FISCHERSCOPE® MMS® PC

System overview

What can be measured?

- Thickness of paint, lacquer, plastic coatings, etc. on steel and iron.
- Thickness of paint, lacquer or anodized coatings on nonferrous metals.
- Thickness of metallic coatings on steel and iron or nonferrous metals.
- Thickness of magnetic (e.g., nickel) coatings on electrically nonconducting, nonmagnetic or magnetic substrate materials.
- Thickness of copper claddings on printed circuit boards.
- Thickness of copper cladded through-holes of printed circuit boards.
- Non-contact measurements of oil or wax coating thickness on metals.
- Electrical conductivity of nonferrous metals.
- Ferrite content in austenitic or duplex steel.

Instrument features

- Windows® CE based application software in typical Windows design comparable to MS Word or MS Excel.
- European and Asian languages can be selected for the software: us, de, fr, it, es, cz, cn, jp.
- Internal memory for more than 1,000 measurement applications and 1 million readings.
- Large high-resolution color LCD with touch screen function.
- Up to 8 same or different probes can be connected.
- Module boards with various measurement methods for the various measured quantities (coating thickness, el. conductivity, ferrite content) and applications.
- Interface module boards for memory expansions using PC or CompactFlash cards or using a LAN network and USB port.
- Standard interfaces for connecting a PC keyboard (P2), PC mouse (P2), a printer with a parallel port and a PC, for example.
- Data export in ASCII, ASCII for Excel import (CSV), Q-DAS and html formats.
- Set up of customer-specific print form templates.

On the one hand independent ...

- Stand-alone instrument for, e.g., control measurements in the lab.
- Printer port
- Interfaces for PC keyboard and PC mouse for pc-like ease of operation.
- COM port for connecting a motorized support stand or a programmable XY measuring stage.
- Data storage on PC, CompactFlash cards or USB sticks.

Application-specific instrument configuration

Measurements of the various quantities, coating thickness, electrical conductivity and ferrite content require different measurement methods. For coating thickness measurements, again different measurement methods may be employed depending on the coating/substrate material combination.
The FISCHERSCOPE® MMS® PC features a modular design to satisfy this multitude of applications and is thus individually configurable.

The instrument is equipped with the required module board corresponding to your measurement application. Module boards for various measurement methods are available to measure the coating thickness of various coating/substrate material combinations. The probe that corresponds to your measurement application is then connected to the module board.

Typically, the FISCHERSCOPE® MMS® PC features the following standard interfaces (see image at the bottom of Page 3):

... on the other hand, capable of being integrated

- Integration into a LAN network with central data storage.
- Automated measurements in production lines, measurement capture and control using an external PC or a PLC control unit.
- Data export to standard software programs such as MS Excel, Q-DAS, etc.

Printer:
Printer port Centronics parallel

Keyboard and Mouse:
Ports for one P2 PC keyboard and one P2 PC mouse.

COM1:
RS232 interface for connecting a PC, for example.

External Start:
Port for pedal, for example for external trigger of the measurement capture.

12VDC/1.2A:
Power supply connector.

Multifunction:
Connector with TTL signal outputs, for example for limit value monitoring etc.

Application-specific instrument configuration

Module board PERMASCOPE® for coating thickness and ferrite content measurements

This module board includes the magnetic induction method (ISO 2178, ASTM B499) and the amplitude sensitive eddy current method (ISO 2360, ASTM B244).

Coating thickness measurement

Applications for the magnetic induction method:

- Coating thickness measurement of nonmagnetic coatings on ferromagnetic substrate materials: e.g., zinc, chrome, copper, tin or paint, lacquer, plastic, enamel on iron or steel.

Applications for the amplitude sensitive eddy current method:

- Thickness measurement of electrically nonconducting coatings on nonferrous metals: e.g., paint, lacquer or plastic on aluminum, brass, zinc.
- Thickness measurement of anodized coatings on aluminum.
- Thickness measurement of lacquer coatings on the inside and outside of tubes and cans made of aluminum.
- Thickness measurement of poorly electrically conducting nonferrous metal coatings on electrically good conducting nonferrous metals: e.g., chrome, chemical nickel on copper, aluminum or brass.

Ferrite content measurement

The ferrite content measurement is carried out according to DIN 32514-1 and the 'Basler Norm' utilizing the magnetic induction method. It measures all magnetizable structural portions, i.e., deformation martensite or other ferrite phases in addition to delta ferrite.

Measurement of the ferrite content in

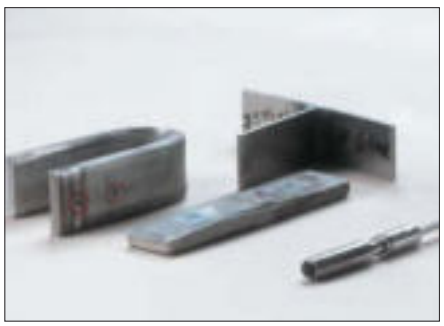
- Weld seams, weld claddings,
- Austenitic and duplex steel.

Applications in the areas:

- Electroplating
- Automotive industry
- Paint manufacturing and application
- Aeronautics, steel and metal construction
- Chemical industry

Measurement of zinc coatings using the probe EGAB1.3 according to the magnetic induction method.

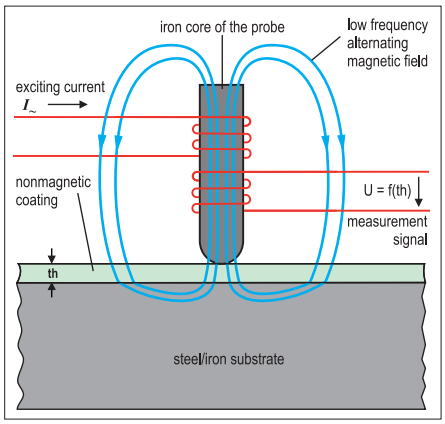
Measurement of an anodic coating on aluminum components using the probe ETA3.3 according to the amplitude sensitive eddy current method.



Measurement of the ferrite content using the probe EGAB1.3-Fe according to the magnetic induction method.

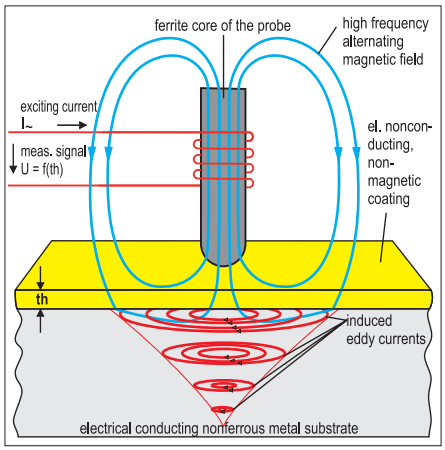
Operating principles of the measurement methods

Magnetic induction method
(ISO 2178, ASTM B499)
Contact method. The excitation current generates a low-frequency magnetic field with a strength that corresponds to the distance between the probe and the substrate. A measurement coil measures the magnetic field.



In the instrument, the obtained measurement signal is converted to the coating thickness values via the characteristic probe output function, i.e., the functional correlation between the probe signal and the coating thickness.

Amplitude sensitive eddy current method
(ISO 2360, ASTM B244)
Contact method. The excitation current generates a high-frequency magnetic field, which induces eddy currents in the substrate material. The strength of the eddy currents corresponds to the distance between the measurement probe and the substrate material. The magnetic field of the eddy currents opposes the original magnetic field and provides the measurement signal. Using the characteristic probe output function, i.e., the functional correlation between the measurement signal and the coating thickness, the measurement signal is converted in the instrument to the coating thickness value.



A selection of probes can be found on Page 14.

Module board NICKELSCOPE® for coating thickness measurements

This module board includes the magnetic method (ISO 2178).

Coating thickness measurement

- Thickness measurement of galvanically deposited nickel coatings on electrically nonconducting or nonmagnetic substrate materials: e.g., nickel on aluminum.
- Thickness measurement of nonferrous metals on magnetic substrate materials, e.g., copper, aluminum, lead on steel or iron.
- Advantageous with thicker coatings because, contrary to the magnetic induction method, the eddy current interference is avoided.

Applications in the areas:

- Electroplating
- Automotive supply industry

Measurement of the nickel coating thickness on a piston using the probe EN3 according to the magnetic method.

Module board SIGMASCOPE®/PHASCOPE®1 for the measurement of the coating thickness and of the electrical conductivity

This module board includes the phase sensitive eddy current method (ISO 21968), which also permits non-contact measurements.

Coating thickness measurement

- Thickness measurement of electrical conducting, magnetic or nonmagnetic coatings on magnetic substrate materials: e.g., zinc or nickel on iron.
- Thickness measurement of magnetic coatings with a high electrical conductivity on nonmagnetic substrate materials with a low electrical conductivity: e.g., copper on brass or stainless steel.
- Thickness measurement of electrical conducting and nonmagnetic coatings on electrically nonconducting materials, e.g., copper on epoxy with printed circuit boards also under lacquer.

Electrical conductivity measurement

- Measurement of the electrical conductivity of all nonmagnetic metals, e.g., aluminum, copper, brass, titanium, stainless steel, etc. For automatic **temperature compensation** of the electrical conductivity value (referenced to +20 °C), the temperature of the specimen can be entered manually or can be measured using a temperature sensor that is either integrated in the probe or an external temperature sensor connected to the instrument.

Applications in the areas:

- Electric and electronics industry
- Electroplating and anodizing
- Aeronautics and metal construction
- Automotive industry

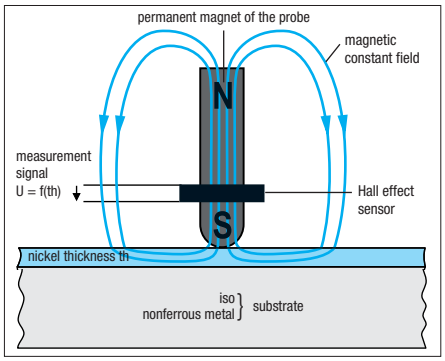
Measurement on rough surfaces, e.g., Zn/Fe, using the probe ESD20Zn according to the phase sensitive eddy current method.

Measurement of the electrical conductivity of aluminum components for testing the strength using the probe ES40.

A selection of probes can be found on Page 14.

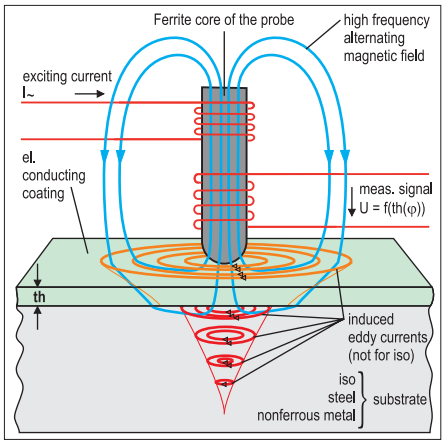
Operating principles of the measurement methods

Magnetic measurement method (ISO 2178)
Contact method. A permanent magnet generates a constant magnetic field with a strength that corresponds to the thickness of the nickel coating to be measured or the distance between the measurement probe and the substrate material.



The magnetic field strength is measured using a suitable sensor; using the characteristic probe output function, i.e., the functional correlation between the measurement signal and the coating thickness, the measurement signal is converted in the instrument to a coating thickness value.

Phase sensitive eddy current method (ISO 21968)
The excitation current generates a high-frequency magnetic field, which induces eddy currents in the material (coating or substrate material). The different formation of the eddy currents in the coating material and the substrate material is used for the coating thickness measurement. The dependence on the electrical conductivity of the material is used for the measurement of the electrical conductivity. The phase shift φ between the excitation current and the measurement signal is converted to a coating thickness value or a conductivity value, respectively.



In a certain range, which is determined by the probe, the reading is not dependent on the distance between the probe and the coating surface.

Module board SIGMASCOPE®/PHASCOPE®2 for the measurement of the copper coating thickness in throughholes of pc-boards

This module board includes the phase sensitive eddy current method (ISO 21968) and works only in combination with the module board SIGMASCOPE®/ PHASCOPE®1.

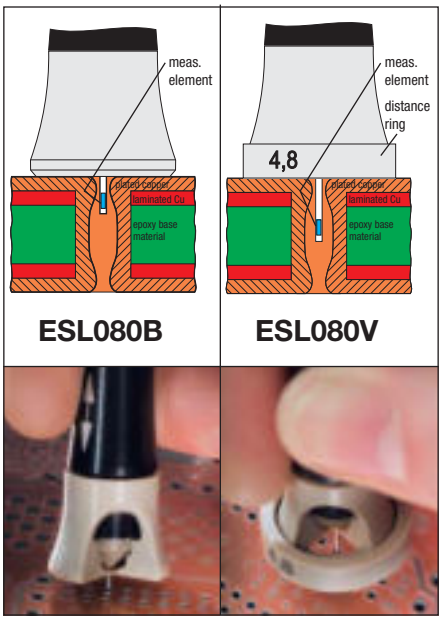
- Thickness measurement of the copper coating in throughholes of pc-boards even under an Sn or SnPb layer.

The probes ESL080B and ESL080V have been developed for this special measuring application. The needle-shaped probe tip, which houses the actual measuring element is inserted into the hole to make the measurement. The patented probe design features a flow of the eddy currents in the longitudinal direction of the hole. Thus, interim copper layers and remaining ring size of the throughholes have no significant influence on the measurements.

The probes are suitable for measurements in throughhole diameters of > 0.8 mm and pc-board thickness of ≧ 0.6 mm. Their measurement range is between 5 and 80 µm copper thickness.

Applications in the areas:

- Electric and electronics industry
- Pc-board manufacturing



Measurement of the copper thickness in a throughhole of a pc-board using the probes ESL080B and ESL080V.

Module board SR-SCOPE® for the measurement of the copper thickness on pc-boards

This module board includes the micro-resistance method according to DIN EN 14571. This method is particularly well suited for measurements on multi-layers or thin laminates because due to the measurement method, there is no penetration to the lower-lying copper layers, which, therefore, do not influence the measurement.

- Thickness measurement of the copper cladding on the upper side of pc-boards without interference of underlying copper layers.

Two probe models are available:
- ERCU D10 for large measurement areas beginning at a width of approx. 26 mm.
- ERCU N for small measurement areas beginning at a width of 4 mm.

For **temperature compensation**, the surface temperature is entered manually or measured via a temperature sensor connected to the temperature module.

Applications in the areas:

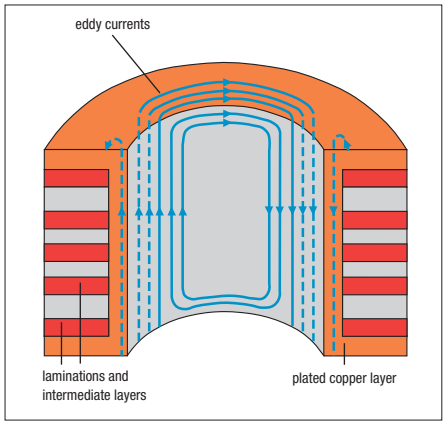
- Electric and electronics industry
- Pc-board manufacturing

Probe ERCU D10 for large measurement areas.

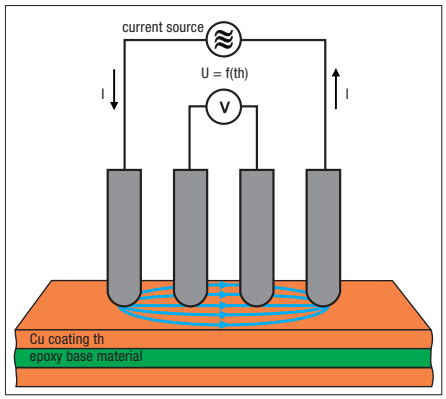
A description of the probes can be found on page 14.

Operational principles of the measurement methods

Phase sensitive eddy current method (ISO 21968) in connection with the probes ESL080B and ESL080V.
The high-frequency magnetic field generated in the probe induces eddy currents in the copper sleeve; the magnetic field of the eddy currents in turn weakens the primary magnetic field. This weakening effect increases as the thickness of the copper sleeve increases. A specially patented probe design results in an expansion of the eddy currents essentially in the longitudinal axis of the copper sleeve.



Micro-resistance measurement method (DIN EN 14571)
Contact method. The probe contacts the specimen surface with 4 electrodes. The two outer electrodes supply a current to the coating. The Cu coating between the two inner electrodes serves as an electrical resistor, and the voltage drop at this resistor is measured. It is indirectly proportional to the thickness of the Cu coating. Using the characteristic probe output function, i.e., the functional correlation between the measurement signal and the coating thickness, the measurement signal is converted in the instrument to a coating thickness value. The el. conductivity of the Cu coating is affected by the temperature, which may necessitate a temperature compensation.



Application-specific instrument configuration

Module board BETASCOPE® for coating thickness measurements and material reference measurements

This module includes the beta-backscatter method according to ISO 3543, ASTM B567. With this measurement method, the magnetic and electrical material properties do not interfere with the measurements.

Coating thickness measurement

- Thickness measurement of oil and grease films, lacquer, plastic or ceramic coatings on nonferrous metals, iron or insulating materials.
- Organic coatings containing zinc on galvanized steel sheet.
- Thickness measurement of metal coatings on metals or electrically nonconducting materials.

All BETASCOPE® measurement stages and hand probes in connection with suitable emitters and apertures can be connected to the module board BETASCOPE®.

Applications in the areas:

- Pc-board and electronics industries
- Automotive industry
- Consumer goods industry and others
- Printing industry

Hand probe Z15NG for the measurement of thin organic coatings (e.g., oil and grease films).

Measurement ranges

Emitter (isotope)		Pm-147	Tl-204	Sr-90	C-14
Coating	Substrate	Measurement ranges in µm			
Ag, Rh, Pd	Cu, Ni, Fe	1.2 – 4.0	5.5 – 22	15 – 70	–
Al	Cu, Ni, Fe	4.5 – 20	25 – 100	90 – 400	–
Au	Cu, Ni, Fe	0.5 – 2.0	2.5 – 10	5.5 – 35	–
Cd	Cu, Ni, Fe	1.5 – 5.0	7.0 – 30	15 – 70	–
Cr	Al	2.0 – 8.0	8.0 – 30	–	–
SnPb(60/40)	Cu, Ni, Fe	1.1 – 4.5	5.0 – 28	10 – 80	–
Ni, Cu	Ag, Mo	1.5 – 5.0	9.0 – 30	20 – 100	–
Sn	Cu, Ni, Fe	1.8 – 5.5	7.5 – 35	15 – 100	–
Zn	Fe, Al	2.0 – 6.5	4.0 – 30	–	–
Lacquer	Ni, Cu, Al	11 – 40	50 – 200	80 – 800	3 - 11
Oil and lubricating film	Cu, Ni, Fe, Al, Mo, Ag, Au	–	–	–	1 - 11

Material reference measurements

The beta transmission method is used to make material reference measurements. This method measures the relative deviations of the specimen from reference parts – e.g., deviations in thickness or mass per unit area. Beta transmission measurements are possible only with the measuring stage Z6NG.

Application examples

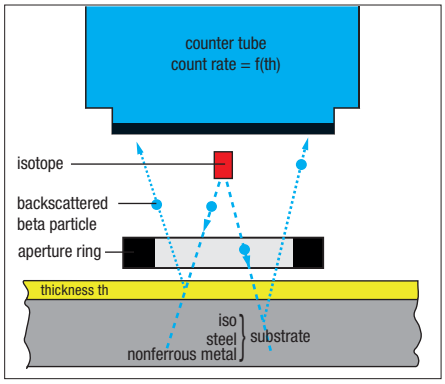
- Thickness inspection of foils
- Determination of the uniformity of fabrics

Inspection of the homogeneity of a screen-print fabric after calandering using the measuring stage Z6NG.

Operational principles of the measurement methods

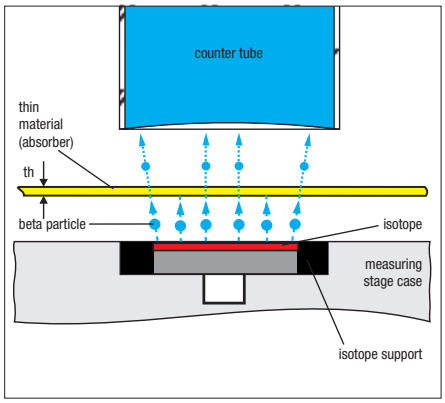
Beta-backscatter method

(ISO 3543, ASTM B567)
With this method, an isotope source emits beta radiation (electrons). The radiation enters the surface of the coated specimen and begins to interact with the atoms of the coating and substrate materials. The measurement effect is based on the number of backscattered electrons, which are measured using a Geiger-Müller counter tube. The coating thickness can be determined using this method if the difference in the atomic number Z between the coating and the substrate materials is at least $\Delta Z = 5$.



Beta transmission method

Analogous to the beta-backscatter method, an isotope source emits beta radiation (electrons), which is measured by the Geiger-Müller counter tube. If a thin material such as a foil or a fabric is inserted in the beam path, the material absorbs a portion of the radiation. The Geiger-Müller counter tube counts the number of transmitted electrons. This allows for the measurement of changes in the mass per unit area or the coating thickness in comparison to a reference part.



A selection of beta emitters, hand probes and measuring stages can be found on Page 13.

Module board TEMPERATURE

This module board is designed for temperature measurements in connection with the surface temperature probe TF100 A (temperature probe with Pt100 sensor).

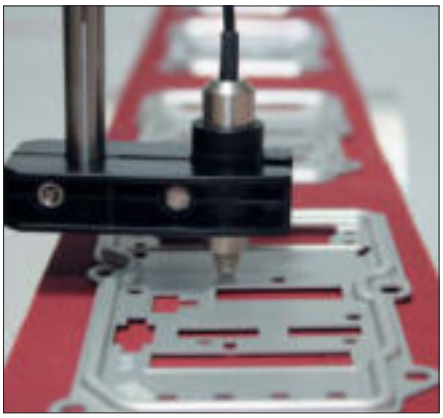
Measurement range: -20 °C to +80 °C.

The temperature measurement is necessary for the temperature compensation, for example, for measurements using the C14 emitter according to the beta-backscatter method (module board BETASCOPE®) or for measurements according to the electrical resistance method (module board SR-SCOPE®).

Shown is the window for the temperature acceptance. In this example, the temperature of the temperature probe (= sensor) is accepted using the command button "<< Temperature". The temperature probe TF100A must be connected to the TEMPERATURE module in the MMS® PC. In this case, the temperature may also be accepted automatically from the temperature probe. Manual entry of the temperature is always an option when making measurements with temperature compensation.

Module board COM2

This module board includes an RS232 interface. Typically, the FISCHERSCOPE® MMS® PC is equipped with one RS232 interface (COM1). If a second RS232 interface is required, for example to connect a support stand V12-AM for continuous measurement in addition to a PC, this can be accomplished easily by installing the module board COM2.



For continuous measurement, the measurement data may be transferred online to an evaluation computer using, for example, the RS232 interface COM1, which is part of the standard equipment of the MMS® PC. The motor-driven support stand V12-AM is connected to the RS232 interface COM2 (module board) and is controlled by the MMS® PC. (A picture of the support stand can be found on Page 15).

Module board LAN/USB

This module board includes a LAN connection and two USB ports.

Network: Ethernet

Transfer rate: 10 MBit/s

LAN connection: RJ45-socket

USB ports: USB (2.0 compatible)

LAN connection (RJ45 socket) for connecting the FISCHERSCOPE® MMS® PC to an Ethernet network.

The network connection offers the ability

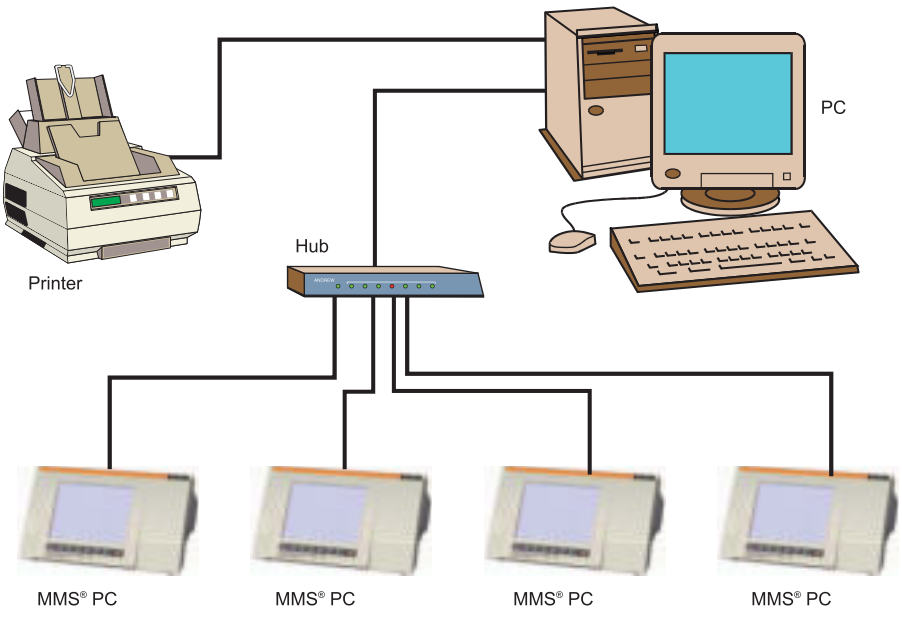
- To store data.
- To exchange data between the network and the MMS® PC. For example, applications (measurement application files) can be directly stored in or recalled from a network directory.
- For exporting measurement print forms to the network.
- For printing print forms/data via a printer connected to a network computer.

USB ports for connecting a printer and USB sticks for data storage.

Module board MMS® PC PCMCIA

Module board for memory expansion using PC cards (PCMCIA cards) or, in connection with an adapter, CompactFlash cards. The internal instrument memory is designed for 1000 measurement applications and 1 million readings. Using the configuration of the module board MMS® PC PCMCIA, data storage can be on PC cards or CompactFlash cards.

Using an adapter, popular CompactFlash cards can be used for optional memory expansion or archiving.



Schematic presentation for the network connection of several FISCHERSCOPE® MMS® PC instruments.

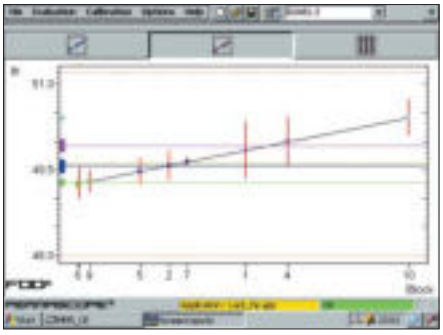
Software

User-friendly

The FISCHERSCOPE® MMS® PC uses an application software based on Windows® CE, which is comparable to WORD or EXCEL. Operation is uncomplicated, easy to learn and the same for all measuring methods. The touch screen function of large high-resolution color LCD screen simplifies the opening of menus and the selection of parameters. A stylus is used to tap directly on the desired command button on the screen, for example. Input is possible as well. If the user prefers to work with a PC mouse and keyboard, these two input devices can be connected to the MMS® PC as well.

Quick and easy selection of parameters on the touch screen.

A file, the so-called application, must be set up to make measurements. It contains all data and settings relevant to a particular measuring application. This includes material properties and geometric shapes of the specimen, which are taken into account through a normalization or calibration. It also includes the settings for capture, display and evaluation of the measurements, e.g., the input of the block size, limit values, settings for the temperature compensation (when applicable), etc. Test information such as operator, product description, product number, batch number, order number, manufacturing date, etc. can be entered and stored in the application for each measurement data block.



Presentation of the measurement data in the FDD® graph.

Measurement data presentation

The FISCHERSCOPE® MMS® PC offers several options for presenting measurement data on the instrument screen corresponding to the respective application.

Numeric display
The last or selected reading of a measurement data list appears magnified for good readability.

Specification limit display
For a quick view of the position of the single readings in relation to the limit values.

Control card display
For monitoring manufacturing processes (e.g., coating process).

Storing measurement data

Fundamentally, the measurement data are stored in the application. Two methods for storing measurement data are available, which differ in the grouping of the measurement data.

Default mode
The measured data are stored sequentially “consecutively“ in the application, possibly separated into blocks (default setting).

Matrix mode
With this storage mode, the measurement data memory (application) is separated into fields (matrix). The change into the individual matrix fields during the measurement is manual or automatic.

Evaluation

The FISCHERSCOPE® MMS® PC offers the user an extensive measurement data statistics at the push of a button as a list with characteristic statistical values such as mean value, standard deviation, etc. The evaluation can be performed for the entire application or for a selection of measurement blocks. Graphical measurement displays offer a quick overview. Sum frequency charts and histogram show clearly if systematic influences are present. The Factory Diagnosis Diagram (short FDD®) provides a quick overall overview of the spread and distribution of the measured quantities, e.g., coating thickness, within prescribed specification limits. In addition, it is possible to individually compare blocks of measurement data. With it, processes of manufacture can be assessed “at a glance” or differences between various deliveries at the incoming goods inspection can be identified as well.

Measurement documentation

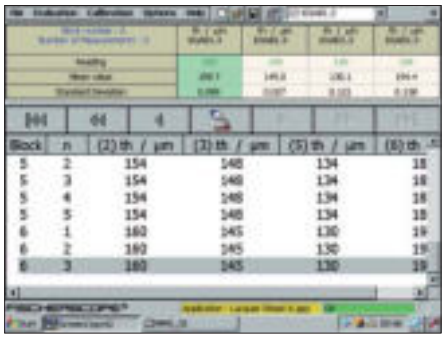
Today, user- or customer-specific result documentation is considered standard. With the FISCHERSCOPE® MMS® PC, it is possible to set up and store any desired number of print form templates. A default print form template is available to all applications. A specific print form template may be assigned to an application. It is possible to incorporate the company logo or a sketch of the specimen, for example, in this print form template. Individual output parameters such as date/time, areas for information text, characteristic statistical values, measurement data, etc. are simply selected when setting up the print form template.

Data export

Similar to the measurement data documentation, any number of templates can also be set up and stored in the FISCHERSCOPE® MMS® PC for the data export. The parameters and measured quantities of the selected templates can be exported in the formats ASCII, Q-DAS or HTML.

Multi-channel measurements

It is possible to measure simultaneously at up to 8 measurement locations. The measurement data can be stored and processed in an application.



Shown in the image above is an automated paint thickness measurement with 4 probes of the type EGAB1.3. The image below shows the associated display where the readings of all 4 probes are shown.

Technical Data

Hardware concept:
Housing with slots for module boards with various measurement methods.

Measurement methods:
- Magnetic method (ISO 2178)
- Magnetic induction method (ISO 2178, ASTM B499)
- Amplitude sensitive eddy current method (ISO 2360, ASTM B244)
- Phase-sensitive eddy current method (ISO 21968)
- Micro-resistance method (DIN EN 14571)
- Beta-backscatter method (ISO 3543, ASTM B567)

Measured quantities:
Coating thickness, electrical conductivity, ferrite content, temperature

Measurement probes:
Connection sockets at the module boards for all FISCHER probes of the type E-.... and for all measuring stages. Simultaneous connection of up to 8 measurement probes.

Software:
- Windows® CE based application software in typical Windows design.
- The software is available in European and Asian languages: German, English, French, Italian, Spanish, Czech, Chinese and Japanese.
- Input devices: Touch screen, PC mouse (P2) or PC keyboard (P2).
- Features: Linking of applications, application security, access prevention to program functions to avoid erroneous operations, limit monitoring.

Saving of measurement data:
Generally in files (applications). In addition to the measurement data, application-specific settings, the name of the application, test information regarding the measurement blocks as well as date and time of the measurement are stored in an application. Furthermore, the parameters determined at the normalization or corrective calibration, with enabled linking mode simultaneously in all linked applications are stored.
Saving of the measurement data can occur in various ways:
- Default mode: Measurement data are stored in successive blocks in the application. Automatic block creation after a specified number n of single readings. Automatic computation of the mean value.
- Matrix mode: Measurement data are stored in blocks, which are set up in matrix form in the application. Block change in any desired block manually or automatically in a specified order.

Multi-channel measurement:
Measurement data of up to 8 measurement probes are displayed and stored parallel in one application.

Measurement presentation:
- Numeric display: Lists the measurements with a large numeric display of the last single reading.
- Specification limit display: Graphical presentation of the measurement data within specified limit values.
- SPC control chart: Control chart presentation as an $\bar{x}$/R or an $\bar{x}$/s chart.
- Simple display: Large numeric display of the last reading only.
- Selectable unit of measurement for the measured quantity
  - Coating thickness: metric or imperial
  - Ferrite: Fe% or WRC-FN
  - El. conductivity: % IACS or MS/m
  - Temperature: °C or °F
  - Free definition of an additional unit of measurement, e.g., g/m²
- Selectable resolution of the measurement display.

Screen:
Large, high-resolution color LCD with touch screen function. 170 mm x 130 mm (W x H)

Measurement accept:
- Automatic after probe touchdown
- Through external start
- In the continuous running mode upon the push of a button
- Clocked in selected intervals either after probe touchdown or after external start

Evaluation:
Statistical evaluation of test series with mean value, standard deviation, coefficient of variation, max and min values, number of readings, individual and block statistics; computation of the process capability factors Cp and Cpk; outlier rejection; histogram, sum frequency chart with parameters of the distribution shape, FDD®; evaluation from groups of blocks, filtered according to block designations (features).

Dimensions (W x H x D):
351 mm x 165 mm x 270 mm

Weight (fully equipped):
about 5 kg

Ambient temperature:
+10 °C ... +40 °C

Connections (standard):
- Printer port Centronics parallel
- RS232 interface
- Multi-function connector with signal outputs for upper and lower limit violations, external start.
- Connection for a customary PC keyboard (P2).
- Connection for a customary PC mouse (P2).
- Jack socket for connecting, for example, a button for externally triggering the measurement capture.
- Power supply: via AC adapter 12VDC/1.2 A.

Connectable printers:
- Printer with Centronics interface.
- Printer with USB port (2.0 compatible), which features one of the following printer language emulations: PCL, ESC/P.

Documentation:
- Printout of single readings, block and final results, specification limits using printform templates. Printout of SPC charts, histogram, sum frequency chart and FDD®.
- Print form design with customer-specific information. The instrument can store any desired number of print forms.

Data storage:
- In the internal memory of the unit – designed for about 1000 applications and 1 million readings.
- On PCMCIA cards, only together with the module board PC PCMCIA.
- On CompactFlash cards, possible only together with the module board PC PCMCIA and the PC card adapter (603-395).
- On USB sticks, only together with the module board LAN/USB.
- On a network, only together with the module board LAN/USB.

Data export:
- Online or offline output of the measurement data via RS232 interface to a PC.
- Export of result documentation as text files, ASCII files for importing into Excel spreadsheets, in the Q-DAS or the html format.

Order information

FISCHERSCOPE® MMS® PC instrument

	Slots	Order number
FISCHERSCOPE® MMS® PC base unit, with RS232, Centronics and multi-function connection, application software based on Windows® CE, AC line adapter (220Vac/12Vdc). The necessary module boards with the required measurement methods are listed below, a selection of measurement probes can be found on page 14.	8 free	603-381

Module boards	Connectable probes/ measuring stages	Required slots	Order number
Module board PERMASCOPE® MMS® PC For coating thickness measurements according to the magnetic induction method and the amplitude-sensitive eddy current method as well as the ferrite content measurement according to the magnetic induction method.	all magnetic induction E-probes all eddy current E-probes all dual probes (ED10, EDX10) all EGAB1.3*Fe probes	1	603-382
Module board NICKELSCOPE® MMS® PC For coating thickness measurements according to the magnetic method.	Probes of the type EN3	1	603-383
Module board BETASCOPE® MMS® PC For coating thickness measurements according to the beta-backscatter method.	Z6NG, Z9NG, Z11NG with all emitters, Z15NG	2	603-384
Module board SR-SCOPE® MMS® PC For copper thickness measurements on pc-boards according to the electrical micro-resistance method.	ERCU D10 ERCU N	1	603-385
Module board SIGMASCOPE®/PHASCOPE®1 for coating thickness and electrical conductivity measurements according to the phase sensitive eddy current method. Possible measurement frequencies: 60, 120, 240, 480 and 1250 kHz.	ESD20Zn (Zn/Fe; Cu/Fe), ESD20Cu, ESD20Ni, ESD2.4 ES40, ES40HF ES20, ES24	2	603-592
Module board SIGMASCOPE®/PHASCOPE®2 MMS® PC For measurements of the copper thickness in pc-board throughholes. This module board functions only together with the module board SIGMASCOPE®/PHASCOPE®1 (603-592).	ESL080B ESL080V	1 (3)	603-625
Module board PHASCOPE® DUPLEX MMS® PC For coating thickness measurements according to the magnetic induction method, amplitude sensitive and phase sensitive eddy current method.	ESG20	1	603-730
Module board TEMPERATURE MMS® PC For the temperature measurement using the temperature probe TF100 A.	Temperature probe TF100A	1	603-390
Module board COM2 MMS® PC With RS232 interface, to expand the instrument with a second RS232 interface.	Support stand V12-AM XY-stage	1	603-887
Module board LAN/USB MMS® PC With LAN-connection for connecting to a network (interface cable LAN J45, 603-397) or to a PC with a LAN card (interface cable LAN J45 twisted, 603-400), With 2 USB ports for connecting a printer with a USB port and for plugging in USB sticks.	No probe connection	1	603-391
Module board PCMCIA MMS® PC With a slot for PC cards for expanding the memory. In connection with the PC card adapter (603-395) also usable for CompactFlash cards.	No probe connection	1	603-392

Order information

Accessories general

	Order number
Support stand V12	602-260
Support stand V12-AM; support stand for motorized probe movement controllable from the MMS® PC	603-717
Interface cable MMS®/PC-AT-Set; for connecting the support stand V12-AM to the RS232 interface of the MMS® PC	602-220
Jig for angle probes; mounting device for the support stands V12 and V12-AM	600-077
Jig for inside probes; mounting device for the support stands V12 and V12-AM	601-691
Jig for 16 mm axial probes (e.g., for ET3.3, ESD1, ESD2, ESD3, ESC1, ESC2, ES2, S2, ...). Mounting device for the support stands V12/V12-AM.	600-213
Quick loading screw fixture	602-916
Interface cable ActiveSync; for the data exchange via the RS232 interface between the MMS® PC and a PC	603-396
Interface cable LAN RJ45; for integrating the MMS® PC into a network	603-397
Interface cable LAN RJ45 twisted; for connecting the MMS® PC to a PC with a LAN card	603-400
PC-Datex; Software for transferring data to an Excel spreadsheet	602-465
PC-Datacc; Software for transferring data to an Access database	603-028
Printer F6000; inkjet printer to be connected to the Centronics interface of the MMS® PC	603-409
PC-Card-Adapter for the module board PCMCIA MMS® PC; to hold CompactFlash cards	603-395
Contact point adapter MMS®; provides isolated signal outputs (relay) for obtaining specification limit information. Connection to the multi-function connector of the MMS® PC.	602-270
Pedal MMS®; for external triggering of the measurement data evaluation. Connection to the external start connector of the MMS® PC.	600-152
Power unit MMS® PC 100-240V (spare part)	603-480

Accessories module board BETASCOPE®

	Order number
Universal measuring stage Z6NG*	602-261
Measuring stage Z14NG*	602-250
Hand probe Z9NG*	600-460
Angle probe Z11NG*	600-471
Hand probe Z15NG; suitable only for beta emitter C-14	602-789
Supplemental kit for the universal measuring stage Z6NG	602-371
Adapter Beta 32 mm; adapter for the measuring stage Z6NG to hold an emitter or an aperture ring	600-550
Centering device for hand probe Z9NG	600-461

* Select the desired beta emitter from the following table.

Beta emitter

All available standard emitters are listed below. Additional aperture rings and special designs on request.

Designation	Aperture ring opening	Energy	Half life	Order number
PM-147	ø 0.63 mm	0.22 MeV	2.65 years	600-488
	0.63 x 1.2 mm			600-489
Tl-204	ø 0.63 mm	0.76 MeV	3.65 years	600-490
	0.63 x 1.2 mm			600-491
SR-90	ø 1.6 mm	2.27 MeV	28 years	600-492
C-14	ø 20 mm	0.156 MeV	5680 years	600-493

Probes

The applicability and accuracy of the measurement system is primarily a matter of the sensing element and of the probe quality. The Helmut Fischer Company provides a broad assortment of probes for varying measuring applications. The diversity of task requires the use of probes that differ in shape and construction. Application engineers of the Helmut Fischer Company develop special designs for specific measuring applications.

A selection of the available standard probes is compiled in the tables on the side. Additional probe types and designs as well as extensive information can be found in our probe data sheets.

Probe selection

In the end, the quality of the measurement technological solution is determined by the correct probe selection. Probe selection is based on several criteria:

- Material combination of coating and substrate materials.
  This determines the measurement method – magnetic, magnetic induction, eddy current or el. resistance – to be used.
- Thickness of coating and substrate material.
  The thickness of the substrate material is also relevant for the selection of the measurement method. The coating thickness determines the required measurement range of the probe.
- Geometric circumstances at the measurement location.
  The shape of the specimen is a determining factor for the probe design. Radial, axial and angle probes are available. These probe designs allow for easy measurements on interior and exterior surfaces of the specimen. An additional factor is the curvature of the measurement area.
- Roughness of the measurement area.
  This is a very important aspect in practical applications. Often, two-pole probes provide more accurate results on very rough surfaces than one-pole probes. The surface roughness is less influential for probes working according to the phase sensitive eddy current method than for those of other methods.

Magnetic induction probes for coating thickness measurements (NF, Iso/Fe)

Design	Designation	Measurement range	Order No.
	EGAB1.3*	0 – 2000 µm	601-793
	EGABI1.3-150	0 – 1000 µm	601-932
	EKB10	0 – 8 mm	602-225

Magnetic probes for coating thickness measurements

Design	Designation	Measurement range	Order No.
	EN3*	Ni/NF, Iso: 0 – 150 µm NF/Fe: 100 – 4000 µm	602-305

Eddy current probes for coating thickness measurements

Design	Designation	Measurement range	Order No.
	ETA3.3	0 – 1200 µm	601-797
	ETA3.3H	0 – 1200 µm	602-128
	EAW3.3	0 – 1200 µm	602-025
	EAI3.3-150	0 – 800 µm	602-026
	ETD3.3	0 – 800 µm	602-607
	EA30	0 – 20 mm	602-027
	ESD20Zn	Cu/Fe: 1 – 200 µm Zn/Fe: 2 – 200 µm	603-419
	ESD20Cu	Cu/Iso: 1 – 270 µm	603-417
	ESD20Ni	Ni/Fe: 2 – 100 µm	603-418
	ESL080B	5 – 80 µm	603-802
	ESL080V		603-968
	ESG20	Paint/Zn/Fe Paint: 2 – 500 µm galv. Zn: 2 – 100 µm Paint/Al: 5 – 2000 µm Zn/Fe: 2 – 600 µm	603-690

Resistance probe for coating thickness measurements (Cu/Iso)

Design	Designation	Measurement range	Order No.
	ERCU N	0.1 – 10 µm 5 – 120 µm	603-220
	ERCU D10	0.1 – 10 µm 5 – 200 µm	603-387

NF: nonferromagnetic material; Iso: nonmetallic material, insulating materials
Cable lengths: 1.5 m, longer cables on request.
** Also available as an angle probe, design like EAW3.3.*

Adjustment of the measurement system to the specimen

The material properties and the shape of the specimen is taken into account using a calibration. Here, calibration refers to the adjustment of the measurement system (probe and instrument) to the specimen. Essentially, the calibration takes into account the magnetic properties (permeability) or the electrical conductivity, respectively, as well as the shape of the part. These measurement application specific calibration parameters are stored in the respective applications (measurement application files).

Eddy current probes for the measurement of the el. conductivity

Design	Designation	Measurement range	Order No.
	ES40	0.3 – 63 MS/m 0.5 – 108 %IACS	603-235
	ES24	0.3 – 63 MS/m 0.5 – 108 %IACS	603-888

Magnetic induction probe for the measurement of the ferrite content

Design	Designation	Measurement range	Order No
	EGAB1.3-Fe*	0 – 80 Fe% (Ferrite %) 0 – 110 WCR (Ferrite no.)	602-221

*Cable lengths: 1.5 m, longer cables on request. * Also available as an angle probe, design like EAW3.3.*

Special probe designs for specific measurement applications

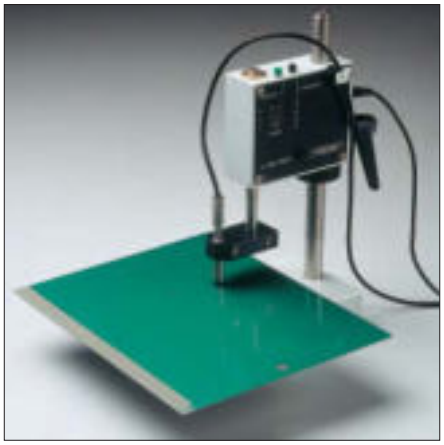
Measuring head with load-free probe positioning to avoid errors caused by the deformation when placing the probe on the specimen surface. Suitable for automated measurements on mass-produced parts, strip, metal sheets, etc. and for the thickness measurement of soft coatings. Simple integration into production lines for 100% testing.

F&B container measuring system TM85 for the measurement of paint coatings on the inside and outside of aluminum tubes and cans.

Piston ring measuring stage V4EKB4 for the measurement of, for example, chrome coatings on piston and oil scraper rings.

Measurement aids

Measurement aids are used for better positioning of the probe on the specimen. Three measurement aids are shown here as examples of our extensive assortment. Additional measurement aids on request.



Support stand V12-AM, to be controlled from the MMS® PC, for automated measurements. Functions that can be controlled: Stroke between the placed and the lifted probe, contact duration of the probe, selectable number of cyclical measurements (1 to unlimited = continuous operation).

Support stand V12 with prism stage (optional) and probe jig 601-691 for supporting the inside probe EGABI1.3-150.

Quick loading screw fixture for the precise measurement of the coating thickness of metallic fasteners according to DIN ISO 4042.

Application-specific instrument configuration

Module board PHASCOPE® DUPLEX for coating thickness measurements in connection with the probe ESG20

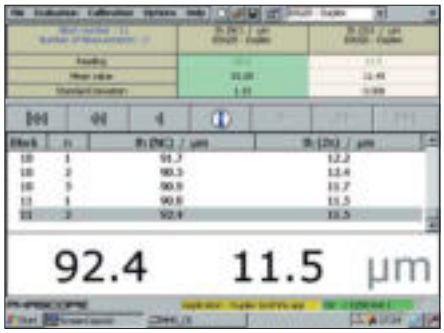
This module board includes 3 measurement methods: magnetic induction method (ISO 2178), amplitude sensitive eddy current (ISO 2360) and phase sensitive eddy current method (ISO 21968).

Applications in the areas:

- Galvanizing
- Automotive industry
- Paint manufacturing and application
- Aeronautics, steel and metal construction
- Electroplating

Measurement of the individual thicknesses of a lacquer-zinc coating system (duplex coating) on steel or iron – DUPLEX mode

- The measurement of the individual thickness occurs in one measurement step.
  - Excellent repeatability precision when measuring thin zinc coatings or ZnAl coatings, preferably starting at a thickness of about 2 µm.
  - Zinc alloy coatings such as ZnNi can be measured with some limitations due to their poor electrical conductivity.
  - Hot-dip galvanized coatings with distinctive diffusion layers that exhibit a different electrical conductivity from that of pure zinc coatings cannot be measured.

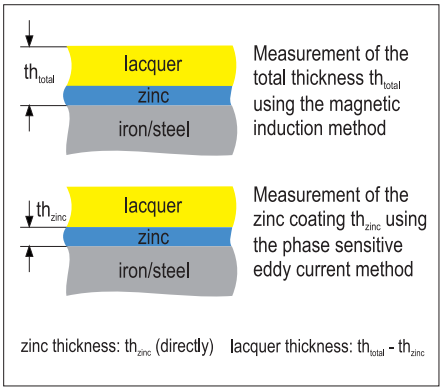


Using the ESG20 duplex measurement probe, the individual coating thicknesses of Zn and lacquer are presented next to each other on the instrument display. Here, the readings are shown in the numeric display.

Operational principles of the measurement methods

Duplex mode

The magnetic induction method (DIN EN ISO 2178) and the phase sensitive eddy current method (DIN EN ISO 21968) are used to measure the lacquer and zinc coatings. The operational principles of these two measurement methods are described on Pages 4 and 5.



The two methods are used parallel such that in one measurement step, the individual coating thickness of lacquer and zinc are computed and displayed from the two readings.

Typical applications are quality control of auto body paints, brake lines, shopping carts and many more.

Measurement of paint coatings on steel and iron or on nonferrous metals – DUAL mode

- Measurement of electrically nonconducting coatings on nonferrous metals: e.g., lacquer, paint, plastic on aluminum, zinc, brass, etc.
- Thickness measurement of anodized coatings on aluminum.
- Measurement of electrically nonconducting coatings on magnetic substrate materials: e.g., lacquer, paint, plastic on steel and iron.
- Measurement of nonferrous metal coatings on magnetic substrate materials: e.g., aluminum, copper, brass, chrome, tin on steel or iron.

Measurement of a paint coating on aluminum using the probe ESG20 in DUAL mode. Here, the readings are shown in the specification limit display.

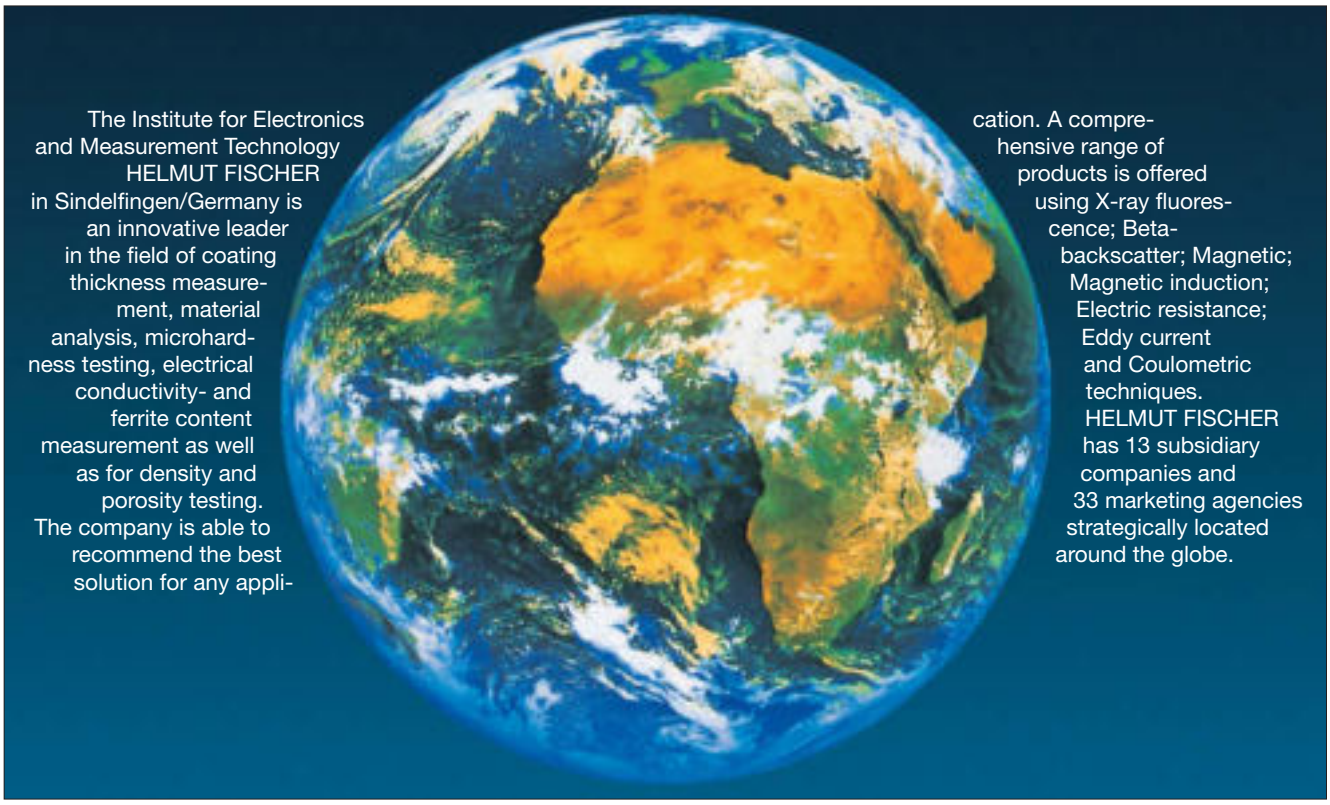
DUAL mode

The measurement of the thickness of individual coatings or the total thickness of duplex coatings on iron or steel is carried out according to the magnetic induction method (ISO 2178). The measurement of electrically nonconducting coatings on nonferrous metals is carried out according to the amplitude sensitive eddy current method (ISO 2360). The operational principles of these two measurement methods are described on Page 4.

In the DUAL mode, the measurement method appropriate for the respective substrate material is used automatically when making measurements. In this manner, the same probe can be used to measure the coating thickness regardless whether the coating has been applied to a magnetic or a nonmagnetic substrate material.

A description of the probe ESG20 can be found on Page 14.

Active around the world



The Institute for Electronics and Measurement Technology HELMUT FISCHER in Sindelfingen/Germany is an innovative leader in the field of coating thickness measurement, material analysis, microhardness testing, electrical conductivity- and ferrite content measurement as well as for density and porosity testing. The company is able to recommend the best solution for any application. A comprehensive range of products is offered using X-ray fluorescence; Beta-backscatter; Magnetic; Magnetic induction; Electric resistance; Eddy current and Coulometric techniques. HELMUT FISCHER has 13 subsidiary companies and 33 marketing agencies strategically located around the globe.

FISCHERSCOPE® X-RAY XDLM® for coating thickness measurements according to the x-ray fluorescence method.

The information provided in this brochure contains general descriptions or features, which may not apply in the described way to a concrete application, or which may change due to continued development of the products. The desired features are binding only if they have been expressly agreed upon in the contract.

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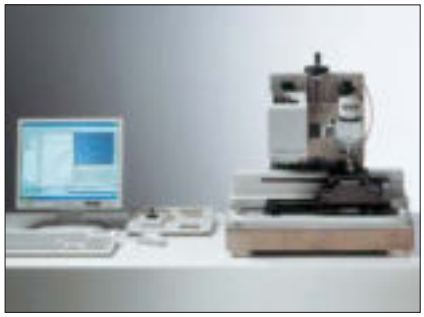

Microhardness test instrument FISCHERSCOPE® HM2000 for testing the hardness according to ISO 14577.

The high level of quality of HELMUT FISCHER instruments is marked by the cooperation with sophisticated partners.

HELMUT FISCHER is a reliable and competent partner, with appropriate consultation, extensive service and practical training events.

HELMUT FISCHER measuring instruments are employed with great success in industry and research, in all areas of technology.

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