

# INSTRUCTION MANUAL

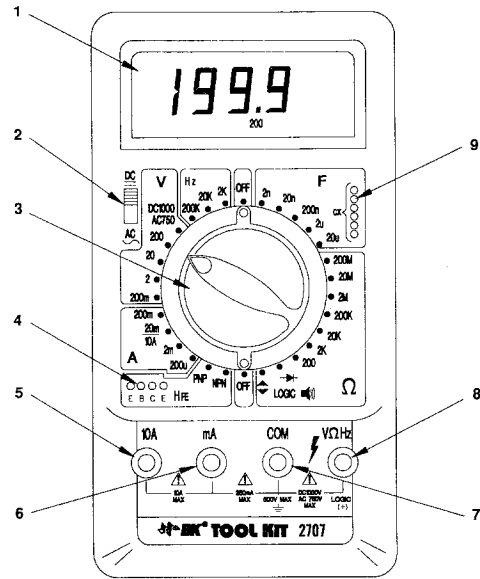


**PRECISION**<sup>®</sup>  
**INTERNATIONAL CORP.**  
Cortland St. • Chicago, IL 60635

**TOOL KIT**  
**3-1/2 DIGIT**  
**MULTIMETER**  
**MODEL 2707**

**Full Multimeter Functions**  
Capacitance Meter  
Frequency Meter  
Transistor Tester  
Logic Probe  
Diode Tester  
Continuity Tester

- 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.
- DC-AC Switch.** Selects dc or ac voltage and current ranges. When switch is set to DC position, all voltage and current ranges are for dc measurements. When switch is set to AC position, all voltage and current ranges are for ac measurements.
- Function/Range Switch.** Selects function and range. V (200 mV, 2 V, 20 V, 200 V, or 1000 VDC/750 VAC), Cx (2 nF, 20 nF, 200 nF, 2  $\mu$ F, or 20  $\mu$ F), A (200  $\mu$ A, 2 mA, 20 mA, 200 mA, or 10 A), hFE (NPN or PNP),  $\nabla$  (logic test),  $\nabla$  (diode test),  $\nabla$  (continuity buzzer),  $\Omega$  (200  $\Omega$ , 2 k $\Omega$ , 20 k $\Omega$ , 200 k $\Omega$ , 2 M $\Omega$ , 20 M $\Omega$ , or 200 M $\Omega$ ), or Hz (2k, 20k, or 200k).
- hFE Socket.** Input jacks for transistor test. E, B, and C identify emitter, base, and collector pins.
- V $\Omega$  Hz Jack.** Input for dc and ac voltage, resistance, continuity, diode, frequency, or logic test.
- COM Jack.** Input for common or reference test lead for all measurements except hFe and Cx. Connect to earth ground or reference point not more than 500 V MAX (dc + ac peak) from earth ground.
- mA Jack.** Input for dc or ac current up to 200 mA; common or reference for logic test.
- 10 A Jack.** Input for 10 A dc or ac current range. For measurements greater than 3 A, high current test leads are recommended.
- Cx Socket (Capacitor Test Socket).** Allows for measurement of small axial-lead or PC-lead capacitors.
- Tilt Stand (not shown, on rear).**



## WARNING

An electrical shock causing 10 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.

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

DC VOLTS	1000 V (dc + ac peak)
AC VOLTS	500 V (dc + ac peak) for 200 mV range 750 V rms
OHMS	500 VDC or AC rms
mA	250mA (fuse protected)
10 A	10 A (no fuse protection)
COM	Do not float more than 500 volts from earth ground.
- 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 VDC or AC. Accidental misuse by connection across a high voltage, high energy power source when the meter is set up for mA measurement may be very hazardous.
- Remove test leads before replacing batteries or fuses, and before performing any servicing on the multimeter.
- Turn off equipment while making test connections in high-voltage circuits. Discharge high-voltage capacitors after removing power.
- For voltage or current measurements in high voltage equipment, do not touch equipment, meter, or test leads while power is applied.

- Never apply an external voltage to the Cx or hFE sockets of the multimeter.
- 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.
- Use an insulated floor material or floor mat to stand on, and an insulated work bench surface; make certain such surfaces are not damp or wet.
- 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.
- When using a probe, touch only the insulated portion. Never touch the exposed tip portion.
- 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 in "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.
- 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.
- Never work alone. Someone should be nearby to render aid if necessary. Training in CPR (cardiopulmonary resuscitation) first aid is highly recommended.

## OPERATING INSTRUCTIONS

### RANGE SELECTION

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

- To measure dc voltage, set function switch to the desired V range and set the DC-AC switch to DC.
- To measure ac voltage, set function switch to the desired V range and set the DC-AC switch to AC.
- Connect red test lead to V $\Omega$  Hz jack and black test lead to COM jack.
- Connect test leads to points of measurement.
- For dc, a (-) sign is displayed for negative polarity; (+) polarity is implied.

### RESISTANCE MEASUREMENTS

- Set function switch to the desired resistance range.
- Remove power from equipment under test.
- Connect red test lead to V $\Omega$  Hz jack and black test lead to COM jack. Red lead is (+) polarity.
- Connect test leads to points of measurement.

### CONTINUITY MEASUREMENTS

- Set function switch to  $\nabla$  position.
- Perform "Resistance Measurements" procedure, steps 2 thru 4.
- Buzzer sounds when resistance is less than approximately 100 $\Omega$ .

### DIODE TEST

- Set function switch to  $\nabla$  position.
- Connect red test lead to V $\Omega$  Hz jack and black test lead to COM jack. Red lead is (+) polarity.
- To check forward voltage (V<sub>f</sub>), connect red test lead to anode and black test lead to cathode of diode. Diodes and semiconductor junctions with normal V<sub>f</sub> of less than approximately 2.0 V can be checked.
- Display indicates forward voltage. Normal diode voltages are approximately 0.4 V for germanium diodes, 0.7 V for silicon diodes, and 1.6 V for light emitting diodes (LED). An overrange indicates an open diode. A shorted diode reads near 0 V.
- Reverse test lead connections to diode. Reading should be same as with open test leads (an overrange indication). Lower reading indicates leaky diode.

### TRANSISTOR MEASUREMENTS

### CAUTION

Never apply an external voltage to the Cx or hFE sockets. Damage to the meter may result.

- Plug transistor directly into hFE socket on meter. Sockets are labeled E, B, and C for emitter, base, and collector.
- Set function switch to NPN or PNP position which corresponds with transistor under test.
- Read transistor hFE (dc gain) from display.

### 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 10 A range has no fuse protection and may severely damage the meter or equipment under test or cause personal injury.

- To measure dc current, set the function switch to the desired A range and DC-AC switch to DC.

- To measure ac current, set the function switch to the desired A range and the DC-AC switch to AC.
- For current measurements under 200 mA, connect the red test lead to the mA jack and the black test lead to the COM jack.
- For current measurements above 200 mA, connect the red test lead to the 10 A jack and the black test lead to the COM jack (set the Function/Range switch to the 20 m/10 A position).
- 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.
- Apply power and read the value from the display.

### CAPACITANCE MEASUREMENTS

### CAUTION

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

- Set function switch to desired Cx range.
- Insert the capacitor leads directly into the Cx capacitor test socket.
- Read capacitance directly from the display.

### FREQUENCY MEASUREMENT

- Set function switch to desired Hz range.
- Connect red lead to V  $\Omega$  Hz jack and black lead to COM jack.
- Connect the test leads to the point of measurement and read the frequency from the display.

### LOGIC MEASUREMENT

- Set function switch to  $\nabla$  logic position.
- Connect red lead to V  $\Omega$  Hz + jack and black lead to COM jack.
- Connect black lead to circuit ground (common).
- Connect red lead to test point.  $\blacktriangle$  on LCD display indicates TTL logic hi and  $\blacktriangledown$  indicates TTL logic lo. If both indicators are on, the point of measurement is toggling between hi and lo.

## MAINTENANCE

### WARNING

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

### BATTERY REPLACEMENT

The (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 fuseholder, and keep these areas free from dirt, oil and corrosion.

## SPECIFICATIONS

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

### DC VOLTS Manual ranging

Range	Resolution	Accuracy	Overvoltage Protection
200 mV	100 µV	± (0.5% rdg + 1 dgt)	500 V (dc + ac peak) AC 350 V (rms, sine)
2 V	1 mV		
20 V	10 mV		
200 V	100 mV		
1000 V	1 V		1200 V (dc + ac peak) AC 800 V (rms, sine)

Input impedance ..... 10 MΩ

### AC VOLTS Manual ranging, average responding, rms reading

Range	Resolution	Accuracy 50-500 Hz	Overvoltage Protection
200 mV	100 µV	± (1.0% rdg + 4 dgt) 50 Hz-500 Hz	500 V (dc + ac peak) AC 750 V (rms, sine)
2 V	1 mV		
20 V	10 mV		
200 V	100 mV		
750 V	1 V	± (1.5% rdg + 4 dgt) 50 Hz-500 Hz	1200 V (dc + ac peak) AC 800 V (rms, sine)

Input impedance ..... 10 MΩ

### DC CURRENT Manual ranging

Range	Resolution	Accuracy	Burden Voltage
200 µV	0.1 µA	± (1.0% rdg + 1 dgt)	325 mV max
2 mA	1 µA		
20 mA	10 µA		
200 mA	100 µA		
10 A	10 mA	± (2.0% rdg + 3 dgt)	750 mV max

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

### AC CURRENT Manual ranging, average responding, rms reading

Range	Resolution	Accuracy	Burden Voltage
200 µV	0.1 µA	± (1.2% rdg + 4 dgt) 50 Hz-500 Hz	325 mV max
2 mA	1 µA		
20 mA	10 µA		
200 mA	100 µA		
10 A	10 mA	± (2.0% rdg + 4 dgt) 50 Hz-500 Hz	750 mV max

Overload protection same as dc current.

### RESISTANCE Manual ranging

Range	Resolution	Accuracy	Burden Voltage
200 Ω	0.1 Ω	± (1.0% rdg + 3 dgt)	3.2 V
2 kΩ	1 Ω		
20 kΩ	10 Ω	± (0.8% rdg + 1 dgt)	0.3 V
200 kΩ	100 Ω		
2 MΩ	1 kΩ	± (3.0% rdg + 1 dgt)	3.2 V
20 MΩ	10 kΩ		
200 MΩ	100 kΩ		

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

### CAPACITANCE Manual ranging

Range	Resolution	Accuracy	Test Frequency
2 nF	1 pF	± (3.0% rdg + 10 dgt)	400 Hz
20 nF	10 pF		
200 nF	100 pF		
2 µF	1 nF		
20 µF	10 nF		

Test voltage ..... 50mV

### FREQUENCY COUNTER Manual ranging.

Range	Resolution	Accuracy	Sensitivity	Min. Input Freq.
2 kHz	1 Hz	± (1.0% rdg + 1 dgt)	35 mV rms	20 Hz
20 kHz	10 Hz			200 Hz
200 kHz	100 Hz			2 kHz

Overvoltage protection ..... 500 V (dc + ac peak)  
Reading ..... 10 to 1999

### LOGIC

Test Voltage ..... TTL  
Logic Threshold .....  
Logic 1 (high) ..... 2.8 V ± 0.8 V  
Logic 0 (low) ..... 0.8 V ± 0.5 V  
Input Impedance ..... 120 kΩ nom  
Minimum Pulse Width ..... 25 ns  
Overload Protection ..... 500 V (dc + ac peak)

### TRANSISTOR hFE (DC GAIN) MEASUREMENT

0-1000 hFE values on either PNP or NPN transistors  
Test condition ..... Base DC current = 10 µA; Vce = 2.8 V

### CONTINUITY CHECK

Buzzer Threshold ..... Approx. 100 Ω  
Response Time ..... <100 ms

### DIODE CHECK

Range	Resolution	Max. Test Current	Max. Open Circuit Voltage
←	1 mV	1.6 mA	3.2 V

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 1999.

**Polarity.** Automatic, (-) negative polarity indication.

**Overrange Indication.** "1" or "-1".

**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.** 200 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  
Battery  
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.



Continuity buzzer.

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 VΩ Hz 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.

## WARRANTY INFORMATION

### LIMITED ONE YEAR WARRANTY

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

Without charge, repair or replace, at its option, the product or component parts upon delivery to an authorized **B + K Precision** service contractor or the factory, accompanied by proof of the purchase date and a sales receipt.

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

removed. We shall not be liable for any consequential damages, without limitation damages resulting from loss of use. We do not allow limitation of incidental or consequential damages. The above limitation or exclusion may not apply to you.

Some states give you specific rights and you may also have other rights which vary from state to state.

For convenience we suggest you contact your **B + K Precision** distributor, who may be authorized to make repairs for you to the nearest service contractor. If warranty repair is to be obtained locally, please send the unit to **B + K Precision** Service Department, 6470 West Cortland Street, Chanhassen, MN 55015, 60635, properly packaged to avoid damage in transit.

INTERNATIONAL CORPORATION warrants products sold only in the United States and its overseas territories. In other countries, each distributor warrants the **B + K Precision** products which it sells.

## FEATURES

- Basic accuracy: DCV  $\pm$  0.5%.
- Resolution of 100  $\mu$ V, 0.1 $\Omega$ , 0.1  $\mu$ A, 1 pF, 1 Hz.
- Single function and range control.
- Five dc voltage ranges: 200 mV to 1000 V.
- Five ac voltage ranges: 200 mV to 750 V.
- Five capacitance ranges: 2 nF to 20  $\mu$ F.
- Five dc current ranges: 200  $\mu$ A to 200 mA and 10 A.
- Five ac current ranges: 200  $\mu$ A to 200 mA, and 10 A.
- Seven resistance ranges: 200 $\Omega$  to 200 M $\Omega$ .
- Three frequency ranges: 2 kHz to 200 kHz.
- Logic probe function: indicates logic high or logic low for TTL circuits.
- hFE transistor test function: Measures dc gain (dc  $\beta$  or hFE) of PNP and NPN transistors.
- Diode test function: measures forward voltage drop.
- Audible continuity buzzer.
- 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.