MetaScope 4

User manual

MetaScope 4 is a device used to measure tin, silver and nickel layers on copper wires based on a coulometric technique. The charge required to dissolve the layer in electrolyte is measured and is proportional to the defined wire surface for the layer concerned.

Content

1. Scope of supply

- Measuring device with a 7“ touchscreen
- Electrolysis appliance with
    - magnetic stirrer
    - glass beaker
    - lowering mechanism for the wire sample

The device functions based on the method specified in DIN EN ISO 21771.

(DIN EN ISO 2177:2004-08, Metallic coatings – Measurement of coating thickness – Coulometric method by anodic dissolution (ISO 2177:2003))

Also required:

- 1 beaker min. 800 ml
- 1 ruler, min 30 cm
- 1 measuring hook

2. Commissioning

- Set up the device on the support handle and place the magnetic stirrer next to it.
- Remove the screw-on cover for the USB port.
- Insert the enclosed USB stick into the USB port (if it has not been inserted already).
- Screw the screw cap of the USB port back on. The cap protects the USB stick and the USB port. The device also works without the USB stick, but parameter files and measurement results are saved there as a backup if required.

- Insert the magnetic stirrer‘s round connector into the corresponding jack on the left-hand side of the MetaScope4. In doing so, take care with the notch on the side and fasten the connector into position with the union nut.
- Connect the device to the mains.
- Press the switch on the right-hand side. The ring light will turn green.

3. The electrolysis device

Elektrolyte for tinned wires:
chemically pure hydrochloric acid 1:4 mixed with distilled water
Elektrolyte for nickel-plated wires:
chemically pure hydrochloric acid 1:9 mixed with distilled water
Elektrolyte for silver-plated wires:
100 g potassium fluoride and fill to 1,000 ml with distilled water

Preparation of elektrolyte for tinned wires:
A quantity of 1 liter should contain:

- 800 ml of distilled water
- 200 ml of hydrochloric acid 37%

Fill the hydrochloric acid into the water and stir ingredients with a glass rod.
Do apply all necessary safety measures such as protective gloves and goggles!
Please observe the warnings and safety information provided by the manufacturer and the local regulations on the specified electrolytes!

Filling of measuring device:
Insert the cathode sheet (negative pole) into the beaker. Fill it up with the hydrochloric acid mixture (mixing ratio 1:4). Adhere to the maximum fill level (overtopping the cathode sheet by 1cm at the most).
Do apply all necessary safety measures such as protective gloves and goggles!

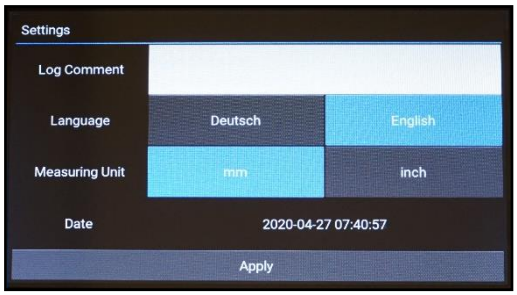
4. Measuring process

Setup procedure

Four parameters are required to take a measurement:

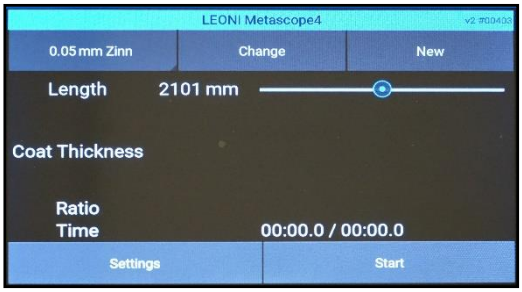
- **Coating material** on the sample
- **Wire diameter** for the sample (from ... to; as per input values)
- **Length** of the wire sample
- **Stirring speed**

The surface area of the wire sample is calculated by multiplying the length by its diameter. As the surface area needs to lie within a certain range for the layer thickness measurement, the software restricts the input values in relation to one another and adjusts the measurement current to the surface area.

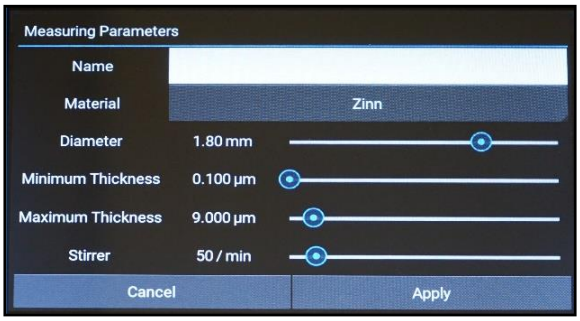


Switch on device.

Go to „Einstellungen/Settings“ and select relevant language as well as measuring unit.



Choose „Change“ when startup screen is displayed.



The values can be set either using the sliders or entering the value using an on-screen keyboard.
Select type of coating to be examined (AG – SN – NI).
Define and set diameter.

Set minimum plating thickness to 0.1 µm.
Set maximum plating thickness to be 2-3 µm more than target value.
Setting for magnetic stirrer: 50/min.

„Apply“.

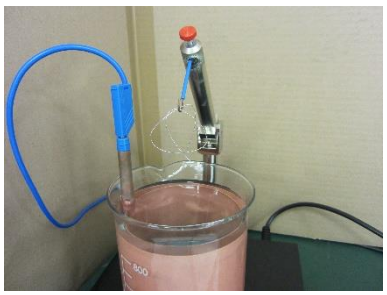
Note:
If the maximum and minimum layer thickness is set to 0, the measured thickness will be merely displayed and not evaluated. If limiting values have been entered, the software compares the measured layer thickness with the maximum and minimum values. If these values are exceeded, the background colour for the measurement reading changes to red (FAIL). If the measurement reading lies within the limits, the background is green (PASS).

Operating screen appears and indicates required gauge length.

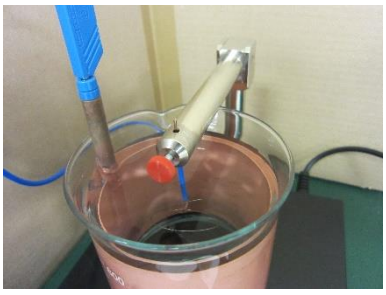
Let the device warm up for about 5 minutes first!

Diameters below 1.20 mm

Diameters below 1.20 mm are to be measured with the hook. The respective wire sample has to be cut to a suitable size depending upon its diameter (with the default value shown in the display of the device). A ring is to be formed from this.



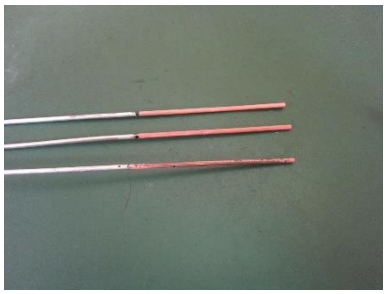
Right after drawing, the material has to be degreased before being put into the beaker (use spirit or the like).
Put the wire into the beaker as shown in the picture below.



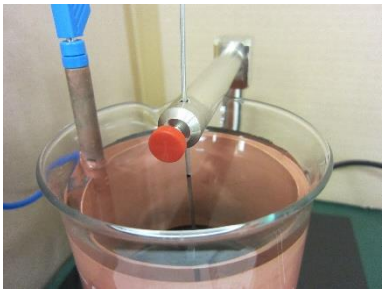
Please ensure that the wire does not come into contact with the cathode sheet during the measuring process.

Diameters over 1.20 mm

Diameters over 1.20 mm are to be fixed right over the hole with a screw.
The measuring length is shown in the display of the device.
Mark the test sample with a waterproof pen.
Immerse as far as the lower edge of the marking.



The picture above shows the following:
Top – Test sample is properly fixed
Center and bottom – Wrong fixation, as can be seen from the blurred marking.



The picture above shows an ideal fixation.
Please ensure that the wire does not come into contact with the cathode sheet during the measuring process.

The tin-plating thickness is shown on the display in micrometers Mikrometer (µm).

Initiate the measurement by pressing the „Start“ button.

Important: The beaker must not be moved during the measuring process!

The hydrochloric acid should be exchanged as a function of the application. Depending on the plating thickness, this corresponds to about 30 measurements.
All wire samples thinner than 0.10 mm should generally be treated with fresh acid and require a precedent degreasing cycle!
When the device is not in use, the copper sheet has to be removed from the acid and to be cleaned.
As the sample holder (measuring hook) is affected by the measuring process, it must be replaced periodically.

Clean up:
The cathode sheet must be cleaned upon reaching a certain level of contamination. This ensures consistent test conditions. Dip the cathode sheet into nitric acid and rinse it. 500 ml of nitric acid (65%) and 500 ml of distilled water are required per liter. **Never leave your workplace during the cleaning process as this may result in the acid mixture boiling over (very high risk of injury!). In addition, the emerging fumes must be exhausted on the spot!**
Once the cathode sheets have been cleaned they must not be exposed to air since this would lead to immediate oxidation.

5. General information

Intended use

MetaScope4 was developed to measure the thickness of tin, silver and nickel layers on copper wires. Any other use is not permitted and releases the manufacturer from any warranty and liability.

Warranty

Any warranty is voided if the specifications in the operating instructions are not observed, modifications are made or the device or parts are replaced with ones which do not meet the original specifications. The same applies in the event of incorrect operation or non-compliance with installation conditions or transport damage.

Danger to human health and the environment

Hydrochloric acid and potassium fluoride, the chemicals required for electrolysis, may cause damage to health if they are inhaled or ingested or come into contact with the skin. Observe the manufacturers' data sheets. When diluting hydrochloric acid, always pour the acid into the distilled water and not the other way round!

Response in the event of faults

Switch the MetaScope4 off and, when necessary, disconnect the mains plug immediately if the device makes unusual noises or emits strange odours. Do not open the device yourself. Contact the manufacturer.

How to clean the device

Since all the metallic parts of the magnetic stirrer, of the electronic measuring equipment and all the connectors are heavily exposed to chemicals, with the surfaces oxidizing, they should be wiped with a damp cloth once a day. At longer intervals, we recommend a thorough cleaning, in order to enhance the life span of your MetaScope4. You may run the risk of the device failing in the event of over-oxidization! In this case the manufacturer will not provide any warranty.

6. Protective measures and rules of conduct

- Wear suitable protective clothing, protective gloves and safety glasses / face protection while working.
- Do not inhale substances.
- Avoid vapours and aerosols.
- Avoid contact with the skin.
- Use binders to collect impure chemical residues in a suitable container.
- They must not enter waste water, water courses or the ground.
- Do not smoke, eat or drink at the workstation.
- Causes chemical burns.
- In cause of eye contact:
  Rinse eye with plenty of water with the eye lid open (eye shower).
- Ingestion:
  Drink plenty of water. Do not induce vomitin. Call a doctor.

Must not be stored or brought into contact with: alkali metals, alkaline compounds, ammonia, alkaline earth metals, alkaline earth metal compounds, alkaline solutions/bases, acids, metals, metal alloys, phosphorus, phosphorus oxides, hydrides, interhalogen compounds, halogen oxides, permanganates, nitrates, carbides, flammable substances, organic solvents, acetylides, nitriles, organic nitro compounds, anilines, peroxides, picrates, nitrides and lithium silicide.

7. Technical data

Measuring device

Dimensions:	W320 x H85 x D170 mm
Weight:	3.5 kg
Operating temperature:	15 °C – 35 °C
TFT touch display:	7 inch capacitive
	800 x 480 pixels, colour
Power connection:	100 – 240 V, 50 – 60 Hz
Hz Output:	max. 75 W
Connections:	M12 connectors
	8-pole
	USB socket type A
Measurement range:	0.2 – 30 µm

Magnetic stirrer

Material:	PVC, black
Dimensions:	W210 x H140 x D330 mm
Weight:	2.3 kg
Lowering mechanism:	brass, nickel-plated
Agitator:	stepper motor with rod magnet
Recess for glass beaker:	Ø 107 mm
Connection:	1 m cable with 8-pole
	angled M12 jack

Date: June 2020

Technical changes reserved.

Recommendation:

We recommend having your MetaScope 4 calibrated every year to ensure its accuracy of measurement.

Our service partner will be pleased to help you with calibrations, repairs and ordering accessories:

Gesellschaft für Test Systeme mbH
Eresburgstraße 24-29
12103 Berlin
Phone: +49 30 7478-1807
Fax: +49 30 7478-1808
info@gts-online.net

Accessories available for MetaScope 4:

Electrolytes on request
Item no. 21166 – copper electrode
Item no. 21189 – glass beaker, 1,000 ml
Item no. 21190 – magnetic stirring rod, 6x30, cylindrical, PTFE

Clamp for small wires: