Operating instructions

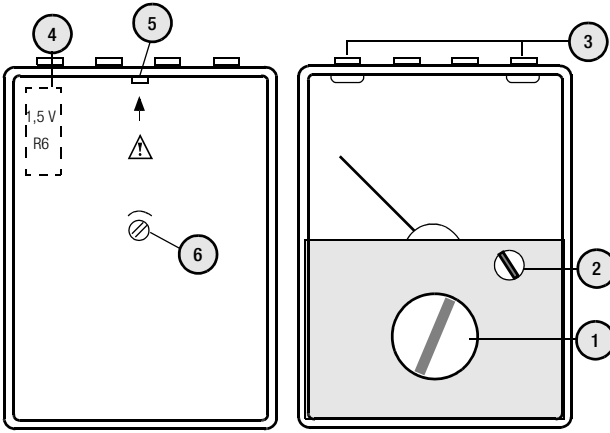
GOSSEN METRAWATT

METRAmax 6

Analog Multimeter

3-348-602-02
4/4.10

Operating Controls



1 Range selector switch
2 Rotary knob to adjust the full-scale deflection
3 Socket connectors
4 Battery compartment
5 Nose to open the meter
6 Adjustment screw for the mechanical zero
(∞ on black scale)

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1 Safety Features and Precautions

This instrument fulfills the requirements of the applicable European and national EC guidelines. We confirm this with the CE marking. The relevant declaration of conformity can be obtained from GMC-I Messtechnik GmbH.

The analog multimeter METRAmax 6 is manufactured in accordance with safety regulations IEC 61010-1/EN 61010-1/VDE 0411-1. When used for its intended purpose, the safety of the operator, as well as that of the instrument, is assured. Their safety is however not guaranteed if the instrument is used improperly or handled carelessly. It is therefore imperative that you read the operating instructions thoroughly and carefully before placing the METRAmax 6 into service, and that you follow all instructions contained therein.

Observe the following safety precautions:

- The instrument may only be operated by persons who are capable of recognizing contact hazards and taking the appropriate safety precautions.
- Contact hazards exist anywhere, where voltages of greater than 30 V may occur (effective value).
- Be prepared for the occurrence of unexpected voltages at devices under test (e.g. defective devices).
  For example, capacitors can be dangerously charged!
- Housing and measurement cables may not be damaged, e.g. by cracks or ruptures.
- No measurements may be made with the METRAmax 6 in electrical circuits with corona discharge (high-voltage).
- Special care is required when measurements are made in HF electrical circuits. Dangerous pulsating voltages may be present.

- Measurements under moist ambient conditions are not allowable. Hands, shoes, floor and workplace must be dry.
- Be absolutely certain that the measuring ranges are not overloaded beyond their allowable capacities.

Meaning of Symbols on the Instrument

indicates EC conformity

Warning concerning a point of danger.
(Attention: observe documentation!)

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'.

2 Description

The METRAmax 6 is a battery-powered ohmmeter. It excels by its handy size, ease of use, and a large measuring span. It is meant for measurement of resistances between 0.05 Ω and 1 MΩ, for rough capacitance measurements between 1 µF and 30,000 µF, and for continuity tests with beeper.

The METRAmax 6 offers 9 measuring ranges for resistance and capacitance measurements. The measuring ranges are selected with a range switch.

The meter has a rugged movement with spring-loaded jewels. It is widely insensitive to vibrations and shocks.

The scale is mirror-backed for exact reading of the measured values.

The measuring range Ω x 1, marked in red, and the scale marked in red are provided for measurements of small resistance values (0.05 Ω bis 50 Ω). To measure higher resistance values, there are 4 measuring ranges which have a common black scale.

A part of the two scale arcs is boldly marked. The measuring error, referred to the actual resistance value, is smallest on these marked indicating ranges.

For rough capacitance measurements, there are 4 measuring ranges with a common scale.

A beeper is incorporated for audible continuity tests.

The connectors are protected against accidental contact. It is recommended to use measuring leads with shockproof connection plugs (4 mm diameter).

3 Operation

Attention!
Only voltage-free devices under test may be measured!
Prior to each measurement, check mechanical zero and full-scale deflection.

3.1 Inserting the Battery

Prior to starting the METRAmax 6, insert a 1.5 V mignon cell into the battery compartment. This requires removal of the lower part of the case.

Attention!
Disconnect the measurement cables from the measuring circuit before opening the meter!

- ➪ Press the nose (5) on the rear of the meter inwards, using an adequate tool, and remove the lower part.
- ➪ Insert a leakproof 1.5 V mignon cell according to IEC R6 into the battery compartment (4), paying attention to the polarity markings. Verify that reliable contact is made.
- ➪ Replace the lower part of the case and press the two parts together until they engage.

3.2 Checking the Mechanical Zero

- ⇨ Place the METRAmax 6 into a horizontal position.
- ⇨ Set the range selector switch (1) to the "O" position (OFF).
- ⇨ The pointer has to be exactly over the bar code of the full-scale deflection (∞ on the black scale).
- ⇨ Correct deviations with the adjusting screw (6) on the rear of the meter with a screwdriver, if required.

3.3 Battery Test

- ⇨ Set the range selector switch (1) to the "Ω x 1" position (red marking).
- ⇨ With the rotary knob (2), adjust the movement pointer on the red scale to full-scale deflection (∞).

If the pointer can no longer be adjusted to full-scale deflection, or if the indication is instable after the adjustment, the battery is exhausted and has to be replaced with a new one, see chapter 3.1.

4 Measurement

4.1 Resistance Measurement

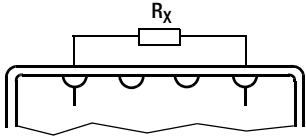
Resistance is measured with DC voltage from the inserted 1.5 V mignon cell. The maximum measuring currents at full-scale deflection, with a battery voltage of 1.5 V, are listed in the range table (see chapter 6 "Characteristic Values").

If possible, select the measuring range in such a way that indication is in the range of the boldly drawn scale arc. The measuring error, referred to the actual resistance value, is smallest in this range.

During prolonged resistance measurements, occasionally check for full-scale deflection (0 Ω or ∞).

When switching the range selector switch (1) to another resistance range, always check for full-scale deflection and adjust with the rotary knob (2), if required.

4.1.1 Measuring in the Range up to 50 Ω (Ω x 1, red)

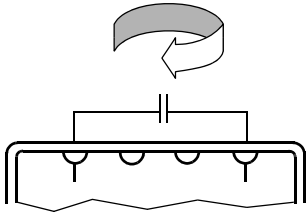


- Set the range selector switch (1) to Ω x 1 (red marking).
- With the rotary knob (2), adjust the pointer to full-scale deflection (∞) on the **red** scale.
- Connect the unknown resistance R_x to be measured and read the resistance value on the **red** scale.

4.1.2 Measuring in the Ranges up to 1 MΩ
(Ω x 1/10/100/1000, black)

- Set the range selector switch (1) to one of the measuring ranges Ω x 1 ... Ω x 1000, depending upon the resistance value to be measured.
- Short-circuit the measuring leads.
- With the rotary knob (2), set the pointer to full-scale deflection (0 Ω) on the **black** scale.
- Connect the resistance R_X to be measured to the measuring leads and read the resistance value on the black scale. The indicated value must be multiplied by the specified factor in line with the selected measuring range.

4.2 Rough Capacitance Measurement



- ➪ Set the range selector switch (1) to one of the measuring ranges µF x 1 ... µF x 1000, depending upon the capacitance value to be measured.
- ➪ Capacitance is measured according to the ballistic method. Connect the capacitor a few times to the measuring leads with changing polarity and read the largest pointer deflection on the µF scale.

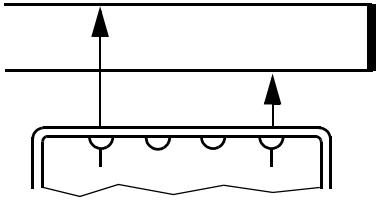
With this method, the capacitance of the capacitor to be measured can only roughly be determined. The measured value can deviate from the actual value by up to ±25 %.

4.3 Diode and Transistor Test

The resistance range Ω x 1000 is suited for a rough functional check on semiconductor elements. A resistance measurement is an easy way to find a short circuit or an interruption on a diode and/or a diode junction between base, collector and emitter. The polarity of a diode and the base connection of a transistor can also be determined by this test.

This measurement does not destroy semiconductor elements to be tested as the 1.75 V voltage and the 100 μA current are not exceeded.

4.4 Acoustic Continuity Test



The continuity test (range selector switch (1) set to position ♪ is suitable for testing low-ohmic connections with a resistance value of ≤1.5 Ω.

No external voltage must be applied during the measurement!

The forward direction of semiconductor elements should not be tested by the audible continuity test but only according to the deflection method (see chapter 4.3). When using the audible continuity test, inductive voltage spikes appear at the meter connectors which could damage the semiconductors.

5 End of Measurement

After the measurement, the range selector switch (1) should be set to "0" to conserve the battery life.

6 Characteristic Values

Measuring Ranges

Resistance	Measuring Range Span	Mid-scale Value (R_i)	Max. Measuring Current I_{max} [1] approx.
Ω x 1 (red scale)	0.05 Ω ... 50 Ω	1 Ω	75 mA
Ω x 1	1 Ω ... 1 kΩ	20 Ω	75 mA
Ω x 10	10 Ω ... 10 kΩ	200 Ω	7.5 mA
Ω x 100	100 Ω ... 100 kΩ	2 kΩ	0.75 mA
Ω x 1000	1 kΩ ... 1MΩ	20 kΩ	0.075 mA

Capacitance Measuring Range	Measuring Range Span	Max. Measuring Current $I_{max.}$ [1]
µF x 1	0 ... 30 µF	0.075 mA
µF x 10	0 ... 300 µF	0.75 mA
µF x 100	0 ... 3 000 µF	7.5 mA
µF x 1 000	0 ... 30 000 µF	75 mA

[1] with a battery voltage 1.5 V

Acoustic Continuity Test

Response range	0 ... 1.5 Ω (integrated beeper)
Response current	365 mA
Operating current	170 mA

Accuracy

Error limit	±1.5 %	of scale length
	± 8.2 %	as a function of the actual resistance value in the display range with boldly marked scale arc.

Reference Conditions

Ambient temperature	+20 °C
Position of use	horizontal

Display

Scale	mirror-backed
Scale length	approx. 90 mm
Pointer deflection	∠ 0° ... 100°

Ambient Conditions

Storage temperatures	–25 ... 65 °C (without battery)
Relative humidity	max. 75%, no condensation allowed

Power Supply

Battery	1 mignon cell 1.5 V per IEC LR6 (AA), leak-proof

Overload Protection

Fusible link	F 6.3 H/250 V per DIN VDE 0820 part 22/EN 60127-2, embedded

Electrical Safety

Protection class	II per IEC 61010-1/EN 61010-1/ VDE 0411-1
Contamination degree	2
Test voltage	2 kV~
EMC	Electromagnetic compatibility
Interference emission/ interferene immunity	EN 61326-1

Mechanical Design

Protection: Housing IP50, terminals IP20
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
2	≥ 12,5 mm ∅	0	not protected
5	dust protected	0	not protected

Dimensions	100 mm x 140 mm x 35 mm
Weight	approx. 0.3 kg (without battery)

7 Maintenance

7.1 Battery

The state of the battery should be ckecked from time to time. An exhausted or deteriorating battery must not remain in the battery compartment. Check and replace the battery as described in chapter 3.1 on page 7.

7.2 Fusible Link

The holder for the fuse link is soldered to the circuit board. See chapter 6, "Overload Protection" for the specified fuse.

7.2.1 Fuse Replacement

- Disconnect the meter from the measuring circuit!
- Remove the lower part of the case, see chapter 3.1 on page 7.
- Changing the fuse it is possible to put the holder carefully to side or to desolder it.

Attention!
Please make definitely sure that only the specified fuse is inserted! Using a fuse with other cut-out characteristics, other nominal current or other switching capacity may endanger the user and damage protective diodes, resistors and other components.

The use of mended fuses or short-circuiting of the fuse holder is not permitted.

7.3 Housing

The meter may only be cleaned with a soft cloth or brush. Possible static charges of the glass pane can be removed with an antistatic agent or a moist cloth.

7.4 Device Return and Environmentally Compatible Disposal

The METRAmax 6 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 with the trash. Please contact our service department regarding the return of old devices, see chapter 8 on page 18.

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

When you need service, please contact:

GMC-I Messtechnik 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

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**

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

Competent Partner

GMC-I Messtechnik GmbH is certified in accordance with DIN EN ISO 9001:2000.

Our DKD calibration laboratory is accredited by the Deutscher Kalibrierdienst *(German Calibration Service)* in accordance with DIN EN ISO/IEC 17025:2005 under registration number DKD–K–19701.

We offer a complete range of expertise in the field of metrology: from **test reports** and **proprietary calibration certificates** right on up to **DKD calibration certificates**.

Our spectrum of offerings is rounded out with free **test equipment management**.

An **on-site DKD calibration station** is an integral part of our service department. If errors are discovered during calibration, our specialized personnel are capable of completing repairs using original replacement parts.

As a full service calibration laboratory, we can calibrate instruments from other manufacturers as well.

9 Product Support

When you need support, please contact:

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