UNIGOR® A43

Instruction manual

The battery is required for the operation of all a.c. and ohms ranges. To economize the battery set switch to highest volts range and depress ⎓Ω button after each measurement.

BBC GOERZ

BBC GOERZ GOERZ ELECTRO Ges. m. b. H. A-1101 WIEN Postfach 204
Telefon: 64 36 66 Telex: 13161 Telegramm: goerzelectro wien

BA 22 62 43 9. 74 M 3

PRINTED IN AUSTRIA

UNIGOR® A 43

Type 22 62 43
Instruction manual

Contents page

1. General 2
2. Technical data 3
2.1 Voltage and Current ranges 3
2.2 Resistance and Capacity ranges 3
2.3 Accessories for range extension 4
2.4 Accuracy 5
2.5 Scale 6
2.6 Test voltage 6
2.7 Overload protection 6
2.8 Battery for resistance and a. c. measurements 6
2.9 Dimensions and Weight 6
3. Basic instructions 7
3.1 General 7
3.2 Auxiliary battery supply 9
3.3 Overload protection 9
4. Measurement of d. c. 11
4.1 Current 11
4.2 Voltage 12
5. Measurement of a. c. 13
5.1 Direct current measurement 13
5.2 Measurements via current transformers 13
5.3 Voltage measurement 15
5.4 Measuring alternating currents and voltages at frequencies up to 40 kHz 15
6. Measuring superimposed d. c. and a. c. 16
6.1 Testing without removing the d. c. component 16
6.2 Measurements with the d. c. component removed . . 16
7. Resistance measurements 17
8. Capacity measurements 18
9. Testing of diodes and transistors 19
9.1 Assessing a diode or a transistor diode-path 19
9.2 Ascertaining the cathode or base lead resp. 20
9.3 Determining the Zener voltage 20
10. Maintenance 21
11. Accessories 21
12. Circuit diagram 22
13. Components list 23

1. General

The instruments of the UNIGOR A series have been designed to meet the highest demands in the field of analogue multimeters. Gaining from the experience with the UNIGOR p and UNIGOR n series of instruments – renowned troughout the world – the multimeter UNIGOR A 43 has been developed which is characterised by the following special features:

- **Wide range of measurement providing 62 ranges without accessories**
- **High measuring accuracy**
- **Equally high internal resistance and low consumption on d. c. and a. c. owing to the use of an amplifier with rectifier for a. c. measurements**
- **Selection of all ranges with a single switch**
- **Selection of measurement function and polarity reversal by push-button switch**
- **A single pair of terminals for all measurement (except 10 A range)**
- **Small frequency error between 15 Hz and 40 kHz**
- **Shock-proof, frictionless, taut ligament movement**
- **Common floodlit linear 95 mm scale for all d. c. and a. c. ranges**
- **Comprehensive overload protection by automatic cut-out, fuse, surge limiter, neon discharge lamp, protective diodes**
- **Resistance measurements up to 50 MΩ, using a single standard self-contained monocell, with open-circuit f. s. d. adjustment**
- **Easy access and clearly identified printed circuits result in low maintenance costs**
- **Attractive case**

2. Technical data

2.1 Voltage and Current ranges (d. c. and a. c.)

Voltage ⎓	Output*)	Internal resistance[1])	Current ⎓	Voltage drop appr.
1000 V	+50 dB	100 MΩ	10 A	115 mV
300 V	+40 dB	31.6 MΩ	3 A	270 mV
100 V	+30 dB	10 MΩ	1 A	160 mV
30 V	+20 dB	3.15 MΩ	300 mA	110 mV
10 V	+10 dB	1 MΩ	100 mA	105 mV
3 V	dB-scale*)	316 kΩ	30 mA	
1 V	−10 dB	100 kΩ	10 mA	
0.3 V	−20 dB	31.6 kΩ	3 mA	100 mV
100 mV	−30 dB	10 kΩ	1 mA	
*) 0 dB equals 0.775 V			0.3 mA	
Ci appr. 100 pF			100 µA	90 mV
			30 µA	66 mV
			10 µA	100 mV

[1]) Corresponding to a current consumption of 10 µA (100 kΩ/V) at scale division 100 resp. 31.6 (lower scale).

2.2 Resistance and Capacity ranges

Range	Span	Maximum test current/voltage
Ω x 1	0.2 Ω . . . 500 Ω	10 mA/ 0.1 V
Ω x 10	2 Ω . . . 5 kΩ	1 mA/ 0.1 V
Ω x 100	20 Ω . . . 50 kΩ	20 µA/ 0.09 V
kΩ x 1	200 Ω . . . 500 kΩ	10 µA/ 0.1 V
kΩ x 10	2 kΩ . . . 5 MΩ	10 µA/ 1 V
kΩ x 100	20 kΩ . . . 50 MΩ	10 µA/10 V
nF x 100	100 nF . . . 10 µF	1.8 mA/18 mV*)
nF x 10	10 nF . . . 1 µF	0.18 mA/18 mV*)
nF x 1	1 nF . . . 100 nF	16 µA/18 mV*)

*) r. m. s.-value, measuring frequency appr. 28 kHz

2.3 Accessories for range extension

Extended range	With Accessory	Type	Code No.
100 A d. c.	Shunt, class 0.5, 100 mV	GE 42 77	834 2770 00
50 A d. c.		GE 42 75	834 2750 00
25 A d. c.		GE 42 73	834 2730 00
600—300—100—30 A a. c.	Current transformer, 100 : 1 Class 0.2 at 500/5 A, 5 VA (45 . . . 65 Hz)	GE 44 07	834 4070 00
600—200—60—20 A a. c.	Clip-on current transformer 2000 : 1 additional reading error <3% (45 . . . 65 Hz)	GE 44 53	834 4530 00
300—100—30—10 A a. c.	Clip-on current transformer 10,000 : 1 additional reading error <1% (45 . . . 65 Hz)	GE 44 55	834 4550 00
1000—300—100 A a. c.	Clip-on current transformer 1000 : 1 additional reading error <1% (45 . . . 65 Hz)	GE 44 56	834 4560 00
30 and 10 kV d. c. (1000 MΩ)	High-voltage multiplier (test probe) additional reading error <6%	GE 41 96	834 1960 00
6 and 2 kV d. c. and a. c. (20 MΩ)	High-voltage multiplier additional reading error <6%	GE 41 57	834 1570 00

Other accessories see page 21.

2.4 Accuracy

2.4.1 Limits of Error

The specified limits apply when the instrument is used in its horizontal working position, at the reference temperature of 20° C and with sinusoidal a. c. at 25 . . . 100 Hz.

For the voltage and current ranges

Direct current: ±1% of f. s. d.
Alternating current: ±1.5% of f. s. d.

For the resistance and capacity ranges

Resistance: ±1% of scale length
±4% of true value at mid-scale
±6% of true value for a span extending from 0.25 to 4 times the value at mid-scale
Capacity: ±2% of scale length
±8% of true value at mid-scale

2.4.2 Frequency Influence

Ranges 100 mV – 30 V, 10 µA – 1 A:
1.5% max. between 15 Hz and 20 kHz
4% max. above 20 kHz up to 40 kHz
Ranges 100 V, 3 A and 10 A:
3% max. between 15 Hz and 3 kHz

The input capacitance Ci is approximately 100 pF.

2.4.3 Temperature Influence

Between – 10 and + 50° C
On d. c.: 0.5% max. of indication per 10° C
On a. c.: 1% max. of f. s. d. per 10° C

2.4.4 External Magnetic Influence

The effect of a d. c. or a. c. field (50 Hz) of 5 Gauss (0.5 mT) is negligible.

2.4.5 Waveform errors

The instrument is calibrated in r. m. s. values with a form factor of 1.11 for sinusoidal alternating current. The reading produced by the instrument is equivalent to the mean value x 1.11 – including non-sinusoidal waveforms. Consequently, a triangular waveform will produce a negative, and a sqare waveform a positive error.

2.4.6 Errors with superimposed d. c. and a. c.

The accuracy of the reading is retained as long as the peak value of the a. c. signal does not exceed 1.5 times the maximum of the range selected for the d. c. component and the d. c. signal does not exceed the maximum of the range selected for measuring the a. c. component.

2.5 Scale

The mirror-backed scale has length of 95 mm

2.6 Test voltage

5000 V a. c. in accordance with IEC, VDE, BS regulations. A voltage test of 5000 V ensures safe handling of the instrument with voltages of up to 1500 V.
When measuring higher voltages, do not touch the instrument.

2.7 Overload protection

Semi-time lag 4 A miniature fuse, 5 mm dia. x 20 mm (M 4 E, DIN 41 571, BS 4265)
Automatic cut-out
Surge limiter
Neon discharge lamps and Protective diodes

2.8 Battery for resistance, capacity and a. c. measurements

1 baby-monocell 1.5 V, IEC-R 14, 26 mm dia. x 50 mm, leak-proof
Operating time approx. 700 hours.

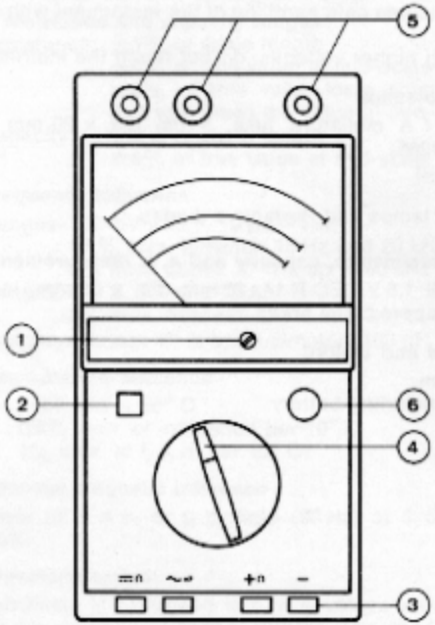
2.9 Dimensions and Weight

212 x 110 x 82 mm
approx. 1.1 kg, including battery

3. Basic Instructions

3.1 General

To avoid errors of measurements, place the UNIGOR in a relatively horizontal position clear of the effects of iron masses, stray fields (bus-bars) or moving-coil instruments.



① Check mechanical zero setting with the instrument disconnected. After cleaning the scale window, dissipate static electricity by breathing on, or touching, the glass or by wiping with a damp cloth. Antistatics (e. g. spray or "Plexiklar") are recommended.

② Reset push-button of automatic cut-out to "ON" if it is in the "OFF" (upper) position.

③ Set the push-button switch for d. c. to "⎓", "+" or "−", for a. c. to "~", when measuring the resistance. These switches can be operated during measurement as the measuring circuit is not interrupted. The polarity ("+" or "−") set by the push-button switch applies to the right-hand terminals when the deflection is positive.

④ Turn the range selector switch to the desired range. When carrying out current or voltage measurements, start with the highest range and continue to switch down towards the most favourable smaller range (this does not cause an interruption to the measured circuit).
Be sure to observe the range limits! Higher values can only be measured by using separate series resistors and shunts, instrument transformers or clip-on transformers (see page 4).

On completion of the measurement, it is recommended to turn the range switch to the highest voltage range. It must not be used as an "OFF" switch, by turning from the 3 A/10 A range to the empty position beside it. For checking and economizing the battery, refer to para 3.2 below!

⑤ ⑥ When connecting the instrument and operating the Ω-adjust control, take note of the detailed instructions in the later sections. Abbreviated operating instructions appear on the baseplate.
The measured values of current and voltage should be read on the scale numbered 0 . . . 100 when using a decadic range, whilst for ranges divisible by 3 the scale numbered 0 . . . 30 must be used.

Earthing and maximum potentials relative to earth will be discussed in detail in the sections dealing with current and voltage measurements.

3.2 Auxiliary battery supply

3.2.1 Battery check

In the position "Batt." of the range selector switch, with push-buttons "⎓Ω" and "+Ω" depressed, a battery check is carried out. The battery voltage is adequate when the meter reads within the lowest scale sector marked "Batt.". Otherwise, a new 1.5 V-element (IEC R 14, Ø 26 x 50) should be inserted. The battery compartment becomes accessible after loosening the knurled screw and removing the baseplate at the underside of the UNIGOR.

Disconnect the instrument before removing the baseplate and observe the correct polarity of the battery.

The battery serves for resistance and capacity measurements as well as for all a. c. current and voltage measurements. D. C. current and voltage measurements, however, can be carried out without the battery, all functions of the overload protection being preserved in this case.

3.2.2 Economizing the battery

To prevent permanent discharge of the battery (approx. 5 to 8 mA) when the UNIGOR is not used, take note of the following.

On completion of an **a. c. measurement** (V~ or A~), always depress the "⎓Ω" button!
On completion of a resistance measurement (Ω of kΩ), turn the range selector switch to a current or voltage range (preferable "1000 V")!
On completion of a capacity measurement (nF), depress the "⎓Ω" button **and** turn the range switch to "1000 V"!

3.3 Overload protection

The instrument is fitted with multiple protection against improper use and overloads, achieved by a number of protective devices. Generally speaking, the instrument will remain unharmed as long as voltages below 250 V⎓ are applied to its (outer) terminals. The voltage ranges 300 and 1000 V will with-stand twice their full scale value, with a maximum of 1500 V.
In the case of a. c. current measurements via current transformers on the ranges 3 A or below, attention should be paid to the possibility of higher voltages (up to several kV) arising across the input terminals when either the cut-out has operated or the fuse is defective.

● The 10 A range (separate terminal) is **not protected!** ●

3.3.1 Automatic cut-out

The relay coils of the cut-out are connected to a selection circuit whose switch is coupled to the range switch. As a result of this arrangement, the sensitivity of the cut-out is at optimum for a given measuring range. When the relay operates the protective switch opens and interrupts the entire measuring circuit.
The relay is self-energised by the overload, d. c. or a. c., and does not require an auxiliary energy source.
A special interlocking mechanism prevents the resetting of the cut-out while an overload is applied to the instrument.
Maximum rating: 2 kW⎓, 15 kVA~/500 V⎓

3.3.2 Protective fuse

A semi-time lag fuse (rated current 4 A) protects the instrument in the high-current region before the automatic cut-out is triggered and also when a direct short-circuit occurs. It is connected in series with the terminal "⏚" and is placed behind the black plastic slotted screw on the underside of the instrument.
Rating: 250 A/250 V⎓, 1000 A/250 V~
Two spare fuses become accessible when the baseplate is removed.

● Disconnect instrument before removing baseplate! ●

3.3.3 Surge limiter

A spark gap, connected in parallel with the input terminals, has a flashover voltage lower than the breakdown voltage of the internal circuit and prevents damage to the instrument due to excessively high voltages (voltage peaks) at low power such as occur, for example, when testing TV receivers, transductors, d. c.-carrying high-inductance coils etc.

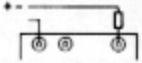
3.3.4 Protective diodes

Additional protection of the movement is provided by two diodes connected in anti-parallel configuration across the moving coil.

4. Measurement of d. c.

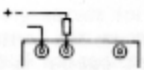
4.1 Current

4.1.1 Direct connection for currents up to 3 A



Range switch: 3 A . . . 30 µA
Push-button switch: "⎓", "+" or "−"
Reading: V, A scale

4.1.2 Direct connection for currents up to 10 A



Range switch: 10 A
Push-button switch: "⎓", "+" or "−"
Reading: V, A scale

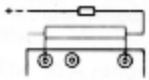
Attention: No overload protection is provided in the 10 A range (separate terminal)! It can, however, be continuously overloaded up to 12 A.

The instrument should always be inserted in that line which has the lowest potential relative to earth. This potential should not exceed 1500 V for reasons of safety.

4.1.3 Currents up to 100 A, measured with external shunt

The shunts listed in the table below are available (see also page 4).

Shunt 100 mV class 0.5 (connection to the outer terminals)	100 A	**GE 42 77**
	50 A	**GE 42 75**
	25 A	**GE 42 73**
Range switch	100 mV, 10 µA	
Push-buttons	"⎓" and "+" or "−"	
Reading on	V, A scale 0 . . . 100; additional reading error ≤0.5% of indication	

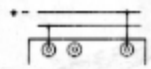


Insert the shunt in that line which has the lowest potential relative to earth (for safety). This potential should not exceed 1500 V!

4.2 Voltage

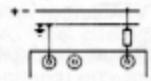
4.2.1 Direct connection for voltages up to 1000 V

Internal resistance: 100 kΩ/V



Range switch: 1000 V . . . 100 mV
Push-button switch: "⎓", "+" or "−"
Reading: V, A scale

4.2.2 Voltages up to 2 and 6 kV, measured with external voltage multiplier (20 MΩ), Type GE 41 57

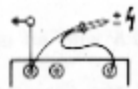


Range	Range switch	Reading on V, A scale
2000 V	100 µA	0 . . . 100 x 20
6000 V	0.3 mA	0 . . . 30 x 200
Push-button switch: "⎓" and "+" or "−"		

In the interest of safety, the following remarks should be noted when measuring voltages above 1500 V to earth:

Put the UNIGOR on an insulated support and connect the "⊥" terminal directly to earth, if possible.
First, select range and polarity, before applying the voltage. For probing the voltage, use the special cable with test prod (20 kV test voltage) Zb 09s.
Do not touch the instrument while the voltage is applied.

4.2.3 Voltages up to 10 and 30 kV, measured with external high voltage multiplier probe (1000 MΩ), Type GE 41 96



Range	Range switch	Reading on V, A scale
10 kV	10 µA	0 . . . 100 x 0.1
30 kV	30 µA	0 . . . 30 x 1
Push-button switch: "⎓" and "+" or "−"		

In the interest of safety, the following remarks should be noted:

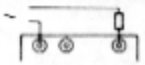
Connect the earth wire of the high voltage probe to the "⊥" terminal and connect the latter directly to earth. First, select range and polarity before applying or probing the voltage. Do not touch the instrument while the voltage is applied.

Technical data for the separate voltage multipliers are given on page 4.

5. Measurement of a. c.

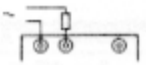
5.1 Direct current measurement

5.1.1 Direct connection for currents up to 3 A



Range switch: 3 A . . . 10 µA
Push-button switch: "~"
Reading: V, A scale

5.1.2 Direct connection for currents up to 10 A



Range switch: 10 A
Push-button switch: "~"
Reading: V, A scale

Warning: No overload protection is provided in the 10 A range (separate terminal)! It can, however, be continuously overloaded up to 12 A.

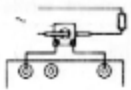
The instrument should always be inserted in that line which has the lowest potential relative to earth. This potential should not exceed 1500 V for reasons of safety.

5.2 Measurements via current transformers

Check the continuity of the current circuit (e. g. by a resistance measurement), before connecting up a current transformer to a range other than 10 A. Excessive voltages may appear across the input terminals if the secondary circuit of the current transformer is interrupted, e. g. because the cut-out is in the "OFF" position. Connect the transformer secondary to the " ⊥ " and "±~" terminals before closing the primary circuit. If possible, connect terminal " ⊥ " to earth.

5.2.1 Measuring alternating current up to 600 A with an external Current transformer, Type GE 44 07

Connect the secondary winding to the " ⊥ " and the "±~" terminals. Depending upon the desired range of measurement, the primary conductor carrying the current to be measured should be passed once or several times through the center hole of the transformer.



Current range: see table
Range switch: see table
Push-button switch: "~"
Reading: V, A scale

Instrument range	Primary current range with n turns of primary conductor		
	n=1	n=2	n=5
10 A	600 A*)	300 A*)	–
3 A	300 A	150 A	60 A
1 A	100 A	50 A	–
0.3 A	30 A	15 A	6 A

*) at div. 60 of the scale 0 . . . 100

The accuracy of the current transformer corresponds to class 0.2 for a secondary load up to 5 VA and a rated current ratio of 500/5 A. The additional error due to the insertion of this transformer does not exceed 0.2% of the full scale value at a frequency of 45 . . . 65 Hz. This applies to all ranges listed in the above table.

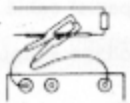
Use the current transformer for operating voltages up to 600 volts only.

5.2.2 Measuring alternating currents up to 1000 A, using a clip-on transformer

In order to measure alternating currents without interrupting the measuring circuit, use clip-on transformers, types

GE 44 53, transformation ratio 2 000 : 1
GE 44 55, transformation ratio 10 000 : 1
GE 44 56, transformation ratio 1 000 : 1

(see page 4). Connect the secondary winding of the clip-on transformer to the " ⊥ " and the "±~" terminals.



Current range: see table
Range switch: see table
Push-button switch: "~"
Reading: V, A scale

Primary current range A		1000	600	300	200	100	60	30	20	10
range setting (mA) when using transformer type	GE 44 53	–	300	–	100	–	30	–	10	–
	GE 44 55	–	100[1])	30	–	10	–	3	–	1
	GE 44 56	1 A	–	300	–	100	–	–	–	–

[1]) 60 mA at 600 A max. prim. current

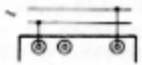
The additional reading error when using types GE 44 55 and GE 44 56 is less than ±1%, and when using type GE 44 53 less than ±3% of f. s. d., provided that there is virtually no air gap between the split cores. Keep the split-core faces clean!

Use the clip-on transformers for operating voltages up to 600 V only.

5.3 Voltage measurement

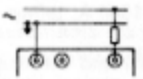
5.3.1 Direct connection for voltages up to 1000 V

Internal resistance at 100 mV . . . 1000 V : 100 kΩ/V



Range switch: 1000 V . . . 100 mV
Push-button switch: "~"
Reading: V, A scale

5.3.2 Voltages up to 2 and 6 kV, measured with external voltage multiplier (20 MΩ), Type GE 41 57



Range	Range switch	Reading on V, A scale
2000 V	100 µA	0 . . . 100 x 20
6000 V	0.3 mA	0 . . . 30 x 200
Push-button switch: ~		

In the interest of safety, the following remarks should be noted when measuring voltages above 1500 V to earth:

Put the UNIGOR on an insulated support and connect the "⊥" terminal directly to earth, if possible.
First, select appropriate range, before applying the voltage. For probing the voltage, use the special cable with test prod (20 kV test voltage) Zb 09s.
Do not touch the instrument while the voltage is applied.

5.4 Measuring alternating currents and voltages at frequencies up to 40 kHz

In order to preserve the highest accuracy of indication with frequencies up to 40 kHz, connect the "⊥" terminal of the instrument direct to earth, if possible, or to the point with the lowest potential relative to earth. With higher frequencies, the input capacitance of approximately 100 pF causes a reduction of the internal resistance of the instrument.

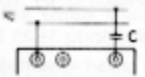
6. Measuring superimposed d. c. and a. c.

6.1 Testing without removing the d. c. component

The amplifier with capacitive coupling, used for a. c. measurements, makes it possible to measure the d. c. and a. c. components separately. Carry out separate measurements of the two components as already described for current and voltage measurements on pages 11 to 15.
If the peak value of the a. c. component does not exceed 1.5 times the maximum value of the range selected for d. c. measurement, the accuracy of the measurement of the d. c. component will not be affected. Similarly, the accuracy of the measurement of the a. c. component will not be affected if the d. c. component does not exceed the maximum value of the range selected for the a. c. measurement. Consequently, the same measuring range should be selected for both d. c. and a. c. and both components should be measured before changing over to a lower range.

6.2 Measurements with the d. c. component removed

If it is intended to reject the d. c. component from the instrument when measuring audio-frequency alternating voltages with a superimposed d. c. voltage, connect a suitable capacitor in series with the instrument[1]).
If the capacitor is not to be damaged its operating voltage must always be higher than the d. c. voltage to be removed.



Carry out the measurement of the a. c. voltage in the manner previously described. Because of the capacitor, which is connected in series with the internal resistance of the instrument, the reading will become frequency-dependent in the lower frequency region.

The higher the frequency and the higher the measuring range, the smaller the additional indicating error, shown by the equation

$$\Delta F\% = \frac{1.25 \times 10^{12}}{f^2 R^2 C^2}$$

where f is the frequency in Hz, R the internal resistance in Ω and C the capacitance in µF and ΔF the additional negative error as a percentage of the reading.

[1]) The use of a 1.2 µF capacitor, operating voltage 630 V, is recommended. The employment of this capacitor introduces an additional negative indicating error of less than 0.2% in all ranges from 1 V upwards at frequencies ≥50 Hz.

7. Resistance measurements

When resistance measurements are carried out the circuit operates from a constant-current supply, fed either direct or via a converter from a 1.5 V leak-proof baby-monocell IEC-R 14, 26 dia. x 50 mm.
Remove baseplate and insert battery, observing the correct polarity. Check the condition of the battery after long intervals (see para 3.2).
Adjust full-scale deflection, using the Ω-adjust control in the open-circuit condition. The positive pole of the test voltage appears at the terminal "⊥~".
The maximum loads (current or voltage) applied to the resistor under test are shown in the table on page 3 on the baseplate.

Carrying out the measurement:

Push-button switch:	Depress "⎓Ω" and "+Ω"
Range selector:	Set to the desired Ω- or kΩ-range
Adjustment before measurement:	With open circuit terminals, adjust pointer to ∞ on the Ω, kΩ scale, using the "Ω, nF" adjust control[1]).
Measurement and reading:	Connect the unknown resistor to the outer terminals. Obtain the measured value by multiplying the Ω, kΩ or MΩ scale reading by the range factor.

When the resistance measurement has been completed, set the range selector to one of the current or voltage ranges. Otherwise the battery will be drained.

By using the Ω x 1, Ω x 10, Ω x 100, kΩ x 1 ranges, resistors in transistorised circuits can be measured without having to unsolder them, since the test voltage is below the linear-to-exponential transition of the I/V characteristic for Si-transistors and diodes. In assessing the measurement result it is necessary to distinguish between a reading indicating the value of the resistor under test and a reading which indicates a resistance network interconnected with the resistor under test.

[1]) Readjustment is only necessary on change-over between the range groups Ω x 1 . . . Ω x 100 and kΩ x 1 . . . kΩ x 100; otherwise, the f. s. d. setting remains constant.

8. Capacity measurements

Capacity measurements are carried out with sinusoidal a. c. at a frequency of approx. 28 kHz. Owing to the very low measuring voltage of 18 mV max., the capacity ranges are also suitable for the measurement of electrolytic capacitors (up to 10 µF). The maximum values of the test current or voltage resp. can be seen from table on page 3.

Carrying out the measurement:

Push-button switch:	Depress "~nF"
Range selector:	Set to the desired nF-range
Adjustment before measurement:	With open circuit terminals, adjust pointer to 0 on the nF-scale, using the "Ω, nF" adjust control*).
Measurement and reading:	Connect the unknown capacity to the outer terminals. The measured value is obtained by multiplying the nF-scale reading by the range factor.

When measuring small capacities in the "nF x 1" range it is recommended to take a reading before connecting the capacitor to be measured, however, with the measuring leads – if any – connected up. The instrument now indicates the capacity of the leads. This value should be deducted from the measured value, obtained after connecting up the capacitor.

On completion of a capacity measurement, turn the range selector switch to a current or voltage range (preferably "1000 V") and depress the "⎓Ω" button. Otherwise the battery will be drained.

*) A readjustment on a change-over within the 3 nF-ranges is not necessary.

9. Testing of Diodes and Transistors

The kΩ x 10 resistance range is also suitable for a rough check of the functioning of diodes and transistors. Measuring the "resistance" is a simple way of ascertaining whether a diode, the base-collector or base-emitter path of a transistor has a short or open circuit. Moreover, the polarity of the leads of a diode or the base lead of a transistor can be determined in this way.

This test will not destroy the component as the voltage across it will not exceed 1 V and the test current will not exceed 10 µA.

However, as a consequence of this limited test voltage and/or current it may not be possible to test semiconductors with relatively high reverse current – e. g. power diodes or transistors –, or rectifiers with a number of series-connected elements, because in such cases the difference between the readings in the forward and reverse direction may not be sufficiently distinct.

Push-button switch: Depress "Ω" and "$+\Omega$"

Range selector setting: kΩ x 10

Preparatory adjustment: Turn "Ω, nF"-adjuster for meter to read $\infty\Omega$

Connections: Refer to table. Always test forward **and** reverse performance of the diode or diode path of transistor. In connecting the component, note that the "$\pm\sim$" terminal carries the "+" pole of the test voltage.

Test of	Connect diode cathode to terminal	Connect transistor base to terminal	
		pnp	npn
Forward current ($+I_D$)	⊥	⊥	$\pm\sim$
Reverse current ($-I_D$)	$\pm\sim$	$\pm\sim$	⊥
Read on	100 div. V, A scale		

9.1 Assessing a diode or a transistor diode-path

A diode or transistor is operable when the reading on the V, A scale obtained for the forward current is lower than the reading obtained for the reverse current. However, the magnitude of the readings does not allow conclusions about the type quality of the semiconductor device under test; in particular, the current amplification of a transistor can not be assessed. In the reverse current test the "kΩ x 10"-range of the UNIGOR A 43 also indicates the voltages ($-U_D$) across the diode path. Full scale deflection (i. e. division 100 of the scale numbered 0 . . . 100) corresponds to 1 V. The reverse current ($-I_D$) can be calculated as the difference between full scale deflection (div. 100, equaling 10 µA) and the reading "α" on the V, A scale numbered 0 . . . 100, i. e.

$$-I_D = (100-\alpha) \times 0.1 \ [\mu A]$$

In this manner it can be ascertained whether the diode under test is of the Si- or of the Ge-type.

Typical values of the reverse current are

for a Si-diode: $-I_D \leq 0.5$ µA, corresponding to $\alpha = 95 \ldots 100$ divisions

for a Ge-diode: $-I_D$ 5 . . . 0.6 µA, corresponding to $\alpha = 50 \ldots 94$ divisions

A diode or transistor has an open circuit when the reading on the kΩ scale is ∞ or the same value near ∞ (insulation resistance) in both the forward and the reverse test.

A diode or transistor has an electrode short circuit when the reading on the kΩ scale is 0 or the same value near 0 in both the forward and the reverse test.

9.2 Ascertaining the cathode or base lead, respectively

In that one of the two tests which produces the lower reading on the V, A scale, the cathode lead of a diode or zener diode or the base lead of a pnp transistor is the lead connected to terminal "⊥". In case of a npn transistor, the base is the lead connected to the "$\pm\sim$" terminal.

9.3 Determining the Zener voltage

The Zener voltage of Zener diodes whose Zener (reverse) voltage is below 10 V can also be determined in a simple manner. For this purpose, change over to the "kΩ x 100"-range where the maximum test voltage ($\alpha = 100$) is exactly 10 V. When connecting the cathode, ascertained in accordance with para 9.2, to the "$\pm\sim$" terminal, the Zener voltage is obtained from the relation

$$U_Z = 0.1\alpha[V]^*)$$

where α again represents the reading on the V, A scale numbered 0 . . . 100.

*) It should be pointed out that, due to the small testing current of 10 µA max., the full Zener voltage – especially with Zener diodes for higher power – may not be reached, and the determined U_Z might be somewhat smaller than the actual Zener voltage.

10. Maintenance

No special maintenance is indicated for this instrument. It is recommended, however, to check the state of the battery after long intervals. A drained or decomposing battery should not be left in the battery compartment.

Attention: Disconnect the instrument before removing the baseplate! Ensure that the instrument surface between the terminals remains clean because heavy soiling impairs the insulation and may reduce the input resistance, especially in relation to the higher voltage ranges.
If the instrument has become soiled by dust, liquids etc., clean with a dry, soft cloth and, in the case of heavy soiling, with a watersoaked, damp cloth.
The outer surface of the scale window should only be cleaned with a soft, watersoaked cloth. Antistatics (e. g. spray or "Plexiklar") are recommended.
The inner surface of the scale window should not be cleaned with a cloth or other cleaning agent because the glass on this side is provided with a coating which prevents charging with static electricity which could affect the reading.

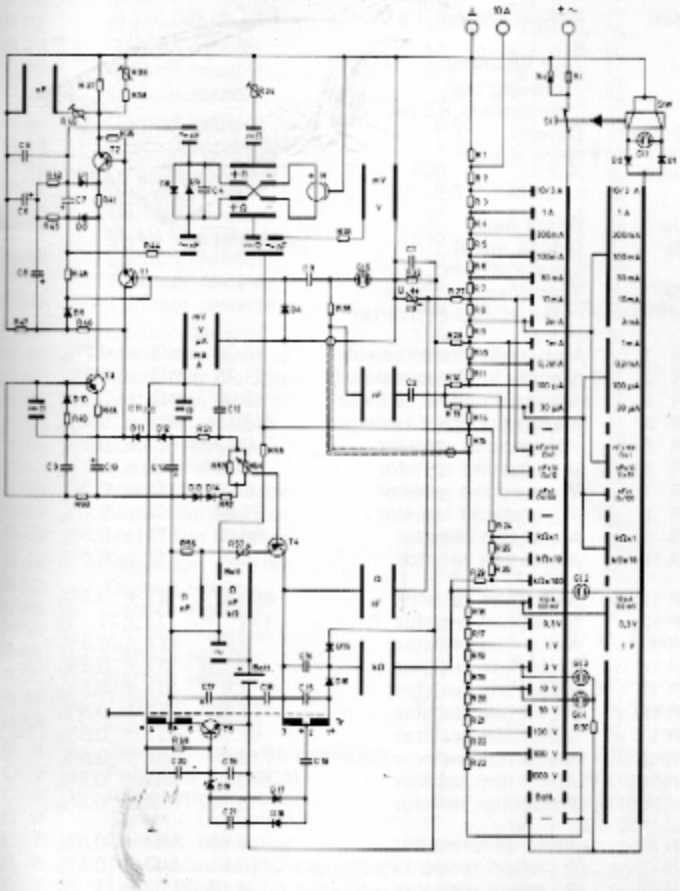
11. Accesories

Pair of leads with plugs	Zb 483[1])	195 4830 00
Plug-on test prod red	Zb 189r[1])	195 1890 74
Plug-on test prod grey	Zb 189g[1])	195 1890 75
Special cable with test prod and plug for 6 kV d. c., a. c. (test voltage 20 kV)	Zb 09s	195 0090 74
Carrying case	Zb 170	195 1700 00
Glass fuse 5 dia. x 20 mm, DIN 41571, 4 A, semi-time lag	M 4 E	689 9500 00
Carrying case for clip-on transformer GE 44 56	Zb 338	195 3380 00

1) supplied without charge to each UNIGOR A.

Accessories for range extension see page 4.

12. Circuit diagram



13. Components list

Part. No.	Designation	Type, Value, Tolerance
Batt.	Baby-monocell 1.5 V	DIN 40 850 (EET) or IEC (R 14)
M	Taut ligament moving coil movement 8.8 µA	
S 1 W	Cut-out	
Gl 1 - Gl 5	Neon lamp	striking voltage in complete darkness 70 . . . 85 V=
Su	Spark gap	
Si	G-fuse insert 5 dia. x 20 mm	DIN 41 571, M 4 E
Tr	Transformer for DC/DC-converter	
R 1	Manganin sheet resistor	10.04 mΩ ± 0.2%
R 2	Manganin sheet resistor	21.75 mΩ ± 0.2%
R 3	Manganin sheet resistor	69.06 mΩ ± 0.2%
R 4	Manganin sheet resistor	217.15 mΩ ± 0.2%
R 5	Wire wound resistor	0.6906 Ω ± 0.2%
R 6	Wire wound resistor	2.184 Ω ± 0.2%
R 7	Wire wound resistor	6.906 Ω ± 0.2%
R 8	Wire wound resistor	21.84 Ω ± 0.2%
R 9	Metal film resistor	69.06 Ω ± 0.5%
R 10	Metal film resistor	216.2 Ω ± 0.5%
R 11	Metal film resistor	683.8 Ω ± 0.5%
R 12	Metal film resistor	110 Ω ± 1 %
R 13	Metal film resistor	2.05 kΩ ± 0.5%
R 14	Metal film resistor	6.838 kΩ ± 0.5%
R 15	Metal film resistor	8.8 kΩ ± 0.5%
R 16	Metal film resistor	21.62 kΩ ± 0.5%
R 17	Metal film resistor	68.38 kΩ ± 0.5%
R 18	Metal film resistor	216.2 kΩ ± 0.5%
R 19	Metal film resistor	683.8 kΩ ± 0.5%
R 20	Metal film resistor	2.162 MΩ ± 0.5%
R 21	Metal film resistor	6.838 MΩ ± 0.5%
R 22	2 carbon resistors	10.81 MΩ ± 0.5%
R 23	2 carbon resistors	34.19 MΩ ± 1 %

Part. No.	Designation	Type, Value, Tolerance
R 24	Metal film resistor	8.8 kΩ ± 1 %
R 25	Metal film resistor	90 kΩ ± 1 %
R 26	Metal film resistor	903 kΩ ± 1 %
R 27	Wire wound resistor	15 Ω ± 5 %
R 28	Carbon resistor	10 kΩ ± 5 %
R 29	Carbon resistor	47 kΩ ± 5 %
R 30	Carbon resistor	3.3 kΩ ± 5 %
R 32	Carbon resistor	6.8 Ω ± 5 %
R 33	Metal film resistor	1.365 kΩ ± 0.5%
R 34	Trimmer resistor	500 Ω ±20 % linear
R 35	Carbon resistor	3.3 kΩ ± 5 %
R 36	Carbon resistor	27 kΩ ± 5 %
R 37	Metal film resistor	510 Ω ± 1 %
R 38	Carbon resistor	2.7 kΩ ± 5 %
R 39	Trimmer resistor	25 kΩ ±20 % linear
R 40	Trimmer resistor	100 Ω ±20 % linear
R 41	Carbon resistor	150 Ω ± 2 %
R 42	Metal film resistor	680 Ω ± 1 %
R 43	Metal film resistor	680 Ω ± 1 %
R 44	Metal film resistor	10 kΩ ± 1 %
R 45	Carbon resistor	3.3 MΩ ± 5 %
R 46	Carbon resistor	180 kΩ ± 5 %
R 47	Carbon resistor	100 kΩ ± 5 %
R 48	Metal film resistor	910 Ω ± 1 %
R 49	Metal film resistor	33 kΩ ± 1 %
R 50	Metal film resistor	33 kΩ ± 1 %
R 51	Metal film resistor	8.2 kΩ ± 1 %
R 52	Carbon resistor	1.8 kΩ ± 5 %
R 53	Carbon resistor	2.7 kΩ ± 2 %
R 54	Trimmer resistor	10 kΩ ±20 % linear
R 55	Carbon resistor	154 kΩ ± 2 %
R 56	Carbon resistor	82 kΩ ± 2 %
R 57	Trimmer resistor	100 Ω ±20 % linear
R 58	Carbon resistor	56 kΩ ± 2 %
C 1	Tantal electrolytic capacitor	47 µF +50 –20%/6.3 V–
C 2	Polyester capacitor	68 nF ±10%/100 V–
C 3	Polyester capacitor	0.47 µF ±10%/100 V–
C 4	Ceramic capacitor	22 nF +100 –20%/40 V–
C 5	Ceramic capacitor	22 nF +100 –20%/40 V–
C 6	Tantal electrolytic capacitor	33 µF +50 –20%/10 V–
C 7	Tantal electrolytic capacitor	3.3 µF +50 –20%/35 V–

Part No.	Designation	Type, Value, Tolerance
C 8	Tantal electrolytic capacitor	3.3 µF +50–20%/35 V–
C 9	Ceramic capacitor	22 nF +100–20%/40 V–
C 10	Tantal electrolytic capacitor	33 µF +50–20%/10 V–
C 11	Polyester capacitor	180 pF ±10%/63 V–
C 12	Ceramic capacitor	4.7 nF ±10%/100 V–
C 13	Tantal electrolytic capacitor	3.3 µF +50–20%/35 V–
C 14	Ceramic capacitor	4.7 nF ±10%/100 V–
C 15	Polyester capacitor	2.7 nF ±2%/63 V–
C 16	Ceramic capacitor	22 nF +100–20%/40 V–
C 17	Tantal electrolytic capacitor	33 µF +50–20%/10 V–
C 18	Ceramic capacitor	22 nF +100–20%/40 V–
C 19	Ceramic capacitor	4.7 nF ±10%/100 V–
C 20	Ceramic capacitor	390 pF ±10%/100 V–
C 21	Ceramic capacitor	22 nF +100–20%/40 V–
D 1	Silicon diode	1 N 916 B
D 2	Silicon diode	1 N 916 B
D 3	Silicon varistor	V 75
D 4	Silicon diode	1 N 916 B
D 5	Silicon diode	1 N 4148
D 6	Silicon diode	1 N 4148
D 7	Silicon diode	1 N 4148
D 8	Silicon diode	1 N 4148
D 9	Silicon diode	1 N 4148
D 10	Silicon diode	1 N 4148
D 11	Germanium diode	OF 325
D 12	Germanium diode	OF 325
D 13	Silicon diode	1 N 4148
D 14	Silicon diode	1 N 4148
D 15	Silicon diode	1 N 4148
D 16	Silicon diode	1 N 4148
D 17	Silicon diode	1 N 4148
D 18	Silicon diode	1 N 4148
D 19	Silicon zener diode	BZX 79 B 10
T 1	npn-Silicon transistor	BC 238 C
T 2	npn-Silicon transistor	BF 240
T 3	pnp-Silicon transistor	BC 308 B
T 4	pnp-Silicon transistor	BC 309 C
T 5	npn-Silicon transistor	BC 238 C