off the software version number

– You can turn the DynaMIC on with MODE.

The DynaMIC automatically carries out a system self-check. The following is then displayed for about 2 seconds:



Basic 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.: 01.0**1.00** (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, this will be indicated by an error code in the display. You will find a breakdown of error codes in Chapter 9.2 Troubleshooting.

If an impact device is connected, the DynaMIC will subsequently display for about 1.5 seconds the total number of measurements carried out using this impact device, for example:

This display always gives you an overview of the status of the corresponding impact device. You can read more about this in Chapter 8. Maintenance and Servicing.

Note:

You can reset this display to 0 by:

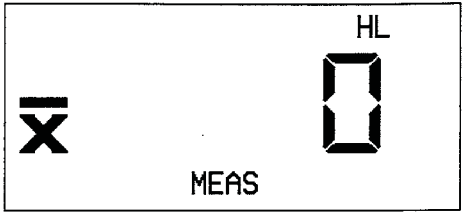
– pressing [C] while the total number is being displayed.

The display flashes.

– Press [C] one more time.

The counter is reset to 0.

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



This status of the instrument is indicated by **MEAS** on the display.

If there is no impact device connected, the contact symbol on the left of the display will flash:

Note:

If the Data Logger version is being used and the Data Logger is activated or a Memory Card is inserted, this is indicated by the following status symbol in the display:

DATA

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 DynaMIC, all instrument settings will automatically be loaded from there into the instrument. Please refer to page 5-30.

Turning off the instrument

You can turn off the DynaMIC using a key combination.

– Simultaneously press MODE and EXIT.

The set function values are saved.

Automatic instrument switch-off

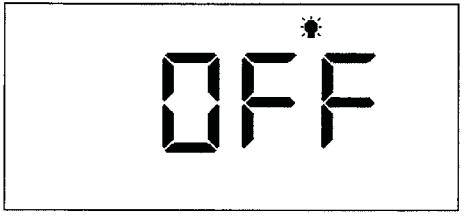
The DynaMIC will automatically switch off after 3 minutes of non-operation, i.e. no measurements or settings have been carried out.

This saves energy and increases the service life by avoiding unnecessary current consumption.

Setting the display backlight

You can set the display backlight.

– Press MODE until the following indication is displayed:



– You can switch on the display backlight using ▲ or ▼.

– Press MODE or EXIT if you wish to return to the **MEASUREMENT** level.

The display backlight is automatically switched off after a certain period of time if you have not carried out any measurements or adjustments. You can determine this period of time yourself (5 to 60 seconds). Please refer to Chapter 6 *Configuration.*

Note:

The operating time decreases when the display backlight is used!

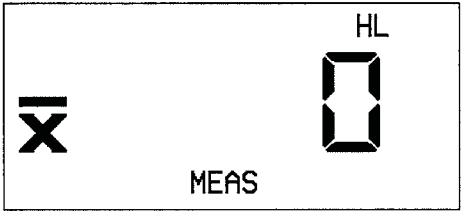
Selecting the measured value display

In your measurements you can select between the display of single readings or the display of the current arithmetic mean calculated from continuous readings. You can change the display at any time, even during the measurement.

– Select the **MEASUREMENT** level.

– Use ▲ to switch between the two alternatives.

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



Selecting the hardness scale

The default scale for the display of measurement results is **HL** (Leeb hardness corresponding to the rebound method).

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

- **HS** Shore
- **HB** Brinell
- **HV** Vickers
- **HRC** Rockwell C
- **HRB** Rockwell B
- **N/mm²** Tensile strength

– Select the **MEASUREMENT** level.

The currently active hardness scale (e.g. HL) is displayed behind the measured value.

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

– Press ▼.

The newly selected hardness scale is indicated in the display.

You can select another hardness scale also during the measurement process. The displayed reading is then converted; the set alarm thresholds (see following page) are also converted according to the new hardness scale.

Note:

You will find more information on conversion in Chapter 12.2 *Conversion of hardness values.*

Note:

If the displayed 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 [C] twice in order to delete the reading.

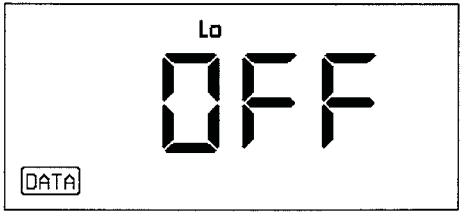
After the hardness scale has been changed, the set thresholds are deactivated if the corresponding range is exceeded.

Setting the alarm thresholds

This function is useful for identifying measured values which exceed or fall below defined limit values. You can set an upper and a lower alarm threshold in order to obtain a visual and acoustic alarm signal whenever these tolerances are exceeded.

Lower alarm threshold

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



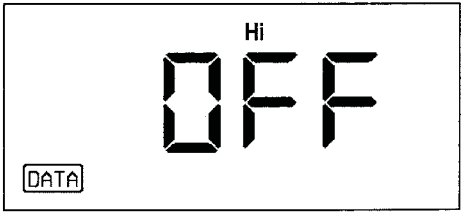
– [▲] [▼] sets the alarm threshold.

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

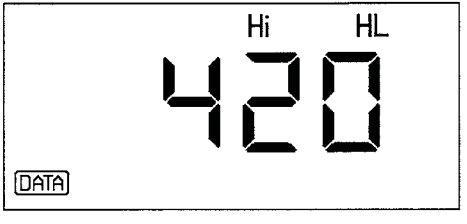
If a measured value falls below the set alarm threshold during the measurement process, a signal tone is given twice and a flashing **LO** symbol will appear on the display.

Upper alarm threshold

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



– Set the upper alarm threshold with ▲ ▼, for example:



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

If a measured value exceeds the set alarm threshold during the measurement process, a signal tone is given twice and a flashing **HI** symbol will appear on the display.

Note:

You can switch the alarm threshold off again by selecting the corresponding function and pressing [C].

Note:

The set alarm thresholds are automatically converted into the corresponding new values when the hardness scale is changed. The alarm thresholds are deactivated if the range is exceeded.

Attention:

It is imperative that the settings of the alarm threshold be checked or readjusted in the following cases:

- if the material group setting has been changed
- if the conversion type (DynaMIC, ASTM E 140, DIN 50 150) has been changed
- if the impact device has been changed.

Carrying out the measurement

You can make measurements on low-alloy or unalloyed steels directly with the default setting of the instrument - i.e. without selecting another material group - because the material groups are preset to low-alloy or unalloyed steels.

- Make sure that the impact device is connected to the DynaMIC.
- Turn on the instrument.
- When the instrument is already turned on, you are able to carry out the measurement from any function without having to select the **MEASUREMENT** level beforehand.
- Select the required measured value display (single reading or average reading) and the hardness scale, and set the alarm thresholds if necessary.
- Push the loading tube of the impact device all the way through to the limit stop and place the impact device vertically onto the test material.
- Press the release button.

The tip of the impact body is impelled against the material surface and rebounds from there. The contact signal on the display shows the moment of impact.

An acoustic signal indicates the end of the measurement.

The measured hardness value is displayed.

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

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

⚠ **Attention:**

In this connection, please make sure that you do not place the impact device twice at the same test position, otherwise measurement errors may occur due to surface hardening. The distance between the test positions should be at least 3 mm.

Moreover, do not load the impact device at the actual test position but at another point (e.g. or another position on the test object).

- Using ▲ you can alternately switch between single reading or average reading.
- You can close a measurement set by pressing EXIT.

If you are working with the DL version of the DynaMIC and if the Data Logger is activated, the measurement

set is now stored and the number of the measurement set is displayed (please refer to Chapter 5.2 Data Storage).

– Press [EXIT] to return to the **MEASUREMENT** level or carry out a new measurement straight away.

Deleting the last measured value

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

– Press [C].

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

– Press [C] again.

The reading is deleted. At the same time, the average is automatically recalculated. This is displayed if you have selected the display mode Average.

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

Note:

As long as the display is flashing, you can still abort the delete process by

– simply carrying out a further measurement or

– pressing [EXIT] to close the measurement set.

Viewing the last average reading

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

Due to the fact that the last settings are always saved in the instrument, the average reading is also saved within the scope of the calibration setting.

– Press [MODE].

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

Viewing measurement set and deleting any reading

You can view the active measurement set during the measurement. However, this only applies if you have not yet closed the set with EXIT.

Note:

With the DL version of the DynaMIC you have access to measurement sets already stored. Please read Chapter 5.2 *Data storage*.

The display shows single readings as well as their total number, readings exceeding the threshold, absolute relative standard deviation and the current average reading. You have the possibility to directly select and to delete a single reading. The average and standard deviation is then recalculated.

The basic procedure

You obtain this function via FILE MEM; select all the individual steps one by one in the order described below using MODE. If you wish to abort the function and to continue your measurement, press EXIT or simply carry out another measurement.

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

MEAS

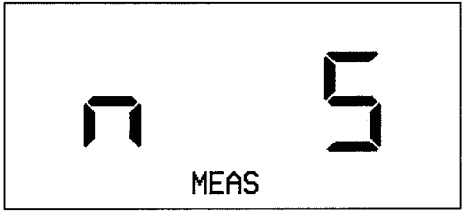
Viewing the readings

– Press FILE MEM.

Note:

If DynaMIC DL is used and data storage is active, the current file number is displayed at this point. Press the MODE-key.

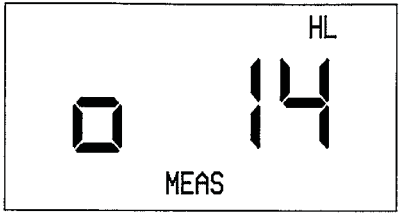
The previous number of readings appears on the display:



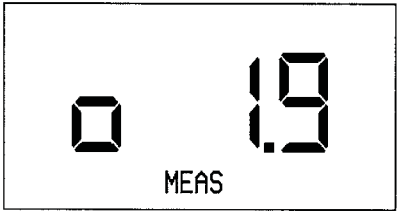
Example: 5 previous readings

– Press MODE.

The current absolute standard deviation appears on the display:



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

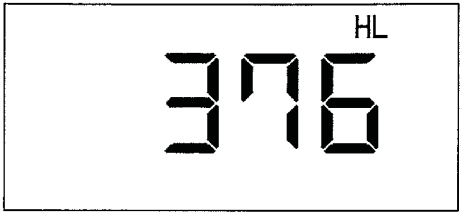


Using ▲ or ▼ you can toggle between both displays:

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

– Press MODE.

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



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

– You can scroll through the measurement set with ▲▼:
  Using ▼ you are able to recall the 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, their violation by the recalled reading will be indicated by a flashing **LO** or **HI** symbol.

Deleting readings

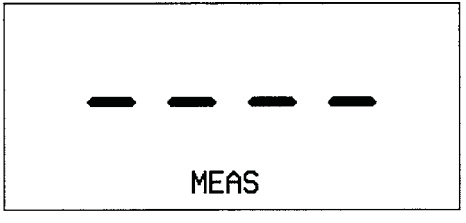
You can delete any displayed reading. The average will then be recalculated.

– When the display shows the reading that you wish to delete, press [C].

The displayed reading flashes.

– If you press [C] once again, the reading is deleted.

This is indicated on the display as follows:

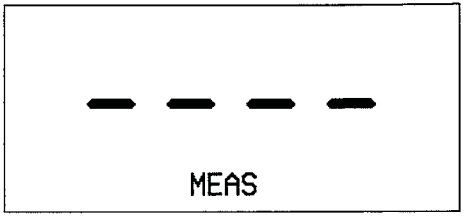


After this, the next reading of the measurement set is displayed.

Cancelling a deletion

You can retrieve the deleted reading.

– Scroll through the measurement set with [▲][▼] until the indication for the deleted reading reappears on the display:



– Press [C].

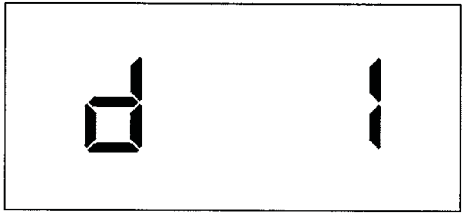
The deleted reading appears on the display and flashes.

– Press [C] once again.

The reading is now retrieved.

Direct selection of a reading from the measurement set

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



– Use ▲▼ to select the index of the reading that you wish to be displayed.

– Then press MODE.

The selected reading appears.

– Press MODE again.

The index of the reading that was last selected reappears.

Displaying the average reading

– If you press MODE again, the current average reading of the measurement set will appear.

If you wish to view the measurement set once again:

– Press MODE.

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

If you wish to exit the function:

– Press EXIT or simply continue with your measurement.

Measuring other material

If you wish to carry out measurements on high-alloy steels or other materials, e.g. nonferrous metals, then you must adjust the DynaMIC to the required material.

To do this, select the suitable material group from the 9 available ones in the DynaMIC (please refer to the overview opposite). For precision measurements, you must then carry out a calibration for accurate adjustment.

For calibration you will need a test piece made of the same material having a known hardness. In the course of the calibration process, you determine the calibration value which you will need for further measurements on this specific 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.

Selecting a material group

The following 9 material groups are available (dependent from the used impact device, refer also to page 12-5) :

No.	Material group	Impact dev.
1	Low-alloy/unalloyed steel and cast steel	D E G
2	Tool steel	D E
3	Corrosion-resistant steel	D
4	Gray cast iron	D G
5	Spheroidal graphite cast iron	D G
6	Aluminium cast alloys	D
7	Brass	D
8	Bronze	D
9	Copper wrought alloys	D

Note:

For material group 1 you can also make the conversion according to DIN 50 150 or ASTM E 140.

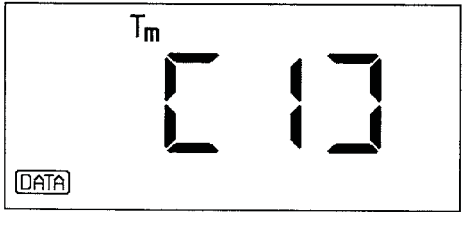
Please refer to chapter 6, page 6-5, on this. For more information on conversions, please read chapter 12.2 *Conversion of hardness values.*

Note:

With numbers 10-14 you are able to allocate your own material groups. Refer to chapter 12.5.

First you have to select the suitable material group from the available ones:

– Press the MODE key to go to the **Set** level and to obtain the function **material groups** there (indicated by T_m):

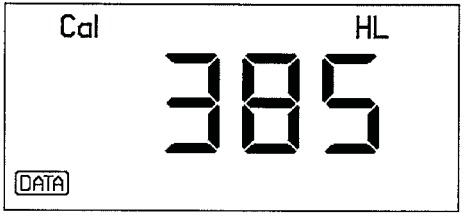


– Select the required number with ▲▼.

– Press EXIT to return to the **Measurement** level.

– 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 MODE in order to go to the **Set** level and then select the function **Calibration** (indicated by **Cal**):



Note:

With the DL version of the DynaMIC (if the Data Logger is active) the measurement set is stored at first after pressing MODE. After that, the above display appears.

The current average of your measurements will be displayed.

However, this value does not correspond to the known, real hardness value of the material because you have not yet calibrated the instrument.

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

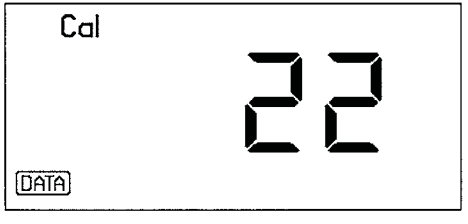
– With ▲▼ you can increase or decrease the displayed value (please refer to Chapter 4, page 4-6, *Accelerated Setting*).

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

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

– Press MODE.

The calibration value is displayed:



– Note down this calibration value.

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

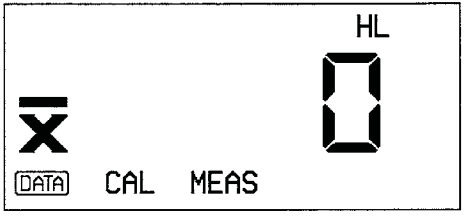
⚠ **Attention:**

The calibration value only applies to the selected material group.

Note:

The Memory Card makes the recalibration with the DL version of the DynaMIC considerably easier. All calibration and adjustment parameters can be stored on a Memory Card and loaded at any later time by inserting this card (please refer to page 5-29).

The calibration variation is indicated by the status symbol **CAL** in the measurement mode:



The calibration is saved when the instrument is turned off.

After you have adjusted the DynaMIC to the material

to be measured, you can carry out the measurement as described above.

Restoring the calibration

If you wish to reset the calibration parameters to the measurement on low-alloy steels after having calibrated to another material, proceed as follows:

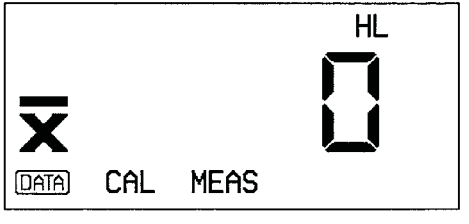
- Press MODE until the calibration value is displayed.
- Press C to reset the calibration value to 0.
- Press MODE once again and select material group 1 in the function T_m.
- Press EXIT if you wish to return to the **MEASUREMENT** level, or simply carry out a measurement.

The instrument is now calibrated back to standard measurement; the satus symbol **CAL** is no longer displayed.

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

- Press MODE until the calibration value is displayed.
- Enter the known calibration value with ▲▼.
- Select the corresponding material group, e.g. [2]. Note that the material groups are not completely available for all impact devices (refer to page 5-15).

The calibration variation is correspondingly displayed in the **MEASUREMENT** level by **CAL**.



5.2 Data storage (only DynaMIC DL)

The DynaMIC DL has a Data Logger which enables you to directly store measured values and settings in the instrument.

The stored data of a measurement set can be

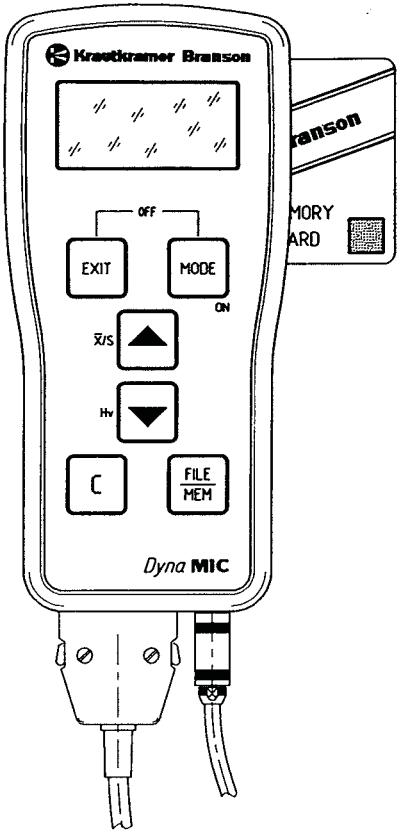
- viewed on the display
- deleted
- printed out via a printer
- transferred to a PC with special software.

Apart from this, Memory Cards offer you 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 additional possibility to

- load instrument settings back into the DynaMIC without having to carry out recalibration for repetitive tests.

Note:

The possibilities of printing out stored data and of transferring them to a PC are described in Chapter 7 *Documentation.*

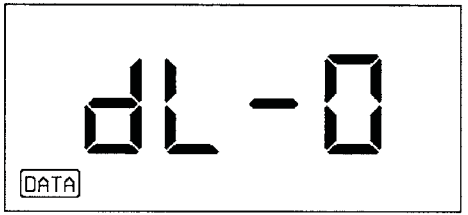


Switching on the Data Logger

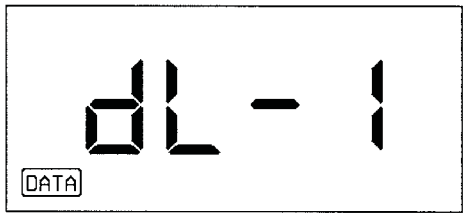
In the default setting of the DynaMIC DL the Data Logger is switched off. In order to store data in the Data Logger you must first activate it.

– Press FILE MEM

You will see the following display:

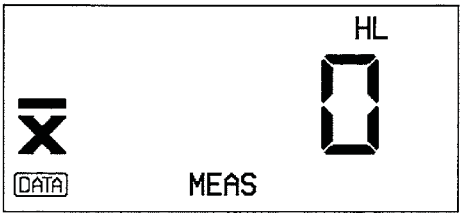


– With ▲ or ▼ you can change the setting:



– Press EXIT to go back to **MEASUREMENT** level, or simply carry out a measurement.

The Data Logger is now activated. This setting is saved even after the instrument has been switched off. You can recognize that the Data Logger is activated by the status indication **DATA** in the measurement mode:



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

– Press FILE MEM and with ▲ ▼ set **dL-0** again.

Note:

The DynaMIC DL needs not be activated when working with the Memory Card. Simply insert the Memory Card.

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

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

With the DynaMIC DL you can carry out several measurements within one measurement set and store them.

– Make sure that the Data Logger is active.

If you wish to work with the Memory Card:

– insert it into the slot until it latches.

The DynaMIC DL automatically stores the data onto the Memory Card. The instrument only accesses the internal Data Logger if it does not detect any Memory Card.

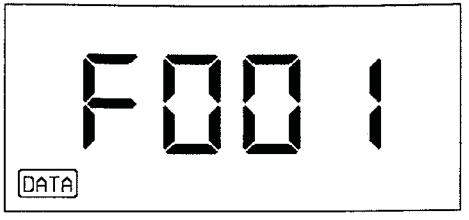
⚠ Attention:

Never use a Memory Card written by the DynaMIC when working with the MIC 10 (up to software version 01.01.05). The data are overwritten without any warning. Please also refer to page 5-31 on this.

– Carry out your measurements.

– On completion of the measurement set press EXIT.

The measurement set, including the instrument settings, is stored in a file. The number of the measurement set will appear on the display, for example:



The DynaMIC DL always stores the data to the next free memory location.

You can store 255 measurements in a measurement set. The Data Logger has storage capacity for up to 1,350 measurements and the Memory Card for up to 590 measurements (with an average number of 10 readings per measurement set).

Note:

Before data are stored, the DynaMIC DL automatically checks the memory capacity. An error message will appear if there is insufficient memory capacity. Please refer to Chapter 9.2 *Troubleshooting.*

⚠ Attention:

Do not remove the Memory Card whilst you have access to data. The card could be damaged by this.

Viewing a measurement set and deleting single readings

You can have the stored data of a measurement set displayed. The following data are displayed:

- Average reading
- Number of single readings
- Single readings
- Index via which you are able to select a certain single reading
- Standard deviation, absolute and relative
- Range, absolute and relative
- Calibration value
- Material group
- Lower alarm threshold (LO)
- Upper alarm threshold (HI)
- Impact device

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

Basic procedure

You have access to the stored measurement sets via FILE MEM. You can consecutively select individual data of the stored measurement set with MODE.

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

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

Selecting a measurement set

– Press FILE MEM.

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

– Press MODE.

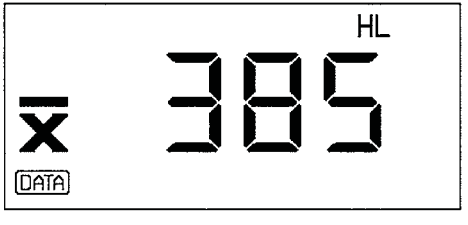
The number of the measurement set that was last stored will appear:

– With ▲ ▼ select the measurement set that you would like to view.

Displaying the average reading

– Press MODE again.

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



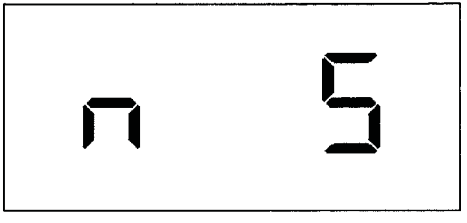
– The hardness scale can be changed with ▼. The new hardness scale is stored.

– With C you can reset the hardness scale back to the original setting.

Viewing single readings

– Press MODE again.

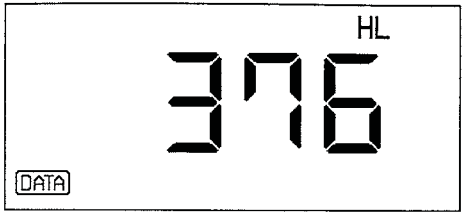
The indication for the number of measurements stored in the measurement set appears on the display:



Example: 5 single readings within a measurement set

– Press MODE again.

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



– With ▲ and ▼ you can view all the readings of the measurement set:
▲ shows the next reading in the storage sequence. As soon as you reach the last reading of the measurement set, a signal tone will sound.
With ▼ you can select the readings in the opposite direction until you are back at the first measured value.

If alarm thresholds were set during the measurement, their violations are displayed with the corresponding reading (**Lo** or **Hi** at the top of the display).

Deleting single readings

You can delete a displayed reading. The average is then recalculated.

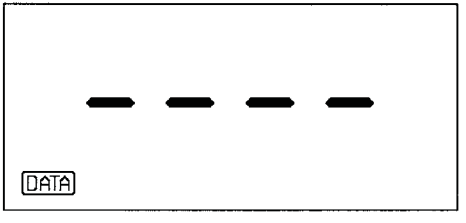
– Press C.

The displayed reading flashes.

– Press C again.

The reading is deleted.

This is indicated by the following display:

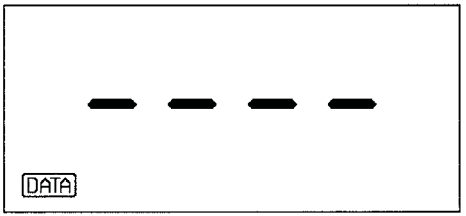


After this, the next reading of the measurement set is displayed.

Cancelling a deletion

You can retrieve the deleted reading.

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



– Press C.

The deleted reading appears on the display and flashes.

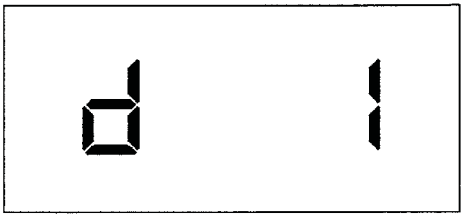
– Press C again.

The reading is now retrieved.

Direct selection of a reading from the measurement set

– Press MODE again.

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



– With ▲▼ select the index of the reading that you wish to display.

– Press MODE.

The selected reading appears.

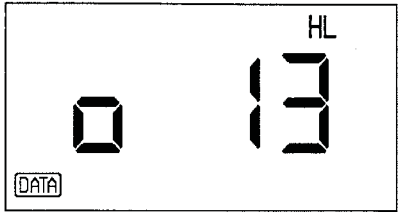
– Press MODE one more time.

The index of the reading selected last will again appear.

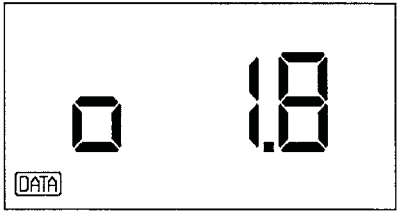
Displaying the standard deviation

– Press MODE again.

The absolute standard deviation is displayed:



– If you press ▲ or ▼, the relative standard deviation is displayed in percent:

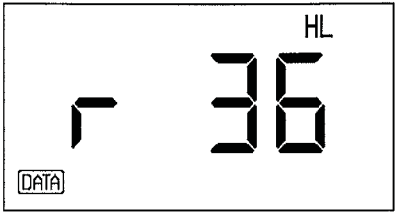


– Using ▲ or ▼ you can switch between both displays.

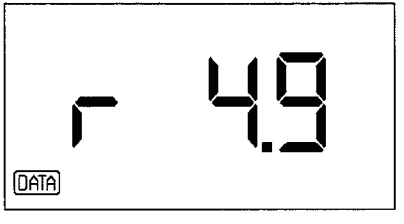
Displaying the range

– Press MODE 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.

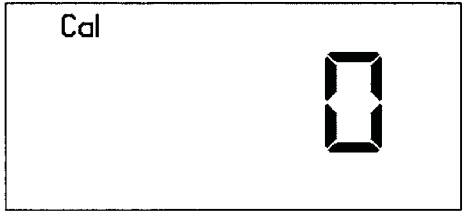
Information about standard deviation and range can be found in chapter 12.4.

Viewing the instrument settings

In the following steps of this function, the instrument settings applicable to the measurement are displayed.

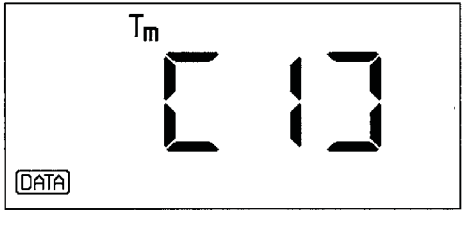
– Press MODE.

The calibration value is displayed e.g. for the unchanged, preset calibration to unalloyed and low-alloy steel:



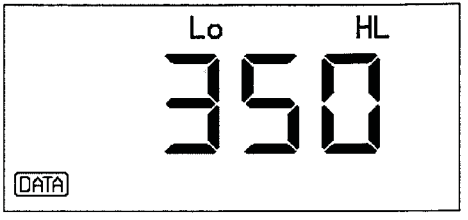
– Press MODE.

The set material group is displayed.



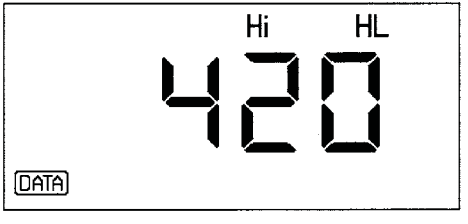
– Press MODE.

The lower alarm threshold is displayed, e.g.



– Press MODE.

The upper alarm threshold is displayed, e.g.



– Press MODE.

The impact device used for the measurement is displayed:

- Impact device Dyna D

– If you now press [MODE], the next file is displayed and you can view the corresponding data:

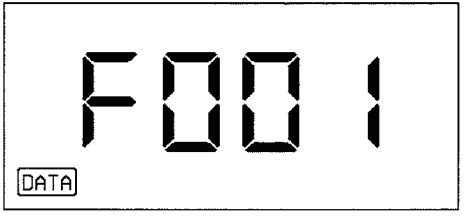
– If you wish to return to the **MEASUREMENT** level, press [EXIT] or simply carry out another measurement.

Deleting a stored measurement set

– Close your currently active measurement set if required.

– Press [FILE MEM] and then [MODE].

– Select with [▲][▼] the number of the measurement set that you wish to delete, e.g.:



– Press [C].

The display flashes.

– Press [C] again.

All data of the selected measurement set are deleted.

Note:

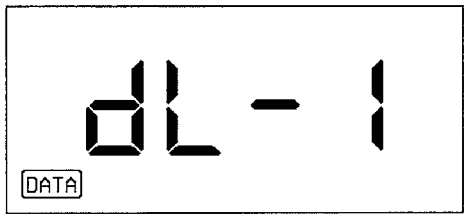
As long as the display flashes, you can still abort the delete process by pressing the [MODE] key.

Deleting the whole memory

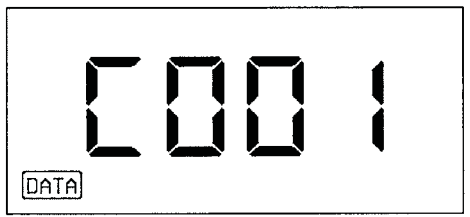
– If necessary, close your currently active measurement set.

– Press [FILE MEM].

With an active Data Logger the following display appears:



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



– Press [MODE] and subsequently the [▼]-key until the following appears on the display:

– Press [C].

The display flashes.

– Press [C] again.

⚠ **Attention:**

All stored data are deleted.

Note:

As long as the display flashes, you can still abort the delete process by pressing the [MODE] key.

Changing the number of the Memory Card

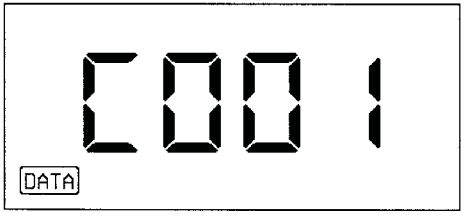
The Memory Card has an identification number which also appears in the report printout (please refer to Chapter 7.1, page 7-6).

You can change this number in order to identify different Memory Cards. To do this, the Memory Card must be empty. You must first delete any data stored on the card in order to be able to change the number.

– Insert the **empty** Memory Card into the card slot.

– Press FILE MEM.

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



– Change the number of the Memory Card using ▲▼.

The card is marked with the new number when you return to the measurement mode.

Using the Memory Card as a Parameter Card

You can use the Memory Card for instrument calibration. To do this, you require an **empty** Memory Card where 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 DynaMIC, 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.

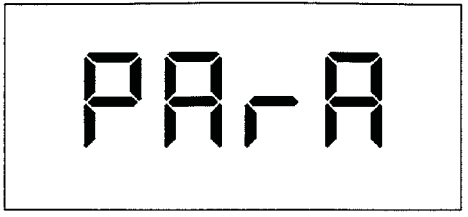
Storing parameters

– Make your instrument settings, e.g. calibration to another material, threshold and material group selection.

– Insert an **empty** Memory Card into the DynaMIC.

– Press FILE MEM. You must still be in the **SET** level during this.

The following indication flashes on the display:



– Press FILE MEM.

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

– Note down the necessary information on your stored settings.

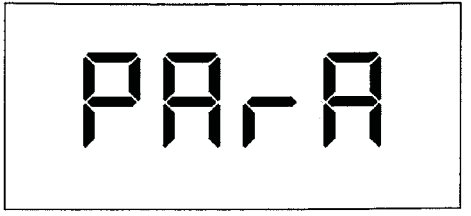
Loading parameters

The stored settings on a Parameter Card can be loaded back into the DynaMIC at any time.

– Close your active measurement set if you want to save its data.

– Simply insert the Parameter Card into the DynaMIC.

The following display appears:



The instrument loads the stored settings.

⚠ **Attention:**

The moment the Parameter Card is inserted, the current measurement is terminated and the currently active instrument settings are overwritten. The instrument does not prompt for any confirmation to make sure you mean it!

You should therefore always close your current measurement set before inserting a Parameter Card if you want to save 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.

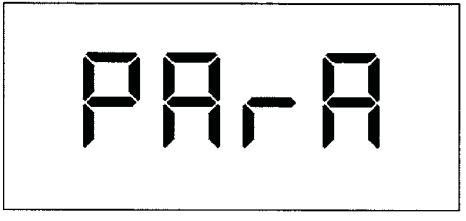
– Close your current measurement set if you want to save the corresponding data.

– Insert the Parameter Card into the DynaMIC.

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

– Press [FILE MEM].

The following display appears:



– Press [C].

The display flashes.

– Press [C] once more.

All stored parameters are deleted. The DynaMIC 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

DynaMIC and MIC 10 up to software version 01.01.05

⚠ **Attention:**

If you use a Memory Card that has been written by the DynaMIC when working with a MIC 10 up to software version 01.01.05, the stored data are overwritten without any warning. Please do not therefore interchange the Memory or Parameter Cards in this case! Use the labeling field provided on the card to make a distinction between the instruments.

DynaMIC and MIC 10 as a software version 01.01.06

You can use the 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 [C] key.

The display flashes.

– Press the [C] key one more time.

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

Configuration 6

The DynaMIC offers you various possibilities of instrument configuration using a special mode. It enables you to compile the function range for the instrument according to your individual requirements. You can

- select the language for the report printout
- select the format of the report printout
- inhibit individual hardness scales
- inhibit calibration variation possibility
- inhibit the variation possibility for material groups
- inhibit the possibility to set alarm thresholds
- adjust the display backlight period
- inhibit the function Data Logger or Memory Card.

Basic procedure

– Select the **Configuration** level by simultaneously pressing [C] and [MODE] when the instrument is turned off.

– Select the different functions one by one in the Configuration level with [MODE].

– Carry out the function settings with [▲][▼].

– You can reset each function back to the setting that was stored last by pressing [C].

You can exit the Configuration level from any function and return to the **MEASUREMENT** level by pressing [EXIT].

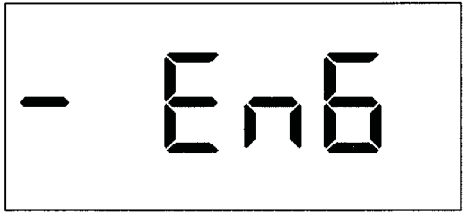
The instrument is automatically switched off after 3 minutes if no key is pressed.

While you are in the configuration level, a minus sign flashes in the display.

Selecting the language for report printout (only for DynaMIC DL)

You can select the language in which the stored data are to be printed out.

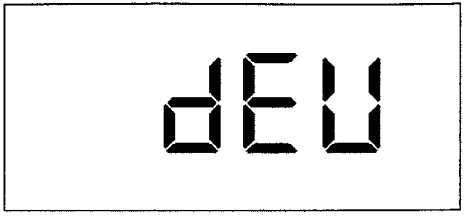
After you have switched on the configuration mode, this function will be the first to appear in the display:



You have the following choices:

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

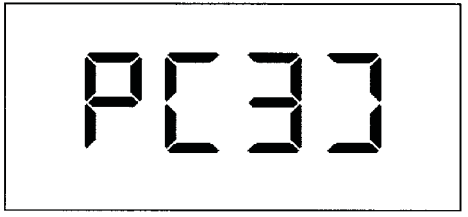
– ▲▼ selects the required language, for example:



Selecting the report format (only for DynaMIC DL)

You can print out the stored data in six different formats. For more details, please read Chapter 7, *Documentation*.

– Press MODE until the following display appears:

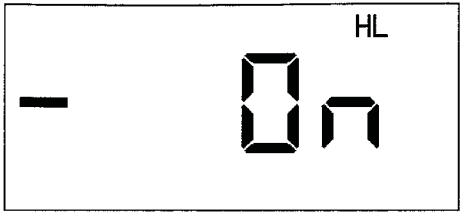


– Using ▲▼ select one of the report formats (1 to 6).

Inhibiting hardness scales

You can switch off the individual hardness scales.

– Press MODE 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 the hardness scales**HS**, **HRC** and **HRB:**

- OFF
- 0.1
- 0.5
- 1

Note:

One hardness scale must of course always remain switched on. If you switch **OFF** all hardness scales, the DynaMIC will automatically switch the HL scale **ON** again.

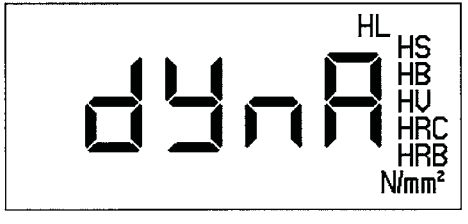
Selecting the type of conversion

The DynaMIC offers the following conversion possibilities for hardness values:

- DynaMIC-specific (basic setting)
- DIN 50 150
- ASTM E 140

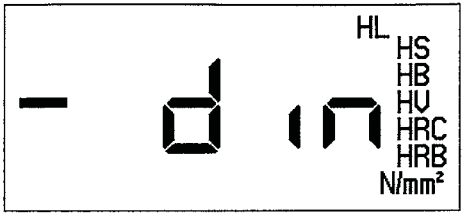
The conversions according to DIN 50 150 and ASTM E 140 only apply to the materal group 1 (low-alloy/plain steel). Please also refer to the overview of the conversion ranges in chapter 12.2 on this.

– Press the MODE key until the following display appears:

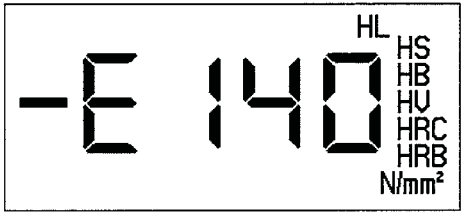


– Use ▲▼ to select one of the other conversion possibilites:

DIN 50 150:



or ASTM E 140:

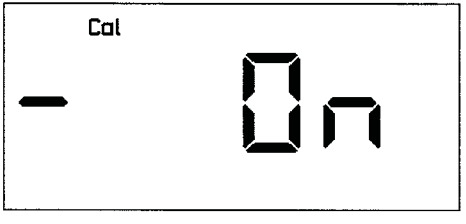


Inhibiting calibration variation

You can inhibit the possibility for calibration variations. This is especially useful whenever

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

– Press MODE until the following display appears:



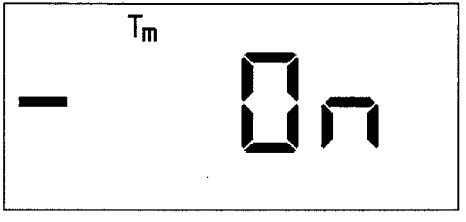
– ▲▼ switches the function **OFF**.

The calibration can now no longer be changed.

Inhibiting the variation of material groups

You are able to inhibit the possibility to change the material group setting.

– Press MODE until the following display appears:



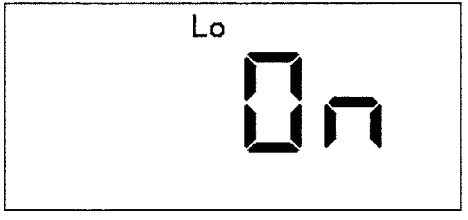
– Using ▲▼ you can switch the function **OFF**.

The material group can now no longer be changed.

Inhibiting alarm thresholds

You can inhibit the possibility to set the upper (Hi) and lower (Lo) alarm threshold.

– Press MODE until the required display appears, e.g. for the lower (Lo) alarm threshold:



– Using ▲▼ you can switch the function **OFF**.

The lower alarm threshold can now no longer be changed.

Adjusting the time period for the display backlight

You can select the period of time after which the display backlight is switched off if the instrument is not used. A time setting from 5 to 60 seconds is possible. You can also set a permanent backlight.
The display backlight is activated and deactivated in the **SET** level (please refer to Chapter 5.1, page 5-4).

Note:

Operation with the backlight reduces the life of the batteries!

– Press MODE until the following display appears:

– Using ▲▼ set the required time.

– Using C you can set the function to **ON**.

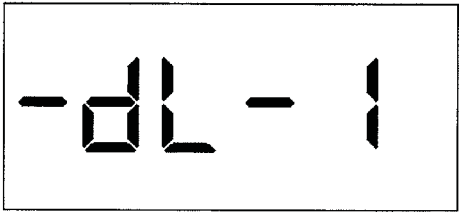
This sets the permanent display backlight, which

means that it is no longer automatically switched off after a certain period of time.

Switching off the Data Logger (only DynaMIC DL)

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

– Press MODE until the following display appears:

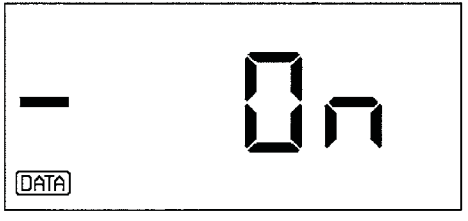


– You can switch off the Data Logger with ▲▼.

Switching off the Memory Card (only DynaMIC DL)

You can switch off the possibility to use the Memory Card if you do not need it.

– Press MODE until the following display appears:



– Using ▲▼ you can switch off the Memory Card option.

Note:

You can use Data Logger and Memory Card independently of each other, which means that you can also switch off only one of the two options.

Documentation (only DynaMIC DL) 7

7.1 Printing data

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

You can either print out all measurement sets, i.e. the complete contents of the Data Logger or a Memory Card, or a single measurement set. You can select different report formats as well as various languages for your printouts.

You require:

- a printer with serial interface RS 232
- a data cable TGDL/PC and an adaptor/gender changer GCH1 to connect the DynaMIC to the printer

Note:

If you want to print out longer measurement sets (more than 1 page), you need a printer with automatic paper feed or tractor-driven feeder because the printout could be interrupted with single-sheet feed.

Preparing the printer

– Connect the printer to the DynaMIC via the serial interface.

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

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

For more information on how to set the transfer parameters, please read the operating manual of your printer.

Printing all measurement sets

– Press FILE MEM.

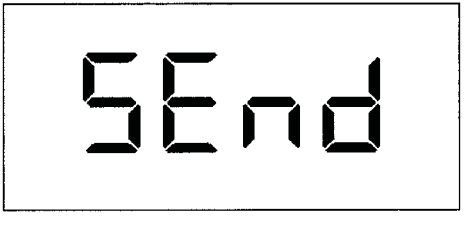
The display for the active Data Logger (dL - 1) or Memory Card (card number) - if inserted - appears.

– If the Data Logger is switched off (dL - 0), you can switch it on with ▲▼.

– Press MODE and then use the ▼-key until **"ALL.F"** appears on the display.

– Press FILE MEM.

The following message appears on the display:



– Press FILE MEM again.

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

The format and language of the printout depend on the presetting made in the configuration level of the DynaMIC (please see following pages).

Printing a single measurement set

– Press FILE MEM.

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), you can switch it on with ▲▼.

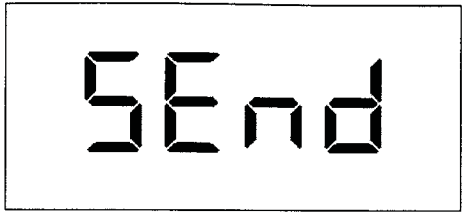
– Press MODE.

The number of the measurement set which was last stored will appear.

– With ▲▼ select the measurement set that you want to print out.

– Press FILE MEM.

The following message is displayed:



– Press FILE MEM once again.

The data of the selected data set are printed.

The format and language of the printout depend on the presetting made in the configuration level of the DynaMIC (please see following pages).

Selecting the report language

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

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

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

Selecting the report format

You can select one of five preset formats in which the report is to be printed out.

The following are differentiated:

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

Single measurement sets can be printed out completely or in the short format, the complete memory as a list with measurement sets in complete or short format. A detailed description of the individual printout formats is given on the following pages.

You can make the setting in the configuration level of the DynaMIC. Proceed as described in Chapter 6 *Configuration*, page 6-4.

You can select the following combinations with the numbers 1 to 6:

	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	

The combination 3 is used as a default setting. This means that you receive a complete printout when you print out single measurement sets, and a list when you print out 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 DynaMIC
- **Date**: field for the entry of date
- **Instrument SN**: DynaMIC serial number
- **Data Source:** Data Logger (DL-1) or Memory Card (number of Memory Card)
- **File #**: Number of the stored measurement set
- Adjustment data:
  Cal Value
  Material (material group)
  Lo Alarm (lower alarm threshold)
  Hi Alarm (upper alarm threshold)
- **Probe SN:** Serial number of the impact device used
- **Probe Type:** Type of the impact device used
- **# of Readings:** Number of readings in the measurement set
- **Avg. Reading**: Arithmetic mean of the measurements in a measurement set
- **Min. Value:** Smallest single value
- **Max. Value**: Greatest single value
- **Range**: Range between minimum and maximum value (absolute and relative)

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

Cal Value       0
Material        2
Lo Alarm      OFF
Hi Alarm      OFF
Probe SN      618
Probe Type      D

# 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   %

Readings
    1          412   HV
    2          424   HV
    3          405   HV

* deleted readings
+ or - out of tolerance
```

- **Standard Dev.:** Standard deviation (absolute and relative)
- **Measurements:**
  List of all single readings
  Readings falling below the lower alarm threshold are marked with "-" and readings exceeding the upper alarm threshold are marked with "+".
- **deleted readings:**
  The single readings deleted from the measurement set are marked with "*". They are not taken into account in the statistical calculation.

Note:

Information about calculation of the average, range and standard deviation 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:

```
-----------------------
   DynaMIC (01.01.00)
-----------------------
Date: __.__.__

Instrument SN  500
Data Source   DL-1
File #        F001

Cal Value        0
Material         2
Probe SN       618
Probe Type       D

# 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 out with the following information:

- Header with software version of the DynaMIC
- Data source
- Measurement set #
- # of single readings
- Average

```
-----------------------
   DynaMIC (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 (signture)
- Date

Hardness testing

Test object:

Order No./Drawing No.

Party ordering:

Material:

Treatment condition:

Remarks:

DynaMIC (01.02.04)
Instrument SN 500
Data source DL-1
File # F001

Cal Value 0
Material 1
Lo Alarm OFF
Hi Alarm OFF
Probe SN 618
Probe type D

# of Readings 4
Avg. Value 597 HV
Min. Value 536 HV
Max. Value 627 HV
Range 91 HV
15.2 %
Standard Dev. 42 HV
7.0 %

Readings

1	536	HV
2	605	HV
3	620	HV
4	627	HV

* deleted readings
\+ or - out of tolerance

( ) Set hardness is met

( ) Set hardness exceeded
( ) Set hardness not reached

Person testing: _____ Date: _____

7.2 Data transfer with the application software UltraDOC

Using the application program UltraDOC from Krautkrämer you are able to transfer stored measurement sets to a PC, edit and further process them there. In addition to this, you can remote control the DynaMIC from a PC with this program.

The program offers a choice of several dialog languages nad has a uniform graphics user interface as well as an internal text editor for various dialog languages. All files can be further processed with commercially available word processing or DTP programs.

You will find more 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
- operating system DOS, version 3.3 or higher, or operating system WINDOWS, version 3.0 or higher
- a data cable TGDL/PC and an adaptor/gender changer GCH1 to connect the DynaMIC to the PC.

Maintenance and servicing 8

8.1 Maintenance

Maintenance of instrument

Clean the instrument and accessories only with a dry cloth.

Attention:

Never use water for cleaning the DynaMIC DL!
The DynaMIC DL is neither waterproof nor protected against moisture (board slot).

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

Maintenance of batteries

Battery capacity and life depend mainly on correct handling. 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 fast battery charger MIC 1090 (refer to Chapter 2.3 *Recommended accessories*). With this charger unit, a charging time of only 1 - 2.5 hours is needed.

Attention:

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

Note:

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

Handling of AlMn batteries

Due to the fact that incorrect handling of batteries can cause damage to the instrument, please observe the following:

- only use leakproof batteries!
- remove the batteries from the instrument if you are not going to use it for a longer period!

Attention:

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

Note:

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

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

8.2 Servicing

DynaMIC

Basically, the instrument does not require any servicing.

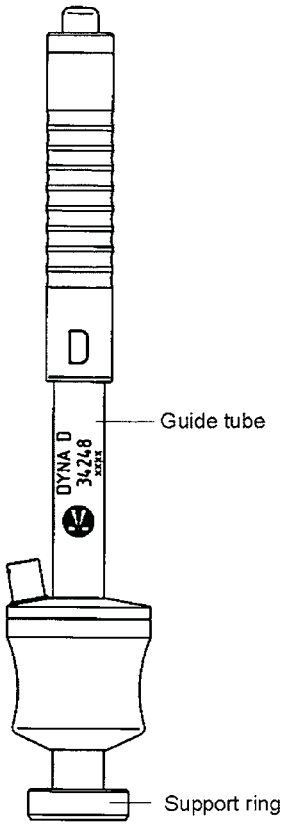
Attention:

Any repair work may only be carried out by authorized Krautkrämer service personnel.

Impact device

The impact device must be cleaned after about 1,000 measurements. The number of measurements carried out is continuously indicated by the DynaMIC (please refer to Chapter 5, page 5-3).

- Unscrew the support ring and remove the impact body from the guide tube.
- Clean the support ring, impact body and probe tip with a dry cloth.
- Clean the guide tube with a cleaning brush (order no. 34 420).



⚠ **Attention:**

Never use oil for cleaning the impact device!

Function check and troubleshooting 9

9.1 Checking the function

Before using the instrument for the first time, and from time to time afterwards (after every 1,000 impacts at the least), check the functioning of impact device and hardness tester by measuring the HL hardness value on the corresponding hardness reference block.

- To do this, carry out 3 to 5 measurements on the hardness reference block. In this connection, make sure that the distance between the measurement positions is at least 6 mm.
- Read off the average and compare it with the nominal value of the hardness reference block.

Minor deviations from the nominal value amounting to ±5 HL can be compensated for by the calibration function (Cal function).

If any larger deviations occur, the spherical tungsten-carbide tip has to be replaced.

9.2 Troubleshooting

After the DynaMIC has been turned on, it runs an automatic system self-check.
In addition to this, the DynaMIC 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 off the instrument.
- Keep both ▲ and ▼ pressed at the same time while turning the instrument on again with MODE.

Attention:

All settings are deleted.
Stored data are saved.

Error code	Cause	Action
E 0.0	Internal error in the EPROM	Restart the instrument. If the error reoccurs, contact Service.
E 0.1	Batterie voltage is too low.	Replace or recharge the 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 impact device	Contact Service.

Error code	Cause	Remedy
E 1.1	Error in handling the impact device during measurement.	Repeat the measurement.
E 1.2	Measurement cannot be evaluated, e.g. when the impact device is not suitable for the material under test.	Repeat measurement. If necessary, use another impact device.
E 2.0	Error when reading the Memory Card (e.g. inserted the wrong way).	Remove the Memory Card and reinsert it again. If the error reoccurs, use another Memory Card.
E 2.1	Memory Card written by MIC 10 (Krautkrämer UCI hardness tester) has been inserted.	If you do not need the data any more, you can delete them. Otherwise, use another Memory Card.
E 2.2	Not enough storage capacity for conversion tables.	Delete one or more of the conversion tables that you don't need any more.
E 2.3	You tried to delete a conversion table that is used in the Data Logger.	Delete the respective Data Logger entry or the complete Data Logger contents.
E 3.0	Interface is not ready.	Check to see if your printer or PC is correctly connected (data transfer interrupted with 10 sec. time-out).

Error code	Cause	Remedy
The DynaMIC 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.

Technical Data 10

Method of measurement	Rebound hardness testing; dynamic method of measurement on the basis of the ratio from rebound phase (Rp) and impact phase (Ip) velocities with output of hardness in HL = 1000 Rp/Ip
Test load	Impact device Dyna D with tungsten-carbide spherical test tip, 12 Nmm impact energy, dia. 3 mm, length 160.5 mm; for standard applications Impact device Dyna G with tungsten-carbide spherical test tip, 90 Nmm impact energy, dia 5 mm, length 265 mm; for solid test objects Impact device Dyna E with diamond test tip, 12 Nmm impact energy; for the hardness range over 650 HB
Test materials	Metallic materials; cast materials
Measurement tolerances	± 5 HL deviation of the average reading from the nominal value of the hardness reference block with 3 to 5 measurements
Measurement/conversion range	depending on the material group Leeb: 150 to 1000 HL Shore: 30 to 100 HS Brinell: 75 to 700 HB Vickers: 75 to 1000 HV Rockwell C: 20 to 70 HRC Rockwell B: 35 to 100 tensile strength: 250 to 2200 (for low alloyed steel)

Display resolution	1.0 HL 1.0 HV 1.0 HB 5.0 N/mm^2 1.0 / 0.5 / 0.1 HS 1.0 / 0.5 / 0.1 HRB 1.0 / 0.5 / 0.1 HRC
Display	4-digit LCD with switchable backlight, variable time setting (5 to 60 seconds or permanent operation)
Power supply	Battery operation with 2 pieces of 1.5V AA (Mignon) Batteries: AlMn operating time at 20 ° C (68 °F) and max. 500 measurements / 8 hours: at least 24 hours Accumulators: NiCd: at least 24 hours operating time NiMH: at least 30 hours operating time
Instrument dimensions	approx. 160 mm x 70 mm x 45 mm / 6.3 " x 2.8 " x 1.8 " (L x W x H))
Weight	approx. 300 g (including batteries)
Permissible ambient temperature	-15 °C to +50 °C (5 °F to 122 °F)
Storage/transport temperature	-40 °C to +70 °C (-40 °F to 158 °F)

Data storage (only DynaMIC DL)	internal Data Logger: typically 1,350 measurements Memory Card: typically 590 measurements (depending on the number of measurements per set) Warning given with memory overflow
Interface	RS 232 bidirectional for printer and computer
Protection class	IP 40 for DL version IP 42 for Basic version
Shock	according to IEC 68-2-27, 6 shocks 65 g, 6 ms according to IEC 68-2-29, 1000 shocks 10 g, 11 ms half-sine in each of the 3 main axes
Vibration	according to IEC 68-2-6 Fc, 5-150-5 Hz, 5 g 1 octave per minute in each of the 3 main axes
Noise immunity and emitted interference	according to EN 55011/1991, Klasse B, Gruppe 1 and EN 50082-2/1994

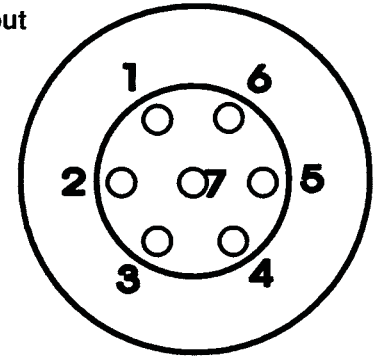
Interface and peripherals (only DynaMIC DL) 11

11.1 Interface RS 232

The DynaMIC has a bidirectional RS232 interface (Lemo 0) enabling you to transfer data between the instrument and peripherals, e.g. a printer or PC.

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

Pin layout 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 ± 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 DynaMIC's RS232 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 sure that the transfer parameters of the connected equipment correspond with these settings.

Note:

As long as data are transferred the automatic instrument switch-off is deactivated.

11.2 Data transfer to a printer

With the DynaMIC DL you have the possibility to print out adjustment and measurement data including statistical data.

For this you will need:

- a printer with serial interface RS 232,
- a data cable TGDL/PC with adaptor/gender changer GCH1 to connect the instrument to a printer.

You have a choice between various options. Please read Chapter 7.1 *Printing data* for more details on this.

11.3 Data communication with a PC

When you connect the DynaMIC DL to a PC, you can

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

You require

- a PC with a standard interface RS 232, e.g. an IBM-compatible PC
- a data cable TGDL/PC to connect the instrument to the PC
- the application software UltraDOC if necessary.

Remote operation of the DynaMIC DL

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

Note:

Remote control can also 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:

- Inquiry about (reading) a value or status of a DynaMIC DL function with the command structure:

  <ESC><CODE><CR>

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

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

Function codes and parameters can be separated by a space or an equality-sign, however, this is not absolutely necessary. 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 total command, including <ESC> and <CR>, must not contain more than 16 characters. When the DynaMIC 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 initiator character <ESC> is returned as "*" and the command end character <CR> as a space.

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

With an erroneous command the return of the DynaMIC DL is:

"?<CR><LF>".

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

Echo mode on:

Rx (DynaMIC)	ESC		C		A		CR								
TX (DynaMIC)		*		C		A		␣	-	2	0	0	0	CR	LF

Echo mode off:

Rx (DynaMIC)	ESC	C	A	CR							
TX(DynaMIC)					-	2	0	0	0	CR	LF

Code list for remote operation

Code	Description
AV	Read / set display mode
CA	Read / set calibration value
CF	Close data set
CM	Select printed report format
CO	Read / set instrument configuration
CU	Enable / disable hardness scales
DL	Activate / deactivate Data Logger; Read status of Data Logger
DG	Select language for printed report
EC	Echo mode on / off
HI	Read / set upper threshold value
IL	Read / set display backlight state
IN	Load default setting
KB	Keyboard operation
LO	Read / set lower threshold value
MR	Read number of stored measurement sets; Issue measurement set contents
NF	Read current base line position
OE	Output of error messages on/off Read status of error message output
OH	Output of the measured hardness on/off Read status of measured hardness output
PN	Read probe serial number
PT	Read probe type
SN	Read DynaMIC serial number
TL	Read / set time for display backlight switch-off
TM	Read / set material group
TP	Read / set time for instrument switch-off
UN	Read / select hardness scale
VE	Read DynaMIC 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, however, this is not absolutely necessary.
(a | b) a or b

AV - Read / set display mode

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

Description:

Toggle between display of singe value and average reading, 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 display

⚠ **Warning:** The actual measurement set is closed!

CA - Read / set calibration value

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

Description:

Set calibration value or read active value.
Range: **-5000 to +5000.**

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

⚠ Attention:

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

CF- Close data set

Syntax: <ESC>CF<CR>

Description:

Close active data set.

CM - Select report printout format

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

Description:

Selection of the format for the report printout. 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

Examples:

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

CO - Read / set instrument configuration

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

Description:

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

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

n = c(Cal) + 2•c(Tm) + 4•c(Lo) + 8•c(Hi) + 16•c(Logger) + 32•c(Card) + 128•c(E140) + 256•c(Dyna)

Meaning of the individual factors:

c(Cal) = 0	calibration value cannot be modified
c(Cal) = 1	calibration value can be modified
c(Tm) = 0	material group cannot be modified
c(Tm) = 1	material group can be modified

c(Lo) = 0	lower alarm threshold cannot be modified
c(Lo) = 1	lower alarm threshold can be modified
c(Hi) = 0	upper alarm threshold cannot be modified
c(Hi) = 1	upper alarm threshold can be modified
c(Logger) = 0	Data Logger function disabled
c(Logger) = 1	Data Logger function enabled (only DynaMIC DL)
c(Card) = 0	Memory Card function disabled
c(Card) = 1	Memory Card function enabled (only DynaMIC DL)
c(E140) = 0	Conversion according to DIN 50 150
c(E140) = 1	Conversion according to ASTM E 140 (if Dyna = 0)
c(Dyna) = 0	Conversion according to DIN/ASTM
c(Dyna) = 1	DynaMIC standard conversion

For example, in order to only make the calibration value variable and to disable the Data Logger and Memory Card functions, the code is:
n = 1 + 2•0 + 4•0 + 8•0 + 16•0 + 32•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:

$n = c(N/mm^2) + 4 \cdot c(HB) + 16 \cdot c(HV) + 64 \cdot c(HRC) + 256 \cdot c(HRB) + 1024 \cdot c(HS) + 4096 \cdot c(HL)$

Meaning of the individual factors:

$c(N/mm^2) = 0$	N/mm^2 scale disabled
$c(N/mm^2) = 1$	N/mm^2 scale enabled

c(HB) = 0	HB scale disabled
c(HB) = 1	HB scale enabled
c(HRC) = 0	HRC scale disabled
c(HRC) = 1	HRC scale: resolution 1 HRC
c(HRC) = 2	HRC scale: resolution 0.5 HRC
c(HRC) = 3	HRC scale: resolution 0.1 HRC
c(HRB) = 0	HRB scale disabled
c(HRB) = 1	HRB scale: resolution 1 HRB
c(HRB) = 2	HRB scale: resolution 0.5 HRB
c(HRB) = 3	HRB scale: resolution 0.1 HRB
c(HS) = 0	HS scale disabled
c(HS) = 1	HS scale: resolution 1 HS
c(HS) = 2	HS scale: resolution 0.5 HS
c(HS) = 3	HS scale: resolution 0.1 HS
c(HL) = 0	Leeb scale disabled
c(HL) = 1	Leeb scale enabled

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

n = 0 + 4*0 + 16*1 + 64*3 + 256*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 Data Logger status. Only the values 0 and 1 are available for setting, status reading can also result in **2** (Memory Card).

Examples:

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

DG - Select report printout language

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

Description:

Selection of the report printout language:

0 = German
1 = English
2 = French
3 = Italian
4 = Spanish
On recall without parameter, the currently selected report language is returned in the same code.

Examples:

<ESC>DG<CR>	Read report printout 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.

Examples:

<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 | HS | HL | N/MM2)] | ON | OFF)]<CR>

Description:

Set upper threshold value or read active setting. If no hardness scale is specified, then the currently 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.

Examples:

<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

⚠ **Attention:**

When you set the upper threshold, the currently 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 on backlight

IN - Initialization

Syntax: <ESC>IN<CR>

Description:

The default setting of the instrument is loaded.

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

Default settings

Function	Default setting	Code
Display mode	Single value	AV 0
Hardness scale	HL	UN HL
Calibration value	0	CA 0
Material table	1	TM 1
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
Alarm output	not active	OA 0
Error messages output	not active	OE 0
Language for report printout	English	DG 1
Report printout format	P(3)	CM 3

Function	Default setting	Code
Active hardness scales: HV HRC HRB HB N/mm^2 HS HL	 on resolution: 0.1 resolution: 0.1 on on resolution: 0.1 on	 CU 8181
Active functions: Cal tm Lo Hi Data Logger Memory Card	 on on on on on (DynaMIC DL) on (DynaMIC DL)	 CO 63
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
- Inquiry 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	EXIT key
MODE	MODE key
UP	▲ key
DOWN	▼ key
C	C key
FILE/MEM	FILE MEM key
OFF	EXIT + MODE key (instrument switched off)

The first two letters are sufficient for all key designations.

Examples:

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

Note:

After the instrument has been switched off, the keyboard operation is always enabled.

LO - Read / set lower threshold

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

Description:

Set the lower threshold value or read the active setting. If no hardness scale is specified, the currently 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.

Examples:

<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

⚠ Attention:

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

MR - Data Logger access

Syntax: <ESC>MR [n]<CR>

Description:

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

Examples:

<ESC>MR<CR>	Read measurement set number:
3<CR><LF>	Result: 3
<ESC>MR 3 <CR>	Request measurement set no. 3

NF - Read base line position

Syntax: <ESC>NF<CR>

Description:

Reading the instantaneously valid base line position.

Example:

<ESC>NF<CR>	Read base line position:
32784<CR><LF>	Result: 32784

Note:

This remote control is not used for operation of the instrument but can be usefull for service purposes.

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>

Examples:

<ESC>OE<CR>	Inquiry 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 saved even if 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 current status of the hardness value output. When the function is switched on, the measurement results are transferred in the selected hardness scale, for example:

40.5HRC<CR><LF>
40.7HRC<CR><LF>

Examples:

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

Note:

The last setting is saved 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 - Type of the probe

Syntax: <ESC>PT<CR>

Description:

Reading the type of the connected probe. If there is no probe connected, the result is **0.**

Example:

<ESC>PT<CR>	Read probe type:
D<CR><LF>	Result: D

SN - DynaMIC 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 material group

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

Description:

Set the material group or read currently active setting Range: **1 to 14,** dependent on the impact device and on the stored material groups (10-14).

Examples:

TM 5<CR>	Select material group no. 5
TM<CR>	Read material group:
5<CR><LF>	Result: 5

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 60 seconds to 300 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) | HS | HL] <CR>

Description:

Selecting hardness scale or display of currently active scale.

Examples:

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

⚠ **Attention:**

When you change the hardness scale, the currently 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.:
01.01.00<CR><LF>	Result: 01.01.00

The rebound hardness testing method 12

12.1 General information

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

The equipment consists of an impact body, impact device and display unit. The impact body has a spherical tungsten-carbide tip and a permanent magnet for generating a voltage pulse; the impact device has a spring mechanism for loading and impelling the impact body, and an induction coil for detecting the magnet in the impact body. In the rebound hardness testing method, the speed variation caused by the impact of the impact body against the material surface is measured.

The impact energy is adjusted via the spring for the measurement. The impact body contained in the tube of the impact device is impelled against the test surface by means of the release button.

In the course of this, the magnet of the impact body induces in the coil a voltage signal whose height is proportional to the impact phase speed (Ip). The impact causes a plastic deformation of the material and a permanent spherical indentation is produced in the surface. This plastic deformation leads to a loss of energy of the impact body and thus to a lower speed after the actual rebound phase (Rp).

The hardness value is calculated from the ratio of these two speeds and output as follows:

HL = 1000 Rp/Ip

Please also refer to VDI reports no. 308 (1978).

The speed ratio is determined exactly at the moment of impact/rebound by means of the special signal processing. The speed ratio is therefore unaffected by the impact direction. As opposed to this, other rebound hardness testers require presetting of the impact direction in fixed steps (influence of gravitation on the speed ratio) - which constitutes a considerable disadvantage with frequently changing test positions.

DynaMIC requires no input of the impact direction.

12.2 Conversion of hardness values

Regarding the conversion of hardness values, please note the following (please refer to DIN 50 150 and ASTM E 140):

Hardness values which were measured by different methods cannot be converted to each other on the basis of generally applicable relationships.

On the one hand, the reasons for this can be found in the fact that the penetration behaviour of a material is determined by its deformation behaviour under stress (stress-strain relations). On the other hand, the form and material of the indentor, the size of the indent and, therefore, the measured area vary with the hardness testing methods used.

You should therefore be aware of the fact that the conversion of hardness values both to each other and into tensile strength values may be inaccurate and unreliable depending on the material, its preparation and surface finish.

Therefore, please indicate the hardness values in the scale that was experimentally determined with the hardness method used (e.g. rebound method in HL).

Consequently, you should make conversions only in cases where:

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

Special aspects of conversion with the DynaMIC

The conversion of hardness values to other scales, which you can select on the instrument, is made in the basic setting according to specific conversion tables of the instrument; however, you can also make a conversion according to DIN 50 150 or ASTM E 140. All the limitations of conversion, mentioned in these standards, will apply. Please also observe that the conversions according to DIN 50 150 and ASTM E 140 (for Rockwell scales) only apply to the material group 1 (low-alloy / unalloyed steel). The specific conversions of the instrument are used for other material groups after selections of DIN 50 150 150 or ASTM E 140.

There are 9 material groups available in the DynaMIC from which you first have to choose the ones coming

closest to your test material. After that, you should carry out an instrument calibration for your specific material in order to ensure accurate measurements (please refer to page 5-15).
With regard to the steel material groups, please keep in mind that the hardness values in the lower hardness ranges (up to about 500 HL) are less material-dependent than those in the upper ranges. Please check the calibration of your instrument especially if you are dealing with hardness values exceeding 500 HL.

On the following page you can find a survey of the existing conversion possibilities for the individual material groups and impact devices. Due to the higher material-dependency, converted hardness values in the upper hardness ranges show considerably larger differences.

Material groups

No.	Material group	Impact dev.
1	Low-alloy/unalloyed steel and cast steel	D E G
2	Tool steel	D E
3	Corrosion-resistant steel	D
4	Gray cast iron	D G
5	Spheroidal graphite cast iron	D G
6	Aluminium cast alloys	D
7	Brass	D
8	Bronze	D
9	Copper wrought alloys	D

Note:

Concerning the allocation of own conversion tables to the groups 10-14 please refer to chapter 12.5.

Conversion possibilities and ranges

Impact device	Conversion type/ Material group	HV	HB	HRB	HRC	HS	N/mm^2
Dyna D	DIN 1	80 - 1000	80 - 650	40 - 106	19 - 70	30 - 100	275 - 2200
	ASTM1	90 - 1000	90 - 560	52 - 102	19 - 70	30 - 100	300 - 2200
	Dyna 1	75 - 1000	75 - 700	35 - 100	20 - 70	30 - 100	250 - 2200
	2	75 - 1000			20 - 70		
	3	75 - 1000	75 - 700	35 - 100	20 - 70		
	4		90 - 350				
	5		120 - 400				
	6		20 - 180	10 - 85			
	7		40 - 180	10 - 95			
	8		45 - 320				
	9		45 - 320				
Dyna E	DIN 1	80 - 1000	80 - 650	40 - 100	19 - 70	35 - 100	250 - 2200
	ASTM1	95 - 1000	90 - 560	52 - 100	19 - 70	35 - 100	300 - 2200
	Dyna 1	80 - 1000	80 - 700	40 - 100	20 - 70	35 - 100	250 - 2200
	2	80 - 1000			20 - 70		
Dyna G	DIN 1	85 - 650	80 - 650	45 - 103	20 - 60	30 - 85	275 - 2200
	ASTM1	95 - 650	90 - 560	52 - 100	20 - 56	30 - 85	300 - 2200
	Dyna 1	75 - 650	75 - 700	45 - 100	20 - 60	30 - 85	250 - 2200
	4		90 - 350				
	5		100 - 380				

Measurement range for the default scale HL: 150 - 1000

12.3 Preparation of the test material

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

Surface finish

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

The surface roughness (peak-to-valley height) of the material should not exceed 10 micrometers.

– Grind rougher surfaces, e.g. with the battery-powered grinding machine
MIC 1060 (please refer to chapter 2.3).

Curved surfaces

With surfaces showing a radius of curvature 30 mm (convex or concave), a correspondingly shaped test attachment must be used to ensure a stable and safe positioning of the impact device.

Measuring small test pieces

With smaller and less heavy test objects, the impact effect of the impact device may cause vibrations which could produce distorted measurement results.

– Test objects weighing less than 2 kg must in any case be fixed to the support using couplant so that there are no vibrations.

– Test objects weighing between 2 kg and 5 kg must be placed on a large metal support (e.g. a table) in such a way that they are not moved or caused to vibrate by the impact. If necessary, use our ZG couplant (included in the standard package) to couple the test objects.

Minimum wall thickness

Similar difficulties occur with test objects having lower wall thicknesses. Walls can be triggered into oscillation (e.g. on tubes) when the impact device hits the surface the same e.g. as the membrane of a drum. This normally causes lower hardness values.

Therefore for the rebound hardness testing we recommend that objects be tested down to a minimum thickness of 20 mm.

The UCI hardness tester MIC 10 should be used for measurment below 20 mm. However, you should at least check the measured hardness value with a stationary hardness tester.

12.4 Notes on statistical evaluation

The DynaMIC offers you the opportunity to output the following statistical data in a report printout:

- maximum value
- minimum value
- average reading
- absolute and relative range
- absolute and relative standard deviation

Average, range and standard deviation are also indicated on the display.

How this information is printed out has been covered in Chapter 7.1 *Printing data*. The average 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. In view of this, the measuring errors consist of the following individual errors:

- the basic measurement inaccuracy of the applied testing method
- the handling 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 meant to help you in your measurement assessments and to give you more confidence in making your decision on 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 of a measurement set becomes more accurate the more single measurements you make. On the other hand, the more single measurements you make the more measurements can go wrong (mismeasurements). 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

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

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

in which 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:

$$STD = \frac{S}{AVG} \cdot 100$$

in which S = Standard deviation (mean error of single measurement)

S is calculated as follows:

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

12.5 Creating own conversion tables (only for DynaMIC DL)

If you work with materials for which there is no generally applicable conversion table, you will be able to create your own by using a special Krautkrämer utility program. Creation of tables can be made under the condition that there is a knowledge of calculating compensation curves by non-linear regression.

Note:

As a service, we can also create your conversion tables if you send us your material specimens. To do this please contact our Applications Lab.

The DynaMIC has 9 permanent material groups. You can define a further 5 material groups, each having up to 7 conversion tables, and store them in the DynaMIC as material groups 10 to 14 using the memory card.

Conditions

You require:

- DynaMIC DL with the SW Version 01.01.04
- TGDL-PC cable
- Memory card
- IBM compatible PC with the operating system MS-DOS from Version 3.3 onwords, serial interface
- Krautkrämer utility program **DynaSoft**
- Statical hardness testing machine

Before creating the hardness values for your reference curve please observe the following:

- The surface of your specimen must be carefully treated.
- Select test objects with large dimensions. This should weigh a least 2.5 kg, depending on the impact device, so that coupling is not necessary.
- Check the DynaMIC display using a hardness reference plate.
- Only allocate such HL values to the statically determined hardness values which immediately adjoin.

Operation

1. Determination of the hardness value pairs

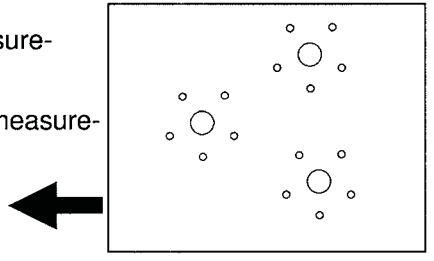
– Determine in a series of tests your material value pairs, consisting of the Leeb hardness value (HL) and the corresponding hardness value of the hardness scale, in which you would like to convert (e.g. HS or HRC).

We recommend the average from at least 10 - 15 adjoining HL values and at least 3 statical values as a basis for a value pair.

Example:

- 3 Rockwell measurements
- 3 x 5 DynaMIC measurements

= 1 value pair



2. Calculation of the compensation curve

– Calculate the corresponding compensation curve by non-linear regression, e.g. using a polynomial of the 2nd degree. Polynomials of the 3rd and the 4th degree can also be determined.

– Determine the coeffecients of the compensation curve.

For this you will require the following conversion rule (e.g. for HRC):

$HRC = C2 \times HLD^2 + C1 \cdot HLD + C0$

HLD is the Leeb hardness value determined with impact device D.
The formula also applies to conversions into other hardness scales.

– For example you have now determined the following coefficients:

C0 = -52,98
C1 = 0,1777
C2 = -4,4172E-5

3. Creation of the definition file (source file)

You must enter your coefficients into a source file. This file, with the name **example.scr**, is on the disk supplied by Krautkrämer.

– With the **edit** command, recall the Editor under MS-DOS and load the file **example.scr**. Firstly recall the MS-DOS entry enquiry if you work under Windows.

– Replace the example data with your own data, e.g.:

```
; Conversion table HL-D -> HRC
  for material group 10

Table
     Material        10
^    Probe           D
     Scale           HRC
     Lower           630
     Upper           850
     Polynomial
       C0            -52,98
       C1              0,1777
       C2             -4,4172E-5
     EndPolynomial
EndTable
End
```

In this table it concerns a conversion table form HL (impact device D) to HRC which is defined here as material group 10. The material groups 10-14 are selectable. A definition file or material group can contain up to 7 table blocks.

The first line is a comment. Each text which follows a semicolon is treated as a comment. The actual table description is between the key words **Table** and **EndTable.**

The fist three lines in the table block specifiy the material group code (10), impact device (D) and hardness scale (HRC) into which is to be converted. After this there is a determination of the lower and upper limits of the valid range in Leeb.

The polynomial coefficients which you have determined are to be entered in the block between the key words **Polynomial** and **Endpolynomial.**

End finishes file processing. The text which follows is ignored.

– Save the file under a new name after you have entered your data, the file type ***.scr** should be retained, e.g. **M10.scr** (for the Material Group 10).

– Exit the Editor.

4. Creation and saving the new material groups

You will require the utility program **DynaSoft** for translating the definition file and an empty memory card for saving the new material groups.

– Insert a memory card into the DynaMIC's card slot.

The memory card must be empty. If there are stored data on the card this can be overwritten after knowledging an enquiry.

– Recall the program **DynaSoft** for translation of your definition file with the following form of entry:
>dynasoft <scrfile> /w
therefore in our example:
>dynasoft M10.src /w

The material group is created with this entry; the parameter **w** means that the file will be directly written on the memory card.

The program DynaSoft

There are additional parameters available in order to control the program **DynaSoft**. These are displayed if you recall **DynaSoft** without parameters:

```
Options:
      /T[=tabfile>] Write table to file, default:
                    source file name, type .TAB
      /I-<incr>     Specify table increment,
                    default 10 HL
      /W            Write to card
      /C={COM1|COM2}Specify serial port,
                    default COM1
```

If you recall the program with the name of the definition file but without an additional parameter, e.g.

>dynasoft M10

then the **DynaSoft** program will only check the file **M10.scr** for formal correctness but will not produce an output.

If the definition file has another type of file than ***.scr**, then the complete file name must be entered. Even drive and path data are possible, e.g.:

>dynasoft A:\src\M10.mgr

The parameter /T files the calculated conversion table into a text file. For example, the entry

>dynasoft M10 /T

writes the data into the file M10.TAB.

If the output file shall get another name, e.g. **MAT10.TBL**, then this must be additionally specified:

>dynasoft M10 /T=MAT10.TBL

The hardness value step range can be specified with the parameter /I. In the output table the connection between Leeb and the selected hardness scale within the fixed range limits is determined in steps of 10 HL as a standard. For example, if you require a step range of 5 HL then you enter:

>dynasoft M10 /T /I=5

The most important parameter is **/W** because with this parameter the created conversion table is written on the memory card in a form that is readable for the DynaMIC.

>dynasoft M10 /W

It is assumed that the DynaMIC is connected to COM1. If the DynaMIC is connected to the COM2 interface of your computer then this must be additionally entered with the parameter **/C**:

>dynasoft M10 /W /C=COM2

The parameter **/C** can also be used in order to reroute the output file. Instead of entering COM1 or COM2 you then enter the file name and if necessary the drive identification and path.

5. Saving and enabling the new material group in the DynaMIC

You now transfer the material group stored on the memory card into the permanent memory of the DynaMIC.

– Firstly withdraw the memory card out ot the instrument and insert it into the card reader of the DynaMIC.

The indication **"table"** will briefly appear on the display of the instrument. The file is read and is now available in the instrument.

– As described on page 5-15, select the function material group and then select the requred material group, e.g. TM 10.

The conversion table created is now active.

The saved table in material groups 10-14 can be overwritten if needed.

Deleting the material groups

You can delete a self-created material group which has been saved.

– Select the material group which you wish to delete and press the [C] key.

The display flashes.

– Press the [C] key again.

The material group is deleted.

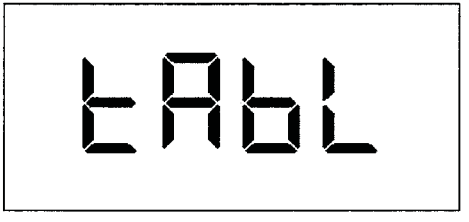
Deleting the memory card

You can delete the material group saved on your memory card and reuse the card again.

– Insert the memory card into the DynaMIC.

– Press the [FILE MEM] key.

The following is displayed on the display:



– Press the [C] key.

The display flashes.

– Press the [C] key again.

The contents of the memory card are deleted.

Appendix 13

13.1 EC Certificate of Conformity regarding Electromagnetic Compatibility

The DynaMIC meets the EMC protection requirements as specified in the council guidelines 89/336/EEC and the law governing the electromagnetic compatibility from 9.11.92 (EMVG).

13.2 Service addresses

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

Nevertheless, should any malfunctions occur, please inform your Krautkrämer or Krautkramer-Branson Service giving details and a description of the error (if possible, also error code number).

Please retain the instrument's shipping packing for any repairs possibly required which cannot be carried out at the test location.

If you have any questions regarding the application, use, operation or specifications of your DynaMIC, please contact your local Krautkrämer agent or the following addresses direct:

Krautkrämer GmbH & Co.

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

or:

Postfach 1363
D - 50330 Hürth

Phone:	(49) - 2233 - 601 111
Fax:	(49) - 2233 - 601 402
Telex:	888 1643 echo d

France

Krautkrämer France
ZAC Sans Souci
68, chemin des Ormeaux
F - 69760 Limonest

Phone:	(33) - 72 - 17 92 20
Fax:	(33) - 78 - 47 56 98
Telex:	3 05 734

Great Britain

Buehler Krautkramer Ltd.
Univ. of Warwick Science Park
GB - Coventry CV4 7-HS

Phone: (44) - 1203 - 69 00 69
Fax: (44) - 1203 - 69 30 32

Italy

Branson Ultrasuoni S.P.A.
Div. Krautkramer Italiana
Via dei Lavoratori, 25
I - 20092 Cinisello balsamo
Milano

Phone: (39) - 2 - 66 01 04 79
Fax: (39) - 2 - 66 01 04 80
Telex: 314 190

Japan

Krautkrämer Japan Co., Ltd.
Shin Tsaiso Building No. 3
10-12, Dogenzaka 2 - Chome
Shibuya-ku
Tokyo 150

Phone: (81) - 3 - 3461 - 3971
Fax: (81) - 3 - 3770 - 4879
Telex: 02 423 507

USA

Krautkramer Branson
50 Industrial Park Road
P.O. Box 350
Lewistown, PA 17044

Phone: (1) - 717 - 242 03 27
Fax: (1) - 717 - 242 26 06
Telex: 842 354

Changes 14

Changes

Existing changes or additions are described in this chapter.

Otherwise this chapter remains empty.

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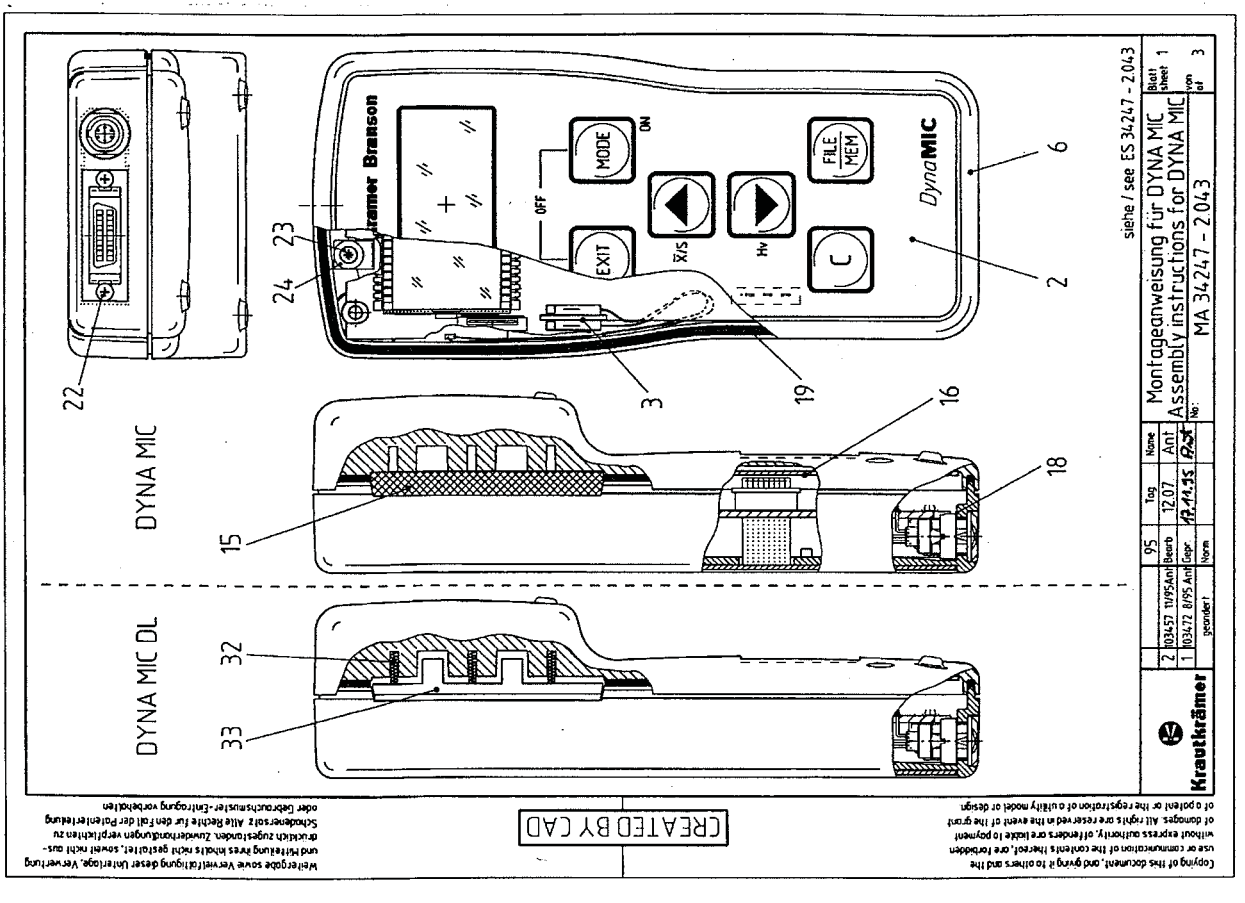
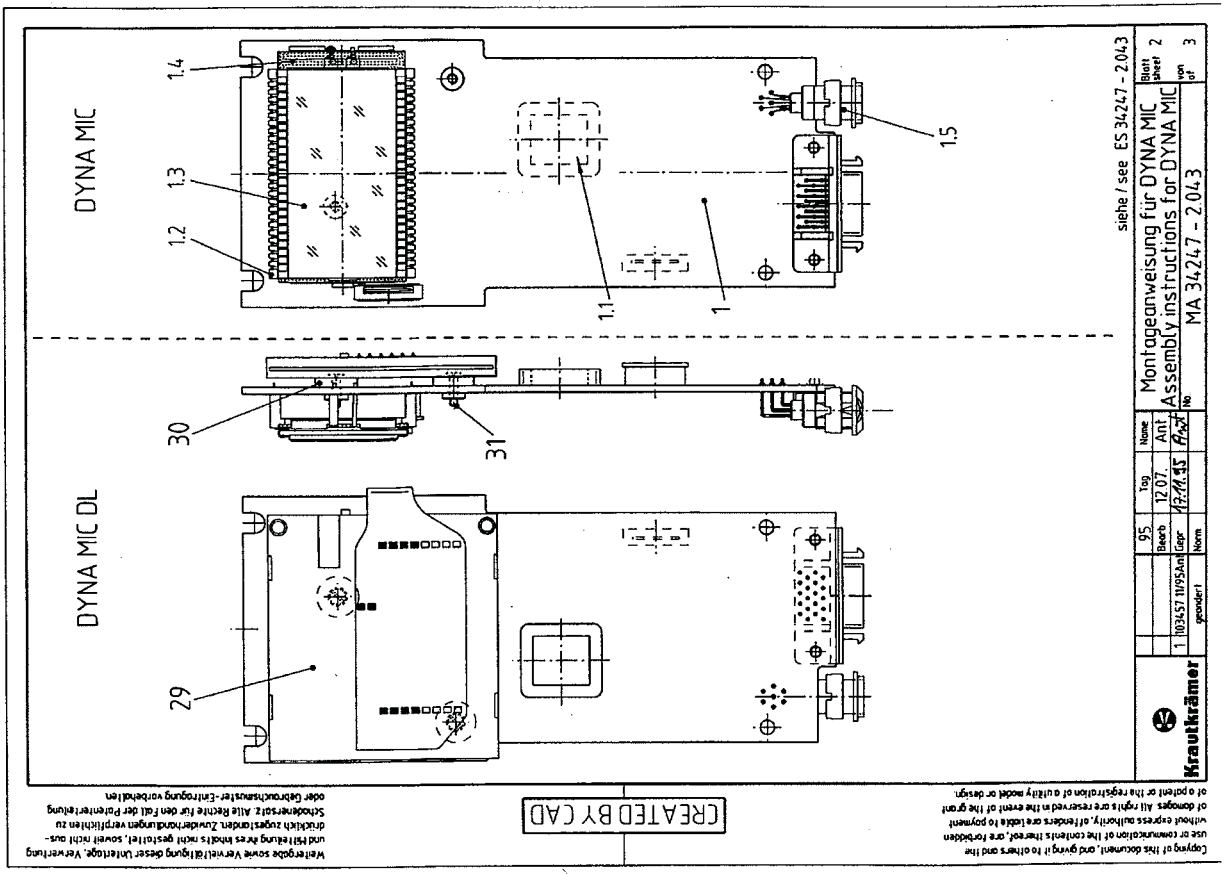
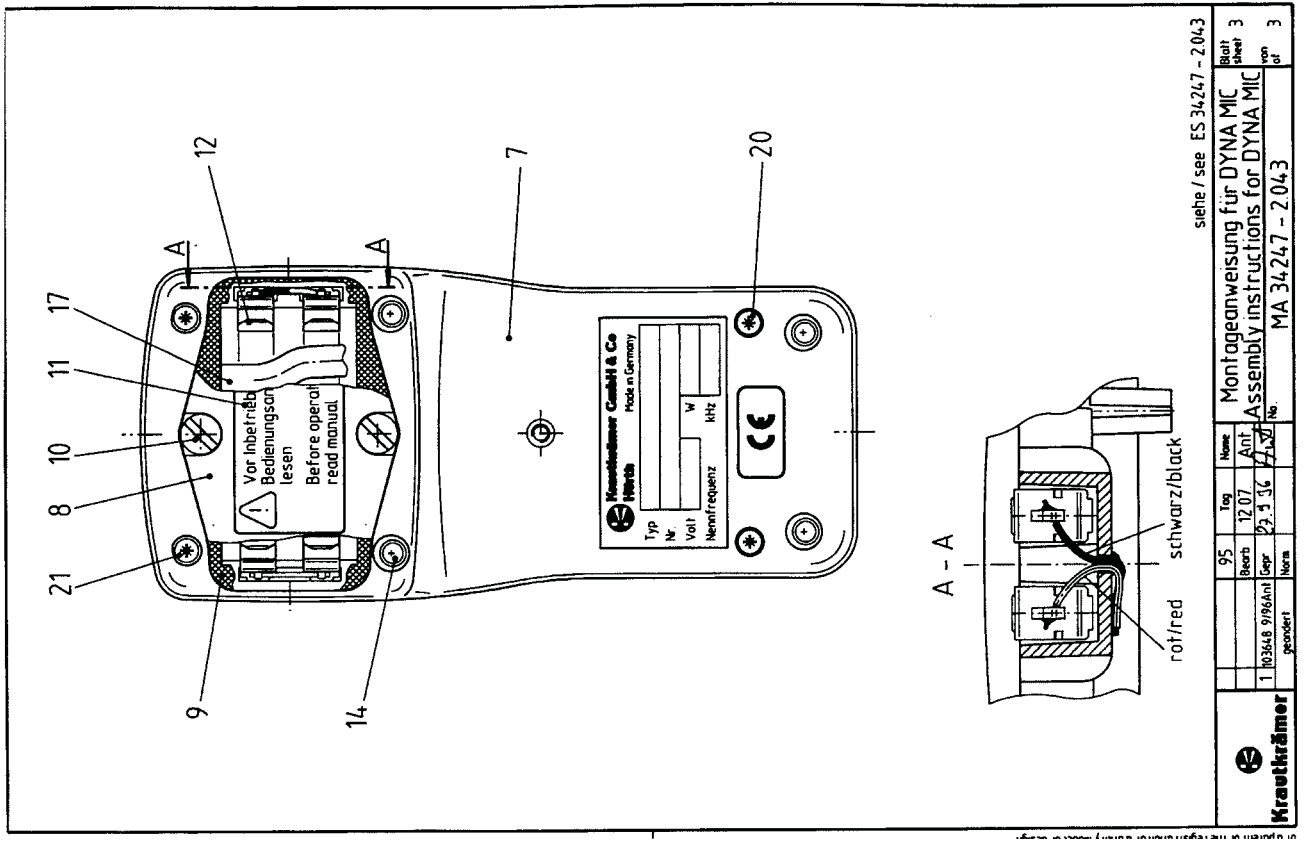
Assembly Instructions, Spare Parts List 16






12
17
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21
9
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7
20
A
A
Vor Inbetriebnahme Bedienungsanleitung lesen
Before operation read manual
Typ
Nr
Volt
W
kHz
Nennfrequenz
Made in Germany
A - A
rot/red
schwarz/black
siehe / see ES 34247 - 2043
Montageanweisung für DYNA MIC
Assembly instructions for DYNA MIC
MA 34247 - 2043
Krautkrämer
Blatt / sheet 3
von / of 3

1	2	3	4	5	6
No.	Qty	Designation	Part no.	Remarks	Kind
1		PCB assembly - MIC D	34292-3.220		
1.1		Eprom, programmed for DYNA MIC	34356-3.295		
1.2		LCD-support	34026-6.640		
1.3		LC-display	17102-7.232		
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, low er 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 DYNA MIC	
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	370mmm 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 w asher	00866-8.150		
		Only for DYNA MIC DL			
29		Chipcard reader	14503-7.000		
30		Spacer w asher	34276-6.660		
31		Countersunk screw M2x8	00487-8.020		
32		Pressure spring	14824-7.850		
33		Strip	34116-6.600		
		02.10.96 / Berg			