

GB Introduction

Dear Customer,

Thank you for making the excellent decision to purchase this Voltcraft® product.

You have acquired a high-quality product with a brand name that stands out for professional competence and permanent innovation in the field of measuring, charging and power technology.

With Voltcraft®, you will be able to cope even with difficult tasks as an ambitious hobbyist or as a professional user. Voltcraft® offers you reliable technology at an extraordinarily favourable cost-performance ratio.

We are positive: Starting to work with Voltcraft will also be the beginning of a long, successful relationship.

Enjoy your new Voltcraft® product!

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Scope of delivery

Insulation tester
2 safety measuring lines (red and black)
1 safety measuring line with alligator clip
6 AA batteries
Bag with carrying strap
Operating instructions

Intended use

- Measuring and displaying electric quantities in the range of overvoltage category CAT III (up to max. 600 V to ground potential, in accordance with EN 61010-1) and all lower categories.
- Measurement of direct and alternating voltages to max. 600 V DC/AC rms (effective).
- Measurement of insulation resistances of up to 4000 M Ω with an auxiliary supply of 125 V to max. 1000 V/DC in accordance with EN 61557-2.
- Measurement of resistances of up to 400 Ω with a test current of approx. 200 mA
- Acoustic continuity check (< 35 ohms).

The measuring functions are selected with a rotary switch.

The low-resistance measuring range is secured against overload with a ceramic quick-break fuse. The voltage in the measuring circuit must not exceed 600 V.

The measuring device must not be operated when it is open, i.e. with an open battery compartment or when the battery compartment lid is missing. Measurements must not be carried out under adverse ambient conditions.

Adverse ambient conditions include:

- Dust or combustible gases, vapours or solvents
- Storms or stormy conditions, strong electrostatic fields, etc.

For safety reasons, only use measuring lines or accessories in correspondence with the specifications of the measuring device.

The measuring device may only be used by electrical specialists or technically skilled persons familiar with the required standards and possible resulting risks.

Any use other than that described above will damage the product and involves other risks, such as short-circuit, fire, or electric shock. Do not change or modify any part of the product!

Read the operating instructions carefully and keep them for future reference.

The safety instructions must be observed!

Control elements

See fold-out page

- 1 LCD display
- 2 LOCK button for permanent insulation measurement
- 3 HOLD button to “freeze” the current display and MAX/MIN button to display min. and max. values
- 4 TEST button for insulation measurement
- 5 Rotary switch
- 6 LIGHT button to turn on the backlight and ZERO function
- 7 Attachment point (for holding strap etc.)
- 8 Fold-out tilt stand
- 9 Battery compartment
- 10 Red measuring socket “VΩ” (positive potential)
- 11 Black “COM” measuring socket for earth potential or negative potential

Safety instructions



Please read through the operating instructions before using the product for the first time; they contain important information on proper operation.

The guarantee will be void if damage is incurred resulting from non-compliance with these operating instructions! We assume no liability for any consequential damage! We do not assume any liability for material and personal damage caused by improper use or non-compliance with the safety instructions! In such cases the warranty/guarantee is voided.

This device left the factory in perfect condition in terms of safety. To maintain this status and to ensure risk-free operation, the user must comply with the safety instructions and warnings in these operating instructions.

The following symbols must be observed:



An exclamation mark in a triangle indicates important information in these operating instructions that has to be observed.



A lightning symbol in a triangle warns of danger of an electric shock or of the impairment of the electrical safety of the device.



The hand symbol informs you that there are special tips and hints concerning the operation.



This product has been CE certified and meets the required European guidelines.



Protection class II (double or reinforced insulation)

CAT II

Overvoltage category II for measurements on electric and electronic devices connected to the mains supply. This category also covers all smaller categories (e.g. CAT I for measuring signal and control voltages).

CAT III

Overvoltage category III for measuring building wiring installation (e.g. outlets or sub-distributions). This category also covers all smaller categories (e.g. CAT II for measuring electronic devices).



Earth potential

For safety and licensing reasons (CE), unauthorised conversion and/or modification of the device is not permitted.

Consult an expert when in doubt as to the operation, the safety or the connection of the device.

Measuring devices and accessories are no toys and do not belong in the hands of children!

In commercial facilities, the regulations for the prevention of accidents as laid down by the professional trade association for electrical equipment and devices must be observed.

In schools, training centres, hobby and self-help workshops, the operation of measuring devices must be supervised by trained personnel.

Before measuring voltages, always make sure that the measuring device is not set to resistance or insulation measuring range.

The voltage between the connection points of the measuring device and the earth potential must not exceed 600 V DC/AC in CAT III.

The test prods have to be removed from the test object before the measuring range is changed.

Pay particular attention when dealing with voltages exceeding 25 V AC or 35 V DC! If electrical conductors are touched, even these voltages involve the risk of a fatal electric shock.

Before measuring, always check your measuring device and its measuring lines for damage. Never carry out measurements when the protective insulation is damaged (ripped, torn off etc.).

To avoid an electric shock, do not touch the connections/measuring points directly or indirectly during measurements. When measuring, only touch within the tangible grip markings on the test prods and the alligator clip.

Do not use the measuring device shortly before, during or directly after an electrical storm (lightning! / high-energy overvoltages!). Please make sure that your hands, your shoes, your clothing, the floor, circuits and circuit components are dry.

Avoid operation near strong magnetic or electromagnetic fields, transmitter aerials or HF generators. This might lead to distorted measuring results.

If you have reason to believe that the device can no longer be operated safely, disconnect it immediately and make sure it is not unintentionally operated. It can be assumed that safe operation is no longer possible if:

- the device shows visible damage,
- the device does not function any longer or
- after it has been stored under unfavourable conditions over a period of time or
- after it has been exposed to heavy stress during transport.

Do not switch on the measuring device immediately after it has been taken from a cold to a warm environment. The condensation generated can lead to faulty measurements or even destroy the device. Allow the device to reach room temperature before switching it on.

Do not leave packaging material lying around carelessly. It may become a dangerous toy for children.

For safety reasons, only use the provided measuring lines and accessories in correspondence with the specifications of the measuring device.

You should also observe the safety instructions in each chapter of these instructions.

Product description

The measuring device shows measured values and the corresponding units and symbols on the digital display. The display for measured values comprises 4000 counts (count = smallest display value). A bargraph shows rapid changes in value.

The measuring device shuts down automatically if it is not operated for about 10 minutes. This saves battery power and thus extends operating time. Battery voltage is displayed in the "600 V~" range, which helps estimate the remaining operating time.

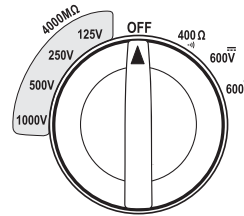
The measuring device can be used for do-it-yourself or for professional applications.

For better readability, the measuring device can be placed ideally using the tilt stand on the back.

Rotary switch (5)

The individual measuring functions are selected via the rotary switch. The automatic range selection "auto range" is active in the "400 Ω " measuring function. The appropriate measuring range is set automatically.

If the rotary switch is set to "OFF", the measuring device is switched off. Always turn off the device when it is not in use.



Displayed information and symbols

The following is a list of symbols and information the measuring device can display.

MIN	Min value display
MAX	Max. value display
HOLD	Data hold function is active
ZERO	Zero adjustment symbol in the low-resistance and voltage measuring range
OL	Overload; the measuring range has been exceeded
OFF	Off position; the measuring device is switched off

 BATT Battery replacement symbol



Warning symbol for dangerous voltage (<30 V) at the test prods



Acoustic continuity check symbol




Backlight symbol

BATT Display of battery voltage in the measuring device (battery check)

\equiv V Direct voltage

\sim V Alternating voltage

mV Millivolt (exp.-3)

V	Volt (unit of electric voltage)
Ω	Ohm (unit of electric resistance)
k Ω	Kiloohm (exp.3)
M Ω	Megaohm (exp.6)
 LOCK	Symbol for permanent measurement (in the insulation measuring range)

Measuring



Do not exceed the permitted max. input values. Never touch circuits or parts of circuits with a possible voltage of more than 25 V/ACrms or 35 V/DC! Danger to life! Before measuring, check the connected measuring lines for damage such as cuts, cracks or pinches. Defective measuring lines must no longer be used! Danger to life! When measuring, only touch within the tangible grip markings on the test prods. Measuring is only permitted with the housing and the battery compartment closed.



During insulation tests, dangerous voltages can be present at the test prods. A lightning symbol on the display warns of such voltages. The insulation may only be tested on currentless components or devices.



As soon as "OL" (overload) appears on the display, you have exceeded the measuring range.

a) Switching on the measuring device

The measuring device is switched on using the rotary switch (5). Turn the rotary switch to select the desired measuring function. Turn the rotary switch to "OFF" to switch off the measuring device. Always switch off the measuring device when it is not in use ("OFF" position).



Before the measuring device can be used, the enclosed batteries have to be inserted. See chapter "Cleaning and maintenance" for information on inserting and replacing the batteries.

b) Voltage measurement "V"

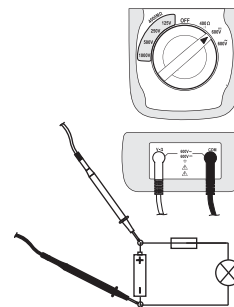
Proceed as follows to measure DC voltages "V/DC":

- Switch on the measuring device and select measuring range "600 V=-".
- Plug the red measuring line into the "V" measuring socket (10) and the black measuring line into the COM measuring socket (11).
- Now connect the two test prods with the test object (battery, switch etc.). The red test prod is the positive terminal, the black test prod is the negative terminal.
- The polarity of the measured value is displayed with the measured value.



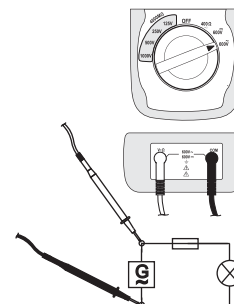
If a minus "-" appears for direct voltage in front of the measured value, the measured voltage is negative (or the measuring lines have been mixed up).

- After measuring, remove the measuring lines from the test object and switch off the measuring device.



Proceed as follows to measure AC voltages "V/AC":

- Switch on the measuring device and select measuring range "600 V~".
- Plug the red measuring line into the "V" measuring socket (10) and the black measuring line into the COM measuring socket (11).
- Connect the two test prods with the test object (generator, switch etc.).
- The measured value is shown on the main display. The small display at the bottom right shows the current battery voltage in the measuring device.
- After measuring, remove the measuring lines from the test object and switch off the measuring device.



c) Resistance measurement “ Ω ”

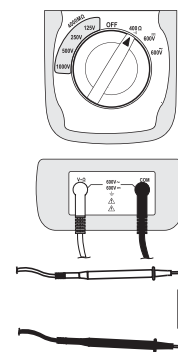


Make sure that all circuit parts, circuits, components and any other test objects are currentless and discharged.

The measuring device allows measuring resistances in the low-resistance measuring range from 0.01 to 400 Ω . For accurate results, resistance is measured with a test current of approx. 200 mA.

Proceed as follows to measure resistances:

- Switch on the measuring device and select measuring range “400 Ω ”.
- Plug the red measuring line into the Ω -measuring socket (10) and the black measuring line into the COM measuring socket (11).
- Check the measuring lines for continuity by connecting both test prods with one another. The resistance value must be approximately 0 - 0.5 ohms (inherent resistance of the measuring lines) along with a beep.
- Connect the test prods with the test object. The measured value is displayed as long as the test object is not a high-resistance object or interrupted. Wait until the display has stabilised.
- IF “OL” (overload) is displayed, you have exceeded the measuring range or the measuring circuit is broken.
- After measuring, remove the measuring lines from the test object and switch off the measuring device.

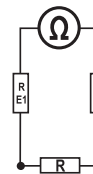


If no measurement can be carried out or if the continuity check fails (zero display), check the built-in fuse. Fuse replacement is described in chapter “Cleaning and maintenance”.



If you carry out a resistance measurement, make sure that the measuring points where you connect the test prods are free from dirt, oil, solderable lacquer or the like. Faulty measurements may result under such circumstances.

For low-voltage measurement, the resistance of the measuring lines is included in the measuring result. Measuring line resistance is approx. 0.5 Ω . The equivalent circuit diagram is illustrated on the right. Resistances “R E1” and “R E2” represent the measuring lines. “R” represents the test object. All three resistances contribute to the measured value. In order to exclude measuring line resistance from the result, activate the ZERO function.





When measuring, a beep along with a flashing lightning symbol warns of test voltage present in the measuring lines.

If a voltage of more than 30 V (AC/DC) has been detected, no test is carried out and “>30 V” is displayed along with the voltage type (AC or DC). This is indicated by a warning sound. Stop measuring immediately and disconnect the measuring circuit, any components and the device from the power supply.

- For a single measurement, hold down the TEST button (4) for the duration of the measurement. After a short while, the insulation resistance is displayed along with the current auxiliary test voltage. Wait until the main display has stabilised. This may take several seconds. Let go of the TEST button to stop measuring. The last measured result is recorded (“HOLD” displayed) and the measuring circuit is discharged.
- For permanent measurement, press the LOCK button (2). The display shows “LOCK” and the lock symbol. Press the TEST button (4) shortly to start the insulation test. Permanent measuring mode is active for about 10 minutes. Then the measuring device turns off automatically. If you want to end the measurement before that time, press the TEST button. The last measured result is recorded (“HOLD” displayed) and the measuring circuit is discharged.
- IF “OL” (overload) appears on the display, you have exceeded the measuring range or the measuring circuit is highly resistive.
- After measuring, remove the measuring lines from the test object and switch off the measuring device.

HOLD function

The HOLD function locks the displayed value to allow you to read it comfortably or log it.



If you test live conductors, make sure that this function is deactivated when you start measuring. Otherwise, a false measuring result is shown!

To activate the HOLD function, press the “HOLD” button (3). An audio signal confirms the activation and “HOLD” appears on the display.

To deactivate the HOLD function, press the “HOLD” button again or switch to another measuring function.

ZERO function



The ZERO function is only active in the 400 Ω , 600 V/DC and 600 V/AC measuring ranges.

The ZERO function allows zero adjustment of the display or a fast relative measurement, e.g. to display component tolerances. The reference value is measured and saved in the internal memory and then automatically deducted from subsequent measurements. This allows the easy display of deviations from the reference values.

- Connect the test object as described for resistance measurement or voltage measurement. Wait until the measured value has stabilised.
- Press the "ZERO" button (6) shortly while measuring. "ZERO" appears on the display and the display is reset to zero. The reference value is saved.
- Continue with the differential measurements on the other test objects.
- Press the ZERO button again to deactivate the function.



After changing the measuring range or the measuring function, the ZERO memory is deleted.

MAX/MIN function

This function shows the measured max. and min. values on the display. The MAX/MIN function can only be used in the 400 Ω , 600 V/DC and 600 V/AC measuring ranges.

- Hold down the MAX/MIN button for about 1 second during the measurement. The display shows "MAX" along with the highest value.
- Press the "MIN/MAX" button again to switch to "MIN". The lowest value is displayed.
- Pressing the button switches the display.
- To abort this function, hold down the "MAX/MIN" button for about 1s until "MAX" or "MIN" is blanked accompanied by a beep.

Auto power-off function

The measuring device turns off automatically after 10 minutes if no button or rotary switch is operated. This function saves battery power and extends the service life.

To reactivate the measuring device after automatic power-off, use the rotary switch or press any function key on the measuring device.

Switching on the backlight

The display can be illuminated in bad lighting conditions. To switch on the backlight, hold down the light button (6) for about 2 seconds. The backlight is active for about 10 seconds until it goes out automatically to save battery power. Hold down the button for about 2 seconds while the backlight is active to switch it off manually.

Cleaning and maintenance

General

To ensure the accuracy of the measuring device over an extended period of time, it should be calibrated once a year.

Apart from occasional cleaning and fuse replacements, the measuring device requires no servicing. See the next chapter for information on battery and fuse replacement.



Regularly check the technical safety of the device and measuring lines, e.g. check for damage to the housing, the insulation or squeezing etc.

Cleaning

Always observe the following safety instructions before cleaning the device:



**Live components may be exposed if covers are opened or parts are removed (unless these parts are intended to be removed without tools).
Before cleaning or repairing the device, connected lines must be disconnected from the measuring device and from any test objects. Switch off the measuring device.**

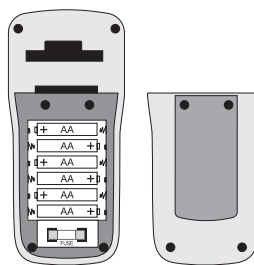
Do not use agents containing carbon, benzine, alcohol or similar substances to clean the device. They corrode the surface of the measuring device. In addition, the vapours are detrimental to health and explosive. Sharp-edged tools, screwdrivers or metal brushes should not be used for cleaning purposes. Use a clean, lint-free, antistatic and slightly moistened cloth to clean the device, the display and the measuring lines. Allow the product to dry completely before you use it again to carry out measurements.

Inserting and replacing the batteries

Operation of the measuring device requires six AA batteries. You need to insert new, charged batteries before operating the device or when the battery replacement symbol **BATT** appears on the display. Rechargeable batteries must not be used!

Proceed as follows to insert or replace the batteries:

- Disconnect all measuring lines from the measuring device and switch it off.
- Fold out the tilt stand (8) and loosen the four screws of the battery compartment (9).
- Remove the battery compartment lid from the measuring device. The batteries are accessible now.
- Replace all batteries with new batteries of the same type. Observe the polarity markings in the battery compartment when inserting the batteries.
- Close the battery compartment and screw on the lid in reverse order.
- The measuring device is ready for use again.



Never operate the measuring device when it is open.

!RISK OF DEATH!

Rechargeable batteries must not be used!

Do not leave flat batteries in the device. Even batteries protected against leaking can corrode and thus release chemicals which are detrimental to your health or destroy the device.

Do not leave batteries lying around carelessly. They could be swallowed by children or pets. If swallowed, consult a doctor immediately.

Remove the batteries if the device is not used for a longer period of time to prevent leaking.

Leaky or damaged batteries may cause caustic burns if they come into contact with skin. Therefore, you should use suitable protective gloves.

Make sure that batteries are not short-circuited. Do not throw batteries into fire.

Always replace all batteries at the same time. Mixing fully charged batteries and half-full batteries reduces battery life. Always use batteries of the same type and manufacturer in a set of batteries. Batteries can be damaged by equalizing currents and may leak.

Batteries must not be recharged or dismantled. There is danger of explosion.



You can order suitable alkaline batteries stating the following order no.:

Order no. 65 25 06 (please order six).

Only use alkaline batteries. They are powerful and long-lasting.

Checking the batteries

The insulation tester ET-100 allows you to check the battery voltage anytime. Switch the measuring device to the “600 V~” measuring range. After about 3 seconds, the small display at the bottom right shows the current battery voltage. At a voltage of <7.5 V the battery replacement symbol starts flashing automatically.

Replacing the fuse

The low-voltage “400 Ω” measuring range is secured with a quick-break fuse. If measuring in this range is no longer possible, you have to replace the fuse.

Proceed as follows to replace the fuse:

- Disconnect all measuring lines from the device and switch it off.
- Open the battery compartment as described in chapter “Inserting and replacing the batteries”.
- The fuse is accessible.
- Replace the defective fuse with a new fuse of the same type and nominal voltage. The fuse has the following characteristics: F 500 mA/600 V, size 6.3 x 30 mm, ceramic.
- Properly close the housing again in reverse order.



Using repaired fuses or bridging the fuse holder is not admissible for safety reasons. This can cause fire or electric arc explosions. Never operate the measuring device when it is open.

Disposal



Old electronic devices are resources and do not belong in the household waste. At the end of its service life, dispose of the product at the collection point of your community according to the relevant statutory regulations. It is prohibited to dispose of the device in the household waste.

Disposal of used batteries!

The end user is legally obliged (**battery regulation**) to return all used batteries and rechargeable batteries. **Disposal in the household waste is prohibited!**



Batteries containing toxic substances are marked with the symbols shown that indicate they must not be disposed of in the household waste. The heavy metals concerned are: **Cd** = cadmium, **Hg** = mercury, **Pb** = lead. You can return used batteries/rechargeable batteries free of charge at the official collection points of your community, in our stores, or wherever batteries/rechargeable batteries are sold!

You will thus carry out your legal obligations and contribute to the protection of our environment!

Troubleshooting

By purchasing the measuring device you have acquired a state-of-the-art product which operates reliably.

Nevertheless, problems or malfunctions may occur.

For this reason, the following is a description of how you can eliminate possible malfunctions yourself:



Always adhere to the safety instructions!

Error	Possible cause	Remedy
The measuring device . does not work	Are the batteries exhausted?	Check the status. Replace the batteries
No change in measured values.	Is the wrong measuring function active (AC/DC)?	Check the display (AC/DC) and switch the function,if necessary.
	Is the fuse defective in the current range?	Check the fuse.
	Is the HOLD function activated? ("HOLD" displayed)	Press the HOLD button to deactivate this function.



Repairs other than those described should only be carried out by an authorised specialist. If you have any questions about the use of the measuring device, our technical support is available under the following telephone number:

Voltcraft®, 92242 Hirschau, Lindenweg 15, Tel. no. 0180 / 586 582 7.

Specifications

Display	LCD, 4000 counts with bargraph
Measuring rate	approx. 2.5 measuring operations/second
Measuring line length	2 x approx. 120 cm (test prods), 1 x approx. 90 cm (alligator clip)
Measuring impedance	>10M Ω (V range)
Automatic power-off	approx. 10 minutes
Power supply	6 x AA batteries
Operating conditions	0 to 40°C (< 80 % RH)
Operating altitude	max. 2,000 m
Storage temperature	-10°C to +60°C (< 70 % RH)
Weight	approx. 585 g
Dimensions (L x W x H)	200 x 92 x 50 (mm)
Over-voltage category	CAT III 600 V, degree of pollution 2

Measurement tolerances

Accuracy in \pm (% of reading + display error in counts (= number of smallest points)). The accuracy is valid for one year at a temperature of +23°C (\pm 5°C) with relative humidity less than 80 % RH, non-condensing.

Direct voltage

Range	Resolution	Accuracy
600 V	1 V	$\pm(0,8\% + 3)$
Overload protection: 600 V; impedance approx. 10 MOhm		

Alternating voltage

Range	Resolution	Accuracy
600 V	1 V	$\pm(1,2\% + 10)$
Frequency range 40 - 400 Hz; effective average at sinusoidal voltage; overload protection 600 V; impedance approx. 10 MOhm		

Resistance

Range	Resolution	Accuracy
40 Ω	0.01 Ω	$\pm(1.2\% + 3)$
400 Ω	0.1 Ω	
Overload protection 600 V, test voltage max. 5.8 V, test current approx. 200 mA; max. number of measurements with full batteries: x 500		

Acoustic continuity check

Range	Resolution	Test voltage	Test current
<35 Ω permanent audio signal	0,01 Ω	5.8 V	200 mA (typical)
Overload protection 600 V			

Insulation test

Nominal voltage at output (0 to + 10 %)	Measuring range	Resolution	Accuracy	Nominal test current	Short-circuit current
125 V	0.125 - 4 M Ω	0.001 M Ω	$\pm(2.0\% + 10)$	1 mA (at 125 k Ω)	≤ 1 mA
	>4 - 40 M Ω	0.01 M Ω	$\pm(2.0\% + 10)$		
	>40 - 400 M Ω	0.1 M Ω	$\pm(4.0\% + 5)$		
	>400 - 4000 M Ω	1 M Ω	$\pm(5.0\% + 5)$		
250 V	0.250 - 4 M Ω	0.001 M Ω	$\pm(2.0\% + 10)$	1 mA (at 250 k Ω)	≤ 1 mA
	>4 - 40 M Ω	0.01 M Ω	$\pm(2.0\% + 10)$		
	>40 - 400 M Ω	0.1 M Ω	$\pm(3.0\% + 5)$		
	>400 - 4000 M Ω	1 M Ω	$\pm(4.0\% + 5)$		
500 V	0.500 - 4 M Ω	0.001 M Ω	$\pm(2.0\% + 10)$	1 mA (at 500 k Ω)	≤ 1 mA
	>4 - 40 M Ω	0.01 M Ω	$\pm(2.0\% + 10)$		
	>40 - 400 M Ω	0.1 M Ω	$\pm(2.0\% + 5)$		
	>400 - 4000 M Ω	1 M Ω	$\pm(4.0\% + 5)$		
1000 V	1 - 4 M Ω	0.001 M Ω	$\pm(3.0\% + 10)$	1 mA (at 1 M Ω)	≤ 1 mA
	>4 - 40 M Ω	0.01 M Ω	$\pm(2.0\% + 10)$		
	>40 - 400 M Ω	0.1 M Ω	$\pm(2.0\% + 5)$		
	>400 - 4000 M Ω	1 M Ω	$\pm(4.0\% + 5)$		
Overload protection ≥ 30 V					
max. number of measurements with full batteries:					
125 V		x 500			
250 V		x 500			
500 V		x 500			
1000 V		x 500			



Do not exceed the permitted max. input values. Never touch circuits or parts of circuits with a possible voltage of more than 25 V/ACrms or 35 V/DC! Danger to life!