

# Prüf- und Messtechnik



Spitzentechnologie, die überzeugt



**Operation manual**

**Digital Multimeter**

## 1. Safety Precautions

This product complies with the requirements of the following European Community Directives: 2004/108/EC (Electromagnetic Compatibility) and 2006/95/EC (Low Voltage) (CE-Marking). Overvoltage CAT III 1000V, Pollution degree 2.

CAT I: For signal level, telecommunication, electronic with small transient over voltage

CAT II: For local level, appliances, main wall outlets, portable equipment

CAT III: Distribution level, fixed installation, with smaller transient overvoltages than CAT IV.

CAT IV: Units and installations, which are supplied overhead lines, which are stand in a risk of persuade of a lightning, i.e. main-switches on current input, overvoltage-diverter, current use counter.

To ensure safe operation of the equipment and eliminate the danger of serious injury due to short-circuits (arcing), the following safety precautions must be observed.

Damages resulting from failure to observe these safety precautions are exempt from any legal claims whatever.

- \* Do not use this instrument for high-energy industrial installation measurement.
- \* Do not place the equipment on damp or wet surfaces.
- \* Do not exceed the maximum permissible input ratings (danger of serious injury and/or destruction of the equipment).
- \* The meter is designed to withstand the stated max voltages. If it is not possible to exclude without that impulses, transients, disturbance or for other reasons, these voltages are exceeded a suitable presale (10:1) must be used.
- \* Replace a defective fuse only with a fuse of the original rating. Never short-circuit fuse or fuse holding.
- \* Disconnect test leads or probe from the measuring circuit before switching modes or functions.
- \* Do not conduct voltage measurements with the test leads connected to the mA/A- and COM-terminal of the equipment.
- \* The 20A-range is protected. To avoid damage or injury, use the meter only in circuits limited by fuse or circuit breaker to 20A or 4000VA.
- \* To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any resistance measurements.
- \* Do not conduct current measurements with the leads connected to the V/ $\Omega$ -terminals of the equipment.
- \* Check test leads and probes for faulty insulation or bare wires before connection to the equipment.
- \* To avoid electric shock, do not operate this product in wet or damp conditions. Conduct measuring works only in dry clothing and rubber shoes, i. e. on isolating mats.

- Never touch the tips of the test leads or probe.
- Comply with the warning labels and other info on the equipment.
- Always start with the highest measuring range when measuring unknown values.
- Do not subject the equipment to direct sunlight or extreme temperatures, humidity or dampness.
- Do not subject the equipment to shocks or strong vibrations.
- Do not operate the equipment near strong magnetic fields (motors, transformers etc.).
- Keep hot soldering irons or guns away from the equipment.
- Allow the equipment to stabilize at room temperature before taking up measurement (important for exact measurements).
- Do not input values over the maximum range of each measurement to avoid damages of the meter.
- Do not turn the rotary function switch during voltage or current measurement, otherwise the meter could be damaged.
- Use caution when working with voltages above 35V DC or 25V AC. These Voltages pose shock hazard.
- Replace the battery as soon as the battery indicator "BAT" appears. With a low battery, the meter might produce false reading that can lead to electric shock and personal injury.
- Fetch out the battery when the meter will not be used for long period.
- Periodically wipe the cabinet with a damp cloth and mild detergent. Do not use abrasives or solvents.
- The meter is suitable for indoor use only.

- \* Do not operate the meter before the cabinet has been closed and screwed safely as terminal can carry voltage.
- \* Do not store the meter in a place of explosive, inflammable substances.
- \* Do not modify the equipment in any way.
- \* Do not place the equipment face-down on any table or work bench to prevent damaging the controls at the front.
- \* Opening the equipment and service – and repair work must only be performed by qualified service personnel
- \* **Measuring instruments don't belong to children hands.**

### **CAUTION!**

**Note on using the supplied safety test leads according the IEC / EN 61010-031:2008:**

Measurements in the field of overvoltage category CAT I or CAT II can be performed with test leads without sleeves with a maximum of up to 18mm long, touchable metallic probe, whereas for measurements in the field of overvoltage category CAT III or CAT IV test leads with put on sleeves, printed with CAT III and CAT IV must be used, and therefore the touchable and conductive part of the probes have only max. 4 mm of length.

### **Cleaning the cabinet**

Clean only with a damp, soft cloth and a commercially available mild household cleanser. Ensure that no water gets inside the equipment to prevent possible shorts and damage to the equipment.

## 1.1. Safety Symbols

The following symbols are imprinted on the front panel of the meter to remind you of measurement limitations and safety.

20 A The maximum current that you can measure at this terminal is 20A DC/AC. This terminal is fuse protected by F 20A/250V fuse. When using this range with high current, keep the duty cycle to 10 seconds on load and 15 minutes off load.

mA The maximum current that you can measure with this terminal is 200mA that is fuse protected by 200mA/250V fuse.

Max.



To avoid electrical shock or instrument damage, do not connect the COM Terminal to any source of 1000V DC/AC with respect to earth ground.



The maximum voltage this meter can measure is 1000V DC or 750V AC. Be exceptionally careful when measuring high voltages. Do not touch the terminals or test leads ends




Refer to the complete operating instructions.



Indicates protection class II, Double Insulation

CATII Overvoltage category III

## 1.2. Input Limits

Function	Terminal	Input limits
V DC	V/Ω/Hz+COM	1000 V DC/ 750 V AC <sub>pp</sub>
V AC		1000 V DC/ 750 V AC <sub>pp</sub>
Ω		250 V DC/AC
mA DC/AC	mA + COM	200 mA DC/AC
20 A DC/AC	20 A + COM	20 A DC/AC
 ))	V/Ω/Hz/+COM	250 V DC/AC <sub>pp</sub>
Frequency		250 V DC/AC <sub>pp</sub>
Temperature	mA+COM	250 V DC/AC <sub>pp</sub>
Capacitance		250 V DC/AC <sub>pp</sub>

## 2. Introduction

The multimeter is heavy-duty and rugged hand-held multimeter that will give you confidence and peace of mind in your every measuring job. Please read these operating instructions very carefully before commencing your measurements.

- \* PEAK Hold Function - freezes the max. display so you can keep the measured value there even after you disconnect the probes.
- \* Auto polarity operation
- \* Overload and Transient protection
- \* Backlight

- \* Low Battery indicator appears when you need to replace the batteries.
- \* Beeper sounds tones for continuity function
- \* Auto power off

## 2.1. General Characteristics

Display	3 ½ digit 28 mm LCD display, max. indication 1999, with automatic polarity indication
Overrange indication	OL
Reading time	3 reading per second
Auto power off	after approx. 15 minutes
Operating temperature	0° C...+40° C < 80 % RH
Storage temperature	-10° C...+50° C < 80 % RH
Temperature for guaranteed accuracy	+18 C° ... +28° C < 75% RH
Low battery indication	Battery symbol
Battery Type	NEDA 1604 9V or 6F22 9V
Dimensions	95 (W) x 190 (H) x 45 (D) mm
Weight	400 g



Accessories

test leads, operating manual, battery, temperature and hFE-adaptor, thermocouple, carrying case and manual

### 3. Functions and Ranges

#### 3.1. DC Voltage

Range	Resolution	Accuracy
200 mV	100 $\mu$ V	$\pm 0,5\%$ rdg. + 3dgt.
2 V	1 mV	
20 V	10 mV	
200 V	100 mV	
1000 V	1 V	$\pm 1,0\%$ rdg. + 5dgt.

Input impedance: 10M $\Omega$

Overload protection: 250V DC/AC<sub>pp</sub> in 200mV-range  
1000V DC/AC<sub>pp</sub> in all other ranges

#### 3.2. AC Voltage

Range	Resolution	Accuracy
200 mV	100 $\mu$ V	$\pm 1,2\%$ rdg. + 3 dgt.
2 V	1 mV	$\pm 0,8\%$ rdg. + 5 dgt.
20 V	10 mV	
200 V	100 mV	
750 V	1 V	$\pm 1,2\%$ rdg. + 5 dgt.

Input impedance: 10M $\Omega$

Overload protection: 250V DC/AC<sub>pp</sub> in 200mV-range  
1000V DC/AC<sub>pp</sub> in all ranges

Frequency range: 40 ... 400Hz in ranges 200mV...200V  
40 ... 100Hz in 750V-ranges

### 3.3. DC Current

Range	Resolution	Accuracy
2 mA	1 $\mu$ A	$\pm 0,8\%$ rdg. + 3 dgt.
20 mA	10 $\mu$ A	
200 mA	100 $\mu$ A	$\pm 1,2\%$ rdg. + 4 dgt.
20 A	10 mA	$\pm 2,0\%$ rdg. + 5 dgt.

Overload protection:

0,2A / 250V: 5 x 20 mm fuse in mA-Input

20A / 250V: 5 x 20 mm fuse in 20A-Input (Fast-blow fuse)

20A for max. 10 sec.

### 3.4. AC Current

Range	Resolution	Accuracy
2 mA	1 $\mu$ A	$\pm 1,0\%$ rdg. + 5 dgt.
20 mA	10 $\mu$ A	
200 mA	100 $\mu$ A	$\pm 2,0\%$ rdg. + 5 dgt.
20 A	10 mA	$\pm 3,0\%$ rdg. + 10 dgt.

Overload protection

0,2A / 250V: 5 x 20 mm fuse in mA-Input

20A / 250V: 5 x 20 mm fuse in 20A-Input (Fast-blow fuse)

20A for max. 10 sec.

Frequency - range: 40 ... 200Hz

### 3.5. Resistance

Range	Resolution	Accuracy
200 $\Omega$	0,1 $\Omega$	$\pm 0,8\%$ rdg.+ 5 dgt.
2 k $\Omega$	1 $\Omega$	
20 k $\Omega$	10 $\Omega$	$\pm 0,8\%$ rdg.+ 3 dgt.
200 k $\Omega$	100 $\Omega$	
2 M $\Omega$	1 k $\Omega$	$\pm 1,0\%$ rdg.+15 dgt.
20 M $\Omega$	10 k $\Omega$	
2000 M $\Omega$	1 M $\Omega$	$\pm 5,0\%$ (rdg.-10) +20 dgt.

Overload protection: 250V DC/AC<sub>10</sub>

### 3.6. Frequency

Range	Resolution	Accuracy
2 kHz	1 Hz	± 1,0% rdg. + 10 dgt.
20 kHz	10 Hz	
200 kHz	100 Hz	
2000 kHz	1 kHz	
10 MHz	10 kHz	

Sensitivity: > 3,5V<sub>pp</sub>

Overload Protection: 250V DC or AC<sub>pp</sub>

### 3.7. Capacitance

Range	Resolution	Accuracy
20 nF	10 pF	± 2,5% rdg. + 20 dgt.
200 nF	100 pF	
2 μF	1 nF	
20 μF	10 nF	
200 μF	100 nF	± 5,0% rdg. + 5 dgt.

Overload protection: 36V DC/AC<sub>pp</sub>

Test frequency: 100Hz

### 3.8. Inductivity

Range	Resolution	Accuracy
2 mH	1 μH	± 2,5% rdg. + 20 dgt.
20 mH	10 μH	
200 mH	100 μH	
2 H	1 mH	
20 H	10 mH	

Overload protection: 36V DC or AC<sub>pp</sub>

Test frequency: 100Hz

### 3.9. Temperature

Range	Resolution	Accuracy
-20... +1000°C	1°C	± 1,0% rdg.+ 4 dgt. (< 400°C)
		± 1,5 % rdg. + 15 dgt. (≥ 400°C)

Sensor: Type-K Thermocouple

### 3.10. Diode

Range	Resolution	Accuracy	Test-current	Open circuits volts
2 V	1 mV	±1,5% rdg. +3 dgt.	1,0mA	2,8V DC typical

### 3.11. Continuity check

Audible continuity threshold: Less than 90 Ω

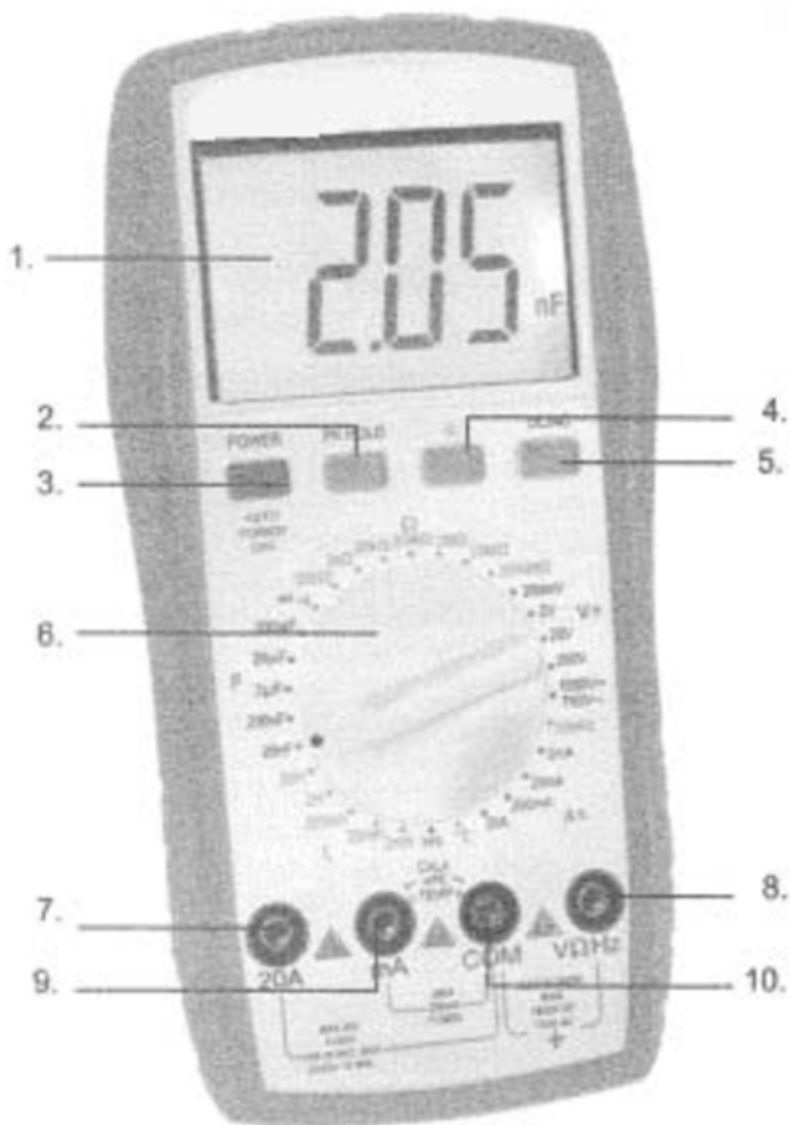
Test current: < 0,3 mA

Overload protection: 250V DC or AC<sub>pp</sub>

### 3.12. Transistor (hFE)

Range	Display	Test Condition
hFE NPN or PNP	0 – 1000	Base current approx. 10μA and V <sub>CE</sub> : 3V

## 4. Front Panel Description



1. 3 ½ digit LCD-display with backlight
2. Peak-Hold button
3. ON/OFF-button
4. Backlight-button (approx. 10 sec.)
5. AC/DC-button
6. Function selector
7. 20 A input-jack
8. V/Ω/Hz-input jack
9. mA/Temp.-input-jack
10. COM-input-jack

#### **4.1. Description**

##### **1. Digital Display**

Digital readings are displayed on a 1999 count display with automatic polarity indication and decimal point placement.

##### **2. Peak Hold function**

The peak hold feature lets you hold the max. reading on the display. To turn on the peak hold feature, press PK HOLD until PH appears on the display.

##### **3. ON/OFF-button**

To switch on or off the unit.

##### **4. Backlight**

The backlight helps to read measuring values from the display at unfavourable lighting conditions.

##### **5. AC/DC-Button**

The AC/DC-button is used for the switchover between AC/DC and current measurement

#### 6. Function selector

To select the measuring range

#### 7. 20 A - Input Terminal

For current measurements (AC or DC) up to 20A when the rotary selector switch is in the 20A position.

#### 8. V/ $\Omega$ /Hz – Input Terminal

Continuity, Diode, Ohms, Volt, Frequency terminal.

#### 9. mA Input terminal

For current measurements up to 200mA DC/AC when the rotary selector is in the mA position.

#### 10. COM Common Terminal

Return terminal for all measurements.

## **5. Preparation for Operation**

### **5.1. Using the test leads**

Use only the identical type of test leads supplied with your meter. These test leads are rated for 1000V.

#### **Cautions!**

- \* The maximum rating of your meter is 1000V DC and 750V AC. If you try to measure DC voltages above 1000V or AC voltages 750V, you might damage your meter and expose yourself to a serious shock hazard. Use extreme care when you measure high voltages.
- \* Never connect the probe you plug into the COM terminal to a source of voltage greater than 1000V DC/750V AC with respect to earth/ground. This creates a serious shock hazard.

## 5.2. Using the stand

Use your meter's stand to prop up the meter. If you prop your meter on a bench-top, the stand helps provide a better viewing angle.

To use the stand as a prop, just open it away from the meter and set it on a flat surface.

## **6. How to make measurements**

Understanding Phantom readings:

In some DC and AC voltage ranges, when the test leads are not connected to any circuit, the display might show a phantom reading. This is normal. The meter's high input sensitivity produces a wandering effect. When you connect the test leads to a circuit, accurate reading appear.

### 6.1. Measuring AC/DC voltage

#### **WARNING!**

Do not try to measure a voltage greater than 1000V DC or 750V AC. You might damage your meter and expose yourself to a severe shock hazard.

Follow these steps to measure DC/AC Voltage.

1. Set the rotary selector to the desired position. Select the range as required for the voltage level to be measured. If you do not know the voltage level, start with the range switch set to the highest voltage position and reduce the setting as needed to get a reading.
2. Plug the black test lead into the meter's COM terminal and the red test lead into the V/ $\Omega$ /Hz-terminal.



3. Connect the test leads to the DC/AC voltage source you want to measure.

**Warning!** When you connect the test probes to an AC outlet, do not turn the rotary selector switch to another range. It could damage the meter's internal components or injure you.

## 6.2. Measuring DC/AC Current

### **WARNING!**

- \* Do not apply voltage directly across the terminals. You must connect the meter in series with the circuit.
- \* The 20A terminal is fused. A severe fire hazard and short circuit danger exists if you apply a voltage with high-current capability to this terminal. The meter can be destroyed under such conditions.

To measure current, break the circuit and connect the probes to two circuit connection points. Never connect the probes across a voltage source in parallel. Doing so can blow the fuse or damage the circuit under test.

**Note:** The maximum input current is 0,2A or 20A depending on the terminal used. In the 20A range excessive current flow blows up the fuse, which must be replaced.

1. Set the rotary selector to the desired A range. If you do not know the current level, set it to the highest position and reduce the setting as needed to get a reading.
2. Plug the black test lead into your meter's COM terminal and the red test lead into your meter's mA or 20A terminal.

3. Remove power from the circuit under test and then break the circuit at the appropriate point.
4. Connect the test leads in series with the circuit.
5. Apply power and read the current. Your meter displays the current value.

**Note:** If you see the meter for DC current, "-" appears or disappears. This indicates the polarity of the measured current.

### 6.3. Measuring Resistance

#### **WARNING!**

- \* Never connect the test leads to a source of voltage when you have selected the OHMS function and plugged the test leads into the V/ $\Omega$ /Hz-terminal.
  - \* Be sure that the circuit under test has all power removed and that any associated capacitors are fully discharged before you make a resistance measurement.
1. Set the rotary selector to the desired OHM range.
  2. Plug the black test lead into your meter's COM terminal and the red test lead into your meter's V/ $\Omega$ /Hz-terminal.
  3. Connect the test leads to the device you want to measure.

The resistance measuring circuit compares the voltage gained through a known resistance (internal) with the voltage developed across the unknown resistance. So, when you check in-circuit resistance, be sure the circuit under test has all power removed (all capacitors are fully discharged).

### Notes:

- \* If the measured resistance value exceeds the maximum value of the range selected, 1 appears flashes. This indicates an overload. Select a higher range. In this mode, the beeper does not sound.
- \* When you short the test leads in the 200  $\Omega$  range, your meter displays a small value (no more than 0.3  $\Omega$ ). This value is due to your meter's and test leads internal resistance. Make a note of this value and subtract it from small resistance measurements for better accuracy.
- \* If in 200 Ohm, please short the test leads and measure wire resistance. And then subtract the resistance from the value measured.
- \* It is normal to display 10 M $\Omega$  when the test leads shorted in range 2000 M $\Omega$ , it will not affect the accuracy and shall be subtracted from the value measured. For example: The object resistance is 1000 M $\Omega$ , the reading value is 1010 M $\Omega$ , then the correct value shall be 1010 M $\Omega$  - 10 M $\Omega$  = 1000 M $\Omega$ .

## 6.4. Capacitance measurements

### **Warning !**

To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any capacitance measurements. Remove the batteries and unplug the line cords.

1. Set the function switch to the corresponding CAP measuring range.
2. Plug the black test lead into your meter's COM-terminal (-) and the red test lead into your meter's mA-terminal (+).
3. Touch the test leads to the capacitor to be tested. The display will indicate the proper decimal point value.

## 6.5. Inductance measurements

1. Switch to a proper range and insert test leads into "mA" and "com" jack.
2. Connect the test leads crosswise to the two ends of inductor.

### **Notes:**

1. If inductance exceeds the range selected. "OL" will be displayed on LCD, then you shall increase the range by one step.
2. The inductance value measured for identical inductor may be different if there is different impedance.

3. If in range 2mH, please short test leads and measure lead inductance and then subtract the inductance from the value measured.
4. Avoid measuring small inductor in high range, or the accuracy is not guaranteed.

### 6.6. Temperature measurements

#### **Warning!**

To avoid electric shock, disconnect both test probes from any source of voltage before making a temperature measurement.

1. If you wish to measure temperature set the function switch to the °C-range
2. Insert the temperature-adaptor to the input sockets mA (-) and COM (+)
3. Touch the Temperature probe head to the part whose temperature you wish to measure. Keep the probe touching the part under test until the reading stabilizes (about 30 seconds).
4. Read the temperature in the display. The digital reading will indicate the proper decimal point and value.

#### **Warning!**

To avoid electric shock, be sure, that the thermocouple has been removed before changing to another measurement function.

### 6.7. Measuring Frequency

**Warning!** If you try to measure the frequency of a signal that exceeds 250V AC<sub>pp</sub>, you might damage your meter and expose yourself to a severe shock hazard.

Follow these steps to measure the frequency of a signal:

**Note:**

- \* In noisy environments, use shielded cable to measure small signals
- \* When measuring high voltage circuit, any parts of your body should not touch the high voltage circuit, otherwise it may hurt your body

**Note:** For the most accurate measurements, we strongly recommend you to use a BNC cable with ferrite core.

1. Set the rotary selector to 10MHz.
2. Plug the black test lead into your meter's COM terminal and the red test lead into you meter's V/ $\Omega$ /Hz-terminal.
2. Connect the test leads to the frequency source.

**Warning!** When you connect the test leads to an AC outlet, do not turn the function rotary selector to another range. It could damage the meter's internal components or injure you.

### 6.8. Checking diodes

This function lets you check diodes and other semiconductors for opens and shorts. It also lets you determine the forward voltage for diodes. You can use this function when you need to match diodes.

1. Set the rotary selector to the diode position.
2. Plug the black test lead into your meter's COM terminal and the red test lead into your meter's V/ $\Omega$ /Hz/- terminal.
3. Connect the test leads to the diode you want to check and note the meter reading.


**Notes:**

- \* If the display shows a value for example 0.2 for a germanium diode or 0.5 for a silicon diode, reverse the diode. If the meter indicates an overrange, the diode is good. The displayed number is the diode's actual forward voltage (up to 2.0V).
- \* If the display indicates an overrange condition, reverse the polarity of the connection. If the display shows a value, the device is good. The displayed value is the component's actual forward voltage (up to 2.0V). If the display still indicates an overrange condition, the device is open.
- \* If the display shows a value both before and after you reverse the polarity, the device is shorted.

When you connect the diode to the meter and the meter displays the device's forward voltage, the red test lead is connected to the diode's anode, and the black test lead is connected to the diode's cathode. This meter supplies enough forward voltage to light most LED's. However, if the LED's forward voltage is greater than 2.0V, the meter incorrectly indicates that the device is open.

### 6.9. Checking Continuity

Follow these steps to check a circuit's continuity.

1. Set the rotary selector to 
2. Plug the black test lead into your meter's COM terminal and the red test lead into your meter's V/ $\Omega$ /Hz/- terminal.
3. Remove power from the circuit.
4. Connect the test leads to the circuit.

#### **Note:**

The buzzer sounds if the measured resistance is below about 90  $\Omega$  approximately.

**Warning!** Never perform a continuity measurement on a circuit that has power connected.

### 6.10. Transistor hFE

1. Turn the range switch to "hFE" position.
2. Insert test leads into "mA" and "com" jack. Please pay attention to the polarity, as the "Com" for positive and "mA" for negative.
3. To determine the transistor's type, NPN or PNP, insert the emitting, base and collector electrode into the corresponding jacks in testing accessory.



## 7. Care and Maintenance

### 7.1. Installing the battery

Your meter requires a 9V battery for power. The battery symbol appears when the battery voltage drops to the certain limits. For proper operation, replace the battery as soon as possible. Continued use with a low battery will lead to abnormal readings.

#### **Warning!**

To avoid electric shock, disconnect both test leads from equipment before you remove or install the battery.

Follow these steps to install the battery:

1. Turn off the power and disconnect the two test leads.
2. Remove the screw to open the battery cover.
3. Remove the battery.
4. Place the battery into the battery compartment.
5. Replace the battery cover and secure it with the screw.

**WARNING!** Do not operate the meter until you replace the battery and close the battery compartment cover.

#### **Notes:**

Never leave a weak or dead battery in your meter. Even a leakproof battery can leak damaging chemicals. When you are not going to use your meter for a week or more, remove the battery.

## Statutory Notification about the Battery Regulations

The delivery of many devices includes batteries, which for example serve to operate the remote control. There also could be batteries or accumulators built into the device itself. In connection with the sale of these batteries or accumulators, we are obliged under the Battery Regulations to notify our customers of the following:

Please dispose of old batteries at a council collection point or return them to a local shop at no cost. The disposal in domestic refuse is strictly forbidden according to the Battery Regulations. You can return used batteries obtained from us at no charge at the address on the last side in this manual or by posting with sufficient stamps.



Batteries, which contain harmful substances, are marked with the symbol of a crossed-out waste bin, similar to the illustration shown left. Under the waste bin symbol is the chemical symbol for the harmful substance, e.g. „Cd“ for cadmium, „Pb“ stands for lead and „Hg“ for mercury.

You can obtain further information about the Battery Regulations from the Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (*Federal Ministry of Environment, Nature Conservation and Reactor Safety*).

### 7.2. General Maintenance

Your digital multimeter is an example of superior design and craftsmanship. The following suggestions will help you care for your meter so you can enjoy it for years.

- \* Keep your meter dry. If it does get wet, wipe it dry immediately. Liquids might contain minerals that can corrode the electronic circuits.
- \* Handle your meter gently and carefully. Dropping it can damage circuit boards and cases and cause the meter to work improperly.
- \* Keep your meter always from dust and dirt, which can cause premature wear of parts.
- \* Wipe your meter with a damp soft cloth occasionally to keep it looking new. Do not use harsh chemicals, cleaning solvents or strong detergents to clean the meter.
- \* Use only a brand-new battery of the same size and type. Always remove an old or weak battery. It can leak chemicals that destroy electronic circuits.

Modifying or tampering with your meter's internal components can cause malfunction and might invalidate its warranty.

### **7.3. Replacing the fuse**

**WARNING!** To avoid electric shock disconnect the test leads before removing the battery or the fuse. Replace only with the same type of battery or fuse. Service should be performed only by qualified personnel.

**Caution!** For continued protection against fire or other hazard, replace only with a fuse of the specified voltage and current ratings.

F1 200mA / 250V F : 5 x 20 mm

F2 20A / 250V F: 5 x 20 mm

Follow these steps to replace the fuse:

1. Turn off the meter and disconnect the test leads.
2. Remove the screw on the battery cover, remove the battery cover and remove the old battery, too.
3. Remove the defective fuse and replace it with a new one with the correct specified voltage and current ratings.
4. Replace the battery and replace the battery cover on the case and secure it with the screw.

*Batteries, which are used up dispose duly. Used up batteries are hazardous and must be given in the for this being supposed collective container.*

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*This manual considers the latest technical knowing. Technical changing which are in the interest of progress reserved.*

*We herewith confirm, that the units are calibrated by the factory according to the specifications as per the technical specifications.*

*We recommend to calibrate the unit again, after 1 year.*