PERMASCOPE® MP0R
ISOSCOPE® MP0R
DUALSCOPE® MP0R

PERMASCOPE® MP0R-FP
DUALSCOPE® MP0R-FP
DUALSCOPE® MP0RH-FP

MP0R Instrument Series

Coating thickness measurement instruments.

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1 Instrument Description

The MP0R series measure coating thickness easily, quickly and non-destructively. Depending on the measurement task and user preference, two model groups are available.

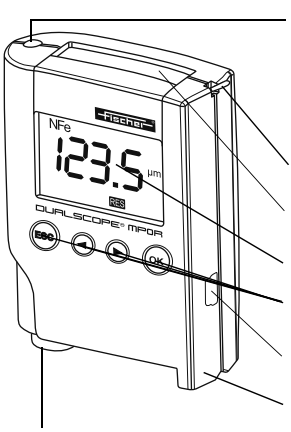
- MP0R models with the probe integrated in the unit for one-hand measurements. Preferably suited for measurements on flat and cylindrical specimens.
- MP0R-FP models with a connected cable probe are ideal for measurements on various specimen shapes.

1.1 Areas of Application

- DUALSCOPE MP0R models
  measure coatings on all metallic materials (ferrous and nonferrous metals). The DUALSCOPE instruments automatically recognizes the substrate material under the coating and selects the appropriate test method.
- ISOSCOPE MP0R model
  measure all insulating coatings on non-ferrous metals (e. g., paint or anodic coatings on Aluminium).
- PERMASCOPE MP0R models
  measure all non-magnetic coatings on ferromagnetic materials (e. g., zinc, chrome, copper, tin or paint, lacquer, plastic, enamel on steel or iron.

1.2 Components

Front view (instrument model MP0R illustrated)



1 Signal LED for measurement accept; red: limit violation, green: ok

2 Wrist strap

3 Display on the top

4 Display on the front

5 Function keys

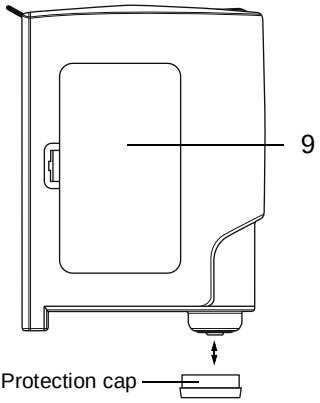
6 USB connector

7 Placement support

8 *MP0R*: Probe with orange protection cap

MP0R-FP/MP0RH-FP: Probe connected with cable

Rear view



9 Battery compartment cover

Please Note!

Remove the battery contact foil before first use.

1.3 Display symbols

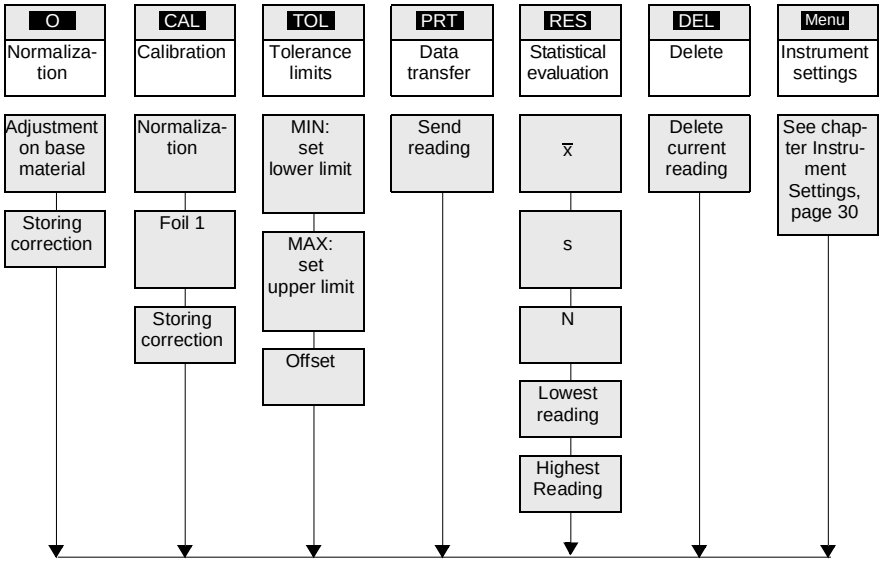
Symbols	Explanation
	Indicates the data transfer.
	Indicates low battery power.
	Indicates the active lock function for the calibration/normalization.
NFe	The measurement uses the eddy current test method, magnetic base material is necessary.
Fe	The measurement uses the magnetic induction test method, non-magnetic metal base material is necessary.
µm, mils	Unit of measurement for the displayed reading.
▲, ▼	Indicates the violation of the set specification limits.

1.4 Instrument keys

Keys	Function
[ESC]	• Switching to the scroll mode to scroll through the single readings in the measurement data memory. • Cancel/exit the menu function, except calibration functions.
[◂], [▸]	• Selects menus and parameters settings. • Sets values for the tolerance limits. • Scroll mode active: calls the single readings from the measurement data memory.
[OK]	• Confirms selection or settings. • Selects the individual statistic values. • Press twice to leave the calibration functions.

1.5 Main menus - Functional overview

Select the specific menus with **[◂]** or **[▸]** and press key **[OK]**.



2 Switching the Instrument ON / OFF

2.1 Switching the instrument ON

• Switch the instrument ON by pressing the key **[OK]**. The set measuring mode will display temporary.

Please Note!

For instrument types MP0R only: Remove the orange protective cap before measurement.

2.2 Switching the instrument OFF

Measurement data are stored in the instrument memory at all times even without battery. The measurement data must be deleted from the memory 18.

Please Note!

We recommend removing the batteries if the instrument is not used for an extended period of time to avoid serious damages from battery leakage.

Auto-Switch-Off

If no action occurs (pressing a key or measurement capturing) the instrument will switch off automatically after a certain time.
Instrument OFF = display is empty.

Change the auto-switch off time setting 37.

Manually Switch-Off

Before you start

▶ The instrument must be in the measuring mode: the display shows the last measurement.

Procedure

• Press the **[OK]** button for about 2 seconds. The instrument switched off and the display is blank and dark.

Switching off the instrument manually, always activates the Auto-Switch-Off function. Switch-on only the instrument only by pressing the **[OK]** button the Auto-Switch-Off function is activated again as set in the service menu 4 (OFF1 or OFF2, 🗐 37).

Deactivate Auto-Switch-Off

The instrument does not switch off automatically after a certain time. It will be switched on as long as the instrument is switched-off manually.

🗐 *5, switching off the instrument manually and activate the Auto-Switch-OFF function.*

Before you start

▶ The instrument is switched off.

Procedure

1. Press the button **[OK]** while pressing the button **[ESC]**. The instrument switched on.
2. Release the button **[ESC]** not until the last measurement value appears in the displays.

The instrument is ready for measurements.

3 Measurement

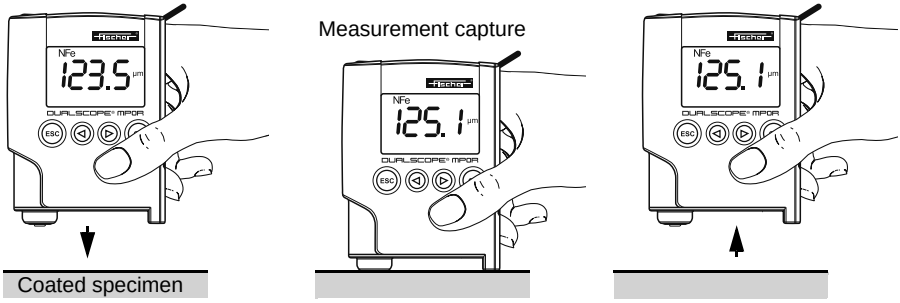
Before you start

- Switch the instrument ON by pressing the key **[OK]** .
- For instrument models MP0R only: Remove the orange protective cap from the probe.

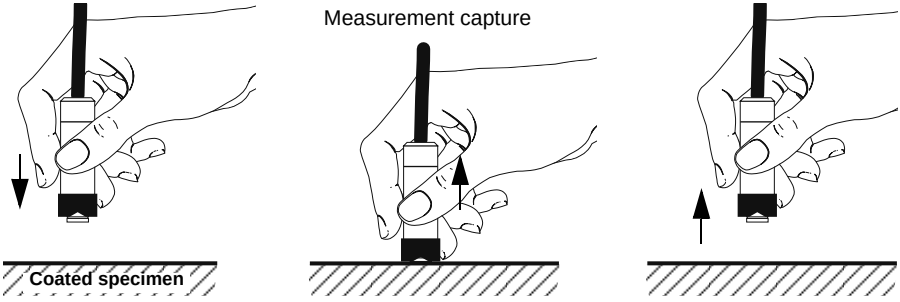
Procedure

1. Place the instrument/probe on the specimen and wait until the acoustic signal sounds and the signal LED illuminates. The measurement will be displayed.
2. Lift the instrument/probe off the specimen before making the next measurement. Minimum distance 25 mm.

Measuring with instrument models MP0R



Handling the probe of the instrument models MP0R-FP



Please Note!

There are no verified instruments available for measuring the coating thickness, as is the case, for example, for weight measurements with balances. Rather, the measurement results for the coating thickness are influenced by the materials and the shape of the specimen. However, these individual influences can taken into account using appropriate calibrations. 🗐 10, "Influencing Variables Taken into Consideration".

🗐 *30, Selecting the measuring mode*
🗐 *20, Setting specification limits and an offset value*

3.1 Measurement accept

The measurement accept are signaled optical and acoustic. All signals are listed in the following tables. The set measuring mode will display temporary after switching on the instrument.

SHd - Measuring mode active

Signal LED / Display	Acoustic Signals	Meaning
green / reading	1 short signal	• Measurement accept. • Limit monitoring enabled: Reading is between the specification limit values.
red / ▲	2 short signals	Reading has violated the upper specification limit.
red / ▼	2 short signals	Reading has violated the lower specification limit.

90.10 - Measuring mode active

Signal LED / Display	Acoustic Signals	Meaning
green / reading	1 short signal	• Measurement accept. • Limit monitoring enabled: Reading is above the set specification limit value.
red / ▼	2 short signals	Reading has violated the specification limit. The captured reading is < 90 % of the set specification limit value.

SSPC - Measuring mode active

Signal LED / Display	Acoustic Signals	Meaning
green / reading	1 short signal	• Measurement accept. • Limit monitoring enabled: Reading is between the specification limit values.
red / ▲	2 short signals	Reading has violated the upper set specification limit. The captured reading is > 120 % of the set upper specification limit value.
red / ▼	2 short signals	Reading has violated the lower set specification limit. The captured reading is < 80 % of the lower set specification limit value.

3.2 Scroll through the single readings

Display single readings in the instrument data memory.

Before you start

▶ Instrument is switched on.

Procedure

1. Press the **[ESC]** button for about 2 second for calling the scroll mode. The number of all single readings stored in the memory will display temporary.
2. Use the arrow keys **[◀]** and **[▶]** to scroll through the readings.

   An arrow in the displays show the direction to find the next single reading.

   Display ▲: Use the key **[▶]** to scroll backward. Scrolls to the newest readings.

   Display ▼: Use the key **[◀]** to scroll forward. Scrolls to the oldest readings.

   Display - - - - : end of the list.

Leave the scroll mode

▶ Press the button **[ESC]** or **[OK]** or do further measurements.

4 Influencing Variables Taken into Consideration

Main variables influencing the coating thickness measurement:

- Physical properties of the specimen substrate material such as the electrical conductivity or the permeability.
- The geometric design of the specimen such as the thickness of the substrate material or a cylindrical shape.
- The position of the measurement spot on the specimen: distance to the edge, hole, offset or step.
- Surface roughness.

For correct measurements of the coating thickness, the instrument and the probe, together referred to as the measurement system, must “become familiar” with the specimen (part). This is done using a calibration. The influencing parameters are captured using a reference part and can then be compensated in future measurements. The calibration is preformed for the respective open Application.

4.1 Kinds of calibration

In calibration, we distinguish between normalization and corrective calibration.

Normalization

The Normalization is the simplest kind of calibration and is used for adapting the measurement system to a reference point. These are the base materials (magnetizable or non-magnetizable and electrically conducting depending on the used test method). Measurements are made on a reference part that corresponds in material and shape to the actual part to be measured. It consists only of the base material, i.e., without the coating material to be measured.

Corrective Calibration

If the trueness is not met when making measurements on customer reference parts (customer standards), a Corrective Calibration should be performed. The Corrective Calibration adjust the measurement system to the properties of the specimen. The Corrective Calibration not only adjusts the system to the substrate material but also to 1 coating thickness value by using so-called calibration foil or standard.

4.2 Calibration - General Notes to Observe

- Care should be taken during the calibration to ensure that the measurement location on the reference part is approximately at the same position where it will be on the part to be measured (curvature, distance to edge, hole, offset and step).
- In general, the material properties (permeability) of the specimen will differ significantly from those taken into account in the factory pre-calibration. It is, therefore, essential to perform the normalization or corrective calibration, respectively, using uncoated reference parts (specimens) from your own production!

Please Note!

Perform the calibration carefully! It determines the accuracy for the subsequent measurements. - Measurements can never be more accurate than the calibration!

4.3 Normalization

When necessary

When the readings during a test measurement on a reference part are no longer acceptable. Test measurements should be carried out for a measuring application when it has not been used for a while.

Required Materials

Base = part made from substrate material. In geometry and substrate material, this specimen should correspond exactly to the parts to be measured. If

- Fe displayed: Utilizes the magnetic induction measuring method.
  Base = ferromagnetic reference part without the coating to be measured from customer's own production.
- NFe displayed: Utilizes the eddy current measuring method.
  Base = non-magnetic reference part without the coating to be measured from customer's own production.

Please Note!

Do not use the supplied metal sheet (NF/FE or ISO/NF) for base!!!

As a rule, the material properties will not correspond to the uncoated specimen from customer‘s own production! Use it only for instrument check!

Before you start

- Instrument must be turned ON by pressing the key **[OK]**.
- For MP0R instrument models: Remove the orange protective cap from the probe.

Please Note!

All readings in the memory will be deleted when performing a normalization.

Please Note!

The menu „Normalization“ can be locked to protect the instrument from unintended interventions. Procedure 31 and 33.

Normalization procedure

1. Open the normalization menu: Set the display menu with [◀] or [▶] to show O.
2. Press button **[OK]**. The message "Base" (for substrate material) appears.
3. Perform 5 to 10 measurements on the uncoated reference part (= Base, specimen without the coating). After each measurement, the current reading will appear on the display.
4. Press button **[OK]**. The reading 0.00 appears on the display. The reference point received from the normalization will be stored in the instrument as zero point.

The instrument is ready to make measurements.

Please Note!

If you want to delete wrong readings, press button **[ESC]***. Then, the complete data memory will be deleted, but the normalization routine will not be interrupted. After that, perform five more measurements and go on with step 4.*

Please Note!

Only for DUALSCOPE® instrument types: If you want to measure on both substrate materials a normalization procedure must be carried out for each substrate material (Fe and NFe).

4.4 Corrective Calibration

When necessary

- If the trueness is not met when making measurements on customer reference parts (customer standards), a Corrective Calibration should be performed.
- When normalization is not sufficient to compensate for the influence.

Required Materials

Base = part made from substrate material. In geometry and substrate material, this specimen should correspond exactly to the parts to be measured. If

- For instrument types PERMASCOPE® and DUALSCOPE®,
  Fe displayed: Utilizes the magnetic induction measuring method.
  Base = ferromagnetic reference part without the coating to be measured from customer's own production.
- For instrument types ISOSCOPE® and DUALSCOPE®,
  NFe displayed: Utilizes the eddy current measuring method.
  Base = non-magnetic reference part without the coating to be measured from customer's own production.

Please Note!

Do not use the supplied metal sheet (NF/FE or ISO/NF) for base!!!

As a rule, the material properties will not correspond to the uncoated specimen from customer‘s own production! Use it only for instrument check!

Standard = Calibration foil supplied with the instrument for the entire range. On the foil, the measurement area is marked with a circle.

Before you start

- Instrument must be turned ON by pressing the key **[OK]**.
- For MP0R instrument models only: Remove the orange protective cap from the probe.

Please Note!

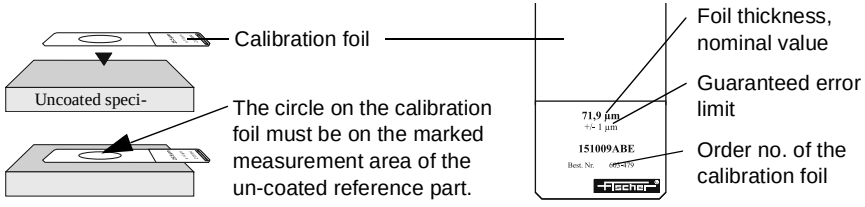
All readings in the memory will be deleted when performing a corrective calibration.

Please Note!

The menu „Calibration“ can be locked to protect the instrument from unintended interventions. Procedure 31 and 33.

Corrective Calibration procedure

1. Open the calibration menu: Set the display menu with **[◂]** or **[▸]** to show CAL.
2. Press button **[OK]**. The message "Base" (for “substrate (base) material”) appears.
3. Perform 5 to 10 measurements on the uncoated reference part (= Base, specimen without the coating). After each measurement, the current reading will appear on the displays.
4. Press button **[OK]**. The value "0.00" and "STD1" (for calibration foil) appears. The reference point received from the normalization (step #3) will now be stored in the instrument as zero point.
5. Place the calibration foil on the uncoated specimen.



6. Perform 5 to 10 measurements on the calibration foil. For this purpose, place the probe inside the circle onto the foil. After each measurement, the current single reading will appear on the display.
7. Use the arrow key **[◄]** or **[►]** to set the nominal value for the calibration foil, e.g., "71.9 µm". The nominal value is printed on the calibration foil.
8. Press button **[OK]**. The reference point and correction factor received from the calibration will be stored in the instrument.

The instrument is ready to make measurements.

Please Note!

If you want to delete wrong readings, press button **[ESC]***. Then, the complete data memory will be deleted, but the corrective calibration routine will not be interrupted. After that, perform five more measurements and go on with the next step.*

Please Note!

Only for DUALSCOPE® instrument types: If you want to measure on both substrate materials a Corrective Calibration procedure must be carried out for each substrate material (Fe and NFe).

4.5 Deleting the Corrective Calibration and Normalization / Restoring the baseline of the characteristic

Sometimes, if the instrument does not measure correctly even after the calibration, the calibration can be deleted. This can occur if the previous calibration has not been carried out correctly. In such a case, the default calibration can be restored.

Procedure

Perform a Corrective Calibration modificate as follows:
Differing from the description of the corrective calibration procedure beginning on page 15 use in this special case the supplied metal boards (NF/FE or ISO/NF) for base. Instead measuring on calibration foil measure on the supplied metal board again. Set the nominal value to 00.0.

Please Note!

For DUALSCOPE® instrument types: The base line of each of the two measurement channels (Fe and NFe) must be restored separately.

Now the instrument is set to the default calibration.

Please Note!

Perform a new Normalization or Corrective Calibration according the instruction, beginning on page 10.

5 Deleting Measurements

5.1 Deleting only the last reading

1. Set the display menu with **[◀]** or **[▶]** to show DEL .
2. Press button **[OK]**. The last reading will be deleted.

5.2 Deleting all measurement data

1. Set the display menu with **[◀]** or **[▶]** to show RES.
2. Press button **[OK]**.
3. Set the display menu with **[▶]** to show DEL.
4. Press button **[OK]**. All measurement data will be deleted from the measurement data memory.

6 Evaluation

The evaluation is performed over all single readings stored in the measurement data memory.

Before you start

- At least two readings must have be saved in the measurement data memory for evaluation.
- Check measurement memory. It should be empty to avoid evaluation with wrong measurements. Perform steps #1 and #2 of the procedure described below. No statistic evaluation are displayed if the memory is empty.

Procedure

1. The display menu shows RES (default instrument setting). Otherwise use the arrow key **[◀]** or **[▶]** to select this setting.
2. Press button **[OK]** repeatedly. After each **[OK]**, the display will change to the next statistic number (see following table).
3. Leave evaluation menu: Press button **[ESC]** or do further measurements.

Display	Explanation
$\bar{x}$	Mean value (= the sum of all single readings of a test series, divided by the number of measurements.)
s	Standard deviation (= a measure of the deviations of single readings of a test series from their common mean value.)
N	Number of measurements in the test series
MIN	Lowest value in the test series
MAX	Highest value in the test series

Table: Meaning of statistical evaluation data shown in the display.

Scrolling through the single readings in the data memory see page 9.

7 Specification Limits / Offset value

Having the specification limits enabled allows for a simple and quick determination, whether the measurements are within specification limits. The violation of the set limit values will signaled as follow:

Signal LED	Signal / Display	Meaning
red	2 short signals / ▲	Reading has violated the upper specification limit.
red	2 short signals / ▼	Reading has violated the lower specification limit.
green	1 short signal / reading	Reading is between the specification limit values

7.1 Setting the specification limits/offset value

Depending on the active measuring mode, the following settings can be made:

Mode	Settings	Limit violation signalisation if ...
SEd	MIN: lower limit value MAX: upper limit value OFFS: offset value subtracted from reading	... captured reading is < set MIN value or > set MAX value
90.10	MIN: lower limit value Default setting: 320 µm	... captured reading is < 90 % of the set MIN value
SSPC	MIN: lower limit value MAX: upper limit value	... captured reading is < 80 % of the set MIN value or > 120 % of the set MAX value

Before you start

- Instrument must be turned ON by pressing the key **[OK]**.
- For instrument models MP0R only: Remove the orange protective cap from the probe.

Procedure

1. Set the display menu with **[◂]** or **[▸]** to show TOL.
2. Press button **[OK]**. The message "MIN" appears on the display. The instrument await the entry for the lower specification limit.
3. Make one measurement on the specimen to be tested to get a approximate value for the lower specification limit.
4. Set the desired MIN value using the key **[◂]** or **[▸]**.

   90.10 measuring mode active: continue with step 10. In this mode a lower limit specification value can be set up only.
5. Press button **[OK]** to accept this value into the memory. The message "MAX" appears on the display. The instrument await the entry for the upper specification limit.
6. Make one measurement on the specimen to be tested to get a approximate value for the upper specification limit.
7. Set the desired MAX value using the key **[◂]** or **[▸]**.

   SSPC measuring mode active: continue with step 10. In this mode a lower and upper limit specification value can be set up only.
8. Press button **[OK]** to accept this value into the memory. The message "OFFS" appears on the display. The instrument await the entry for an offset-value.

   An offset-value will be subtracted automatically from the readings. Application example: Having a given, constant thickness of an intermediate layer, you can set this thickness as “offset”. The thickness of both coatings are measured. In this case, only the thickness of the top coating will be displayed because of the subtracted offset value from the captured measurement.
9. Set the desired OFFS value using the key **[◂]** or **[▸]**. Value 0.00 means no Offset value set.

10. Press button **[OK]** to accept this value into the memory. The menu TOL will be left.

Now the specification limits are set. The instrument is ready to make measurements. The new captured measurements will be monitored if they are between or outside the specification limits. Additional the offset value will subtracted from the captured reading if an offset value is set.

7.2 Deleting the specification limits / Offset value

Before you start

▶ Instrument must be turned ON by pressing the key **[OK]**.

Procedure

- Procedure as described on page 21.
- Instead of getting the approximate values set the desired value (MIN, MAX, OFFS) or all values to 00.0.

Now the specification limits no longer apply. The MIN and MAX values are deleted from the memory. The instrument is ready to make measurements.

8 Data Transmission

The current reading and the values stored in the measurement data memory of the instrument can be transmitted to a PC. The USB driver and the USB interface cable are included in delivery.

Data are transmitted directly via an USB-cable connection from the instrument to the computer.

Transmission via USB-cable connection

Both commercial or one's own data processing programs can be used to process the data exported by the instrument. Information regarding import and processing of the data using such programs may be obtained from the respective manuals for these programs.

8.1 Prerequisite for data transmission

1. Installing the USB driver (from shipment) on the computer. Therefore use the Support CD from the shipment. Select "MP0R" from the CD menu. Click on the button **Install** in the open window. The USB driver will install automatically. When finish close the installation window and the CD menu.
2. Connect the instrument to the computer via USB interface cable (from shipment).

8.2 Transmitting measurements

Transmitting only the current reading while measurment

Please Note!

No transmission of current reading in the measuring mode SSPC.

Before you start

- USB driver is installed on the computer where the instrument will connected.
- The instrument is connected at the computer via the USB cable.
- The instrument is turned ON (**[OK]** key).
- Mode Std: Settings of service menu 4 must be SI = 1 (single reading transmission is active, only single readings will then be transmitted). Procedure 🗐 31 and 37.

  Mode 90.10: default setting, always single readings are transmitted.
- For instrument models MP0R only: Remove the orange protective cap from the probe.
- The program on the computer to which the data will transmitted is open. Attend the manual of the program for data import.

Procedure

Each reading is transmit to the computer automatically with every measurement capture. At the same time, the reading is accepted into the measurement data memory of the instrument and can be evaluated statistically.

Transmitting all measurement data to the PC after measurement

Please Note!

No transmission of single readings in the measuring mode SSPC.

Before you start

- USB driver is installed on the computer where the instrument will connected.
- The instrument is connected at the computer via the USB cable.
- The instrument is turned ON (**[OK]** key).
- The program on the computer to which the data will transmitted is open. Attend the manual of the program for data import.

Procedure

1. Set the display menu with **[◀]** or **[▶]** to show PRT.
2. Press button **[OK]**.
   All readings in the memory are then transmit to the PC.

8.3 Transmitting the mean value to the PC

Transmitting the mean value manually to the PC after measurement

Please Note!

Only available for measuring mode Std.

Before you start

- USB driver is installed on the computer where the instrument will connected.

- The instrument is connected at the computer via the USB cable.
- The instrument is turned ON (**[OK]** key).
- For instrument models MP0R only: Remove the orange protective cap from the probe.
- Settings of service menu 1 must be bL = 0. Procedure 31 and 33.
- Settings of service menu 4 must be SI = 0 (mean value transmission is active). Procedure 31 and 37.
- The program on the computer to which the data will transmitted is open. Attend the manual of the program for data import.

Procedure

1. Make the desired number of measurements.
2. Set the display menu with [◀] or [▶] to show RES.
3. Press button **[OK]**. The displayed mean value of the readings is transmit to the computer.
4. Delete all measurements. This step is necessary to ensure that only the desired number of new measurements are used for the next mean value computation. Delete procedure:
    1. Set the display menu with **[◀]** or **[▶]** to show RES.
    2. Press button **[OK]**.
    3. Set the display menu with **[▶]** to show DEL.
    4. Press button **[OK]**. All measurement data will be deleted from the measurement data memory.

Transmitting the mean values automatically to the PC while measurement

In this case, all data of the measurement memory are deleted automatically after the displayed mean value is transmit to the computer.

Please Note!

No automatically transmission of mean values in the measuring mode 90.10.

Before you start

- USB driver is installed on the computer where the instrument will connected.
- The instrument is connected at the computer via the USB cable.
- The instrument is turned ON (**[OK]** key).
- For instrument models MP0R only: Remove the orange protective cap from the probe.
- Settings of service menu 1 must be bL = between 2 (mode SSPC: 3) and 20 (number of readings, which are collected in one block). Procedure 🗐 31 and 33.
- Mode Std: Settings of service menu 4 must be SI = 0 (mean value transmission is active, no single readings will then be transmitted). Procedure 🗐 31 and 37.

  Mode SSPC: default setting, always mean values are transmitted.
- The program on the computer to which the data will transmitted is open. Attend the manual of the program for data import.

Procedure

1. Make measurements.
2. After reaching the set number of measurements, the mean value is sent automatically to the computer and the measurement data memory of the instrument will be deleted. A new measurement series begin.

8.4 Triggering the group separator to the PC

The group separator separates the different measurement blocks at the data transmission. In an Excel spreadsheet the group separator has the effect of writing the succeeding single readings of the next measurement block in a new column next to the one that has just been processed.

Triggering the group separator manually to the PC

Please Note!

Not available in measuring mode SSPC.

Before you start

- USB driver is installed on the computer where the instrument will connected.
- The instrument is connected at the computer via the USB cable.
- The instrument is turned ON (**[OK]** key).
- For instrument models MP0R only: Remove the orange protective cap from the probe.
- Settings of service menu 1 must be bL = 0. Procedure 31 and 33.
- Settings of service menu 4 (Procedure 31 and 37) must be
  SI = 1 or 0 (mode Std only; 1 = only single readings, 0 = only mean values are transmitted),
  GS = 1 (group separator is active).
- The program on the computer to which the data will transmitted is open. Attend the manual of the program for data import.

Procedure

1. Make the desired number of measurements.
2. Set the display menu with [◀] or [▶] to show RES and press button [**OK]** to the statistics computation.

3. Set the display menu with [◀] or [▶] to show DEL and press button **[OK]** to delete the measurement memory. After this delete command, the instrument will sent a group separator to the PC automatically or at next measurement capture.

Triggering the group separator automatically to the PC

Please Note!

Not available in measuring mode 90.10.

Before you start

- USB driver is installed on the computer where the instrument will connected.
- The instrument is connected at the computer via the USB cable.
- The instrument is turned ON (**[OK]** key).
- For instrument models MP0R only: Remove the orange protective cap from the probe.
- Settings of service menu 1 must be bL = between 2 (mode SSPC: 3) and 20 (number of readings, which are collected in one block). Procedure 🗐 31 and 33.
- Settings of service menu 4 (Procedure 🗐 31 and 37) must be
  SI = 1 or 0 (for mode Std only; 1 = only single readings, 0 = only mean values are transmitted),
  GS = 1 (group separator is active).
- The program on the computer to which the data will transmitted is open. Attend the manual of the program for data import.

Procedure

A group separator is sent automatically at each block creation. The collection to a block performs automatically the computation of the block statistics and the subsequent deletion of the data of the block in the measurement memory.

9 Instrument Settings

The display menu Menu contains several topics for instrument settings. The following instrument settings are possible:

Settings/selections in the instrument setting menus	Parameter	Menu no.	Page
Measuring mode • Std (common coating thickness measurement) • 90.10* (coating thickness measuring according the "Performance Standard for Protective Coatings" from the International Maritime Organization) • SSPC* (coating thickness measuring in compliance with the SSPC-PA2 specification from the Society for Protective Coatings) * reduced instrument settings	 Std 90.10 SSPC	1	32
Lock function for the calibration functions (O, CAL)	CE	1	33
Block size - number of single readings collected to a block.	bL	1	33
Display resolution - number of numerals after the decimal point in the display	d1	1	34
Data storage enable/disable	nEn	1	34
Dimension unit (µm, mils)	UnIt MILS	3	34
Measurement data display (coating thickness value, count rates)	r	3	35
Acoustic signal enable/disable for measurement accept	bEP	3	35
Test method selection (for DUALSCOPE instruments only)	dUAL FE nF	3	36
Data transmission in the Free-Running Display mode	FrL	3	36
Data selection for transmission (single readings, mean values)	S1	4	37

Settings/selections in the instrument setting menus	Parameter	Menu no.	Page
Group separator triggering enable/disable	GS	4	37
Auto-switch Off, time setting (approx. 1 or 5 minutes)	OFF	4	37
Display illumination on/off	EL	4	38
Free-Running display mode enable/disable (continuous display of the readings)		5	39
Factory reset (all settings in the instrument setting menus are set back to the factory settings)	FrES	9	40

The menus 2, 6 to 8 and 10 to 12 are not callable and for service purposes only.

9.1 Access to the instrument setting menus

Before you start

▶ Instrument must be switched ON by pressing the key **[OK]**.

Procedure

1. Set the display menu with **[◀]** or **[▶]** to show Menu.
2. Press button **[OK]**. "157" will appear on the display.
3. Set "159" using the key **[▶].**
4. Press button **[OK]**. "FrEE" will appear on the display.
5. Select the desired menu number using [◀] or [▶].
6. Press button **[OK]** repeatedly to select the menu features.
7. Set the current setting using the key **[◀]** or **[▶]**.
8. Press button **[OK]** to save the setting.
9. Press button **[ESC]** to leave the setting routine at any time. If you have modified an instrument setting, this will be saved automatically.

9.2 Instrument setting menus

Measurement modes Std, 90.10, SSPC - Menu 1

Additional to the common coating thickness measurement, measurement modes can be select for measurements according to the specifications of the IMO PSPC (90.10) and of the SSPC-PA2.

Call up instrument setting menu 1 see description on page 31.

Default setting	**Further settings** (use [◀] or [▶])
Std	90.10 or SSPC

Std Common coating thickness measurement

90.10 Coating thickness measurement according to the "Performance Standard for Protective Coatings" (PSPC) from the International Maritime Organization (IMO).

- Nominal Dry Film Thickness set at 320 µm (TOL).
- No block size setting (not available: menu 1, parameter bL).
- Data storage always enabled (not available: menu 1, parameter MEM)
- Only single readings transmission (not available: menu 4, parameter S1).

SSPC Coating thickness measuring in compliance with the SSPC-PA2 specification from the Society for Protective Coatings.

- Block size 3, default setting (menu 1, parameter bL)
- Data storage always enabled (not available: menu 1, parameter MEM)
- Only mean value transmission (not available: menu 4, parameter S1).
- No group separator transmission (not available: menu 4, parameter GS)

Lock function CE - Menu 1

Enable/disable the calibration functions (CAL and O). This avoids erroneous measurements due to unintentional adjustments of instrument parameters.

Call up instrument setting menu 1 see description on page 31.

Mode	Default setting	Further settings
Std, SSPC, 90.10	CE2 = CAL free and O free	CE0 = CAL locked and O locked CE1 = CAL locked and O free

Block length bL - Menu 1

Number of single readings collected to a block.

Call up instrument setting menu see description on page 31.

Mode	Default setting	Further settings
Std	bL0, bL1 = block creation disabled	bL2...20 = block creation of n single readings (n = 2 .... 20)
SSPC	bL3 = 3 single readings collected to a block	bL3...20 = block creation of n single readings (n = 3 .... 20)
90.10	not available - only manual block creation possible by using the key **[OK]**	

The mean value of the block is displayed automatically after the set number of single readings.

Display resolution d 1 - Menu 1

Number of numerals after the decimal point in the display.

Call up instrument setting menu 1 see description on page 31.

Mode	Default setting	Further settings
Std, SSPC, 90.10	d 1 0 = low resolution: 0.0	d 1 1 = medium resolution: 0.00 d 1 2 = high resolution: 0.000

Data storage MEM - Menu 1

Enable/disable the data storage in the instrument. The single readings and the evaluation of one block (last block) can be stored in the instrument.

Call up instrument setting menu 1 see description on page 31.

Mode	Default setting	Further settings
Std	MEM 1 = data storage enabled	MEM0 = data storage disabled
SSPC, 90.10	data storage always enabled for this modes.	not available - fixed instrument setting, not changeable

Dimension unit UNIT MILS - Menu 3

Set the unit of measurement.

Call up instrument setting menu 3 see description on page 31.

Mode	Default setting	Further settings
Std, SSPC, 90.10	UM = µm	MILS = mils

Measurement data display r - Menu 3

Mode that the measurement value is shown in the display. The captured measurement value may display as coating thickness value or as count rate.

Call up instrument setting menu 3 see description on page 31.

Mode	Default setting	Further settings for service purposes only
Std, SSPC, 90.10	r 0 0 = measurement display as coating thickness values	r 0 1 = measurement display as normalized countrate Xn r 0 2 = measurement display as probe countrate X

Acoustic signal bEP - Menu 3

Each measurement capture can be indicated audibly with a signal tone.

Call up instrument setting menu 3 see description on page 31.

Mode	Default setting	Further settings
Std, SSPC, 90.10	bEP 1 = signal tone on	bEP 0 = signal tone off

Test method selection dUAL / FE / nF - Menu 3

Only displayed with instrument type DUALSCOPE

Set the test method you want to use.

DUALSCOPE instruments combine the magnetic induction and the eddy current test methods. These instrument types are capable of measuring non-magnetic coatings or non-conducting coatings on steel or iron as well as non-conducting coatings on non-ferromagnetic substrate materials.

Call up instrument setting menu 3 see description on page 31.

Mode	Default setting	Further settings
Std, SSPC, 90.10	dUAL = The measurement test method appropriate for the respective substrate material is used automatically	FE = only measurements on ferromagnetic substrate material with the magnetic induction test method are possible nF = only measurements on non-ferromagnetic substrate material with the eddy current test method are possible

Data transmission in the Free-Running Display mode FrL - Menu 3

Continuous data transmission while measurements detection.

Call up instrument setting menu 3 see description on page 31.

Description of the Free-Running Display mode and how to switch on/off see page 39.

Mode	Default setting	Further settings
Std, SSPC, 90.10	FrL 0 = data transmission in the Free-Running Display mode OFF	FrL 1 = data transmission in the Free-Running Display mode ON

Data transmission SI - Menu 4

Set the data to be transmitted during and after the measurement.

Call up instrument setting menu 4 see description on page 31.

Mode	Default setting	Further settings
Std	SI 1 = each single reading will be transmitted to the PC	SI 0 = mean values only will be transmitted to the PC
SSPC	Always single readings will be transmitted	not available - fix instrument setting, not changeable
90.10	Always mean values will be transmitted	not available - fix instrument setting, not changeable

Group separator GS - Menu 4

The end of a block can be marked with a group separator. The group separator can be transferred to the computer together with the readings or mean values.

Call up instrument setting menu 4 see description on page 31.

Mode	Default setting	Further settings
STD, 90.10	GS 1 = group separator triggering enabled	GS 0 = group separator triggering disabled
SSPC	not available - Triggering of group separator not possible.	

Auto switch-off OFF - Menu 4

Use this menu topic to set time period after which the instrument will switch OFF automatically if no key is pressed, no measurement is carry out, or no data are transferred to the PC.

Call up instrument setting menu 4 see description on page 31.

Mode	Default setting	Further settings
Std, SSPC, 90.10	OFF 1 = short switch-off time, approx. 1 minute	OFF 2 = long switch-off time, approx. 5 minutes

Display illumination EL - Menu 4

Switch display illumination ON or OFF.

Call up instrument setting menu see description on page 31.

Mode	Default setting	Further settings
Std, SSPC, 90.10	EL 1 = display illumination ON	EL 1 = display illumination OFF

Free-Running Display mode - Menu 5

When making measurements with the Free-Running Display mode, the coating thickness distribution across the surface can be determined simply by moving the instrument/probe along the surface.

Features of the Free-Running Display mode

- The readings are displayed continuously.
- The readings may not accepted automatically or manually.
- The readings are transmit continuously via USB interface if in menu 3 "FrL 1" are set.
- The measurement data are not evaluated statistically.

Please Note!

The Auto-switch OFF (OFF, menu 4) doesn‘t work in the Free-Running Display mode!

▶ *Switch the Free-Running Display mode off if you does not use it any longer. Otherwise the batteries will go empty very fast!*

Switching ON and OFF the Free-Running Display mode

Calling the instrument setting menu 5 to switch the mode ON.

Calling the instrument setting menu 5 again to switch the mode OFF.

🗐 *Call up instrument setting menu see description on page 31.*

Factory Reset - Menu 9

All settings of all instrument setting menus are set back to the factory settings. A calibration will be deleted, too.

Call up instrument setting menu see description on page 31.

Procedure

1. Calling the instrument setting menu 9, "FrES" will appear on the display.
2. Press button **[OK]**. "YES" will appear on the display.
3. Use the key **[▶]** to confirm the reset procedure. "FrES" and " 0.00 " appears in succession on the display. The reset of the instrument to the default factory settings is finished.

Please Note!

The reset to the factory settings deletes also the last calibrations! It is necessary to perform a calibration on the corresponding reference part for precise measurement.

▶ *Perform a new normalization or corrective calibration before next measurement. Procedure* 11.

10 Trouble Shooting

Message	Explanation	Solution
Dark display	• Instrument switched OFF.	▶ Press the button **[OK]** to turn the instrument ON.
	• Battery contact foil still in the battery compartment and the instrument can not switched ON.	▶ Remove the battery contact foil before (first) use.
	• The USB interface is in an undefined condition.	▶ Remove the batteries from the instrument and insert the batteries again. Press the button **[OK]** to turn the instrument ON.
Er1	Internal error	▶ Perform a normalization. If the error occurs repeatedly, call the Fischer servicing. www.helmut-fischer.com
Er4	Overflow of the data memory.	▶ Delete the data memory, 🗐 18.
Er5	Cannot determine value for substrate material. • Button **[OK]** would be pressed although no measurement was performed on the uncoated reference part (base). This results in the termination of the normalization or corrective calibration.	▶ Use parts with applicable base material, see pages 🗐 12 and 14. ▶ Call the desired calibration menu (O, CAL) again and perform 5 to 10 measurements on the uncoated reference part (base).

Message	Explanation	Solution
Er6 or – – – –	Reading is out of the measuring range. Cause: • Coating is too thick.	▶ Perform measurements on a specimen having a coating thickness measurable by the instrument.
	• Measurement was not performed correctly.	▶ Perform measurements correctly (e.g. do not hover with the instrument/probe over the specimen before or after the measurement or do not lift off the instrument/probe from the specimen too swiftly after the measurement).
	• Wrong base material of the specimen.	▶ Use parts with applicable base material. *Fe displayed*: base made from ferromagnetic metal. *NFe displayed*: base made from non-ferrous metal.
	• Erroneous normalization or calibration.	▶ Perform a normalization or calibration again. Perform the normalization/calibration carefully! It determines the accuracy for the subsequent measurements. - Measurements can never be more accurate than the normalization or calibration!

Message	Explanation	Solution
Er7	Outlier measurement was recognized during normalization or calibration. • Measurement on the calibration standard was not performed correctly.	▶ Repeat normalization or calibration correctly (e.g. do not hover with the instrument/probe or do not lift off the instrument too swiftly after the measurement).
	• Measurement was performed on the calibration foil instead of the uncoated specimen (base).	▶ Repeat all measurements using the uncoated specimen.
	• Measurement on a creased calibration foil.	▶ Replace calibration foil.
	• Instrument/probe was not placed perpendicular or squarely on the specimen or the calibration standard.	▶ Perform all measurements correctly with the instrument/probe placed squarely on the uncoated specimen (base) or the calibration foil.
Er13	Readings of the calibration foil are not in the admissible interval range of the master calibration.	▶ Inform customer service.
Er17	Not enough readings. • Calibration foil has been measured only once.	▶ 2 measurements are necessary as a minimum. To get a better precision of calibration we recommend 5 to 10 measurements on the calibration foil.
Er22	Internal instrument error. Error accessing the instrument memory.	▶ Contact customer service.

Message	Explanation	Solution
Er28	Internal instrument error: Not able to compute measurement. • Different reference parts with different base materials are used for corrective calibration.	▶ Use always one reference part for the corrective calibration. Base: measurement on uncoated reference part. STD: place the calibration foil on the reference part used for base measurement. Then perform measurements on the calibration foil.
Er29	The locked function has been called (O or CAL).	▶ Set the function free again in instrument setting menu 1, 🗐 33.
🔒	The lock function for the calibration functions (O or CAL) is active.	▶ Set the function free again in instrument setting menu 1, 🗐 33.
0.00	Instrument setting menu quitted and no measurement captured yet.	▶ Perform measurements on the specimen.
- ----	No measurement storage.	
	• Free-Running Display mode is active.	▶ Deactivate the mode in the instrument setting menu 5, 🗐 39.
	• Value is out of the measuring range.	▶ See under Er06, 🗐 42.
	• The USB interface is in an undefined condition. • End of the list of the single readings.	▶ Remove the batteries from the instrument and insert the batteries again. Press the button **[OK]** to turn the instrument ON.
-ECAL	No Master Calibration	▶ Contact customer service.

Problem	Explanation	Solution
Calibration/ Normalization not possible	The lock function is active for the calibration or normalization functions (O or CAL).	▶ Deactivate the lock function in service menu 1, 🗐 33.
measurement values also after calibration too high.	An Offset value is still set.	▶ Set the Offset value to zero 🗐 22.

10.1 Data transmission via USB - trouble shooting

Problem	Explanation	Solution
Erroneous data transmission via USB	USB connectors may have different quality. Especially the connectors on the PC front side have problems with the data transmission.	▶ Use an USB connection on the rear side of the PC. Possible that for this (new) USB connector you have to install the USB driver again. 🗐 23.
Instrument can not switched ON	The USB interface is in an undefined condition.	▶ Remove the batteries from the instrument and insert the batteries again. Press the button **[OK]** to switch the instrument ON.
Impossible to open the evaluation, RES	The data storage is deactivated.	▶ Activate the data storage in the instrument setting menu 1, 🗐 34.

11 Technical Data

General technical data -
valid for all instrument models MP0R and MP0R-FP

Weight MP0R models MP0R-FP models	 138 g (4.88 oz) with two batteries 184 g (6.48 oz) with two batteries; cable length 80 cm (33“)
Dimensions	W x D x H: 64 x 28 x 85 mm (2.5" x 1.1" x 3.4")
Power supply	2 x battery LR6, AA, 1.5 V (weight 47 g / 1.7 oz)
Power consumption	Max. 0.2 Watt
Ambient temperature	+5 ... +40 °C (41 to 104 °F) during operation +5 ... +60 °C (41 to 140 °F) storage temperature
Relative humidity	30 ... 90 % (non-condensing)
USB port	2.0 compatible, mini AB for connecting an external computer via optional USB cable.
Data memory	Max of 9999 single readings can be stored. The memory contents are retained even without power supply.
Measurement interval	Less than 1 seconds duration between two measurements.

Further technical data depending on instrument model

Instrument	**Page**
PERMASCOPE MP0R, PERMASCOPE MP0R-FP	47
ISOSCOPE MP0R	47
DUALSCOPE MP0R, DUALSCOPE MP0R-FP*	48
DUALSCOPE MP0RH-FP*	49

*The instrument model is labeled inside the battery compartment.

PERMASCOPE MP0R and PERMASCOPE MP0R-FP - specific technical data

Applications	Thickness measurement of non-magnetic coatings or el. non-conductive coatings on steel or iron (Fe).
Test method	Magnetic induction
Measurement range	0 - 2500 µm (0 - 97.5 mils)
Trueness (based on Fischer standards)	0 ... 100 µm (0 - 3.9 mils): ≤ 1.5 µm (≤ 0.06 mils) 100 ... 1000 µm (3.9 - 39 mils): ≤ 1.5 % of reading 1000 ... 2500 µm (39 - 97.5 mils): ≤ 3 % of reading
Repeatability precision (based on Fischer standards)	0 ... 100 µm (0 - 3.9 mils): ≤ 0.3 µm (0.01 mils) 100 ... 2500 µm (3.9 - 97.5 mils): ≤ 3 % of reading

ISOSCOPE MP0R - specific technical data

Applications	Thickness measurement of el. non-conductive coatings on nonferrous metals (NFe).
Test method	Eddy current
Measurement range	0 - 1200 µm (0 - 46.8 mils)
Trueness (based on Fischer standards)	0 ... 70 µm (0 - 2.7 mils): ± 1 µm (± 0.04 mils) 70 ... 250 µm (2 - 9.8 mils): ≤ 1.5 % of reading 250 ... 1200 µm (9.8 - 46.8 mils): ≤ 3 % of reading
Repeatability precision (based on Fischer standards)	0 ... 50 µm (0 - 2 mils): ≤ 0.25 µm (0.01 mils) 50 ... 1000 µm (2 - 39 mils): ≤ 0,5 % of reading

DUALSCOPE MP0R and DUALSCOPE MP0R-FP - specific technical data

Applications	**Fe**: Non-magnetic coatings or el. non-conductive coatings on steel or iron (Fe) and **NFe**: El. non-conductive coatings on nonferrous metals (NFe) • Automatically recognizes the substrate material under the coating (default setting). The DUALSCOPE instruments select the appropriate test method. • Suited for measurements on rough surfaces.
Test method	Magnetic induction and Eddy current
Measurement range	**Fe**: 0 - 2000 µm (0 - 78 mils) **NFe**: 0 - 2000 µm (0 - 78 mils)
Trueness (based on Fischer standards)	**Fe**: 0 ... 75 µm (0 - 3 mils): ≤ 1.5 µm (± 0.06 mils) 75 ... 1000 µm (3 - 39 mils): ≤ 2 % of reading 1000 ... 2000 µm (39 - 78 mils): ≤ 3 % of reading
	NFe: 0 ... 50 µm (0 - 2 mils): ± 1 µm (± 0.04 mils) 50 ... 1000 µm (2 - 39 mils): ± 2 % of reading 1000 ... 2000 µm (39 - 78 mils): ≤ 3 % of reading
Repeatability precision (based on Fischer standards)	**Fe**: 0 ... 50 µm (0 - 2 mils): ≤ 0.25 µm (0.01 mils) 50 ... 2000 µm (2 - 78 mils): ≤ 0.5 % of reading
	NFe: 0 ... 100 µm (0 - 3.9 mils): ≤ 0.5 µm (0.02 mils) 100 ... 2000 µm (3.9 - 78 mils): ≤ 0.5 % of reading

DUALSCOPE MP0RH-FP - specific technical data

Applications	**Fe**: Thickness measurement of non-magnetic coatings or el. non-conductive coatings on steel or iron (Fe). Measurement unaffected from the electrical conductivity of the coating material. and **NFe**: Thickness measurement of el. non-conductive coatings on nonferrous metals (NFe). • Automatically recognizes the substrate material under the coating. The DUALSCOPE instruments select the appropriate test method.
Test method	Magnetic induction and Eddy current
Measurement range	**Fe**: 0 - 7000 µm (0 - 273 mils) **NFe**: 0 - 2500 µm (0 - 97.5 mils)
Trueness (based on Fischer standards)	**Fe**: 0 ... 150 µm (0 - 5,9 mils): ± 5 µm (± 0.19 mils) 150 ... 3000 µm (5.9 - 117 mils): ≤ 3 % of reading 3000 ... 6000 µm (117 - 234 mils): ≤ 5 % of reading
	NFe: 0 ... 50 µm (0 - 2 mils): ± 1 µm (± 0.04 mils) 50 ... 1000 µm (2 - 39 mils): ± 2 % of reading 1000 ... 2200 µm (39 - 86 mils): ≤ 3 % of reading
Repeatability precision (based on Fischer standards)	**Fe**: 0 ... 200 µm (0 - 7.8 mils): ≤ 2 µm (0.08 mils) 200 ... 6000 µm (7.8 - 234 mils): ≤ 1 % of reading
	NFe: 0 ... 50 µm (0 - 2 mils): 0.5 µm (0.02 mils) 50 ... 1000 µm (2 - 39 mils): ≤ 1 % of reading 1000 ... 2200 µm (39 - 86 mils): ≤ 1.5 % of reading

12 Ordering Information

Instruments	Part no.
PERMASCOPE MP0R	604-533
ISOSCOPE MP0R	604-558
DUALSCOPE MP0R	604-555
PERMASCOPE MP0R-FP	604-534
DUALSCOPE MP0R-FP	604-556
DUALSCOPE MP0RH-FP	604-557

Instrument standard content of shipment: Hard shell case; Instrument protective sleeve; Carrying strap; 2 batteries; Test metal sheets ISO/NF and NF/FE; Calibration foil; printed operator's manual; Support CD with USB driver, manuals and programs; USB interface cable; supplier inspection certificate

Accessories / Spare parts	Part no.
Carrying loop	603-481
Protective cover for instrument	603-582
Software PC-DATEX for data import into an Excel table sheet	602-465
Interface set (USB driver, USB cable) for PC connection	604-087
Calibration foil	603-479
Test metal sheet ISO/NF	603-478
Test metal sheet NF/FE	603-477
Battery set, 2 x LR6; AA; 1.5 V	603-534

13 Disposal

Please observe!

Do not dispose of batteries and accus with regular household waste! Thereby you will endanger the environment.

- *Place damaged or used batteries / rechargeable batteries in designated collection containers! Please observe the guidelines in your region concerning proper handling of waste electrical and electronic equipment and accessories.*

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