GOSSEN METRAWATT

Operating Instructions

3-349-346-03
3/3.11

METRISO®5024

Insulation and Resistance Measuring Instrument with Voltage Measuring Range

Figure 1 Controls

1 Measuring probe on housing (positive pole)
2 Scale
2a Adjusting screw for mechanical zero balancing
3 **Rotary switch** for
– Ω : Low-resistance measurement (toggle switch in Ω position)
– 100 V/250 V/500 V:
Toggle switch in neutral position:
• Voltage measurement
• Test for absence of voltage and discharge capacitive DUTs
Toggle switch in MΩ position:
• Insulation measurement with the selected test voltage
4 **Toggle switch** for switching amongst V, Ω and MΩ
(with illuminated scale when Ω or MΩ is selected)
5 Carrying strap
6 Battery compartment
7 Detaining fork
8 Test probe on coil cord (negative pole)
9 Opening for securing the test probe
10 LED for indicating device and battery status
(see chapter 4.2 and 4.3)

Meanings of symbols on the instrument:


Indicates EC conformity


Continuous, doubled or reinforced insulation


Warning concerning a source of danger
(attention: observe documentation!)

CAT II **Maximum allowable voltage** between the test probes (1 and 8) and earth is **600 V, category II**.


This device may not be disposed of with the trash. Further information regarding the WEEE mark can be accessed on the Internet at www.gossenmetrawatt.com by entering the search term 'WEEE'.

Table of Contents Page

1 Safety Precautions

The METRISO 5024 insulation measuring instrument is manufactured and tested in accordance with the following standards:
IEC 61010-1/EN 61010-1/VDE 0411-1,
IEC 61557-2/EN 61557-2/VDE 0413-2
IEC 61557-4/EN 61557-4/VDE 0413-4
IEC 61326-1/EN 61326-1
IEC 61000-4-2/EN 61000-4-2
IEC 61000-4-3/EN 61000-4-3
IEC 61000-4-4/EN 61000-4-4
IEC 61000-4-5/EN 61000-4-5
IEC 61000-4-6/EN 61000-4-6
IEC 61000-4-8/EN 61000-4-8
In order to maintain flawless technical safety conditions, and to assure safe use, it is imperative that you read these operating instructions thoroughly and carefully before placing your instrument into service, and that you follow all instructions contained herein.

1.1 Defects and Excessive Stressing

If it can be assumed that safe operation is no longer possible, the instrument must be removed from service and secured against inadvertent use. It must be assumed that safe operation is no longer possible:

- If the device demonstrates visible damage
- If the instrument no longer functions
- After long periods of storage under unfavorable conditions
- After extraordinary stressing due to transport

2 Device Description

2.1 Using Device

The METRISO 5024 measuring instrument is a battery operated combination device with direct display. It is suitable for the following measurements:

- **AC and DC voltages** without indication of polarity within a range of 0 to 500 V. This function is especially well suited for testing DUTs for absence of voltage before performing resistance or insulation measurements.
- **Low resistance measurement** within a range of 0 to 4 Ω. Advantageous for resistance measurements at coils, over contacts, and at equipotential bonding conductors and protective conductors.
- **Measurement of insulation resistance** within a range of 100 kΩ to 400 MΩ. The device is suitable for measuring and testing insulation resistance at electrical systems and devices and allows for the selection of the following nominal voltages: 100 V, 250 V or 500 V DC.

2.2 Design Description

Thanks to its design and the use of two-hand operation (Figure 1), the device is well suited for safe, daily use. It can be secured against dropping with the attached carrying strap.
The METRISO 5024 includes two switches for device operation:

- Toggle switch for function selection (4)
- Rotary switch (3)

Measured values are displayed at three analog scales (2). Figure 1 shows these scales in detail. Insulation resistance is displayed at the

uppermost scale, low-resistance at the middle scale and voltage at the bottom scale. The device's operating status and battery charge level are indicated with the 2-color LED in the scale (Figure 1).
The battery compartment is located in the housing base (6). The procedure for replacing batteries is described in 3.2.

All measurements are performed with two test probes:

- One test probe (1) is permanently attached to the housing – positive pole.
- The other (8) is attached to a coil cord – negative pole

This test probe (8) can be inserted into the opening (9) and secured by snapping the handle into the detaining fork (7).
As long as the toggle switch (4) is in the neutral middle position, the METRISO 5024 can be utilized as a voltmeter.
The rotary switch must be set either to the 100 V, 250 V or 500 V position in order to perform voltage measurements. No batteries are required for this function.
The rotary switch must be set to the Ω position in order to perform low-resistance measurements. Measurement is performed with the toggle switch (4) in the Ω position. Voltage cannot be measured as long as the rotary switch (3) remains in this position.
The desired test voltage must be selected with the rotary switch (3) before performing insulation measurements. Measurement is performed with the toggle switch (4) in the MΩ position.

3 Preparation for Device Operation

3.1 Unpacking the Device

Check for mechanical damage after unpacking the device. The device is ready for use as soon as the batteries have been inserted into the battery compartment.

3.2 Power Supply – Battery Replacement

The METRISO 5024 is operated exclusively with batteries for safety reasons. Batteries are inserted or replaced as follows:

- ➪ First disconnect the measurement cables from the device under test.
- ➪ Loosen the fastening screw at the bottom of the battery compartment (6) and remove the battery compartment.
- ➪ Remove the depleted batteries and replace them with new or fully charged batteries. Make sure that battery polarity is not reversed during insertion (see printed symbols on the compartment).
- ➪ Push the battery compartment back in and secure it with the screw.

Recommended batteries: 4 ea. alkaline batteries per LR6, mignon cells, AA cells, 1.5 V, at least 2300 mAh

3.3 Checking the Mechanical Zero Point

- ➪ Lay the device horizontally onto a work surface.
- ➪ Check the pointer for correct zero point adjustment and reset with the adjusting screw (2a) if necessary.
  The device may not be connected to a measuring circuit during this procedure, and the toggle switch may not be activated.
  Don't forget: Negative pointer deflection is suppressed by the scale's limit stop. Always turn the adjusting screw clockwise for this reason, and then slowly turn it counterclockwise until the 0 Ω or 0 V position is reached.

3.4 Checking Device Functions

The METRISO 5024 functions as a voltmeter when the toggle switch (4) is in the neutral position:

- The **voltmeter function** can be checked by applying a voltage to both test probes (1 and 8), e.g. line voltage from a mains outlet. The rotary switch must be set to any of positions 100 V, 250 V or 500 V.
- When the toggle switch (4) is in either the Ω or MΩ position, the batteries are activated and the METRISO 5024 remains in the selected function as long as the toggle switch is activated. Measurements in the Ω and MΩ ranges are evaluated by means of the green LED (10), the beeper and the pointer.
- The **ohmmeter function** – rotary switch in the Ω position and toggle switch in the Ω position – can be tested by short-circuiting the two test probes (1 and 8): 0 Ω appears at the display, continuous acoustic signal from the beeper.
  Avoid open test probes (resistance approaching ∞), (pointer oscillates, periodic sequence of acoustic signals from the beeper).
- The **insulation measuring function** – rotary switch in the xxx V position and toggle switch in the MΩ position – can be tested with the help of the two limit values: Short-circuit the two test probes (1 and 8): Pointer oscillates, periodic sequence of acoustic signals from the beeper, green LED blinks; separate the test probes: ∞ appears at the display, continuous acoustic signal from the beeper, green LED lights up.

Display accuracy can be tested using the ISO Calibrator 1 (article no. M662A) as an accessory by connecting it to the low or high value resistor.

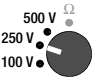
4 Operation

4.1 Voltage Measurement

Attention!
Before connecting the measuring instrument to an external source of voltage, make sure that the battery compartment has been correctly secured to the housing because the battery connector terminals are electrically connected to the measuring circuit!

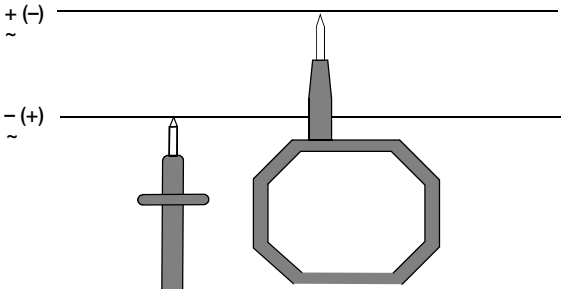
No auxiliary power is required for voltage measurement, i.e. no batteries need to be inserted into the battery compartment.
Direct and alternating voltages of up to 500 V can be measured without switching between zero-frequency and periodic quantities. Pointer deflection is always positive for the measurement of direct voltage, regardless of polarity.
Devices under test can be conveniently tested for absence of voltage using the voltage measuring function without activating any of the controls. Immediately after connecting the device under test, the instrument indicates whether or not external voltage is present.
The voltage measuring range can also be used for discharging capacitive devices under test. The falling voltage value can be observed at the display.
Adhere to the prescribed sequence for the performance of voltage measurement:

- Set the rotary switch (3) to the xxx V position.



The rotary switch may be set to any position other than Ω!

- Leave the toggle switch (4) in its neutral position (do not press).
- Contact the device under test with the test probes (1 and 8). Read the measured value from the voltage scale within a range of 0 to 500 V.

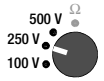


- End the measurement by removing the test probes from the device under test.

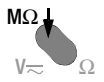
4.2 Insulation Resistance Measurement (VDE 0413, part 2 / EN 61557, part 2)

Attention!
Insulation resistance measurements may only be performed on voltage-free system components and devices!

Adhere to the prescribed sequence:



- Set the rotary switch (3) to the desired test voltage: 100 V, 250 V or 500 V.
- Contact the device under test with the test probes (1: positive pole and 8: negative pole).
- When the toggle switch is in the neutral position, the METRISO 5024 functions as a voltmeter for **testing for the absence of voltage**.
  Immediately after contacting the device under test, the user can determine whether or not it is voltage-free.
  A capacitively charged device under test is discharged directly via the voltmeter's internal resistance. Discharging can be observed at the display. However, if the voltage value remains constant insulation resistance cannot be measured until the device under test has been disconnected from all sources of voltage.
  If zero voltage is displayed, measurement can be performed immediately.
- **Insulation resistance measurement** is performed for as long as the toggle switch is held in the MΩ position. Read the measured value from the logarithmic scale within a range of 100 kΩ to 400 MΩ.



- End the measurement by releasing the toggle switch. Capacitive devices under test which have been charged by direct test voltage are discharged by the voltmeter.
- Remove the test probes from the device under test.

Attention!
When insulation resistance is measured at capacitive devices under test, e.g. cables, they may be charged with an open-circuit voltage of up to approximately 700 V, and may retain this charge for a lengthy period of time. This is a life endangering voltage, and the device under test must be discharged after measurement for this reason (see "testing for the absence of voltage" above).

Insulation Resistance	Scale	LED	Beeper
Measured value ≥ limit	value is displayed	green	continuous signal
Meas. value < 250 kΩ with U_N=250 V Meas. value < 500 kΩ with U_N=500 V	value is displayed	green	periodic sequence of signals
Measurement not possible: – < 100 kΩ	pointer oscillates	green blinks	periodic sequence of signals
– Battery voltage too low	pointer oscillates	red	no signal
– Rotary or toggle switch not adjusted correctly	pointer oscillates	green blinks	no signal

Evaluating Measured Values

According to DIN VDE 0100, the insulation resistance of system components must have a value of at least 1000 Ω per V nominal voltage without any current-consuming apparatus in the line section between two overcurrent protection devices or switches, or downstream from the last overcurrent protection device, for example

380 kΩ at an operating voltage of 380 V.
In order to assure that the insulation resistance limit values specified in the applicable standards are not exceeded, maximum measuring error of the measuring instrument must be taken into consideration. The required minimum display values for various limit values are listed in the following table. Intermediate values can be interpolated in a linear fashion.

MΩ Range	
Limit value	**Min. Display ***
0.10 MΩ	0.130 MΩ
0.25 MΩ	0.325 MΩ
0.40 MΩ	0.520 MΩ
0.50 MΩ	0.650 MΩ
0.60 MΩ	0.780 MΩ
0.70 MΩ	0.910 MΩ
0.80 MΩ	1.040 MΩ
1 MΩ	1.300 MΩ
2 MΩ	2.600 MΩ

* Minimum display values for insulation resistances with specified limit values in consideration of maximum measuring error.

Test Voltages

During measurement of insulation resistance, a test voltage U is applied to the device under test, which lies between the nominal voltage U_N selected with the rotary switch (3), and open-circuit voltage U_0:

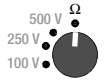
U_N Position at Rotary Switch (3)	Test Voltage at DUT
100 V	100 V < U < 110.8 V
250 V	250 V < U < 277.0 V
500 V	500 V < U < 554.0 V

4.3 Low-Resistance Measurement (VDE 0413, part 4 / EN 61557, part 4)

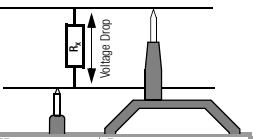
Attention!
Resistance measurements may only be performed on voltage-free devices under test, because interference voltages distort measurement results.

Adhere to the prescribed sequence:

- ➪ Make sure that the device under test is voltage-free in accordance with chapter 4.1.
- ➪ Set the rotary switch to Ω.
- ➪ Contact the device under test with the test probes (1: positive pole of the 200 mA constant current source and 8: negative pole of the constant current source).
- ➪ Measurement is performed for as long as the toggle switch is held in the Ω position. Observe the LED. Read the measured value from the scale within a range of 0 to 4 Ω. It is advisable to perform a second measurement with reversed polarity in order to eliminate semiconductor circuits.



- ➪ End the measurement by releasing the toggle switch.
- ➪ Remove the test probes from the device under test.



Low Voltage	Scale	LED	Beeper
measured value ≤ 2 Ω	value is displayed	green	continuous signal
2 Ω < measured value ≤ 4Ω	value is displayed	green	periodic sequence of signals
measured value ≥ 4Ω	pointer oscillates	green blinks	periodic sequence of signals
measurement not possible: – battery voltage too low	pointer oscillates	red	no signal
– rotary or toggle switch not adjusted correctly	pointer oscillates	green blinks	no signal

5 Maintenance – Recalibration

5.1 Housing

No special maintenance is required for the housing. Keep outside surfaces clean. Use a slightly dampened cloth for cleaning. Avoid the use of cleansers, abrasives and solvents.

5.2 Batteries

Check the batteries at short regular intervals to makes sure no leakage has occurred. If leakage occurs, electrolyte must be fully removed from the instrument and new batteries must be installed. Remove the batteries from the battery compartment if the measuring instrument will not be used for a lengthy period of time. Refer to chapter 3.2 regarding battery replacement
Attention: If the LED lights up red before or during measurement, the batteries must be replaced immediately.
Use only recommended battery types (see chapter 3.2).

5.2.1 Details on Power Consumption and Operating Time

Low-Resistance Measurement

The instrument draws the most power from the batteries when the value of the contact resistance is the lowest.
Power consumption does not exceed the value of 0.4 A.

Insulation Resistance Measurement

Power consumption from the batteries depends on the selected test voltage and the actual value of the insulation resistance, i.e. on the load imposed on the source of the measuring voltage U_N. The table below specifies the power consumption from the batteries for the indicated parameters.

Test Voltage U_N	R_X measured at I_{BAT} (U_{BAT} = 6 V) (*if LED lights up green, pointer oscillates and there is no acoustic signal, the transformer is overloaded)			
500 V	0 kΩ / < 1 A *	0.1 MΩ / < 1.1 A	> 1 MΩ / < 0.6 A	> 400 MΩ / < 0.3 A
250 V	0 kΩ / < 1 A *	0.1 MΩ / < 0.4 A	> 500 kΩ / < 0.4 A	> 400 MΩ / < 0.2 A
100 V	0 kΩ / < 1 A *	0.1 MΩ / < 0.2 A	> 200 kΩ / < 0.3 A	> 400 MΩ / < 0.2 A

The following table lists the number of possible measurements with one set of alcaline batteries by taking into account the power consumption from the batteries.
The number of possible measurements depends on the following conditions:

- one measurement takes 1 minute
- the insulation resistance complies with the requirements of the standard (power consumption from the battery in accordance with column 3 of the table above).

Test Voltage U_N	AlMn Battery min. 2300 mAh
500 V	> 300 measurements
250 V	> 500 measurements
100 V	> 750 measurements

5.3 Replacing the Fuse

The low-resistance measuring range is protected with a fuse, see chapter 6. The fuse blows if a voltage is applied to the test probes which may cause damage to the instrument as a result of its magnitude or polarity.
Adhere to the prescribed sequence when replacing the fuse:

⇨ Remove the test probes from the device under test.
⇨ Loosen the 3 screws in the housing base.

- ➪ Turn the device over so that the control panel faces up and remove the housing top (i.e. control panel).
- ➪ Remove the fuse from its holder with the help of an object such as a test probe, and replace it with a new fuse.
  (A replacement fuse is available in the carrying pouch).

Note!
Replace the fuse only in a clean and dust-free environment. Soiling may possibly impair the correct functioning of the measuring instrument.

Attention!
Use specified fuses only! If fuses with other blowing characteristics, other current ratings or other breaking capacities are used, the operator is placed in danger, and resistors and other components may be damaged.
The use of repaired fuses or short-circuiting the fuse holder is prohibited.

- ➪ Set the housing top back into place without applying pressure.
- ➪ Lay the carrying strap over the metal pin.

Note!
Make sure that the cable from the measuring element is not pinched when the housing bottom and the housing top are fitted together.

- ➪ Position the measuring instrument so that you view it from the side with the test probe snapped in to the detaining fork. The support included on the housing top must slide into the guide in proximity to the test probe holder, and may not be tilted at the display module. In this way, the housing top can be pressed onto the housing bottom without applying excessive force.
- ➪ Hold the housing top and bottom together and turn the entire instrument over so that the housing bottom faces up.
- ➪ Retighten the screws.

5.4 Recalibration

The respective measuring task and the stress to which your measuring instrument is subjected affect the ageing of the components and may result in deviations from the guaranteed accuracy.

If high measuring accuracy is required and the instrument is frequently used in field applications, combined with transport stress and great temperature fluctuations, we recommend a relatively short calibration interval of 1 year. If your measuring instrument is mainly used in the laboratory and indoors without being exposed to any major climatic or mechanical stress, a calibration interval of 2-3 years is usually sufficient.

During recalibration* in an accredited calibration laboratory (DIN EN ISO/IEC 17025) the deviations of your instrument in relation to traceable standards are measured and documented. The deviations determined in the process are used for correction of the readings during subsequent application.

* Verification of specifications or adjustment services are not part of the calibration. For products from our factory, however, any necessary adjustment is frequently performed and the observance of the relevant specification is confirmed.

We are pleased to perform DKD or factory calibrations for you in our calibration laboratory. Please visit our website at www.gossenmetrawatt.com (→ Services → DKD Calibration Center *or* → FAQs → Calibration questions and answers).

By having your measuring instrument calibrated regularly, you fulfill the requirements of a quality management system per DIN EN ISO 9001.

5.5 Device Return and Environmentally Compatible Disposal

The **instrument** is a category 9 product (monitoring and control instrument) in accordance with ElektroG (German Electrical and Electronic Device Law). This device is not subject to the RoHS directive.
We identify our electrical and electronic devices (as of August 2005) in accordance with WEEE 2002/96/EG and ElektroG with the symbol shown to the right per DIN EN 50419.

These devices may not be disposed of with the trash. Please contact our service department regarding the return of old devices.

If you use **batteries** or **rechargeable batteries** in your instrument or accessories which no longer function properly, they must be duly disposed of in compliance with the applicable national regulations. Batteries or rechargeable batteries may contain harmful substances or heavy metal such as lead (PB), cadmium (CD) or mercury (Hg). They symbol shown to the right indicates that batteries or rechargeable batteries may not be disposed of with the trash, but must be delivered to collection points specially provided for this purpose.

6 Characteristic Values

Insulation Resistance Measurement, Measuring Voltages: 100 / 250 / 500 V

Measuring Range	Intrinsic Uncertainty	Overload	Measuring Current	Short-Circuit Current
0.1 … 400 MΩ	2.5% *	600 V AC	> 1 mA	< 10 mA

* Measuring error under reference conditions relative to scale length (l = 84.6 mm)

Low-Resistance Measurement, Measuring Voltage: 4.5 V

Measuring Range	Intrinsic Uncertainty	Overload	Measuring Current
0 … 4 Ω	2.5% *	250 V DC	>200 mA

* Measuring error under reference conditions relative to upper range value (l = 74.9 mm)

Voltage Measurement, DC / AC (40 … 200 Hz)

Measuring Range	Intrinsic Uncertainty	Overload	Internal Resistance
0 … 500 V	2.5% *	600 V AC	450 kΩ

* Measuring error under reference conditions relative to scale length (l = 73.3 mm)

Reference Conditions

Normal position of use	horizontal
Ambient temperature	+23 °C ±2 K
Relative humidity	40 ... 60%
Measured quantity frequency	45 ... 65 Hz (during voltage measurement)
Line voltage waveshape	sinusoidal (RMS value)
Battery voltage	5.5 V ±0.5 V

Influence Error under Nominal Conditions of Use

Total error caused by battery,
temperature and normal position of use = 10%

Nominal Conditions of Use

Temperature	0 ... 40 °C
Normal position of use	any
Battery voltage	4.4 ... 6.5 V

Ambient Conditions

Storage temperature	–25 °C ... + 60 °C (without batteries)
Relative humidity	max. 75%, no condensation allowed
Elevation	to 2000 m
Deployment	indoors only, except within specified ambient conditions
EMC	EN 61326
Interference emission	EN 55022 class B
Interference immunity	EN 61000 -4-2 power feature A -4-3 power feature B

Power Supply

Batteries	4 ea. 1.5 V mignon-cell per IEC LR6 (4 x size AA)
Working range	4.4 ... 6.5 V
Battery test	by means of LED (see chapter 4.2 and 4.3)

Electrical Safety

Safety class	II
Test voltage	3.7 kV
Measuring category	II / 600 V
Fouling factor	2
Fuse	F0.25A/500V, 6.3x32

Mechanical Design

Protection IP 40 per DIN VDE 0470 part 1/EN 60529

Extract from table on the meaning of IP codes

IP XY (1st digit X)	Protection against foreign object entry	IP XY (2nd digit Y)	Protection against the penetration of water
4	≥ 1.0 mm dia.	0	not protected

Dimensions	98 mm x 310 mm x 40 mm
Weight	approx. 0.5 kg with batteries

7 Repair and Replacement Parts Service Calibration Center * and Rental Instrument Service

When you need service, please contact:

GMC-I Service GmbH
Service Center
Thomas-Mann-Strasse 20
90471 Nürnberg • Germany
Phone +49 911 817718-0
Fax +49 911 817718-253
E-Mail service@gossenmetrawatt.com
www.gmci-service.com

This address is only valid in Germany.
Please contact our representatives or subsidiaries for service in other countries.

* **DKD Calibration Laboratory for Electrical Quantities DKD–K–19701 accredited per DIN EN ISO/IEC 17025:2005**

Accredited measured quantities: direct voltage, direct current values, DC resistance, alternating voltage, alternating current values, AC active power, AC apparent power, DC power, capacitance, frequency and temperature

8 Product Support

When you need support, please contact:

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Product Support Hotline
Phone +49 911 8602-0
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