

**DVM990BL**

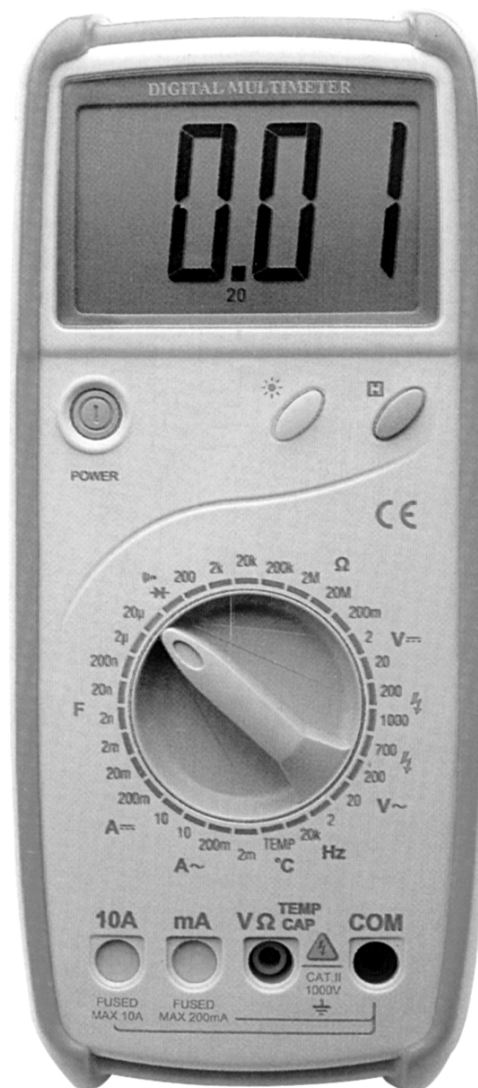
**DIGITAL MULTIMETER  
OPERATING MANUAL**

**MULTIMETRE DIGITAL  
MANUEL D'UTILISATION**

**DIGITALE MULTIMETER  
BEDIENINGSHANDLEIDING**

**DIGITALES MULTIMETER  
BEDIENUNGSANLEITUNG**

**MULTÍMETRO DÍGITAL  
MANUAL DEL USUARIO**



**velleman®**



## 1. SAFETY INFORMATION

### WARNING

To ensure safe operation, and in order to exploit to the full functionality of the meter, please follow the directions in this section carefully.

This multimeter has been designed according to IEC-1010 for electronic measuring instruments, with an overvoltage category CAT II and pollution category 2.

Follow all safety and operating instructions to ensure that the meter is used safely and is kept in good operating condition.

### 1.1. PRELIMINARY

- 1.1.1. When using the meter, the user must observe all normal safety rules concerning:
  - protection against the dangers of electric current
  - protection of the meter against misuse
- 1.1.2. When the meter is delivered, check that it has not been damaged in transit.
- 1.1.3. If in a poor condition due to harsh storage or shipping conditions, immediately inspect the meter and confirm its condition.
- 1.1.4. Test leads must be in good condition. Before using check that the test lead insulation is not damaged and/or the lead wire is not exposed.
- 1.1.5. Full compliance with safety standards can only be guaranteed if used with the test leads supplied. If necessary, they must be replaced with leads of the same type with the same electric ratings.

### 1.2. DURING USE

- 1.2.1. Never exceed the protection limit values indicated in the specifications for each measurement range.
- 1.2.2. When the meter is connected to a circuit under measurement, do not touch unused terminals.
- 1.2.3. If the value to be measured is unknown beforehand, set the range selector to the highest position.
- 1.2.4. Do not measure voltage if the voltage on the terminals exceeds 1000V above earth.
- 1.2.5. Always be careful when working with voltages above 60V DC or 30V AC rms, keep your fingers behind the probe barriers while measuring.

- 1.2.6. Before rotating the range selector to change functions, disconnect the test leads from the circuit under test.
- 1.2.7. Never connect the meter leads across a voltage source while the function switch is in the current, resistance, diode or continuity mode. Doing so can damage the meter. When doing measurements on TV or power switching circuits always remember that there may be high amplitude voltage pulses at test points which can damage the meter.
- 1.2.9. Never perform resistance measurements on live circuits.
- 1.2.10. Never perform capacitance measurements unless the capacitor to be measured has been fully discharged.
- 1.2.11. If any faults or abnormalities are observed, the meter should not be used and it needs to be inspected.
- 1.2.12. Never use the meter unless the back of the casing is in place and fastened securely.
- 1.2.13. Do not store or use the meter in areas exposed to direct sunlight, high temperature, humidity or condensation.

### 1.3. SYMBOLS



Important safety information, refer to the operating manual.



Dangerous voltage may be present.



Double insulation (Protection Class II)



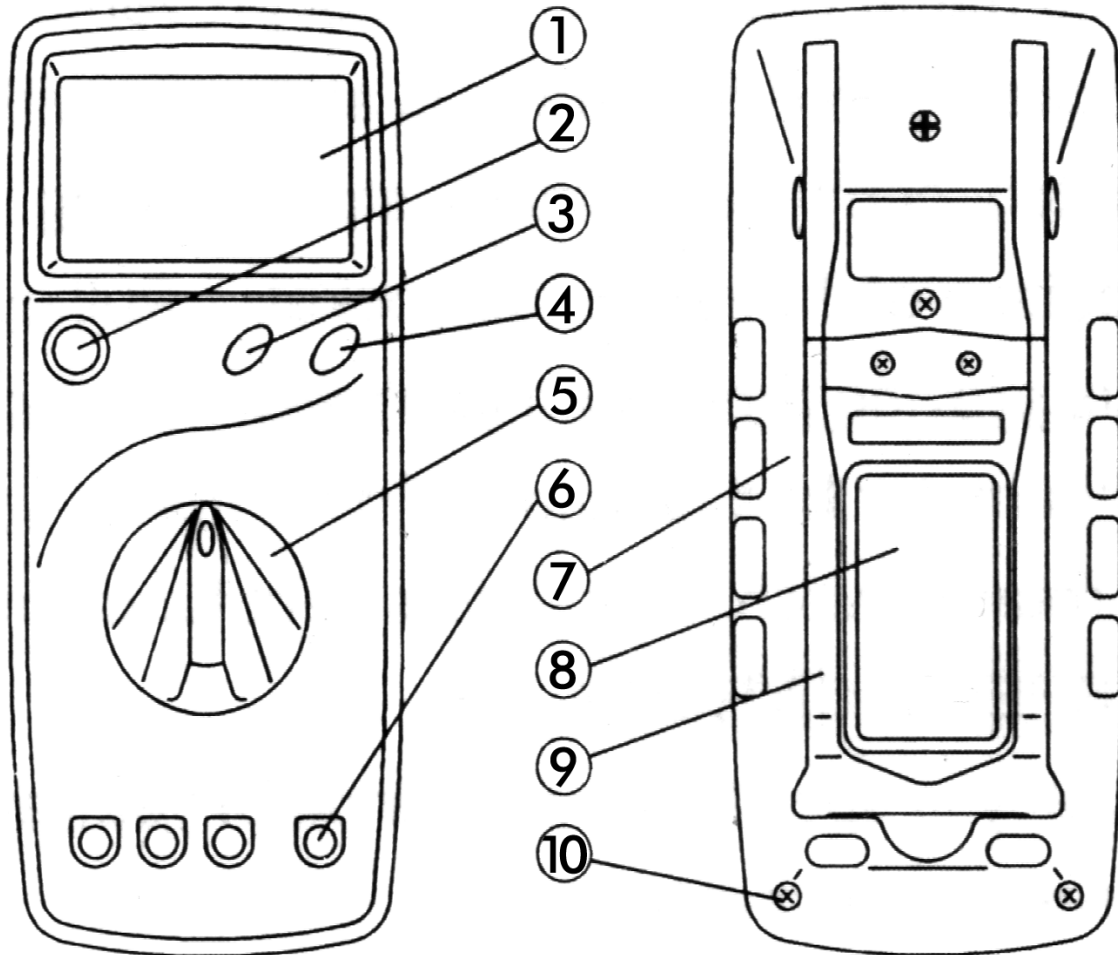
Earth

### 1.4. MAINTENANCE

- 1.4.1. Do not attempt to adjust or repair the meter by removing the back of the casing while voltage is applied. Only a technician who fully understands the danger involved should carry out such operations.
- 1.4.2. Before opening the meter battery cover, always disconnect the test leads from all sources of electric current.
- 1.4.3. For continued protection, only replace the fuse with the specified voltage and current ratings:
  - F1: F 200mA/250V (quick acting)
  - F2: F 10A/250V (quick acting)
- 1.4.4. Do not use abrasives or solvents on the meter, use a damp cloth and mild detergent only.
- 1.4.5. Always set the power switch to the OFF position when the meter is not in use.
- 1.4.6. If the meter is to be stored for a long period of time, the batteries should be removed to prevent damage to the unit.

## 2. DESCRIPTION

### 2.1. NAMES OF COMPONENTS



- (1) LCD display
- (2) Power switch (POWER)
- (3) Black light switch (-●-)
- (4) Data hold switch (H)
- (5) Rotary switch
- (6) Input socket
- (7) Case
- (8) Battery door
- (9) Brace
- (10) Screw


## 2.2. FUNCTION AND RANGE SELECTOR

- This meter is a portable professional measuring instrument with a large LCD and back light for easy reading.
- This meter has built-in protection to prevent the test leads being connected incorrectly. The input socket for the red test lead senses the correct functions and ranges. When the rotary switch cannot be turned, do not force it as it means that the selected range isn't suitable for what the red lead is connected to. Pull out the red lead and then select the required range. This provides protection for the meter in order to avoid damage through incorrect operation.
- This meter has a data hold function.
- A rotary switch is used to select the functions and the ranges.

## 3. SPECIFICATIONS

Accuracy is specified for a period of one year after calibration and at 18°C to 28°C (64°F to 82°F) with relative humidity to 75%.

### 3.1. GENERAL SPECIFICATIONS

- 30 ranges of functions.
- Over range protection for all ranges.
- Operating altitude: 2000m max.
- Max. voltage between terminals and earth: 1000V DC or AC (peak value)
- Fuse protection: F1 200mA/250V F2 10A/250V
- Display: 28mm LCD, word is 28mm high
- Max display value: 1999 (3 1/2)
- Polarity indication: "-" indicates negative polarity
- Over range indication: displays "1" or "-1"
- Sampling time: approx. 0.4 seconds
- Power supply: 9V battery, 6F22 or NEDA 1604
- Low battery indication: " " displayed
- Temperature factor:  $< 0.1 \times \text{accuracy} / ^\circ\text{C}$
- Operating temperature: 0°C to 40°C (32°F to 104°F)
- Storage temperature: -10°C to 50°C (10°F to 122°F)
- Dimensions: 191 x 82 x 36mm (without holster)
- Weight: approx. 280g (including battery)

## 3.2. ELECTRICAL SPECIFICATIONS

Ambient temperature:  $23 \pm 5^{\circ}\text{C}$

Relative humidity:  $< 70\%$

### 3.2.1. DC Voltage

Range	Resolution	Accuracy (% reading + digits)
200mV	0.1mV	$\pm (0.5\% \text{ of rdg} + 1 \text{ digit})$
2V	1mV	$\pm (0.5\% \text{ of rdg} + 3 \text{ digits})$
20V	10mV	$\pm (0.5\% \text{ of rdg} + 3 \text{ digits})$
200V	100mV	$\pm (0.5\% \text{ of rdg} + 3 \text{ digits})$
1000V	1V	$\pm (0.8\% \text{ of rdg} + 3 \text{ digits})$

Input impedance: 10 Mohm

Overload protection: 200mV range: 250V DC or rms AC

2V-1000V ranges: 1000V DC or 700V rms AC

#### NOTE:

At low voltage range, the meter will show an unsteady reading when the test leads are not connected to the circuit. This is normal because the meter is very sensitive. When the test leads touch the circuit, you get the true reading.

### 3.2.21. AC Voltage

Range	Resolution	Accuracy (% reading + digits)
200mV	0.1mV	$\pm (1.2\% \text{ of rdg} + 5 \text{ digits})$
2V	1mV	$\pm (1.0\% \text{ of rdg} + 5 \text{ digits})$
20V	10mV	$\pm (1.0\% \text{ of rdg} + 5 \text{ digits})$
200V	100mV	$\pm (1.0\% \text{ of rdg} + 5 \text{ digits})$
1000V	1V	$\pm (1.2\% \text{ of rdg} + 5 \text{ digits})$

Input impedance: 10 Mohm

Overload protection: 200mV range: 250V DC or rms AC

2V-1000V ranges: 1000V DC or 700V rms AC

Frequency range: 40 to 400Hz

Test on 60Hz/50Hz

Response: average, calibrated in rms of sine wave

#### NOTE:

At low voltage range, the meter will show an unsteady reading when the test leads are not connected to the circuit. This is normal because the meter is very sensitive. When the test leads touch the circuit, you get the true reading.

### 3.2.3. DC Current

Range	Resolution	Accuracy (% reading + digits)
2mA	1 $\mu$ A	$\pm$ (1.0% of rdg + 3 digits)
20mA	10 $\mu$ A	$\pm$ (1.0% of rdg + 3 digits)
200mA	100 $\mu$ A	$\pm$ (1.5% of rdg + 5 digits)
10A	10mA	$\pm$ (2.0% of rdg + 10 digits)

Overload protection: 2mA to 200mA ranges: F1: F 200mA/250V fuse

10A range: F2: F 10A / 250V fuse

Max. input current: mA socket: 200mA

10A socket: 10A (less than 15 seconds)

Voltage drop: 200mV

### 3.2.4. AC Current

Range	Resolution	Accuracy (% reading + digits)
2mA	1 $\mu$ A	$\pm$ (1.2% of rdg + 5 digits)
20mA	100 $\mu$ A	$\pm$ (2.0% of rdg + 5 digits)
10A	10mA	$\pm$ (3.0% of rdg + 10 digits)

Overload protection: 2mA to 200mA ranges: F1: F 200mA/250V fuse

10A range: F2: F 10A / 250V fuse

Max. input current: mA socket: 200mA

10A socket: 10A (less than 15 seconds)

Voltage drop: 200mV (full range)

Frequency range: 40 to 400Hz

Test on 60Hz/50Hz

Response: average, calibrated in rms of sine wave

### 3.2.5. Resistance

Range	Resolution	Accuracy (% reading + digits)
200ohm	0.1ohm	$\pm$ (1.0% of rdg + 10 digits)
2kohm	1ohm	$\pm$ (1.0% of rdg + 1 digit)
20kohm	10ohm	$\pm$ (1.0% of rdg + 1 digit)
200kohm	100ohm	$\pm$ (1.0% of rdg + 1 digit)
2Mohm	1kohm	$\pm$ (1.0% of rdg + 1 digit)
20Mohm	10kohm	$\pm$ (1.0% of rdg + 5 digits)
200Mohm	100kohm	$\pm$ (5.0% of (rdg - 10 digits) + 20 digits)

Open Circuit Voltage: 200 Mohm range: 3V

Other ranges: less than 700mV

Overload protection: 250V DC or rms AC

**NOTE:**


With the 200 Mohm range, if the input is short circuited, the display will read 1Mohm. This 1Mohm should be subtracted from the measured results.

**3.2.6. Capacitance**

Range	Resolution	Accuracy (% reading + digits)
2nF	1pF	$\pm (4.0\% \text{ of rdg} + 3 \text{ digits})$
20nF	10pF	$\pm (4.0\% \text{ of rdg} + 3 \text{ digits})$
200nF	0.1nF	$\pm (4.0\% \text{ of rdg} + 3 \text{ digits})$
2 $\mu$ F	1nF	$\pm (4.0\% \text{ of rdg} + 3 \text{ digits})$
20 $\mu$ F	10nF	$\pm (4.0\% \text{ of rdg} + 3 \text{ digits})$

Overload Protection: 250V DC or rms AC

**3.2.7. Diode**


Range	Resolution	Function
	1mV	Display: reads approximate forward voltage of diode

Overload Protection: 250V DC or rms AC

Forward DC current: approximate 1mA

Reverse DC voltage: approximate 2.8V

**3.2.6. Continuity**

Range	Function
	Built-in buzzer will sound, if resistance is less than 70 ohms

Overload Protection: 250V DC or rms AC

Open circuit voltage: approximate 2.8V

**3.2.9. Frequency**

Range	Resolution	Accuracy (% reading + digits)
20kHz	10Hz	$\pm (1.5\% \text{ of rdg} + 10 \text{ digits})$

Overload Protection: 250V DC or rms AC

Sensitivity: 200mV rms and input no more 10V rms



### 3.2.10. Temperature

Range	Resolution	Accuracy (% reading + digits)	
-20°C to 1000°C	1°C	-20°C to 0°C	± (5.0% of rdg + 5 digits)
		0°C to 400°C	± (1.0% of rdg + 3 digits)
		400°C to 1000°C	± (2.0% of rdg + 3 digits)

Overload Protection: 250V DC or rms AC

## 4. OPERATING INSTRUCTIONS




### 4.1. DATA HOLD

If you want data hold when measuring, press "H" and it will hold the reading. Press the button again to remove data hold.



### 4.2. BACK LIGHT

In poor lighting conditions, press "" to put the back light on to make reading easier.

#### NOTE:

1. An LED is the main back light source. Its operating current is large, although the meter has a timer (the time is 5 seconds and it will switch off automatically after 5 seconds). Frequent use of the back light will shorten the battery life. It is better not to use the back light when not necessary.
2. When the battery voltage is less than 7V, it will display "". However, when using the back light at the same time, "" may appear even if the battery voltage is more than 7V, because the operating current is higher and the voltage will fall. You do not need to replace the battery if this happens. In normal use (back light off), "" will not appear if the battery is good.

### 4.3. PREPARATION FOR MEASUREMENT

- 4.3.1. Switch on with the "POWER" switch. If the battery voltage is less than 7V, "" will appear and the battery should be replaced.
- 4.3.2. The " " next to the input socket means that the input voltage or current should be less than that specified on the meter sticker in order to protect the interior circuit from damage.
- 4.3.3. Select the appropriate range for the item to be measured with the rotary switch.

## 4.4. MEASURING VOLTAGE

- 4.4.1. Connect the black test lead to the COM socket and the red test lead to the V/ $\Omega$  socket.
- 4.4.2. Set the rotary switch to the desired V  $\overline{\text{---}}$  or V  $\sim$  range.
- 4.4.3. Connect the test leads across the source or load under test.
- 4.4.4. You can see the reading on the LCD. The polarity of the red lead will be indicated along with the voltage value when making DC voltage measurements.

### NOTE:

1. When only the figure "1" or "-1" is displayed, it indicates an over range situation and a higher range has to be selected.
2. When the value to be measured is unknown beforehand, set the range selector to the highest position.
3. " $\triangle$ " means you cannot have a voltage input that is higher than 1000V DC or 7000V rms AC. It is possible to display a higher voltage, but it may destroy the interior circuit.
4. Be careful to avoid electric shocks when measuring high voltages.

## 4.5. MEASURING CURRENT

- 4.5.1. Connect the black test lead to the COM socket and the red test lead to the mA socket for a maximum of 200mA current. For a maximum of 10A, move the red lead to the 10A socket.
- 4.5.2. Set the rotary switch to the desired A  $\overline{\text{---}}$  or A  $\sim$  range.
- 4.5.3. Connect the test leads in series with the load under test.
- 4.5.4. You can see the reading on the LCD. The polarity of the red lead will be indicated along with the current value when making DC current measurements.

### NOTE:

1. When only the figure "1" or "-1" is displayed, it indicates an over range situation and a higher range has to be selected.
2. When the value to be measured is unknown beforehand, set the range selector to the highest position.
3. " $\triangle$ " means you cannot input a voltage that is more than 200mA or 10A depending on the socket used. Excess current will blow the fuse.

## 4.6. MEASURING RESISTANCE

- 4.6.1. Connect the black test lead to the COM socket and the red test lead to the V/ $\Omega$  socket.
- 4.6.2. Set the rotary switch to the desired  $\Omega$  range.
- 4.6.3. Connect the test leads across the resistance under measurement.
- 4.6.4. You can see the reading on the LCD.

### NOTE:

1. When only the figure "1" is displayed, it indicates an over range situation and the higher range has to be selected.
2. When measuring resistance above 1 M $\Omega$ , the meter may take a few seconds to get a stable reading.
3. When the input is not connected, i.e. an open circuit, the figure "1" will be displayed for the over range condition.
4. When measuring in-circuit resistance, be sure that the circuit under test has all power removed and that all capacitors have been fully discharged.
5. At 200 M $\Omega$  range, the display reading is around 10 (1 M $\Omega$ ) when the test leads are shorted. This has to be subtracted from the measured results. For example, when measuring 100 M $\Omega$  resistance the display reading will be 101.0 and the correct result should be  $101.0 - 1.0 = 100.0$  M $\Omega$

## 4.7. MEASURING CAPACITANCE

- 4.7.1. Connect the black test lead to the COM socket and the red test lead to the V/ $\Omega$  socket.
- 4.7.2. Set the rotary switch to the desired F range.
- 4.7.3. Before inserting capacitors into the capacitance test socket, be sure that the capacitor has been fully discharged.
- 4.7.4. You can see the reading on the LCD.
- 4.7.5. When frequent capacitor testing is required, put the capacitor test unit plug (spare parts) into COM and V/ $\Omega$  and put the capacitor leads into the two long sockets of the capacitor test unit, and capacitor testing is ready.



### WARNING

**To avoid electric shock, remove the test leads from the circuit under test before measuring the capacitance of a capacitor.**

**NOTE:**

1. At the low capacitor range, the reading will include the small residual value of the test leads. It will not influence the accuracy of the measurement.
2. It takes time for the reading to become steady when measuring a high capacitance.

**4.8. MEASURING TEMPERATURE**

- 4.8.1. Set the rotary switch to the °C position.
- 4.8.2. The 'LCD' display will show the current ambient temperature.
- 4.8.3. To measure temperature with a thermocouple, the temperature probe for this meter can be used. Insert the "K" type thermocouple into the temperature measuring socket on the front panel and bring the thermocouple probe into contact with the object to be measured.
- 4.8.4. You can see the reading on the LCD.


**4.9. MEASURING FREQUENCY**

- 4.9.1. Connect the black test lead to the COM socket and the red test lead to the V/ $\Omega$  socket.
- 4.9.2. Set the rotary switch to the desired 20kHz range position.
- 4.9.3. Connect the test leads across the source or load under test.
- 4.9.4. You can see the reading on the LCD.

**NOTE:**

1. Readings can be done at input voltages above 10Vrms, but the accuracy is not guaranteed.
2. In noisy environments, it is preferable to use shielded cable to measure small signals.


**4.10. DIODE TEST**

- 4.10.1. Connect the black test lead to the COM socket and the red test lead to the V/ $\Omega$  socket. (The polarity of the red lead is "+").
- 4.10.2. Set the rotary switch to the  position.
- 4.10.3. Connect the red lead to the anode, and the black lead to the cathode of the diode under test.
- 4.10.4. You can see the reading on the LCD.

## NOTE:

1. The meter will show the approximate forward voltage drop of the diode.
2. If the lead connection is reversed, only the figure "1" will be displayed.

## 4.11. CONTINUITY TEST

- 4.11.1. Connect the black test lead to the COM socket and the red test lead to the V/ $\Omega$  socket.
- 4.11.2. Set the rotary switch to the  position.
- 4.11.3. Connect the test leads across two points of the circuit under test.
- 4.11.4. If there is continuity (i.e. resistance less than about 70 $\Omega$ ), the built-in buzzer will sound.

## NOTE:

If the input is open circuit, the figure "1" will be displayed.


## 5. MAINTENANCE



### WARNING

**Before attempting to remove the battery door or open the case, be sure that the test leads have been disconnected from the circuit under test in order to avoid electric shock hazard.**

## 5.1. BATTERY REPLACEMENT

- 5.1.1. If the "" indicator appears on the LCD display, it indicates that the battery should be replaced.
- 5.1.2. Loosen the screw fixing the battery door and remove it.
- 5.1.3. Replace the dead battery with a new one.
- 5.1.4. Put back the battery door.

## 5.2. FUSE REPLACEMENT



### **WARNING**

**To avoid electric shock, remove the test leads from the circuit under test before replacing the fuse. For continued protection, only replace fuses with specified ratings:**

**F1: F 200mA/250V F2: F 10A/250V.**

- 5.2.1. Fuses rarely need replacing and almost always blow as a result of operator error.
- 5.2.2. Loosen the screw fixing the case and remove it.
- 5.2.3. Replace the blown fuse with the specified ratings.
- 5.2.4. Put back the case.

## 5.3. TEST LEAD REPLACEMENT



### **WARNING**

**Full compliance with safety standards can only be guaranteed if used with the test leads supplied. If necessary, they must be replaced with leads of the same type or ones with the same electrical ratings**

**Electrical ratings of the test leads: 1000V 10A**

The test leads must be replaced if bare wire is exposed.

## 5.4. HOW TO USE THE BRACE

- 5.4.1. When the meter is not in use: attach the case to the panel face for safekeeping. @@
- 5.4.2. When measuring: attach it either to the back of the case or use it as a stand as illustrated in the cover. It has 3 different positions for easy reading.
- 5.4.3. Attach the stand to the top part of the meter and use as a hook for hanging.

## **6. ACCESSORIES**

### **6.1. SUPPLIED WITH THE MULTIMETER**

- test leads
- 9V battery type 6F22 or NEDA 1604
- fuse: F1 200mA/250V (Ø5 x 20mm)
- fuse: F2 10A/250V (Ø5 x 20mm)
- K-type thermocouple
- operating manual

### **6.2 OPTIONAL ACCESSORIES**

- capacitance test socket
- holster