**FEATURES**

- Complete Handheld Test Bench
- 11 Functions, 41 Ranges.
- Auto power off extends battery life.
- Five dc voltage ranges: 400 mV to 1000 V.
- Five ac voltage ranges: 400 mV to 750 V.
- Six dc current ranges: 400 μA to 20 A.
- Six ac current ranges: 400 μA to 20 A.
- Six resistance ranges: 40 Ω to 40 MΩ.
- Five capacitance ranges: 4 nF to 40 μF.
- Four autoranging frequency ranges: 4 kHz to 4 MHz.
- hFE transistor test function; measures dc gain (hFE) of NPN and PNP transistors.
- Logic probe function; indicates logic high or logic low for TTL circuitry.
- Diode test function; measures forward voltage drop.
- Audible continuity buzzer.
- Audible warning buzzer if probe inserted into wrong jack.
- Extra-large, easy to read 3-3/4 digit display with annunciators for polarity, decimal, frequency, ac/dc, capacitance, and low battery.
- Basic accuracy: ±0.3% (DCV).
- Resolution of 100 μV, 0.1 μA, ±0.1 %, ±1 μF, ±1 Hz.
- Auto polarity, auto zero.
- Overrange indication on all ranges.
- Overload protection.
- High energy fuses.
- Fused 20 A range.
- Safety type test leads.
- Tilt stand.
- Hanger strap.
- Protective holster (withstands 10 ft drop on concrete).
- Built-in probe storage.

**SPECIFICATIONS**

**RESISTANCE**

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Max Open Circuit Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 Ω</td>
<td>0.1 Ω</td>
<td>±(1.0% rdg + 1 digit)</td>
<td>3.45 V</td>
</tr>
<tr>
<td>4 kΩ</td>
<td>1 Ω</td>
<td>±(0.75% rdg + 4 digit)</td>
<td>0.6 V</td>
</tr>
<tr>
<td>40 kΩ</td>
<td>10 Ω</td>
<td>±(1.5% rdg + 5 digit)</td>
<td>500 V DC or peak AC</td>
</tr>
</tbody>
</table>

**CAPACITANCE**

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Test Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 nF</td>
<td>1 pF</td>
<td>±(3.0% rdg + 4 digit)</td>
<td>180 Hz</td>
</tr>
<tr>
<td>40 nF</td>
<td>10 pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 μF</td>
<td>1 nF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 μF</td>
<td>10 nF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FREQUENCY COUNTER**

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 kHz</td>
<td>1 kHz</td>
<td>±(0.1% rdg + 2 digit)</td>
<td>250 mV rms (10 Hz to 1 MHz)</td>
</tr>
<tr>
<td>40 kHz</td>
<td>10 kHz</td>
<td>±(0.1% rdg + 2 digit)</td>
<td>1000 mV rms (1 MHz to 10 MHz)</td>
</tr>
<tr>
<td>400 kHz</td>
<td>1 kHz</td>
<td>±(0.1% rdg + 2 digit)</td>
<td>4000 kHz rms (10 kHz to 1 MHz)</td>
</tr>
</tbody>
</table>

**Overvoltage Protection**

- 1000 V
- 10 V
- 10 mV
- 100 mV
- 5000 V

**Overload Protection**

- 2 A (600 V) fast blow ceramic fuse
- 20 A (600 V) fast blow ceramic fuse
- 20 A Range Maximum Current
- 20 A for continuous, 20 A for 1 sec max.

**AC VOLTAGE Manual ranging. Average responding rms reading.**

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Overvoltage Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 mV</td>
<td>0.1 μA</td>
<td>±(1.2% rdg + 3 digit)</td>
<td>500 VDC or peak AC</td>
</tr>
<tr>
<td>4 V</td>
<td>1 μA</td>
<td>±(1.5% rdg + 4 digit)</td>
<td>1200 VDC or peak AC</td>
</tr>
<tr>
<td>40 V</td>
<td>10 μA</td>
<td>±(2.0% rdg + 5 digit)</td>
<td>900 VDC or peak AC</td>
</tr>
</tbody>
</table>

**AC CURRENT Manual ranging. Average responding rms reading.**

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Burden Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 μA</td>
<td>0.1 μA</td>
<td>±(1.0% rdg + 1 digit)</td>
<td>600 mV max.</td>
</tr>
<tr>
<td>4 mA</td>
<td>1 μA</td>
<td>±(0.5% rdg + 1 digit)</td>
<td>900 mV max.</td>
</tr>
<tr>
<td>40 mA</td>
<td>10 μA</td>
<td>±(1.0% rdg + 1 digit)</td>
<td>9000 mV max.</td>
</tr>
<tr>
<td>400 mA</td>
<td>100 μA</td>
<td>±(1.5% rdg + 3 digit)</td>
<td>9000 mV max.</td>
</tr>
</tbody>
</table>

**DC VOLTAGE Manual ranging.**

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Overvoltage Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 mV</td>
<td>100 μV</td>
<td>±(0.5% rdg + 1 digit)</td>
</tr>
<tr>
<td>4 V</td>
<td>1 mV</td>
<td>±(1.5% rdg + 3 digit)</td>
</tr>
<tr>
<td>40 V</td>
<td>10 mV</td>
<td>±(2.0% rdg + 5 digit)</td>
</tr>
<tr>
<td>400 V</td>
<td>100 mV</td>
<td>±(2.5% rdg + 5 digit)</td>
</tr>
<tr>
<td>750 V</td>
<td>1 V</td>
<td>±(1.5% rdg + 3 digit)</td>
</tr>
</tbody>
</table>
SYMBOLS

See instruction manual for further precautionary information.

High voltage terminal, up to 1000 V may be present if connected to high voltage.

COM
Common input terminal.

Diode test.

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

1000 VDC MAX
Maximum input rating of VΩΩ Hz terminal with respect to earth ground.

CONTROLS AND INDICATORS

1. Display, 3-3/8 digit display (1999 maximum) with automatic decimal point, polarity indication, high-low logic indicators, and low battery indicator. Indicates measured value, unit of measurement, and whether dc or ac is selected (for current and voltage ranges). Overrange is indicated by displaying DL.

2. MAX Switch. Selects maximum hold or normal mode.

3. Function/Range Power Switch. Selects function and range: V (1000 VDC/750 A), V/Ω (400 V, 400 mV/40 kHz), V/Ω (1000 V/100 mV), V/Ω (100 mV/100 kHz), V/Ω (400 mV/40 kHz), V/Ω (100 mV/200 kHz), V/Ω (40 mV/1 MHz), V/Ω (40 mV/200 MHz), or V/Ω (40 mV/10 MHz). If range is selected, a warning tone is heard when the range is exceeded.

4. HFE Jacks. Input for direct insertion of NPN and PNP transistor leads.Emitter, collector, and base sockets are labeled.

5. 20 A Jack. Input for dc or ac current measurements on the 20 A range (currents greater than 10 A not to be connected to TEST BENCH for longer than 60 seconds). For measurements greater than 3 A, high current test leads are recommended.

6. mA/A Jack. Input for dc or ac current up to 2 A.

7. COM Jack. Input (for common reference test lead for measurements except Cx (capacitance) and HFE transistor gain). Connect to earth ground or reference point not more than 500 V (dc and ac) from earth ground.

8. VΩΩ Hz Jack. Input for voltage, resistance, frequency, HFE, Logic, and continuity/diode test functions.


10. AC/DC Switch. Selects ac and dc voltage and current ranges. When switch is set to DC position, all voltages and current ranges are for ac measurements. When switch is set to AC position, all voltages and current ranges are for ac measurements.

OPTIONAL ACCESSORIES

Replacement Test Leads.......................... Model TL-1
Deluxe Test Leads.................................. Model TL-2
Accessory Tips for Deluxe Test Leads........... Model TL-3
High Current Test Leads.......................... Model FP-10
High Voltage Probe (40 kVDC).................... Model PR-28
High Voltage Probe (6 kVDC)...................... Model HV-6
Temperature Adapter, Type K thermocouple...... Model TP-30

OPERATING I

RANGE SELECTION

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

2. When an overrange is indicated, reset the switch to the next highest range.

CAUTION

Do not switch between ranges while connected to a high voltage.

AUTO POWER OFF

1. The meter will automatically shut off if the Function/Range switch position is not changed within 45 minutes.

2. To restore operation, rotate the Function/Range switch to any other position.

VOLTAGE MEASUREMENTS

1. The annunciator in the lower left corner of the display indicates whether the ac or dc function is selected. The mV or V annunciator to the right indicates that voltage is selected.

a. To measure ac voltage, set the AC/DC switch to the AC position.

b. To measure dc voltage, set the AC/DC switch to the DC position.

2. Set the Function/Range switch to the desired voltage range.

3. Connect the red test lead to the + VΩΩ Hz jack and the black test lead to the COM jack.

4. Connect the test leads to the points of measurements.

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

CURRENT MEASUREMENTS

For current measurements, the meter must be connected in series with the load. If incorrectly connected, the meter presents a very low impedance (almost a short), which may flow the fuse or damage the equipment under test.

NOTE

A warning tone will be heard if the test lead is connected to mA or A input jack while the knob is not set to mA or A range. A warning tone will also be heard if the test lead is connected to 20 A input jack while the knob is not set to 20 A range.

1. The annunciators in the upper left corner of the display indicate whether the ac or dc function is selected. The mA or A annunciator to the right indicates that current is selected.

a. To measure ac current, set the AC/DC switch to the AC position.

b. To measure dc current, set the AC/DC switch to the DC position.

2. For current measurements, less than 2 A, connect the red test lead to the mA/A jack and the black test lead to the COM jack.

3. For current measurements greater than 2 A, connect the red test lead to the 20 A jack and the black test lead to the COM jack.

4. 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.

5. Apply power and read the value from the display.

RESISTANCE MEASUREMENTS

1. Set the Function/Range switch to the desired resistance range.

2. Remove power from the equipment under test.

3. Connect the red test lead to the + VΩΩ Hz jack and the black test lead to the COM jack.

4. Connect the test leads to the points of measurements and read the value from the display.

CAPACITANCE MEASUREMENTS

Never apply an external voltage to the Cx jacks. Damage to the meter may result. Always short capacitor leads together before connecting to meter.

1. Set the Function/Range switch to the desired Cx (capacitance) range.

2. Insert the capacitor leads directly into the slots (or test jacks). Observe polarity when measuring polarized capacitors. Insert one lead into the (+) jack and the other lead into the (-) jack.

3. Read the capacitance directly from the display. A shorted capacitor will indicate an overrange. An open capacitor will indicate zero on all ranges.

USEFUL CONVERSIONS

<table>
<thead>
<tr>
<th>pF</th>
<th>nF</th>
<th>μF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000</td>
<td>1.0</td>
<td>0.001</td>
</tr>
<tr>
<td>10,000</td>
<td>10.0</td>
<td>0.001</td>
</tr>
<tr>
<td>100,000</td>
<td>100.0</td>
<td>0.01</td>
</tr>
<tr>
<td>1,000,000</td>
<td>1,000.0</td>
<td>0.1</td>
</tr>
<tr>
<td>10,000,000</td>
<td>10,000.0</td>
<td>1.0</td>
</tr>
<tr>
<td>100,000,000</td>
<td>100,000.0</td>
<td>10.0</td>
</tr>
<tr>
<td>1,000,000,000</td>
<td>1,000,000.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

1 pF = picofarads (10^-12)
1 nF = nanofarads (10^-9)
1 μF = microfarads (10^-6)

FREQUENCY MEASUREMENTS

1. Set the Function/Range switch to the kHz function.

2. Connect the red test lead to the + VΩΩ Hz jack and the black test lead to the COM jack.

3. Connect the test leads to the point of measurement and read the frequency from the display.

TRANSISTOR GAIN MEASUREMENTS

Never apply an external voltage to the HFE sockets. Damage to the meter may result.
TILT STAND AND HANGER

The tilt stand and hanger are located on the back of the case. The tilt stand, Figure 1, can be used to position the unit at approximately a 45 degree angle of the bench top. The hanger clip can be used to support the meter on top of a panel as shown in Figure 2 or to suspend the meter from a wire, strap or screw as shown in Figure 3.

TRUCTIONS

1. Set the Function/Range switch to the desired hFE (dc transistor gain) range (PNP for pnp type transistors and NPN for npn type transistors).
2. Plug the transistor directly into the hFE socket. The sockets are labeled E, B, and C for emitter, base, and collector.
3. Read the transistor hFE (dc gain) directly from the display.

LOGIC MEASUREMENTS

1. Set the Function/Range switch to the LOGIC position.
2. Connect the red test lead to the \( \rightarrow \) V Ω Hz jack and the black test lead to the COM jack.
3. Connect the black test lead to the circuit ground (common).
4. Connect the red test lead to the test point.
5. A \( \rightarrow \) on the display indicates TTL logic high and a \( \rightarrow \) indicates a TTL logic low. Both indicators are on when the point of measurement is toggling high and low.

CONTINUITY MEASUREMENTS

1. Set the Function/Range switch to the \( \rightarrow \) position.
2. Connect the red test lead to the \( \rightarrow \) V Ω Hz jack and the black test lead to the COM jack.
3. Touch the test leads to the desired test point.
4. The buzzer will sound when resistance is less than 1,500 Ω.

DIODE TEST

1. Set the Function/Range switch to the \( \rightarrow \) position.
2. Connect the red test lead to the \( \rightarrow \) V Ω Hz jack and the black test lead to the COM jack.
3. To check forward voltage (Vf), connect the red test lead to the anode and the black test lead to the cathode of the diode. Diodes and semiconductor junctions with normal Vf of less than approximately 1,000 V can be checked.

4. The display indicates the forward voltage. Normal diode voltages are approximately 0.300 V for germanium diodes, 0.700 V for silicon diodes, and 1.600 V for light emitting diodes (LED's). A reading of approximately 3.45 V indicates an open diode. A shorted diode reads near 0 V.

5. To check reverse voltage, reverse the test lead connections to the diode. The reading should be the same as with open test leads (approx. 3.45 V). Lower readings indicate a leaky diode.

MAX MEASUREMENTS

MAX is used to measure the maximum value of a changing voltage or current such as surge current when power is first turned on or peak audio.

LEAD STORAGE

The holster provides a means of storing the test leads when not in use. Refer to Figure 5 and proceed as follows:

1. Press the probe end of the test leads into the storage slots with the end of the probes pointing toward the top of the unit.
2. Press the leads into the lead slots to prevent the leads from unwrapping.
3. Wrap both test leads together in the storage channel near the bottom of the holster leaving about a foot of test lead.
4. Turn the unit over then plug end of the test leads into the COM and \( \rightarrow \) V Ω Hz connectors on the front of the unit.

Figure 1.

Figure 2.

Figure 3.

Figure 4.

Figure 5.
SAFETY

WARNING

An electrical shock causing 10 milliamperes to pass through the heart will stop most 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 precautions.

1. Do not exceed the following input ratings. Personal injury or damage to the equipment may result.
   - DC VOLTS: 1000 V (dc + ac peak)
   - AC VOLTS: 750 V rms
   - VOLTS: 500 V (dc + ac peak)
   - OCVIS: 500 V (dc + ac peak)
   - mA: 2000 mA (fuse protected)
   - COM: 20 A; 10 A continuous, 20 A for 60 seconds max.

2. Do not exceed more than 500 volts from earth ground.

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

4. Use only the safety type leads supplied with the instrument.

5. Turn off equipment while making test connections in high voltage circuits. Discharge high voltage capacitors after removing power.

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

7. Never apply an external signal to the Cx or Mf input jacks. Damage to the meter will result.

8. 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.

DIODE CHECK

- Range: 1 mV
- Resolution: ±1.0% dBg or +1 digit
- Accuracy: 1.0 mA
- Max Open Circuit Voltage: 3.45 VDC

- Overvoltage Protection: 500 V DC or peak AC

CONTINUITY TEST

- Range: 100 ms
- Response Time: Buzzer sounds below approx. 150 Ohm
- Description: Low
- Accuracy: 3.45 VDC

LOGIC

- LCD Displays Number “01” when selected
- Detector: AC coupled
- Logic Threshold: 2.8 V
- Logic 0 (low): 0.8 V
- Logic 1 (high): 20.5 V
- Duty Cycle: 20%
- Indication: 40 ms beep at low logic
- Pulse Width: 25 ms
- Pulse Rep Rate: 1 Msps max.
- Pulse Rise Time: 10 µs max.
- Input Impedance: 120 kΩ/100 pF
- Input Overvoltage Protection: 500 V DC or peak AC

TRANSISTOR hFE (DC GAIN) MEASUREMENT

- Base Current: 10 mA
- Peak Current: 3.45 V
- Gain Measurement Range: 0-1000

GENERAL SPECIFICATIONS

- Display: 3-3/4 digit liquid crystal display (LCD) with a maximum reading of 3999 counts. Large 0.7" digits.
- Polarity: automatic (+/- negative polarity indication.
- Overrange Indication: “OL”.
- Functional Announcer: AC, DC, V, A, F, kHz, Ω, Hz, and Logic on LCD display.
- Low Battery Indication: “.” is displayed when the battery drops below minimum operating voltage.
- Sampling Rate: 2 measurements per second, nominal. 1 time per second for frequency measurements.
- Operating Temperature: 0°C to +50°C, 0 to 70% relative humidity.
- Power: Single 9V battery, NEDA 1604.
- Battery Life: 500 hours typical (alkaline). Auto Power Off: Automatically shuts down after 65 minutes inactivity. Dimensions (H x W x D): 7.5 x 3.4 x 1.5" (189 x 87 x 37 mm). Weight: 12.9 oz. (370 g) including battery.
- Accessories: Test leads (pair), battery, instruction manual.

WARRANTY

LIMITED THREE-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 three 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.

To obtain warranty coverage in the U.S.A., this product must be registered by completing and mailing the enclosed warranty registration card to MAXTEC, B-K Precision, 5470 West Cortland Street, Chicago, Illinois 60635 within 15 days from the date of purchase.

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 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 product which it sells.

BATTERY REPLACEMENT

A low battery is indicated when the symbol in the upper right hand corner is on. The low battery 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.

1. Remove rubber holder.
2. Remove two screws from back of unit securing the tilt stand.
3. Remove tilt stand.
4. Remove two screws securing case back, then carefully lift back off to gain access to battery. Remove and save the battery insulator.
5. Replace the dead battery with a fresh 9 volt “transistor” battery. Replace the battery insulator. Use alkaline batteries such as the NEDA 1604 or equivalent for longer life. To prolong battery life set the Function/Range switch to the OFF position when not in use.
6. Reinstall back cover, tilt stand and holder.

FUSE REPLACEMENT

If no current measurements are possible, check for a blown overload protection fuse. There are two fuses, F1 for the mA/A and F2 for the 20 A. A quick check for a blown 20 A fuse can be performed by inserting the probe into the 20A jack and setting the function switch to any other position except 20A or OFF. If no warning light is heard the fuse is probably blown. This procedure can be used for the mA/A fuse jack by inserting the probe into the mA/A jack and setting the function switch to any position other than the OFF, mA/A or mA positions. For access to fuses, remove the case back as described for battery replacement. Replace F1 only with the original type. 2 A, 600 V, fast acting ceramic fuse (B-K Precision Part No. 194-049-001). Replace F2 only with the original type 20 A, 600 V, fast acting ceramic fuse (B-K Precision Part No. 194-045-001).

TEST LEADS

Use only safety type leads, like these supplied. Periodically examine the test leads to ensure that the conductors are not irremediably or broken. Also make sure that good contact pressure exists at the test receptacles and fastener, and keep these areas free from dirt and corrosion.