Certified acc. to
ISO 9001
Germanischer Lloyd
Certification

FERITSCOPE® MP30

Order number 902-512
Version 2.0
Issue date 12/2001
Subject to changes.

1 Conventions

1.1 Symbols and Styles Used

The following symbols and styles are used in this manual:

!	Safety remarks and warnings of possible damage to the instrument or the accessories or danger to the operating personnel.
ENTER	Refers to instrument keys (e.g. **ENTER** key)
ON/OFF + ENTER	Refers to instrument keys, which have to be pressed immediately one after the other Do **not** keep both keys pressed!
_____ 24.8 Appl: 2 WRC-FN Blck: 5 n= 2 _____	Simplified representation of the display with all elements relevant for the current action
Std. dev.	Style used for texts appearing on a printout
/ 1 /	Cross reference to additional literature: see "17 Additional Literature", beginning on page 205

1.2 General Note

Illustrations of displays in this manual are examples only.
Actual ferrite content measurement data, the prompt lines on the display (e.g. the number of the selected application, the number of measurements stored in a particular application) or the results of an evaluation depend on your individual application.
It is possible that different numbers may appear on the display.
This is not an indication of any malfunction.

2 Notes Concerning the Operation of the Instrument and Handling the Accessories

2.1 Proper Use of the Instrument

The FERITSCOPE® MP30 is suitable for ferrit content measurement in weld metal and clad layers of austenitic or Duplex stainless steel and for determination of the ratio of martensite in austenitic stainless steels.
Only accessories recommended or used by Fischer (e.g. AC power supply, probes, printer) may be assigned to the instrument.

2.2 Requirements on the Operating Personnel

The instrument may be operated by suitably qualified personnel only.

Knowledge about configuration, operation and programming of the computer as well as of the software used, is necessary to connect the instrument to a computer. Refer to the corresponding operator manuals if necessary.

2.3 Power Connection

To prevent damage to the instruments or wrong measurement results due to wrong A/C line voltage, connect the instruments to a power outlet only with the AC power supply supplied by Fischer. The A/C line voltage must agree with the A/C line voltage rating on the serial number plate of the AC power supply.

2.4 Environmental Conditions for Operation and Storage of Instrument and Accessories

The instrument FERITSCOPE® MP30 is designed to meet and comply with all requirements as set forth in the EC Guideline 89/ 336/ EEC “Electromagnetic Compatibility”. The measured ferrite contents are not influenced by the highest level of interference as stated in the guideline EN 50082-1 (which refers to IEC 801-2, 801-3 and 801-4).
In particular, the instrument is effectively shielded from electromagnetic fields (e. g. motors, power lines, etc.).
Instrument and accessories are designed for use at temperatures between 5

and 45 °C (41 ... 113°F). The equipment may be stored at temperatures between 5 and 60°C (41 ... 140°F).

Avoid excessivly hot operation environment!
Temperatures behind windows (e.g. in cars) in direct sunshine rise easily above 60 °C (140°F).
To avoid damage to the instrument or the accessories by heat, do not keep or store the instrument or the accessories in such places.

Avoid direct contact with fluids!
Danger of short circuits instrument and accessories (in particular the AC power supply).

Instrument and accessories may be operated, kept and stored only in places where the environmental relative humidity is between 30 and 90 % (non-condensing).

Instrument and accessories are not acid resistant!
Make sure to avoid direct contact of acid or acid solutions with the instrument or the accessories.

Do not operate instrument and accessories in an explosive atmosphere!

Protect instrument and accessories from static charge!
Electric discharges may delete internally stored data or damage internal components.

2.5 Opening the Instrument or the Accessories

The battery is the only user-serviceable part of the instrument FERITSCOPE® MP30 and the accessories.

To prevent damages to the internal components, the instrument or the accessories should only be opened to replace the battery. Further servicing of the instrument or the accessories should only be performed by Fischer authorized service technicians.

2.6 Handling the Probes

When measuring, the probe tips is placed directly on the material to be measured. To reduce probe tip wear, keep the following in mind:

Avoid hard impacts! Place the probes rapidly, but gently on the surface of the material to be maesured!

Do not drag the probe over the surface of the the material to be measured!

Do not place the probe on hot or acid-covered surfaces, do not immerse the probes into liquids!

2.7 Handling the Base and the Calibration Standards

The base and the calibration standards are used to normalize and calibrate the FERITSCOPE® MP30.
The good condition of the Base and the calibration standards is an important requirement for an accurate normalization and calibration.

To ensure the perfect condition of the Base and the calibration standards, keep the following in mind:

To reduce the wear and tear of the Base and the calibration standards, the Base and the calibration standards should only be used for normalization and corrective calibration. Do not use them for test measurements!

Do not soil or scratch the calibration standards! Corroded, soiled or scratched calibration standard or standards with deep gouges have to be replaced by new standards.

To protect the calibration standards from dirt or damage, keep and store the standards in the supplied calibration standard case.

2.8 Warranty

Fischer will not be responsible or honor any warranty claims for the following cases:

- Misuse of the instrument or the accessories
- Improper use of the instrument or accessories (e. g. operating in an explosive, highly corrosive or excessively hot atmosphere)

3 Instrument and Accessories Description

3.1 Instrument

3.1.1 Measurement Application Capabilities / Intended Use

The FERITSCOPE® MP30 is suitable for ferrit content measurement in weld metal and clad layers of austenitic or Duplex stainless steel and for determination of the ratio of martensite in austenitic stainless steels.

Figure 3.1: FERITSCOPE® MP30 in use

3.1.2 Test Method

The instrument uses the magnetic induction test method according to / 9 / 15 / or / 16 / whereby the ferrite content is obtained from the magnetic permeability.

3.1.3 Unit of Measurement

The measurements can be displayed in point count ferrite (Fe%) or in ferrite numbers (FN).
Selecting the unit of measurement for the current application:
see "11.4.3 Instrument Configuration", beginning on page 137.

Measurement of ferrite content in ferrite numbers is defined in / 13 /.
It is not possible to determine the ferrite content in point count ferrite destructively or non-destructively. The measurement, which is displayed in point count ferrite by the FERITSCOPE® MP30, is computed by conversion of the measurement, which was determined in ferrite numbers.
Using the results of measurements on reference standards, the conversion relationship shown in figure 3.2 was determined at Fischer. The measurement converted to point count ferrite shows an uncertainty of ±16% of the measurement (indicated by the grey area above and below the conversion curve).

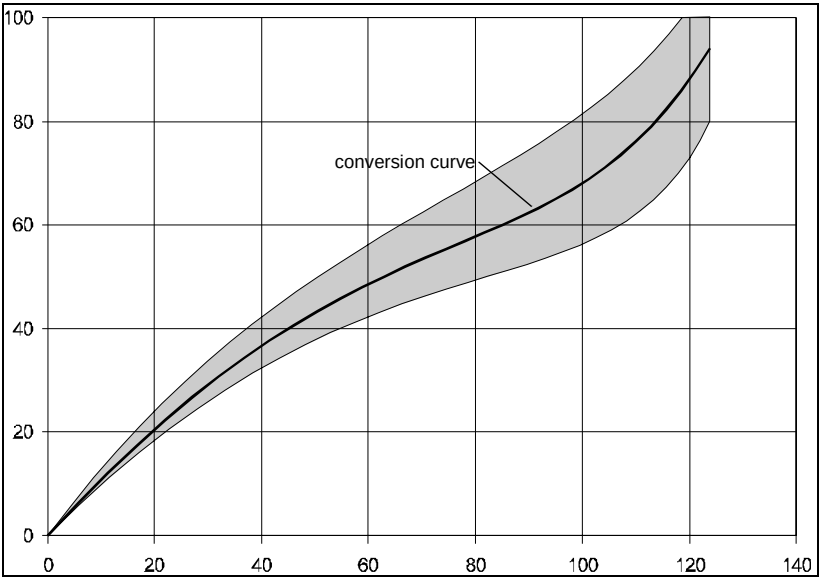

Figure 3.2: Conversion of FN to Fe%

3.1.4 Front and Rear View

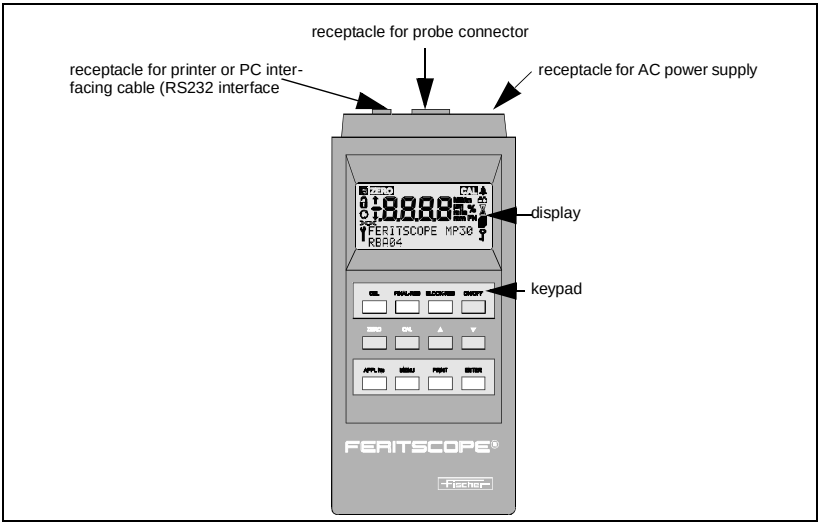

Figure 3.3: Front view of the FERITSCOPE® MP30

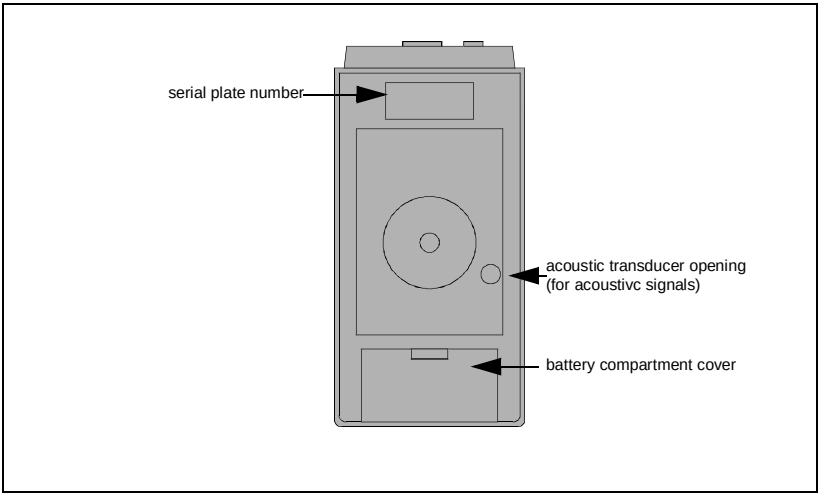

Figure 3.3: Rear view

3.1.5 Keypad Functions

The white and grey rectangles of the keypad are the actual membrane keys. Pressing and releasing a key produces a slight click. Pressing the text above the key instead of the key membrane will not actuate the key function.

The overview on the following pages contains a brief description of the individual keypad functions:

Key	Function
DEL	**Delete the last measurement:** pressing **DEL** repeatedly: delete the measurements of the current block one after the other **during normalization:** 1x **DEL** - delete the last measurement, 2x **DEL** - delete measurement series taken on Base **during calibration:** 1x **DEL** - delete the last measurement 2x **DEL** - delete the measurement series taken on the current calibration standard pressing **DEL** repeatedly: delete the measurement series taken on the previous calibration standards
FINAL-RES	Call-up final result: Pressing **FINAL-RES** repeatedly: display in sequence the parameters of the final result (mean value, standard deviation, ...) Followed by **ENTER**: end the display of the final result (return to measurement) without deleting the stored values (the current measurement block will be closed) Followed by **DEL**: delete the stored values of the current application and end the display of the final result (return to measurement) During **normalization** and **corrective calibration**: enabling and disabling the “continuous” display mode (display the normalized probe output signal of the measurement, measurements will not be stored and not be used for calibration or normalization purposes), or with enabled external start: initiate a measurement

Key	Function
BLOCK-RES	Call-up block result; Pressing **BLOCK-RES** repeatedly: display in sequence the parameters of the block result (mean value, standard deviation, ...) Followed by ▲: end the display of the block result (return to measurement) without closing the current measurement block (current measurement series can be continued) Followed by ▼: display the block result of the previous measurement block (pressing ▼ repeatedly will display all block results of the current application) Followed by **PRINT**: print the displayed block result Followed by **MENU**: display the single readings of the evaluated measurement block (pressing ▲ repeatedly will display all single readings) pressing **MENU** again will terminate displaying the single readings Followed by **DEL**: delete the measurements of the last open measurement block and end the display of the block result (return to measurement) Followed by **ENTER**: end the display of the block result (return to measurement) and close the current measurement block

Key	Function
ON/OFF	Switch the instrument on and off: **ON/OFF** + ▲: switch the instrument on and enable the acoustic measurement accept signal (with the instrument switched off before) **ON/OFF** + ▼: switch the instrument on and disable the acoustic measurement accept signal (with the instrument switched off before) **ON/OFF + DEL:** switch the instrument on and enable the restricted operating mode (with the instrument switched off before) **ON/OFF + ENTER:** switch the instrument on and disable the restricted operating mode (with the instrument switched off before) **ON/OFF + PRINT:** switch the instrument on and print theinstrument status record (with the instrument switchedoff before); **ON/OFF + ZERO:** switch the instrument on and set time and date (with the instrument switched off before)
ZERO	Call-up the normalization
CAL	Call-up the corrective calibration; followed by **CAL**: cancel the corrective calibration **CAL + DEL**: delete the corrective calibration of the currentapplication
▲	Change the displayed numerical values or parameters during application selection, calibration, or parameter entry (if s is pressed for more than 3 seconds, the display will change faster) with enabled external start: initiate a measurement

Key	Function
▼	Enabling and disabling the “continuous” display mode: Change the displayed numerical values or parameters during application selection, calibration, or parameter entry (if ▲ is pressed for more than 3 seconds, the display will change faster)
APPL No	Selecting the desired application Followed by **DEL**: delete the selected application Followed by **PRINT**: print the list of all previously created applications
MENU	Display and change the application specific settings By pressing **ENTER** repeatedly: specification limits, display resolution, block size and number of single readings (which have to be taken before the actual measurement is computed as mean value of these single readings), as well as outlier rejection can be displayed in sequence and changed by pressing ▲ or ▼) Followed by **MENU**: stop the display of the application specific settings and return to measurement **MENU + DEL + MENU:** disable specification limits monitoring and return to measurement **MENU + (▲ or ▼) + MENU:** enable specification limits monitoring and return to measurement **MENU + PRINT:** print or display the instrument status record
PRINT	Print the values stored in the current application (with block results) or transfer them to the assigned computer

Key	Function
ENTER	Confirm the input **10x ENTER**: call-up the configuration programs

3.1.6 Display

The display consists of multiple segments and symbols. At power-up with **ON/OFF**, briefly all segments and symbols will appear simultaneously.

Figure 3.5: Display of the FERITSCOPE® MP30 at power-up

Display element	Explanation
g	Fischer trademark
z	Indicates that a normalization is performed (on uncoated measuring object (= substrate material))
j	Indicates that a calibration is performed
b	Bell: indicates that specification limits monitoring is enabled
e	Padlock: indicates that the restricted operating mode has been enabled, i. e. the keys **ZERO, CAL** and **MENU** are not active, it is not possible to call-up the configuration programs or to delete applications
p	Arrow-circle: indicates that the “continuous” display mode has been enabled resulting in continuous display of the measurements with placed probe
u	Arrow upwards: indicates that the upper specification limit has been violated

Display element	Explanation
d	Arrow downwards: indicates that the lower specification limit has been violated
u d	Both arrows together: indicates that the displayed measurement value has been recognized as **outlier**
-8.8.8.8	Number elements to display the measurement values, error messages and warnings
MS/m µm % mils mm FN	Unit of measurement of the displayed value
c	Hour glass: indicates that the instrument is busy
s	Battery: indicates that the battery has to be changed or recharged, because of low battery voltage
v	Chain: indicates that all applications, created with the very same probe, are linked, i.e. the same normalization or corrective calibration is used for the measurements performed in those applications
t	Wrench: indicates that the configuration programs have been called-up (the parameters of the individual configuration programs can be changed now)
m	Sheets: indicates that the matrix measuring mode is selected
k	Key: indicates that the measurement block is closed
	Prompt lines containing notes to guide the use [FERITSCOPE MP30]: instrument model [RBA..]: instrument software version

3.2 Smart Probes

All probes, which can be assigned to the FERITSCOPE® MP30, are equipped with a memory chip in the probe connector. The description E... (e. g.: EGAB1.3-FE) indicates the use of the memory chip (E stands for EEPROM). The EEPROM stores all probe-specific information (e.g. probe type, manufacturing code, test method and the coefficients of the master calibration). When switching the instrument ON, the instrument reads and processes the information of the assigned probe automatically; the instrument "recognizes" the probe.

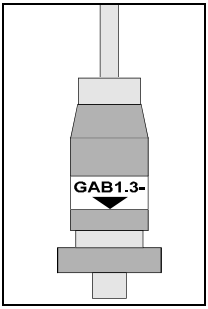

Figure 3.6: Probe Connector of a EGAB1.3-FE Smart Probe

For information on the available probes, or advise regarding probes best suited to your applications, please refer to the brochure "Probes and Measurement Fixtures - Application Specific Probes - The key to successful coating measurement". This brochure is available from Fischer or your nearest Fischer sales representative.

3.3 Base and Calibration Standards

The Base of the calibration standard set is used for the normalization; one, two or three calibration standards (ferrite standards) are used in addition to the Base for the corrective calibration.

Various calibration standards sets for corrective calibration are available from Fischer to prepare the instrument for different measuring ranges.

Calibration standard sets contain:

- Base
- 3 calibration standards

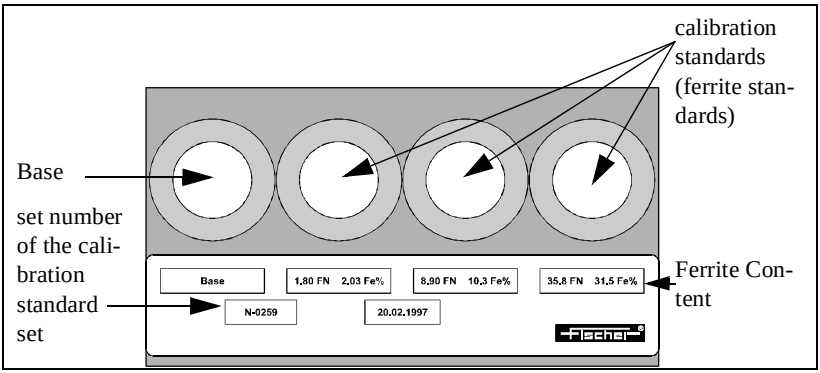

Figure 3.7: Calibration standard set (example)

Normalization and calibration measurements are to be taken on the Base or the calibration standards.
Measurements taken on the plastic material surrounding the actual Base or calibration standard will lead to erroneous data.

Normalization and calibration measurements are to be taken within a circular area having a diameter of 10 mm around the center of the Base or the calibration standard.

For information on the available calibration standard sets, please contact your your nearest Fischer sales representative or Fischer directly.

3.3.1 Certification of the Calibration Standard Sets

Calibration standards sets are delivered by Fischer with a test certificate.

Please refer to this test certificate for information concerning warranty and calibration standard inspection.

3.4 Printer

Following printers with serial interface are suited for operation with the FERITSCOPE® MP30:

Epson P40S	Seiko DPU-411
Kyosha Kyoline	Epson compatible serial dot matrix printers

For notes concerning functions or maintenance of the printer, please refer to the printer manual.

4 Switching the Instrument ON and OFF

4.1 Switching the Instrument ON

To avoid erroneous measurements, keep the probe tip(s) at least 50 mm (2“) away from any metal object when switching the instrument ON!

Depending on the selected display mode, a ferrite content measurement value (Fe% or FN), a probe output signal or a normalized probe output signal is displayed after switching the instrument on.
Selecting the display mode:
see "11.4.3 Instrument Configuration", beginning on page 137.

If no measurements are stored in the last open block, no measurement is displayed after switching the instrument on.

If **[Storage mode do not store]** or **[Storage mode delete at off]** was selected in the configuration program FINAL-RES, no measurement will be displayed after switching the instrument on (because the measurements have not been saved or have been deleted when the the instrument was switched off).
Selecting the storage mode: see "11.4.1 Instrument Configuration", beginning on page 135.

If **[E022 - Missing probe !]** appears briefly when switching the instrument on, there is no probe assigned to the instrument, the probe is not assigned correctly or the assigned probe is defective. Measurements are not possible without a probe assigned.
Connecting a probe: see "10.3 Start-Up, Maintenance and Cleaning", beginning on page 125.

If **[Appl: Not opened]** appears after switching the instrument on, no application has been created up to now.
An application has to be created with the assigned probe so that ferrite content measurements can be performed.
Creating an application: see "5.2 Applications", beginning on page 28.

Switching the Instrument ON:

Keys	Detail of Display	Explanation
ON/OFF		Press the **ON/OFF** key to switch the instrument on. An acoustic signal will sound. The instruments performs an automatic power-up selftest. All display elements appear briefly. **[FERITSCOPE® MP30]:** instrument model **[RBA..]**: instrument software version
	C	Following that, C appears briefly.

Keys	Detail of Display	Explanation
	30.2 FN Appl: 2 WRC-FN Blck: 1 n= 8 or for measurements with fixed block size: 30.2 FN Appl: 2 WRC-FN Blck: 1 n= 1/ 4 or for measurements with “mean reading” mode enabled: (see following page)	Following the power-up selftest, the application used last with the assigned probe will be called. The instrument is ready to measure. The last measurement of the last open block will be displayed. **[FN]** or **[Fe%]**: unit of measurement of the displayed value **[Appl:]:** number of the current application **[WRC-FN]** or **[Fe %]**: ferrite content measurement values are displayed (display mode of the current application: see "5.6.6 Applications", beginning on page 58 **[Blck:]**: number of the current block

Keys	Detail of Display	Explanation
	_____ 30.2 FN Appl: 2 i = 0/ 4 Blck: 1 n = 8 _____	[**n=**]: number of single readings stored in the current block; when measuring with fixed block size, the fixed block size appears after the slash: see "7.3.5 Measurement", beginning on page 72. **[i=]**: number of single readings taken with “mean reading” mode enabled; the number of single readings to be averaged appears after the slash: see "7.3.6 Measurement", beginning on page 74.

If **[%]** or **[FN]** flashes, no application has been created with the currently assigned probe.
Measurements are *not* possible with flashing display.
An application has to be created with the assigned probe so that ferrite content measurements can be performed.
Creating an application: see "5.2 Applications", beginning on page 28.

4.2 Switching the Instrument OFF

Auto switch-off mode
The instrument will switch itself off automatically if no measurement is taken and no key is pressed for approximately three minutes.

However, if the auto switch-off mode has been disabled in the configuration programs, the instrument will not switch itself off automatically.

Disable the auto switch-off mode:
see "11.4 Instrument Configuration", beginning on page 134

To switch the instrument off manually simply press the **ON/OFF** key.
The display will go blank.

5 Applications

You can create up to 100 different applications.
Up to 10,000 measurements can be stored in these applications.
The measurements can be combined into up to 1,000 blocks.

An application contains:

- single readings
- application specific settings
- coefficients determined during normalization and corrective calibration (used for fitting the master calibration curve stored in the memory chip of the probe connector to the current measurement application)

5.1 Selecting the Desired Application

An application has to be selected which was created with the currently assigned probe so that measurements can be performed.

If **[NF]** or **[%]** flashes on the display after switching the instrument on or when an application has been selected, it is indicating that no application has been created with the probe currently being used. Measurements are not possible with flashing display.

If no application has been created with the assigned probe, these are the choices:

- Create a new application with the assigned probe
  see "5.2 Applications", beginning on page 28
- Overwrite an existing application with the assigned probe
  see "5.3 Applications", beginning on page 32
- Select an existing application, that has been created for the probe currently in use ; see "10.3 Start-Up, Maintenance and Cleaning", beginning on page 125

Selecting an Application (with the instrument switched on):

Keys	Detail of the Display	Explanation
APPL No	APPL % Appl: 1 n= 13 Select: ENTER EGAB1.3_FE or EGAB1.3_FE miss. or EGAB1.3_FE wrong	Press **APPL No** to start the application selection. **[NF] or [%]**: unit of measurement of the ferrite contents displayed in the current application **[Appl:]:** number of the current application **[n=]:** number of the measurements stored in the current application **[Select: ENTER]**: press **ENTER** to select the current application **[EGAB1.3_FE]**: type of the probe, which was used to create the current application **[miss.]**: current application was created with another probe type **[wrong]**: current application was created with a probe of the same type but with a different serial number
▲ , ▼	APPL FN Appl: 3 n=11 Select: ENTER	Select the desired application using the arrow keys.

Keys	Detail of the Display	Explanation
ENTER	Select the desired application using the arrow keys.	Confirm the selected application with **ENTER**. The selected application will be called. The last measurement of the last open block will be displayed. If no measurements are stored in this block, no measurement will be displayed. Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21

If **[miss.]** or **[wrong]** is displayed in the prompt lines during selection of an application, the selected application was not created with the probe currently being used.

These are the choices:

- Select an application which has been created with the assigned probe
- Overwrite the selected application with the assigned probe: see "5.3 Applications", beginning on page 32.
- Create a new application with the assigned probe: see "5.2 Applications", beginning on page 28.

5.2 Creating an Application

An application has to be created and a probe has to be assigned so that measurements can be stored in this application.

The unit of measurement for the ferrite content which are to be taken in the application to be created, can be selected in the configuration program ZERO.
Selecting the unit of measurement: see "11.4.3 Instrument Configuration", beginning on page 137.
If, for instance, ferrite numbers are selected as unit of measurement in the configuration program ZERO, the ferrite content of a newly created application will be displayed in ferrite numbers.

When creating an application with the linking mode enabled (indicated by v in the display), the instrument checks automatically, if one or more applications have been created with the assigned probe.If at least one application has been created with the assigned probe, no normalization is necessary when creating an application. The normalization and corrective calibration of the application(s) previously created with this probe is used in this case.

With the restricted operating mode enabled (indicated by e in the display), only applications already created can be selected, i. e. new applications cannot be created.
Restricted Operating Mode: see "11.3 Instrument Configuration", beginning on page 133.

Creating an Application (with the Instrument Switched on):

Keys/Actions	Detail of the Display	Explanation
APPL No	APPL % Appl: 1 n=13 Select: ENTER EGAB1.3_FE or EGAB1.3_FE miss. or EGAB1.3_FE wrong	Press **APPL No** to start the application selection. **[NF] or [%]:** unit of measurement of the ferrite contents displayed in the current application **[Appl:]**: number of the current application **[n=]**: number of the measurements stored in the current application **[Select: ENTER]**: press **ENTER** to select the current application **[EGAB1.3_FE]**: type of the probe, which was used to create the current application **[miss.]**: current application was created with another probe type **[wrong]**: current application was created with a probe of the same type but with a different serial number

Keys/Actions	Detail of the Display	Explanation
▲, ▼	APPL FN Appl: 3 n= 0 Not opened Open: ENTER	Select an application, which has not been created yet (indicated by **[Not opened]**) using the arrow keys. **[NF] or [%]**: unit of measurement of the ferrite contents displayed in the current application **[Not opened]**: application has not been created yet **[Open: ENTER]**: press **ENTER** to create the application
ENTER 01 Base	z 0.00 Base Cancel: ENTER z 140.0 s= 0.01 n= 5 OK: ENTER Delete: DEL	Start creating an application by pressing **ENTER**. z appears and remains in the display as long as the normalization is performed. **[Base]**: measurements have to be performed on the Base. **[Cancel: ENTER]**: press **ENTER** to cancel the normalization. Perform the normalization. Explanations about normalization: see "9.2 Normalization and Corrective Calibration", beginning on page 110.

Keys/Actions	Detail of the Display	Explanation
ENTER	Appl: 3 WRC-FN Blck: 1 n= 0	Confirm and end the normalization with **ENTER**. The application will be created and called automatically. The instrument is ready to measure. Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21

5.3 Overwriting an Application

An existing application can be overwritten by connecting a different probe and performing a normalization with this probe, if it is no longer needed.

When overwriting an application with the linking mode enabled (indicated by v in the display), the normalizations of all applications linked to the current application will also be overwritten automatically.

With the restricted operating mode enabled (indicated by e in the display), the key **ZERO** is not active, i. e. applications cannot be overwritten.
Restricted Operating Mode: see "11.3 Instrument Configuration", beginning on page 133

Overwriting an Application (with the instrument switched on):

Keys/Actions	Detail of the Display	Explanation
APPL No	APPL % Appl: 1 n= 13 Select: ENTER EGAB1.3_FE or EGAB1.3_FE miss. or EGAB1.3_FE wrong	Press **APPL No** to start the application selection. **[NF] or [%]**: unit of measurement of the ferrite contents displayed in the current application **[Appl:]**: number of the current application **[n=]**: number of the measurements stored in the current application **[Select: ENTER]**: press **ENTER** to select the current application **[EGAB1.3_FE]**: type of the probe, which was used to create the current application **[miss.]**: current application was created with another probe type **[wrong]**: current application was created with a probe of the same type but with a different serial number

Keys/Actions	Detail of the Display	Explanation
▲ , ▼	APPL FN Appl: 3 n=11 Select: ENTER	Select the application to be overwritten using the arrow keys.
ENTER	30.2 FN Appl: 3 WRC-FN Blck: 1 n= 11	**Confirm** the selection with **ENTER**.

Keys/Actions	Detail of the Display	Explanation
ZERO	z 0.00 Base Cancel: ENTER or: z 30.2 New Probe? Yes: DEL No:ENTER EGABW1.3FE (if the assigned probe is not identical with the probe, the application was created with)	Start a normalization by pressing **ZERO** to overwrite the current application. z appears and remains in the display as long as the normalization is performed. **[Base]**: measurements have to be performed on the uncoated measuring object (substrate material) **[Cancel: ENTER]**: press **ENTER** to cancel the normalization **[New probe ?]**: the assigned probe is not identical with the probe, the application was created with (test method in the uppermost line in the display is flashing) **[Yes: DEL No:ENTER]**: press **DEL** to perform a normalization with the assigned probe (stored normalization will be overwritten); press **ENTER** to cancel the normalization (stored normalization will remain unchanged) **[EGABW1.3FE]**: type of the assigned probe

Keys/Actions	Detail of the Display	Explanation
DEL	_____ z 0.00 Base Cancel: ENTER _____ or: _____ z 30.2 Delete measure? Yes: DEL No:ENTER _____ (if **[New probe ?]** appeared in the display before and measurements are stored in the application to be overwritten)	Confirm overwriting of the existing application with **DEL** (necessary only if **[New probe ? Yes:DEL No:ENTER]** appeared in the display before). **[Delete measure ? Yes: DEL No:ENTER]:** press **DEL** to delete the measurements press **ENTER** to keep the measurements

Keys/Actions	Detail of the Display	Explanation
DEL 01 Base	z 0.00 Base Cancel: ENTER z 140.0 s= 0.01 n= 5 OK: ENTER	Confirm the deleting of the measurements with **DEL** (necessary only if [Delete measure ? Yes: **DEL** No:**ENTER**] appeared in the display before). **[Base]**: measurements have to be performed on the Base **[Cancel: ENTER]**: press **ENTER** to cancel the normalization Perform the normalization. Explanations about normalization: see "9.2 Normalization and Corrective Calibration", beginning on page 110.
ENTER	Appl: 3 WRC-FN Blck: 1 n= 0	Confirm and end the normalization with **ENTER**. The existing application will be overwritten. The instrument is ready to measure. Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21

5.4 Deleting an Application

Deleting an Application (with the Instrument Switched on):

Keys	Detail of the Display	Explanation
APPL No	_____ APPL Appl: 1 n= 13 Select: ENTER _____ EGAB1.3_FE or EGAB1.3_FE miss. or EGAB1.3_FE wrong	Press **APPL No** to start the application selection. **[Appl:]**: number of the current application **[n=]**: number of measurements stored in the current application **[Select: ENTER]**: press **ENTER** to select the current application **[EGAB1.3_FE]:** type of the probe, which was used to create the current application **[miss.]**: current application was created with another probe type **[wrong]**: current application was created with a probe of the same type but with a different serial number

Keys	Detail of the Display	Explanation
▲, ▼	APPL Appl: 3 n= 11 Select: ENTER	Select the application to be deleted using the arrow keys.
DEL	APPL Delete appl. ? Yes:DEL No:ENTER	Delete the selected application with **DEL**. **[Delete appl. ? Yes:DEL No:ENTER]:** press **DEL** to delete the application, keep the application with **ENTER**
DEL	APPL Appl: 3 n= 0 Not opened Open: ENTER	Confirm the deletion with **DEL**. The selected application will be deleted. Another application can be selected now or a new application can created.

With the restricted operating mode enabled (indicated by e in the display), the key **DEL** is not active, i. e. applications cannot be deleted.
see "11.3 Instrument Configuration", beginning on page 133.

5.5 List of Existing Applications

Printing a List of Existing Applications:

Keys	Explanation
APPL No	Press **APPL No** to start the application selection (with the instrument switched on and a probe assigned).
PRINT	Print the list of existing applications by pressing **PRINT**. With a printer assigned and switched on, the list of existing applications will be printed (see figure 5.1). Another application can be selected now or a new application can created.
ENTER	Confirm the selected application with **ENTER**. The selected application will be called. The last measurement of the last open block will be displayed. If no measurements are stored in this block, no measurement will be displayed.

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Applications:

1	EGAB1.3_FE	WRC-FN	23.11.01	n=	17
2	EGABW1.3FE	WRC-FN		n=	0
3	EGAB1.3_FE	Fe %	23.11.01	n=	23

Figure 5.1: List of existing applications (example)

Explanations for Figure 5.1:

28.11.01	current date
1, 2, 3, 4 (1. column)	application number
EGAB1.3_FE, ... (2. column)	short name of the probe this application was created with
WRC-FN, Fe %, ... (3. column)	unit of measurement
23.11.01, ... (4. column)	creation date of the last closed block of this application (if no date appears the application contains no closed block!)
n= (5. column)	number of measurements stored in this application

5.6 Application-Specific Settings

The following settings are valid only for the current application, i. e. they are application-specific:

- settings made with the **MENU** key
- display mode; see "5.6.6 Applications", beginning on page 58.
- unit of measurement; see "11.4.7 Instrument Configuration", beginning on page 145.

After pressing the key **MENU** the following application-specific settings can be changed:

- specification limits monitoring
- display resolution
- automatic block formation and block size
- number of single readings, which have to be taken before the actual measurement is computed as mean value of these single readings
- outlier rejection

The procedure after pressing the key **MENU** may be terminated at any time by pressing **MENU** again.

During the procedure after pressing the key **MENU** the record of the instrument status can be printed or displayed at any time by pressing the key **PRINT**
see "11.5 Instrument Configuration", beginning on page 148.

With the restricted operating mode enabled (indicated by e in the display), the key **MENU** is not active, i. e. the application-specific settings cannot be changed!
Restricted Operating Mode: see "11.3 Instrument Configuration", beginning on page 133.

5.6.1 Specification Limits Monitoring

With specification limits monitoring enabled, it is possible to check quickly and easily whether the measurements are within a preset specification range.
see "7.3.4 Measurement", beginning on page 71

Enabling or Disabling Specification Limits Monitoring:

Keys/Actions	Detail of the Display	Explanation
MENU	u d No spec. limits Selection: {}	Press **MENU** to start the setting procedure. If specification limits monitoring is enabled, the lower tolerance limit set for this application appears as shown in the next step. **[No spec. limits]**: specification limits monitoring is disabled **[Selection: {}]**: press either arrow key to enable specification limits monitoring

Keys/Actions	Detail of the Display	Explanation
	u 0.00 b d Lower spec. limit OK: ENTER	Enable specification limits monitoring by pressing either arrow key (necessary only if specification limits monitoring has not been enabled yet). **[Lower sp. limit]**: lower specification limit is displayed **[OK: ENTER]**: press **ENTER** to confirm the setting of the lower specification limit **[no limits: DEL]**: press **DEL** to disable specification limits monitoring
01 or { / }	u 27.4 b d Lower spec. limit OK: ENTER	Perform a measurement on a coating having a ferrite content similar to the specification limit to be set. Use the arrow keys to set the measured ferrite content to the limit to be entered. Alternatively, the specification limit can be set using only the arrow keys, i. e. without measurement.

Keys/Actions	Detail of the Display	Explanation
ENTER	u 80.0 b d Upper spec. limit OK: ENTER	Confirm the setting of the lower specification limit with **ENTER**. Proceed for setting the upper specification limit in the same manner as for the lower specification limit.
MENU	b 57.8 Appl: 1 WRC-FN Blck: 5 n= 7	Confirm the setting of the upper specification limit with **MENU**. Specification limits monitoring is enabled. The instrument is ready to measure. Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21

As long as specification limits monitoring is enabled, **b** appears in the display.

5.6.2 Display Resolution

The display resolution determines the resolution the measurements will be displayed with.

Example:

The measurement value 73.29, will be displayed as 73 if low resolution is selected, as 73.3 if medium resolution is selected and as 73.29 if high resolution is selected.

Selecting the Display Resolution:

Keys	Details of the Display	Explanation
MENU		Press **MENU** to start the setting procedure. If desired, use the arrow keys to enable specification limits monitoring or set the limits (procedure: see above).
ENTER,...	_____ u d Disp. resolution medium _____	Press **ENTER** repeatedly until **[Disp. resolution]** appears in the display. **[Disp. resolution]**: use the arrow keys to select the display resolution **[medium] / [low] / [high]:** resolution: medium / low / high
▲ , ▼	_____ u d Disp. resolution low _____	Select the desired resolution using the arrow keys.

Keys	Details of the Display	Explanation
MENU	57.5 Appl: 1 WRC-FN Blck: 5 n= 7	Confirm the selected display resolution with **MENU**. The last measurement will be displayed in the selected resolution. The instrument is ready to measure. Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21

5.6.3 Automatic Block Formation and Block Size

Automatic block formation has to be enabled so that a fixed number of measurements is combined automatically into a block after measurement. The block size, i. e. the number of measurements to be combined into a block, has to be selected after enabling the automatic block formation. The block size must be between 2 and 99.
see "7.3.5 Measurement", beginning on page 72.

Automatic block formation cannot be enabled with matrix measuring mode enabled.

Enabling Automatic Block Formation and Setting the Block Size:

Keys	Detail of the Display	Explanation
MENU		Press **MENU** to start the setting procedure. If desired use the arrow keys to enable specification limits monitoring or set the specification limits see "5.6.1 Applications", beginning on page 42

Keys	Detail of the Display	Explanation
ENTER,...	_____ u d Block size free Selection: {} _____	Press **ENTER** repeatedly until **[Blocksize]** appears. If desired, the display resolution can also be changed during this procedure (as described above). **[Block size free]:** automatic block formation disabled **[Selection: {}]**: use the arrow keys to enable automatic block formation
	_____ u d Delete measure ? Yes:DEL No: ENTER _____	Use an arrow key to enable automatic block formation. If no measurements are stored in the current application, the block size appears as shown in the next step. **[Delete measure ?** **Yes: DEL No:ENTER]**: the measurements stored in the current application have to be deleted with **DEL** so that the block size can be set

Keys	Detail of the Display	Explanation
DEL	_____ u d 5 Meas. per block Delete: DEL _____	Press **DEL** to delete the measurements stored in the current application (necessary only if [**Delete measure ? Yes: DEL No:ENTER]** was displayed before). **[Meas. per block]**: block size is displayed **[Delete: DEL]:** press **DEL** to disable automatic block formation
▲, ▼	_____ u d 4 Meas. per block Delete: DEL _____	Set the desired block size using the arrow keys.
MENU	_____ Appl: 3 WRC-FN Blck: 1 n= 0/ 4 _____	Confirm the block size setting with **MENU**. **[n= 0/]**: number of measurements stored in the current block equals 0 (measurements were deleted!); the fixed block size appears after the slash Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21

Changing the Block size (with Automatic Block Formation enabled):

MENU		Press **MENU** to start the setting procedure. If desired use the arrow keys to enable specification limits monitoring or set the specification limits. see "5.6.1 Applications", beginning on page 42
ENTER,...	u d 5 Meas. per block Delete: DEL	Press **ENTER** repeatedly until **[Meas. per block]** appears. If desired, the display resolution can also be changed during this procedure (as described above). **[Meas. per block]**: block size is displayed **[Delete: DEL]**: press **DEL** to disable automatic block formation
▲, ▼	u d 7 Meas. per block Delete: DEL	Set the desired block size using the arrow keys.

MENU	_____ Delete measure ? Yes: DEL No:ENTER _____	Confirm the block size setting with **MENU**. If no measurements are stored in the current application, the block size is accepted and the instrument is ready to measure (see next step but one). **[Delete measure ? Yes:DEL No:ENTER]:** the measurements stored in the current application have to be deleted first with **DEL** so that the block size can be set; if **ENTER** is pressed to keep the measurements, the block size is reset to the previous value
DEL	_____ u d 7 Meas. per block Delete: DEL _____	Press **DEL** to delete the measurements stored in the current application (necessary only if **[Delete measure ? Yes: DEL No: ENTER]** was displayed before).

MENU	——————— Appl: 3 WRC-FN Blck: 1 n= 0/ 7 ———————	Confirm the block size with **MENU**. The instrument is ready to measure. **[n= 0/]:** number of measurements stored in the current block equals 0 (measurements were deleted!); the fixed block size appears after the slash Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21

Disabling Automatic Block Formation:

Keys	Detail of the Display	Explanation
MENU		Press **MENU** to start the setting procedure. If desired use the arrow keys to enable specification limits monitoring or set the specification limits.

Keys	Detail of the Display	Explanation
ENTER,...	u d 5 Meas. per block Delete: DEL	Press **ENTER** repeatedly until **[Meas. per block]** appears. If desired, the display resolution can also be changed during this procedure (as described above). **[Meas. per block]**: block size is displayed **[Delete: DEL]**: press **DEL** to disable automatic block formation
DEL	u d 5 Block size free Selection: {}	Disable automatic block formation by pressing **DEL**. **[Block size free]**: automatic block formation disabled **[Selection: {}]**: use the arrow keys to enable automatic block formation
MENU	57.5 Appl: 3 WRC-FN Blck: 2 n= 2	Confirm with **MENU**. The instrument is ready to measure. Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21.

5.6.4 “Mean Reading” Mode

With “mean reading” mode enabled, the mean value of multiple single measurements is stored instead of the single measurement.
The number of single measurements, which have to be taken before the actual “mean” measurement is computed, has to be between 2 and 20.
see "7.3 Measurement", beginning on page 68

Selecting the number of single measurements to be averaged:

Keys	Detail of the Display	Explanation
MENU		Press **MENU** to start the setting procedure. If desired use the arrow keys to enable specification limits monitoring or set the specification limits (see "5.6.1 Applications", beginning on page 42
ENTER,...	u d 1 i single read. OK:ENTER i=1:DEL	Press **ENTER** repeatedly until **[i single read.]** appears. If desired, the display resolution or the block size can also be changed during this procedure. see "5.6.2 Applications", beginning on page 44 **[i single read.]**: number of single measurements, which have to be taken before the actual measurement is computed as mean value of these single measurements **[OK:ENTER i=1:DEL]**: press **ENTER** to confirm the number; press **DEL** to reset the number to 1

Keys	Detail of the Display	Explanation
▲ , ▼	u d 3 i single read. OK: ENTER i=1:DE	Set the desired number using the arrow keys.
MENU	57.5 Appl: 3 i= 0/ 3 Blck: 2 n= 3	Confirm the number with **MENU**. The instrument is ready to measure. **[i=]:** number of single measurements taken with “mean reading” mode enabled; the number of single measurements to be averaged appears after the slash Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21.

5.6.5 Outlier Rejection

With outlier rejection enabled measurements recognized as outliers will be indicated in the display and an acoustic signal will sound.
see "7.3.7 Measurement", beginning on page 76

There is a choice of the following criteria for outlier rejection:

- Grubbs test
- entry of a known standard deviation (Sigma)

Enabling the Outlier Rejection and Setting the Criteria:

Keys	Detail of the Display	Explanation
MENU		Press **MENU** to start the setting procedure. If desired use the arrow keys to enable specification limits monitoring or set the specification limits see "5.6.1 Applications", beginning on page 42
ENTER,...	_____ u d Outlier Reject. Off _____ or On	Press **ENTER** repeatedly until **[Outlier Reject.]** appears. If desired, the display resolution or the block size or the number of measurements to be averaged for the “mean reading” mode can also be changed during this procedure. • see "5.6.2 Applications", beginning on page 44 • see "5.6.3 Applications", beginning on page 46 • see "5.6.4 Applications", beginning on page 53 **[Outlier Reject.]**: use the arrow keys to enable or disable outlier rejection **[Off]**: outlier rejection disabled **[On]:** outlier rejection enabled

Keys	Detail of the Display	Explanation
▲ , ▼	_____ u d Outlier Reject. On _____	Enable outlier rejection by pressing an arrow key (if outlier rejection was disabled and is to be enabled) or disable it (if the outlier rejection was enabled and is to be disabled).
ENTER	_____ u d Method: {} Automatic _____ or Sigma	Confirm the setting with **ENTER**. **[Method: {}]**: use the arrow keys to select the outlier rejection criteria (this option will be displayed only with outlier rejection **enabled**; with outlier rejection **disabled**, the procedure will be terminated automatically and the instrument is ready to measure again (see below)) **[Automatic]**: automatic outlier rejection using to the Grubbs test **[Sigma]:** Sigma outlier rejection

Keys	Detail of the Display	Explanation
▲, ▼	_____ u d Method: {} Sigma _____ or Automatic	Select the desired criteria using the arrow keys.
ENTER	_____ u d 10.0 Sigma Entry: **{}** _____	Confirm the selection with **ENTER**. **[Sigma - Entry: {}]**: Set the desired standard deviation (Sigma) using the arrow keys (appears only if the Sigma outlier rejection has been selected; if automatic outlier rejection has been selected, the procedure will be terminated automatically and the instrument is ready to measure again (see below))
▲, ▼	_____ u d 10.0 Sigma Entry: **{}** _____	Use the arrow keys to adjust the desired standard deviation (Sigma).

Keys	Detail of the Display	Explanation
ENTER	57.5 Appl: 1 WRC-FN Blck: 5 n= 7	Confirm the selected standard deviation with **ENTER**. The procedure will be terminated automatically and the instrument is ready to measure again. Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21

5.6.6 Display Modes

The following display modes can be selected according to table 5.1
Selecting the display mode:
see "11.4.3 Instrument Configuration", beginning on page 137.

- Display Ferrite Content (WRC-FN or Fe%)
- Display Xn and Xs
- Display Ferrite Content Fe and Xs
- Display Countrate
- Display Normalized Countrate

The display mode can be set separately for each application. The setting of the display mode of the other applications remains unchanged.

Display Mode	Detail of the Display (with Measurement)	Explanation
WRC-FN or **Fe%**	2.2 FN Appl:1 WRC-FN BLck:1n=1	Display of the ferrite content Fe (in ferrite numbers or point count ferrite)
Xn and **Xs**	.9656 Xs=24083 Blck:1n=1	Display of the measured normalized probe output signal Xn **[Xs=]: countrate Xs**
Fe and **Xs**	2.2 FN Xs=24083 Blck: 1n=1	Display of the ferrite content Fe **[Xs=]:** countrate Xs (countrate measured on a measuring objekt with no ferrite content)
Countrate	2467 X=24670 Blck:1n=1	Display of the first four figures of the measured probe output signal X **[X=]:** countrate X (all figures)
norm. Countrate	.9656 Appl: 1 Blck:1n=1	Display of the measured normalized probe output signal Xn

Table 5.1: Display modes (overview) (with exemplary display)

5.7 Linking the Applications

With linking mode enabled all applications created with the very same probe (having the same serial number) are linked with respect to normalization and calibration. The same normalization and corrective calibration is used for the computation of the measurement values in linked applications.

As an example, if separate applications were created to measure different batches of the same part, it would make sense to link these applications. By linking all applications share the same corrective calibration and normalization.

A normalization or calibration performed in any of the linked applications will be effective for all of the linked applications.
The normalization or calibration stored in these applications will be overwritten.

To ensure that the linked applications use the same normalization and calibration, perform a normalization and calibration in any of these linked applications.

Applications created with different probes of the same probe type (having the same probe type but different serial numbers) cannot be linked!

5.7.1 Enabling or Disabling the Linking Mode

The linking mode can be enabled or disabled only in the configuration program **APPL No.**
see "11.4.7 Instrument Configuration", beginning on page 145.

As long as the linking mode is enabled, v will be displayed.

After disabling the linking mode, the applications become independent again!
Every application can be normalized or calibrated separately again.

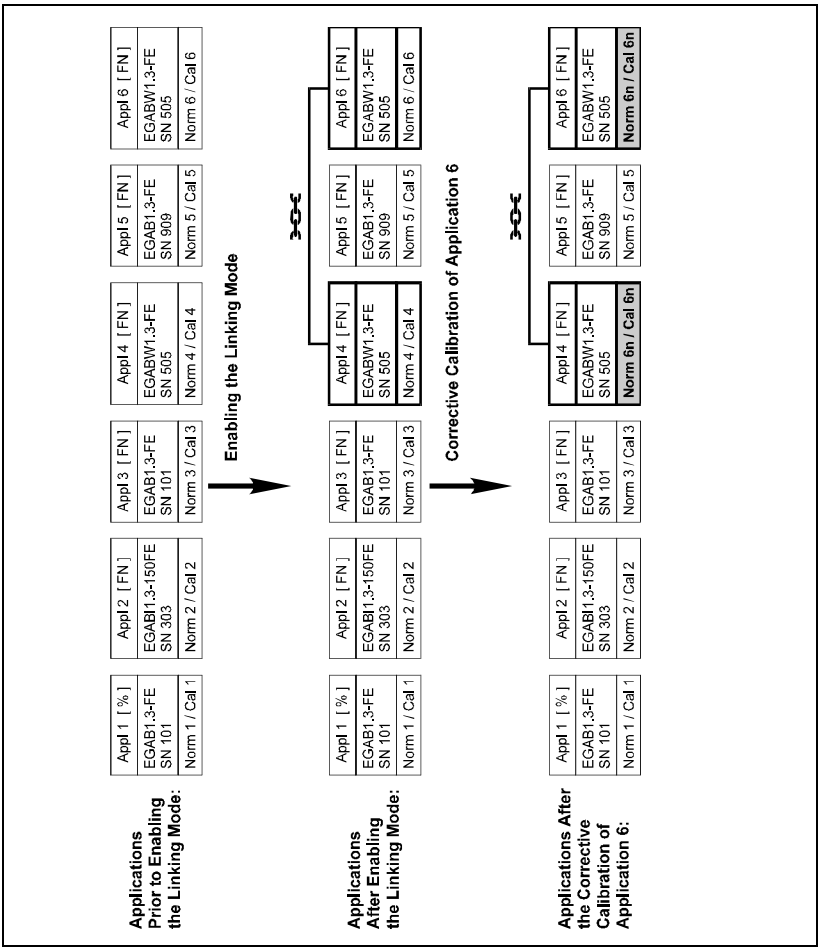
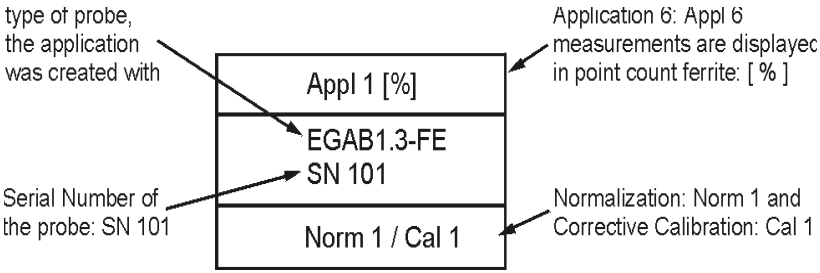


Figure 5.2: Linking of applications (example)

Explanations for Figure 5.2:



Immediately after Enabling the Linking Mode:

The normalizations and calibrations of the linked applications are different from one another because no normalization or calibration was performed in any of the linked applications immediately after enabling the linking mode.

Since the applications 4 and 6 were created with the same EGABW1.3-FE probe (serial number 505), they are linked (v).

Since the measurements of application 1 are displayed in point count ferrite **[%]** and the measurements of application 3 are displayed in ferrite numbers **[FN]**, these applications are not linked, even though they created with the same EGAB1.3-Fe probe.

Since the application 5 was created with the EGAB1.3-FE probe having the serial number 909, it is not linked to these applications.

Since no other application was created with the EGABI1.3-150FE probe (serial number 303), application 2 is not linked to any other application.

After the Corrective Calibration of Application 6:

Since the applications 4 and 6 are linked, the new corrective calibration (Norm 6n, Cal 6n, indicated by the grey box in figure 5.2) of application 6 will also be effective for application 4. The previous normalizations and calibrations (Norm 4/6 and Cal 4/6) are overwritten.

Since no normalization or calibration was performed with the other probes, in spite of the enabled linking mode, the normalizations and calibrations of the other applications remain unchanged.

6 Standard and Matrix Measuring Mode

The following measuring modes are available:

- standard measuring mode
- matrix measuring mode

6.1 Standard Measuring Mode

With the standard measuring mode enabled single measurements are taken consecutively on the same part, for example on a board, and are then combined by pressing **BLOCK-RES** into a block. The resulting block mean value then represents the local ferrite content of the reference area.

With the standard measuring mode enabled, measurements can only be stored in the last open block of an application.
The applications can contain different numbers of blocks.
Each block can store a different number of measurements.

However, if automatic block formation has been enabled, only blocks with fixed block size can be formed.

Enable automatic block formation and selecting the block size:
see "5.6.3 Applications", beginning on page 46

Measurement with fixed block size:
see "7.3.5 Measurement", beginning on page 72

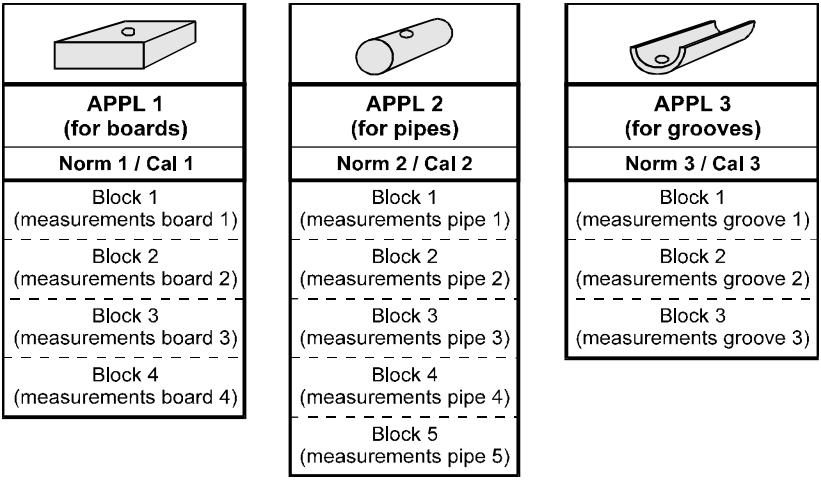


Figure 6.1 shows an example for the applications with standard measuring mode enabled.

6.2 Matrix Measuring Mode

The number of applications and the number of blocks has to be entered when changing the measuring mode to matrix measuring mode.
The same number of blocks is created for every application.
Each block can store the same maximum number of measurements.

After entering the number of applications and blocks, the maximum number of measurements each application and block can hold is calculated and displayed automatically by the instrument.
If, for example, **[Matrix mode On (3/20/318)]** appears during display of the instrument status, 3 applications with 20 blocks each can be created at most. Every block can store 318 measurements at most.

The block, the measurement is to be stored in, can be selected freely before taking the measurement. It is possible, for example, to store one measurement in block 7 and the next measurement in block 3.

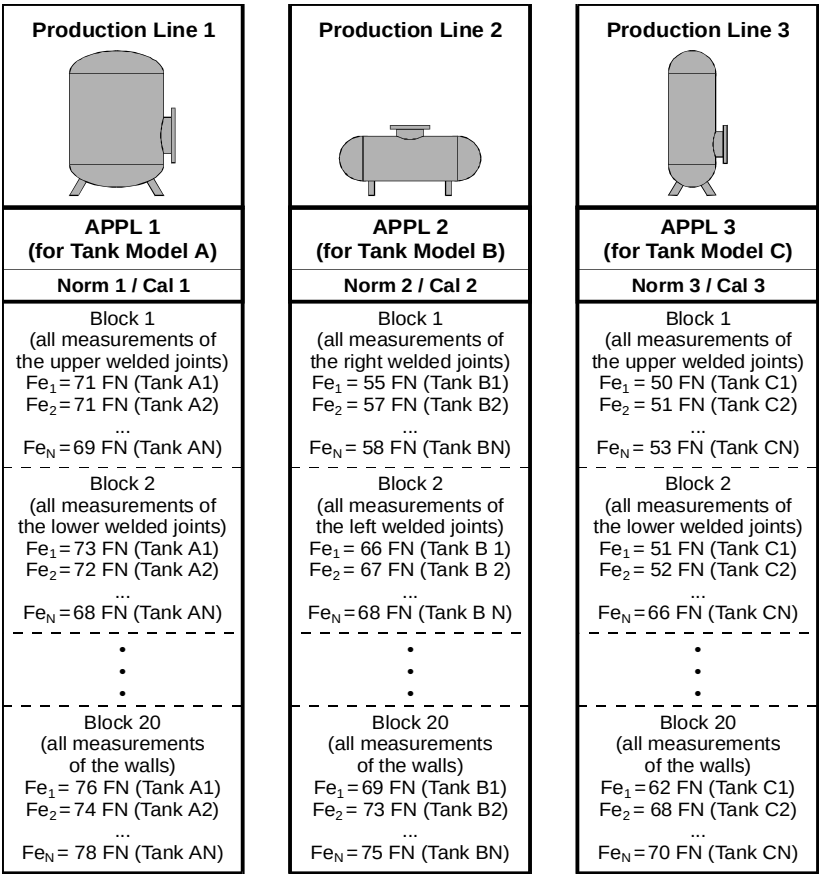


Figure 6.2: Applications with matrix measuring mode enabled (example)

This measuring mode is ideally suited for coating thickness measurement applications, where different measuring objects of the same type have to be measured sequentially always on the same specific reference areas, and where the measurement data from the corresponding areas are to be combined into blocks.

When selecting the reference areas of the different objects to be measured, is has to be noted that the same normalization and calibration is used for computation of the ferrite content measurement values. Therefore reference areas have to be selected, which do not require different normalizations or calibrations.

The number of applications or blocks cannot be changed again afterwards without re-initializating the instrument.

The matrix measuring mode is indicated by m in the display.

With matrix measuring mode enabled, automatic block formation cannot be enabled! Accordingly it is not possible to set a block size for the automatic block formation after pressing **MENU** to change the application-specific settings.
see "5.6 Applications", beginning on page 41

6.3 Changing the Measuring Mode

The measuring mode can be changed only in the configuration program **APPL No** (see "11.4.7 Instrument Configuration", beginning on page 145).

The instrument will be re-initialized automatically when changing the measuring mode.
When re-initializing the instrument, all applications as well as all measurements stored will be deleted; the parameters of the configurations programs will be reset to the default settings.
After re-initialization, i. e. as well after changing the measuring mode, the required applications have to be created again and the parameters of the configuration programs have to be adjusted to the required settings again!

7 Measurement

It is absolutely necessary to follow the instructions of the chapter -> see "2 Notes Concerning the Operation of the Instrument and Handling the Accessories", beginning on page 5!

7.1 Preparations for Measurement

Instrument and measuring area have to be prepared as follows:

- Determination of the significant surface and the reference area according to / 8 /.
- Making sure, that the reference area is not damaged and clean (e.g. free of fluids, dirt or grease).
- Perform the instrument start-up (see "10.1 Start-Up, Maintenance and Cleaning", beginning on page 123).
- Connect the printer and switch the printer on if necessary (if printer is available and printout of the measurements desired).
- Switch the instrument on (see "4.1 Switching the Instrument ON and OFF", beginning on page 21) and
  select an application that fits the current measuring object
  see "5 Applications", beginning on page 25.
- Check the normalization and calibration by reference measurement on an object with known ferrite content.
  see "9.1 Normalization and Corrective Calibration", beginning on page 110.
- Check whether a correction factor has to be taken into consideration.
  see "7.2 Measurement", beginning on page 68.
- Definition of the instrument configuration
  see "11 Instrument Configuration", beginning on page 129) and of the application-specific settings
  see "5.6 Applications", beginning on page 41).

7.2 Influencing Factors

The following factors affect the ferrite content measurement with the FERITSCOPE® MP30:

- curvature of the measuring object
- thickness of the measuring object
- layer thickness
- distance of the measuring position to the edge

The effects of these factors can be corrected for by multiplying the measured ferrite content with the corresponding correction factors
see "15 Correction Factors", beginning on page 169.

Generally, a correction of these influences is required only if:

- the diameter of the curvature is
  smaller than 50 mm (2") (for measuring objects with convex curvature) or
  smaller than 80 mm (3.2") (for measuring objects with concave curvature), or
- the thickness of the measuring object is smaller than 2 mm (80 mils), or
- the layer thickness is smaller than 2 mm (80 mils), or
- the distance of the measuring position to the edge is smaller than 2 mm (80 mils).

7.3 Making a Measurement

The probe has to be placed vertically on the surface of the measuring object to perform a measurement. The measurements should be performed within the reference area.

Following the measurement accept, i. e. after the measurement appears in the display, the probe can be lifted again. The instrument is ready to measure again.

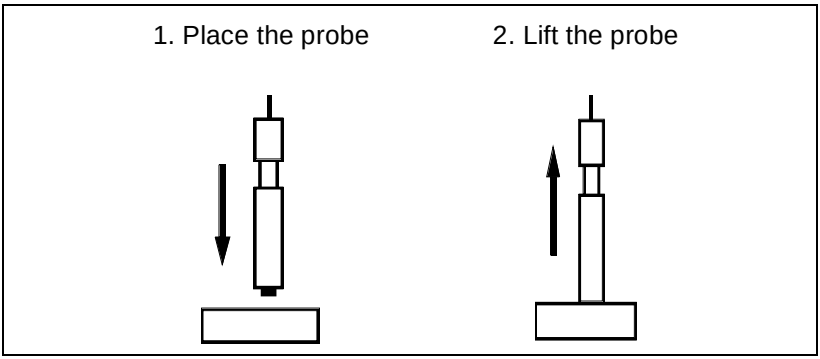


Figure 7.1: Measurement with axial single tip probes

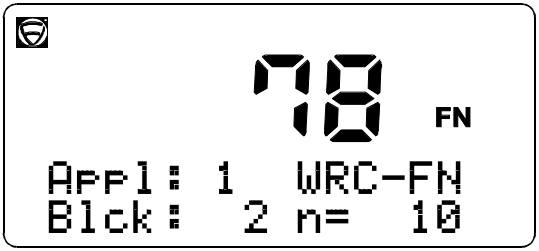


Figure 7.2: Display with measurement

With automatic measurement accept enabled, the probe has to be lifted at least 50 mm (2") from the measuring object between readings.

To avoid erroneous measurements, do not hover above the measuring object with the probe!

7.3.1 Measurement Accept

With automatic measurement accept enabled, the measurement will be accepted immediately after placing the probe on the measuring object.

With “continuous” display mode enabled (enabling the “continuous” display mode: see "7.6 Measurement", beginning on page 83), measurement accept can be initiated by:

- pressing the key **ENTER**
- sending the command G0 (G Zero) via the RS232 interface

7.3.2 Measurements with External Start Enabled

If automatic measurement accept is not desired, e. g. for measurement inside pipes, bores or grooves, measurements should be performed with external start enabled and with automatic measurement accept disabled.

The external start feature allows measurement accept by pressing the key ▲ or by sending the command G0 (G Zero) via the RS232 interface.

Enable external start and disable automatic measurement accept:
see "11.4.3 Instrument Configuration", beginning on page 137.

There are several ways to initiate measurement accept manually with external start enabled after placing the probe on the measuring area:

- pressing the key ▲
- sending the command G0 (G Zero) via the RS232 interface

During normalization or corrective calibration, a measurement can be initiated with external start enabled by:

- pressing the key **FINAL-RES**
- sending the command G0 (G Zero) via the RS232 interface

7.3.3 Acoustic Signals after Measurement Accept

An acoustic signal will sound with every measurement taken (unless it is disabled) after measurement accept.
The signal indicates that the measurement signal coming from the probe is captured and the probe may be lifted off from the measuring object again.

Enable and disable the acoustic measurement accept signal:
see "11.1 Instrument Configuration", beginning on page 129.

In addition to the acoustic measurement accept signal, the acoustic signals listed in table 7.1 may sound.
If applicable, the signals will sound in succession.
If, for example, the last measurement of a block has violated the upper specification limit when measuring with fixed block size, the acoustic measurement accept signal will sound followed by two short signals to indicate the violation of the upper specification limit and at last one long signal to indicate the closing of the block.

Signal	Meaning
1xshort	Measurement violated the lower specification limit see "7.3.4 Measurement", beginning on page 71
2xshort	Measurement violated the upper specification limit see "7.3.4 Measurement", beginning on page 71
1xlong	The black was closed automatically and the block result is display see "7.3.5 Measurement", beginning on page 72
2xlong	Measurement was recognized as outlier see "7.3.7 Measurement", beginning on page 76

Table 7.1: Meaning of the acoustic signals

7.3.4 Measurement with Specification Limits Monitoring Enabled

With specification limits monitoring enabled, it is possible to check quickly and easily whether the measured ferrite contents are within a preset specification range.
Enable specification limits monitoring and set the specification limits:
see "5.6.1 Applications", beginning on page 42.

As long as specification limits monitoring is enabled, b appears in the display.

After a measurement violating the lower specification limit, d appears in front of the measurement in the display (see figure 7.3). Additionally, a short acoustic signal will sound following the acoustic measurement accept signal to indicate the specification limit violation.

After a measurement violating the upper specification limit, u appears in front of the measurement in the display (see figure 7.4).
Additionally, two short acoustic signals will sound following the acoustic measurement accept signal to indicate the specification limit violation.

With disabled acoustic measurement accept signal, only the signal(s) to indicate the specification limit violation will sound.

With outlier rejection enabled, only the acoustic signals to indicate the recognition of an outlier measurement will sound at outlier recognition. The specification limit violation will not be indicated in this case.

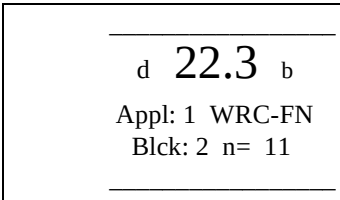
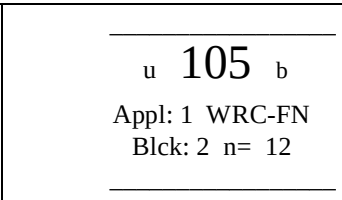
	

Figure 7.3: Display with specification limits monitoring enabled showing a measurement violating the **lower** specification limit	Figure 7.4: Display with specification limits monitoring enabled showing a measurement violating the **upper** specification limit

7.3.5 Measurement with Fixed Block Size

When measuring with fixed block size, block formation will be performed automatically by the instrument after an adjustable number of measurements (= block size).
Selecting the block size: see "5.6.3 Applications", beginning on page 46

Automatic block formation cannot be enabled with matrix measuring mode enabled!

With a printer assigned and switched on, the block result will be printed automatically following the block formation.

k appears in the display after storing the last measurement in the block.Additionally, a long acoustic signal will sound after the acoustic measurement accept signal to indicate the block formation.
With disabled acoustic measurement accept signal, only the signal to indicate the block formation will sound.

Measurement with Fixed Block Size:

Keys/Actions	Detail of the Display	Explanation
01	78 Appl: 1 WRC-FN Blck: 2 n= 1/ 4	Perform a measurement. The measurement value will be displayed. **[Appl:]:** number of the current application **[WRC-FN]:** ferrite content measurement values are displayed in ferrite numbers (display mode of the current application) **[Blck:]:** number of the current block **[n=]**: number of single measurements stored in the current block; the fixed block size appear after the slash

Keys/Actions	Detail of the Display	Explanation
01	78 Appl: 1 WRC-FN Blck: 2 s= 1.55 k	Perform measurements repeatedly until the block is closed automatically. **[Ap:]**: number of the current application **[d.=]:** mean value of the current block **[Bl:]:** number of the current block **[s=]:** standard deviation of the current block **[k]:** block is closed; additional measurements cannot be stored in this block
01	78 Appl: 1 WRC-FN Blck: 3 n= 1/ 4	Performing the next measurement opens the next block automatically.

7.3.6 Measurement with “Mean Reading” Mode Enabled

When measuring with “mean reading” mode enabled, the mean value of multiple single measurements (i single readings) is stored instead of the single measurement. This mode is especially well suited for rough surfaces.(Selecting the number of single measurements, which have to be taken before the actual measurement is computed as mean value of these single measurements: see "5.6.4 Applications", beginning on page 53

With “mean reading” mode and outlier rejection enabled, single measurements recognized as outliers are not included in the computation of the actual measurement!

Measurements with "Mean Reading" Mode Enabled:

Keys/Actions	Detaile of the Display	Explanation
01	78 Appl: 1 i= 1/ 4 Blck: 2 n= 1	Perform a measurement. The measurement value will be displayed. **[Appl:]:** number of the current application **[i=]:** number of single measurements taken with "mean reading" mode enabled; the number of single measurements to be averaged appears after the slash **[Blck:]:** number of the current block **[n=]:** number of measurements stored in the current application
01	78 Appl: 1 i= 0/ 4 Blck: 2 n= 2	Perform measurements repeatedly until the number of measurements stored is increased by one (**[i= 0/]** is displayed again). The mean value of the measurements performed will be displayed and stored.

7.3.7 Measurement with Outlier Rejection Enabled

With outlier rejection enabled, the measurements recognized as outliers will be indicated in the display and acoustically.
Enabling the outlier rejection: see "5.6.5 Applications", beginning on page 54.

After a measurement recognized as outlier by the instrument, d and u appear in front of the measurement in the display (see figure 7.5).
Additionally, two long acoustic signals will sound following the acoustic measurement accept signal to indicate the recognition of the outlier measurement.

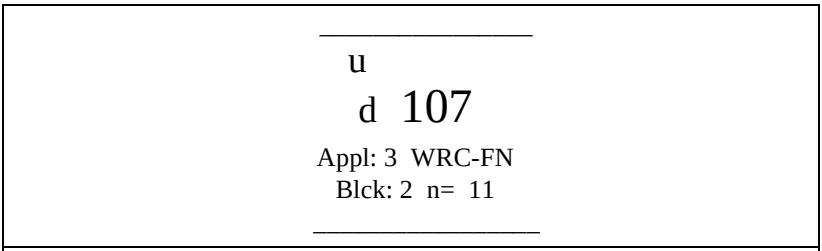


Figure 7.5: Display showing a measurement recognized as outlier

In addition to the acoustic signal to indicate the recognition of an outlier measurement, [Outlier !] appears briefly in the prompt lines in the display, if a previous measurement is recognized as outlier. The measurement is then displayed (see figure 7.6).

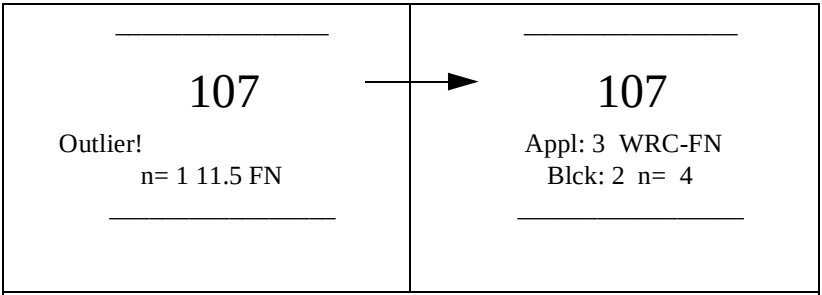


Figure 7.6: Display after recognition of a previous measurement as outlier

With outlier rejection enabled, measurements recognized as outliers will not be included in the evaluation of the current block or application.

With acoustic measurement accept signal disabled, only the signals to indicate the outlier measurement will sound.

With “mean reading” mode and outlier rejection enabled, single measurements recognized as outliers are not included in the computation of the actual measurement!

With outlier rejection enabled, only the acoustic signals to indicate the recognition of an outlier measurement will sound at outlier recognition. The specification limits violation will not be indicated in this case.

7.4 Recording the Measurements with a Printer

With a printer assigned and switched on, single measurements will be printed immediately after measurement accept (see figure 7.7).
With specification limits monitoring enabled, the measurements will be printed between or beside the specification limits (see figure 7.8).

However, if **[Print sgl. meas. Off]** has been selected in the configuration program **PRINT**, the measurements will not be printed until the block result is called-up!
see "11.4.8 Instrument Configuration", beginning on page 147.

With “mean reading” mode enabled, only the mean value of the single readings will be printed. The single readings will not be printed.

When measuring with fixed block size, with a printer assigned and switched on, the block result of the closed block will be printed automatically following the block formation.
see "8.1 Evaluation", beginning on page 92.

With outlier rejection enabled, the previous measurement recognized as outlier will be printed once again below the current measurement and indicated as outlier (see figures 7.7 and 7.8).

7.4.1 Printing Measurements Later

With a printer assigned and switched on, the measurements and the block results of all blocks of the current application can be printed by pressing **PRINT**.

The measurements and the block result of an individual block can be printed during evaluation of this block by pressing **PRINT**.
see "8.1.1 Evaluation", beginning on page 96.

```
Application No.1 Block No.:2
n=   1      Fe=        2.7FN
n=   2      Fe=       48.9FN
n=   3      Fe=       49.0FN
n=   4      Fe=       48.5FN
n=   1      Fe=        2.7FN ! previous measurement recognised as an outlier
n=   5      Fe=       49.3FN
n=   6      Fe=       49.7FN
n=   7      Fe=       99.7FN ! previous measurement recognised as an outlier
```

Figure 7.7: Printout of the measurements (example)

```
Application No. 1 Block No.:3
n                LSL              USL
                 45.0 FN          55.0 FN
 1: :      *                          : :    48.7
 2:<<:                                : :    33.9
 3: :         *                       : :    49.8
 4:!!:                                : :    33.9
 5: :             *                   : :    49.7
 6: :               *                 : :    49.9
 7:<<:                                : :    36.2
 8: :               *                 : :    50.2
 9: :                                 :!!:   74.2
10: :               *                 : :    50.1
11: :                                 :>>:   59.1
12:!!:           *                    : :    49.6
```

Figure 7.8: Printout of the measurements with specification limits monitoring enabled (example)

Explanations for Figures 7.7 and 7.8

Application No.	nummber of the current application
Block No.	number of the current block
n	sequential number of the measurement
Fe	measured Ferrite Content with unit of measurement
LSL/USL	lower/upper specification limit
*	measurement is within specification limits
<</>>	measurement isnot within specification limits
!/!!	measurement was recognized as oulier

7.5 Erroneous Measurements

7.5.1 Deleting Single Erroneous Measurements

If an erroneous measurement is recognized immediately after measurement accept, the measurement can be deleted from the application by pressing the **DEL** key once.
The deleted measurement will not be included in the block or final result.

If **DEL** is pressed after the fifth measurement for example, the following line

n= 5 deleted

appears on the printout (with a printer assigned and switched on).
All measurements of the current block can be deleted one after the other by pressing **DEL** repeatedly.

7.5.2 Deleting all Measurements of an Open Block

The measurements stored in the current, open block can be deleted all at once by pressing **DEL** during the evaluation of the current block
see "8.1 Evaluation", beginning on page 92.

7.5.3 Deleting all Measurements of the Current Application

The measurements stored in the current application can be deleted all at once during the evaluation of the current application. ,
To do this, press the key **DEL** twice after pressing **FINAL-RES**
see "8.2 Evaluation", beginning on page 100.

7.5.4 Overwriting Single Erroneous Measurements Later

Erroneous measurements of the current or previous blocks can be overwritten with new measurements during evaluation of the current block.,

Overwriting of Stored Measurements:

Keys/Action	Detail of the Display	Explanation
BLOCK-RES	48.8 Mean value Block: 4 n= 9	Call-up the block result of the current block with **BLOCK-RES** (see "8.1 Evaluation", beginning on page 92). **[Mean value]:** mean value of the current block is displayed **[Block]:** number of the current block **[n=]:** number of measurements stored in the current block
▲,▼	35.5 Mean value Block: 2 n= 5 k	Select the block containing the erroneous measurement to be overwritten using the arrowkeys. **k:** indicates a closed block

Keys/Action	Detail of the Display	Explanation
MENU	27.3 Blck: 2 n= 1 Back: MENU k Single meas.: {} Remeas.: DEL	Call-up display of the single readings with **MENU**. **[Blck]:** number of the selected block **[n=]:** sequential number of the displayed single reading **[Back: MENU]:** press **MENU** to end the display of the single readings **[Single meas.: {}]:** use the arrow keys to display the single readings one after the other **[Remeas.: DEL]:** press **DEL** to delete the displayed single reading
▲, ▼	77.2 Blck: 2 n= 4 Back: MENU k Single meas.: {} Remeas.: DEL	Select the erroneous measurement to be overwritten using the arrow keys. **[Back: MENU]:** press **MENU** to end the display of the single readings **[Single meas.: {}]:** press the arrow keys to display the single readings one after the other **[Remeas.: DEL]:** press **DEL** to delete the displayed single reading

Keys/Action	Detail of the Display	Explanation
DEL	_____ - ---- Remeas. Blck: 2 n= 4 k _____ Cancel: DEL	Delete the measurement with **DEL**. **[remeasure]:** request to perform a measurement **[Cancel: DEL]:** press **DEL** to cancel the procedure (measurement stored will be kept)
01	_____ 24.9 Blck: 2 n= 4 Back: MENU k _____ Single meas.: {} Remeas.: DEL	Perform a measurement. The measured value will be displayed.
MENU	_____ 25.3 Mean value Blck: 2 n= 5 k _____	End the display of the single readings with **MENU**. The block result will be calculated again and the updated mean value will be displayed.
ENTER	_____ 25.3 Appl: 3 WRC-FN Blck: 5 n= 0 k _____	End the display of the block result with **ENTER**. The evaluated block will be closed automatically and a new block will be opened.If further measurements are to be included in the last open block, press the key ▲ instead of **ENTER**. The instrument is ready to measure again.

No outlier rejection will be performed when overwriting stored measurements during block result (not even if outlier rejection is enabled).

7.6 Measurement with “Continuous” Display Mode

With the “continuous” display mode enabled, you can easily determine the ferrite content distribution over the surface of the measuring object by moving the placed probe over the surface.
With “continuous” display mode enabled,

- measurements will be displayed continuously,
- measurements will not be accepted or stored automatically, and
- no data will be transferred via the RS232 interface unless [Send in free ? On] is selected in the configuration program ▼ see "11.4.6 Instrument Configuration", beginning on page 143.

When moving the placed probe over a test surface, the probe tips are subject to increased wear and tear!

Measurement with “Continuous” Display Mode Enabled:

Keys/Actions	Detail of the Display	Explanation
▼	p ____ Appl: 1 WRC-FN Blck: 2 n= 1	Press the key ▼ to enable the “continuous” display mode.
04	p 78.5 Appl: 1 WRC-FN Blck: 2 n= 1	Place the probe on the measuring object and move the probe over the surface of the object to determine the coating thickness distribution.

Keys/Actions	Detail of the Display	Explanation
1	p Appl: 1 WRC-FN Blck: 2 n= 1	Lift off the probe from the measuring object.
▼	108 Appl: 1 WRC-FN Blck: 2 n= 1	Press the key ▼ again to disable the “continuous” display mode.

As long as the “continuous” display mode is enabled, p appears in the display.

As long as the “continuous” display mode is enabled, measurement accept can be initiated only by pressing **ENTER** or by sending the command G0 (G Zero) via the RS232 interface.
With external start enabled, measurement accept can be initiated by pressing s additionally.

The “continuous” display mode will be disabled automatically when switching the instrument off!

7.7 Measurement with Standard or Matrix Measuring Mode Enabled

The preparations necessary for measurement and the making of a measurement are independent of the measuring mode selected and can be taken from the chapters “see "7.1 Measurement", beginning on page 67 and see "7.3 Measurement", beginning on page 68.
Detailed information about the standard and matrix measuring mode:
see "6 Standard and Matrix Measuring Mode", beginning on page 63.

The measuring mode can be changed only in the configuration program APPL No (see "11.4.7 Instrument Configuration", beginning on page 145).

7.7.1 Measurement with Standard Measuring Mode Enabled

When measuring with standard measuring mode enabled, the measurements can be stored only in the last open block.

It is not possible, to select the block the next measurement is to be stored in freely.

7.7.2 Measurement with Matrix Measuring Mode Enabled

The matrix measuring mode is indicated by m in the display.

When measuring with matrix measuring mode enabled, the block, the measurement is to be stored in, can be selected freely before measuring.
It is possible, for example, to store one measurement in block 20 and the next measurement in block 26.

Selecting the block, the next measurement is to be stored in:

Keys/Actions	Detail of the Display	Explanation
BLOCK-RES	47.2 Mean value m Block: 20 n= 15	Press **BLOCK-RES** to start the selection of the block. **[Mean value]:** mean value of the measurements stored in the evaluated block up to now **[Block:]:** number of the evaluated block **[n=]:** number of measurements stored in the evaluated block
▲(▼)	32.2 Mean value m Block: 26 n= 10	Select the desired block using the arrow keys. **[Mean value]:** mean value of the measurements stored in the evaluated block up to now **[Block:]:** number of the evaluated block **[n=]:** number of measurements stored in the evaluated block

Keys/Actions	Detail of the Display	Explanation
01	33.4 Appl: 2 WRC-FN m Blck: 26 n= 11	Perform the measurement on the next measuring object. **[Appl:]:** number of the current application **[Blck:]:** number of the current block

The block will be automatically closed if the maximum number of measurements, which can be stored in a block, is reached.
k appears in the display to indicate that the block is closed.
Additionally, a long acoustic signal will sound after the acoustic measurement accept signal to indicate the block formation.

With disabled acoustic measurement accept signal, only the signal to indicate the block formation will sound.

Measurements taken with matrix measuring mode enabled and k appearing in the display will not be stored, printed or included in the evaluation.
[E024 - Result block full !] appears briefly in the display after the measurement.
The block the next measurement is to be stored in, has to be selected as described above so that the next measurement can be stored.

7.8 Transferring Measurements to a Computer and Remote Control of the Instrument

With a computer assigned to the RS232 interface of the instrument, the following functions are available:

- transferring of the measurements from the instrument to a computer
- remote control of the instrument by sending commands from an external computer to the instrument

To do this, instrument and computer have to be assigned by an interface cable. The interface cable and the adapter for correct connection of instrument and computer (9-pin or 25-pin) are included in the RS232 interface cable MP,

which is available from Fischer or your local supplier.

Connecting a computer: see "10.5 Start-Up, Maintenance and Cleaning", beginning on page 127",

Factory settings and connector pin-out of the RS232 interface: see "14.2 Technical Data and Contents of Shipment", beginning on page 164.

Suitable commercial or self-programmed data processing software can be used to acquire and process the measurements coming from the instrument.

Refer to the corresponding software manuals for information about import and processing the measurements with this software.

7.8.1 Output Format of the Measurement Data String

The measurements will be transferred via the RS232 interface as floating point string followed by CR + LF.
The word length, i. e. the number bits an ASCII character consists of, can be selected in the configuration program ▼ (**[Word length 7 Bits]** or **[Word length 8 Bits]**).
Selecting the word length:
see "11.4.6 Instrument Configuration", beginning on page 143.

7.8.2 Transferring the Measurements to an External Computer

There are two modes to transfer the measurements from the instrument to an external computer:

- on-line mode and
- off-line mode.

In the **on-line mode** the instrument is assigned to the computer during measurement and the measurements are transferred to the computer immediately (on-line) after the measurement.

Single measurements are transferred via the RS232 interface immediately after measurement accept, if **[Output to port Single meas.]** is selected in the configuration program ▼.
However, if **[Output to port Block mean values]** is selected, the block mean values will be transferred via the RS232 interface after pressing **BLOCK-RES**; the single measurements will be displayed but not transferred.
Selecting the type of data to be transferred via the RS232 interface:
see "11.4.6 Instrument Configuration", beginning on page 143.

In the **off-line mode** the measurements already stored in the instrument can be transferred via the RS232 interface at any time (off-line).
The data transfer can be initiated by pressing **PRINT**.

Single measurements are transferred via the RS232 interface after pressing **PRINT**, if **[Output to port Single meas.]** is selected in the configuration program ▼.
However, if **[Output to port Block mean values]** is selected, only the block mean values will be transferred.
Selecting the type of data to be transferred via the RS232 interface: see "11.4.6 Instrument Configuration", beginning on page 143

A series of single measurements can be combined into a block by pressing **BLOCK-RES** (see "8.1 Evaluation", beginning on page 92).
The end of each block formed by pressing **BLOCK-RES** can be marked with a group separator code (ASCII GS).
The group separator will be written to the end of each block and transferred via the RS232 interface followed by CR + LF only if **[Group separator On]** has been selected in the configuration program ▼.
Setting the group separator mode: see "11.4.6 Instrument Configuration", beginning on page 143

7.8.3 Remote Control of the Instrument

ASCII	Decimal	Hexadecimal	Function
G 0	71 48	47 30	Initiate a measurement accept and transfer the measurement via the RS232 interface.
ESC ?	27 63	1B 3F	Initiate a measurement accept and transfer the measurement via the RS232 interface.
ESC0	27 48	1B 30	Actuate key **DEL**
ESC1	27 49	1B 31	Actuate key **FINAL-RES**
ESC2	27 50	1B 32	Actuate key **BLOCK-RES**
ESC3	27 51	1B 33	Actuate key **ON/OFF**
ESC4	27 52	1B 34	Actuate key **ZERO**
ESC5	27 53	1B 35	Actuate key **CAL**
ESC6	27 54	1B 36	Actuate key ▲
ESC7	27 55	1B 37	Actuate key ▼

ASCII	Decimal	Hexadecimal	Function
ESC8	27 56	1B 38	Actuate key **APPL No**
ESC9	27 57	1B 39	Actuate key **MENU**
ESC:	27 58	1B 3A	Actuate key **PRINT**
ESC;	27 59	1B 3B	Actuate key **ENTER**

Table 7.2: Available commands for remote control of the instrument

The instrument can be remote controlled by sending the commands from table 7.2 via the RS232 interface.

Each command has to be followed by CR + LF (ASCII CR: Dec. 13, Hex. 0D; ASCII LF: Dec.10, Hex. 0A)!

8 Evaluation

Two options for evaluation of the measured Ferrite Content are available:

- evaluation of the current block (block result)
- evaluation of the current application (final result)

When calling a block result or a final result, the following parameters are calculated from the measurements of the current block or the current application and can be displayed in succession:

- mean value
- number of the evaluated block or application
- number of the measurements evaluated
- standard deviation
- date and time of the block formation of the evaluated block or current date (if the evaluated block has not yet been closed)
- lowest or highest measurement or block mean value (if automatic block formation has been enabled)
- number of measurements violating the lower or the upper specification limit (only if specification limits monitoring is enabled)

When printing the result, the following will be printed in addition:

- current date
- 95% confidence interval for the mean value
- coefficient of variation C.O.V.
- Standard deviation sa (only when displaying or printing the final result if automatic block formation has been enabled)
- lower and upper specification limit LSL and USL
- process capability indices cp and cpk, estimated value s^ of the standard deviation (only if specification limits monitoring and automatic block formation have been enabled)
- histogram with information if a normal distribution of the measurements was found, skewness, kurtosis and a normal probability chart (only when printing the final result, and if the histogram mode **[Histogram On]** is selected in the configuration programs)

The block or final result cannot be called if there are no measurements stored in the current application or if the measurements have been deleted!

The display will not change after pressing **BLOCK-RES** or **FINAL-RES**.

With outlier rejection enabled, measurements recognized as outliers will not be included in the evaluation!

Detailed explanations about the evaluation parameters :
see "16 Glossary of Terms and Symbols", beginning on page 177.

8.1 Evaluation of the Current Block (Block Result)

Single measurements are combined automatically into a block at evaluation of the current block.
However, the block will not be closed until the evaluation is terminated by performing a measurement or pressing **ENTER**.
If no measurements are stored in the current block, the block result of the last closed block will be displayed after pressing **BLOCK-RES**.

If k appears in the display, the evaluated block has been closed already.

If the last block has not been closed when measuring with fixed block size, the next measurement will be added to this block (even if the evaluation was terminated with **ENTER**). The block formation is not accomplished until the number of measurements stored in this block equals the fixed block size (see "7.3.5 Measurement", beginning on page 72.

Evaluation of the Current Block (Display of the Block Result):

Keys	Detail of the Display	Explanation
BLOCK-RES	48.8 Mean value Block: 2 n= 9	Call-up the block result of the current block with **BLOCK-RES**. **[Mean value]:** mean value is displayed **[Block:]:** number of the evaluated block **[n=]:** number of measurements evaluated
BLOCK-RES	0.30 Std. dev. s 04.07.96 11:0	Display the next calculated parameter with **BLOCK-RES.** **[Std. dev. s]:** standard deviation s is displayed **[04.07.01 11:02]:** current date and time (for open blocks) or date and time of block formation (for closed blocks)

Keys	Detail of the Display	Explanation
BLOCK-RES	48.6 lowest meas. n= 0< LSL: 0%	Display the next calculated parameter with **BLOCK-RES.** **[lowest meas.]:** the lowest measurement is displayed **[n= 0<LSL: 0%]:** number of measurements violating the lower specification limit (LSL) (will be displayed only with specification limits monitoring enabled)
BLOCK-RES	49.2 highest meas. n= 2>USL: 22%	Display the next calculated parameter with **BLOCK-RES.** **[highest meas.]:** the highest measurement is displayed **[n= 2>USL: 22%]:** number of measurements violating the upper specification limit (USL) (will be displayed only with specification limits monitoring enabled)

Keys	Detail of the Display	Explanation
BLOCK-RES	_____ 49.2 Leave open: **{** Change block: } _____ Single meas: MENU Delete block: DEL Select block: {} End: ENTER	Display the notes concerning block closure with **BLOCK-RES**. **[Leave open: {]:** end the display of the block result without closing the current block with ▲, further single measurements can be added to the current block (displayed only when evaluating open blocks) **[End: ENTER]:** end the display of the block result and close the evaluated block with **ENTER** (displayed only when evaluating open blocks) **[Change block:}]** or **[Select block:{}]**: display the block result of the previous or next block using the arrow keys **[Single meas:MENU]:** display the single measurements of the evaluated block with **MENU** (the single measurements can be displayed in succession with s, return to the block result with **MENU**) **[Delete block:DEL]:** delete the measurements of the last open block with **DEL** (is displayed only when evaluating open blocks)

Keys	Detail of the Display	Explanation
ENTER	_____ Appl: 1 WRC-FN Blck: 3 n= 0 _____	End the display of the block result with **ENTER**. The instrument is ready to measure again. Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21

8.1.1 Recording the Block Result with a Printer

With a printer connected and switched on, the block result of the current block with date and time will be printed after pressing **BLOCK-RES**.
If no measurements are stored in the current block, no block result will be printed after pressing **BLOCK-RES**, but the block result of the last closed block will be displayed.

When measuring with fixed block size and with a printer connected and switched on, the block result of the closed block will be printed automatically after the block formation.

Depending on the selected block result mode (see "11.4.2 Instrument Configuration", beginning on page 136), the short or the long block result is printed (see figures 8.1 and 8.2).

```
Fischer Feritscope P30 12.11.01
Appl.No.        1       --Block result--
Block No.       2             12.11.01   12:23
Mean value      Fe.     =     49.02 +/-0.48 FN
Std. dev.       s       =      0.39 FN     n=5
```

Figure 8.1: Printout of a short block result (example)

```
Fischer Feritscope MP30 12.11.01
Appl.No.          1       --Block result--
Block No.         2             12.11.01   12:23
Mean value        Fe.     =     49.02 +/-0.48 FN
Std. dev.         s       =      0.39 FN     n=5
C.O.V.                    =      0.79 %
lowest meas.              =     48.51 FN
highest meas.             =     49.57 FN
```

Figure 8.2: Printout of a long block result (example)

```
Fischer Feritscope MP30 12.11.01
Appl.No.          1       --Block result--
Block No.         2             12.11.01   12:23
Mean value        Fe.     =     49.02 +/-0.48 FN
Std. dev.         s       =      0.39 FN     n=5
C.O.V.                    =      0.79 %
lowest meas.              =     48.51 FN
highest meas.             =     49.57 FN
          1 Meas. < LSL (48.71 FN) = 20.00%
          1 Meas. > USL (49.20 FN) = 20.00%
```

Figure 8.3: Printout of a long block result with specification limits monitoring enabled (example)

With specification limits monitoring enabled, the number of measurements violating the specification limits are printed in addition to the long block result (see figure 8.3).

If the printer is switched on during display of the block result, the block result can be printed by pressing **PRINT**.
A list of all measurements stored in the current block will be printed additionally (see figures 8.4 and 8.5).

```
Application No. 1 Block No.:2
n=1             Fe=   49.6 FN
n=2             Fe=   48.9 FN
n=3             Fe=   49.0FN
n=4             Fe=   99.8FN!
n=5             Fe=   48.5FN
n=6             Fe=   49.2 FN

Fischer Feritscope MP30 12.11.01
Appl.No.        1--Block result--
Block No.       2 12.11.01 12:23
Mean value      Fe.   =49.02+/- 0.48 FN
Std. dev.       s     = 0.39 FN n=5
C.O.V.                =0.79%
      lowest meas.    =48.51
      highest meas.   =49.57
```

Figure 8.4: Printout of a long block result with a list of the measurements stored in the evaluated block (example)

```
Application No. 1 Block No.:2
n            LSL                          USL
            48.7FN                       49.2FN
1: :                                     :>>:   49.6
2: :         *                           : :    48.9
3: :            *                        : :    49.0
4: :                                     :!!:   99.8
5:<<:                                    : :    48.5
6: :                    *                : :    49.2

Fischer Feritscope MP30 12.11.01
Appl.No.        1--Block reult--
Block No.       2 12.11.01 12:23
Mean value      Fe.   =49.02+/- 0.48 FN
Std. dev.       s     = 0.39 FN n=5
C.O.V.                =0.79%
      lowest meas.    =48.51
      highest meas.   =49.57
1 Meas. <LSL (48.71 FN)=20.00%
1 Meas. >USL (49.20 FN)=20.00%
```

Figure 8.5: Printout of a long block result with a list of the measurements (with specification limits monitoring enabled) (example)

Explanations for Figures 8.1 to 8.5:

FERITSCOPE® MP30	**instrument model**
12.11.01	current date
Appl.No.	number of the current application
Block result	type of result
Block No.	number of the current block
12.11.01 12:23	date and time of the last measurement of the last block or the last block formation
Mean value Fe	mean value with 95% confidence interval
Std. dev.	standard deviation
n	in the list of measurements: sequential number of the measurement in the block result: number of measurements evaluated
C.O.V.	coefficient of variation
lowest meas	lowest measurement
highest meas	highest measurement
LSL/USL	lower / upper specification limit
*	measurement is within specification limits
<< / >>	measurement is not within specification limits
! / !!	measurement was recognized as outlier

If the block result of a previous block is displayed (by pressing t while displaying the block result of the current block), the block result of this previous block can be printed by pressing **PRINT**. A list of all measurements stored in this previous block will be printed additionally.

With matrix measuring mode enabled (indicated by m in the display), the block result will not be printed after pressing **BLOCK-RES**.
With matrix measuring mode enabled, the block result can be printed only by pressing **PRINT** during display of the block result.

8.2 Evaluation of the Current Application (Final Result)

The evaluation of all measurements stored in the current application is summarized in the final result.
Performing a measurement or pressing the key **ENTER** during evaluation of the current application will end the display of the final result.
The current block will be closed and a new block will be opened.
If the last block has not been closed when measuring with fixed block size, the next measurement will be added to this block (even if the evaluation was terminated with **ENTER**). The block formation is not accomplished until the number of measurements stored in this block equals the fixed block size (see "7.3.5 Measurement", beginning on page 72).

When measuring with fixed block size, only the measurements stored in closed blocks will be included in the evaluation of the current application.

Evaluation of the Current Application (Display of the Final Result):

Keys	Detail of the Display	Explanation
FINAL-RES	49.0 Mean value Appl: 1 n= 17 or (with fixed block size): 49.0 Appl: 1 Mean v. from 3 blocks	Call-up the final result of the current application with **FINAL-RES.** **[Mean value]:** mean value is displayed **[Appl:]:** number of the current application **[n=]:** number of measurements evaluated **[Mean v. from 3 blocks]:** mean value of three closed blocks is displayed

Keys	Detail of the Display	Explanation
FINAL-RES	0.26 Std. dev. s 12.11.01 12:29 or (with fixed block size): 0.26 Std. dev. s 12.11.01 12:29	Display the next calculated parameter with **FINAL-RES.** **[Std. dev. s]** or **[Std. dev. s.]:** standard deviation s or s. is displayed **[12.11.01 12:29]:** current date and time (if the last block of the application has not yet been closed) or date and time of the block formation of the last closed block
FINAL-RES	5.1 Std. dev. sa Appl: 1 n Bl= 3 (appears only with fixed block size)	Display the next calculated parameter with **FINAL-RES.** **[Std. dev. sa]:** standard deviation sa is displayed **[nBl=]:** number of blocks evaluated

Keys	Detail of the Display	Explanation
FINAL-RES	_____ 48.5 lowest meas. n= 2< LSL: 12% _____ or (with fixed block size): _____ 48.5 smallest meas. n= 2< LSL: 12% _____	Display the next calculated parameter with **FINAL-RES.** **[lowest meas.]:** the lowest measurement is displayed **[n= 2<LSL: 12%]:** number of measurements violating the lower specification limit (LSL) (will be displayed only with specification limits monitoring enabled) **[smallest block]:** smallest block mean value of all blocks evaluated is displayed
FINAL-RES	_____ 49.6 highest meas. n= 4>USL: 24% _____ or (with fixed block size): _____ 49.6 largest block n= 4>USL: 24 _____	Display the next calculated parameter with **FINAL-RES.** **[highest meas.]:** the highest measurement is displayed **[n= 4>USL: 24%]**: number of measurements violating the upper specification limit (USL) (will be displayed only with specification limits monitoring enabled) **[largest block]:** largest block mean value of all blocks evaluated is displayed

Keys	Detail of the Display	Explanation
FINAL-RES	49.6 Delete meas.: DEL Continue: ENTER	Display the notes concerning the ending of the final result with **FINAL-RES.** **[Delete meas.:DEL]:** delete all measurements stored in the current application with **DEL** **[Continue: ENTER]:** end the display of the final result with **ENTER** (measurements stored will not be deleted)
ENTER	Appl: 1 WRC-FN Blck: 4 n= 0	End the display of the final result with **ENTER**. If **DEL** was pressed before, all measurements stored in the current application are deleted now. The instrument is ready to measure again. Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21

8.2.1 Recording the Final Result with a Printer

With a printer connected and switched on, the final result of the current application with date and time will be printed after pressing **FINAL-RES**.

Only if specification limits monitoring is enabled, the number of measurements violating the specification limits will be printed (see figure 8.6).

```
Fischer Feritscope MP30 11.11.01
Product     .....
Name        .....
Appl.No.        1 --Final result--
from 11.11.01 11:11 to 11.11.01 11.12
Mean value      Fe.         = 49.04 +/- 2.13 FN
Std. dev.       s           = 0.26 FN n=17
C.O.V.                      = 0.52%
lowest meas.                = 48.51 FN
highest meas.               = 49.57 FN
2 Meas. < LSL (48.71 FN) = 11.76%
4 Meas. > USL (49.20 FN  = 23.53%
```

Figure 8.6: Printout of a final result with specification limits monitoring enabled (example)

When measuring with fixed block size and with specification limits monitoring enabled, the standard deviation sa, the process capability indices cp and cpk, the estimated standard deviation s^, the number nBl of blocks evaluated and the block size ni will be printed in addition (see figure 8.7).

```
Fischer Feritscope MP30 11.11.01
Product     .....
Name        .....
Appl.No.        1 --Final result--
from 11.11.01 11:11 to 11.11.01 11.21
Mean value      Fe.         = 49.04 +/-     2.13 FN
Std.dev.        s           =  0.26 FN       ni =5
Std.dev.        sa          =              nBl=2
smallest block              = 48.51 FN
largest block               = 49.57 FN
                2 Meas.<LSL (48.71FN) = 11.76%
                4 Meas.>USL (49.20FN) = 23.53%
cp              = 0.82 cpk = 0.18  s^ = 0.29
```

Figure 8.7: Printout of a final result with fixed block size and with specification limits monitoring enabled (example)

Explanations for Figures 8.6 and 8.7

FERITSCOPE MP30	**instrument model**
11.11.01	current date
Product .... / Name	the exact description of the measuring object the measurements were performed on and the operator name can be entered here for example
Appl.No.	number of the current application
Final result	type of result
from ... to ...	date and time of the block formation of the first and the last block of this application or current date and time (if the last block has not been closed yet)
Mean value Fe./Fe..	mean value / mean value of the block mean values with 95% confidence interval
Std. dev. s/s.	std. deviation s (s. with fixed block size)
n	number of measurements evaluated
ni	block size (number of measurements per block)
Std. dev. sa	standard deviation sa (only if the deviations of the block mean values cannot be attributed to the deviations within the blocks, as determined by analysis of variance methods (A.O.V.))
nBl	number of blocks evaluated
C.O.V.	coefficient of variation
lowest meas. / smallest block	lowest measurement / lowest block mean value
highest meas. / largest block	highest measurement / highest block mean value
LSL/USL	lower / upper specification limits
cp / cpk	process capability index cp / cpk
s^	estimated value s^ of the std. deviation

A histogram will be printed only if the histogram has been enabled in the configuration programs and if more than 9 measurements are stored in the application.
Selecting the histogram mode: see "11.4.2 Instrument Configuration", beginning on page 136.

To determine whether the measurements evaluated can be classified as having normal distribution, the instrument automatically performs a Kolmogorov-Smirnov test (if up to 40 measurements are to be evaluated) or a $\chi 2$ test (if more than 40 measurements are to evaluated) when evaluating the current application. The test result will be printed below the histogram and indicates whether the measurements were classified as having normal distribution **[Normal distribution]** or not **[Distribution not normal]** (see figure 8.8).

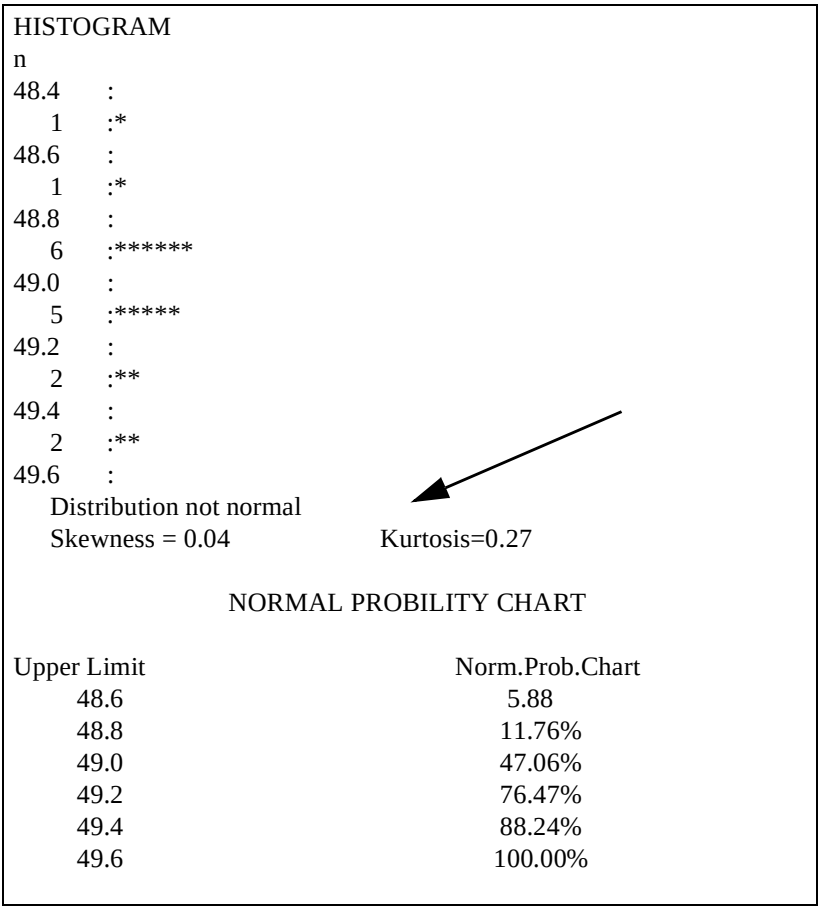


Figure 8.8: Printout of a histogram

9 Normalization and Corrective Calibration

The following factors affect the Ferrite Content measurement:

- geometry of the measuring object
  (size of the reference area, curvature and thickness of the measuring object, layer thickness and distance of the measuring position to the edge)
- wear of the probe tip

The effects of the geometry of the material to be measured can be corrected for by multiplication of the measured ferrite content and the corresponding correction factors.
The wear of the probe tip can be corrected for up to a certain extent by corrective calibration. If the wear of the probe tip becomes too strong, no correction is possible. The probe has to be sent to your local supplier or to Fischer for repair.

To ensure the measurement accuracy specified for the probe assigned, it is absolutely necessary to perform each normalization and corrective calibration very carefully.

It is absolutely necessary to follow the instructions
see "2 Notes Concerning the Operation of the Instrument and Handling the Accessories", beginning on page 5.

Perform reference measurements after each normalization and corrective calibration to check the normalization or corrective calibration!

Following a normalization or corrective calibration the block will be closed automatically and a new block will be opened. The measurements stored before performing the normalization or corrective calibration will not be deleted after the normalization or corrective calibration.
If required, the measurements have to be deleted before the next measurement.

With the restricted operating mode enabled (indicated by e in the display) it is not possible to start a normalization or corrective calibration!

With external start enabled, during normalization or corrective calibration a measurement can be initiated by pressing **FINAL-RES** or by sending the command G0 (G Zero) via the RS232 interface.

9.1 Reference Measurement

When performing a reference measurement, measurements are taken on a reference sample. If the deviations of these measurements from the ferrite content of the reference sample violate the specified tolerances, the normalization or calibration has to be performed again.

A reference measurement requires:

- reference sample (coated measuring object with known ferrite content and of the same geometry as the objects to be measured)

Reference samples are subject to wear and tear caused by the tactile measurement.
Reference samples have to be checked regularly and replaced by new reference samples if the wear and tear becomes significant.

9.2 Normalization

A normalization is necessary when creating a new application.
During a normalization, a new zero point will be determined for the calibration curve of the current application and stored.

A normalization requires:

- Base (supplied in the calibration standard set)

A normalization is valid only for the current application. The other applications remain unchanged.
However, if the linking mode is enabled (v in the display), the normalization is valid for all applications linked to the current application.

Normalization (with the Instrument Switched on):

Keys/Action	Detail of the Display	Explanation
ZERO	z 0.00 Base Cancel: ENTER	Call-up the normalization of the current application with **ZERO**. z appears and remains in the display as long as the normalization is performed. **[Base]:** measurements have to be performed on the Base **[Cancel: ENTER]:** press **ENTER** to cancel the normalization

Keys/Action	Detail of the Display	Explanation
01 **Base**	z 139.7 s= 0.01 n= 5 OK: ENTER Delete: DEL	Perform a measurement on the Base. Repeat the measurement at several points of the Base until the mean value is stable (or the change of the mean value after another measurement does not violate the admissible limit for this change). The mean value of all normalization measurements will be displayed. **[s= 0.01 n= 5]:** standard deviation s=0.01, number of measurements n=5 **[OK: ENTER]:** press **ENTER** to confirm and end the normalization **[Delete: DEL]:** 1x **DEL** deletes the last measurement, 2x **DEL** deletes all normalization measurements

Keys/Action	Detail of the Display	Explanation
ENTER	Appl: 2 WRC-FN Blck: 3 n= 0	Confirm and end the normalization with **ENTER**. The new calibration parameters will be computed and stored automatically. The instrument is ready to use now. Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21 Perform reference measurements to check the normalization!

9.2.1 Recording the Normalization with a Printer

With a printer assigned and switched on, a record of the normalization is printed while a normalization is performed.

```
Fischer Feritscope MP30 12.11.01
Normalization 12.11.01 08:13
Appl.No.:4 Probe: EGAB1.3_Fe
n=1             Fe=  0.00 FN
n=2             Fe=-0.02 FN
n=3             Fe=-0.07 FN
n=4             Fe=  0.04 FN
n=5             Fe=  0.00 FN
Fe.=141.3FN s = 0.66 FN
```

Figure 9.1: Record of a normalization (example)

Explanations for Figure 9.1:

FERITSCOPE MP30	**instrument model**
03.12.01	current date
NORMALIZATION	record of a normalization will be printed
11.11.01 11:11	date and time of the normalization
Appl.No.:	number of the current application (i. e. of the application, which is normalized now)
Probe:	probe, which is used to perform the normalization
n	sequential number of the normalization measurements
Fe	measured ferrite content with unit of measurement
Fe.	mean value of the normalization measurements
s	standard deviation of the normalization measurements

9.3 Corrective Calibration

During a corrective calibration, a new zero point and

- one additional point (one-point calibration with one calibration standard) or
- two additonal points (two-point calibration with two calibration standards) or
- three additionale point (three-point calibration) will be determined to adjust the calibration to the measuring object.
  The new calibration parameters will be computed and stored.

A corrective calibration requires:

- a calibration standard set for the corrective calibration (corrective set)

When performing a corrective calibration for a specific ferrite content range, calibration standards with ferrite contents covered by this range should be used.

A corrective calibration is valid only for the current application.
The other applications remain unchanged.
However, if the linking mode is enabled (v in the display), the corrective calibration is valid for all applications created with the probe, which is used to perform the corrective calibration.

When deleting the corrective calibration of the current application, the corrective calibrations of the other applications remain unchanged.
However, if the linking mode is enabled, (v in the display), the corrective calibration of all applications linked with the current application will be deleted.
(All applications created with the very same probe are linked!)

Corrective Calibration (with the Instrument Switched on):

Keys /Actions	Detail of the Display	Explanation
CAL	_____ j 0.00 Base Skip: ENTER _____ Cancel: CAL Delete cal.: DEL	Call-up the corrective calibration with **CAL**. j appears and remains in the display as long as the corrective calibration is performed. **[Base]:** measurements have to be performed on the uncoated measuring object (normalization) **[Skip: ENTER]:** press **ENTER** to skip the normalization (stored normalization will not be changed) **[Cancel: CAL]:** press **CAL** to cancel the corrective calibration **[Delete cal.: DEL]:** press **DEL** to delete the corrective calibration of the current application

Keys /Actions	Detail of the Display	Explanation
01 Base	_____ j 140 s= 0.01 n= 5 OK: ENTER _____ Delete: DEL	Perform a measurement on the uncoated measuring object (substrate material). Repeat the measurement at several points of the reference area until the mean value is stable (or the change of the mean value after another measurement does not violate the admissible limit for this change). The mean value of all normalization measurements will be displayed. **[s= 0.01 n= 5]:** standard deviation s=0.01 number of measurements n=5 **[OK: ENTER]:** press **ENTER** to confirm the normalization **[Delete: DEL]:** **1x DEL** deletes the last measurement, **2x DEL** deletes all normalization measurements

Keys /Actions	Detail of the Display	Explanation
ENTER	j 0.00 Cal.Std.1: 0.00 End: ENTER Back: DEL Entry: {}	Confirm and store the normalization with **ENTER**. Previous normalization will be overwritten. **[End: ENTER]:** press **ENTER** to confirm and end the corrective calibration at this point **[Back: DEL]:** press **DEL** to go back to the normalization **[Entry: {}]:** use the arrow keys to enter the thickness of the corrective foil

Keys /Actions	Detail of the Display	Explanation
23 calibr. standard	——————— j 1.77 Cal.Std.1: 1.8 OK: ENTER ——————— Delete: DEL Entry: {}	Place the first calibration standard (corrective foil) on the uncoated measuring object and perform a measurement. Repeat the measurement at several points of the reference area until the mean value is stable (or the change of the mean value after another measurement does not violate the admissible limit for this change). The mean value of all measurements performed for this calibration step will be displayed. **[Cal.Std.1:]:** foil thickness stored for the first calibration standard **[OK: ENTER]:** press **ENTER** to confirm and end the current calibration step **[Delete: DEL]:** **1x DEL** deletes the last measurement, **2x DEL** deletes the whole measurement series (all measurements performed for this calibration step), **3x DEL** to go back to the previous calibration step **[Entry: {}]:** use the arrow keys to enter the thickness of the corrective foil

Keys /Actions	Detail of the Display	Explanation
▲ , ▼	j 1.8 Cal.Std.1: 13.2 OK: ENTER Delete: DEL Entry: {}	Use the arrow keys to set the displayed value to the current foil thickness (this step is not required, if the displayed foil thickness corresponds to the current foil thickness of the corrective foil). **[OK: ENTER]:** press **ENTER** to confirm and end the current calibration step
ENTER	j 0.00 Cal.Std.2: 0.00 End: ENTER Back: DEL Entry: {}	If a corrective calibration with two calibration standards is desired: proceed for the second calibration standard (corrective foil) in the same manner as described above for the first calibration standard. Otherwise: press **ENTER** to confirm and end the corrective calibration.
ENTER	Appl: 2 WRC-FN Blck: 5 n= 0	Press **ENTER** to confirm and end the last calibration step. The new calibration parameters will be determined and stored automatically. The instrument is ready to use now. Further explanations concerning the display: see "3.1.6 Instrument and Accessories Description", beginning on page 16. Perform reference measurements to check the corrective calibration!

9.3.1 Deleting the Corrective Calibration

When deleting the corrective calibration of a dual probe, the corrective calibration of both channels (magnetic induction and eddy current) will be deleted.

Deleting the Corrective Calibration (with the Instrument Switched on):

Keys	Detail of the Display	Explanation
CAL	j 0.00 Base Skip: ENTER Cancel: CAL Delete cal.: DEL	Call-up the corrective calibration with **CAL**. **[Cancel: CAL]:** press **CAL** to cancel the corrective calibration **[Delete cal.: DEL]:** press **DEL** to delete the corrective calibration
DEL	j 0.00 Delete Cal ? Yes:DEL No:ENTER	Delete the corrective calibration with **DEL**. **[Yes:DEL No:ENTER]:** press **DEL** to delete the corrective calibration; press **ENTER** to cancel the procedure and keep the corrective calibration stored
DEL	Appl: 2 WRC-FN Blck: 5 n= 0	Confirm the deleting of the corrective calibration with **DEL**. The corrective calibration will be deleted. The instrument is ready to measure now.

9.4 Determination of the Normalized Probe Output Signal Xn of a Calibration Standard during Calibration

During calibration, the normalized probe output signal Xn of a calibration standard can be determined as described below without interference with the calibration.

Since **FINAL-RES** initiates the measurement accept with external start enabled, it is not possible to determine the normalized probe output signals during calibration with external start enabled!

Determining Xn of a Calibration Standard during Calibration:

Keys /Actions	Detail of the Display	Explanation
FINAL-RES	j p 1.000 Free disp. mode off: FINAL-RES	Press **FINAL-RES** to enable the “continuous” display mode during calibration. **[Free disp. mode off: FINAL-RES]:** press **FINAL-RES** to disable the “continuous” display mode again

Keys /Actions	Detail of the Display	Explanation
23 calibration standard	_____ j p 0.130 Free disp. mode off: FINAL-RES _____	To determine the normalized probe output signal Xn of a calibration standard, place the probe on the standard. The normalized probe output signal Xn will be displayed. The normalized probe output signal will not be stored! **[Free disp. mode off: FINAL-RES]:** press **FINAL-RES** to disable the “continuous” display mode again
FINAL-RES		Disable the “continuous” display mode by pressing **FINAL-RES**. The interrupted calibration can be continued.

10 Start-Up, Maintenance and Cleaning

Switch the instrument off before connecting or disconnecting any components! Switch the instrument off before connecting the AC power supply or changing the battery! Even small electrical discharges may delete internally stored data.

To prevent damage to the connector pins do not tilt the plug when inserting or disconnecting it.

It is absolutely necessary to follow this instructions ->
see "2 Notes Concerning the Operation of the Instrument and Handling the Accessories", beginning on page 5

10.1 Instrument Start-Up

An instrument start-up includes the following steps:

- providing a power supply for the instrument
  see "10.2 Start-Up, Maintenance and Cleaning", beginning on page 123
- connecting a probe to the instrument
  see "10.3 Start-Up, Maintenance and Cleaning", beginning on page 125
- connecting a printer (if available) to the instrument
  see "10.4 Start-Up, Maintenance and Cleaning", beginning on page 127
- connecting an external computer (if desired) to the instrument
  see "10.5 Start-Up, Maintenance and Cleaning", beginning on page 127

10.2 Power Supply

There are three ways to provide power for the instrument:

- AC power supply
- 9 V battery
- rechargeable 9 V NiCd battery

To prevent damage to the instrument or wrong measurement results due to wrong A/C line voltage, connect the instrument to a power outlet only with the AC power supply supplied by Fischer.
The A/C line voltage must agree with the A/C line voltage rating on the serial number plate of the AC power supply.

To connect the instrument with the AC power supply to a power outlet, switch the instrument off and connect the AC power supply to the instrument and to power outlet.

If s appears in the display, the battery is discharged and needs to be replaced or recharged!

Installing or Replacing the Battery:

1. Switch the instrument off using **ON/OFF** (if it isn't off already).
2. Place the instrument with the back side facing up on a table. To open the battery compartment cover, insert the tip of a screwdriver into the slotted recess of the battery compartment cover and carefully push the screwdriver down (see figure 10.1). The cover will lift up on the side with the recess.

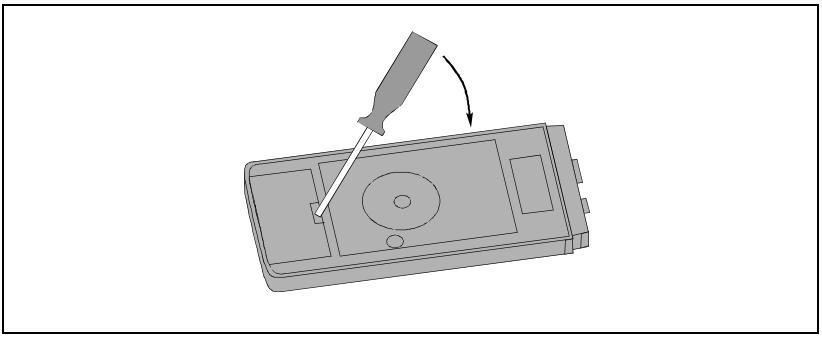


Figure 10.1: Open the battery compartment cover

When handling the screwdriver take care not to injure yourself or other people with the screwdriver (e.g. because the screwdriver slipped at trying to open the battery compartment cover)!

3. Remove the battery compartment cover.
4. If an old battery has to be replaced, remove the old battery from the instrument and pull the battery connector clips from the contacts of the battery.

   Otherwise: Install the new battery as described in step 5.

Exhausted or defective batteries are hazardous waste.
Observe your local waste disposal ordinances!

5. Connect the new battery by snapping the battery connector clips onto the contacts of the new battery. The shape of the clips prevents connecting the battery in reverse polarity.

Be careful not to touch the battery terminals to the battery connector clips with reverse polarity!

6. Put the battery back into its compartment.
7. Close the battery compartment cover.

Ensure that the battery clip wires are completely within the compartment so that the compartment can be closed correctly.

10.3 Connecting or Replacing a Probe

To prevent damage to the connector pins of the probe receptacle do not rotate the probe connector in the probe receptacle.

To prevent electrical discharges, switch the instrument off before connecting or replacing a probe!
Even small electrical discharges may delete internally stored data.

To prevent wrong connection of probe and instrument or damage to the pins of the probe connector, do not try to plug in the probe connector unless keyway and notch are properly aligned (see figure 10.2)!

Connecting or Replacing a Probe:

1. Switch the instrument off with **ON/OFF** (if it isn't off already).
2. If the probe assigned to the instrument needs to be replaced, unscrew the knurled locking ring completely. Carefully pull the the probe connector from the probe receptacle of the instrument.
   If no probe is assigned to the instrument, continue with step 3.
3. Plug the probe connector of the new probe into the probe receptacle of the instrument (refer to figure 10.3).

To prevent wrong connection of probe and instrument or damage to the pins of the probe connector, do not try to plug in the probe connector unless keyway and notch are properly aligned (see figure 10.2)!

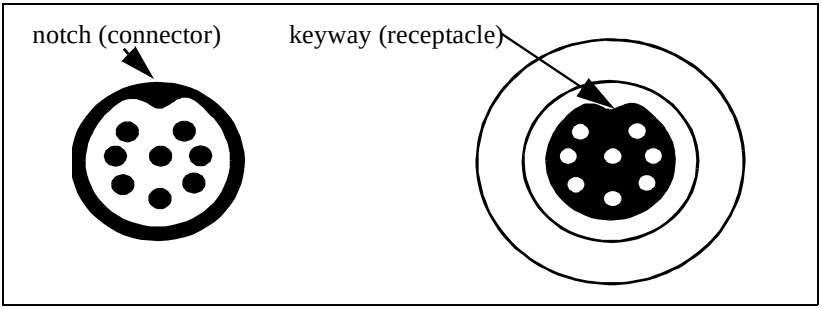


Figure 10.2: Probe connector and probe receptacle

4. To prevent unintentional turning of the probe connector, keep hold of the probe connector when tightening the knurled locking ring.

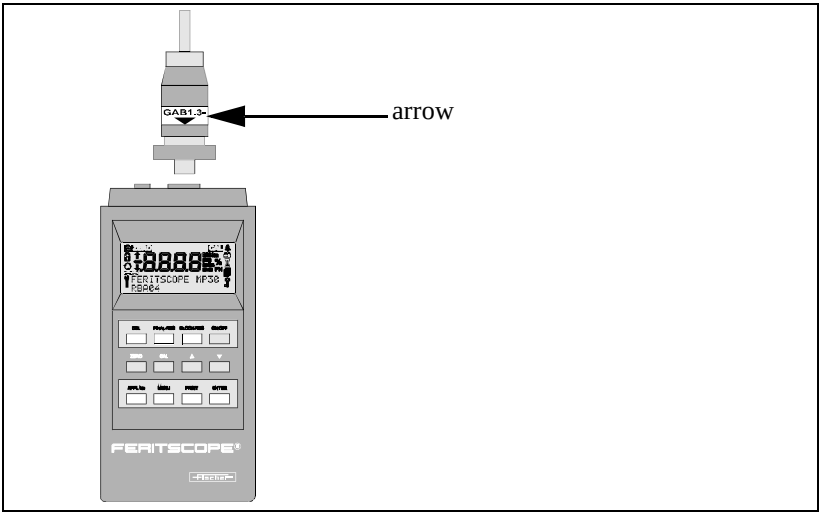


Figure 10.3: Orientation of the probe connector when plugging the probe connector into the probe receptacle

To prevent damage to the connector pins of the probe receptacle turn only the knurled locking ring. Do not rotate the probe connector in the probe receptacle!

5. Switch the instrument on with **ON/OFF**.
   The instrument recognizes automatically the type of probe assigned.

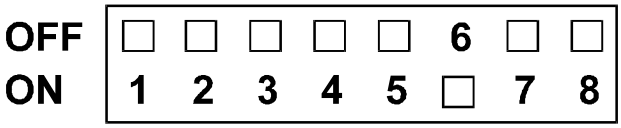
10.4 Connecting a Printer

Proper data transfer is possible only if the RS232 control parameters of the instrument and the connected printer agree!

Connecting a Printer:

1. Switch the instrument off with **ON/OFF** (if it isn't off already).
2. Connect the printer to the RS232 interface of the instrument.
   For further information refer to printer manual.

   The dip switches on the backside of the printer EPSON P40S have to be set according to the illustration below.



3. Switch the instrument on with **ON/OFF**.
4. Adjust the settings of the configuration programs of the instrument to the connected printer (see "11.4.8 Instrument Configuration", beginning on page 147).

10.5 Connecting an External Computer

An external computer can be connected to the RS232 interface of the instrument.

Knowledge about configuration, operation and programming of the computer as well as of the software used is necessary to connect the instrument to an external computer. Refer to the corresponding software manuals if necessary.

Proper data transfer is possible only if the RS232 control parameters of the instrument and the connected computer agree!

Connecting an External Computer:

1. Switch the instrument off with **ON/OFF** (if it isn't off already).
2. Connect the computer to the RS232 interface (with RS232 interface cable MP).
3. Set the control parameters of the RS232 interface of the instrument see "11.4.6 Instrument Configuration", beginning on page 143.

   Factory settings and connector pin-out of the RS232 interface of the instrument: see "11.4.2 Instrument Configuration", beginning on page 136

10.6 Cleaning

To prevent the instrument or the accessories from damage caused by electrical strokes, the instrument or the accessories must be unplugged before performing any cleaning work!

Should the instrument or the accessories get dirty, clean them with a cleaner suited for plastics and a soft cloth.

When cleaning observe the following:

Wipe off dirt immediately before it gets a chance to adhere to the surface!

Do not use aggressive cleaners that may blemish the plastic housing!

To prevent the instrument or the accessories from damage, do not clean them by scraping off the dirt, especially not near the probe tips.

Prevent water or any other liquid from entering the instrument or the accessories! (Danger of short circuits!)
Do not immerse the instrument or the accessories into liquids to remove dirt by soaking!
Do not pour any liquids over the instrument!

11 Instrument Configuration

Certain instrument settings, i.e. time and date, the unit of measurement or the control parameters of the RS232 interface, can be changed as required.

11.1 Acoustic Measurement Accept Signal

The acoustic measurement accept signal, i.e. the acoustic signal that sounds after each measurement, can be disabled.

The acoustic signals that sound after switching the instrument on, after violation of the specification limits, after recognition of an outlier measurement or after automatic block formation (when measuring with fixed block size), cannot be disabled!
Details about the acoustic signals: see "7.3.3 Measurement", beginning on page 70.

11.1.1 Enabling the Measurement Accept Signal

To enable the acoustic measurement accept signal after the instrument has been switched off, switch the instrument on using the key **ON/OFF** immediately followed by the key ▲.

The acoustic measurement accept signal remains enabled unless it will be disabled again. It is not necessary to enable the acoustic measurement accept signal each time, the instrument is switched on.

11.1.2 Disabling the Measurement Accept Signal

Pressing the key ▼ immediately after switching the instrument on using **ON/OFF** will disable the acoustic measurement accept signal, i.e. the measurement accept signal will no longer sound from then on.

The acoustic measurement accept signal remains disabled unless it will be enabled again. It is not necessary to disable the acoustic measurement accept signal each time, the instrument is switched on.

11.2 Setting the Date and Time

Setting the Date and Time:

Keys	Detail of the Display	Explanation
ON/OFF+ZERO	u d 7 Timehours	With the instrument switched off, press **ON/OFF + ZERO** to start the setting procedure for date and time. Following the power-up selftest, the hour currently set appears automatically.
▲,▼	u d 9 Timehours	Use the arrow keys to set the hours.
ENTER	u d 36 Time minutes	Confirm the hour by pressing **ENTER**. The minutes currently set appear.

Keys	Detail of the Display	Explanation
▲,▼	u d 7 Time minutes	Use the arrow keys to set the minutes.
ENTER	u d 4 Date day	Confirm the minutes by pressing **ENTER**. The day currently set appears. The order, day, month and year appear in, depends on the currently set date format. (Setting the date format: see "11.4.3 Instrument Configuration", beginning on page 137
▲,▼	u d 14 Date day	Use the arrow keys to set the day.
ENTER	u d 2 Date month	Confirm the day by pressing **ENTER**. The month currently set appears.

Keys	Detail of the Display	Explanation
▲,▼	u d 1 Date month	Use the arrow keys to set the month.
ENTER	u d 2002 Date year	Confirm the month by pressing **ENTER**. The year currently set appears.
▲,▼	u d 2003 Date year	Use the arrow keys to set the year.
ENTER	30.2 Appl: 2 WRC-FN Blck: 1 n=	Confirm the year by pressing **ENTER**. The instrument switches to measuring mode automatically. The application used last for the assigned probe will be called. Further explanations concerning the display: see "4.1 Switching the Instrument ON and OFF", beginning on page 21.

Another way to set the date and time is described in the configuration programs (see "11.4.3 Instrument Configuration", beginning on page 137).

11.3 Restricted Operating Mode

With the restricted operating mode enabled, only those keys necessary for measurement and evaluation are active. This may prevent erroneous measurements due to unintentional changes to the instrument parameters.

With the restricted operating mode enabled, the following keys are deactivated:

- **ZERO**
- **CAL**
- **MENU**

Pressing these keys will not trigger any action, the display will not change. In addition, it is not possible to call-up the configuration programs, to create, overwrite or delete applications!

11.3.1 Enabling and Disabling the Restricted Operating Mode

To enable the restricted operating mode with the instrument switched off, switch the instrument on using the key **ON/OFF** immediately followed by the key **DEL**.

As long as the restricted operating mode is enabled, e appears in the display.

The restricted operating mode remains enabled unless it will be disabled. It is not necessary to enable the restricted operating mode each time, the instrument is switched on.

Pressing the key **ENTER** immediately after switching the instrument on using the key **ON/OFF** will disable the restricted operating mode again.

11.4 Configuration Programs

To change the parameters defined in the configuration programs, you need to call-up the configuration programs, select the desired configuration program by pressing the corresponding key, step through the individual parameter positions by pressing **ENTER**, and make the changes where desired.
Using the arrow keys, the parameters can be changed.

As long as the restricted operating mode is enabled (indicated by e in the display), it is not possible to call-up the configuration programs!

Call-up the Configuration Programs:

Keys	Explanation
10 x ENTER	Call-up the configuration programs by pressing **ENTER** 10 times (with the instrument switched on). **[157]** appears in the display.
2 x ▲	Set the display by pressing ▲ to **[159]**
ENTER	Confirm with **ENTER**. **[FrEE]** appears in the display. The desired configuration program can be selected by pressing the corresponding key.

As long as the configuration programs are called-up, t appears in the display.

The following description of the configuration programs is based on the assumption that the configuration programs are called-up and have not yet been exited.

Exit the Configuration Programs:

Keys	Explanation
DEL	If **[FrEE]** appears in the display, the configuration programs can be exited by pressing **DEL**. The instrument is ready to measure again.

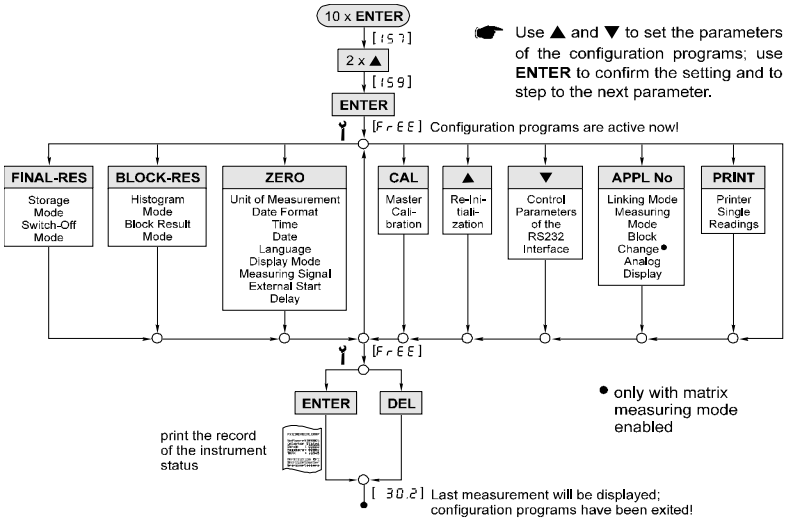


Figure 11.1: Configuration programs (overview)

11.4.1 Configuration Program FINAL-RES (Storage Mode and Auto Switch-Off Mode)

Keys	Explanation
FINAL-RES	Select the configuration program FINAL-RES by pressing **FINAL-RES**. Select the desired storage mode by pressing ▲ or ▼ : **[Storage mode store]:** measurements are stored (and remain stored when switching the instrument off) **[Storage mode do not store]:** measurements are displayed, but not stored **[Storage mode delete at off]:** all measurements are deleted when switching the instrument off

Keys	Explanation
ENTER	Confirm the selection with **ENTER**. Select the desired auto switch-off mode by pressing ▲ or ▼ : **[Auto. switch off On]:** the instrument switches itself off, if no measurement is taken and no key is pressed for approximately three minutes (auto switch-off mode enabled) **[Auto. switch off Off]:** the instrument does not switch itself off (auto switch-off mode disabled)

11.4.2 Configuration Program BLOCK-RES (Histogram Mode and Block Result Mode)

Keys	Explanation
BLOCK-RES	Select the configuration program BLOCK-RES by pressing **BLOCK-RES**. Select the desired histogram mode with ▲ or ▼ : **[Histogram On]:** when printing the final result the histogram will be printed as well **[Histogram Off]:** when printing the final result the histogram will not be printed
ENTER	Confirm the selection with **ENTER**. Select the block result mode by pressing ▲ or ▼ : **[Block result short]:** when printing the block result the short block result will be printed **[Block result long]:** when printing the block result the long block result will be printed

11.4.3 Configuration Program ZERO (Unit of Measurement, Date Format, Time, Date, Language, Display Mode, Measurement Accept, External Start Mode and Delay)

Keys	Explanation
ZERO	Select the configuration program ZERO by pressing **ZERO**. Select the desired unit of measurement for the current application (and for every application to be created in future) by pressing ▲ or ▼ (the setting of the unit of measurement of already existing applications remains unchanged): **[Ferrite Fe %]**: unit of measurement µm or mm **[Ferrite WRC-FN]**: unit of measurement mils When changing the unit of measurement the normalization and corrective calibration of the current application will be deleted. A new normalization or corrective calibration has to be performed if required after changing the unit of measurement. When creating new applications, the measurements of these newly created applications will be displayed in the unit of measurement which is selected in the configuration program ZERO
ENTER	Confirm the selection with **ENTER** (and delete the measurements by pressing **DEL** if required to select another unit of measurement). Select the desired date format by pressing ▲ or ▼ : **[Date format european]**: dd.mm.yy date format **[Date format USA]**: mm.dd.yy date format
ENTER	Confirm the selection with **ENTER**. Set the hours by pressing ▲ or ▼ : **[Time hours]**: hours
ENTER	Confirm the selection with **ENTER**. Set the minutes by pressing ▲ or ▼ : **[Time minutes]**: minutes

Keys	Explanation
ENTER	Confirm the selection with **ENTER**. The order, day, month and year appear in, depends on the previously set date format. Set the day by pressing ▲ or ▼ : **[Date day]**: day
ENTER	Confirm the selection with **ENTER**. Set the month by pressing ▲ or ▼ : **[Date month]**: month
ENTER	Confirm the selection with **ENTER**. Set the year by pressing ▲ or ▼ : **[Date year]**: year
ENTER	Confirm the selection with **ENTER**. Select the language for prompt lines and printouts by pressing ▲ or ▼: **[Language deutsch]**: German **[Language english]**: English **[Language français]**: French **[Language italiano]**: Italian **[Language español]**: Spanish

Keys	Explanation
ENTER	Confirm the selection with **ENTER**. Select the display mode of the current application by pressing ▲ or ▼ (the setting of the display mode of the other applications remains unchanged (display modes (overview): see "5.6.6 Applications", beginning on page 58 **[Appl: 5 Display WRC-FN]** or **[Appl: 5 Display Fe %]**: the ferrite content measurement value will be displayed **[Appl: 5 Display Xn and Xs]**: in addition to the normalized probe output signal Xn of the measurement the probe output signal Xs will be displayed **[Appl: 5 Display Fe and Xs]**: in addition to the ferrite content measurement value the probe output signal Xs will be displayed **[Appl: 5 Display Countrate]**: in addition to the first four figures of the probe output signal all figures of the probe output signal will be displayed **[Appl: 5 Display norm. Countrate]**: the normalized probe output signal of the measurement will be displayed

Keys	Explanation
ENTER	Confirm the selection with **ENTER** (and delete the measurements by pressing **DEL** if required to select another display mode). Select the desired measuring signal with ▲ or ▼ : **[Meas. signal On]:** measuring signal enabled, i. e. the measurement will be accepted automatically when the probe is placed on the measuring object (automatic measurement accept enabled) **[Meas. signal Off]:** measuring signal disabled, i. e. the measurement will not be accepted automatically when the probe is placed on the measuring object (automatic measurement accept disabled)
ENTER	Confirm the selection with **ENTER**. Select the desired external start mode by pressing ▲ or ▼ : **[External start Off]**: external start disabled **[External start On]**: external start enabled, i. e. the measurement accept can be initiated by pressing S (or **FINAL-RES** during normalization or calibration) The combination **[Meas. signal Off]** and **[External start Off]** is not allowed, since measurement accept is not possible with this setting. The parameters are reset to **[Meas. signal On]** and **[External start Off]** if this combination is selected.

Keys	Explanation
ENTER	Confirm the selection with **ENTER**. Set the displayed measurement accept pause to the pause desired after initiation of the external start (= delay) by pressing ▲ or ▼ : **[Delay 0 ms]:** no pause after initiation of the external start **[Delay 100 ms]:** 100 ms pause **... [Delay 2500 ms]:** 2500 ms pause

11.4.4Configuration Program CAL (Master Calibration)

During a master calibration the coefficients of the master calibration are computed and stored in the EEPROM memory chip of the probe connector. These coefficients define the relationship between probe signal and ferrite content. A master calibration requires a specific set of calibration standards (master set).

A master calibration should only be performed by Fischer authorized service technicians!

Keys	Explanation
CAL	Select the configuration program CAL by pressing **CAL**. Perform the master calibration with assigned probe.

11.4.5Configuration Program ▲ (Re-Initialization)

Re-initialization: Restoring the default factory settings of the instrument.

When re-initializing the instrument, all applications will be deleted, i. e. all measurements stored, all normalizations and corrective calibrations of all applications will be deleted! The applications have to be created again if required after re-initialization.

In addition, all settings of the configuration programs are reset to the default factory settings as well. The parameters have to be changed again if required.

Keys	Explanation
▲	Select the configuration program ▲ by pressing ▲ . **[Initialize unit? Yes:DEL No:ENTER]:** press **DEL** to re-initialize the instrument, or press **ENTER** to exit without re-initializing
DEL	Press **DEL** only if the re-initialization is indeed desired. The re-initialization will be performed automatically.

11.4.6 Configuration Program ▼ (Parameters of the RS232 Interface)

Keys	Explanation
▼	Select the configuration program ▼ by pressing ▼. Select the desired baud rate by pressing s or t : **[Baud rate 9600] ... [Baud rate 300]:** baud rate: 9600 ... 300
ENTER	Confirm the selection with **ENTER**. Select the desired parity by pressing ▲ or ▼ : **[Parity none]**: no parity **[Parity even]**: even parity **[Parity odd]**: odd parity
ENTER	Confirm the selection with **ENTER**. Select the desired word length by pressing ▲ or ▼ : **[Word length 8 Bits]**: word length: 8 bit **[Word length 7 Bits]**: word length: 7 bit
ENTER	Confirm the selection with **ENTER**. Select the desired number of stop bits by pressing ▲ or ▼ : **[Stop bits 1 Bit]**: number of stop bits: 1 **[Stop bits 2 Bits]**: number of stop bits: 2
ENTER	Confirm the selection with **ENTER**. Select the desired handshake by pressing ▲ or ▼ : **[Handshake Hardware RTS/CTS]**: hardware handshake **[Handshake none]**: no handshake **[Handshake Xon/Xoff]**: Xon/Xoff handshake
ENTER	Confirm the selection with **ENTER**. Select the desired transmit pause (= pause before sending the next measurement to the RS232 interface) by pressing ▲ or ▼ : **[Transmit pause 0 ms]:** measurements will be sent without pause **... [Transmit pause 8000 ms]:** 8000 ms before sending the next measurement

Keys	Explanation
ENTER	Confirm the selection with **ENTER**. Select the type of data to be sent to the RS232 interface by pressing ▲ or ▼: **[Output to port Single meas.]:** single readings **[Output to port Block mean values]:** block mean values
ENTER	Confirm the selection with **ENTER**. Enable or disable the group separator with ▲ or ▼ : **[Group separator On]:** a group separator will be sent between the single blocks when transferring the data via the RS232 interface **[Group separator Off]:** no group separator will be sent between the single blocks when transferring the data via the RS232 interface
ENTER	Confirm the selection with **ENTER**. Select the desired “continuous” transfer mode by pressing ▲ or ▼ : **[Send in free ? Off]:** measurements taken with “continuous” display mode enabled will not be sent to the RS232 interface **[Send in free ? On]:** measurements taken with “continuous” display mode enabled will be sent to the RS232 interface

11.4.7 Configuration Program APPL No (Application Linking Mode and Measuring Mode)

Keys	Explanation
APPL No	Select the configuration program **APPL No** by pressing **APPL No.** Select the desired application linking mode by pressing ▲ or ▼ : **[Link appl. ? Off]:** applications are not linked (application linking mode disabled) **[Link appl. ? On]:** all applications created with the same probe are linked (application linking mode enabled)) As long as the application linking mode is enabled, v will be displayed. To ensure that the linked applications use the same normalization and corrective calibration, perform a normalization and corrective calibration in one of these linked applications after enabling the linking mode with every probe used to create more than one application!

Keys	Explanation
ENTER	Confirm the selection with **ENTER**. Select the desired measuring mode with ▲ or ▼ : **[Matrix mode: {} Off]:** standard measuring mode enabled **[Matrix mode: {} On (20/40/17)]:** matrix measuring mode enabled [(20/40/17)]: 20 applications with 40 blocks of 17 measurements each (the numbers are examples only!) The instrument will be re-initialized automatically when changing the measuring mode. **[Initialize unit ? Yes:DEL No:ENTER]:** press **DEL** to re-initialize, or press **ENTER** to exit without re-initialization. Following the re-initialization the number of applications and the number of block has to be entered when switching to the matrix measuring mode **[number of fixed applications]** **[No. of blocks per application: {}].** With that the maximum number of measurements that can be stored in a block is fixed. As long as the matrix measuring mode is enabled, m will be displayed. The number of applications and blocks cannot be changed again afterwards without re-initializating the instrument. When re-initializing the instrument, all applications will be deleted, i. e. all measurements stored, all normalizations and corrective calibrations of all applications will be deleted! The applications have to be created again if required after re-initialization!

11.4.8Configuration Program PRINT (Printer)

Keys	Explanation
PRINT	Select the configuration program **PRINT** by pressing **PRINT**. Select the desired printer with ▲ or ▼ : **[Printer FMP3-EPSON P40S]:** printer Epson P40S **[Printer DPU 411]:** printer Seiko DPU 411 **[Printer Kyosha-Kyoline]:** printer Kyosha Kyoline **[Printer With HW hndshk]**: Epson-compatible serial printer with hardware handshake **[Printer no HW handshake]:** Epson-compatible serial printer without hardware handshake
ENTER	Confirm the selection with **ENTER**. Select the desired left margin for the printout by pressing ▲ or ▼. This option is displayed only if **[Printer With HW hndshk] or** **[Printer no HW handshake]** has been selected before: **[left margin]:** width of the left margin
ENTER	Confirm the selection with **ENTER**. Press ▲ or ▼ to select whether single readings are printed immediately after measurement accept or when printing the block result: **[Print sgl. meas. On]:** single readings will be printed immediately after measurement accept **[Print sgl. meas Off]**: single readings will not be printed until the block result is called-up

11.5 Record of the Instrument Status

Printing the Record of the Instrument Status:

Keys	Explanation
ENTER	With the configurations programs called-up and with **[FrEE]** being displayed, the record of the instrument status can be printed by pressing **ENTER** (see figure 11.2). The configuration programs will be exited automatically and the instrument is ready to measure again.

A record of the instrument status without probe-specific data can be printed by pressing **PRINT** immediately after switching the instrument on with **ON/OFF**.
Another way to print the record of the instrument status is to press **MENU+ PRINT** with the instrument switched on.

Displaying the Record of the Instrument Status:

Keys	Explanation
MENU + PRINT	With the instrument switched on call-up the display by pressing **MENU + PRINT**. If no printer is connected, **[Software version]** will be displayed in the prompt lines. With a printer connected and switched on, the record of the instrument status will be printed
▲,...,▲	Display the next information by pressing ▲ . All parameters can be displayed by pressing ▲ repeatedly. The instrument is ready to use again when all parameters have been printed or displayed.

The procedure after pressing **MENU** may be terminated at any time by pressing **MENU** again or by performing a measurement.

Fischer Feritscope MP30 18.11.01		
Software version	:	RBA05
internal state	:	0x0000000D00000
Probe	:	EGAB1.3_Fe ***PROBE-SPECIFIC DATA!***
Serial number	:	0297V00001 ***PROBE-SPECIFIC DATA!***
Meas.range	:	0.000-140 ***PROBE-SPECIFIC DATA!***
TKFK	:	0.000 ***PROBE-SPECIFIC DATA!***
Application No.	:	1
Lower spec.limit	:	47.00
Upper spec. limit	:	52.00
Disp. resolution	:	high
Meas./Single read.	:	4
Outlier Rejection	:	On
Method	:	Sigma
Sigma	:	5.00
Storage mode	:	store
Auto. switch off	:	On
Histogramm	:	Off
Block result	:	long
Unit of meas.	:	WRC-FN
Language	:	english
Display	:	WRC-FN
Meas. Signal	:	on
Extern start	:	Off
Delay	:	0ms
Baud rate	:	9600
Parity	:	none
Word length	:	8
Stop bits	:	1
Handshake	:	Hardware RTS/CTS
Transmit pause	:	0
Outout to port	:	single readings
Group seperator	:	On
Send in free mode	:	Off
Link appl	:	Off
Matrix mode	:	On(20/40/17)
Printer	:	FMP3-EPSON P40S
left margin	:	0
Print single meas.	:	On

Figure 11.2: Record of the instrument status with probe-specific data (example)

12 Errors

Error	Possible Cause	Solution
No display	Instrument not switched on or instrument switched itself off automatically (battery save feature for operation without AC power supply)	Switch on the instrument with **ON/OFF**
	Battery discharged (when operating without AC power supply)	Replace the battery or-connect the AC power supply
No results displayed after pressing **FINAL-RES**	No data stored in the application (e.g. because the data were deleted)	Perform measurements
No results displayed after pressing **BLOCK-RES**	No data stored in the application (e.g. because the data were deleted)	Perform measurements
No change of the display after pressing **ZERO, CAL** or **MENU**	Restricted operating mode enabled	With the instrument switched off disable the restricted operating mode with **ON/OFF** + **ENTER**
Applications cannot be created, overwritten or deleted	Restricted operating mode enabled	With the instrument switched off disable the restricted operating mode with **ON/OFF + ENTER**
Configuration programs cannot be called-up	Restricted operating mode enabled	With the instrument switched off disable the restricted operating mode with **ON/OFF + ENTER**

Error	Possible Cause	Solution
Probe does not measure	Wrong probe assigned (application was created with another probe) (**[FN]** or **[%]** flashes in the display)	Connect the proper probe
	Automatic measurement accept disabled	Enable automatic measurement accept in the configuration program ZERO orinitiate measurement accept with external start by pressing the key ▼ (or **FINAL-RES** when normalizing or calibrating)
	Probe defective	Replace probe
Erroneous measurements (continued on next page)	Measurement is influenced by the curvature of the measuring object, distance of the measuring position to the edge, thickness of the measuring object or by the layer thickness	Multiply the measured ferrite content with the corresponding correction factor
	Erroneous normalization or calibration	Perform the normalization or calibration correctly

Error	Possible Cause	Solution
Erroneous measurements (continuation)	Probe not placed correctly on the measuring object (e.g probe hovers above the measuring object)	Place probe correctly on the measuring object
	Selected application is unsuitable for this measuring object	Select the proper application with **APPL No**
	Wrong input power voltage caused by connectionof the wrong AC power supply (e. g. AC power supply with 220V insteadof 110 V)	Connect the proper AC power supply
	Probe tip worn	Have probe tips replaced by the Fischer service department
Printer prints hieroglyphics	Wrong printer selected (configuration programs)	Select the proper printer in the configuration program **PRINT**
No histogram has been printed	Not enough measurements stored in the evaluated application (at least 10 measurements are required to print the histogram)	Perform more measurements
	Histogram disabled in the configuration program BLOCK-RES	Enable histogram in the configuration program BLOCK-RES
Block result is not printed after pressing **BLOCK-RES**	Matrix measuring mode enabled (block result will not be printed automatically with matrix measuring mode enabled)	Press **PRINT** to print the block result

Error	Possible Cause	Solution
Printer does not print	Printer not switched on or not assigned to the instrument	Switch on the printer or connect the printer to the instrument
	Printer battery dischargedand printer not connected to a power outlet	Charge the printer batteryor connect the printer to a power outlet
	Wrong printer selected (configuration programs)	Select the proper printer in the configuration program **PRINT**
	Configuration of the printer interface does not correspond to the control parameters of the RS232 interface of the instrument (wrong baud rate, parity, word length, ...)	Bring the interface configuration of printer and instrument into line
	Wrong printer cable used	Use the proper printer cable
	Printer or printer cable defective	Replace printer or printer cable

13 Display Messages

The display messages, error messages (E***) and warnings (U***), that may occur during operation of the instrument, are included in the overview on the following pages.

Display Message	Explanation/ Possible Cause	Solution
- - - -	Measurement cannot be displayed (since the valueis larger than 9999 or smaller than -9999) Cause: measurement was not performed correctly	Perform the measurement-correctly (e.g. do not hover with the probe over the measuring object before or after the measurement)
E000 Not enough measurements	Histogram has not been printed since less than 10 measurements are stored in the evaluated application	Perform more measurements
E001 Math Error !	Internal error	Switch the instrument off and on again with **ON/OFF** If the error occurs repeatedly, call the Fischer service department
E004 Appl. memory overflow !	Overflow of the internal application memory	Delete the measurements stored in the applications ordelete an entire application
E006 Measurement out of range !	Measurement cannot be displayed since it is out of the measuring range of the assigned probe Cause: measurement was not performed correctly	Perform the measurement-correctly (e. g. do not hover with the probe over the measuring object before or after the measurement)

Display Message	Explanation/ Possible Cause	Solution
E007 Measurements invalid !	Outlier measurement was recognized during normalization or calibration Cause: measurement on the calibration standard was not performed correctly Cause: measurements were performed on the wrong calibration standard (e.g. one measurement was performed on the Base instead of the calibration standard)	Repeat the calibration step and perform the measurements correctly (e.g. do not hover with the probe over the measuring object before or after the measurement). Repeat the calibration step and perform the measurements on the proper calibration standard
E010 Meas. method not supported	The assigned probe is not suitable (the test method of the assigned probe does not correspond to the instrument model, e. g. an eddy current probe is assigned to an FERITSCOPE® MP30). Probe defective	Connect a suitable probe. Replace probe.

Display Message	Explanation/ Possible Cause	Solution
E011 Measurement is out of interval	Corrective calibration cannot be terminated. Cause: measurement was not performed correctly	Repeat the corrective calibration and perform the measurements correctly (e.g. do not hover with the probe over the measuring object before or after the measurement)
	Cause: the ferrite content of the calibration standards used is not suitable or the calibration standards are defective	Repeat the corrective calibration with proper calibration standards
	Cause: normalization was performed on a calibration standard instead of the Base	Repeat the corrective calibration and perform the normalization on the Base
E012 Invalid std. sequence !	Calibration standards were measured in the wrong sequence during corrective calibration (standard 1 was interchanged with standard 2) and the ferrit contents were not set correspondingly	Repeat the corrective calibration and measure the calibration standards in the correct sequence

Display Message	Explanation/ Possible Cause	Solution
E013 Countrate is out of interval !	Master calibration cannot-be terminated Cause: measurement was not performed correctly	Repeat the master calibration and perform the measurements correctly (e. g. do not hover with the probe over the measuring object before or after the measurement)
	Cause: the ferrite content of the calibration standards used is not suitable or the calibration standards are defective	Repeat the master calibration with proper calibration standards
	Cause: normalization wasperformed on a calibration standard instead of the Base	Repeat the master calibration and perform the normalization on the Base
E014 Unable to calc. parameters !	Internal error: the coefficients of the master calibration curve cannot be calculated (the previous master calibration curve will not be changed)	Repeat the master calibration If the error occurs repeatedly, call the Fischer service department
E015 Unable to store cal. in probe	Master calibration parameters cannot be stored	
	Cause: the probe connector is not plugged correctly into the receptacle or the locking ring was not tightened	Plug-in the probe correctly, tighten the lockingring and repeat the master calibration
	Cause: probe defective	Replace the probe and repeat the master calibration if required

Display Message	Explanation/ Possible Cause	Solution
E016 Std. and meas. not matching !	The ferrite contents stored and the Ferrite Contents measured do not match Cause: calibration standards were measured in thewrong sequence during master calibration (e.g. standard 1 was interchanged with standard2) and the ferrite contents were not set correspondingly	Repeat the master calibration and measure the calibration standards in the correct sequence
E017 Not enough measurements !	When measuring with fixed block size, the block result cannot be called-up if the first block of the evaluated application has not yet been closed	Perform measurements until the first block will be closed and call-up the block result again
E021 Standard invalid !	Corrective calibration is not possible with the entered ferrite content (e.g.because **[Cal.Std. 2: 0]** has been entered)	Set the ferrite content of the calibration standard used and continue the corrective calibration
E022 Missing probe !	No probe is assigned Probe was not assigned correctly Probe defective	Connect a probe Connect the probe correctly Replace probe
E023 Meas. method different !	When overwriting an application, the stored measurements can be kept only, if the test method of the assigned probe is the same as the test method of the probe the application was created with	Delete the measurements when overwriting an application or create a new application with the assigned probe

Display Message	Explanation/ Possible Cause	Solution
E024 Result block full !	The next measurement cannot be stored in this block since this block was closed (occurs only with matrix measuring mode enabled)	Select another block with **BLOCK-RES** and the arrow keys
E025 Error in application !	Internal error	Delete the application and transfer the measurementsvia the RS232 interface **[Delete Appl. ? Yes: DEL No: ENTER]**: press **DEL** to delete the application **[Meas. to port ? Yes: DEL No: ENTER]:** press **DEL** to transfer the measurements via the RS232 interface to the printer or external computer
E026 Cal. on coating not possible !	A calibration on the coating cannot be performed with the FERITSCOPE® MP30 (**CAL + ZERO** were pressed by mistake)	If the error occurs repeatedly, call the Fischer service department
E028 Normalization missing !	Measurements cannot be computed since no normalization has been performed with the assigned probe after enabling the application linking mode	Perform a normalization with the assigned probe

Display Message	Explanation/ Possible Cause	Solution
E029 Calibration missing !	Measurements cannot be computed since no corrective calibration has been performed with the assigned probe after enabling the application linking mode	Perform a corrective calibration with the assigned probe
E999 System error !!!	Internal error	Call the Fischer service department
U000 Block memory full !	An additional block cannot be formed since the maximum number of 1,000 blocks has been formed	Delete the measurements stored in the applications ordelete an entire application
U001 Printer not ready !	Printer not switched on Printer off line Printer not connected to the instrument Wrong printer selected (configuration programs)	Switch the printer on and repeat the print command Switch the printer on line and repeat the print command. Connect the printer to the instrument and repeat the print command Select the proper printer in the configuration program **PRINT** and repeat the print command
U003 Options corrected !	Erroneous settings were corrected automatically by the instrument	
U004 Action canceled!	An action was canceled (e. g. a corrective calibration was canceled with **ENTER**)	Repeat the action if required

Display Message	Explanation/ Possible Cause	Solution
U005 1 point calibration !	The difference of the ferrite contents of the two calibration standards the corrective calibration was performed with, is not large enough (will be treated as one-point calibration)	Perform the corrective calibration with suitable standards (the difference between the normalized probe output signals of the standards has to be larger than 0.1: $Xn_{\text{Cal. Std 2}} - Xn_{\text{Cal. Std 1}} = \Delta Xn > 0.1$

14 Technical Data and Contents of Shipment

14.1 Technical Data

Instrument type:	**FERITSCOPE® MP30**
Display:	LC display with symbols and prompts to guide the user
Measurement application capabilities:	Ferrite content measurement in weld metal and clad layers of austenitic or Duplex stainless steel. Determination of the ratio of martensite in austenitic stainless steels.
Dimensions:	Instrument: 160 mm x 80 mm x 30 mm (L x W x H) 6.3" x 3.1" x 1.2" (L x W x H) Display: 60 mm x 30 mm (L x W) 2.4" x 1.2" (L x W)
Weight:	250 g (0.55 lbs)
Admissible ambi-enttemperature ran-geduring operation:	5 ... 45 °C (41 ... 113 °F)
Admissible storage-temperature:	5 ... 60 °C (41 ... 140 °F)
Admissible environ-mental relative hu-mid-ity during ope-ration:	30 ... 90 % (non-condensing)
Applications:	100 for up to 10,000 measurements, which may be combined into up to 1,000 blocks
Measuring modes:	Standard and matrix measuring mode
Measuring range:	Depending on the assigned probe
Trueness:	Depending on the assigned probe
Repeatability:	Depending on the assigned probe
Accuracy:	Depending on the assigned probe

Power supply:	9 V battery (6LR61) for up to 25 hours of operation or 9 V rechargeable NiCd battery for up to 5 hours of operation (battery can be recharged with the plug-in type battery charger) or AC power supply (12V 30 mA) 220 V or 110 V
Power consumption:	0.2 W
Receptacles:	Probe: 8-pin round plug AC power supply: 2-pin tubular plug RS232 interface: 9-pin micro-T-plug
RS232 interface	Bidirectional (data transfer to an external computer and remote control of the instrument by sending commands from an external computer)

14.2 RS232 Interface

By using the appropriate connection cable, the instrument recognizes automatically, if a printer or a computer is connected to the RS232 interface. Printers with suitable connection cables or an RS232 interface cable MP to connect the instrument and the external computer are available from your local supplier or from Fischer directly.
Available options: see "14.3.2 Technical Data and Contents of Shipment", beginning on page 166.

14.2.1 Factory Settings

Baud rate:	9600
Word length:	8 bit, 1 stop bit, no parity
Handshake:	In off-line mode, the PC hardware handshake needs to be supported by the RTS and CTS lines
Measurement data format:	Floating point string consisting of ASCII characters followed by CR + LF
Voltage levels:	5 V TXD, RTS, DTR, to - 15 V inputs

14.2.2 Connector Pin-Out

FERITSCOPE® MP30		Computer		
Pin No.	**Signal**	**Signal**	**9-pin**	**25-pin**
1	not used			
2	TXD	RXD	2	3
3	RXD	TXD	3	2
4	DSR	DTR	4	20
5	GND	GND	5	7
6	DTR	DSR	6	6
7	CTS	RTS	7	4
8	RTS	CTS	8	5
9	used internally			

For safe operation, a shielded connector cable with a total length should be used.
The admissable length of this cable depends on the environmental operating conditions. Guideline: 2.5 m (8.2 feet).

14.3 Contents of Shipment and Options

Shipping container and contents should be checked for possible damages immediately after receipt of the shipment.
If the packaging and the instrument or the accessories are damaged, the packaging should be kept.
It may be needed as proof when making damage claims with the carrier.
We recommend to keep the packing material for possible future use when moving or shipping the instrument.

Also check that all the standard items and options ordered are included in the shipment.
Contact your local supplier or Fischer if the shipment is incomplete.

14.3.1 Standard Contents of an Instrument Shipment

The standard contents of an instrument shipment includes:

- Instrument in a protective plastic cover
- Battery
- Carrying and storage case
- Operator manual
- Short-form operator manual

14.3.2 Options

The following options are available:

- Additional probes
- set of calibration standards for the corrective calibration
- 9 V rechargeable NiCd battery
- 9 V alkaline battery
- Plug-in type battery recharger
- AC power supply
- desk top support for hand-held instruments
- V12 measurement stand for reproducible probe positioning
- Magnetic slide table for V12 measurement stand
- Quick loading screw fixture for V12 measurement stand to mount and measure metric and sheet metal screws
- Adapter for mounting right angle probes on the V12 measurement stand (e.g. for probe EGABW 1.3FE)
- Mounting adapter for inside probes to use with V12 measurement stand (e. g. for probe EGABI1.3-150FE mm)
- Motorized V12 measurement stand for automatic placement and lifting of probes
- FMP3 printer with cable
- Thermal paper (10 rolls) for FMP3 printer
- DKMP3-3A printer cable to connect to a Epson compatible 9-pin serial printer
- MP / RS232 interface cable with adapter for connection to an external computer (9-pin or 25-pin)
- FCC Software (**F**ischer **C**alibration and **C**ontrol Software) for manage-

ment, documentation, evaluation and archiving of measurement data and measurement application specific calibrations

The instrument can only transfer measurement data to the FCC Software via the RS232 interface. It is not possible to transfer the calibration parameters from the FCC Software back to the instrument!

15 Correction Factors

The following factors affect the ferrite content measurement with the FERITSCOPE® MP30:

- curvature of the measuring object
- thickness of the measuring object
- layer thickness
- distance of the measuring position to the edge

The effects of these factors can be corrected for by multiplying the measured ferrite content with the corresponding correction factors.

15.1 Influence of the Curvature of the Measuring Object

The deviation of the measured ferrite content from the true ferrite content of curved measuring objects increases with increasing curvature.

The true ferrite content can be calculated as follows:

$$Fe_t = Fe_m \cdot Correction\ factor$$

with:

	Fe_t	true ferrite content
	Fe_m	measured ferrite content

The correction factor depends on the diameter of curvature $Ø_C$ of the measuring object and can be taken from figures 15.1 and 15.2 for convex and concave curvatures.

Figure 15.1 shows that convex curvatures with diameters larger than 50 mm (2") have a negligible influence. The influence of concave curvatures with diameters larger than 80 mm (3") is negligible (see figure 15.2).

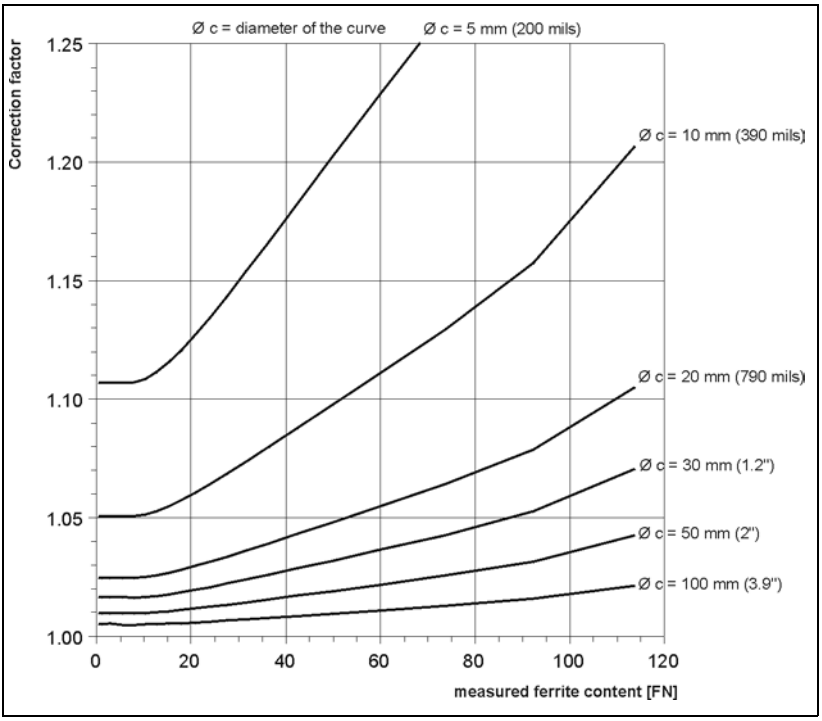


Figure 15.1: Correction factors (measuring objects with convex curvature)

Example:
A ferrite content of 50 FN is measured on a cylindrical surface with a diameter of 20 mm (790 mils).
The correction factor 1.05 can be taken from figure 15.1.
The true ferrite content is calculated as follows:

$$Fe_t = Fe_m \cdot Correction\ factor$$
$$Fe_t = 50\ FN \cdot 1.05$$
$$Fe_t = 52.5\ FN$$

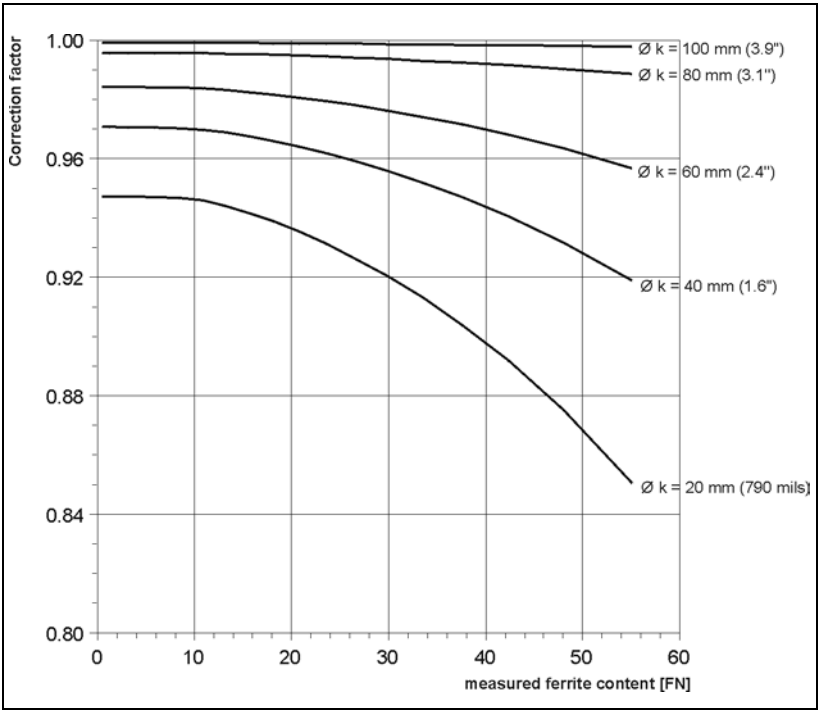


Figure 15.2: Correction factors (measuring objects with concave curvature)

15.2 Influence of the Thickness of the Measuring Object

The deviation of the measured ferrite content from the true ferrite content of thin measuring objects (e.g. sheet metals) increases with decreasing thickness.

The true ferrite content can be calculated as follows:

$$Fe_t = Fe_m \cdot \text{Correction factor}$$

with:

	Fe_t	true ferrite content
	Fe_m	measured ferrite content

The correction factor depends on the thickness of the measuring object and

can be taken from figure 15.3.

As shown in figure 15.3 the influence of the thickness of the measuring object is negligible for measuring objects having a thickness larger than 2 mm (80 mils).

Example:

A ferrite content of 1.8 % Fe is measured on a sheet metal with a thickness of 1 mm (40 mils).
The correction factor 1.1 can be taken from figure 15.3.
The true ferrite content is calculated as follows:

$$Fe_t = Fe_m \cdot Correction\ factor$$
$$Fe_t = 1.8\ \%\ Fe \cdot 1.1$$
$$Fe_t = 1.98\%\ Fe$$

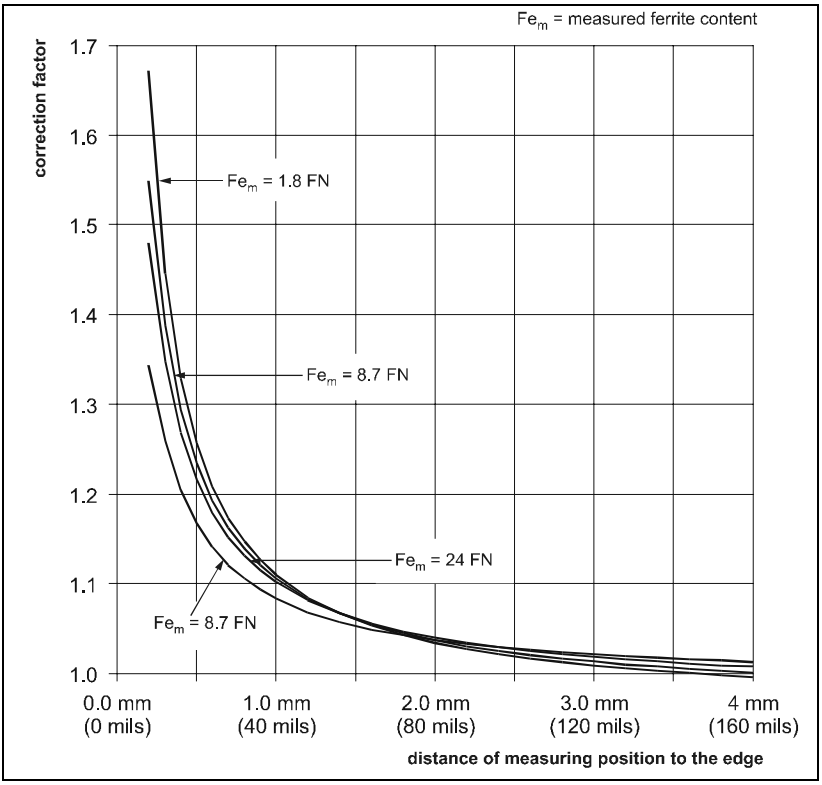


Figure 15.3: Correction factors (thickness of the measuring object)

15.3 Influence of the Layer Thickness

When measuring the ferrite content of austenitic layers the deviation of the measured ferrite content from the true ferrite content increases with decreasing layer thickness.

The true ferrite content can be calculated as follows:

$$Fe_t = Fe_m \cdot Correction\ factor$$

with: Fe_t true ferrite content
Fe_m measured ferrite content

The correction factor depends on the layer thickness and can be taken from figure 15.4.

As shown in figure 15.4 the influence of the layer thickness is negligible for measuring objects with layers which have a thickness larger than 2 mm (80 mils).

Example:
A ferrite content of 3.9 % Fe is measured on a layer with a thickness of 1 mm (40 mils).
The correction factor 0.75 can be taken from figure 15.4.
The true ferrite content is calculated as follows:

$$Fe_t = Fe_m \cdot Correction\ factor$$
$$Fe_t = 3.9\ \%\ Fe \cdot 0.75$$
$$Fe_t = 2.925\%\ Fe$$

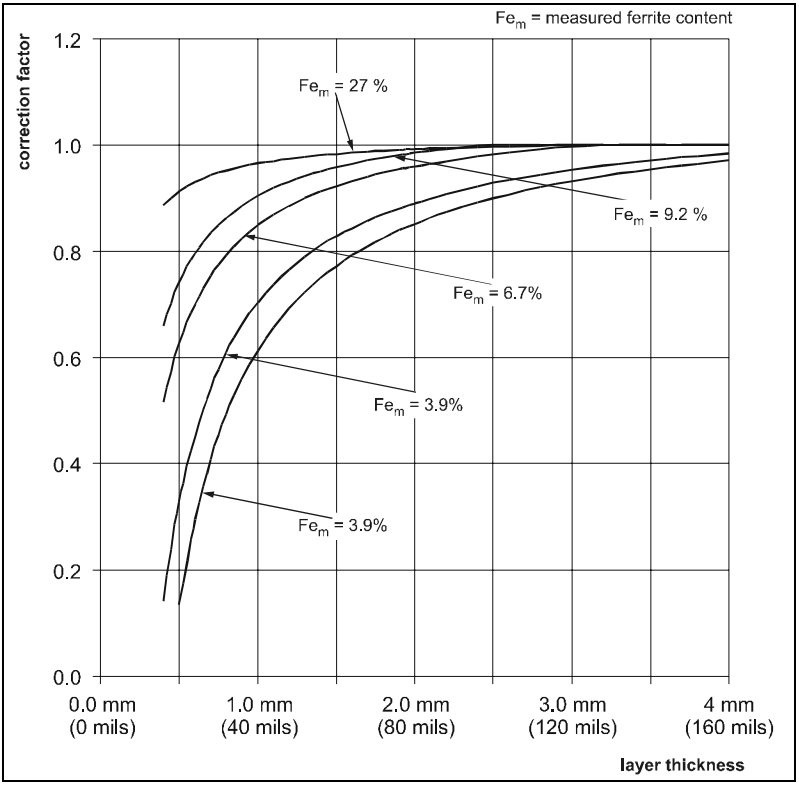


Figure 15.4: Correction factors (layer thickness)

15.4 Edge Effect

The deviation of the measured ferrite content from the true ferrite content increases with increasing distance of the measuring position to the edge.

The true ferrite content can be calculated as follows:

$$Fe_t = Fe_m \cdot Correction\ factor$$

with:

Fe_t true ferrite content
Fe_m measured ferrite content

The correction factor depends on the distance to the edge and can be taken

from figure 15.5.

As shown in figure 15.5 the influence of the distance to the edge is negligible for measuring positions which have a distance to the edge larger than 2 mm (80 mils).

Example:
A ferrite content of 24 FN is measured on a measuring position which is 1 mm (40 mils) from the edge.The correction factor 1.1 can be taken from figure 15.5. The true ferrite content is calculated as follows:

$$Fe_t = Fe_m \cdot Correction\ factor$$
$$Fe_t = 24\ N \cdot 1.1$$
$$Fe_t = 26.4\ FN$$

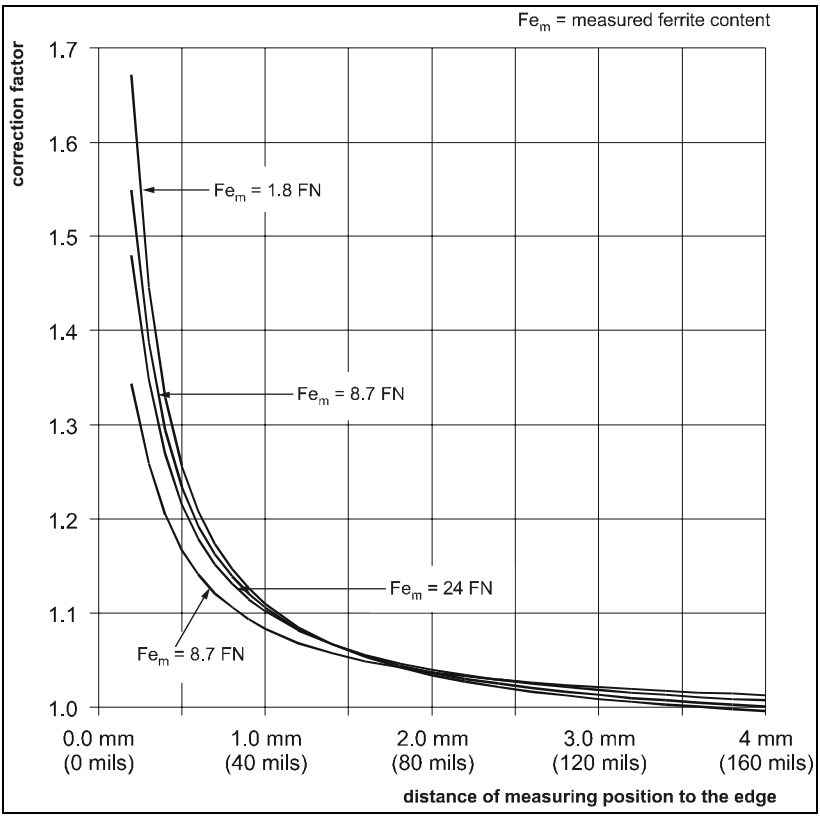


Figure 15.5: Correction factors (distance of the measuring position to the edge)

16 Glossary of Terms and Symbols

This chapter explains the most common terms and symbols in ferrite content measurement and related fields (e. g. quality assurance). In some cases, alternate terms or synonyms are mentioned in parentheses.

χ2 test
see term "Chi squared test (c2 test)" on page 181

Accuracy
Difference between the average result of a measurement with a particular instrument and the true value of the quantity being measured.
Usually, accuracy is divided into -> Trueness and -> Precision.

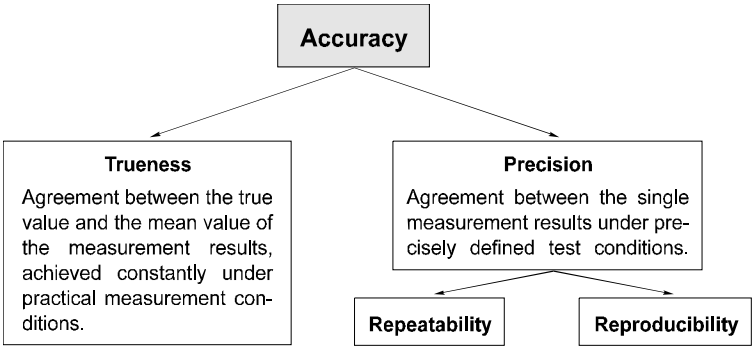


Figure 16.1: Accuracy

AC Power supply
The FERITSCOPE® MP30 can be connected to a power outlet with the AC power supply.

Application
Measurement application of the user.

Application
In the use of ferrite content measurement instruments, the application memory is the memory that stores the instrument characteristic and the single measurements for a particular measurement application.
In addition, the application-specific settings are stored in the applications.
Up to 100 different applications can be created in the FERITSCOPE® MP30.

It is recommended that the user create a list of application memories (e.g. in form of a table) and their uses and probes, which were used to create the application.

Attributive features
see term "Features" on page 185

B (Bit)
see term "Bit (Binary Digit)" on page 178

Base
Component of the calibration standard set.
The Base is used for normalization and corrective calibration of the FERITSCOPE® MP30. see term "Calibration standard set" on page 180.

Baud
Unit of speed for transferring information via a serial port.
1 baud corresponds to a data transfer rate of 1 bit per second.

Baud rate
Data transfer rate. Used mainly in connection with terminal programs for serial data transfer. Since data are transferred via a serial port, the transfer rate is calculated in bits per second.

Bd (Baud)
see term "Baud" on page 178

Bidirectional data exchange
Data can be sent to and received from both participants (for example from instrument to computer and from computer to instrument).

Bit (Binary Digit)
Binary number. 1 bit is the smallest unit in the binary number system.
The value of a bit is either 0 or 1. Being the smallest unit of information in a computer, a bit forms the basis of every computer system.
8 bits are combined to a byte, or several bytes to a word.

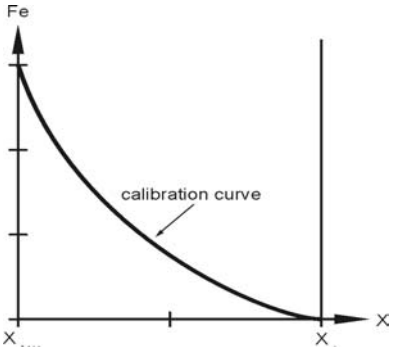
Block
Several measurements can be combined into a block. A closed block is indicated by k in the display. A block can only be closed by pressing the key **BLOCK-RES** or **FINAL-RES** followed by **ENTER** (or a measurement).

Block mean value
Mean value of the measurements combined into a block.
see term "Fe." on page 185.

Block result
After pressing **BLOCK-RES** the measurements will be combined into a block and the results of the evaluation of the current block (e. g. mean value and standard deviation of the measurements combined into this block) will be displayed or printed.

Block size
Number of measurements that are combined into a block.

Calibration curve (characteristic)
Quantitative relationship between the probe signal and a function of the ferrite content as defined by calibration standards.
The mid portion of the calibration curve (see figures 16.2 and 16.3) approaches a straight line. This is the range with the smallest relative measurement error. As long as no normalization or corrective calibration has been performed, the calibration curve is identical with the master calibration curve.
During normalization or corrective calibration the calibration curve is adjusted to the individual measurement application and the coefficients of the normalization or corrective calibration are stored in the current application.

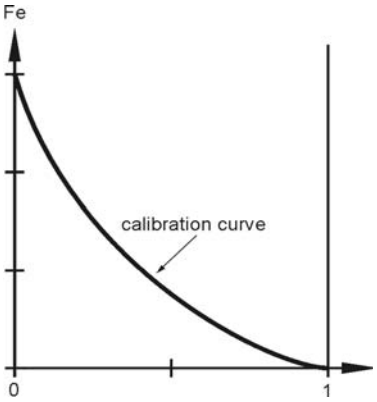


The ferrite content is displayed in dependence of the countrate X as calibration curve.

$X = X_{Base}$ -> Base (ferrite content: 140 FN or 105 Fe%)

$X = X_{S}$ -> ferrite content: 0 FN or 0 Fe%

Figure 16.2: Calibration curve (ferrite content as a function of the countrate)



The ferrite content is displayed in dependence of the normalized countrate X_n as calibration curve.

X = 0 -> Base (ferrite content: 140 FN or 105 Fe%)

X = 1 -> ferrite content: 0 FN or 0 Fe%

Figure 16.3: Calibration curve (ferrite content as a function of the normalized countrate)

Calibration standards (ferrite standards)
Objects with the same attributes (or as close as possible) as the measuring object with known ferrite contents. The ferrite content of the calibration standards has been measured with an extremely accurate test method.

Calibration standard set
The calibration standard sets used for the corrective calibration of the FERITSCOPE® MP30 consist of the Base and three calibration standards of different ferrite contents (see figure 16.7).
Various calibration standards sets for corrective calibration are available from Fischer to prepare the instrument for different measuring ranges.

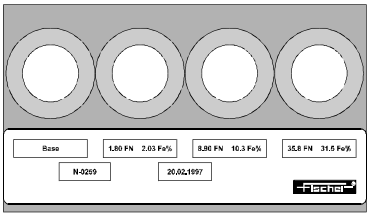


Figure 16.7: Calibration standard set (example)

Carriage Return (CR)
Character of the ASCII character set with the following function: when data or commands are entered, the line one is currently working on will be closed by pressing the CR key (Enter or Return key); the information entered will be processed accordingly.
The cursor is again placed at the beginning of the line. It is usually used together with the LF (Line Feed) character to start the next line at the beginning.

Characteristic
see term "Calibration curve (characteristic)" on page 179.

Chi squared test (χ2 test)
Test used to determine whether the evaluated measurements are normal distributed (Normal distribution). This test is performed when calling-up the final result of more than 40 measurements with the FERITSCOPE® MP30.

Class
Range between a lower and an upper class boundary (e. g. ferrite content limits). The single readings of a measurement series can be sorted according to classes of equal width which cover the entire range of the measurement series. The number of measurements per class plotted for each class is called a histogram.

Coefficient of variation
abreviated: C.O.V.

Comparative sample
see term "Reference sample" on page 196

Confidence level
see term "u" on page 203

„Continuous" display mode
With the probe placed on the measuring object, measurements will be displayed continuously. Will be indicated by p in the display of the FERITSCOPE® MP30.

Control chart
see term "Process control chart (SPC chart, quality control chart)" on page 195

Control limits
If the measurements are entered in a process control chart, there is no need for process control measures, if the measured quantity lies within the range defined by control limits.

Corrective calibration (one-point, two-point or three-point calibration)
Adjustment of the instrument using a Base and one, two or three calibration standards. The corrective calibration includes calibration and adjustment. During corrective calibration the calibration curve is adjusted to the individual measurement application, the current application is calibrated for.
The coefficients of the adjusted calibration curve are stored in the current application. The coefficients of the master calibration curve, which are stored in the EEPROM of the probe connector, remain unchanged.

Countrate
Digitized form of the measurement signal, which is proportional to the ferrite content. The measurement signal is produced in the probe by the coating to be measured. The larger the ferrite content is, the larger is the countrate.
see term "Calibration curve (characteristic)" on page 179.
The numeric values of the normalized countrate Xn range between 0 and 1, and are calculated according to the following equation:

$$X_n = \frac{X - X_{Base}}{X_s - X_{Base}}$$

with:

X count rate measured on the coated measuring object

X_{Base}: countrate measured on the Base of the calibration standard set

X_s: countrate measured on a measuring object with no ferrite content

C.O.V. (Coefficient of Variation)
Also known as relative standard deviation. It is a measure of variation of a measurement series expressed in percentage points. For many coating processes, C.O.V. [%] is a characteristic process constant. A change in a parameter during the coating process can alter C.O.V. [%] significantly; thus, a sudden change of indicates a change in the process conditions.

C.O.V. [%] is calculated as follows:

$$C.O.V. = \frac{s}{Fe.} \cdot 100\ [\%]$$

with:

Fe. mean value of the single measurements

s standard deviation

Cp
see term "Process capability index" on page 194.

Cpk
Process capability index

CR (Carriage Return)
see term "Carriage Return (CR)" on page 181.

Cumulative frequency distribution
A form of display of the measurement data distribution, such that the number of measurements smaller or equal to a particular measurement is calculated and displayed in percent.

Cumulative frequency distribution chart
see term "Normal probability chart (Gaussian probability paper, cumulative frequency distribution chart, probability paper)" on page 192

Curvature
Excess and Kurtosis are measures for the curvature (e. g. how pointed or how wide) of a distribution compared to a normal distribution. A positive Kurtosis indicates a relatively narrow, pointed distribution; a negative Kurtosis indicates a relatively flat distribution. The Kurtosis of a normal distribution is Zero. When evaluating the current application with the FERITSCOPE® MP30, the excess will be calculated and printed after “Kurtosis”.

Data transfer rate
see term "Baud rate" on page 178

Dip switch (Dual Inline Package Switch)
Electronic component ready to be installed. In this case, a series of little switches. They are often used in peripheral devices, i. e., in printers, to change the basic settings of the device.

Display
The display of the FERITSCOPE® MP30 is large, neatly arranged and includes a multitude of symbols to indicate the instrument status and prompts to guide the user.

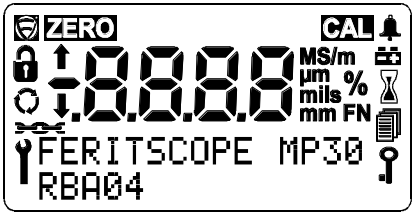


Figure 16.5: Display of the FERITSCOPE® MP30

EEPROM (Electrically Erasable Programmable Read Only Memory)
Advanced EPROM.

Evaluation
Calculation of statistical parameters, e. g. mean value or standard deviation, with graphic output on the connected printer if required.
With the FERITSCOPE® MP30, the evaluation can be called-up with the keys **BLOCK-RES** and **FINAL-RES**.

- **BLOCK-RES** will start the display of the block result
- **FINAL-RES** will start the display of the final result.

Excess
see term "Curvature" on page 183.

External start
With external start enabled, measurement accept can be initiated by pressing the key ▲ or by sending the command G0 (G Zero) from an external computer.

Fe.
Mean value. Arithmetic mean value

Fe. of a measurement series consisting of *N* single readings Fe_i, according to the equation

$$Fe. = \frac{Fe_1 + Fe_2 + \ldots + Fe_N}{N} = \frac{\sum_{i=1}^{N} Fe_i}{N}$$

with:

Fe_i single reading

N number of single readings evaluated

Fe..
Mean value of the block mean values of the evaluated blocks (see -> Block).

$$Fe.. = \left(\frac{1}{N_{Bl}} \cdot \sum_{i=1}^{N} Fe._j\right)$$

with:
N_{Bl} number of evaluated blocks
$Fe._j$ mean value of the j-th block

Features
Properties of a product.
Variable features are the measurable properties of a product subject to change or variability. Ferrite content is a variable feature.
Attributive features are the properties of a product that usually cannot be captured by taking measurements.
Examples are, deviations in color, or whether the product is true to gauge size.

Ferrite standards
see term "Calibration standards (ferrite standards)" on page 180.

Final result
Evaluation of all measurements stored in the current applications.
The results of this evaluation (e.g. mean value and standard deviation) will be displayed or printed after pressing **FINAL-RES**.

Frequency distribution
see term "Histogram (frequency distribution)" on page 186

Gaussian distribution
see term "Normal distribution (Gaussian normal distribution, Gaussian distribution)" on page 190

Gaussian normal distribution
see term "Normal distribution (Gaussian normal distribution, Gaussian distribution)" on page 190

Gaussian probability paper
see term "Normal probability chart (Gaussian probability paper, cumulative frequency distribution chart, probability paper)" on page 192

Group separator
The end of a block can be marked with a group separator. The group separator can be transferred with the measurement data to the external computer.

Grubbs test
Method for outlier rejection. see term "Outlier rejection" on page 193.

Histogram (frequency distribution)
Graphic representation of the single readings of a measurement series by classes (ferrite content ranges) of equal width. The degree to which a statistical result is meaningful depends, among other things, on this distribution. When evaluating the current application with a FERITSCOPE® MP30, the histogram of the ferrite content measurement values will be printed as follows:

```
HISTOGRAMM
n
48.4   :
   1   : *
48.6   :
   1   : *
48.8   :
   6   : ******
49.0   :
   5   : *****
49.2
   2   : **
49.4   :
   2   : **
```

Figure 16.6: Printout of a histogram (example)

Interface
Transfer and connecting point between components, circuits or programs. Interfaces are used for data transfer. Using a serial interface, the data are transferred bit by bit. Using a parallel interface, the data are transferred by sending several bits simultaneously.

Kolmogorov Smirnov test
Test, which is performed when evaluating the current application with the FERITSCOPE® MP30, to determine whether the evaluated measurements can be classified as having normal distribution (if up to 40 measurements are to be evaluated).

Kurtosis
see term "Curvature" on page 183

Largest measurement
see term "Maximum measurement" on page 188

LF (Line Feed)
see term "Line Feed (LF)" on page 187

Limits
see term "Specification limits (LSL and USL)" on page 200

Line Feed (LF)
Advances the printer paper by one line. It is usually used together with the CR (Carriage Return) character to start the next line at the beginning.

Local ferrite content
The local ferrite content is the arithmetic mean value of the single measurements performed on the reference area.

LSL (Lower Specification Limit)
see term "Specification limits (LSL and USL)" on page 200

Master calibration
Adjustment of the instrument using a Base and calibration standards. During a master calibration, the master calibration curve is determined. The master calibration includes calibration and adjustment.

Master calibration curve (probe characteristic)
Characteristic of the measuring system (see -> Calibration curve)
The master calibration curve is determined during master calibration on the Base and calibration standards. It is the basis for determination of the measurement values, since it represents the relationship between the ferrite content and the probe signal. The coefficients of the master calibration curve are stored in the EEPROM of the probe connector.

Maximum measurement
Largest measurement of a measurement series.

Mean value
see term "Fe." on page 185

Measurement
Numeric reading of an instrument, expressed in the unit of measurement. The measurement can be obtained as the result of a single measurement or as arithmetic mean of several single measurements (e. g. when measuring with “mean reading” mode enabled).

Measurement accuracy
see term "Accuracy" on page 177

Measurement application
Structure of the measuring object according to material, thickness and other properties (hard/soft, porous/dense, homogenous/inhomogenous, etc.) and any other conditions relevant to the measurement requirement. These factors determine the selection of a suitable test method and the instrument.

Measurement block
see term "Block" on page 178.

Measurement errors
The difference between the actual and measured value of a measured quantity.
For measuring instruments there is a distinction between random (unpredictable) and systematic (correctable) errors.
Random errors determine the repeatability precision.
Systematic (bias) errors affect the trueness and the reproducibility.
Systematic errors are far more prevalent in practical ferrite content measurement applications (see / 7 / for further details).

Systematic (bias) errors can be traced back to:

- faulty calibration,
- operator related errors, or
- changes in test conditions (inhomogeneities of the substrate, aging, etc.).

Systematic (bias) errors tend to lean in one direction. With appropriate care, causes 1 and 2 can usually be avoided or corrected. Causes of the third kind can sometimes be eliminated by using an appropriate correction technique.

Measurement range
see term "Measuring range" on page 190

Measurement series
A series of single measurements made between two block or final results. Measurement system check: A significant part of monitoring the test equipment. Calibration standards or, even better, reference samples, are used to check the calibration and to verify the stability of the instrument.

Measurement uncertainty
see term "u" on page 203

Measuring
- Measuring is comparing -
The probe signal generated at the measuring position is compared to the probe signal of the calibration standard. Using the calibration curve, the instrument converts the probe signal to the measurement result.

Measuring method
see term "Test method" on page 202

Measuring object
Object on which the measurements are to be performed to determine the ferrite content for example.

Measuring position
A limited and clearly defined point within the reference surface of the measuring object where the ferrite content is to be determined.
Detailed information is included in / 8 /.

Measuring probe
see term "Probe" on page 193

Measuring range
The range between the two limits within which a measurement is possible at a specified trueness and precision. In a narrower sense, it refers to the range of an analog instrument. The measuring range depends on the test method, the design of the probe, and the measurement application.

Memory
Data storage element of a microprocessor-based measuring instrument. Information is saved in the memory. see term "Application" on page 177.

Method
see term "Test method" on page 202

Minimum measurement
Smallest measurement of a measurement series.

Monitoring of test equipment
A quality assurance task. It consists of ensuring that the measuring system (instrument) is operating properly and is still calibrated correctly, and to take corrective measures, if necessary (re-calibration of instrument or repair).
See -> Measurement system check.

Normal distribution (Gaussian normal distribution, Gaussian distribution)
Probability distribution, discovered by C. F. Gauß in 1794.
If a quantity X can be classified as having normal distribution, 68.3 % of the observed values of X are within the σ-interval (σ - deviation) around the mean value μ of the quantity X, i. e. the following is valid for 68.3 % of the observed values: $\mu-\sigma \leq X \leq \mu+\sigma$.
This interval is indicated in figure 16.7 by the grey area below the curve.

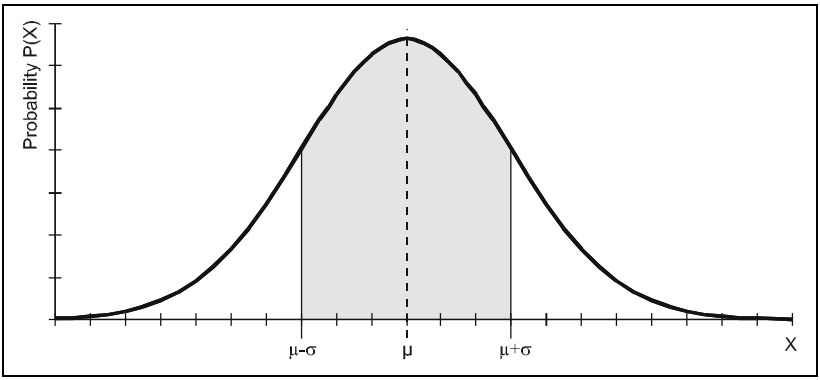


Figure 16.7: Probability distribution P(X) of a quantity X, which can be classified as having normal distribution

The probability distribution P(X) is symmetrical around the mean value μ of the quantity X, which can be classified as having normal distribution. Skewness and curvature are zero for the normal distribution.
The populations, which are tested for technical purposes, often can be classified as having approximately normal distribution.

However, the following fact is of great importance: if several random samples with equal size are drawn of a population, and the mean values of these random samples are determined, these mean values can be classified as having normal distribution (Central Limits Theorem).

The mean value of these sample mean values is an estimated value for the mean value μ of the population. The uncertainty of measurement u can be determined using the standard deviation of the sample mean values (since the sample mean values can be classified as having normal distribution) (see term "u" on page 203) Whether a quantity can be classified as having normal distribution can be checked in the normal probability chart, since a straight line in the normal probability chart indicates normal distribution.

When evaluating the current application with the FERITSCOPE® MP30, a Kolmogorov-Smirnov test is performed for small random samples (up to 40 measurements) and a $\chi 2$ test is performed for large random samples (more than 40 measurements) to check whether the measurements can be classified as having normal distribution.

Normalization
Adjusting a measuring instrument to a new zero value.
Important for some applications when the substrate changes, or when the test method is subject to instability (e. g. to drift) (e.g. for beta backscatter and X-Ray fluorescence methods). During normalization the calibration curve is adjusted to the individual measurement application, the current application is calibrated for. The coefficients of the adjusted calibration curve are stored in the current application. The coefficients of the master calibration curve, which are stored in the EEPROM of the probe connector, remain unchanged.

Normalized countrate
see term "Countrate" on page 182

Normalized probe output signal
see term "Countrate" on page 182.

Normal probability chart (Gaussian probability paper, cumulative frequency distribution chart, probability paper)
Can be used to check graphically for normal distribution of the measurements.
A straight line in the normal probability chart indicates normal distribution.

Off line
Status of a peripheral device, for instance a printer or a computer, that does not allow it to receive data.

One-point calibration
see term "Corrective calibration (one-point, two-point or three-point calibration)" on page 182

On line
Ready condition of a peripheral device, for instance a printer or a computer, that allows it to receive data. The connected instrument is ready for operation then.

Outlier measurements
Measurements that are considerable larger or considerable smaller than the other measurements of the measurement series and therefore can be considered as unexpected or unacceptable.With outlier rejection enabled, recognized outlier measurements will be indicated by two short acoustic signals immediately after measurement accept and the simultaneous appearing of d and u in

the display.

Outlier rejection
Is used to prevent the distortion of the measurement results by outlier measurements. With the FERITSCOPE® MP30, outlier rejection can be enabled or disabled. Measurements recognized as outliers will not be included in the evaluation. Two methods are available for outlier rejection:

- Grubbs test
- Sigma outlier rejection (entry of a known standard deviation)

Parity
An error checking method where the digits of a number must add up to an even or an odd number. During data transfer the parity bits are added to the data bits of each character to be transferred. In a word, this bit is set such that Ones of the byte always result in an even or an odd number (corresponding to an even or odd parity). The type of parity must be defined prior to the data transfer. By checking the parity, the receiver can determine if simple bit transfer errors occurred.

Pin
Connectors for integrated circuits or connecting plugs of computers and peripheral devices. Usually in the shape of a pin.

Precision
Agreement between the single measurement results under precisely defined test conditions. The precision is composed of repeatability and reproducibility (see -> Accuracy; see -> Repeatability; see -> Reproducibility).

Probability paper
see term "Normal probability chart (Gaussian probability paper, cumulative frequency distribution chart, probability paper)" on page 192

Probe
The instrument receives the electrical probe signal, which is proportional to the ferrite content measured, from the probe. The probe signal is then converted by means of the calibration parameters into the ferrite content measurement value. The Fischer E... probes are equipped with a memory chip (EEPROM) in the probe connector. The EEPROM stores probe-specific information (e. g. probe type, manufacturing code, test method and coefficients of the master calibration curve).

Probe characteristic
see term "Master calibration curve (probe characteristic)" on page 188

Probe output signal
see term "Countrate" on page 182

Probe signal
see term "Countrate" on page 182

Process capability
The process capability is assessed by the indices cp and cpk. (For further information see / 4 /.) Process capability is met when the process capability exceeds specified values. Commonly required is:

Process capability is a measure for long-term influences stemming from the so-called 6 Ms (mankind, machine, material, method, measuring instrument and milieu). To determine the process capability, a longer sequence of cyclical production steps needs to be employed (same product, same production line, same conditions, but different orders on different days).

Process capability index
The process capability is assessed by the indices cp and cpk. (For further information see / 4 /.)The process capability index cp takes the deviation of a process in relation to the width of the specification limit range (USL-LSL) into account.The process capability index cpk takes the position of the mean value in relation to the set specification limits into account.
The FERITSCOPE® MP30 calculates the process capability indices as follows:

$$c_p = \frac{USL - LSL}{6 \cdot \hat{s}} \text{ and } c_{pk} = Min\left[\left(\frac{USL - th.}{3 \cdot \hat{s}}\right); \left(\frac{th. - LSL}{3 \cdot \hat{s}}\right)\right]$$

with:

th. mean value of all single measurements

c_p process capability index

c_{pk} critical process capability index

USL upper specification limit

LSL lower specification limit

s^ estimated value for the standard deviation -> s^

Process control
see term "Statistical process control (SPC)" on page 201

Process control chart (SPC chart, quality control chart)
Statistical Process Control (SPC) often uses random samples to control a production such that the production process is under statistical control.
To do this, the variable features of the product are entered in a process control chart. Process control charts plot process variation over time and help to identify the causes of variations.
A random sample is taken from the production process and measured.
The result (e. g. mean value and standard deviation (x-s chart)) is graphically documented. The results of the control chart are used to determine when action should be taken in the process.

Quality assurance
All measures taken by a producer to ensure a controlled production process within the established quality criteria. One aspect of it is quality control, specifically, ferrite content measurements where ferrite content limit specifications are involved.

Quality control chart
see term "Process control chart (SPC chart, quality control chart)" on page 195

R
Range R of all measurements being displayed in the process control chart. The range is the difference between the maximum measurement Fe_{max} and the minimum measurement Fe_{min} in a measurement series.

$$R = Fe_{max} - Fe_{min}$$

Random measurement errors
see term "Measurement errors" on page 188

Random sample
A representative group selected from the production lot, using random sample principles. The sample is used to determine the properties of the entire lot (batch, unit of production).

Random sample size
Number of parts, combined into a random sample.

Range
see term "R" on page 195

Reference area
A portion of the significant surface area of a product where one or more measurements are to be taken. It is recommended to include the reference area or significant surface area in the production specifications, in addition to the specifications limits for the ferrite content.

Reference measurement
Measurement on a reference sample to check the normalization or calibration which was performed before.

Reference sample
Measuring object with a known ferrite content on a defined reference area that can be used to check the calibration. The ferrite content within the reference area should be as regular as possible. The reference sample should have the same properties (geometry, etc.) as the measuring object, the calibration is performed for. The reference samples may be from in-house production or may be from external sources. The ferrite content of a reference sample should have been determined using a reliable and properly calibrated instrument. Reference samples are used for the monitoring of test equipment. Reference samples are subject to wear and tear caused by the tactile measurement. The wear and tear is dependent on the properties of the surface and on the probe which used for measurement. For this reason, reference samples have to be checked regularly and replaced by new reference samples if the wear and tear becomes significant.

Relative standard deviation
see term "Coefficient of variation" on page 181

Repeatability
The standard deviation of the measurements taken under repeatability conditions is a measure for the repeatability. The smaller the standard deviation of these measurements, the better is repeatability. The repeatability is dependent on the test method and the quality of the instrument, but often also on the properties of the measuring object (for instance, surface roughness).
The standard deviation of the measurements under repeatability conditions

can be reduced by generating the mean value of the measurements (for instance, when measuring with the “mean reading” mode enabled).
see term "Accuracy" on page 177

Reproducibility
The ability of different operators to achieve practically the same measurement result, when taking measurements with different instruments at the same measuring position of the same measuring object at different locations.
see term "Accuracy" on page 177

Right value
see term "Trueness" on page 202

RS232 Interface
A serial interface protocol standardized originally in the United States. Employed, for instance, to connect a printer to a measuring instrument.

s
The standard deviation *s* is a measure of the deviations of single measurements of a measurement series from their common mean value.
The mean square deviation of the single measurements from the mean value is calculated as follows:

$$s = \sqrt{\frac{((Fe. - Fe_1)^2 + (Fe. - Fe_2)^2 + \ldots + (Fe. - Fe_N)^2)}{(N-1)}}$$

$$s = \sqrt{\frac{1}{(N-1)} \cdot \sum_{i=1}^{N} (Fe. - Fe_i)^2}$$

with:

Fe. mean value of the single measurements

Fe_i single measurement

N number of measurements

Figure 16.8 demonstrates that two measurement series with different standard deviations can still have the mean value.

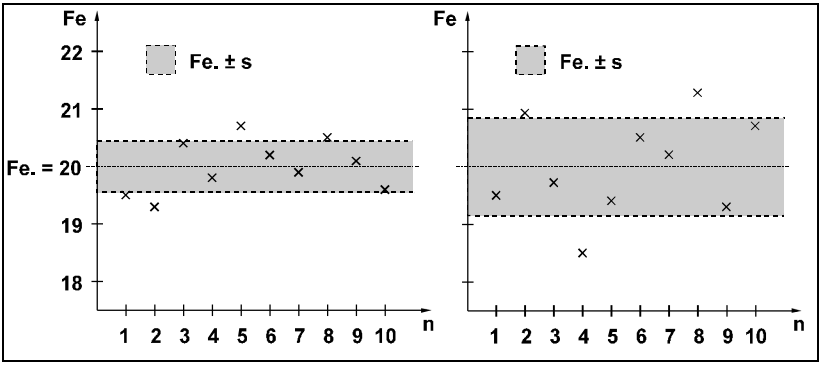


Figure 16.8: Measurement series with the same mean value but different standard deviation

s^

Estimated value for the standard deviation.

$$\hat{s} = \frac{s.}{c_4}$$

with:

s. standard deviation -> see „s.´´

c_4 the factor c4 depends on the number of measurements N and can be obtained from any popular publication of mathematical statistics table

s.

Standard deviation of the measurements taken with fixed block size (will be displayed or printed only when evaluating the current application).

$$s. = \frac{1}{N_{Bl}} \cdot \sum_{j=1}^{N_{Bl}} s_j$$

with:

N_{Bl} number of evaluated blocks

s_j standard deviation of the measurements stored in the j-th block

s_a

Calculated by the FERITSCOPE® MP30 only when the measurements were performed with fixed block size and the deviations of the block mean values cannot be attributed to the deviations within the subgroups, as determined by

analysis of variance methods (A.O.V.). It describes the deviations of the block mean values in relation to the deviations of the single measurements within the blocks. With a suitable measurement strategy, sa is a measure of the product deviation.

$$s_a = \sqrt{\frac{s_{II}^2 - \hat{s}^2}{N_i}}$$

with

s_{II}	see -> s_{II}
N_i	block size (number of measurements per block)
	Estimated value for the standard deviation -> s^
s^	Estimated value for the standard deviation.

If, for instance, the same number of measurements is performed on several measuring objects and the measurements on each object are combined into a block (e. g. when measuring with fixed block size), *s.* is a measure for the instrument deviation and s_a is the product deviation with the instrument deviation eliminated.

s_{II}
is calculated like this:

$$s_{II} = \sqrt{N_i} \cdot \sqrt{\frac{1}{N_{Bl} - 1} \cdot \sum_{j=1}^{N_{Bl}} (Fe.. - Fe._j)^2}$$

with:

N_{Bl}	number of evaluated blocks
N_i	block size (number of measurements per block)
Fe..	mean value of all evaluated measurements
$Fe._j$	mean value of the measurements stored in the j-th block

Sigma outlier rejection
Method for outlier rejection. (see term "Outlier rejection" on page 193)

Significant surface
Area on the surface of a measuring object containing the the ferrite content to be measured. All properties necessary for the use and appearance of the product must occur at this significant area.

Single measurement
see term "Single reading" on page 200

Single reading
Measurement result as displayed by the instrument after a single measurement at the measuring position.

Skewness
Measure for the asymmetry of a single-peak probability distribution around its mean value. A positive skewness indicates a distribution whose peak stretches more towards values that are greater than the mean value. A negative skewness indicates a distribution whose peak stretches more towards values that are smaller than the mean value. The skewness of symmetric distributions is zero (e. g. for normal distributions). When evaluating the current application with the FERITSCOPE® MP30, the skewness is calculated.

Smallest measurement
see term "Minimum measurement" on page 190

SPC (Statistical Process Control)
see term "Statistical process control (SPC)" on page 201

SPC chart
see term "Process control chart (SPC chart, quality control chart)" on page 195

Specification limits (LSL and USL)
The lower specification limit LSL is the minimum ferrite content allowed for the measuring object. The upper specification limit USL is the maximum ferrite content allowed for the measuring object. Specification limits are usually set by engineering requirements to assure proper functioning or serviceability of the product. (see -> Specifications). With specification limits monitoring enabled, b appears in the display of the FERITSCOPE® MP30.

Specifications
Requirements according to which production is defined within certain limits for variable and attributive properties, like for instance the lower and the upper specification limit for the ferrite content. Quality control monitors adherence to these requirements. (-> Specification limits)

Specimen
see term "Measuring object" on page 189

Stability
As with every process, test methods are also subject to deviations. This may lead to systematic measurement errors (e. g. drift), independent of handling. By examining the stability and by regular checks, one can ensure stability.

Standard
see term "Calibration standards (ferrite standards)" on page 180

Standard deviation
see term "s" on page 197

Statistical process control (SPC)
A statistical method to analyze and control the quality of a process. In high volume productions, only random samples are taken instead of 100% inspection which would be too costly. The measurement results of the random samples are extrapolated for the entire production lot with mathematical-statistical methods, and then used to control the production process. This modern method of quality control ensures constant good quality, with a minimum level of rejected parts. Normal distribution of the measurements is required so that statistical process control can be used for quality control purposes.

Stop bit
With serial asynchronous data transfer, the stop bit is added to the data word to be transferred. 1 to 2 bit logic Ones are used. After the stop bit, the sender remains at logic One until the start bit of the next character arrives.

Student distribution factor
see term "t" on page 202

Systematic measurement errors
see term "Measurement errors" on page 188

t
The student distribution factor t can be obtained from any popular publication of mathematical statistics tables and is given as follows:

$$t_{\left(1-\frac{\alpha}{2}\right);f}$$

Example:
At a confidence level of 95 % and N>200 (resulting in a degree of freedom f=199 (because of f = N-1)) the student distribution factor is
$t_{97.5;199} = 1.96$.

Test method
Procedures and process to obtain information about the properties of a measuring object. The test method is based on scientific findings and depends on the application. (For further details, see / 12 /.)

Three-point calibration
see term "Corrective calibration (one-point, two-point or three-point calibration)" on page 182

Tolerance limits
see term "Specification limits (LSL and USL)" on page 200

Transfer rate
see term "Baud rate" on page 178

Trueness
Agreement between the true value and the mean value of the measurement results, achieved constantly under practical measurement conditions. See -> Accuracy. The true value is a value known from mathematical theoretical formulations. Since such values are seldom encountered, a value deduced from national or international standards is taken as “right”.
This right value is often indicated as true value.

True value
see term "Trueness" on page 202

Two-point calibration
see term "Corrective calibration (one-point, two-point or three-point calibration)" on page 182

u
Uncertainty of measurement.
The mean value Fe. of a random sample is not equal to the mean value μ of the population.
However it is possible to define an interval, in which the mean value μ of the population will be found with a certain probability (indicated as confidence level):

$$Fe. - u \leq \mu \leq Fe. + u$$

For a population having normal distribution, the uncertainty of measurement u is calculated as follows for a given confidence level (1-α):

$$u = \frac{t \cdot s}{\sqrt{N}}$$

with:

t student distribution factor

s standard deviation

N number of measurements.

By entering the coefficient of variation C.O.V. in place of the standard deviation s one gets the relative measurement uncertainty u_{rel} in %.
For further details see / 7 /.

$$u = \frac{t \cdot \text{C.O.V.}}{\sqrt{N}}$$

Uncertainty of measurement
see term "u" on page 203

Unit of measurement
Unit used for the measurement display. In ferrite content measurement, the common units of measurement are ferrite numbers (FN) or point count ferrite (Fe%).

USL (Upper Specification Limit)
see term "Specification limits (LSL and USL)" on page 200

Variance
Mean squared deviation.
The square root of the variance is called standard deviation.

X
Countrate. see term "Countrate" on page 182.

X_{Base}
Countrate obtained when measurements are taken on the Base of the calibration standard set. see term "Countrate" on page 182.

X_n
Normalized countrate. see term "Countrate" on page 182.

X_s
Countrate obtained when measuring on a measuring object with no ferrite content. see term "Countrate" on page 182.

17 Additional Literature

17.1 Statistics and Ferrite Content Measurement

/ 1 / American Welding Society 1974: Standard procedures for calibrating magnetic instruments to measure the delta ferrite content of austenitic stainless steel weld metal (AWS A4.2-74); Miami, Florida

/ 2 / DataMyte Corporation: DataMyte Handbook - A practical guide to computerized data collection for Statistical Process Control

/ 3 / Duncan, Acheson J.: Quality Control and Industrial Statistics; Homewood Illinois: Richard D. Irwin, Inc.

/ 4 / Ford Q-101: Quality System Standard

/ 5 / Helmut Fischer GmbH+Co.KG: Reports

/ 6 / Kotecki, D. J.: Extension of the WRC Ferrite Number System; Welding Research Supplement November 1982, p. 352-s ... 361-s

17.2 Standards

/ 7 / DIN 1319: Basic concepts of measurement; concepts for uncertainty of measurement and for evaluation of measuring instruments

/ 8 / DIN EN ISO 2064: Metallic and other non-organic coatings - Definitions and conventions concerning the measurement of thickness

/ 9 / DIN EN ISO 2178: Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method

/ 10 / DIN EN ISO 2360: Non-conductive coatings on non-magnetic substrates - Measurement of coating thickness - Eddy current method

/ 11 / ISO 3534: Statistics; Vocabulary and Symbols

/ 12 / DIN EN ISO 3882: Metallic and other non-organic coatings - Review of methods of measurement of thickness

/ 13 / IIW Document II-1269-95 (II-C-034-95) - Draft Revision of ISO 8249-1985 (E) and II-C-023-94: Welding - Determination of Ferrite Number in austenitic and duplex ferritic-austenitic Cr-Ni stainless steel weld metal

/ 14 / ASTM B 244: Standard method for measurement of thickness of ano-

dic coatings on aluminum and of other non-conductive coatings on nonmagnetic basis metals with eddy-current instruments

/ 15 / ASTM B 499: Standard test method for measurement of coating thicknesses by the magnetic method: nonmagnetic coatings on magnetic basis metals

/ 16 / BS 5411: Methods of test for metallic and related coatings
Part 3: Eddy current method for measurement of coating thickness of non-conductive coatings on non-magnetic basis metals
Part 11: Measurement of coating thickness of non-magnetic metallic and vitreous or porcelain enamel coatings on magnetic basis metals: magnetic method

Short-Form Operator Manual FERITSCOPE® MP30

Display

Fischer trademark	
ZERO	Normalization is performed
CAL	Calibration is performed
	Restricted operating mode has been selected
	"Continuous" display mode has been enabled
↑ / ↓	Upper/ lower tolerance limit has been violated
	Displayed measurement value has been recognized as outlier
	Linking mode has been enabled, applications are linked
	Configuration programs have been called-up

-8.8.8.8	Measurement values, error messages and warnings
MS/m µm % mils mm FN	Unit of measurement of the displayed value
	Specification limits monitoring has been enabled
	Battery has to be changed or recharged
	Internal routine is performed
	Matrix measuring mode has been enabled
	Measurement block is closed
..SCOPE	Instrument type
RBA..	Instrument software version

Symbols and Styles Used

ENTER	Refers to instrument keys, which have to be pressed
ZERO → perform	Refers to instrument keys or actions, which have to be pressed or performed one after the other
ON/OFF + ▲	Refers to instrument keys, which have to be pressed immediately one after teh other (do not keep both keys pressed!)
[New probe ?]	Refers to operating notes appearing in the prompt lines of the display

☛ **For more detailed information please refer to the operator manual FERITSCOPE® MP30!**

Matrix Measuring Mode, Evaluation, Applications, Normalization and Corrective Calibration

Matrix Measuring Mode:

Only with matrix measuring mode enabled:

- the block, the next measurement is to be stored in, can be selected with **BLOCK-RES** and the arrow keys
- in the display
- all applications contain the same number of blocks
- all blocks can store the same maximum number of measurements

Enabling / Disabling the Matrix Measuring Mode: APPL No configuration program

Evaluation of the Measurements:

Block Evaluation:
BLOCK-RES ➛ ... ➛ **BLOCK-RES** ➛ ▲ (continue the current block) or **ENTER** (begin a new block)

Evaluation of the Current Application:
FINAL-RES ➛ ... ➛ **FINAL-RES** ➛ **ENTER** (exit the evaluation) or 2x **DEL** (exit the evaluation and delete all the measurements of the current application)

Applications:

Creating an Application:
1. Select an application: **APPL No** ➛ ▲, ▼ until [Not opened] appears ➛ **ENTER**
2. Perform several measurements on the base ➛ **ENTER**

Deleting an Application:
1. Select the application to be deleted: **APPL No** ➛ ▲, ▼
2. Delete the application: **DEL** ➛ **DEL**
3. Select another application: ▲, ▼ ➛ **ENTER**

Overwriting an Application:
1. Select the application to be overwritten: **APPL No** ➛ ▲, ▼ ↦ **ZERO**
2. If [New probe ?] appears: **DEL**; otherwise: after step 1 immediately step 4
3. If [Delete measure ?] appears: **DEL** (deleting the measurements) or **ENTER** (keeping the measurements); otherwise: after step 2 immediately step 5
4. Perform several measurements on the base ➛ **ENTER**

Linking the Applications:
Only those applications, created with the very same probe, are linked.
The same normalization and corrective calibration is used for the computation of the measurement values in linked applications.
(⋈ appears with linking mode enabled.)
Enabling / Disabling the linking mode:
APPL No configuration program

☛ Make sure to perform a normalization or corrective calibration after the linking mode has been enabled with every probe used to create more than one application!

Normalization / Corrective Calibration:

Normalization:
ZERO ➛ perform several measurements on the base ➛ **ENTER**

Corrective Calibration:
1. **CAL** ➛ perform several measurements on the base ➛ **ENTER**
2. Perform several measurements on standard 1
3. Set the ferrite content: ▲, ▼ ➛ **ENTER**
4. If a 2/3 point calibration is desired: Perform several measurements on standard 2 ➛ set the ferrite content: ▲, ▼ ➛ **ENTER**; otherwise: after step 3 immediately step 6
5. If a 3 point calibration is desired: Perform several measurements on standard 3 ➛ set the ferrite content: ▲, ▼; otherwise: after step 4 immediately step 6
6. **ENTER**

☛ **For more detailed information please refer to the operator manual FERITSCOPE® MP30!**

Measuring with an Existing Application

Performing a Measurement:

1. Switch the instrument on: **ON/OFF**
2. Select the desired application:
   APPL No ➛ ▲ , ▼ ➛ **ENTER**
3. Measuring: Place the probe vertically on the measuring object

Deleting Erroneous Measurements:

Single measurements during measurement:
DEL (last value) ➛ **DEL** (previous value) ➛ ...

All measurements of the last open block:
BLOCK-RES ➛ **DEL**

All measurements of the current application:
FINAL-RES ➛ **DEL** ➛ **DEL**

Overwriting Erroneous Measurements:

1. Select the desired block: **BLOCK-RES** ➛ ▼ ➛ ▼, ▲ ➛ ... (Please note: ▲ in the last block exits the evaluation!)
2. Select the erroneous measurement:
   MENU ➛ ▲ ➛ ▲ , ▼ ➛ ...
3. Overwrite the erroneous measurement:
   DEL ➛ perform measurement ➛ **MENU**
4. Exit the evaluation:
   ▲ ➛ ... ➛ ▲ (continue the current block) or **ENTER** (start a new block)

Printing the measurements:

During measurement: automatically (with a printer connected and switched on)

Later (during measurement or during block evaluation): PRINT

"Continuous" Display Mode:

Move the probe over a surface area to determine the ferrite content distribution.

Activate: ▼ ➛ ↻ appears
Deactivate: ▼

Measurement with Specification Limits:

Violation of the specification limits will be indicated during measurement by an acoustic signal and ⬆ or ⬇. (⇳ appears with specification limits mode enabled.)

Enabling / Setting Specification Limits:

1. **MENU**
2. If [No spec. limits] appears: ▲; otherwise: perform step 3 immediately
3. Set the lower specification limit:
   Measurement or ▲ , ▼ ➛ **ENTER**
4. Set the upper specification limit:
   Measurement or ▲ , ▼ ➛ **MENU**

Disabling Specification Limits:
MENU ➛ **DEL** ➛ **MENU**

Measurement with Fixed Block Size:

For automatic block formation after the fixed block size (= number of measurements per block). (⇳ appears with closed blocks.)

Setting the Block Size:

1. **MENU** ➛ **ENTER** ➛ ... ➛ **ENTER** until [Block size] appears ➛ ▲
2. If [Delete measure ?] appears: **DEL**; otherwise: after step 1 immediately step 3
3. Set the block size: ▲, ▼ ➛ **MENU**
4. If [Delete measure ?] appears:
   DEL ➛ **MENU**

Disable Automatic Block Formation:
MENU ➛ **ENTER** ➛ ... ➛ **ENTER** until [Block size] appears ➛ **DEL** ➛ [Block size free] appears ➛ **MENU**

"Mean Reading" Mode :

Only the mean value of i single measurements is stored. Especially well suited for rough surfaces.

1. Define the number i of single measurements to be combined:
   MENU ➛ **ENTER** ➛ ... ➛ **ENTER** until [i single read.] appears ➛ ▲ , ▼
2. **MENU**

☛ **For more detailed information please refer to the operator manual FERITSCOPE® MP30!**

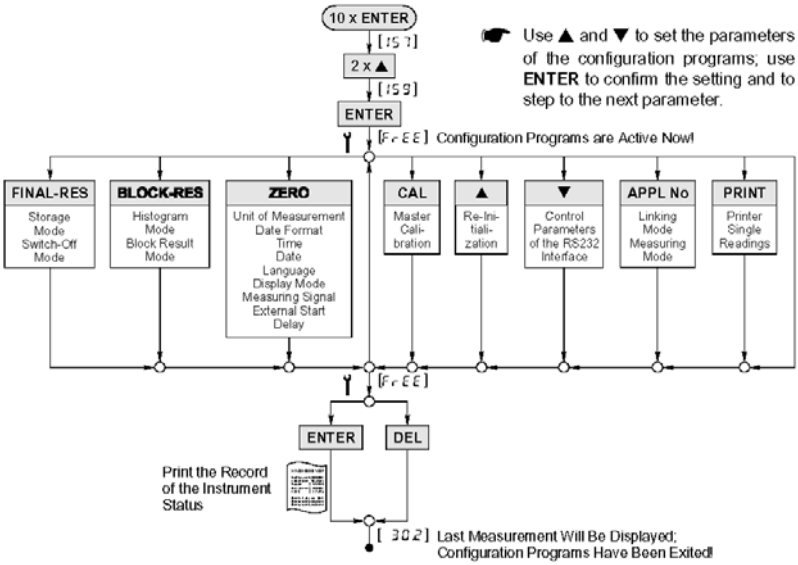
Configuration

Measurement Accept Signal:
Enabling: **ON/OFF + ▲**
Disabling: **ON/OFF + ▼**

Setting the Date and Time:
ON/OFF + ZERO → ▲, ▼ → ENTER → ...

Restricted Operating Mode:
Enabling: **ON/OFF + DEL** (🔒 appears with restricted operating mode enabled)
Disabling: **ON/OFF + ENTER**

Overview of the Configuration Programs:



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