Operator's Manual

MMS® Inspection DFT

Gage type High

MMS® Inspection DFT
Gage type High

Instruments for coating thickness measurements

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On our home page www.helmut-fischer.com you will find the addresses of our sole agencies and subsidiary companies around the globe.

Quality Assurance System of the Helmut Fischer GmbH

DIN EN ISO/IEC 17025	Calibration lab accredited for certified mass per unit area standards
DIN EN ISO 9001:2015	Management system certified by Swiss Association for Quality and Management Systems (SQS)

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1 Safety information

If you use the instrument as intended and observe the safety information, the instrument poses no danger.

Please read and follow this Operator's Manual and observe the safety information. Also observe generally applicable safety and accident prevention regulations.

1.1 Intended use

The gage is intended solely for measurement of coating thicknesses.

Only accessories approved or recommended by the manufacturer may be connected to the gage.

Any use beyond this is not the intended use. The risk of damage ensuing therefrom is borne solely by the user.

1.2 Environmental conditions

Storage and transport temperature: 0 … +60 °C

Temperature

When exposed to sunshine, the areas behind glass windows (e.g. in an automobile) can easily reach temperatures in excess of +60 °C. This can cause damage to the instrument.

▶ Do **not** keep or store the instrument and accessories behind glass windows, or near to sources of heat such as radiators etc.!

Acid

The gage and accessories are **not** acid-proof.

▶ Do **not** place the instrument or accessories in contact with acids or liquids which contain acid!

Potentially explosive environment

The gage and accessories are **not** suitable for use in potentially posted environments.

▶ Operate the gage and accessories only outside of potentially explosive areas!

1.3 Safety of the electrical equipment

Only accessories approved or recommended by the manufacturer may be connected to the gage!

USB cable

Damaged USB cable

Kinking or pinching the USB cable can result in a broken wire. Data transmission is then no longer possible.

▶ Connect only an undamaged USB cable with a max. length of 3 m to the gage.

▶ Always coil up the USB cable for storage.

Batteries/rechargeable batteries

- Use the following alkaline or lithium battery type: Mignon, 1.5 V, LR6 - AA

or

- Use the following NiMH rechargeable battery type: Mignon, 1.2 V, HR6 - AA

Servicing and repairs

Modifications, repairs as well as maintenance and service work on the instrument and accessories may be carried out only by service personnel authorized by the manufacturer.

Exception: Changing the batteries/rechargeable batteries.

2 Description

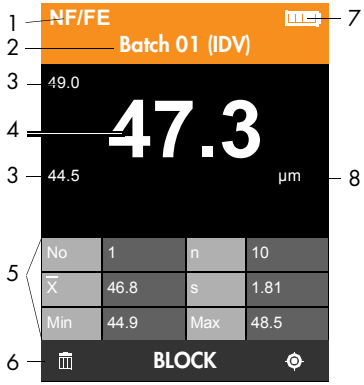
The gages in the MMS Inspection DFT series measure coating thicknesses easily, quickly and in a nondestructive manner. Gage construction with an integrated measuring probe allows single-hand measurements, preferably on flat and cylindrical samples.

This operator's manual describes the following gage variants in the MMS Inspection DFT series:

- High variant
  in the types Fe and Fe+NFe, USB and WiFi interfaces, data storage for 250 000 single readings in 2500 batches, batch template packages for general industrial use as well as specifically for use in the field of corrosion protection

Additional information can be found in the data sheet, page 9

2.1 Measurement reading view (example)



Example of the measurement reading view showing statistics with set tolerance limits

1 Measuring application
NF/FE: Nonferrous coating material on ferrous base material
NC/NF: Electrically nonconducting and nonferrous coating material on electrically conducting nonferrous metals

2 Batch name (batch type abbrev.)

3 Tolerance limits

4 Measurement reading

5 Statistics values

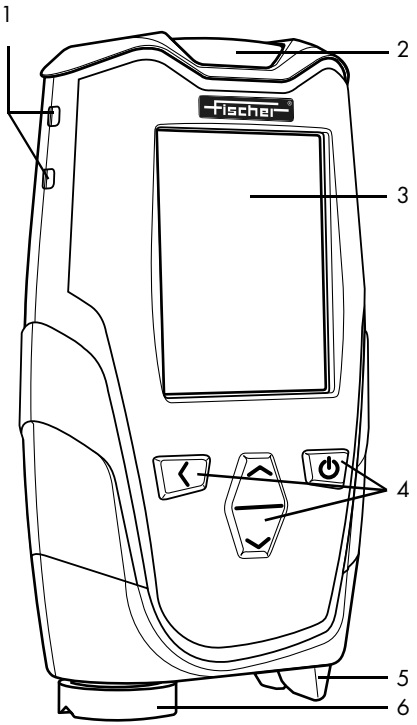
6 Key assignment line (example: delete symbol, open block statistics, symbol for opening calibration)

7 Battery indicator

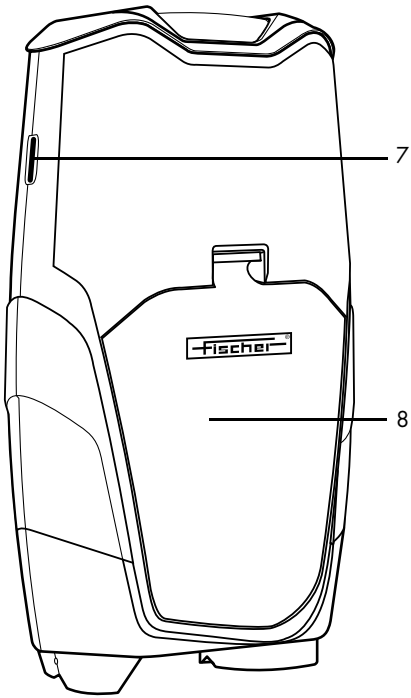
8 Unit of measurement

A list of all display symbols and texts can be found starting on page 43.

2.2 Gage



Front of gage



Rear side of gage

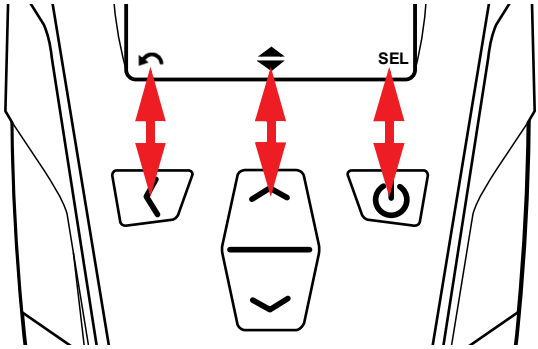
1 Eyes for a carrying strap
2 Signal lamp to indicate measurement acquisition and limit violations
3 Display
4 Keys, On/Off key, for description see page 5
5 Positioning support for reliable placement of the gage on the surface
6 Probe
7 USB port
8 Battery compartment cover

Gage dimensions can be found in the data sheet, page 14

2.3 Keys

There are 4 keys for operating the gage.

The bottom line of the display always shows the functions of the 4 keys (see illustration below). The assignment depends on the opened menu page.



The function shown on the display is assigned to the key directly underneath (example).

The ⏻ key has two functions:

- It switches the gage on and off when the key is held for at least 1 s
- Function shown in the bottom line of the display

The ∨ key has two functions:

- It moves the cursor/mark down when ◆ is shown in the bottom line of the display
- It opens the main menu when ◆ is **not** shown in the bottom line of the display

A description of the remaining key symbols can be found starting at page 43

2.4 Menus - function overview

Main menu for the "Industrial" batch template package (Standard)

Statistics >	Display of the statistics for the opened batch

Batch Modify* > Settings and entries for the opened batch	MEASURE >	Switch to the measurement view
	Tolerance Limits >	Activation of limit monitoring and setting of the limits
	Batch Info >	Input of information
	View Settings >	Measurement view Batch - statistics display Block - statistics display
	Units >	Set the unit of measurement
	Block Size >	Activation of automatic block formation and setting of the block size
	Offset >	Set the offset value
	More Settings >	MEASURE Counted Average Measurement acquisition Value Resolution Save Measurements Air Reference Calibration assign

*If the "Corrosion" batch template package is selected, the functions in the **Batch Modify** menu change to match the selected batch type.

Batches >	New > List of saved batches (After a batch has been selected, it can be opened, copied or deleted.)

Calibrations >	New > List of saved calibrations

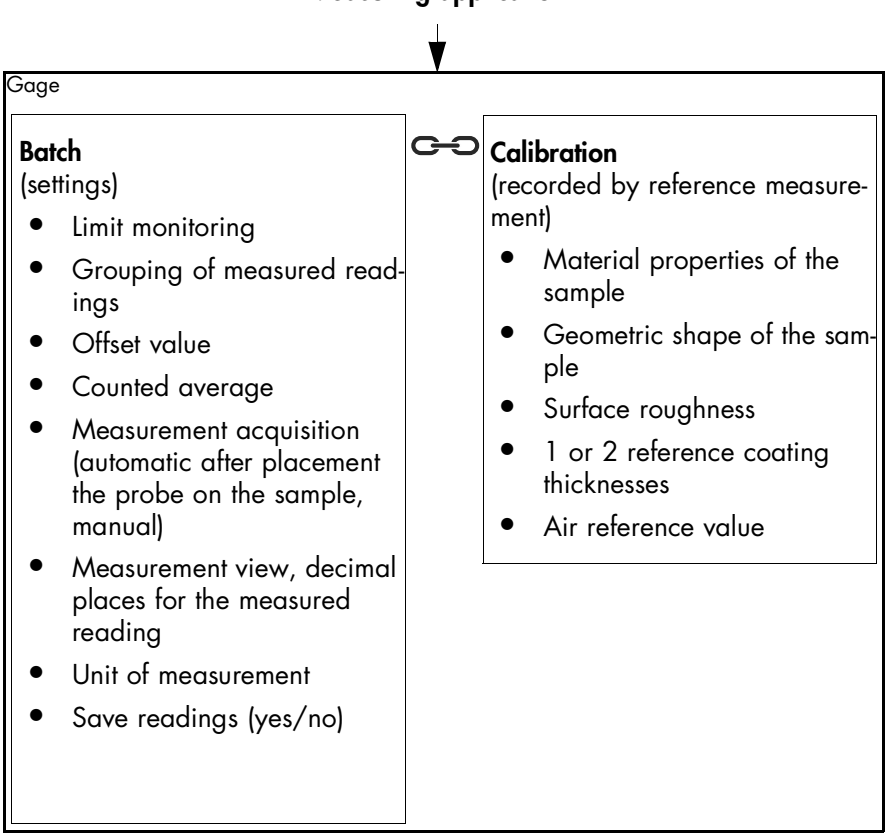
After a calibration has been saved, the following functions are available)	Rename	Rename a selected calibration
	Quick	Activate a semi-automatic calibration routine
	Reset	Delete all coating thickness correction values from the selected calibration
	Delete	Delete a selected calibration

Gage Settings >	Language	Select the display language
	Display Settings >	Brightness
		Flip Display
	Indication Settings >	Key press signal
		Audible signal
		Optical Indication
		Vibration
	Connections >	USB Mode
		WiFi
	Date & Time >	
	More Settings >	Units (for new b atches)
		Default Value Resolution
		Usage (batch template package setting)
	Probe Settings >	Probe Raw Values
		Line Frequency Setup
		Delete All Calibrations
	About >	Information about software version and probe as well as legal information such as copyright, data protection conditions, enhanced labeling

2.5 Gage concept

In order to measure, a Batch (file) **and** a suitable Calibration (reference) must be created in the gage for the Measuring application. A description of the terms measuring application, batch and calibration can be found in Chapter "Glossary".

The essential content of the batch and calibration files and their relationship to each other are shown schematically in the following illustration:



A measuring application is defined in the gage by a batch file and a calibration file and their linking to each other.

MMS® Inspection DFT

Coating Thickness Measurement on Virtually all Metals

- Non-destructive measurements
- Universal applicable coating thickness gage

- Easy and convenient operation
- Compact and robust case

Scale 1:1

Description

The gage models MMS Inspection DFT measure coating thicknesses easily, quickly, non-destructively and with the precision that is typical for all Fischer instruments.

Gage properties

- Ideal for onsite applications (outside and inside) due to the compact size, the light weight and the robust and durable instrument design
- Probe integrated in the gage for single-handed operation
- IP65, dust-tight and water repellant and resistant
- The 3-point-support ensures a stable and sure positioning on the surface
- Intuitive operation of the menu navigation and graphic display
- The measurement presentation flips automatically and thus allows optimum reading in different measuring positions
- Different languages selectable
- Automatic selection of the measuring method corresponding to the base material (only for gage type FE+NF)
- Patented conductivity compensation for measurements on non-magnetic base materials
- Diversity of variants; You can select your suitable gage according to your requirements from 2 variants with different features. You will find an overview in the sections "Variants" and "Order Information".

Applications

	Steel, iron, cast iron base materials (FE)	**Non-ferrous metal base materials (NF)***
Examples	• Zinc, chromium, copper, paint, varnish or plastic on steel, iron or cast iron (NF, NC/FE)	• Paint, varnish or plastic coatings on aluminium, copper or brass (NC/NF) • Anodized coatings on aluminium

*Only measurable with variant type FE+NF

The gages are applicable for measurements both on smooth and rough surfaces

Variants

All gage variants available in 2 types:

- **FE**: Measurements on ferrous base materials (Fe)
- **FE+NF**: Measurements on both as measurements on ferrous (FE) as well as on non-ferrous metal base materials (NF)

Start

Entry level gage with small data memory for max. 10,000 measured readings in one batch and USB interface for data transfer.

High

High-end gage with large data memory for 250,000 measured readings in 2500 batches, USB interface and WiFi for data transfer as well as batch template packages Industrial and Corrosion for easy and fast creation of measurement task files (batches). The package Corrosion contains 5 batch types with preconfigurations especially for coating thickness measurement in the corrosion protection area, e.g. according to the measuring regulation SSPC PA2.

Batch Template Packages	Templates for Creation Measurement Tasks
Only available for gage variant High	The packages contain various batch types. That are batch templates with especially designed measurement tasks for specific coating thickness measurement applications.
Industrial	Template package contains following batch types: • *Individual* Batch template for free configuration: All metrological standard functions are available and calibration method Zero + 1 Foil is used • *Elementary* Template with minimum configuration: No further metrological function settings (customizable), only calibration method Zero is used • *Smooth Surface* Preconfigured batch template for measurements on smooth surfaces: Settings of tolerance limit values (customizable) and calibration method Zero + 1 Foil is used. • *Rough Surface* Preconfigured batch template for measurements on rough surfaces: Display and storage of the mean value of a given number (n) of measurements (customizable, single readings are also stored) and the calibration method Zero + 2 Foils is used.
Corrosion Only available for gage variant High	Template package containing batch types with especially designed measurement tasks for measurements of corrosion-protective coatings. The template package contains following batch types: • *Individual* Batch template for free configuration: All metrological standard functions are available and calibration method Flexible is used • *IMO PSPC* Preconfigured batch template containing 90/10 rule, calibration method and evaluation for coating thickness measurement according to requirements of "Performance Standard for Protective Coatings" of the International Maritime Organization (IMO PSPC), calibration method 2 Foils is used • *SSPC PA2* Preconfigured batch template with settings (partly customizable), calibration method and evaluation regulations for coating thickness measurement according to guideline SSPC-PA2 of the Society for Protective Coatings (SSPC), calibration method 2 Foils is used • *ISO 19840* Preconfigured batch template with settings (partly customizable), calibration method and evaluation regulations for coating thickness measurement according to standard ISO 19840, calibration method 2 Foils is used • *AS 3894.3* Preconfigured batch template with settings (partly customizable), calibration method and evaluation regulations for coating thickness measurement according to Australian standards AS 2331.1.4 and AS 3894.3-B, calibration method 1 Foil is used • *SIS 184160* Preconfigured batch template with settings (partly customizable), calibration method and evaluation regulations for coating thickness measurement according to Swedish standard SIS 184160, calibration method 2 Foils is used

Metrological Standard Functions	Measurement Tasks
Batch	File containing all metrological function settings and the linking to calibration necessary for the measurement task as well as the measured readings and evaluations
Block creation	Measured readings grouped in measurement blocks
Tolerance limits/Nominal thickness	Adjustable, depending on the selected batch type for the gage variant High
Offset value/Correction value	Adjustable, is deducted automatically from the measured reading. Thus, one obtains the thickness of the top coating if for instance the interim coating is known.
Measurement reading acquistion	Automatic upon placement of the gage probe

Metrological Standard Functions — Measurement Tasks

Measurement reading storage	On/Off switchable
Measurement units	µm/mm or mils/inches
Measurement modes	*Single reading mode* After each placing of the gage probe the measuring reading is displayed and stored automatically. *Free running mode* After placing the gage probe the continuous display of the measured readings appears without automatic storage. Useful for quick checking of coating thicknesses over a defined surface area, e.g. in tank construction. *Scan mode* The Scan Mode allows a defined recording of the measurement acquisition while the probe is moving over the surface. You can set the number of measured values and the time interval for the measured value acquisition in the gage. Useful to determine the coating thickness over surface areas.
Resolution of measurement reading	Low (up to 1 decimal place), Medium (up to 2 decimal places), High (up to 3 decimal places)
Air reference value acquisition	During measurement, the air reference value is used to reference the zero point determination. Regular measurement of the air reference value is necessary to achieve high measurement accuracy. Automatic capture of the air value always when the gage probe is lifted from the surface.
Calibration	For a correct measurement of the coating thickness, the gage must record the properties (permeability, electrical conductivity, geometry) of the test piece. This adjustment is carried out by a calibration. A calibration is specified by the reference specimen (comparable in shape, material, permeability/electrical conductivity to the test piece) and by the foil standards used (calibration method).

Calibration Methods

Only available for gage variant High

Gage variant Start uses only method Flexible

- *Flexible*
  Adjustment of the gage to geometrical form and base material of the test piece: Zero point determination and adjustment to up to two coating thickness values by using calibration foils. On recalibration, the individual calibration steps can be skipped.
- *Zero*
  Adjustment of the gage to the base material and the geometry shape of the test piece
- *1 Foil*
  Adjustment of the gage to test piece: Adjustment to a coating thickness value by using 1 calibration foil (especially for measurement tasks in the corrosion field)
- *2 Foil*
  Adjustment of the gage to test piece: Adjustment to 2 coating thickness values by using 2 calibration foils (especially for measurement tasks in the corrosion field)
- *Zero + 1 Foil*
  Adjustment of the gage to the base material and the geometry shape of the test piece: Adjustment to the base material and to 1 coating thickness value by using 1 calibration foil
- *Zero + 2 Foil*
  Adjustment of the gage to the base material and the geometry shape of the test piece: Adjustment to the base material and to 2 coating thickness values by using 2 calibration foils

General Features

Test methods	
Gage type FE and FE+NF	• Magnetic induction method (ISO 2178, ASTM D7091, measurement of non-magnetic coatings on magnetic substrates)
Gage type FE+NF Automatic selection of the test method corresponding to the base material	• Eddy current method (ISO 2360, ASTM D7091, measurement of non-conductive coatings on non-magnetic substrate metals)
Factory Calibration	Each individual gage is factory calibrated at several reference points with the greatest care to ensure the highest possible degree of trueness.
Data memory	The memory content is preserved even when there is no voltage supply; subsequent viewing of the measured single readings and evaluations • Gage variant Start with memory capacity of max. 10,000 measured readings in 1 batch • Gage variant High with memory capacity of 250,000 measured readings in 2500 batches and up to 100 calibrations
Evaluation	*Statistics* • Gage variants Start and High with Batch template package Industrial: Display of mean value, standard deviation, min/ max values and number of measurements per block, per batch, coefficient of variation, number of measured values lower/upper the set limit values • Gage variant High with Batch template package Corrosion: Depending of the selected measuring regulation; e.g. for SSPC-PA2, display per measurement location (Spot)/area section (Area): Number of (Spots), mean value, coefficient of variation, min./max. values, Range, measured readings < 80 %/> 120 % of limit values (coating thickness restriction level 3) *Graphic Presentations* • Histogram • Run-Chart, showing the progress of measured readings
Probe	Single tip axial probe with spring-loaded measuring system and with wear-resistant probe tip built-in into gage Probe tip radius: 2 mm, Probe tip material: Hard metal
Measurement interval	More than 140 measurements per minute
Display of measurement acquisition	Audible by a short beep and visual by colored illuminated LED; gage variant High: Additional by gage vibration
Display for limit monitoring	• Limit violation: Audible by 2 short beeps and visual by red illuminated LED; gage variant High: Additional by gage vibration • Measured readings between the limits: Audible by 1 short beep and visual by green illuminated LED; gage variant High: Additional by gage vibration
Languages	German and English
Presettings for batches Only available in gage variant High	Each new batch is created with a preset measurement unit and resolution for the displayed measured value. For the gage variant High-USB, the batch template package is also preselected here. You can adapt these presettings to your requirements. However, you can also change the unit of measurement and the resolution for the measured value display at any time in the batch that has already been created.
Display	• Graphic display with automatic flipping measuring presentation view (deactivatable) to read measurement results in many different gage positions • Setting of brightness and contrast (definable for Office, Sunlight and Night)
Data transfer Bluetooth/WiFi only available in gage variant High	• USB: Data transfer of single readings to a PC, Data import to MSExcel via PC-Datex software; You can gratis download the PC-Datex program from Fischer-Homepage • Bluetooth/WiFi: Data transfer of measurements and data transfer of batches to App PHASCOPE® PAINT; Creation and export of reports via App; You can gratis download the App from Google Play Store and Apple App Store

General Features

USB port

2.0 Type C

- For service purpose
- For connection to PC for data transfer, max. cable length: 3 m (118 inches)

Wireless interface
Only available in the variants High

WiFi: WiFi module integrated in gage, Standards IEEE 802.11b/g/n

Bluetooth: Bluetooth module integrated in gage, Bluetooth v4.2 BR/EDR and BLE

Admissible climatic conditions during operation

Ambient temperature	Relative Humidity	Altitude of location	Pollution Degree
0 … +50 °C	5 … 85 %RH, at 25 °C (77 °F), non-condensing	up to 2000 m (6561.7 ft (US)) (above sea level)	3

Surface temperature

max. + 60 °C

Protection class (housing)

IP65, measurements under water are not permissible

Weight (incl. batteries)

about 251 g

Power supply

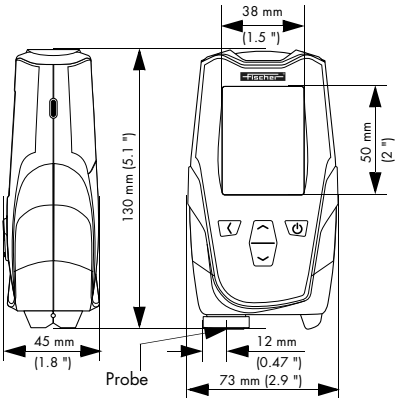
- 2 batteries: Mignon, Alkaline or Lithium, LR6 - AA, 1.5 V
- 2 rechargeable batteries: Mignon, NiMH, HR6 - AA

Battery life
Specifications valid for +20 °C (+68 °F) ambient temperature and Alkaline batteries used

> 8 h for continuous measuring, brightness set to sunlight and deactivated wireless interface

Dimensions

Gage



*

The following specifications are valid for measurements by using the Single reading measurement mode

The values for measurement range, trueness, repeatability precision and measurement errors are valid for electrically non-conductive coating materials on steel or iron (NC/FE). The values may differ for measurements on non-ferrous coating materials (NF).

Measurement Ranges*

	Steel, iron, cast iron base materials (FE)	**Non-ferrous metal base materials (NF)**
	0 … 2500 µm (98.4 mils)	0 … 2000 µm (78.7 mils)

Trueness*

	Steel, iron, cast iron base materials (FE)	**Non-ferrous metal base materials (NF)**
Based on Fischer factory calibration standards and 20 °C (68 °F) for specimen and ambient temperature	0 … 75 µm: ≤ 1.5 µm 75 … 1000 µm: ≤ 2 % of nominal value 1000 … 2500 µm: ≤ 3 % of nominal value 0 … 2.9 mils: ≤ 0.06 mils 2.9 … 39.4 mils: ≤ 2 % of nominal value 39.4 … 98.4 mils: ≤ 3 % of nominal value	0 … 50 µm: ≤ 1 µm 50 … 1000 µm: ≤ 2 % of nominal value 1000 … 2000 µm: ≤ 3 % of nominal value 0 … 2 mils: ≤ 0.04 mils 2 … 39.4 mils: ≤ 2 % of nominal value 39.4 … 78.7 mils: ≤ 3 % of nominal value

Repeatability Precision*

	Steel, iron, cast iron base materials (FE)	**Non-ferrous metal base materials (NF)**
Based on Fischer factory calibration standards, 5 single readings per standard and 20 °C (68 °F) for specimen and ambient temperature	0 … 50 µm: ≤ 0,25 µm 50 … 2500 µm: ≤ 0,5 % of reading 0 … 2 mils: ≤ 0.01 mils 2 … 98.4 mils: ≤ 0.5 % of reading	0 … 100 µm: ≤ 0,5 µm 100 … 2000 µm: ≤ 0,5 % of reading 0 … 3.9 mils: ≤ 0.02 mils 3.9 … 78.7 mils: ≤ 0.5 % of reading

Influence*

	Steel, iron, cast iron base materials (FE)	**Non-ferrous metal base materials (NF)**

The following values are valid for a coating thickness with a nominal value of 75 µm / 2.95 mils.
The quantity of influences are stated with the expanded measurement uncertainty U with the expanded factor of k = 2 (defines an interval with the confidence level of 95.45 %) - according to ISO/IEC Guide 98-3:2008-09 "Guide to the expression of uncertainty in measurement".

Curvature (R), measurement error from nominal value with reference to master calibration on flat surface

Measuring spot

No measurement error within the trueness as of R = 75 mm ± 5 mm (2.95 " ± 0.2 ") Measurement error 10 % for R = 15 mm ± 1 mm (0.59 " ± 0.04 ") A minimum of R = 2 mm (0.08 ") is required	No measurement error within the trueness as of R = 550 mm ± 60 mm (21.65 " ± 2.36 ") Measurement error 10 % for R = 109 mm ± 8 mm (4.29 " ± 0.32 ") A minimum of R = 2 mm (0.08 ") is required

Edge distance (R), specification from probe tip center, measurement error from nominal value

Measuring spot in the center of the circular surface

A minimum of R = 12 mm (0.47 ") is required No measurement error within the trueness	A minimum of R = 12 mm (0.47 ") is required No measurement error within the trueness

Edge distance (X), specification from probe tip center, measurement error from nominal value

Measuring spot = Probe pole center

A minimum of X = 12 mm (0.47 ") is required No measurement error within the trueness	A minimum of X = 12 mm (0.47 ") is required No measurement error within the trueness

Base material thickness (D), measurement error from nominal value

Measuring spot

Steel, iron, cast iron base materials (FE)	**Copper base material (Cu)**
No measurement error within the trueness as of D = 0.86 mm ± 0.09 mm (33.85 mils ± 3.54 mils) Measurement error 10 % for D = 0.44 mm ± 0.02 mm (17.32 mils ± 0.79 mils)	No measurement error within the trueness as of D = 0.09 mm ± 0.009 mm (3.54 mils ± 0.35 mils) Measurement error 10 % for D = 0.035 mm ± 0.002 mm (1.38 mils ± 0.079 mils)

Influence*

	Steel, iron, cast iron base materials (FE)	Non-ferrous metal base materials (NF)

The following values are valid for a coating thickness with a nominal value of 75 µm / 2.95 mils.
The quantity of influences are stated with the expanded measurement uncertainty U with the expanded factor of k = 2 (defines an interval with the confidence level of 95.45 %) - according to ISO/IEC Guide 98-3:2008-09 "Guide to the expression of uncertainty in measurement".

	Steel, iron, cast iron base materials (FE)	Non-ferrous metal base materials (NF)
Base material	Influence on base material (FE) permeability in regard to Fischer calibration standards (master calibration): 137 FN ± 0.2 FN Measurement error of 10 % for ferrite content of 122 FN ± 1.1 FN	Influence of the el. conductivity of the base material (NF) in the range from 30 to 100 % IACS: Measurement error ≤ 2 %, valid for the total measurement range
Temperature	no influence	In a range of ± 20 °C: ± 3 µm In a range of ± 68 °F: ± 0.12 mils

Scope of Supply

Gage; 2 batteries; USB cable type C to type A (1 m (39.4 inches)); guideline; calibration set suitable to gage type

- Calibration set for gage type FE
  (Test plate NF/FE (603-477) and 3 calibration foils (ca. 25 µm/0.98 mils (505-953), 75 µm/2.95 mils (505-955) and 540 µm/21.26 mils (505-965))
- Calibration set for gage type FE+NF
  (Test plates NF/FE (603-477) and ISO/NF (603-478) as well as 3 calibration foils (ca. 25 µm/0.98 mils (505-953), 75 µm/2.95 mils (505-955) and 540 µm/21.26 mils (505-965))

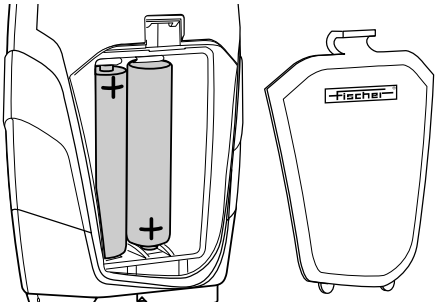
Order Information

Gage MMS Inspection DFT

Variant	Order No.	Type	Batch Template Package	Interface	Memory capacity	Vibration
Start	606-026	FE	no	USB	max. 10,000 measured readings in 1 batch	
	606-029	FE+NF				
High	606-028	FE	Industrial + Corrosion	USB + WiFi	250,000 measured readings in 2500 batches	●
	606-031	FE+NF				

3 Setup

3.1 Installing batteries



Battery polarity

Observe the correct polarity when inserting the batteries!

Damage to the instrument

The use of defective batteries or the wrong type of battery causes damage to the gage. Leaking batteries destroy the gage's electronics.

- ▶ Use only undamaged batteries.
- ▶ Use only the following battery types: Alkaline, 1.5 V, AA - LR6 Lithium 1.5 V, AA - LR6 NiMH rechargeables, 1.2 V, AA - HR6

Rechargeable batteries cannot be charged in the gage

Individual rechargeable batteries in the gage cannot be charged via the USB port.

- ▶ Use a commercially available charger to charge individual rechargeable batteries.

3.2 Switching on the gage

- ▶ Press the ⏻ key for approx. 1 s.

  The main menu appears in the display or the measurement view for the batch that was open at shutdown.

3.3 Switching off the gage

- ▶ Press the ⏻ key for approx. 1 s.

What you can do next

- Setting the language: **Main Menu (∨) > Gage Settings > OK > Language >** *Select the desired language* **> OK > 2 x** ↶
- Create a new calibration, page 28
- Create a new batch, page 20

4 Getting started

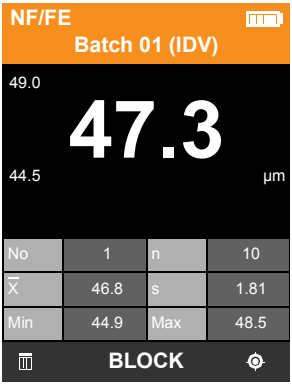
All the settings relevant to measuring the coating thickness of a coated sample [1] and the measurement readings themselves are saved in a file. Such a file is called a batch.

In the batch, you define the measurement procedure, e.g. whether the specification limits are to be monitored during the measurement or whether the measurement readings are to be grouped in measurement block. In addition, you must assign a calibration (reference) to the batch in order to measure.

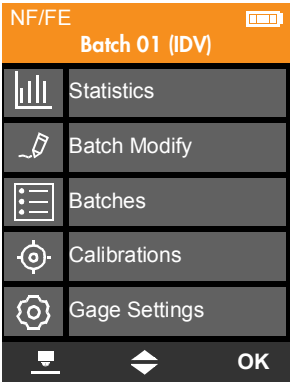
3 steps to the measurement

1. Switch on the gage, ⏻, and remove the protective cap from the probe
2. Open a batch or create a new one
   - Opening a batch, see page 21
   - Creating a new batch, see page 20
3. Take a measurement on the sample, see Page 23

ℹ If the specified precision is not achieved during the measurement, you must recalibrate the gage, see page 25.



After the gage is switched on, the measurement view (example) for the batch that was open at shutdown appears.



After the gage is switched on, the main menu appears (example: Batch 01 is open)

1. In this manual, both a coated part of any shape and size and a surface containing multiple measurement locations are referred to as the sample.

5 Settings for measurement

In order to measure, you need to create and open a Batch (measuring application file). In a batch, you define the Measuring application and settings for the measurement procedure, e.g. whether the specification limits are to be monitored during the measurement or whether the measurement readings are to be grouped in measurement block. The link to the Calibration to which the measurements are referenced is also saved in the batch file.

If any parameter changes, there is a new measuring application and you have to create a new batch.

Overview of the possible settings you have to make before a measurement

Settings . . . . . Page
Creating a new batch. 20
Opening a batch 21
Assigning a different calibration to the opened batch. 22

5.1 Creating a new batch

A Batch is created by selecting a Batch type. Each batch type is assigned a certain Calibration method and contains presets for the measurement process. Calibration and setup routines simplify creation of a batch.

Selection of the batch type and the associated calibration method is based on the requirements of the guideline/standard or the accuracy of measurement needed. An overview and description of the available batch types can be found on page 11.

Before you start

- The gage is switched on (⏻ key)The appropriate batch template package has been selected in the gage settings for the primary field of use of the gage. For a description, see page 11, in the Enhanced gage variants, only available with the corrosion batch template package upgrade. Select batch template package: **Main Menu (∨) > Gage Settings > OK > More Settings > OK > Usage**
- Reference part and/or calibration foils are prepared if you wish also to create a new calibration with the new batch. Which parts you need depends on the calibration method for the selected batch type, see pages 11, 25 and 26.

Creating a new batch

1. **Main Menu (∨) > Batches > New**
2. Select the desired batch type from the list
3. Tap on **OK,** to confirm your selection
4. Select an existing calibration from the list or **New**: ⬍
   Only existing calibrations whose calibration method matches the selected batch type are shown in the list.
5. Tap on **OK,** to confirm your selection
6. Follow the calibration routine
7. Continue with the setup routine and, depending on the selected batch type, specify the rest of the measurement procedure (e.g. setting of limits, block size). Confirm each setting with **OK**. After the setup routine has been completed, the gage switches automatically to the measurement view for the newly created batch.

   Batch type Individual (IDV): Specify the rest of the measurement procedure to suit your needs (e.g. setting of limits, block size). Confirm each

setting with **OK**. Switch to the measurement view for the newly created batch: **MEASURE > OK**.

This completes the creation process for a new batch.

What you can do next

- Measure, see Page 23
- Assign a different calibration to the batch, see page 22

5.2 Opening a batch

Before you start

- The gage is switched on (⏻ key)

Opening an existing batch

1. **Main Menu** (∨) **> Batches**
2. Select the desired batch from the list: ⬍
3. Tap on **OK,** to confirm your selection
4. **MEASURE > OK**

The measurement view for the selected batch opens

What you can do next

- Measure, see Page 23
- Repeat calibration, recalibration, see page 28
- Assign a different calibration to the batch, see page 22

5.3 Assigning a different calibration to the opened batch

Before you start

- The gage is switched on (⏻ key)
- The desired batch is opened, the corresponding batch name appears in the colored header field

Assigning a new calibration

1. **'Main Menu (∨) > Batch Modify > OK > More Settings > OK > Calibration Assign > OK**
2. Select an existing calibration from the list: ⬍

   Only the calibrations whose calibration method matches the open batch are displayed.
3. Tap on **OK,** to confirm your selection
4. **2 x ↶ >** ⏏, switches to the measurement view for the opened batch

You have now assigned a different calibration to the opened batch.

What you can do next

- Measure, see Page 23
- Repeat calibration, recalibration, see page 29

6 Measurement

During the measurement you can also:

- Delete single readings: Press the 🗑 key
- View the statistics of the open measurement block: Press the **BLOCK** key

6.1 Notes on coating thickness measurement

Essentially: If the specified precision is not achieved during the measurement, you must recalibrate the probe, see page 25.

Measured readings outside the specified tolerance limits are displayed in red and indicated by an illuminated red LED.

The gage vibrates during measurement acquisition if this is activated in the gage settings.

6.2 Before you start

- The gage is switched on (⏻ key)
- The desired batch is opened (📥 key in the main menu, see also page 21)

6.3 Measuring - Procedure

1 Place the gage

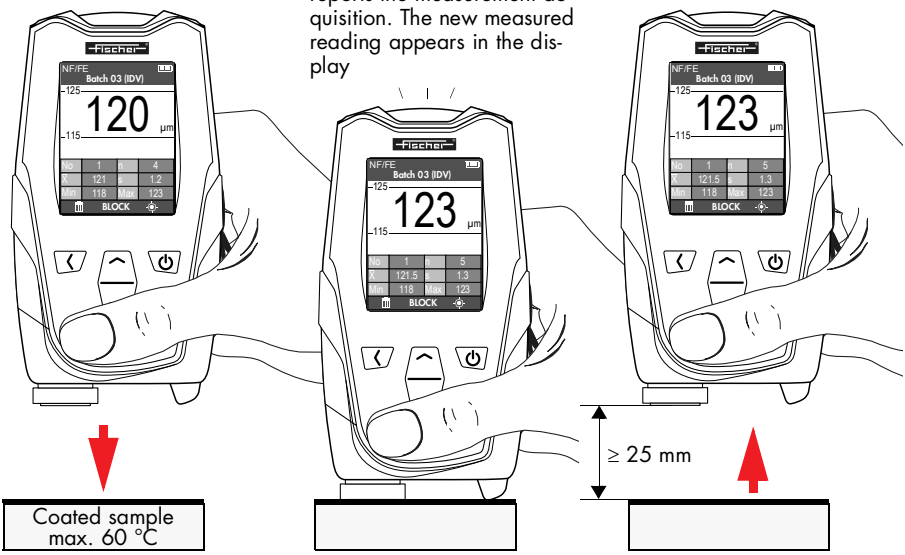
Place the gage on the coated sample.

2 Measurement acquisition

An audible signal as well as the lighting of the signal lamp reports the measurement acquisition. The new measured reading appears in the display

3 Lift the gage

Raise the gage at least 25 mm above the surface of the sample



The display screens are to be understood only as examples

7 Calibration

The coating thickness measurement is mainly influenced by the following variables:

- Physical characteristics of the base material of the sample, such as magnetizability (permeability) or electrical conductivity.
- The geometric shape of the sample, such as the thickness of the base material or curvature of the sample (e.g. cylindrical shape).
- The position of the measurement location on the sample: distance from the edge, hole, platform or step.
- Surface roughness

To ensure the coating thickness is measured correctly, the gage records the properties of the Sample. This is done by means of a calibration (device calibration based on a calibration method). The influencing variables are recorded using an uncoated reference part and one or two calibration foils in order to compensate the influences for future measurements.

Please observe the following information

i Make sure that the measuring point on the reference part has roughly the same position as on the sample to be actually measured (curvature, distance from the edge, hole, platform and step).

i Generally, the base material of your sample will have different material properties than those that were taken into account in the factory calibration. **For this reason, it is essential to perform the calibration with uncoated reference parts from your own production (respect batch)!** Note that a material from different batches can have different magnetic permeabilities!

i If measurements are to be performed on both base materials (magnetizable, non-magnetizable), the calibration must be performed using both base materials (FE and NF)!

i Perform the calibration carefully! This is the measure for the accuracy to which the following measurements can be performed. - Measurements can never be more accurate than the calibration!

7.1 Calibration - When necessary?

- When you have a new measuring application, the influencing factors must be recorded in order to compensate for them when measuring.

Recalibration - When necessary?

- When the correctness of the measurement is not assured

7.2 Selecting the appropriate calibration method

A measurement can only be performed if a calibration using the appropriate calibration method is assigned to the batch in the gage. A calibration method is assigned to each batch type. Selection of the batch type and the associated calibration method is based on the requirements of the guideline/standard or the accuracy of measurement needed.

You can find the associated calibration and calibration method in the batch information for the particular batch.

Open the batch information: **Main Menu** (∨) **> Batch Modify > Batch Infos**.

A calibration method guides you through the calibration procedure step by step. The following calibration methods are available in the gage:

Calibration methods

- **Flexibel** (Calibration steps Zero and up to two time Foil)
  The same routine as **Zero + 2 Foils**, but in this routine you can skip individual calibration steps
- **Zero** (zero point, calibration step Zero)
  This is the simplest type of calibration and is used to adjust the gage to a reference point, the base material, also called Zero (zero point). The measurement is taken on a reference part that has the same material and shape as the uncoated sample to be tested. It utilizes only the sample's base material (magnetizable or non-magnetizable, depending on the test method used), i.e. without the coating material to be measured.
- **Zero + 1 Foil** (calibration steps Zero and one time Foil)
  A calibration with a calibration foil yields the best measurement accuracy in a narrow coating thickness range around the stated film thickness. The

calibration method using 1 foil can be used only in the lower measurement range of the gage.

Foil thicknesses that can be used:

- Measurements on Fe[1] base material: max. 800 µm (31.5 mils)
- Measurements on NF[2] base material: max. 1150 µm (45.3 mils)

- **Zero + 2 Foil** (calibration steps Zero and two times Foil)

  On the one hand, a calibration with 2 calibration foils yields the best measurement accuracy in the coating thickness range delimited by the two calibration foils; on the other, however, 2 calibration foils are needed to calibrate the upper measurement range of the gage.

  To calibrate the upper measurement range of the gage, you need to use the following foil pairs:

  - Measurements on Fe[1] base material:
    Foil 1: ≤ 350 µm, foil 2: ≥ 700 µm
  - Measurements on NF[2] base material:
    Foil 1: ≤ 750 µm, foil 2: ≥ 1150 µm

- **1 Foil** (calibration steps (Zero and) one time Foil),
  in Enhanced gage variants, only available with corrosion batch template package upgrade
  The same routine as **Zero + 1 Foil**, but the zero measurement step will skipped when recalibrating. Useful for calibrations on rough surfaces, e.g. in the corrosion protection region.

- **2 Foil** (calibration steps (Zero and) two times Foil)
  in Enhanced gage variants, only available with corrosion batch template package upgrade
  The same routine as **Zero + 2 Foil**, but the zero measurement step can will skipped when recalibrating. Useful for calibrations on rough surfaces, e.g. in the corrosion protection region.

1. Fe = FE = Ferromagnetic material, e.g.: iron, steel alloys
2. NF = Nonferrous, electrically conducting material, e.g.: Al, Cu, Ms, …

7.3 Performing a calibration

Do not use the metal sheet (NF/FE or ISO/NF) supplied with the gage as a reference part! As a rule, the material properties will not correspond to the uncoated sample/reference part from your own production! The metal plates serve purely as a function check!

Calibration on NF base material (applies only to FE+NF gage types): The difference between the reference part temperature during the calibration and the sample temperature during the measurement should be minimal. Excessive temperature differences have an adverse effect on the measurement accuracy.

Be carefully with the calibration foils. Replace soiled, bent, scratched or cracked calibration foils or those with strong indentations. In particular foils with thicknesses of less than 50 µm are subject to rapid wear. Recommendation: Replace the calibration foils after no more than 100 to 200 measurements!

Before you start

- The gage is switched on
- The protective probe cap has been removed
- Reference part and/or calibration foils are ready. Which parts you need depends on the calibration method used.

Calibration - Procedures

- Create new calibration again, see Page 28
- Recalibration - Repeating an existing calibration, see page 29

7.3.1 Creating a new calibration – Procedure

1. Open the calibration function **New**: **Main Menu** (∨) **> Calibrations > New**
2. Select the appropriate calibration method for the desired batch: ⬍ > **OK** If necessary, close the prompt window that appears by pressing **OK**.
3. Follow the routine and perform the calibration steps displayed (Zero, Foil 1/2). In this regard, refer to the descriptions in the sections "Calibration step Zero", page 30 and "Calibration step Foil", page 32.

Acknowledging (OK) the last calibration step exits the calibration routine automatically and the calibration is completed.

If measurements are to be carried out on both base materials (magnetizable, non-magnetizable), repeat the calibration with the other base material! Proceed as described in Chapter "Recalibration – Procedure".

What you can do next

- Switch on the calibration function Quick, page 29
- Assign the calibration to the opened batch, page 22

7.3.2 Recalibration – Procedure

1. Open the calibration that is to be recalibrated: **Main Menu (∨) > Calibrations > *Name of calibration* > CALIBRATE or** ⌖ (in the measurement data display)
2. Follow the routine and perform the calibration steps displayed (Zero, Foil 1/2). In this regard, refer to the descriptions in the sections "Calibration step Zero", page 30 and "Calibration step Foil", page 32.

   Acknowledging (OK) the last calibration step exits the calibration routine automatically and the calibration is completed.

If the **Quick** function (quick recalibration) is enabled, the calibration routine switches automatically to the next calibration step after 3 measurements. A correction/change for the calibration foil used is not possible when this function is enabled.

If measurements are to be carried out on both base materials (magnetizable, non-magnetizable), repeat the calibration with the other base material!

7.3.3 Fast recalibration

A semi-automatic calibration routine for calibration is activated with the **Quick** function. If the **Quick** function is enabled, the calibration routine switches automatically to the next calibration step after every 3 measurements. Switching to the next step is announced by a long signal tone. A correction/change for the calibration foil used is not possible when this function is enabled.

Enabling the recalibration function Quick

▶ Enable the **Quick** function for the desired calibration: **Main Menu (∨) > Calibrations >** *Name of calibration* **> Quick > OK** (= Function is enabled)

Disabling the recalibration function Quick

▶ Disable the Quick function for the desired calibration: **Main Menu (∨) > Calibrations >** *Name of calibration* **> Quick > OK** (= Function is disabled)

7.3.4 Calibration step Zero

Measurement on the uncoated reference part

Required material

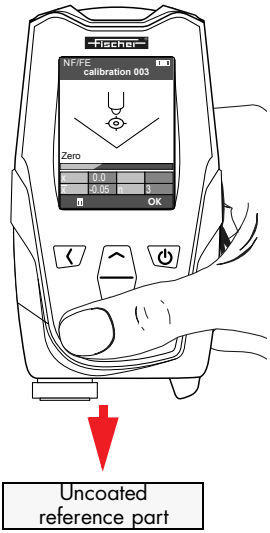
- Base material: Magnetizable material = Fe: Ferromagnetic reference part without the coating to be measured from customer's own production. Gage type FE and FE + NF, use of the magnetic induction test method, NF/FE display screen
- Base material NF: Non-magnetizable, electrically conducting material = NF = Non-magnetic, electrically conducting reference part without the coating to be measured from customer's own production. Gage type FE + NF, use of the amplitude-sensitive eddy current test method., NC/NF display screen

Procedure – Calibration step Zero

1. Perform 5 to 10 measurements on the uncoated reference part.

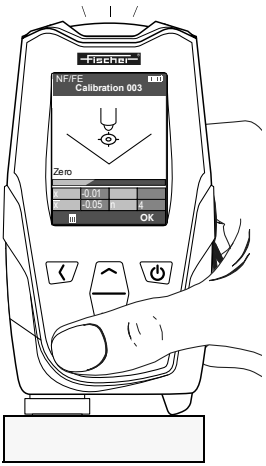
A Placing the gage

Place the gage on the uncoated reference part.



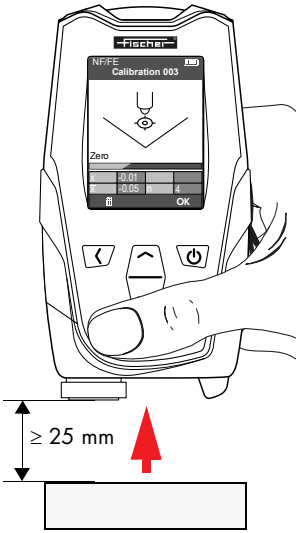
B Acquiring the measurement

An audible signal as well as the lighting of the signal lamp reports the measurement acquisition. The new measured reading appears in the display



C Lifting the gage

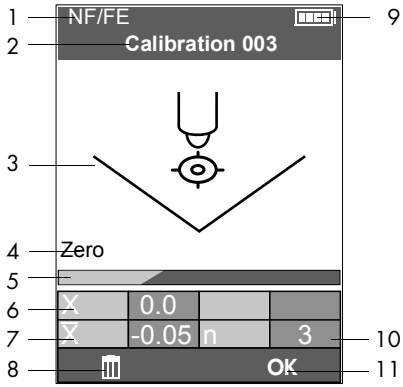
Raise the gage at least 25 mm above the surface



Repeat steps A to C for the next measurement on the uncoated reference part

The display screens are to be understood only as examples

Display description - calibration step Zero



1 Measuring application (example)
2 Name of calibration (example)
3 Schematic illustration of the current calibration step
4 Current calibration step
5 Progress display of the calibration steps (example of 3 calibration steps, calibration step 1 current)
6 Currently measured reading (example)
7 Mean value of the existing number of measured readings (example)
8 Delete last measured reading
9 Battery indicator
10 Number of measurements (example)
11 To next calibration step/exit calibration

7.3.5 Calibration step Foil

Measurement on the calibration foil lying directly on the uncoated reference part.

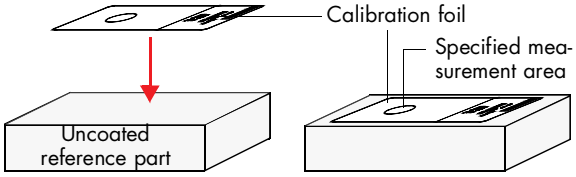
Required material

- Calibration foils with the desired thicknesses or from the scope of supply. The circle on the foil marks the specified measurement area.
- Reference part from customers own production, without the coating to be measured

Procedure – Foil calibration step (foil)

1. Placing the foil

Place the foil (1/2) on the uncoated reference part.



Only **one** foil at a time may lie on the uncoated reference part!

2. Perform 5 to 10 measurements on the calibration foil.

A Placing the gage

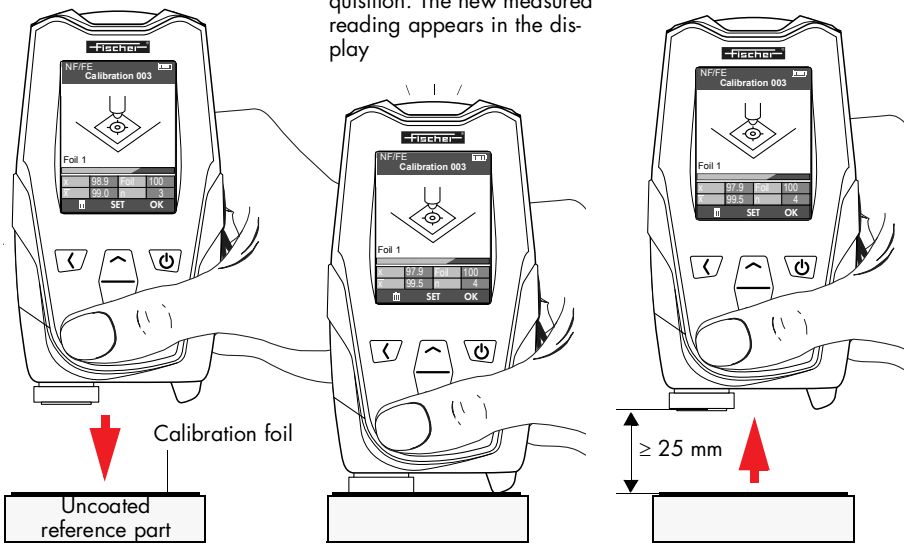
Place the probe of the gage inside the circle on the foil.

B Acquiring the measurement

An audible signal as well as the lighting of the signal lamp reports the measurement acquisition. The new measured reading appears in the display

C Lifting the gage

Raise the gage at least 25 mm above the surface



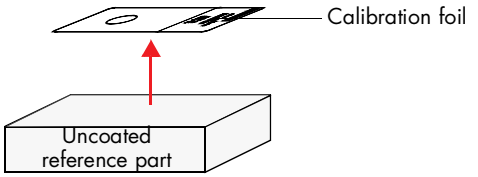
Repeat steps A to C for the next measurement on the calibration foil

The display screens are to be understood only as examples

3. Enter the nominal value of the foil: **SET >** *Use* ⬍ *to set the nominal value of the foil* **> OK**

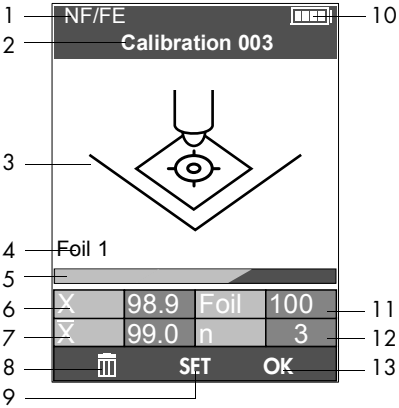
4. Remove the foil from the reference part

Place the foil (1/2) back in the protective sleeve.



When using a calibration method with 2 foils, repeat the entire foil calibration step (steps 1 to 4) with the second foil.

Display description - calibration step Foil



1 Measuring application (example)
2 Name of calibration (example)
3 Schematic illustration of the current calibration step
4 Current calibration step
5 Progress display of the calibration steps (example of 3 calibration steps, calibration step 2 current)
6 Currently measured reading (example)
7 Mean value of the existing number of measured readings (example)
8 Delete last measured reading
9 Open window to enter the nominal value of the foil
10 Battery indicator
11 Nominal value of the foil entered under SET (example)
12 Quantity of measurements (example)
13 To next calibration step/exit calibration

7.4 Calibration- Assigning/changing names

Assign a unique name to the calibration (calibration method, material designation, batch no., ...), example: Cal-1Foil EN AW 6082

Keep in mind that many calibrations with different calibration methods are stored in the gage. A unique name makes it easier to select and assign the desired calibration to a batch.

Procedure

1. Open the **Rename** function: **Main Menu (∨) > Calibrations >** *Name of calibration* **> Rename**
2. Change name:
   - Move cursor by means of the **BACK** and **OK** keys
   - Select the desired character by means of the ◆ keys
   - Delete character: Select space
3. Exit the *Rename* input window:
   a Move the cursor entirely to the right using the **OK** key.
   The character ↵ appears at the right edge of the display.
   b Press **OK** to exit the input window.

7.5 Calibration - Reset

The reset function ensures that all coating thickness correction values for the selected calibration are deleted. The **Reset** function deletes all parameters measured in the foil calibration step; the nominal values for the foil are retained, however. Measurements in the zero calibration step are retained.

Procedure

1. Open the **Reset** function: **Main Menu (∨) > Calibrations >** *Name of calibration* **> Reset > OK**
2. Prompt asking whether you really wish to perform reset, confirm with **YES**.

8 Data transfer

The following data can be transferred from the gage:

- Batch files into the App PHASCOPE PAINT, see page 36
  You can download the app for free from the Google Play Store or Apple App Store.
- Single readings in an Excel file via PC-Datex, see page 38
  You can download the program PC-Datex for free from the Fischer-Homepage.

8.1 Transfer batch files in the PHASCOPE PAINT app

Before you start

- The PHASCOPE PAINT app is installed in the used mobile device. You can use the app on any mobile device (smart phone, tablet) with a Android (as of 5.0) or IOS (as of 9.0) operating system. You can download the app for free from the Google Play Store or Apple App Store.

Procedure

1. Establish a WiFi connection between the Smartphone and the gage:
   a Gage: **Main menu (v) > Gage Settings > Connections > WiFi > Enable AP > OK**
   The WiFi interface of the gage is now activated. (•) shows the activated WiFi connection (WLAN connection) in the header line.
   b Smartphone:
   - Activate the WLAN/WiFi connection
   - Select the gage ID: MMsc_....

2. Import the batch files in the app:
   a Open the PHASCOPE PAINT app in the smart phone.
   b App: Open the data manager: ≡ **> Data Manager**
   c App: Tap on ⬇.

All batch files are be transferred from the gage to the PHASCOPE PAINT app. The data transfer is now finished.

What you can do next

- Use the PHASCOPE PAINT app to export the data as follows:
  - CSV file, for measurement blocks, e.g., for import to MS Excel. Date and time of measurement block creation and measurement capture, single readings, tolerance specification limits, if in the selected application set, are always exported.

  - pdf file, for reports

    Date and time of measurement block creation and measurement capture, tester name, single readings, tolerance specification limits, if in the selected application set, are always reported in the file. The photo will be displayed in the report, if a photo is assigned for the single reading or measurement block. Description, comment and histogram are only reported if set so under Menu overview ( ) > Settings > Export.
- Make further measurements with the gage, see page 23
- Delete readings of the open batch in the gage: **Main menu (v) > > > All Readings > OK**

8.2 Transfer single readings online to an Excel file via PC-Datex

The data is transferred directly from the gage to the computer via an USB cable connection.

i For further processing of the data transferred from the gage commercially as well as internally developed data processing programs can be used. Information on the data import and further processing can be found in the corresponding program manuals.

i You can download the program PC-Datex for free from the Fischer-Homepage.

Before you start

- Excel is installed on the computer with the program PC-Datex as an Add-In
- The gage is switched on and the desired batch is open in the gage, which measured values should be transferred to the computer while measuring.

Procedure

1. Activate the data export via USB interface in the gage:

   Main menu (v) > Gage Settings > Connections > USB Mode > PC-Datex > OK

   - Return to main menu: **2 x** ↶

2. Connect the gage with the computer via USB interfaces. Use the supplied USB cable or another commercially USB cable with Type C/A connectors Maximal usable USB cable length: 3 m (118 ").
3. PC: In the PC-Datex Add-In under „Interface“, select the used COM interface (e.g. COM20) to which the gage is connected
4. PC: Tap in an Excel field
5. PC: Tap on button **Online** in the PC-Datex Add-In to start the online data transfer
6. Gage: Measure, capture the measured values on the surface

   While measurement the single readings are transferred to the open Excel table sheet, one column per block.

Finish data transfer

► PC: In the PC-Datex Add-In tap on button **Cancel** of the PC-Datex window

What can you do next

- Open another batch, see page 21
- Make further measurements with the gage, see page 23
- Delete readings of the open batch in the gage: **Main menu (v) >** **>** **> All Readings > OK**

9 Glossary

Amplitude sensitive eddy current test method

Method for measuring the thickness of electrically nonconducting coating materials on nonmagnetic metals, DIN EN ISO 2360, ASTM D7091

Batch

A file for organizing and controlling the measurement data. All the settings relevant to measuring the coating thickness of a coated *sample* and the measurement readings themselves are saved in a file. Such a file is called a batch in the gage. In the batch, you define the measurement procedure, e.g. whether the specification limit is to be monitored during the measurement or whether the measurement readings are to be logged in measurement block groups. The batch file is assigned to a *Calibration method* and the link to the *Calibration* to which the measurements are referenced is saved. Different preconfigured batch files identified as *Batch types* are available in the gage.

Batch type

Each batch type is assigned a certain *Calibration method* and contains some presets for the measurement procedure. The configuration of a batch type depends on the requirements of the guideline/standard and required measurement accuracy, which is determined by the calibration method.

Calibration

A calibration is a reference measurement during which the material properties and geometric shape of the *Sample* are recorded and saved in a calibration file, separate from the *Batch*. In order to measure, it is absolutely essential that a calibration has been assigned to a batch.

Calibration foil

see under Calibration standards

Calibration method

The calibration method is a predefined calibration procedure. This procedure determines the measurement accuracy for subsequent measurements. A calibration method consists of one or a combination of both of the following calibration steps:

Calibration step Zero: Measurement on the uncoated reference part

- Gage types FE and FE + NF: (display screen NF/FE)

use of the magnetic induction test method

Material needed: Base material = FE = Ferromagnetic reference part from customer's own production, without the coating to be measured.

- Gage types FE + NF: (display screen NC/NF)
  use of the amplitude-sensitive eddy current test method

  Material needed: Base material = NF = Non-magnetic, electrically conducting reference part from customer's own production, without the coating to be measured

Calibration step Foil: Measurement on the calibration foil lying directly on the uncoated reference part.

- Material needed: Calibration foils with the desired thicknesses or from the scope of supply. The circle on the foil marks the specified measurement area.

Calibration standards

- Uncoated reference part which material has the same properties as the base material of the sample. Needed for adjustment to the base material (zero = zero point).
- Foil with a certain thickness that simulates a coating thickness during the calibration process. An adjustment to the corresponding coating thickness value is performed for each calibration foil thickness.
- Calibration standard, coated reference part which base material and coating material have the same properties as the coated sample and whose coating thickness has been determined using the most accurate measurement method possible.

Coefficient of variation V [%]

Percent variation of a *series of measurements*, i. e. standard deviation in terms of the mean value. V [%] is a characteristic process constant. A sudden change in V [%] indicates a change in process conditions.

Foil

see under Calibration standards

Magnetic inductive test method

Method for measuring the thickness of non-magnetic coating materials on magnetic metals, DIN EN ISO 2178, ASTM D7091

Measuring application

A measuring application is characterized not only by the material properties and the geometric shape of the *Sample,* but also by the measuring settings, e.g. limit monitoring and measurement reading grouping. If any one of these parameters changes, there is a new measuring application and you have to create a new *Batch* with appropriate *Calibration*.

Reference part

see under Calibration standards

Sample

- Coated part/surface having any shape and size the coating thickness of which needs to be measured.
- Large surface with several measurement locations

Zero

see under Calibration standards

9.1 Glossary - Display symbols

Batches menu, contains a list of already created batches and the **New** function for creating a new batch.

Batch Modify menu, contains a list of alterable batch settings

Statistics menu, contains statistics displays for the open batch.

- Comprehensive statistics covering all measured readings and measurement blocks
- Statistics for the individual measurement blocks
- Graphical representation of all measured readings in a progress diagram
- Lists of individual values in a block

Calibration

- **Calibrations** menu, contains a list of already created calibrations, the **New** function for creating a new calibration and special calibration functions for already created calibrations, e.g. **Rename** and **Quick** (activation of the semi-automatic calibration routine).
- Opens calibration (keypad function)

Gage Settings menu, contains a list of alterable gage settings

Identifies information and requests for action

Identifies warnings

Switches to the measurement view (keypad function).

Moves the cursor (keypad function)

- Moves the selection marking
- Increases/decreases the numerical value displayed

On/off switch, parameter is active

On/off switch, parameter is not active

Selector switch, option is selected

Selector switch, option is not selected

↶ Scrolls to the previous menu page (keypad function), altered settings are applied

••• Scrolls to the next menu page (keypad function)

🗑 Opens the Delete function (keypad function)

× Cancels the setting process, switches back to previous menu page (keypad function)

Battery status indicator (example: fully charged)

NF/FE Nonferrous coating material on ferrous base material

NC/NF Electrically nonconducting and nonferrous coating material on electrically conducting nonferrous metals

WiFi status indicator of signal strength (example: max. Signal strength)

9.2 Glossary - Display texts

9.2.1 Keypad functions

OK Confirms the selection/setting (keypad function)

BACK Moves the cursor to the left when entering the name

SET Opens the settings window (keypad function), e.g. for setting the nominal value of the calibration of foil used

SKIP Skips the next step in the routine (keypad function)

9.2.2 Display texts - Evaluation / Statistics

ArNo Area number

Foil Nominal value entered for the calibration foil

MDFT Maximal Dry Film Thickness = maximum coating thickness

NDFT Nominal Dry Film Thickness = nominal coating thickness

Max
- Largest single reading measured in a block
- Largest spot value measured in an Area or Location
- Largest mean value of all Area mean values

Min
- Smallest single reading measured in a block
- Smallest spot value measured in an Area or Location
- Smallest mean value of all Area mean values

RdNo Measurement reading number

No Block number

USL Upper specification limit

n Number of measured blocks

nAr Number of measured areas

nRd Number of all single readings measured

nSp Number of spots measured (SSPC PA2)

R The range R equals the difference between the largest measurement reading (maximum) and the smallest measurement reading (minimum) in a series of measurements

s Standard deviation from mean value

Spot Number of individual measurements per spot

LSL Lower specification limit

V[%] Coefficient of variation, percent variation of a series of measurements, standard deviation in terms of the mean value

X Individual measurement

$\overline{X}$ Block mean value of a measurement block with n individual measurements

$\overline{X}$ar Area mean value of n spot values (spots) in an area

$\overline{\overline{X}}$ Population mean of n block mean values

$\overline{\overline{X}}$ar Population mean of n area mean values

$\bar{\bar{x}}_{rd}$ Population mean of all single readings

%<ND
- *Batch type (*ISO): Percentage of measurement readings between 0.8*NDFT and NDFT
- *Batch type (IM*O): Percentage of measurement readings between 0.9*NDFT and NDFT

%≥ND *Batch type (IM*O): Percentage of measurement readings ≥ NDFT

<*Value* Calculated lower specification limit:
- *Batch type (*ISO): 0.8 x NDFT
- *Batch type (*PA2): corresponds to the selected restriction level
- *Batch type (IM*O): 0.9 x NDFT

>*Value* Upper specification limit:
- *Batch type (*ISO): Maximum admissible coating thickness entered
- *Batch type (*PA2): Calculated upper specification limit corresponding to the selected restriction level

10 About

In this menu you will find all device information, information about the device status, the software and legal information.

Navigation

- ⇕ : Select the desired parameter/batch
- × : Confirms selection
- → : Scrolls forward through the page
- ↶ : Exit page, scrolls back to the previous page

Call up menu

▶ **Main menu (V) > Gage Settings > OK > About > OK**

Call up FCC-ID

▶ **Hauptmenü (V) > Gage Settings > OK > About > OK > 4 x →**

What can you do next

- Switch to measurement view : 2 x ↶ > ⍗
- Perform further gage settings: 1 x ↶
- Return to main menu: 2 x ↶

11 Legal Informations

In this chapter you will find all statements on country-specific regulations and directives

11.1 USA, FCC (Federal Communications Commission)

FCC ID: 2ATFE-MMSINSPEC00

FCC Regulations

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This device has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this device does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Consult the dealer or an experienced radio/TV technician for help

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Information about Specific Absorption Rate (SAR)

This device is designed and manufactured not to exceed the emission limits for exposure to radio frequency (RF) energy set by the Federal Communications Commission of the United States.

During SAR testing, this device was set to transmit at its highest certified power level in all tested frequency bands, and placed in positions that simulate RF exposure in usage near the body. Although the SAR is determined at the highest certified power level, the actual SAR level of the device while operating can be well below the maximum value. This is because the Device is designed to operate at multiple power levels so as to use only the power required to reach the network.

The exposure standard for wireless devices employing a unit of measurement is known as the Specific Absorption Rate, or SAR. The SAR limit set by the FCC is 1.6 W/kg.

The FCC has granted an Equipment Authorization for this model Device with all reported SAR levels evaluated as in compliance with the FCC RF exposure guidelines. SAR information on this model Device is on file with the FCC and can be found under the Display Grant section of www.fcc.gov/oet/ea/fccid after searching on FCC ID: 2ATFE- MMSINSPEC00.

For this device, the highest reported SAR value for near the body is 0.001134 W/kg. While there may be differences between the SAR levels of various devices and at various positions, they all meet the government requirements.

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