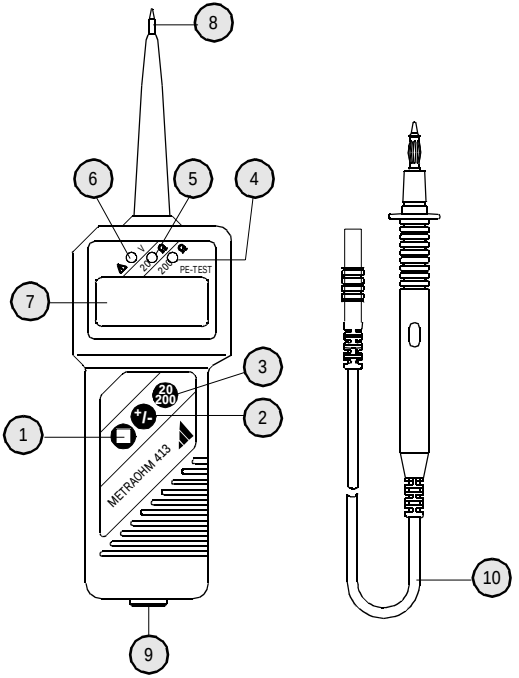
Operating Instructions

GOSSEN METRAWATT CAMILLE BAUER

METRAOHM® 413

Low impedance resistance meas. instrument

3-348-776-37
2/9.97



1 Measurement button (switch on and test)
2 Polarity button (polarity reversal and measurement value display)
3 Measuring range button (measuring range selection and manual shut-off)
4 LED for 200 Ω range
5 LED for 20 Ω range
6 LED for extraneous voltage warning
7 Display of measurement value and test prod polarity
8 Test prod
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1 Safety

You have selected a measuring instrument which provides a high level of safety. It meets requirements in accordance with VDE 0413 Part 4 and IEC 1010.

In order to assure safe and proper use, it is imperative that you read these operating instructions in their entirety before using the instrument.

All points included in these operating instructions must be followed carefully when using the instrument.

Please observe the following safety precautions:

- The measuring instrument may only be used for power systems with an operating voltage of maximum 500 V.
- Measurements may only be taken at voltage-free system components.
- If the instrument comes into contact with a voltage of over 10 V in its switched-on condition, an acoustic, as well as an optical warning, is generated (see 4.4). No measurements may be made at this conductor until it is made voltage-free.

2 Applications

The METRAOHM 413 is a battery powered measuring instrument for the detection of low impedance up to 200 Ω in electrical systems. Extensive protective conductor, earth conductor and potential equalization as well as lightning arrester networks can also be quickly and reliably tested with the METRAOHM 413. Resistance is measured between a reference earth (e.g. a bonding conductor) and other desired points. Various measurement cables with line resistances of up to 3.5 Ω can be used. The line resistance is stored during zero balancing, and is compensated for during measurement. A measuring current of 200 mA (in the 20 Ω range) and the automatic functions assure reliable measurement results.

3 Start-up

The measuring instrument is delivered ready for operation with a 9 V, IEC 6 LR 61 battery. Before initial start-up, or after a period of storage, observe the instructions in Section 6 *Maintenance*.

⇨ You can check to see if the instrument is ready for operation by pressing and holding the measurement button for a period of time.
All of the LCD segments and all 3 LEDs must light up.

4 Measuring and testing

4.1 General

Button functions

measurement button	– switch on – display test – measure – zero balance (together with +/- button)
+/- polarity button	– reverse polarity – call up measurement values – zero balance (together with measurement button)
20/200 meas. range button	– select measuring range (press briefly) – manual shut-off (press and hold)

measurement button switch on, display test

⇨ Press the measurement button; all LCD characters, as well as the three LEDs light up and remain lit until the button is released. An acoustic signal sounds at the same time.
Thereafter the measuring instrument always switches to the 20 Ω measuring range (middle LED lights up). Display: 

Automatic shut-off

The measuring instrument is switched off automatically, if no key activation has occurred for about 20 seconds

⇨ The measuring instrument can be switched off manually by pressing and holding the 20/200 measuring range button for about 1 second.

4.2 Zero balancing

The METRAOHM 413 must be calibrated together with the entire measurement cable prior to each measurement (see Section 4.3 *Measurement set-up*). In this process the line resistance of the measurement cable is stored and compensated for in future measurements.

- ⇨ Affix the measuring cable to the reference earth and ensure good contact (remove corrosion first if necessary!).
- ⇨ Plug the measurement cable jack into the socket at the METRAOHM 413 (with adapter cable if reel-off drum is used).
- ⇨ Press and hold the +/- polarity button and press the (measurement button at the same time ❒ measuring instrument must already be switched on).
  "CAL" appears in the display and the middle LED lights up.
- ⇨ Apply the test prod to the reference earth, assuring good contact, before the two green LEDs start to blink.
- ⇨ Maintain contact as long as the two green LEDs blink alternately. The following display then appears: 

Measurement cable resistance remains in storage, until you perform a new zero balance.
This value also remains in storage if the measuring instrument is switched off, or if the battery is replaced.

Caution!
If the message "Err" (Err = Error) appears and the measuring instrument switches off shortly thereafter, zero balancing must be repeated. This error occurs if the test prod slips during balancing, or if the cable is high of impedance (greater than 3.5 Ω).

➪ For test purposes we recommend that the first measurement (see Section 4.4 *Measuring with both polarities*) always be made directly at the reference earth with the test prod at the measurement cable terminal. The result should always be less than 0.04 Ω.

4.3 Measurement set-up

Any desired measurement cable (up to approx. 3.5 Ω) can be used between the reference earth (bonding conductor or system earth) and the METRAOHM 413, which can be balanced as described in Section 4.2. By connecting several cables, one after the other, measurement locations at distances of up to 100 m can be reached!

- **50 m reel-off drum** (accessory)
  Directly connect the socket of the drum to the socket of the METRAOHM 413. The drum can thus be placed onto the floor during measurement. Connect the contact-protected socket of the measurement cable with test prod to the drum socket. Fix the test prod at the corresponding measuring point.
- **25 m earth clamp** (accessory)
  Directly connect the socket of the earth clamp to the socket of the METRAOHM 413. Fix the second socket at the corresponding measuring point.
- When used in environments with strong interference fields, the cable should be completely unwound from the drum, so that inductive interference is avoided.
- From time to time the plug and the clamp must be cleaned.

4.4 Measuring with both polarities

After zero balancing and measurement set-up, the measuring instrument is ready for operation together with the zero balanced cable (see Section 4.2).

Two measurements are always required for each measurement point, one with positive, and one with negative current.

Direction of current flow is indicated in the display as + or –. The displayed sign applies to the test prod on the measuring instrument.

If necessary, the measurement point is to be cleaned of rust or paint prior to measurement.

⇨ Switch the measuring instrument on with the ⏻ button
Display:  *and LED for 20 Ω range.*

⇨ Place the test prod onto the measuring point, if possible vertically, and assure good contact.

Caution!
If the red LED blinks and an acoustic warning sounds, an extraneous voltage is present! The test at the selected measurement point must be interrupted (see chapter Section 4.6 *Extraneous voltages*). A short warning signal can, on the other hand, be caused by an inductive voltage (e.g. cable not unwound), which has no effect on the measurement.

- Press and hold button for about 3 seconds.
  Display: measurement value in ohms and blinking ÷ sign
- Release button.
  Display: positive measurement value
- Briefly press the +/- polarity button.
  Display: 
- Press and hold the button for about 3 seconds.
  Display: measurement value in ohms and blinking – sign
- Release button.
  Display: negative measurement value
- Call up the stored positive and negative measurement values with the +/- polarity button and compare them.

If they deviate from one another greatly, electrical voltages of < 10 V are probably present.

- Repeat the measurement.

If the result remains unchanged, an average value between the + and the – value is to be taken.

4.5 Quick measurements

For quick measurement only a reduced measuring time with resp. few evaluations take place. Also there is no change of polarity. This type of test is thus only suitable for measurement points with flawless contact, and without fluctuating impedance or electrical interference.

⇨ Press ⏺ button briefly
Display: After the button is released, the measurement value and the selected polarity are displayed for about 2 seconds, if the measurement value lies within the measuring range.

The respective measurement value is not stored. The measuring instrument is immediately ready for further measurements.

Possible errors

No measurement result is indicated.

Causes: – slipping of the test prod
– greatly fluctuating impedance
Remedy: Repeat the measurement, if necessary in a higher measuring range

Even after repeated measurement no clear measurement result is obtained.

Remedy: Perform standard measurement with longer measurement time and both polarities.

4.6 Extraneous voltages

If the measuring instrument comes into contact with a *voltage of over 10 and up to 230 V, an acoustic alarm sounds intermittently* as a warning signal, and the red LED blinks. For informational purposes the voltage value is displayed at the LCD, as long as the test prod makes contact. The symbol for AC "~" is also displayed for alternating voltages.
If either direct or alternating voltage is present, measurement may not be performed, until the conductor is made voltage-free.

Caution!
The METRAOHM 413 is protected for up to 230 V with semiconductors, and up to 500 V with special fusing. If the fuse should blow, the instrument must be sent in for repair.

5 Technical data

Resistance measuring instrument per VDE 0413 part 4 and IEC 1010 (VDE 0411 part 1)

Measuring ranges	0.01...19.99 Ω and 0.1...199.9 Ω
Short-circuit current	in 20 Ω range 200 mA constant in 200 Ω range 20 mA constant
Open-circuit voltage	> 6 V
Digital display	13 mm high, 7 segment characters 0 ... 1999 digits Overflow indication via the numeral 1 at the far left
Voltage display	red LED and acoustic warning signal
Overvoltage protection	Reversible up to 230 V nominal via semiconductors, from 230 to 500 V with special fusing (can only be replaced at the factory)
Accuracy	±(1.5% of rdg. +4 digits) at 20 °C
Operating temperature	–10 ... +50 °C
Power supply	9 V block battery, IEC 6 LR 61 AlMn 1 battery provides for approx. 150 measurements at 200 mA (in 20 Ω range) automatic shut-off after 20 s without measurement, BAT display
Housing	IP 65 protection, high impact with unbreakable display window
Dimensions	60 mm x 230 mm x 40 mm
Weight	250 g (including battery)

Caution!
A dead battery must be removed from the instrument.
If the battery leaks the electrolyte must be completely removed.
Dispose of batteries in accordance with environmental regulations!

➪ If the "BAT" display appears during measurement, the battery must be replaced.
After the BAT display first appears, several measurements may still be taken at 0.2 A.
The battery is located behind the back cover, which is secured with a screw. Only AlMn 9 V, IEC 6 LR 61 block batteries may be used.

☞ Note
If storage batteries are used the instrument may also fail without warning via the "BAT" message, due to their steep discharge slope.

6.1 Measurement cables

The measurement cable contact must be kept clean and free of corrosion, and must be cleaned as needed.

6.2 Housing

The housing requires no special maintenance. Keep the outer surface clean. Use a slightly dampened cloth for cleaning. Avoid the use of cleansers, abrasives and solvents.

7 Storage

For lengthy periods of storage the measuring instrument is to be stored in a dry area with temperatures of between –10 °C to +70 °C. It is to be kept in a closed covering without battery.

8 Repair and Replacement Parts Service

When you need service, please contact:

GOSSEN-METRAWATT GMBH
Service
Thomas-Mann-Straße 16 - 20
D - 90471 Nürnberg
Telefon (09 11) 86 02 - 4 10 / 4 11
Telefax (09 11) 86 02 - 2 53
Telex 6 23 729 gome d

This address is for Germany only. Abroad, our representatives or establishments are at your disposal.

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