

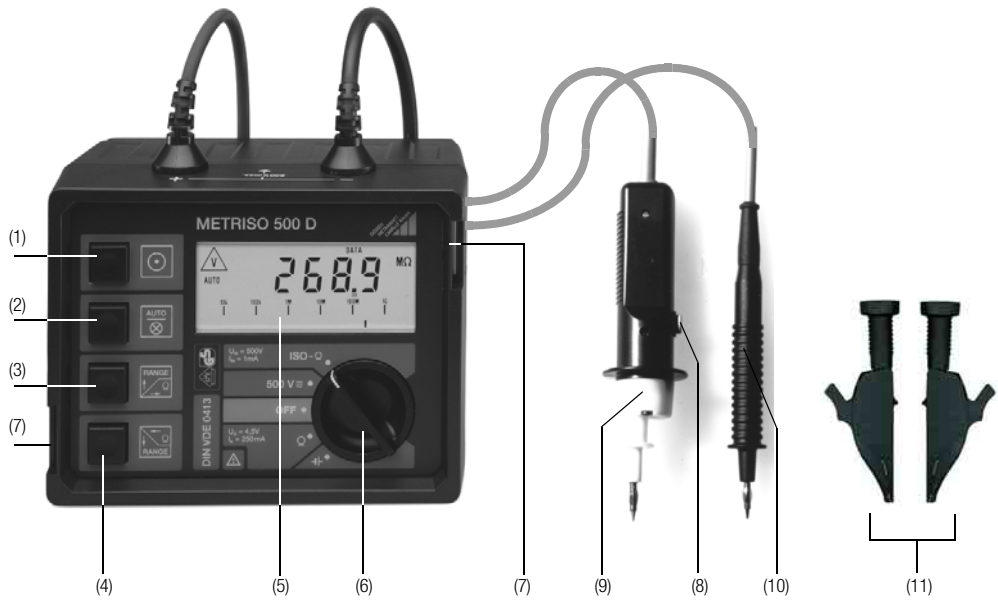
# **METRISO<sup>®</sup> 500D**

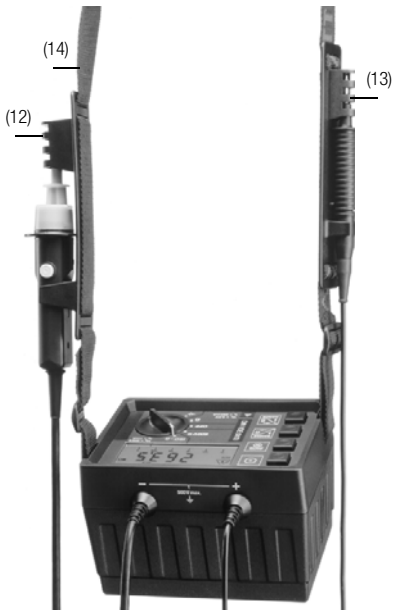
## **Insulation Tester**

3-348-626-02

5/5.07







- (1) Pushbutton for „CONTINUOUSLY ON“
- (2) Pushbutton
  - for switching to autoranging with ISO- $\Omega$  measurement,
  - for measuring with automatic polarity reversal with  $\Omega$  measurement and
  - for switching the lamp in the probe on
- (3) Pushbutton
  - for manual switching to higher measuring ranges with ISO- $\Omega$  measurement and
  - for  $\Omega$  measurement with current direction from + to –
- (4) Pushbutton
  - for manual switching to lower measuring ranges with ISO- $\Omega$  measurement and
  - for  $\Omega$  measurement with current direction from – to +
- (5) LCD display
- (6) Rotary switch for function selection
- (7) Supports for fastening of the carrying strap
- (8) Measurement pushbutton
- (9) Fixed probe with lamp (negative pole)
- (10) Fixed probe (positive pole)
- (11) Crocodile clips for attachment to probes (Z110J)
- (12) Holder for probe with lamp (9)
- (13) Probe holder (10)
- (14) Carrying strap

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## 1 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 insulation tester has been constructed to comply with IEC 61557 / EN 61557 / VDE 0413 and IEC 61010-1 / EN 61010-1 / VDE 0411-1. When properly used, the safety of both the user and the meter is assured. It is not assured, however, if the meter is misused or carelessly handled.

**To maintain the safe and proper condition of the tester and to ensure its safe operation, it is absolutely necessary to carefully and completely read these operating instructions before using the tester. These instructions must be followed in all respects.**

### Repair and replacement of parts

When opening the tester, live parts may be exposed. The tester must be disconnected from all voltage sources prior to repair or replacement of parts. If a repair cannot be avoided unless the tester is open and live, this must be performed by a qualified person who understands the danger involved.

## Faults and extraordinary stress

When it must be assumed that safe operation is no longer possible, take the meter out of service and secure it against accidental use. It is assumed that safe operation is no longer possible,

- when the tester shows obvious signs of damage,
- when the tester no longer functions correctly,
- after prolonged storage under adverse conditions.



### Attention!

The fixed test leads have a double insulation in different colors. You can readily recognize damaged leads by the light insulation on the inside.

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### Meaning of the symbols on the device



Warning of a danger point  
(Attention, refer to documentation)



Double or reinforced all-insulation



Mark approval by testing board



EU-Conformity Mark



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) under the search term 'WEEE'.

## 2 Applications

The insulation tester complies with the IEC 61557 / EN 61557 / VDE 0413 "Measuring and monitoring facilities for testing the electrical safety in lines with nominal voltages up to AC 1000 V and DC 1500 V".

Part 1 „General“;

Part 2 „Insulation resistance“;

Part 4 „Resistance measuring devices“.

It is suited to measure the insulation resistance of electrically dead devices and systems having nominal voltages up to 500 V and to test the resistance of ground conductors, protective conductors and equipotential conductors including their connections and connectors.

In addition, the tester has a 500 V measuring range for DC and AC voltage which complies with DIN VDE 0100 Part 610. This makes it particularly advantageous to test devices for the absence of voltage and to discharge capacitive devices under test.

The most important applications of the insulation tester are found in testing of systems and appliances such as required by DIN VDE 0100, 0105, 0141, 0701 and 0702 specifications, for example.

## 3 Getting started

### 3.1 Inserting the batteries

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#### Attention!

Make sure that the rotary switch (6) is set to the „OFF“ position prior to opening the battery compartment and that the tester is completely disconnected from all external circuits!

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- ⇨ Undo the two slotted screws on the bottom of the tester with an adequate tool and remove the cover of the battery compartment.
- ⇨ Insert 6 each 1.5V mono-cells to IEC R20 (zinc-carbon) or to IEC LR20 (alkaline-manganese) in the battery compartment, paying attention to the correct polarity in line with the given symbols.
- ⇨ Replace the cover of the battery compartment and tighten the screws.

### 3.2 Testing the batteries

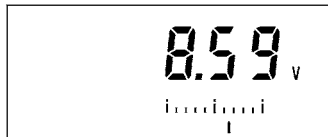
- ⇨ Set the rotary switch (6) to position „-II-“.

The „charging state“ of the six mono-cells is tested at this position. To simulate operating conditions, the lamp in the probe is switched on.

The digital display shows the battery voltage at this load on the LCD display (5).

At the same time, the analog indicator shows the nominal range of use of the battery voltage. You can quickly judge the charging state of the battery set by the location of the pointer.

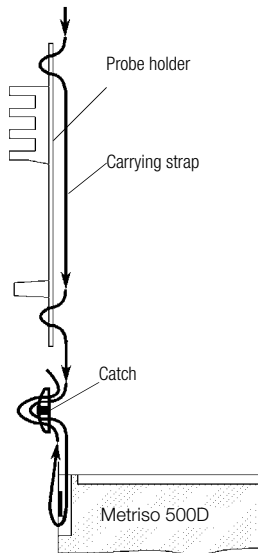
If the battery voltage is below 6.0 V when making the battery test, „U LO“ is shown on the LCD display (4).



The battery test is automatically stopped after about 10 seconds. The lamp goes out and „HOLD“ is shown on the LCD display (5) in addition to the digital display and the analog indication. This presentation is maintained until the tester automatically switches back to „standby“ after approximately 3 minutes. until you press the measurement pushbutton (8) or until you set the rotary switch (6) to another position.

You start a new battery test by pressing the measurement pushbutton (8).

### 3.3 Fastening the carrying strap and the probe holders



Fasten the carrying strap (14) and the two probe holders (12) and (13) as shown in the following figure. Make sure to fix the holder for the slim probe (10) at the left and the holder for the probe with lamp and pushbutton (9) at the right.

### 3.4 Switching the tester on and off

#### „Standby“ for minimum power consumption

- ⇨ Set the rotary switch (6) from the „OFF“ position to position „500 V $\simeq$ “, „ISO- $\Omega$ “ or „ $\Omega$ “.

When set to the „500 V $\simeq$ “ position, the measuring range for DC and AC voltage is switched on. Digital display and analog indication are presented.

When set to the „ISO- $\Omega$ “ position, the tester is switched to „standby“. The digital display only shows the decimal point together with the numeral 3 and the unit M $\Omega$ , and the analog indicator shows the measuring range 500 V.

When set to the „ $\Omega$ “ position, the tester is switched to „standby“. The digital display only shows the decimal point together with the number 30 and the unit  $\Omega$ .

After measuring at the „ $\Omega$ “ and „ISO- $\Omega$ “ positions, the tester automatically switches to „standby“,

- when the rotary switch is not operated for approximately 3 minutes and when no other pushbutton is pressed
  - when the measured value does not change for approximately 3 minutes
  - when no voltage above 25 V is applied to the probes for more than 3 minutes on the „500 V $\simeq$ “ range.
- ⇨ To reactivate the tester, press any pushbutton on the tester or the pushbutton (8) in the probe, or set the switch (6) to another position.

#### „CONTINUOUSLY ON“

When set to the „ISO- $\Omega$ “ and „ $\Omega$ “ positions, the tester measures only as long as you keep the pushbutton (8) in the probe pressed (an exception is the „AUTO“ function at position „ $\Omega$ “, see section 8.1).

When set to these positions, you also can switch the tester „CONTINUOUSLY ON“:

- ⇨ Briefly press the measurement pushbutton „ $\odot$ “ (1) on the tester.

You can cancel „CONTINUOUSLY ON“ by

- again pressing the measurement pushbutton „ $\odot$ “ (1) on the tester
- pressing the pushbutton (8) in the probe
- operating the rotary switch (6)



#### Note!

Electrical discharges and high-frequency interferences can cause incorrect displays. Briefly set the rotary switch (6) to another position; the tester is thus reset.

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### 4 LCD display

The measured values are shown on the LCD display (5) in digital and analog form.

The digital display shows the measured value with decimal point and unit. The numerals immediately under the decimal points show the upper limit of the selected measuring range. When the measuring range is exceeded, „OL“ is displayed in place of the measured value.

The analog indicator with pointer presentation gives the dynamic response of a moving-coil movement. The analog display is of particular advantage when observing variations of measured values and transients. When the upper range limit is exceeded, a triangle is shown at the end of the analog scale.

## 5 Detecting dangerous touch potentials

The tester detects dangerous touch potentials on the probes

- regardless of being switched on or not
- regardless of the selected function
- regardless of the batteries being inserted or not.

Voltages above 25 V are signalled on the LCD display (5) by a warning triangle.



The display of the warning triangle is made without auxiliary voltage. You can recognize the triangle already from approximately 10 V up with low contrast. Full contrast is obtained at 25 V.

The warning triangle directs your attention to a hazardous voltage on the probes. You can determine the voltage value on the voltage measuring range.



### Attention!

When the rotary switch (6) is set to the „ $\Omega$ “ position, the fuse blows when an external voltage is applied to the probes!

Never switch to the „ $\Omega$ “ range when an external voltage is applied as this could damage the switch contacts!

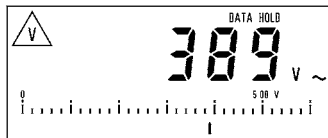
## 6 Measuring DC and AC voltages

- ⇒ Set the rotary switch (6) to position „500 V $\simeq$ “.
- ⇒ Scan the measuring points with the two probes without pressing the measurement pushbutton (6) in the probe.

The tester alternately measures the DC and the AC voltage and displays the higher measured value in both digital and analog form. The symbol behind the „V“ character shows whether a DC or an AC voltage is displayed.

When the measured value is steady, the word „DATA“ is shown on the LCD display (5). A short acoustic signal points to this.

- ⇒ When you briefly press the measurement pushbutton (8) in the probe, the word „HOLD“ is displayed in addition to „DATA“ and the measured value on the digital display is held.



If, after storage of the measured value, the voltage drops to a value below 10 V, the held measured value is cleared the instant the voltage rises again and „DATA HOLD“ is blanked. The digital display then again shows the actual measured value. The measured value can be held as soon as it has reached a steady state again.

If you press the measurement pushbutton (8) even though the measured value is not (yet) stable, only „HOLD“ is shown and not „DATA“. When pressing the measurement pushbutton, the currently existing measured value is held on the digital display.

The pointer of the analog indicator continues to constantly follow the actual measured value.

- ⇨ When pressing the pushbutton again, you clear the measured value. The digital display then shows the actual measured value.
- ⇨ You can use the lamp in the probe (9) to illuminate the measuring point or the LCD (5). Press the pushbutton „AUTO/ ☉“ (2). The lamp lights as long as you keep the pushbutton (2) pressed.



### Note!

The permissible overload capacity on the voltage measuring range is 600 V $\approx$ . If this value is exceeded, a acoustic signal draws your attention to it. The input resistance on the voltage measuring range is 440 k $\Omega$ . With a blown or a missing fuse, the voltage measurement is made with an input resistance of approximately 5 M $\Omega$ .

## 7 Measuring the insulation resistance



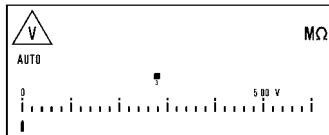
### Note!

#### Testing of Measurement Cables

We recommend short-circuiting the measurement cables with the test probes before carrying out the insulation measurement to check whether the instrument indicates almost zero  $\Omega$  (see chapter 8). This helps to discover interruptions in the measurement cables which simulate a high insulation resistance.

### 7.1 ISO- $\Omega$ measurement with autoranging

- ⇨ Set the rotary switch (6) to the „ISO- $\Omega$ “ position. The following is shown on the LCD display (5):



When there is no voltage applied to the probes, the digital display only shows the decimal point together with the numeral 3 and the symbol for the unit  $M\Omega$ .

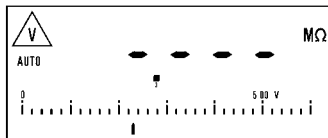
The analog indicator shows the measuring range 500 V. When the „ISO- $\Omega$ “ function is switched on or when changing to this function, the tester always switches to autoranging. The LCD then shows „AUTO“.

### Detecting external voltages

You can measure insulation resistances on electrically dead devices only. That is why it is necessary to detect external voltages.

⇒ Apply the two probes to the measuring points.

If a voltage > approximately 25 V exists, the presentation on the LCD display (5) changes as follows:



- The warning triangle signals a hazardous contact potential > 25 V.
- Four horizontal lines are shown in the middle of the numerals of the digital display.

- The pointer of the analog indicator shows the value of the DC or AC voltage applied.  
If this is the voltage of a charged capacitive device under test, the device under test is discharged. You can observe the drop in voltage on the analog display.

The measurement pushbutton (8) is already pressed before you apply the probes to the measuring points – e.g. to illuminate the measuring points – an acoustic signal points to an external voltage on the device under test.

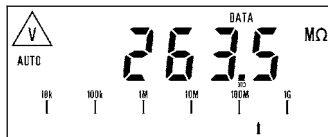
### Starting the measurement



#### Attention!

An insulation measurement is blocked when a voltage  $\geq 25$  V is applied to the probes prior to starting the measurement! An acoustic signal draws your attention to this.

- ⇒ Press the measurement pushbutton (8) in the probe and hold it at this position.  
The display switches to ISO- $\Omega$  measurement with the following presentation:




**Digital display:** In line with the measured value, the tester selects that measuring range from the 6 ISO- $\Omega$  measuring ranges with which the best resolution is obtained.

When the measured value changes, it automatically switches:

- to the next higher range at 3199 digits + 1 digit
- to the next lower range at 300 digits –1 digit

**Analog indication:** The entire measuring span of the ISO- $\Omega$  measurement (all of the 6 measuring ranges) is shown on the analog scale in logarithmic scale in coherent form. This makes for changes in measured value to be quickly detected and observed over several measuring ranges. With measured values below 3 k $\Omega$ , the triangle is shown at the left end of the analog scale in place of the pointer.

**Lamp in the probe (9):** The lamp functions as long as you press the pushbutton in the probe. It illuminates the measuring point when the measured insulation resistance is > approximately 1 M $\Omega$ . The lamp does not light with measured values < approximately 1 M $\Omega$ . It thus serves for a quick Good-Bad judgement of the insulation resistance. As long as the lamp lights, the minimum indication values of the insulation resistance according to DIN VDE 0100 are definitely not fallen below in systems up to 500 V. You can switch the lamp on for illumination of the measuring point even if the insulation resistance is < 1 M $\Omega$ . Press the „AUTO/ “ pushbutton (2). The lamp lights as long as you keep the pushbutton pressed.

**Acoustic signal:** Insulation resistances < 2 k $\Omega$  are reported by an acoustic signal which ceases at values > 6 k $\Omega$ .



### Attention!

**Do not touch the probe ends (9) and (10) when the tester is switched on for ISO- $\Omega$  measurement.**

When the probe ends are free or connected to an ohmic device under test, a current of up to 1 mA would flow through your body at a voltage of 500 V. The electrical shock is noticeably felt but the current does not reach hazardous values. If, however, you measure on a capacitive device under test, e.g. on a cable, this can charge up to about 500 V. Touching means danger to life! For that reason, discharge with caution as described before.

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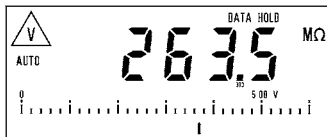
### Holding the measured value

When the measured value is steady, „DATA“ is displayed on the LCD display (5). A short sound signals this state.

- You can read the measured value now – or after releasing the pushbutton (8).
- Now release the measurement pushbutton (8) in the probe. The word „HOLD“ is displayed in addition to „DATA“, and the measured value on the digital display is held. If you release the pushbutton even though the measured value is not (yet) steady, „HOLD“ is displayed instead of „DATA“. When releasing the pushbutton, the measured value shown on the digital display is held.

- ⇒ Continue to contact the measuring points with the two probes.  
After releasing the measurement pushbutton (8), the voltage scale is again shown on the analog indicator. After having measured the insulation resistance of a capacitive device under test, the latter discharges automatically. You can observe the drop in voltage on the pointer of the analog indicator.

**Remove the connection to the device under test only when the warning triangle „V“ is no longer shown!** It is only then that the voltage across the device under test is no longer hazardous.



The measured value held on the digital display is cleared approximately 3 minutes after releasing the measurement pushbutton (8) and the tester switches to „standby“.

- ⇒ The lamp in the probe (9) is a useful means to read the LCD at poor light conditions. The lamp lights as long as you keep the pushbutton „AUTO/ ☒“ (2) pressed.

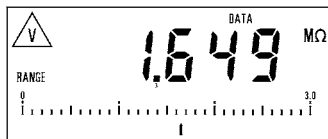
## Repeating the measurement

- ⇒ Press the measurement pushbutton (8) in the probe and hold it at this position. New measured values are immediately shown. The previously held value is cleared.

## 7.2 ISO-Ω measurement with manual range selection

- ⇒ Set the rotary switch (6) to position „ISO-Ω“ and make sure the device under test is free from external voltages as described for the measurement with autoranging in section 7.1.
- ⇒ Briefly press one of the two pushbuttons „RANGE↑“ (3) and „RANGE↓“ (4).  
You thus leave autoranging and fix the 3 MΩ measuring range. The tester always selects this output range when you set the rotary switch (6) to the „ISO-Ω“ position. The LCD shows the word „RANGE“ in place of „AUTO“.
- ⇒ You can now select the measuring ranges manually with the two pushbuttons (3) and (4). Each time you press the pushbutton „RANGE↑“ (3) you switch to the next higher measuring range, each time you press the pushbutton „RANGE↓“ (4) you switch to the next lower range. You can recognize the measuring range selected at a time on the LCD by the location of the decimal point and by the unit.
- ⇒ Apply the two probes to the measuring points.

- ⇨ Press the measurement pushbutton (8) in the probe (9) and hold it at this position.  
The measured value is displayed in digital and analog form on the selected measuring range, regardless of its magnitude. Now the analog scale is linear.  
Depending upon the measured value and the selected measuring range, it is possible that measured values are not displayed with optimum resolution or with overrange display („OL“ or triangle at the end of the analog scale).



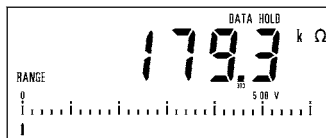
- ⇨ Now release the measurement pushbutton (8) in the probe.  
The measured value is held same as described for the measurement with autoranging in section 7.1.  
As the measurement of the insulation resistance is always made with maximum resolution, you now can select the range which displays the measured value with optimum resolution, using the pushbuttons „RANGE↑“ (3) and „RANGE↓“ (4).

### Example

You measure an insulation resistance of 179,3 kΩ on the 300 MΩ range. The following is shown on the LCD display (5):



Then switch to the 300 kΩ measuring range. The display changes as follows:



- ⇨ With manual range selection, all features of the tester, as described in section „7.1 ISO-Ω measurement with autoranging“ apply analogously.
- ⇨ The tester switches back to autoranging when you briefly press the pushbutton „AUTO/ ⓧ“ (2).

### 7.3 Evaluation of the measured values

So that the limits of the insulation resistance required by DIN VDE specifications are not fallen below under any condition, the measuring error of the insulation tester must be considered. The required minimum display values for insulation resistances which may be indicated with consideration of the maximum service error of the insulation tester (under nominal conditions of use) without exceeding the specified limits (DIN VDE 0413 Part 1) can be found from the following table. Intermediate values can be interpolated.

Minimum display values of insulation resistances (on the minimum range of use) at specified limits:

| Range 300 kΩ   |                 | Range 3 MΩ     |                 | Range 30 MΩ    |                 | Range 300 MΩ   |                 |
|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|
| Limit Value kΩ | Min. Display kΩ | Limit Value MΩ | Min. Display MΩ | Limit Value MΩ | Min. Display MΩ | Limit Value MΩ | Min. Display MΩ |
|                |                 | 0,2            | 0,206           | 2              | 2,06            | 20             | 20,6            |
|                |                 | 0,3            | 0,309           | 3              | 3,09            | 30             | 30,9            |
|                |                 | 0,4            | 0,412           | 4              | 4,12            | 40             | 41,2            |
|                |                 | <b>0,5</b>     | <b>0,515</b>    | 5              | 5,05            | 50             | 50,5            |
|                |                 | 0,6            | 0,618           | 6              | 6,18            | 60             | 61,8            |
|                |                 | 0,7            | 0,721           | 7              | 7,21            | 70             | 72,1            |
|                |                 | 0,8            | 0,824           | 8              | 8,24            | 80             | 82,4            |
|                |                 | 0,9            | 0,927           | 9              | 9,27            | 90             | 92,7            |
| 100            | 103,0           | 1,0            | 1,030           | 10             | 10,30           | 100            | 103,0           |
| 110            | 113,3           | 1,1            | 1,133           | 11             | 11,33           |                |                 |
| 120            | 123,6           | 1,2            | 1,236           | 12             | 12,36           |                |                 |
| 130            | 133,9           | 1,3            | 1,339           | 13             | 13,39           |                |                 |
| 140            | 144,2           | 1,4            | 1,442           | 14             | 14,42           |                |                 |
| 150            | 154,5           | 1,5            | 1,545           | 15             | 15,45           |                |                 |
| 160            | 164,8           | 1,6            | 1,648           | 16             | 16,48           |                |                 |
| 170            | 175,1           | 1,7            | 1,751           | 17             | 17,51           |                |                 |
| 180            | 185,4           | 1,8            | 1,854           | 18             | 18,54           |                |                 |
| 190            | 195,7           | 1,9            | 1,957           | 19             | 19,57           |                |                 |
| 200            | 206,0           | <b>2,0</b>     | <b>2,060</b>    | 20             | 20,60           |                |                 |
| 210            | 216,3           | 2,1            | 2,163           | 21             | 21,63           |                |                 |
| 220            | 226,6           | 2,2            | 2,266           | 22             | 22,66           |                |                 |
| 230            | 236,9           | 2,3            | 2,369           | 23             | 23,69           |                |                 |
| 240            | 247,2           | 2,4            | 2,472           | 24             | 24,72           |                |                 |
| 250            | 257,5           | 2,5            | 2,575           | 25             | 25,75           |                |                 |
| 260            | 267,8           | 2,6            | 2,678           | 26             | 26,78           |                |                 |
| 270            | 278,1           | 2,7            | 2,781           | 27             | 27,81           |                |                 |
| 280            | 288,4           | 2,8            | 2,884           | 28             | 28,84           |                |                 |
| 290            | 298,7           | 2,9            | 2,987           | 29             | 29,87           |                |                 |
| 300            | 309,0           | 3,0            | 3,090           | 30             | 30,90           |                |                 |

## 8 Measuring low-ohmic resistances (0 . . . 30 $\Omega$ )

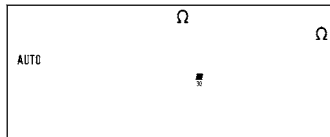
### 8.1 Measuring with automatic polarity reversal



#### Attention!

**Verify** that the **device under test is electrically dead**, e.g. by a voltage measurement, before you perform measurements on the low-ohmic measuring range. The fuse blows, when a voltage source is connected that is sufficiently rich in : energy!

- ⇨ Set the rotary switch (6) to the „ $\Omega$ “position. The LCD display (5) only shows the decimal point together with the numeral 30 and the unit  $\Omega$ . The analog scale is blanked.



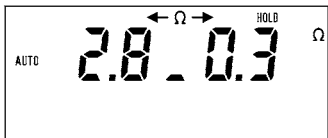
- ⇨ Start measuring by briefly pressing the measurement pushbutton (8) in the probe (9) or the pushbutton (1). „CONTINUOUSLY ON“ with the measurement pushbutton „ $\odot$ “ (1) is not possible when measuring with automatic polarity reversal. The tester now automatically measures first in one direction of the current and then in the other. The LCD display

first shows the arrow at the left and then the arrow at the right of the „ $\Omega$ “ character. The right arrow signals a direction of the current from „+“ to „-“ in line with the imprinted polarity symbols on the front of the tester. Display of the left arrow signals the ongoing measurement with opposite direction of the current.

After a measurement cycle, the higher of the two measured values is shown in digital form together with the word „HOLD“. A short acoustic signal draws your attention to the end of the automatic measurement.



If the measured results for both current directions deviate from each other by more than 10 % – this corresponds to the permissible service error – both measured values are displayed side by side with reduced resolution, e.g. as follows:



This presentation of the measured values informs you that the measurement with automatic polarity reversal does not give an unambiguous display, e.g. with a high contact resistance at the contact points. In this case, measure the resistance with manual polarity reversal according to the following description.

## 8.2 Measuring with manual polarity reversal

- ⇒ Briefly press the „Ω →“ (3) or the „Ω ←“ (4) pushbutton. You thus select the direction of the current with which you want to measure.
- ⇒ Start measuring by pressing the measurement pushbutton (8) in the probe (9) and hold the pushbutton at this position. You may also start measuring by pressing the measurement pushbutton „⊙“ (1) on the tester. Now the measurement is made in the selected direction of the current. You can recognize the direction on the LCD display by the corresponding arrow next to the „Ω“ character.



The measured value is shown in both digital and analog form. At measured values of more than 3.0 Ω the analog indicator shows overrange. In this case, the triangle is shown at the right end of the analog scale. The digital display shows measured values up to 30 Ω. „DATA“ and „HOLD“ function same as with ISO-Ω measurement. When the lamp in the probe (9) lights, it shows you that the measured values are smaller than 0.3 Ω (limit according to DIN VDE). The lamp serves for a quick, optical continuity test.

- ↪ Now measure the resistance with reversed direction of the current.

Different results obtained when measuring in both directions of the current point to external voltages on the device under test (e.g. thermovoltages or element voltages). Particularly in systems where the protective means „overcurrent protective device“ (formerly null method) is used without separate protective conductor, the measured results can be falsified by impedances of operating circuits connected in parallel and by equalizing currents.

To obtain unambiguous measured results, it is required to eliminate the cause of the fault.

- ↪ When you briefly press the pushbutton „AUTO/ ⊗“ (2), the tester switches back to resistance measurement with automatic polarity reversal.

#### Notes on measuring low-ohmic resistances:

- A low-ohmic measurement is made in four-wire connection, whereby the leads must be run up to the probes. The resistance of the fixed test leads does not enter into the measured result for that reason. If you use an extension cord, you must measure its resistance and deduct this value from the measured value obtained at a time.
- To also enable the measurement of larger resistances as required by DIN VDE 0413 Part 4, the measured span of the digital display is larger by one decade (up to 30 Ω) than that of the analog indicator (up to 3 Ω).
- On the low-ohmic measuring range, the tester is protected against overload by a superquick-acting fuse FF 0.315/500. With a blown fuse, only the voltage mea-

suring range functions ( $R_i = 5 \text{ M}\Omega$ ). When you press the measurement pushbutton in the „Ω“ function, the word „FUSE“ is shown in place of the digital display.

- Resistances that reach a stable value only after a „transient response“ should only be measured after manual selection of the direction of the current. A measurement with automatic polarity reversal can lead to different and to higher measured values and thus to an ambiguous display.

Resistances whose values change at the beginning of the measurement are, for instance:

- Resistances having a high inductive content
- Resistances of light bulbs whose values change due to heating caused by the measuring current
- Bad contact resistance; at the contact points.

### 8.3 Determining the maximum display values with allowances made for maximum service error

| Limit Value in $\Omega$ | Max. Display in $\Omega$ |
|-------------------------|--------------------------|
| 0,2                     | 0,16                     |
| 0,3                     | 0,25                     |
| 0,4                     | 0,35                     |
| 0,5                     | 0,44                     |
| 0,6                     | 0,53                     |
| 0,7                     | 0,62                     |
| 0,8                     | 0,71                     |
| 0,9                     | 0,80                     |
| 1,0                     | 0,89                     |
| 1,5                     | 1,35                     |
| 2,0                     | 1,80                     |
| 2,5                     | 2,25                     |
| 3,0                     | 2,71                     |
| 3,5                     | 3,16                     |
| 4,0                     | 3,62                     |

## 9 Specifications

| Measuring function | Measuring range  | Resolution  | Intrinsic error under reference conditions <sup>2) 3)</sup>  | Nominal range of use                           | Service error     | Overload capacity <sup>4)</sup> |                   |
|--------------------|--|---|--|--|-------------------|---------------------------------|-------------------|
|                    |  |   |  |  |                   | Overload value                  | Overload duration |
| 500 V $\simeq$     | 0 ... 500 V $\simeq$   | 1 V   | $\pm (1.5\% \text{ rdg.} + 2D)$  | 50 V ... 500 V                                 | $\pm 3\%$         | 600 V <sub>AC DC</sub>          | continuous        |
| ISO- $\Omega$      | 0 ... 30 K $\Omega$<br>0 ... 300 K $\Omega$<br>0 ... 3 M $\Omega$<br>0 ... 30 M $\Omega$<br>0 ... 300 M $\Omega$<br>0 ... 3 G $\Omega$ <sup>1)</sup> | 10 $\Omega$<br>100 $\Omega$<br>1 K $\Omega$<br>10 K $\Omega$<br>100 K $\Omega$<br>10 M $\Omega$ | $\pm (1.5\% \text{ rdg.} + 2D)$<br>$\pm (1.5\% \text{ rdg.} + 2D)$<br>$\pm (1.5\% \text{ rdg.} + 2D)$<br>$\pm (1.5\% \text{ rdg.} + 2D)$<br>$\pm (1.5\% \text{ rdg.} + 2D)$<br>$\pm (3.0\% \text{ rdg.} + 2D)$ | 100 k $\Omega$ ...<br>100 M $\Omega$<br>(AUTO) | $\pm 3\%$         | 600 V <sub>AC DC</sub>          | continuous        |
| $\Omega$           | 0 ... 3 $\Omega$ , analog<br>0 ... 30 $\Omega$ , digital   | 0.05 $\Omega$<br>0.01 $\Omega$  | $\pm (1.5\% \text{ rdg.} + 5D)$  | 0.2 $\Omega$ ... 4.8 $\Omega$                  | $\pm (10\% + 2D)$ | 0.315 A                         | continuous        |
| $\text{--- ---}$   | 6 ... 9.5 V  | 0.01 V  | $\pm (2.0\% \text{ rdg.} + 2D)$  | 6 ... 9.5%                                     | —                 | —                               | —                 |

1) Last digit is blanked; range span 300 digits

2) rdg. = of reading

3) Error of analog indicator = error of digital display  $\pm 1$  pointer

4) at  $-10^\circ\text{C}$  ...  $+55^\circ\text{C}$

| Measuring function | Measuring range  | Nominal voltage $U_N$ | Nominal/Meas. current                       | Open-circ. voltage $U_0$ | Short-circ. current $I_K$ | Internal resistance $R_i$ | Lamp switching point <sup>5)</sup>                                      | Acoustic Signal <sup>5)</sup>                                       |
|--------------------|--|-----------------------|---|--------------------------|---------------------------|---------------------------|---|---|
| 500 V $\simeq$     | 0 ... 500 V $\simeq$   | —                     | —   | —                        | —                         | 440 $\pm$ K $\Omega$      | —   | $U > 600\text{ V}$  |
| ISO- $\Omega$      | 0 ... 30 K $\Omega$<br>0 ... 300 K $\Omega$<br>0 ... 3 M $\Omega$<br>0 ... 30 M $\Omega$<br>0 ... 300 M $\Omega$<br>0 ... 3 G $\Omega$ <sup>1)</sup> | 500 V                 | $I_N$<br>1.0 mA                             | $\leq 550\text{ V}$      | $\leq 1.5\text{ mA}$      | —                         | on:<br>$R_X > 1.1\text{ M}\Omega$<br>off:<br>$R_X < 1.0\text{ M}\Omega$ | on:<br>$R_X < 2\text{ k}\Omega$<br>off:<br>$R_X > 6\text{ k}\Omega$ |
| $\Omega$           | 0 ... 3 $\Omega$ , analog<br>0 ... 30 $\Omega$ , digital   | —                     | $I_m$ <sup>6)</sup><br>$\geq 200\text{ mA}$ | 4.5 V                    | 250 mA                    | —                         | $R_X < 0.3\ \Omega$   | —   |

5) General: acoustic signal on = warning; lamp automatically on = measured values are within the permissible range (good);

6) 0.2  $\Omega$  ... 4.0  $\Omega$

### Reference conditions

|                                |  |
|--------------------------------|--|
| Temperature                    | +23 °C ± 2 K   |
| Relative humidity              | 40 ... 60%   |
| Frequency of measured quantity | 45 ... 65 Hz   |
| Waveform of measured quantity  | Sinusoidal; deviation between rms value and rectified value ≤ 0.5% |
| Battery voltage                | 9 V ± 0.5 V  |

### Nominal conditions of use

|                 |                  |
|-----------------|------------------|
| Temperature     | 0 °C ... + 40 °C |
| Position of use | Any              |
| Battery voltage | 6.0 V ... 9.5 V  |
| Height oversea  | up to 2000 m     |

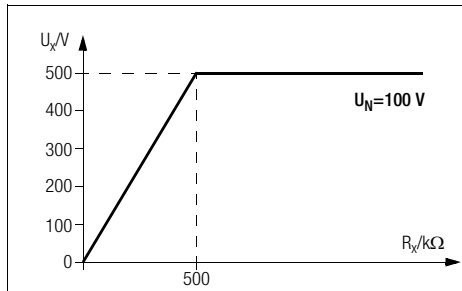
### Influence quantities and variations

|                   |   |
|-------------------|---|
| Capacitance       | A parallel capacitance of 5 µF causes an error of ≤ 5% at the limits of the nominal ranges of use (permissible per DIN VDE 0413 +10%) |
| Relative humidity | Variation 1 x intrinsic error for 3 days of 75% RH and tester switched off  |

| Influence quantity               | Range of influence                                     | Meas. quantity/<br>Meas. range  | Variation<br>±(...% rdg.+ d) |
|----------------------------------|--|---|------------------------------|
| Temperature                      | 0 ... + 21 °C<br>and<br>25 ... + 40 °C                 | 500 V $\sim$  | 0.5 + 2 / 10 K               |
|                                  |  | 30 k $\Omega$ ...<br>300 M $\Omega$                                   | 0.5 + 2 / 10 K               |
|                                  |  | 3 G $\Omega$  | 2.0 + 2 / 10 K               |
|                                  |  | 30 G $\Omega$   | 0.5 + 2 / 10 K               |
|                                  |  | U <sub>batt.</sub> $\pm$  | 0.5 + 2 / 10 K               |
| Frequency of meas. quantity      | 25 Hz ... < 45 Hz<br>and<br>> 65 Hz ... 1 kHz          | 500 V $\sim$  | 0.5 + 2                      |
| Battery voltage                  | 6 V ... < 8.5 V  | 500 V $\sim$  | 0.5 + 2                      |
|                                  |  | 30 k $\Omega$ ...<br>300 M $\Omega$                                   | 0.5 + 2                      |
|                                  |  | 3 G $\Omega$  | 2.0 + 2                      |
|                                  |  | 30 $\Omega$   | 0.5 + 2                      |
|                                  |  | V $\sim$ : R <sub>q</sub> = $\infty$<br>R <sub>q</sub> = 1 k $\Omega$ | > 40 dB<br>> 100dB           |
| Common mode interference voltage | Noise qty.<br>max. 1000 V $\sim$ ,<br>50 Hz sinusoidal | ISO- $\Omega$ :<br>R <sub>q</sub> = 500 k $\Omega$                    | max. ± 1 d                   |
|                                  |  | $\Omega$ : R <sub>q</sub> = 1 $\Omega$                                | max. ± 1 d                   |

## Voltage across the device under test with ISO- $\Omega$ measurement

Measuring voltage  $U_x$  across the device under test as a function of its resistance  $R_x$  when measuring insulation resistance:



## Display

LCD display (86 mm x 35 mm) with analog indication and digital display and display of the unit to be measured and various special functions.

## Digital:

|                      |  |
|----------------------|--|
| Display              | 7-segment numerals                         |
| Height of numerals   | 14 mm                                      |
| Number of digits     | $\pm 3000$ counts (3 $\frac{3}{4}$ digits) |
| Overrange indication | „OL“                                       |

## Analog:

|                      |                        |
|----------------------|------------------------|
| Indication           | LCD scale with pointer |
| Scale length         | 78 mm                  |
| Graduation           | 61 scale divisions     |
| Overrange indication | by triangle            |

## Response time

|               |   |
|---------------|---|
| Response time | for „ISO- $\Omega$ “, measuring ranges up to 300 M $\Omega$ and for „ $\Omega$ “: < 1.5 s; on all other measuring ranges: < 2.5 s |
| Settling time | until „DATA“ is displayed: 2.0 s ... 4.5 s; on the 3 G $\Omega$ range < 7 s   |

## Power supply

|   |   |
|---|---|
| Batteries   | 6 each 1.5 V mono-cells type zinc-carbon to IEC R 20 or ANSI-D or JIS-SUM1, type alkaline-manganese to IEC LR 20 or ANSI-D or JIS-AM1 suitable NiCd storage batteries (NiCd storage batteries must be charged externally) |
| Battery life /number of possible measurements with one battery set (lamp off) |   |
| $V \approx$ measurement   | 150 hours with zinc-carbon,<br>300 hours with alkaline-manganese  |
| ISO- $\Omega$ measurement   | 500 k $\Omega$ , 4 s measure, 25 s pause:<br>9 000 measurements with zinc-carbon,<br>18 000 measurements with alkaline-manganese  |
| $\Omega$ measurement  | 1 $\Omega$ , automatic polarity reversal,<br>25 s pause:<br>3 000 measurements with zinc-carbon,<br>9 000 measurements with alkaline-manganese  |

## Electrical safety

|                            |  |
|----------------------------|--|
| Protection class           | II to IEC 61010-1/EN 61010-1/VDE 0411-1      |
| Nominal insulation voltage | 600 V to IEC 61010-1/EN 61010-1/VDE 0411-1   |
| Test voltage               | 3.7 kV~ to IEC 61010-1/EN 61010-1/VDE 0411-1 |
| Measuring category         | 500 V CAT II                                 |
| Contamination level        | 2  |

## Electromagnetic Compatibility EMC

|                  |                   |
|------------------|-------------------|
| Product standard | DIN EN 61326:2002 |
|------------------|-------------------|

| Interference Emission |                              | Class               |
|-----------------------|------------------------------|---------------------|
| EN 55022              |                              | B                   |
| Interference Immunity | Test Value                   | Performance Feature |
| EN 61000-4-2          | Contact/atmosph. - 4 kV/8 kV | B                   |
| EN 61000-4-3          | 10 V/m                       | B                   |

## Fuse

|      |   |
|------|---|
| Fuse | FF 0.315/500; 6.3 mm x 32 mm, protects the low-ohmic measuring range in conjunction with power diodes |
|------|---|

## Light bulb

|                          |  |
|--------------------------|--|
| Signal lamp in the probe | Lens type lamp 2.5 V / 0.2 A, cap E 10 |
|--------------------------|--|

## Temperature ranges

|                       |                                    |
|-----------------------|------------------------------------|
| Operating temperature | -10 °C + 55 °C                     |
| Storage temperature   | -25 °C + 70 °C (without batteries) |

## Mechanical configuration

|                 |                        |
|-----------------|------------------------|
| Protection type | Case IP 52             |
|                 | Probe IP 20            |
|                 | to EN 60529 / VDE 0470 |

Excerpt 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        |
|---------------------------------|---|---------------------------------|--|
| 0                               | not protected                           | 0                               | not protected                                      |
| 1                               | ≥ 50,0 mm Ø                             | 1                               | vertically falling drops                           |
| 2                               | ≥ 12,5 mm Ø                             | 2                               | vertically falling drops with enclosure tilted 15° |
| 3                               | ≥ 2,5 mm Ø                              | 3                               | spraying water                                     |
| 4                               | ≥ 1,0 mm Ø                              | 4                               | splashing water                                    |
| 5                               | dust protected                          | 5                               | water jets   |

|            |   |
|------------|---|
| Dimensions | 165 mm x 125 mm x 110 mm without test leads |
|------------|---|

|        |                                      |
|--------|--------------------------------------|
| Weight | 1.85 kg approx., including batteries |
|--------|--------------------------------------|

## Accessories

|                 |                     |
|-----------------|---------------------|
| Crocodile clips | 1000 V CAT III 19 A |
|-----------------|---------------------|

**Attention!**

Completely disconnect the tester from all external circuits prior to replacing batteries, bulbs or fuses!

**10.1 Messages on the LCD display**

Messages that appear on the LCD display in place of the digital display have the following meaning:

**U LO** is shown, when

- there is a blown or missing fuse (for ISO- $\Omega$  only)
- the battery voltage is too low
- the tester is defective

**FUSE** is shown when pressing the measurement pushbutton (8) in the  $\Omega$  funktion, when

- there is a blown or missing fuse

**OL** is shown, when

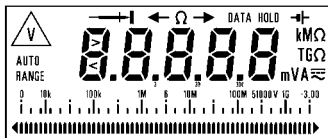
- there is an overrange condition

--- is shown, when

- the tester is in „standby“ mode

**10.2 Testing the LCD display**

- ⇨ Turn the switch (6) from any position to another and simultaneously press the pushbutton „RANGE↑“ (3) and the pushbutton „RANGE↓“ (4). You thus activate the LCD test. Now briefly press the pushbutton „RANGE↓“ (4) twice. All segments of the display, except for the triangle „V“ are presented on the LCD display (5).



Also some segments are shown which are not used in this tester. Pressing of the pushbuttons „RANGE↑“ (3) or „RANGE↓“ (4) lets you switch to test patterns which however, are provided for test and service purposes only.  
⇨ Turn the rotary switch (6) to another position. This sets the tester back to normal condition.

**10.3 Batteries**

At regular, short intervals check that the batteries of your tester do not leak. With leaking batteries, completely remove the battery electrolyte and install new batteries. If U LO is shown on the LCD display while making a battery test according to section 3.2. the batteries must be replaced with new ones. Do this as described in section 3.1. The tester operates on 6 each 1.5 V mono-cells to IEC R20 (zinc-carbon) or IEC LR20 (alkaline-manganese). Always replace the complete battery set!

## 10.4 Fuse

The insulation tester is fitted with a fuse type FF 0.315/500 which protects the low-ohmic measuring range against overload. When a fuse blows, the word „FUSE“ is shown on the LCD display (5) (see section 10.1). In this case, only voltage measurements (with  $R_i = 5 \text{ M}\Omega$ ) can still be performed. The fuse is located in a holder in the bottom of the case.

Replace it as follows:

- ⇒ Completely disconnect the tester from all external circuits.
- ⇒ Undo the two slotted screws at the bottom of the tester using an adequate tool and remove the cover of the battery compartment.
- ⇒ With an adequate tool, unscrew the cap of the fuse holder.
- ⇒ Remove the fuse and replace it with a new one. A spare fuse is located in a holder immediately next to it.



### Attention!

Absolutely verify that only the specified fuse, type FF 0.315/500 is installed. If a fuse of other cut-out capacity, other nominal current or other switching capacity is used, there is danger of damaging components.

- 
- ⇒ Replace the fuse cap together with the new fuse.
  - ⇒ Replace the cover of the battery compartment and tighten it.

## 10.5 Lamp in the probe

The probe (9) is fitted with a lens type lamp of 2.5 V/0.2 A with an E10 cap. Replace an unserviceable bulb as follows:

- ⇒ Completely disconnect the tester from all external circuits.
- ⇒ With a screwdriver, undo the screw with which the white cover cap is fastened to the probe and remove the cap.
- ⇒ Replace the light bulb with a new one.
- ⇒ Re-attach the cover cap to the probe.

## 10.6 Case

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 or solvents.

### 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 with the trash. Please contact our service department regarding the return of old devices.

## 11 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 +49 911 8602-0  
Fax +49 911 8602-253  
E-Mail [service@gossenmetrawatt.com](mailto:service@gossenmetrawatt.com)

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

### \* **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

### 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.

## 12 Product Support

When you need support, please contact:

GMC-I Gossen-Metrawatt GmbH

**Product Support Hotline**

Phone +49 911 8602-112

Fax +49 911 8602-709

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

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