

# METRAmax 2

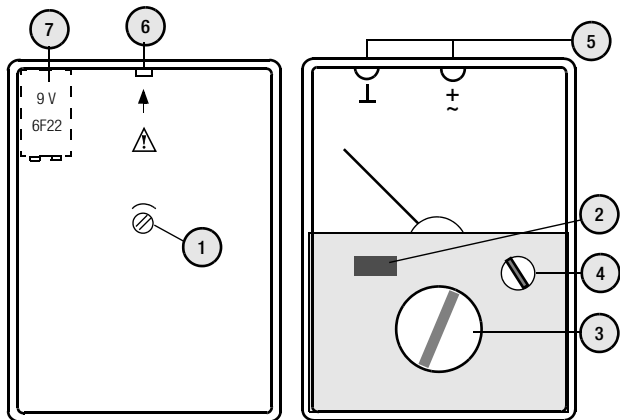
## Analog Multimeter

3-348-734-02

4/5.06



## Operating Controls



- 1 Adjustment screw for the mechanical zero  
( $\text{---|---}$  OFF on scale)
- 2 Sliding function switch
- 3 Rotary range selector switch
- 4 Rotary knob for mid-scale setting of the electrical zero
- 5 Safety connection sockets
- 6 Nose to open the meter
- 7 Battery compartment

# Table of Contents

	Page
<b>1 Safety Features and Safety Precautions .....</b>	<b>4</b>
<b>2 Description .....</b>	<b>6</b>
<b>3 Operation .....</b>	<b>7</b>
3.1 Initial Start-up .....	7
3.1.1 Connecting the Battery .....	7
3.1.2 Checking the Mechanical Zero .....	7
3.1.3 Checking the Electrical Zero .....	8
3.2 Voltage Measurement .....	9
3.2.1 DC Voltage Measurement .....	9
3.2.2 Direct AC Voltage Measurement up to 300 V .....	10
3.2.3 AC Voltage Measurement with Superimposed DC Voltage Component .....	10
3.3 Current Measurement .....	11
3.3.1 DC Current Measurement .....	11
3.3.2 DC Current Measurement via Shunts .....	12
3.3.3 AC Current Measurement .....	13
3.4 End of Measurement .....	13
<b>4 Characteristic Values .....</b>	<b>14</b>
<b>5 Maintenance .....</b>	<b>16</b>
5.1 Battery Replacement .....	16
5.2 Fuse Replacement .....	16
5.3 Cleaning .....	16
5.4 Device Return and Environmentally Compatible Disposal .....	16
<b>6 Repair and Replacement Parts Service DKD Calibration Lab and Rental Instrument Service .....</b>	<b>17</b>
<b>7 Product Support .....</b>	<b>19</b>

# 1 Safety Features and Safety 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 Gossen-Metrawatt GmbH.

The analog multimeter METRAMax 2 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 2 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 2 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](http://www.gossenmetrawatt.com) by entering the search term 'WEEE'.

## 2 Description

On the METRAMax 2, the measuring ranges are selected with a sliding function switch and a rotary range selector switch. The scale is mirror-backed.

The rugged plastic case and the spring-loaded jewel bearings of the stray-field-insensitive moving-coil movement with core magnet protect the meter against damages in the case of severe mechanical stress.

The electrical zero of the pointer can be positioned at mid-scale. This allows for bipolar DC voltage and DC current measurements regardless of the polarity.

The connection sockets are protected against accidental contact. Both the special test leads with contact-protected connection plugs and all test leads with commercial banana plugs (4 mm diameter) can be used.

The DC current measuring ranges can be expanded by means of a shunt (e.g. 10 A/100 mV).

The meter is of service-friendly design.

## 3 Operation

### 3.1 Initial Start-up

#### 3.1.1 Connecting the Battery

The battery compartment (7) contains a 9-V battery (IEC 6F22) which is not connected. To connect the battery, it is required to remove the lower part of the case. For this purpose, press the nose (6) on the front of the meter inwards, using an adequate tool. Securely connect the battery contacts to the battery clip located in the battery compartment. Ensure reliable contact making. Replace the lower part of the case and press the two parts together until they engage.



#### **Attention!**

Both measurement cables must be disconnected from the measuring circuit before opening the meter!




#### **Note**

The integrated battery switches off automatically after 45 minutes. Switching off and on again of the sliding function switch activates the power supply.


#### 3.1.2 Checking the Mechanical Zero

The METRAMax 2 must not be connected when checking the mechanical zero.




- ⇒ Set the sliding function switch (2) to the "0" position
- ⇒ Place the METRAMax 2 in a horizontal position
- ⇒ The pointer must be located exactly above the line marked "  OFF"

- ⇒ Correct the deviation by means of the adjustment screw 1 on the bottom of the case using a screwdriver, if required.

### 3.1.3 Checking the Electrical Zero

- ⇒ Set the sliding function switch (2) to the  position, select the measuring range
- ⇒ The pointer must rest exactly above the line for the zero at mid-scale
- ⇒ Correct deviations by means of the rotary knob (4), if required

### 3.1.4 Battery Test

- ⇒ Set the sliding function switch (2) to the " " position
- ⇒ Set the rotary range selector switch (3) to the " " position
- ⇒ The pointer must travel into the battery test section marked " "

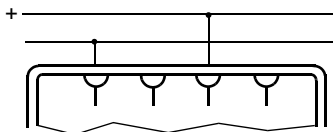
If the pointer no longer travels into the battery test section, or if there is an instable indication, the battery is exhausted. It must be replaced with a new one (see chapter 5.1 on page 16, Battery Replacement).





## 3.2 Voltage Measurement


### 3.2.1 DC Voltage Measurement

#### Operating Mode: Electrical Zero at the Left

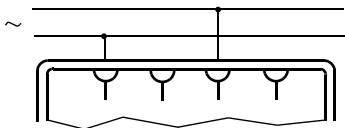




- ⇒ Set the sliding function switch (2) to the  position
- ⇒ Set the rotary range selector (3) to the corresponding measuring range position:  
 $V_{\text{DC}} = 300 \text{ V} \dots 100 \text{ mV}$
- ⇒ Connect the METRMax 2
- ⇒ Read the measured value: black scale 


#### Operating Mode: Electrical Zero at Mid-scale

- ⇒ Set the sliding function switch (2) to the  position
- ⇒ Set the rotary range selector (3) to the corresponding measuring range position:  $V_{\text{DC}} = 300 \text{ V} \dots 100 \text{ mV}$
- ⇒ Check that the pointer rests at mid-scale, see chapter 3.1.3 on page 8
- ⇒ Connect the METRMax 2
- ⇒ Read the measured value: red scale +/-

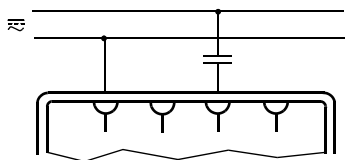
### 3.2.2 Direct AC Voltage Measurement up to 300 V



- Set the sliding function switch (2) to the  position
- Set the rotary range selector switch (3) to the corresponding measuring range:  $V_{\sim} 300\text{ V} \dots 3\text{ V}$
- Connect the METRAMax 2
- Read the measured value: black scale 

To keep the influence of the frequency as low as possible, the connection socket "  " should be connected to the ground potential as directly as possible or to lowest point with respect to ground.

### 3.2.3 AC Voltage Measurement with Superimposed DC Voltage Component



The DC voltage component, such as occurs with an amplifier output stage, for example, can be cut off by means of a capacitor (recommended value:  $4.7\ \mu\text{F}/630\text{ V}$ ). In this case, the additional service error is smaller than 0.2% at a measuring frequency of 50 Hz. The measuring procedure corresponds to the one described above.

The DC component can be determined same as with DC voltage measurement.

To protect the meter against overload, the selected measuring range must always be higher than the DC voltage component determined at first.



### Attention!

Both voltage components must be tested before switching to a lower measuring range.

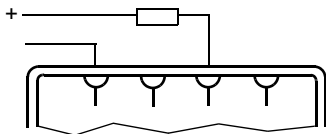
---

## 3.3 Current Measurement

For all current measurements, connect the METRMax 2 in series with the consumer in the line having the lower potential to ground.

### 3.3.1 Direct DC Current Measurement

**Operating Mode: Electrical Zero at the Left**



- Set the sliding function switch (2) to the position
- Set the rotary range selector switch (3) to the corresponding measuring range: A = 3 A...100  $\mu$ A
- Connect the METRMax 2
- Read the measured value: black scale

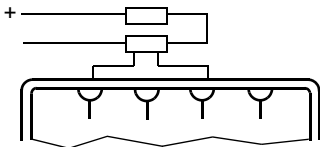
### Operating Mode: Electrical Zero at Mid-scale

- Set the sliding function switch (2) to the  $\uparrow$  position
- Set the rotary range selector switch (3) to the corresponding measuring range:  $A \approx 3 A \dots 100 \mu A$
- Check that the pointer rests at mid-scale, see chapter 3.1.3 on page 8
- Connect the METRMax 2 according to the wiring diagram
- Read the measured value: red scale +/-

### 3.3.2 DC Current Measurement via Shunts

The accuracy of the measurement is influenced by the measuring error of the shunt.

#### Operating Mode: Electrical Zero at the Left

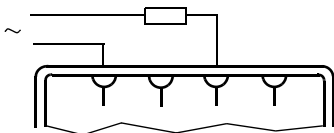


- Set the sliding function switch (2) to the  $\curvearrowright$  position
- Set the rotary range selector switch (3) to the following position:  $V \approx 100 V$
- Connect the METRMax 2
- Read the measured value: black scale  $\approx$

### Operating Mode: Electrical Zero at Mid-scale

- Set the sliding function switch (2) to the  $\uparrow$  position
- Set the rotary range selector switch (3) to the following position:  $V_{\text{DC}} 100 \text{ mV}$
- Check that the pointer rests at mid-scale, see chapter 3.1.3 on page 8
- Connect the METRAMax 2
- Read the measured value: red scale +/-

### 3.3.3 AC Current Measurement



- Set the sliding function switch (2) to the  $\curvearrowright$  position
- Set the rotary range selector switch (3) to the corresponding measuring range:  $A_{\sim} 3 \text{ A} \dots 100 \mu\text{A}$
- Connect the METRAMax 2
- Read the measured value: black scale  $\approx$

### 3.4 End of Measurement

When no measurements are made, the sliding function switch (2) should always be set to "0" to conserve the battery life.

## 4 Characteristic Values

### Measuring Ranges

DC and AC voltage	Internal resistance		DC and AC voltage	Voltage drop
	$\equiv$	$\sim$		
100 mV $\equiv$	10 M $\Omega$		100 $\mu$ A $\equiv/\sim$	55 mV
300 mV $\equiv$	10 M $\Omega$		1 mA $\equiv/\sim$	55 mV
1 V $\equiv$	10 M $\Omega$		10 mA $\equiv/\sim$	55 mV
3 V $\equiv/\sim$	10 M $\Omega$	1 M $\Omega$	100 mA $\equiv/\sim$	55 mV
10 V $\equiv/\sim$	10 M $\Omega$	1 M $\Omega$	1 A $\equiv/\sim$	53 mV
30 V $\equiv/\sim$	10 M $\Omega$	1 M $\Omega$	3 A $\equiv/\sim$	51 mV
100 V $\equiv/\sim$	10 M $\Omega$	1 M $\Omega$		
300 V $\equiv/\sim$	10 M $\Omega$	1 M $\Omega$		

### Influence Quantities and Nominal Ranges of Use

Temperature in the range 0 ... +40 °C	$\pm 2\%/10$ K for $\equiv$
Frequency for all measuring ranges	$\pm 2.5\%$ in the range 30 Hz ... 1.5 kHz $\pm 5\%$ in the range 1.5 kHz ... 3 kHz

### Display

Measuring mechanism	Moving-coil mechanism with core magnet
Scale	mirror-backed
Scale length	<i>black scale:</i> 87 mm in the range V, A, 0 ... 3/10 <i>red scale:</i> 62 mm in the range V, A, -10/-3 ... 0 ... +3/+10

### Accuracy

under reference conditions Class 2 for  $\equiv$ , class 3 for  $\sim$

### Reference Conditions

Ambient temperature	+23 °C $\pm$ 2 K
Position of use	horizontal
Frequency	50 ... 60 Hz

Waveshape sinusoidal

## Ambient Conditions

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

## Power Supply

Battery 9 V flat cell battery, IEC 6 L R61 (IEC 6F22), automatic battery switch-off after 45 minutes

## Overload Protection

Fuse F3, 15 H/250 V per DIN VDE 0820 part 22/EN 60127-2 protects the electrical circuits against overload. The measuring mechanism is protected by 2 diodes in inverse-parallel connection.

## Electrical Safety

Protection class II per IEC 61010-1/EN 61010-1/VDE 0411-1

Measuring category 300 V CAT III

Nominal voltage 300 V

Contamination degree 2

Test voltage 3.7 kV~

**EMC** Electromagnetic Compatibility

Interference emission/immunity EN 61326-1

## Mechanical Design

Protection Housing IP50, terminals IP20  
Extract from table on the meaning of IP codes


IP XY (1 <sup>st</sup> digit X)	Protection against foreign object entry	IP XY (2 <sup>nd</sup> digit Y)	Protection against the penetration of water
2	≥ 12.5 mm dia.	0	not protected
5	dust protected	0	not protected

Dimensions 100 mm x 140 mm x 35 mm

Weight approx. 0.3 kg

## 5 Maintenance

### 5.1 Battery Replacement

When a battery test reveals that the pointer no longer travels into the battery test section marked "  ", the battery must be replaced. Replace the exhausted battery with a new 9-V flat cell battery according to IEC 6 L R61 (IEC 6F 22). Remove the lower part of the case as described in chapter 3.1.1 on page 7.

### 5.2 Fuse Replacement

Remove the case as described in chapter 3.1.1 on page 7. The fuse holders are soldered to the circuit board.

### 5.3 Cleaning

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

### 5.4 Device Return and Environmentally Compatible Disposal

The METRAMax 2 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 6 on page 17.



## **6 Repair and Replacement Parts Service DKD Calibration Lab \* and Rental Instrument Service**

When you need service, please contact:

GMC-I Gossen-Metrawatt GmbH

### **Service Center**

Thomas-Mann-Strasse 16-20

90471 Nürnberg • Germany

Phone +49-(0)-911-8602-0

Fax +49-(0)-911-8602-253

E-Mail [service@gossenmetrawatt.com](mailto: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 Gossen-Metrawatt GmbH is certified in accordance with DIN EN ISO 9001:2000.

Our DKD calibration laboratory is accredited by the Physikalisch Technische Bundesanstalt (*German Federal Institute of Physics and Metrology*) and the Deutscher Kalibrierdienst (*German Calibration Service*) in accordance with DIN EN ISO/IEC 17025 by 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.

## 7 Product Support

When you need support, please contact:

GMC-I Gossen-Metrawatt GmbH

**Product Support Hotline**

Phone +49-(0)-911-8602-112

Fax +49-(0)-911-8602-709

E-Mail [support@gossenmetrawatt.com](mailto:support@gossenmetrawatt.com)

---

Edited in Germany • Subject to change without notice • A pdf version is available on the Internet

**GMC-I**  **GOSSEN METRAWATT**

GMC-I Gossen-Metrawatt GmbH  
Thomas-Mann-Str. 16-20  
90471 Nürnberg • Germany

Phone +49-(0)-911-8602-0  
Fax +49-(0)-911-8602-669  
E-Mail [info@gossenmetrawatt.com](mailto:info@gossenmetrawatt.com)  
[www.gossenmetrawatt.com](http://www.gossenmetrawatt.com)