Basic Multimeter functions

MODEL 2703A
MULTIMETER 3-1/2 DIGIT TOOL KIT

MANUAL
INSTRUCTION

WARRANTY INFORMATION
LIMITED ONE YEAR WARRANTY

MAXTEC INTERNATIONAL CORPORATION warrants to the original purchaser that its B + K Precision product, and the component parts thereof, will be free from defects in workmanship and materials for a period of one years from the date of purchase.

MAXTEC will, without charge, repair or replace, at its option, defective product or component parts upon delivery to an authorized B + K Precision service contractor or the factory service department, accompanied by proof of the purchase date in the form of a sales receipt.

Exclusions: This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repairs. It is void if the serial number is altered, defaced or removed.

MAXTEC shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some states do not allow limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific rights and you may also have other rights which vary from state to state.

For your convenience we suggest you contact your B + K Precision distributor, who may be authorized to make repairs or can refer you to the nearest service contractor. If warranty service cannot be obtained locally, please send the unit to B + K Precision Service Department, 6470 West Cortland Street, Chicago, Illinois, 60635, properly packaged to avoid damage in shipment.

B + K Precision Test Instruments warrants products sold only in the U.S.A. and its overseas territories. In other countries, each distributor warrants the B + K Precision products which it sells.

FEATURES
- Basic accuracy: DCV ± 0.5%.
- Resolution of 100 µV, 0.1 Ω, 0.1 µA.
- Single function and range control.
- Five dc voltage ranges: 200 mV to 1000 V.
- Two ac voltage ranges: 200 V to 750 V.
- Four dc current ranges: 200 µA to 20 mA and 10 A.
- Six resistance ranges: 200Ω to 20 MΩ.
- Diode test function: measures forward voltage drop.
- 3-1/2 digit LCD display.
- Easy to read high contrast display with large 0.7" digits.
- Auto polarity, auto zero.
- Overrange indication on all ranges.
- Overload protection.
- Tilt stand.
- Non-skid feet.
- Rugged case withstands 4-foot drop.
SPECIFICATIONS

Accuracy specifications apply from +18° to +28°C at relative humidity up to 75% unless otherwise noted.

DC VOLTS Manual ranging

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Overvoltage Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 mV</td>
<td>100 μV</td>
<td>± (0.5% rdg + 1 dgt)</td>
<td>500 V (dc + ac peak) 350 V (rms, sine)</td>
</tr>
<tr>
<td>2 V</td>
<td>1 mV</td>
<td>± (0.5% rdg + 1 dgt)</td>
<td>1200 V (dc + ac peak) 800 V (rms, sine)</td>
</tr>
<tr>
<td>20 V</td>
<td>10 mV</td>
<td>± (0.5% rdg + 1 dgt)</td>
<td></td>
</tr>
<tr>
<td>200 V</td>
<td>100 mV</td>
<td>± (0.5% rdg + 1 dgt)</td>
<td></td>
</tr>
<tr>
<td>1000 V</td>
<td>1 V</td>
<td>± (0.5% rdg + 1 dgt)</td>
<td></td>
</tr>
</tbody>
</table>

Input impedance ......................................................... 10 MΩ

AC VOLTS Manual ranging, average responding, rms reading

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy 50-60 Hz</th>
<th>Overvoltage Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 V</td>
<td>100 mV</td>
<td>± (1.2% rdg + 4 dgt)</td>
<td>500 V (dc + ac peak) 750 V (rms, sine)</td>
</tr>
<tr>
<td>750 V</td>
<td>1 V</td>
<td>± (1.2% rdg + 4 dgt)</td>
<td>750 V (rms, sine)</td>
</tr>
</tbody>
</table>

Input impedance ......................................................... 4.5 MΩ

DC CURRENT Manual ranging

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Burden Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 μA</td>
<td>0.1 μA</td>
<td>± (1.2% rdg + 1 dgt)</td>
<td>325 mV max</td>
</tr>
<tr>
<td>20 mA</td>
<td>10 μA</td>
<td>± (1.2% rdg + 1 dgt)</td>
<td>325 mV max</td>
</tr>
<tr>
<td>200 mA</td>
<td>100 μA</td>
<td>± (2.0% rdg + 3 dgt)</td>
<td>750 mV max</td>
</tr>
<tr>
<td>10 A</td>
<td>10 mA</td>
<td>± (2.0% rdg + 3 dgt)</td>
<td>750 mV max</td>
</tr>
</tbody>
</table>

Overload protection 0.8 A, 250 V fuse, 10 A Not fused.

RESISTANCE Manual ranging

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Max. Open Circuit Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 Ω</td>
<td>0.1 Ω</td>
<td>± (1.0% rdg + 3 dgt)</td>
<td>3.2 V</td>
</tr>
<tr>
<td>2 kΩ</td>
<td>1 Ω</td>
<td>± (0.8% rdg + 1 dgt)</td>
<td>0.3 V</td>
</tr>
<tr>
<td>20 kΩ</td>
<td>10 Ω</td>
<td>± (0.8% rdg + 1 dgt)</td>
<td>0.3 V</td>
</tr>
<tr>
<td>200 kΩ</td>
<td>100 Ω</td>
<td>± (0.8% rdg + 1 dgt)</td>
<td>0.3 V</td>
</tr>
<tr>
<td>2 MΩ</td>
<td>1 kΩ</td>
<td>± (3.0% rdg + 1 dgt)</td>
<td>0.3 V</td>
</tr>
</tbody>
</table>

Overload protection .................................................. 500V (dc + ac peak)

DIODE CHECK

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Max. Test Current</th>
<th>Max. Open Circuit Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 mV</td>
<td>1.6 mA</td>
<td>3.2 V</td>
</tr>
</tbody>
</table>

Measures forward voltage drop of diode or semiconductor junction in mV.

GENERAL SPECIFICATIONS

Display: 3-1/2 digit liquid crystal display (LCD) with a maximum reading of 9999.

Polarity: Automatic (+) negative polarity indication.

Overrange Indication: "000" or "−".

Low Battery Indication: "battery symbol" displayed.

Sampling Rate: 3 measurements per second, nominal.

Temperature: Full operation: 0 to 50°C, <70% R.H.

Storage: -20 to +60°C (0 to 80% R.H. battery removed).

Power: Single standard 9V battery, NEDA 1604 or equivalent.

Battery Life: 275 hours typical (alkaline).

Dimensions: (H x W x D) 5.9" x 3.1" x 1.3" (150 x 80 x 35mm)

Weight: 9 oz. (250 g) including battery.

Supplied Accessories: 1-Pair Test Leads

DIODE CHECK

BATTERY

1. Instruction Manual

OPTIONAL ACCESSORIES

Clamp-on AC current probe ............... Model CP-1
High voltage probe (40 kVDC) ............ Model PR-28
High voltage probe (6 kVDC) ............. Model HV-6
High current test leads ................... Model FP-10
Replacement test leads ................... Model FP-30
Semiconductor Temperature Adapter ......... Model TP-28
Thermocouple Temperature Adapter ........ Model TP-30

SYMBOLS

Do not exceed maximum ratings listed with this symbol.

High voltage terminal: up to 1000 volts may be present if connected to high voltage.

COM Common input terminal.

Diode test.

500V MAX Connect to earth ground or point not more than 500 volts from earth ground.

1000V DC 750V AC MAX Maximum input rating of voltage terminal with respect to COM input terminal. (For voltage measurement functions only.)

250 mA MAX Maximum input rating of mA terminal with respect to COM input terminal.

10A MAX Maximum input rating of 10A terminal with respect to COM input terminal.

ANNUNCIATORS

Negative Polarity.

Low Battery indicator.

2, 20, 200 Input Range indicator.
CONTROLS AND INDICATORS

1. **Display.** 3-1/2 digit display (1999 maximum) with automatic decimal point and (\(-\)) sign. Indicates measured value. Overrange indicated by displaying most significant digit "1" and all other digits blank. Also indicates low battery symbol.

2. **Function / Range Switch.** Selects function and range. DCV (200 mV, 2 V, 20 V, 200 V, or 1000 V), ACV (200 V or 750 V), DCA (200 mA, 200 mA, 2000 mA, or 10 A), (diode test), or \( \Omega \) (200 \( \Omega \), 2 k\( \Omega \), 20 k\( \Omega \), 200 k\( \Omega \), 2 M\( \Omega \) or 20 M\( \Omega \)).

3. **10 A Jack.** Input for 10 A dc current range. For measurements greater than 3 A, high current test leads are recommended.

4. **mA Jack.** Input for ac or dc current up to 200 mA.

5. **COM Jack.** Input for common or reference test lead for all measurements. Connect to earth ground or reference point not more than 500 V MAX (dc or ac peak) from earth ground.

6. **V/J Jack.** Input for dc and ac voltage, resistance, and diode test.

7. **Tilt Stand** (not shown, on rear).

OPERATING INSTRUCTIONS

**RANGE SELECTION**

1. If quantity to be measured is unknown start with the highest range.

2. When an overrange is indicated (most significant digit "1" on and all other digits blank) switch to the next highest range.

   **CAUTION**

   Do not switch between ranges while connected to high voltage.

**VOLTAGE MEASUREMENTS**

1. To measure dc voltage, set function switch to the desired DCV range.

2. To measure ac voltage, set function switch to the desired ACV range.

3. Connect red test lead to V/J jack and black test lead to COM jack.

4. Connect test leads to points of measurement.

5. For dc, a (\(-\)) sign is displayed for negative polarity; (\(+\)) polarity is implied.

**RESISTANCE MEASUREMENTS**

1. Set function switch to the desired resistance range.

2. Remove power from equipment under test.

3. Connect red test lead to V/J jack and black test lead to COM jack. Red lead is (+) polarity.

4. Connect test leads to points of measurement.

**DIODE TEST**

1. Set function switch to \( \rightarrow \) position.

2. Connect red test lead to V/J jack and black test lead to COM jack. Red lead is (+) polarity.

3. To check forward voltage \( V_f \), connect red test lead to anode and black test lead to cathode of diode. Diodes and semiconductor junctions with normal \( V_f \) of less than approximately 2.0 V can be checked.

4. Display indicates forward voltage. Normal diode voltages are approximately 0.4 V for germanium diodes, 0.7 V for silicon diodes, and 1.8 V for light emitting diodes (LED). An overrange indicates an open diode. A shorted diode reads near 0 V.

5. Reverse test lead connections to diode. Reading should be same as with open test leads (an overrange indication). Lower reading indicates leaky diode.
SAFETY

WARNING

An electrical shock causing 12 milliamps of current to pass through the heart will stop most human heartbeats. Voltage as low as 35 volts dc or ac rms should be considered dangerous and hazardous since it can produce a fatal current under certain conditions. Higher voltages are even more dangerous. Observe the following safety precautions.

1. Do not exceed the following input ratings. Personal injury or damage to the instrument may result.

   DC VOLTS  
   1000 V (dc + ac peak)  
   500 V (dc + ac peak) on 200 mV range

   AC VOLTS  
   750 V rms
   500 V (dc + ac peak) on 200 mV range
   500 VDC or AC rms

   OHMS  
   250Ω (fuse protected)
   10 A (fuse protected)
   10 A (no fuse protection)

   COM  
   Do not float more than 500 volts from earth ground.

2. This meter is not recommended for high voltage industrial use; for example, not for measurements of 440 VAC or 600 VAC industrial power mains. The unit is intended for use with low energy circuits to 750 VAC or 1000 VDC or high energy circuits to 250 VAC or DC. Accidental misuse by connection across high voltage, high energy power source when the meter is set up for mA measurement may be very hazardous.

3. Remove test leads before replacing batteries or fuses, and before performing any servicing on the multimeter.

4. Turn off equipment while making test connections in high-voltage circuits. Disconnect high-voltage capacitors after removing power.

5. For voltage or current measurements in high-voltage equipment, do not touch equipment, meter, or test leads while power is applied.

6. If possible, familiarize yourself with the equipment being tested and the location of its high voltage points. However, remember that high voltage may appear at unexpected points in defective equipment.

7. Use an insulated floor mat or floor mat to stand on, and an insulated work bench surface; make certain such surfaces are not damp or wet.

8. Keep "one hand in the pocket" while handling an instrument probe. Be particularly careful to avoid contacting a nearby metal object that could provide a good ground return path.

9. When using a probe, touch only the insulated portion. Never touch the exposed tip portion.

10. Some equipment with a two-wire ac power cord, including some with polarized power plugs, is the "hot chassis" type. This includes most recent television receivers and audio equipment. A plastic or wooden cabinet insulates the chassis to protect the customer. When the cabinet is removed for servicing, a serious shock hazard exists if the chassis is touched. Not only does this present a dangerous shock hazard, but damage to test instruments or the equipment under test may result. To make measurements on "hot chassis" equipment, always connect an isolation transformer between the ac outlet and the equipment under test. The B + K Precision Model TR-110 or 1604 Isolation Transformer, or Model 1653 or 1655 AC Power Supply is suitable for most applications. To be on the safe side, treat all two wire ac powered equipment as "hot chassis" unless you are sure it has an isolated chassis or an earth ground chassis.

11. When testing ac powered equipment, remember that ac line voltage is usually present on some power input circuits such as on-off switch, fuses, power transformer, etc. Any time the equipment is connected to an ac outlet, even if the equipment is turned off.

12. Never work alone. Someone should be nearby to render aid if necessary. Training in CPR (cardiopulmonary resuscitation) first aid is highly recommended.

CURRENT MEASUREMENTS

WARNING

For current measurements, the meter must be connected in series with the load. If incorrectly connected in parallel with the load, the meter presents a very low impedance (almost a short), which may blow the fuse or damage the equipment under test. The 10A range has no fuse protection and may severely damage the meter or equipment under test or cause personal injury.

1. To measure dc current, set the function switch to the desired DCA range.

2. This meter does not measure ac current.

3. For current measurements under 200 mA, connect the red test lead to the mA jack, and the black test lead to the COM jack.

4. For current measurements above 200 mA, connect the red test lead to the 10A jack, and the black test lead to the COM jack (set the Function/Range switch to the 20mA/10A position).

5. Remove power from the circuit under test and open the normal circuit path where the measurement is to be taken. Connect the meter in series with the circuit.

6. Apply power and read the voltage from the display.

REPAIR

Remove test leads before changing batteries or fuse or performing any servicing.

BATTERY REPLACEMENT

The "BAT" (Battery Symbol) indication first appears when the battery is about 90% depleted. The meter may be operated a few more hours but the battery should be replaced soon thereafter. Fully loosen the two screws that secure the rear case and remove the rear case. The battery is located in the bottom portion of the case. Replace with a fresh 9 volt " transistor battery. Use alkaline batteries for longer life. To prolong battery life, set POWER switch to OFF when not making measurements.

FUSE REPLACEMENT

If no current measurements are possible, check for blown overload protection fuse F1. This fuse is located adjacent to the battery on the circuit board. Remove the rear case for access. Replace only with original type 5 x 20 mm, 0.8 A, 250V fuse.

A fusible resistor is also connected in series with the fuse for added protection against accidental connections to high voltage, high energy sources (power mains). The fusible resistor is located inside the meter near the input terminals. Under normal operation, the fusible resistor should not require replacement for the life of the instrument. Always check fuse F1 first.

TEST LEADS

Periodically examine the test leads to ensure that the conductors are not intermittent or broken. Also make sure that good contact pressure exists at the test lead receptacles and fuseholders, and keep these areas free from dirt, oil and corrosion.