Operating Instructions

METRISO®1000 D

Insulation Tester

3-348-652-02
4/11.98


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(3)
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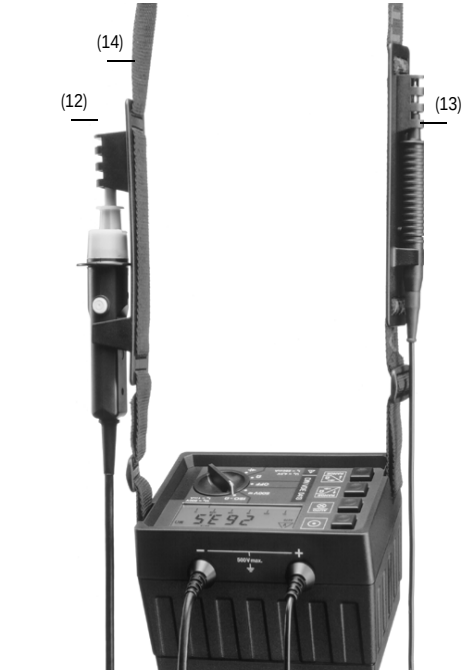
(4)
(5)
(6)
(7)
(9)
(8)
(10)
(11)
AUTO
DATA
296.4
MΩ
ISO-Q
500 V
1000 V
OFF
RANGE
RANGE



(1) Pushbutton for „CONTINUOUSLY ON“

(2) Pushbutton
- for switching to autoranging with ISO-Ω measurement,
- for measuring with automatic polarity reversal with Ω measurement and for switch-on of the lamp in the probe

(3) Pushbutton
- for manual switching to higher measuring ranges with ISO-Ω measurement and
- for Ω-measurement with current direction from + to –

(4) Pushbutton
- for manual switching to lower measuring ranges with ISO-Ω measurement and
- for Ω-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) Pickup clip for attachment to probes

(12) Holder for probe with lamp (9)

(13) Probe holder (10)

(14) Carrying strap

Contents

1 Safety precautions

The insulation tester has been constructed and tested to comply with IEC 61557 / EN 61557 / VDE 0413 und IEC 61010-1 / EN 61010-1 / VDE 0 411-1.
When properly used, the safety of both the user and the tester is assured. It is not assured, however, if the tester 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 only 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 tester 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,
- after severe transport stress.

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.

The VDE Test Office has approved the use of the VDE-GS mark (tested safety) for the insulation tester.

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

2 Applications

The insulation tester complies with the following specifications: 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 1000 V and to test the resistance of ground conductors, protective conductors and equipotential conductors including their connections and connectors.

In addition, the fester has a 1000 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. Furthermore, it is possible to perform a „test of the discharge capability for electrostatic charges for floor coverings in explosion-hazardous rooms“ according to DIN 51 953.

3 Getting started

3.1 Inserting the batteries

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!

- ⇨ 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 1.5 V 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

When measuring the insulation resistance, the load on the batteries is different on the three nominal voltage ranges. That means, for example, that the „charging state“ of the six mono-cells no longer assures compliance with the error limits at a nominal voltage of 1000 V while many measurements can still be made with the specified accuracy at 100 V. That is why the tester offers the possibility to test the batteries under operating conditions for each of the three nominal voltages. The lamp in the probe is on at times.

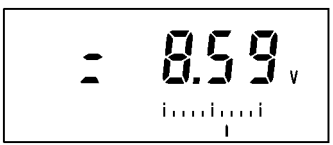
Test for nominal voltage 500 V and for the „Ω“ range:

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

The digital display shows the battery voltage at a simulated load for the 500 V nominal voltage 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.

The battery test for the nominal voltage 500V and for the „Ω“ range is recognized by two superimposed horizontal lines preceding the digital display.



Test for nominal voltages 100 V and 1000 V:

➪ Set the rotary switch (6) to position „-I|-“ as described above.

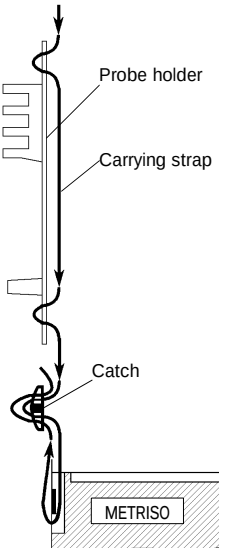
➪ For the test of the nominal voltage 100 V, briefly press the „RANGE↓“ pushbutton (4), or briefly press the „RANGE↑“ pushbutton (3) for the test for the nominal voltage 1000„RANGE↑“V.

The battery voltage is displayed in digital and analog form, as described above.

For recognition, a horizontal line precedes the digital display for 100 V nominal voltage and three superimposed lines for 1000 V nominal voltage.
If the battery test reveals that the battery voltage is below the lower limit, „U LO“ is shown on the LCD display (5).
The battery test is automatically stopped after about 10 seconds. „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 „1000 V≃ “, to one of the „ISO-Ω“ or to the „Ω“ position.

When set to the „1000 V≃“ position, the measuring range for DC and AC voltage is switched on. Digital display and analog indication are presented.

When set to one of the three „ISO-Ω“ positions, the tester is switched to „standby“. The digital display only shows the decimal point together with the numeral 3 and the unit MΩ, and the analog indicator shows the measuring range 100 V, 500 V or 1000 V in line with the selected nominal voltage.

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

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

- when the rotary switch is not operated for approximately 3 minutes and when no pushbutton is pressed
- when the measured values 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 „1000 V≃ “ 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-Ω“ and „Ω“ 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 „Ω“, see section 8.1). When set to these positions, you also can switch the tester „CONTINUOUSLY ON“:

➪ Briefly press the measurement pushbutton „(⊙)“ (1) on the tester. You can cancel „CONTINUOUSLY ON“ by

- again pressing the measurement pushbutton „⊙ “ (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.

4 LCD display

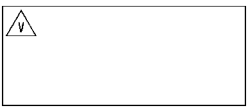
The measured values are shown on the LCD display (5) in digital and analog form.
The digital display shows the measured value with decimal point and unit. The numerals immediately under the decimal points show the upper limit of the selected measuring range. When the measuring range is exceeded, „OL“ 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 „Ω“ position, the fuse blows when an external voltage is applied to the probes!
Never switch to the „Ω“ range when an external voltage is applied as this could damage the switch contacts!

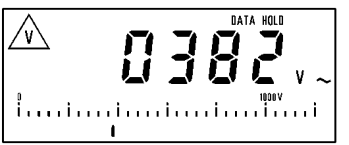
6 Measuring DC and AC voltages

Set the rotary switch (6) to the „1000 V≃ “ position.

⇨ Scan the measuring points with the two probes without pressing the measurement pushbutton (8) 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. A short sound 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!

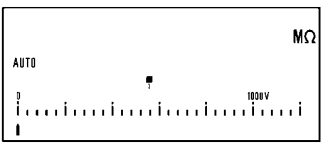
The permissible overload capacity on the voltage measuring range is 1200 V≃ .
If this value is exceeded, a sound signal draws your attention to it.

The input resistance on the voltage measuring range is 880 kΩ. With a blown or a missing fuse, the voltage measurement is made with an input resistance of approximately 5 MΩ.

7 Measuring the insulation resistance

7.1 ISO-Ω measurement up to 3 GΩ with autoranging

➪ Set the rotary switch (6) to one of the three „ISO-Ω“ positions. Depending upon the nominal voltage of the device under test, you can measure the insulation resistance with a nominal voltage of 100 V, 500 V or 1000 V. With a nominal voltage of 1000 V selected, the LCD display (5) shows the following:

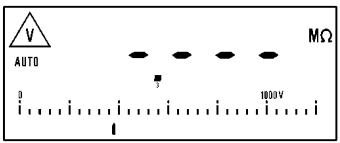


When there is no voltage applied to the probes, the digital display only shows the decimal point together with the numeral 3 and the symbol for the unit MΩ. Depending upon the nominal voltage selected, the analog indicator shows the 100 V, 500 V or 1000 V measuring range.
When the „ISO-Ω“ function is 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:

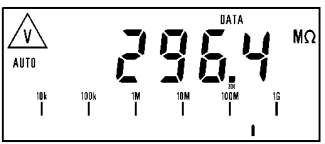


- The warning triangle signals a hazardous contact potential > 25 V.
- Four horizontal lines are shown in the middle of the numerals of the digital display.
- The pointer of the analog indicator shows the value of the DC or AC voltage applied. If this is the voltage of a charged capacitive device under test, the device under test is discharged. You can observe the drop in voltage on the analog indicator.

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

Attention!
An insulation measurement is blocked when a voltage > 25 V is applied to the probes prior to starting the measurement! A short sound signal points to this.

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



Digital display: In line with the measured value, the tester selects that measuring range from the 6 automatically selectable ISO-Ω 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

Overrange „OL“ is signalled, when the meas. value is higher than 3 GΩ. You can measure insulation resistances up to 30 GΩ after manual range selection acc. to section 7.4!

Analog indication: The entire measuring span of the ISO-Ω measurement (all of the 6 automatically selectable 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 kΩ, a triangle is shown at the left end of the analog scale in place of the pointer. With a measured value of more than 3 GΩ, overrange is signalled by a triangle at the right end of the scale. You can measure insulation resistances up to 30 GΩ after manual range selection according to section 7.2!

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
> approx. 200 kΩ on the nominal voltage range 100 V,
> approx. 1 MΩ on the nominal voltage range 500 V and
> approx. 2 MΩ at a nominal voltage of 1000 V. The lamp does not light with measured values that are smaller than the given values.
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.
You can switch the lamp on to illuminate the measuring point even if the insulation resistance is lower than the values given for the lamp switching point.
Press the „AUTO/⊗ “ pushbutton (2). The lamp lights as long as you keep the pushbutton pressed.

Sound signal: Insulation resistances < 2 kΩ are reported by a sound signal which ceases at values > 6 kΩ.

Attention!

Do not touch the probe ends (9) and (10) when the tester is switched on for ISO-Ω 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 100 V, 500 V or 1000 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 100 V, 500 V or 1000 V, depending upon the nominal voltage selected. Touching means danger to life! For that reason, discharge with caution as described before.

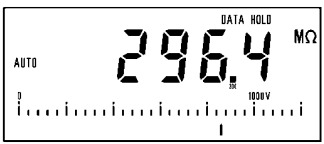
Holding the measured value

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

- ⇨ You can read the measured value now – or after releasing the measurement 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, 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.



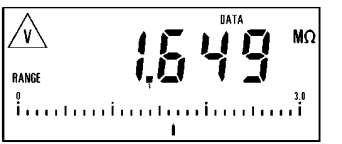
- ⇨ The measured value hold in the digital display is cleared approximately 3 minutes after releasing the measurement pushbutton (8) and the tester switches to „standby“.
- ⇨ The lamp in the probe (9) is a helpful means to read the LCD at poor light conditions. The lamp lights as long as you keep the 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 up to 3 GΩ with manual range selection

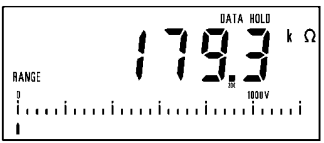
- ⇨ Set the rotary switch (6) to one of the three „ISO-Ω“ positions. Depending upon the nominal voltage of the device under test, you can measure the insulation resistance with a nominal voltage of 100 V, 500 V or 1000 V.
- ⇨ Check that the device under test is free from external voltages as described 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 one of the three „ISO-Ω“ positions. The LCD shows the word „RANGE“ in place of „AUTO“.
- ⇨ You now can 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 on the LCD by the numerals immediately under the decimal points 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“ and/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 in section 7.1 for the measurement with autoranging.
  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 measuring range at a nominal voltage of 1000 V. 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 up to 3 GΩ 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.
The service error is different on the three nominal voltages ranges. That is why different minimum display values must be considered, depending upon the selected nominal voltage.

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

Range 300 kΩ				Range 3 MΩ				Range 30 MΩ				Range 300 MΩ			
Limit	Min. display value (kΩ) at nominal range			Limit	Min. display value (MΩ) at nominal range			Limit	Min. display value (MΩ) at nominal range			Limit	Min. display value (MΩ) at nominal range		
kΩ	100 V	500 V	1000 V	MΩ	100 V	500 V	1000 V	MΩ	100 V	500 V	1000 V	MΩ	100 V	500 V	1000 V
				0.2	0.210	0.206	0.208	2	2.10	2.06	20.8	20	21.0	20.6	20.8
				0.3	0.315	0.309	0.312	3	3.15	3.09	3.12	30	30.5	30.9	31.2
				0.4	0.420	0.412	0.416	4	4.20	4.12	4.16	40	42.0	41.2	41.6
				0.5	0.525	0.515	0.520	5	5.25	5.05	5.20	50	52.5	50.5	52.0
				0.6	0.630	0.618	0.624	6	6.30	6.18	6.24	60	63.0	61.8	62.4
				0.7	0.735	0.721	0.728	7	7.35	7.21	7.28	70	73.5	72.1	72.8
				0.8	0.840	0.824	0.832	8	8.40	8.24	8.32	80	84.0	82.4	83.2
				0.9	0.945	0.927	0.936	9	9.45	9.27	9.36	90	94.5	92.7	93.6
100	105.0	103.0	104.0	1.0	1.050	1.030	1.040	10	10.50	10.30	10.40	100	105.0	103.0	104.0
110	115.5	113.3	114.4	1.1	1.155	1.133	1.144	11	11.55	11.33	11.44				
120	126.0	123.6	124.8	1.2	1.260	1.236	1.248	12	12.60	12.36	12.48				
130	136.5	133.9	135.2	1.3	1.365	1.365	1.339	13	13.65	13.39	13.52				
140	147.0	144.2	145.6	1.4	1.470	1.442	1.456	14	14.70	14.42	14.56				
150	157.5	154.5	156.0	1.5	1.575	1.545	1.560	15	15.75	15.45	15.60				
160	168.0	164.8	166.4	1.6	1.680	1.648	1.664	16	16.80	16.48	16.64				
170	178.5	175.1	176.8	1.7	1.785	1.751	1.768	17	17.85	17.51	17.68				
180	189.0	185.4	187.2	1.8	1.890	1.854	1.872	18	18.90	18.54	18.72				
190	199.5	195.7	197.6	1.9	1.995	1.957	1.976	19	19.95	19.57	19.76				
200	210.0	206.0	208.0	2.0	2.100	2.060	2.080	20	21.00	20.60	20.80				
210	220.5	216.3	218.4	2.1	2.205	2.163	2.184	21	22.05	21.63	21.84				
220	231.0	226.6	228.8	2.2	2.310	2.266	2.288	22	23.10	22.66	22.88				
230	241.5	236.9	239.2	2.3	2.415	2.369	2.392	23	24.15	23.69	23.92				
240	252.0	247.2	249.6	2.4	2.520	2.472	2.496	24	25.20	24.72	24.96				
250	262.5	257.5	260.0	2.5	2.625	2.575	2.600	25	26.25	25.75	26.00				
260	273.0	267.8	270.4	2.6	2.730	2.678	2.704	26	27.30	26.78	27.04				
270	283.5	278.1	280.8	2.7	2.835	2.781	2.808	27	28.35	27.81	28.08				
280	294.5	288.4	291.2	2.8	2.940	2.884	2.912	28	29.40	28.84	29.12				
290	304.5	298.7	301.6	2.9	3.045	2.987	3.016	29	30.45	29.87	30.16				
300	315.0	309.0	312.0	3.0	3.150	3.090	3.120	30	31.50	30.90	31.20				

7.4 ISO-Ω measurement up to 30 GΩ

You can measure insulation resistances on the 30 GΩ measuring range only at a nominal voltage of 500 V or 1000 V and after manual range selection.

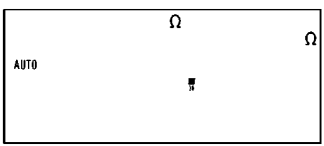
- ⇨ Procede first as described in section „7.2 ISO-Ω measurement up to 3 GΩ with manual range selection“.
- ⇨ Then select the highest measuring range 30 GΩ with the „RANGE↑“ pushbutton (3).
- ⇨ Make a solid connection of the test leads to the device under test using the included alligator clips and make sure the test leads do not touch each other. It is of advantage to run the test leads to the device under test as „free leads“. You can thus prevent the parallel insulation resistance of the test leads from affecting the measured result.
- ⇨ Start the measurement by briefly pressing the measurement pushbutton „⊙“ (1).
  This also is a measure to prevent the measured result from being affected by touching of the probes.
- ⇨ When the LCD display (5) shows „DATA“ and a brief sound signal draws your attention to this, you can end the measurement by again pressing the pushbutton „⊙“ (1), read and hold the measured value (see „Holding the measured value“ in section 7.1).

8 Measuring low-ohmic resistances (0 ... 30 Ω)

8.1 Measuring with automatic polarity reversal

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

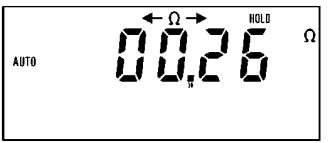
- ⇨ Set the rotary switch (6) to the „Ω“ position.
  The LCD display (5) only shows the decimal point together with the number 30 and the unit Ω. The analog scale is blanked.



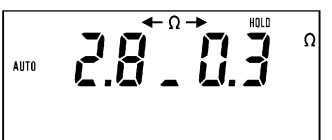
- ⇨ Start measuring by briefly pressing the measurement pushbutton (8) in the probe (9) or the pushbutton (1). „CONTINUOUSLY ON“ with the measurement pushbutton „⊙ “ (1) is not possible when measuring with automatic polarity reversal. The tester now automatically measures first in one direction of the 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 „Ω“ 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 brief sound signal draws your attention to the end of the automatic measurement.



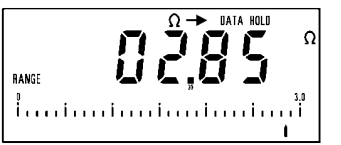
If the measured results for both current directions deviate from each other by more than 10% – this corresponds to the permissible service error – both measured values are displayed side by side with reduced resolution, e.g. as follows:



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→“ pushbutton (3) or the „Ω←“ pushbutton (4). 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. With 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 a 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 are 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.
- To also enable the measurement of larger resistances as required by DIN VDE 0413 Part 4, the measuring 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 FA 0.315 A /1000 V. With a blown fuse, only the voltage measuring range functions (R_i = 5 MΩ). 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
- Poor contact resistance at the contact points.

8.3 Finding the max. display values regarding the maximum service error:

Limit Ω	Max. display values Ω
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

Measuring function	Measuring range	Resolution	Intrinsic error under reference conditions [2) 3)]	Nominal range of use	Service error	Overload capacity [4)]	
						Overload value	Overload duration
1000 V≃	0 ... 1000 V≃	1 V	± (2.0% rdg. + 2D)	50 V ... 1000	± 3.5%	1200 $V_{AC\,DC}$	continuously
ISO-Ω U_N = 100 V	0 ... 30 KΩ 0 ... 300 KΩ 0 ... 3 MΩ 0 ... 30 MΩ 0 ... 300 MΩ 0 ... 3 GΩ [1)]	10 Ω 100 Ω 1 KΩ 10 KΩ 100 KΩ 10 MΩ	± (1.5% rdg. + 2D) ± (1.5% rdg. + 2D) ± (1.5% rdg. + 2D) ± (1.5% rdg. + 2D) ± (3.0% rdg. + 2D) ± (20.0% rdg. + 2D)	100 kΩ ... 100 MΩ (AUTO)	± 5%	1200 $V_{AC\,DC}$	max. 10 s
ISO-Ω U_N = 500 V	0 ... 30 kΩ 0 ... 300 kΩ 0 ... 3 MΩ 0 ... 30 MΩ 0 ... 300 MΩ 0 ... 3 GΩ [1)] 0 ... 30 GΩ [1)]	10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 10 MΩ 100 MΩ	± (1.5% rdg. + 2D) ± (1.5% rdg. + 2D) ± (1.5% rdg. + 2D) ± (1.5% rdg. + 2D) ± (1.5% rdg. + 2D) ± (3.0% rdg. + 2D) ± (20.0% rdg. + 2D)	100 kΩ ... 100 MΩ (AUTO)	± 3%	1200 $V_{AC\,DC}$	max. 10 s
ISO-Ω U_N = 1000 V	0 ... 30 kΩ 0... 300 kΩ 0 ... 3 MΩ 0 ... 30 MΩ 0 ... 300 MΩ 0 ... 3 GΩ [1)] 0 ... 30 GΩ [1)]	10 Ω 100 Ω 1 Ω 10 kΩ 100 kΩ 10 MΩ 100 MΩ	± (1.5% rdg. + 2D) ± (1.5% rdg. + 2D) ± (1.5% rdg. + 2D) ± (1.5% rdg. + 2D) ± (1.5% rdg. + 2D) ± (3.0% rdg. + 2D) ± (20.0% rdg. + 2D)	100 kΩ ... 100 MΩ (AUTO)	± 4%	1200 $V_{AC\,DC}$	max. 10 s
Ω	0 ... 3 Ω, analog 0 ... 30 Ω, dig.	0.05 Ω 0.01 Ω	⇒ 3) ± (1.5% rdg. + 5D	0.2 Ω ... 4.0 Ω	±(10%+2D)	0.315 A	dauernd
⊣⊢	6 ... 9.5 V	0.01 V	± (3.0% rdg. + 2D)	6 ... 9.5%	—	—	—

1) Last digit is balanked; range span 300 digits
2) rdg. = of reading
3) Error of analog indicator = error of digital display ± 1 pointer
4) at –10 ° C ... +55 ° C

Measuring function	Measuring range	Nominal voltage U_N	Nominal/ Meas. current	Open-circuit voltage U_O	Short-circuit current I_K	Internal resistance R_i	Lamp switching point [6]	Buzzer [6]
1000 V≃	0 ... 1000 V≃	—	—	—	—	880 ± 50 kΩ	—	U > 1200 V
ISO-Ω U_N = 100 V	0 ... 30 KΩ 0 ... 300 KΩ 0 ... 3 MΩ 0 ... 30 MΩ 0 ... 300 MΩ 0 ... 3 GΩ [1]	100 V	I_N 1.0 mA	≤ 110 V	≤ 2.0 mA	—	on: R_X > 220 kΩ off: R_X < 200 kΩ	on: R_X < 2 kΩ off: R_X > 6 kΩ
ISO-Ω U_N = 500 V	0 ... 30 kΩ 0 ... 300 kΩ 0 ... 3 MΩ 0 ... 30 MΩ 0 ... 300 MΩ 0 ... 3 GΩ [1] 0 ... 30 GΩ [1]	500 V	I_N 1.0 mA	≤ 550 V	≤ 2.0 mA	—	on: R_X > 1.1 MΩ off: R_X < 1.0 MΩ	on: R_X < 2 kΩ off: R_X > 6 kΩ
ISO-Ω U_N = 1000 V	0 ... 30 kΩ 0... 300 kΩ 0 ... 3 MΩ 0 ... 30 MΩ 0 ... 300 MΩ 0 ... 3 GΩ [1] 0 ... 30 GΩ [1]	1000 V	I_N 1.0 mA	≤ 1100 V	≤ 2.0 mA	—	on: R_X > 2.2 MΩ off: R_X < 2.0 MΩ	on: R_X < 2 kΩ off: R_X > 6 kΩ
Ω	0 ... 3 Ω, analog 0 ... 30 Ω, digital	—	I_m [7] ≥200 mA	4.5 V	250 mA	—	R_X < 0.3 Ω	—

[6] Generally:
Lamp automatically on = measured values are within the permissible range (good); buzzer on = warning

[7] 0.2 Ω ... 4.0 Ω

Reference conditions

Temperature	+23 °C ± 2 K
Relative temperature humidity	45 ... 55%
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

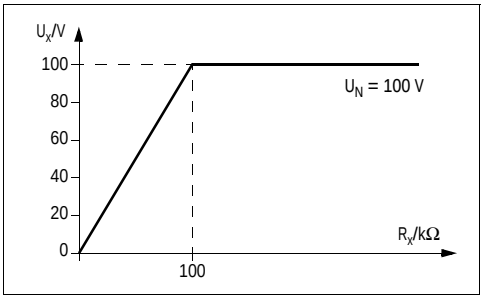
Influence quantities and variations

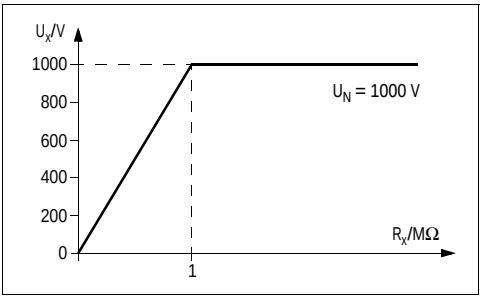
Capacitance	A parallel capacitance of 5 µF causes an error of ≤ 10% at the limits of the nominal ranges of use
Relative humidity	Variation 1 x intrinsic error for 3 days of 75% RH and tester switched off

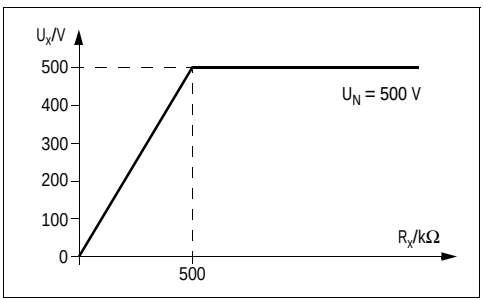
Influence quantity	Range of influence	Meas. quantity/ Meas. range	Variation ±(... % rdg.+ c)
Temp.	0 … + 21 °C and 25 … + 40 °C	1000 V≃	0.5 + 2 / 10K
		30 kΩ … 300 MΩ	0.5 + 2 / 10K
		3 GΩ	2.0 + 2 / 10K
		30 GΩ	5.0 + 2 / 10K
		30 Ω	0.5 + 2 / 10K
		$U_{batt.}$ ⊣⊢	0.5 + 2 / 10K
Frequency of the meas. qty.	25 Hz … < 45 Hz and > 65 Hz … 1 kHz	1000 V≃	1.0 + 2
Battery voltage	6 V … < 8.5 V	1000 V≃	0.5 + 2
		30 kΩ … 300 MΩ	0.5 + 2 1.0 + 2 at U_N = 1000 V
		3 GΩ	2.0 + 2 5.0 + 2 at U_N = 1000 V
		30 GΩ	10.0 + 2
		30 Ω	0.5 + 2
Common mode interf. voltage	Noise qty. max. 1000 V ~ , 50 Hz sinusoidal	V~ : R_q = ∞ R_q = 1 kΩ	> 40 dB > 100 dB
		ISO–Ω : R = 500 kΩ	max. ±1 D
		Ω : R_q = 1 Ω	max. ±1 D

Voltage across the device under test with ISO-Ω measurement

Measuring voltage U_x across the device under test as a function of its resistance R_x at a nominal voltage of 100 V, 500 V and 1000 V:







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	±3000 counts (3 ¾ 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-Ω“, measuring ranges up to 300 MΩ and for „Ω“: < 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 GΩ 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~ measurement	150 hours with zinc-carbon, 300 hours with alkaline-manganese
ISO-Ω measurement	U_N = 100 V: 100 kΩ, 5 s measure, 25 s pause: 10000 measurements with zinc-carbon, 16000 measurements with alkaline-manganese U_N = 500 V: 500 kΩ, 5 s measure, 25 s pause: 5000 measurements with zinc-carbon, 10000 measurements with alkaline-manganese U_N = 1000 V: 1 MΩ, 5 s measure, 25 s pause: 2200 measurements with zinc-carbon, 3500 measurements with alkaline-manganese
Ω measurement	1 Ω automatic polarity reversal (1 measurement cycle), 25 s pause: 10000 measurements with zinc-carbon, 15000 measurements with alkaline-manganese

Electrical safety

Protection class	II to IEC 61010-1/EN 61010-1/VDE 0411-1
Nominal insulation voltage	1000 V to IEC 61010-1/EN 61010-1/ VDE 0411-1
Test voltage	6 kV~ to IEC 61010-1/EN 61010-1/VDE 0411-1
Overvoltage category	II
Contamination level	2
Radio interference suppression	Limit value class B to DIN VDE 0871
EMC	to DIN VDE 0843 / IEC 801 Part 2: severity level 3 Part 3: 27 MHz ... 500 MHz 3 V/m Part 4 : severity level 2

Fuse

Fuse	FA 0.315 A / 1000 V; 6.3 mm x 45 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 / Climatic class

Operating temperature	–10 °C + 55 °C
Storage temperature	–25 °C + 70 °C (without batteries)
Climatic class	2z/-10/55/70/75% with reference to VDI/VDE 3540

Mechanical configuration

Protection type	Case IP 52 Probe IP 20 to EN 60529 / VDE 0470
Dimensions	165 mm x 125 mm x 110 mm without test leads
Weight	1.85 kg approx., including batteries

10 Maintenance

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 show, when
- there is a blown or missing fuse (for ISO-Ω only)
- the battery voltage is too low
- the tester is defective

FUSE is shown when pressing the measurement pushbutton (8) in the Ω funktion, when
- there is a blown or missing fuse

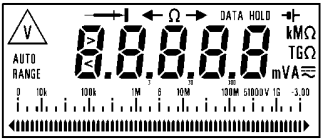
OL is shown, when
- there is an overrange condition

– – – – 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). All segments of the display, except for the warning triangle „V“ are presented on the LCD display (5).



Also some segments are shown which are not used on this tester. Pressing of the pushbuttons „RANGE↑“ (3) and/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 any other 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 FA 0,315 A / 1000 V which protects the low-ohmic measuring range against overload. When a fuse blows, the word „FUSE“ is shown on the LCD display (5) in place of the digital display (see section 10.1). In this case, only voltage measurements (with R_i = 5 MΩ) 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 FA 0,315 A / 1000 V is installed. If a fuse of other cutout 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.
- ➪ Replace the cover cap on the probe.

10.6 Case

Special maintenance of the case is not required. Take care that the surface between the connection sockets is clean. Use a slightly moist cloth for cleaning. Do not use detergents and scouring agents.

11 Repair and Replacement Part Service

When you need service, please contact:

GOSSEN-METRAWATT GMBH
Service-Center
Thomas-Mann-Straße 16 - 20
90471 Nürnberg, Germany
Phone +49 911 86 02 - 410 / 256
Fax +49 911 86 02 - 2 53
e-mail fr1.info@gmc-instruments.com

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

12 Product Support

When you need support, please contact:

GOSSEN-METRAWATT GMBH
Hotline Produktsupport
Phone +49 911 86 02 - 112
Fax +49 911 86 02 - 709

Printed in Germany • Subject to change without notice

GOSSEN-METRAWATT GMBH
Thomas-Mann-Str. 16-20
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Fax +49 911 8602-669
e-mail: info@gmc-instruments.com
http://www.gmc-instruments.com