

Coating thickness measurement



MiniTest 3100

Measurement of

- non-magnetic coatings (e.g. paint, zinc) on steel
- insulating coatings (e.g. paint, anodising coatings) on non-ferrous metals
- non-ferrous metal coatings on insulating substrates

Wear-resistant probes for multi-purpose use
High accuracy and reproducibility
Storage and documentation of readings

Coating thickness measurement with MiniTest

For more than 60 years now, ElektroPhysik has developed and produced an extensive range of precision measuring instruments for surface treatment. Being a pioneer in the field of non-destructive coating thickness measurement, ElektroPhysik in cooperation with national and international standardising bodies, research institutes and universities has successfully advanced the worldwide standardisation of coating thickness measurement. Numerous patents underline ElektroPhysik's position as a leading manufacturer.

MiniTest 3100

Application

The MiniTest gauge is a small universal gauge designed for non-destructive coating thickness measurement. For many years, automotive, ship-building, aircraft and machine manufacturers as well as government departments, inspectors, consultants and the paint and electroplating industry have used ElektroPhysik coating thickness gauges. Well-known automotive producers and leading manufacturers of nearly all branches of industry entrust ElektroPhysik gauges with their quality assurance.

Description

The MiniTest 3100 offers different possibilities of processing of measuring values. Different probes are available which can be connected. In order to select the "right" probe, the thickness of the coating to be measured as well as that of the substrate and the geometry have to be taken into consideration. ElektroPhysik offers a range of probes suitable for standard as well as for special applications. For measurements on steel, the magnetic induction principle is used allowing measurement of all insulating coatings, e.g. paint, enamel etc., and non-ferrous metals on steel and ferrous metals. Probes working on the magnetic induction principle are referred to as F-probes. For measurements of insulating coatings on non-ferrous metals, the eddy current principle is used. Probes working on this principle are referred to as N-probes.

Technical data

- All probes can be connected
- RS 232 interface for portable data printer MiniPrint 4100 or PC
- Calibration with one or two foils

MiniTest 3100 possesses a total memory capacity of 10,000 readings and the possibility to store readings in 10 application memories with 10 batches each. A calibration once performed remains in the application memory. Statistical evaluation of a measuring series allows the user to assess the coating with mean value, max., min., standard deviation and number of readings taken within one measuring series.

DIN EN ISO 9000 ff./QS 9000/ISO/IEC 17025 (Guide 25)

Documentation and data analysis according to DIN EN ISO 9000 ff./QS 9000/ISO/IEC 17025 (Guide 25) requires to meet strictly defined rules and standards.

Therefore, when choosing a gauge for measuring coating thickness, in addition to evaluating the gauge's processing capabilities, consideration specifically to its high resolution and reproducibility capabilities should be focused on as well.

ElektroPhysik's MiniTest 3100 coating thickness testing gauge provides both high resolution (up to 0.1 microns/0.01 mils in the 1...100 microns/0...10 mils thickness range), as well as application-oriented memory capabilities with comprehensive statistical calculations of a series of measurements.

MiniTest standard probes – special probes

The probe is the core component of the coating thickness gauge. In order to meet the various requirements of our customers, probes for the most common applications are part of our range of products. For extraordinary measuring tasks, customer-made probes are available.

ElektroPhysik probes are the result of a combination of modern production technologies as well as of a surface treatment know-how from more than 60 years.

Intelligent probes

ElektroPhysik has developed a concept of “intelligent probes” allowing working with another probe connected to the same gauge if the measuring task alters.

The characteristic curve of the probe is stored in the probe connector and evaluated by the gauge’s microprocessor. It is thus possible to program characteristic curves specified to the customer’s application, e.g. special alloys, special geometries etc.

Wearing protection

For the production of its probes, ElektroPhysik uses precision production procedures from the field of horology. To ensure a long life, the probes are protected through construction features, thus avoiding traces of wear even after years of use. The use of materials such as e.g. rubies, hard metal or special alloys used in tool manufacture protects the contacting measuring pole against wear. The surface of the measuring pole is polished, thus offering to measure even on sensitive measuring objects without leaving any traces.

Newly developed universal probes

Especially for users taking measurements on steel and on non-ferrous metals, ElektroPhysik offers newly developed FN-universal probes which solve both measuring tasks with only one probe.

Why is calibration necessary?

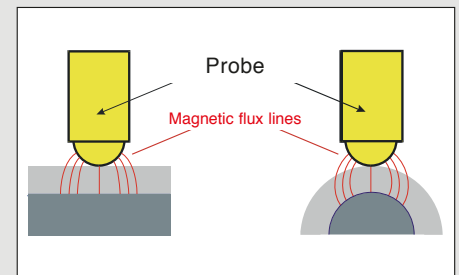
In order to adapt the probe to the individual measuring task in the best possible way, a calibration can be carried out. This calibration serves to compensate for influences exerted by the coating or the substrate as well as by the geometry of the object to be measured and improves the measuring accuracy.

Special features

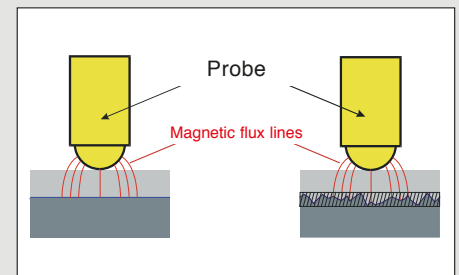
When taking measurements on curved surfaces, the probe can be adapted to the geometry of the object to be measured by means of calibration. The influence of the geometry on the measuring values is thus eliminated.

When taking measurements on rough surfaces, a special feature of the MiniTest serves to compensate for the higher measuring uncertainty which is due to physical reasons.

For measurements on surfaces with high temperature, special probes are available which can briefly be used for temperatures up to 350 °C.













Magnetic flux lines on curved surfaces







Magnetic flux lines on rough surfaces

MiniTest FN- und F-probes

Probe type	Measuring range/ Minimum area for measurement	Application	Illustrations
FN 1.6	0 ... 1600 μm \varnothing 5 mm	non-magnetic coatings on steel and insulating coatings on non-ferrous metal, high resolution (0.1 μm) in the lower part of the measuring range	
FN 1.6 P	0 ... 1600 μm \varnothing 30 mm	powder coatings before baking on steel and non-ferrous metal	
FN 1.6/90	0 ... 1600 μm \varnothing 5 mm	non-magnetic coatings on steel and insulating coatings on non-ferrous metal, especially appropriate for measurements in tubes and pipes or objects which are difficult to access, high resolution (0.1 μm) in the lower part of the measuring range	
FN 2/90	0 ... 2000 μm \varnothing 5 mm		
F 05	0 ... 500 μm \varnothing 3 mm	extremely thin metal, oxide or paint coatings on small steel objects high resolution (0.1 μm) in the lower part of the measuring range	
F 1.6	0 ... 1600 μm \varnothing 5 mm	non-magnetic coatings on steel high resolution (0.1 μm) in the lower part of the measuring range	
F 3	0 ... 3000 μm \varnothing 5 mm	non-magnetic coatings on steel, thick paint and enamel coatings	
F 1.6/90	0 ... 1600 μm \varnothing 5 mm	non-magnetic coatings on steel, especially appropriate for measurements in tubes and pipes or objects which are difficult to access; high resolution (0.1 μm) in the lower part of the measuring range	
F 2/90	0 ... 2000 μm \varnothing 5 mm		
F 10	0 ... 10 mm \varnothing 20 mm	anticorrosive coatings in tanks and pipe construction, e.g. glass, plastics, rubber and concrete on steel	
F 20	0 ... 20 mm \varnothing 40 mm	anticorrosive coatings in tanks and pipe construction, e.g. glass, plastics, rubber and concrete on steel	
F 50	0 ... 50 mm \varnothing 300 mm	anticorrosive coatings in tanks and pipe construction, e.g. glass, plastics, rubber and concrete on steel, antinoise coatings	

MiniTest FN- and CN-probes

Probe type	Measuring range/ Minimum area for measurement	Application	Illustrations
N 08 CR	0 ... 80 μm \varnothing 5 mm	extremely thin chrome coatings on copper	
N 02	0 ... 200 μm \varnothing 2 mm	extremely thin insulating coatings, e. g. paint or anodising coatings on non-ferrous metal high resolution (0.1 μm) in the lower part of the measuring range	
N 1.6	0 ... 1600 μm \varnothing 5 mm	thin insulating coatings, e. g. paint or anodising coatings on non-ferrous metal high resolution (0.1 μm) in the lower part of the measuring range	
N 1.6/90 N 2/90	0 ... 1600 μm \varnothing 5 mm 0 ... 2000 μm \varnothing 5 mm	thin insulating coatings, e. g. paint or anodising coatings on non-ferrous metal especially appropriate for measurements in tubes and pipes or objects which are difficult to access; high resolution (0.1 μm) in the lower part of the measuring range	
N 10	0 ... 10 mm \varnothing 50 mm	insulating coatings, e. g. rubber, plastics, glass, on non-ferrous metal	
N 20	0 ... 20 mm \varnothing 70 mm	insulating coatings, e. g. rubber, plastics, glass, \varnothing 70 mm on non-ferrous metal	
N 100	0 ... 100 mm \varnothing 200 mm	insulating coatings, e. g. rubber, plastics, glass, compounds etc., on non-ferrous metal	
CN 02	10 ... 200 μm \varnothing 7 mm	copper coatings on insulating substrates	

Accessories MiniTest

	Illustrations
<p>MiniPrint 4100 portable data printer, connected to the gauge without cable, for print-out of measuring values and statistics, with built-in accumulator battery and charger</p>	 A red, compact, rectangular portable data printer with a roll of paper emerging from the top.
<p>Rubber case with mounting device to protect against mechanical shocks on-site</p>	 A black rubber case with various straps and mounting hardware, including a shoulder strap and a wrist strap.
<p>Twin case for gauge and printer</p>	 A black carrying case with a red MiniTest 4100 gauge and printer inside, secured with straps.
<p>PC evaluation program MSoft7000 basic edition for data transfer and MSOFT 41 for processing of measuring values, statistics and histograms</p>	 A computer monitor displaying a software interface next to a red MiniTest 4100 gauge connected to the PC.
<p>NiCd accumulator battery with charger 230 V</p>	 A black NiCd accumulator battery and its corresponding 230V charger, with a VARTA battery visible.
<p>Precision support for measurements in production or on small parts</p>	 A precision support stand with a gauge mounted on it, used for measurements on small parts.
<p>Calibration foils with thicknesses ranging from 10 μm up to 8 mm Option: Manufacturer's certificates M according to DIN 55350 part 18 proving the accuracy of calibration foils and/or gauge</p>	 A collection of calibration foils of various thicknesses and materials, with labels indicating their specifications.

Technical data

Probes		Measuring range	Low range resolution	Guaranteed tolerance (of reading) ¹⁾	Minimum radius of curvature (convex/concave)	Minimum area for measurement	Minimum substrate thickness	Dimension in mm
Universal probes	FN 1.6	0 ... 1600 µm	0.1 µm	± (1% + 1 µm)	1,5 mm / 10 mm	Ø 5 mm	F 0.5 mm/N 50µm	Ø 15x62
	FN 1.6 P	0 ... 1600 µm	0.1 µm	± (1% + 1 µm)	only on flat surfaces	Ø 30 mm	F 0.5 mm/N 50µm	Ø 21x89
Magnetic induction	FN 1.6/90 Internal pipe probe	0 ... 1600 µm	0.1 µm	± (1% + 1 µm)	flat / 6 mm	Ø 5 mm	F 0.5 mm/N 50µm	Ø 8x11x159
	FN 2/90 Internal pipe probe	0 ... 2000 µm	0.2 µm	± (1% + 1 µm)	flat / 6 mm	Ø 5 mm	F 0.5 mm/N 50µm	Ø 8x11x159
	F 05	0 ... 500 µm	0.1 µm	± (1% + 0,7 µm)	0,75 mm / 5 mm	Ø 3 mm	0.1 mm	Ø 12x49
	F 1.6	0 ... 1600 µm	0.1 µm	± (1% + 1 µm)	1,5 mm / 10 mm	Ø 5 mm	0.5 mm	Ø 15x62
	F 3*	0 ... 3000 µm	0.2 µm	± (1% + 1 µm)	1,5 mm / 10 mm	Ø 5 mm	0.5 mm	Ø 15x62
	F 1.6/90	0 ... 1600 µm	0.1 µm	± (1% + 1 µm)	flat / 6 mm	Ø 5 mm	0.5 mm	Ø 8x11x159
	F 2/90	0 ... 2000 µm	0.2 µm	± (1% + 1 µm)	flat / 6 mm	Ø 5 mm	0.5 mm	Ø 8x11x159
	F 10	0 ... 10 mm	5 µm	± (1% + 10 µm)	5 mm / 16 mm	Ø 20 mm	1 mm	Ø 25x46
	F 20	0 ... 20 mm	10 µm	± (1% + 10 µm)	10 mm / 30 mm	Ø 40 mm	2 mm	Ø 40x65
	F 50	0 ... 50 mm	10 µm	± (3% + 50 µm)	50 mm / 200 mm	Ø 300 mm	2 mm	Ø 45x70
Eddy current principle	N08 CR	0 ... 80 µm	0.1 µm	± (1% + 1 µm)	2.5 mm / 10 mm	Ø 5 mm	≥ 100 µm Cu	Ø 16x70
	N 02	0 ... 200 µm	0.1 µm	± (1% + 0,5 µm)	1 mm / 5 mm	Ø 2 mm	50 µm	Ø 16x70
	N 1.6	0 ... 1600 µm	0.1 µm	± (1% + 1 µm)	1.5 mm / 10 mm	Ø 5 mm	50 µm	Ø 15x62
	N 1.6/90 Internal pipe probe	0 ... 1600 µm	0.1 µm	± (1% + 1 µm)	flat / 6 mm	Ø 5 mm	50 µm	Ø 8x11x159
	N 2/90 Internal pipe probe	0 ... 2000 µm	0.2 µm	± (1% + 1 µm)	flat / 6 mm	Ø 5 mm	50 µm	Ø 8x11x159
	N 10	0 ... 10 mm	10 µm	± (1% + 25 µm)	25 mm / 100 mm	Ø 50 mm	50 µm	Ø 60x50
	N 20	0 ... 20 mm	10 µm	± (1% + 50 µm)	25 mm / 100 mm	Ø 70 mm	50 µm	Ø 65x75
	N 100	0 ... 100 mm	100 µm	± (1% + 0,3 mm)	100 mm / flat	Ø 200 mm	50 µm	Ø 126x155
CN 02 ²⁾ for Cu coatings on insulating substrates	10 ... 200 µm	0.2 µm	± (3% + 1 µm)	only on flat surfaces	Ø 7 mm	at choice	Ø 17x80	

Power supply: 1 x 9 V alkaline battery, AC adapter

Battery life: 10,000 measurements

Conforming: DIN 50981, 50982, 50984,

standards: ISO 2178, 2360/BS 5411/ASTM B499, B244 – CE

¹⁾ Relating to the supplied standards under laboratory conditions ²⁾ A different copper composition of our standards and the object to be measured requires a reference standard to be prepared (e.g. cross cut)

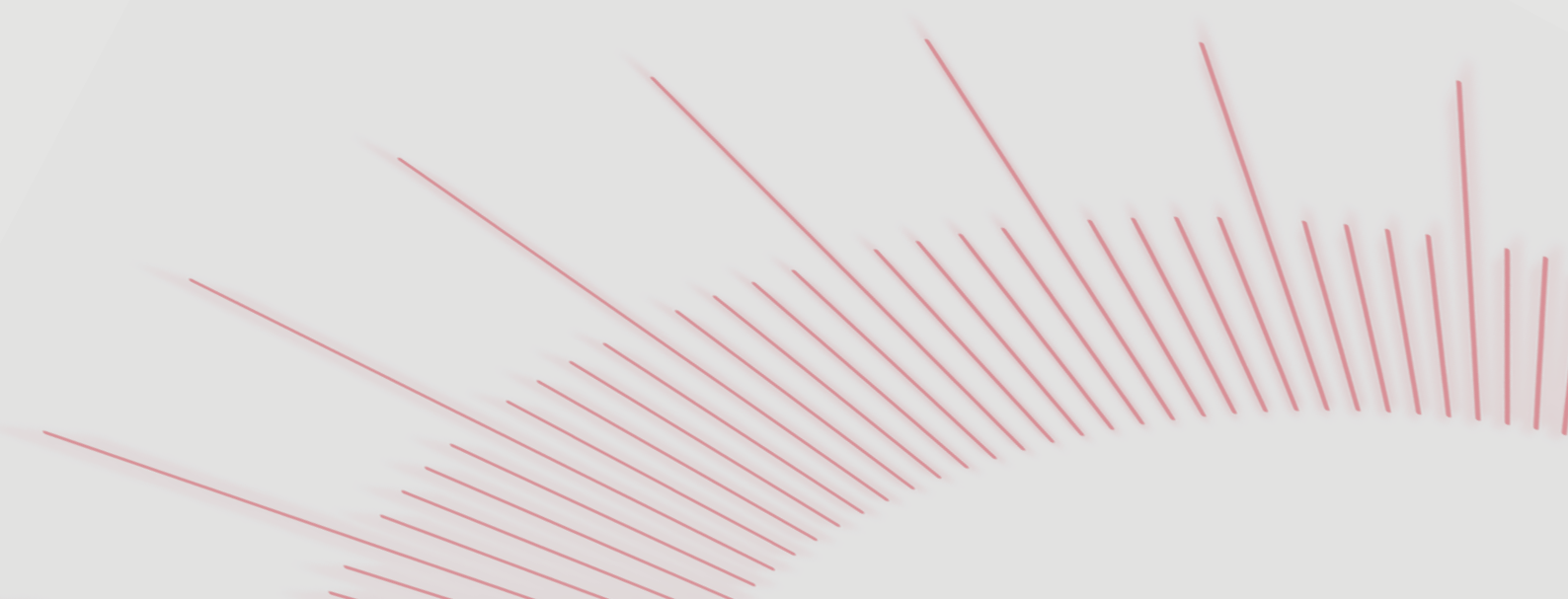
Ambient temperature:

Gauge: 0...50°C; Probe: -10°C...70°C, briefly 120°C

Dimensions/weight: 150 mm x 82 mm x 35 mm/270 g

*Probes for high temperatures up to 350°C

available (measuring range 0...2,000 µm)



Features

MiniTest Memory capacity

Number of application memories	10
Number of batches for each application memory	10
Number of batches with individual value memories	max. 100
Total memory capacity for individual readings	10,000

Statistics

From single values: \bar{x} , σ , kvar, n, max., min.
From single values: \bar{x} , σ , kvar, n, max., min., CP, CPK
Block statistics: \bar{x} , σ , kvar, n, max., min.
Block statistics: \bar{x} , σ , kvar, n, max., min., CP, CPK
From all subgroups (BATCH) in the same application (APPL)
Print values and statistics separately to APPL-BATCH groups
Display and print-out of date and time at the time of print-out and measurement (year, month, day, hour, minute)

Calibration methods

Calibration through a coating (CTC)
Measurement on rough surfaces. The influence of roughness can nearly be eliminated
OFFSET function adds or subtracts a constant value
External function (trigger) to transfer readings to the memory
Key lock to protect calibration
Readings are saved during battery replacement
Limit setting
Measurements in microns or mils
Continuous measuring mode with high speed readings to identify minimum and maximum values
Selectable stabilising procedure in continuous mode for quick display (7 readings/s)
Data transfer with floating or fixed decimal point
Reading of measuring values without probe being connected
Later print-out of single values of one batch
Display of minimum value in continuous mode

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