

# INSTRUCTION MANUAL

# MODEL 2905



## 3 1/2 DIGIT MULTIMETER



**BK PRECISION**  
DYNASCAN CORPORATION  
6460 W. Cortland St. • Chicago, IL 60635  
312-889-8870

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## FEATURES

- Basic accuracy: DCV  $\pm 0.5\%$
- Resolution of 100  $\mu\text{V}$ , 0.1  $\Omega$ , 0.1  $\mu\text{A}$ .
- 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  $\mu\text{F}$ .
- Four dc current ranges: 200  $\mu\text{A}$  to 200 mA and 10 A.
- Three ac current ranges: 20 mA, 200 mA, and 10 A.
- Six resistance ranges: 200  $\Omega$  to 20 M $\Omega$ .
- 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 with large 0.5" characters.
- Auto polarity, auto zero.
- Overrange indication on all ranges.
- Overload protection.
- High energy fuse.
- Safety type test leads.
- Shock resistant case withstands 4-foot drop.
- Slanted display for easy viewing.
- Tilt stand. Also converts for use as hanger strap.

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 $\mu\text{V}$	$\pm (0.5\% \text{ rdg} + 1 \text{ dgt})$	DC 500 V AC 350 V
2 V	1 mV		DC 1200 V AC 850 V
20 V	10 mV		
200 V	100 mV		
1000 V	1 V		

Input impedance ..... 10 M $\Omega$   
Full range step response (to rated accuracy) ..... 3 second max.  
Normal mode rejection ..... Greater than 30 db (50/60 Hz)  
Common mode rejection ..... Greater than 100 db (50/60 Hz)

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

Range	Resolution	Accuracy	Overvoltage Protection
200 mV	100 $\mu\text{V}$	$\pm (1.25\% \text{ rdg} + 4 \text{ dgt})$ 40 Hz - 1 kHz	DC 500 V AC 350 V
2 V	1 mV		DC 1200 V AC 850 V
20 V	10 mV		
200 V	100 mV		
750 V	1 V		

Input impedance ..... 10 M $\Omega$ , less than 100 pF  
Full range step response (to rated accuracy) ..... 8 seconds max.

### DC CURRENT Manual ranging

Range	Resolution	Accuracy	Burden Voltage
200 $\mu\text{A}$	0.1 $\mu\text{A}$	$\pm (1.0\% \text{ rdg} + 1 \text{ dgt})$	600 mV Max.
20 mA	10 $\mu\text{A}$		
200 mA	100 $\mu\text{A}$		
10 A	10 mA	$\pm (2.0\% \text{ rdg} + 3 \text{ dgt})$	900 mV Max.

Overload protection 250 mA (250 V) fast blow fuse, plus hi-energy fuse. 10 A Not fused.

## LIMITED ONE-YEAR WARRANTY

DYNASCAN 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 year from the date of purchase.

DYNASCAN 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 DYNASCAN, **B & K-Precision**, 6460 West Cortland Street, Chicago, Illinois 60635 within fifteen (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.*

DYNASCAN 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, 6460 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.

## SPECIFICATIONS

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

Range	Resolution	Accuracy	Burden Voltage
20 mA	10 $\mu\text{A}$	$\pm (1.5\% \text{ rdg} + 3 \text{ dgt})$ 40 Hz - 1 kHz	600 mV rms Max.
200 mA	100 $\mu\text{A}$		
10 A	10 mA	$\pm (2.5\% \text{ rdg} + 4 \text{ dgt})$ 40 Hz - 400 Hz	900 mV rms Max.

Overload protection 250 mA (250 V) fast blow fuse, plus hi-energy fuse. 10 A Not fused.  
Full range step response (to rated accuracy) ..... 8 seconds max.

### RESISTANCE Manual ranging

Range	Resolution	Accuracy	Max. Test Current	Max Open Circuit Voltage
200 $\Omega$	0.1 $\Omega$	$\pm (0.75\% \text{ rdg} + 4 \text{ dgt})$	2 mA	2.6 V
2 k $\Omega$	1 $\Omega$		250 $\mu\text{A}$	
20 k $\Omega$	10 $\Omega$	$\pm (0.75\% \text{ rdg} + 1 \text{ dgt})$	50 $\mu\text{A}$	1.0 V
200 k $\Omega$	100 $\Omega$		5 $\mu\text{A}$	
2 M $\Omega$	1 k $\Omega$		500 nA	
20 M $\Omega$	10 k $\Omega$	$\pm (2.0\% \text{ rdg} + 5 \text{ dgt})$	50 nA	

Overload protection ..... 250 V DC/AC  
Full range step response (to rated accuracy)  
200  $\Omega$  through 2 M $\Omega$  range ..... 5 seconds max.  
20 M range ..... 15 seconds max.

### CAPACITANCE Manual ranging

Range	Resolution	Accuracy	Test Frequency
2 nF	1 pF	$\pm 2.0\% \text{ rdg} + 4 \text{ dgt})$	300 Hz
20 nF	10 pF		
200 nF	100 pF		
2 $\mu\text{F}$	1 nF		
20 $\mu\text{F}$	10 nF		

Full range step response (to rated accuracy) ..... 8 seconds max.

Carrying case	Model LC-5
Clamp-on AC current probe	Model CP-1
10 amp test leads	Model FP-10
Demodulator probe	Model PR-23
High voltage probe (40 kVDC)	Model PR-28
High voltage probe (6 kVDC)	Model HV-6
Replacement test leads	Model FP-30
Temperature probe, semiconductor type	Model TP-28
Temperature probe, Type K thermocouple	Model TP-30

## SYMBOLS

	See instruction manual for further precautionary information.
	High voltage terminal: up to 1000 volts 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.
500V MAX	Maximum input rating of V- $\Omega$ terminal with respect to COM input terminal. (For voltage measurement functions only.)
1000V DC MAX 750V AC	
	Continuity buzzer.

### TRANSISTOR hFE (DC GAIN) MEASUREMENT

0 - 1000 hFE values on either PNP or NPN transistors  
Test condition ..... Base DC current = 10  $\mu\text{A}$ ; Vce = 2.8 V

### CONTINUITY CHECK

Range	Resolution	Description	Max. Test Current	Max Open Circuit Voltage
	1 $\Omega$	Buzzer sounds below approx. 200 $\Omega$	1.5 mA	3.2 V

Overload Protection ..... 250 V DC/AC

### DIODE CHECK

Range	Resolution	Accuracy	Max. Test Current	Max Open Circuit Voltage
	1 mV	$\pm (1.5\% \text{ rdg} + 5 \text{ dgt})$	1.5 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.** LO BAT displayed.

**Sampling Rate.** 2.5 measurements per second, nominal.

**Temperature.**

Full operation: 0 to 50°C (0 to +35°C, <80% R.H.;

0 to 50°C, <70% R.H.)

Storage: -20 to +70°C

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

**Battery Life.** 200 hours typical (alkaline).

**Dimensions.** (H x W x D). 1-3/8" x 3-9/16" x 7-1/2" (35 mm x 90 mm x 190 mm), 1-3/4" (45 mm) max height at tilted window.

**Weight.** 13 oz (365 g) including battery.

**Supplied Accessories.** Test leads (pair), spare fuse (1/4 A), battery, instruction manual.

**WARNING**

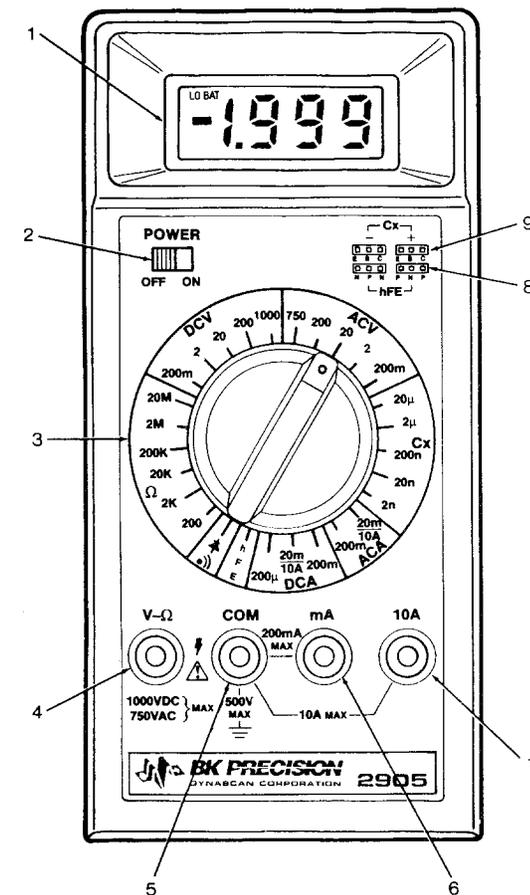
An electrical shock causing 10 milliamps of current to pass through the heart will stop most human heartbeats. Voltage as low as 35 volts dc or ac rms should be considered dangerous and hazardous since it can produce a fatal current under certain conditions. Higher voltages are even more dangerous. Observe 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	750 V rms
OHMS	250 V rms
mA	200 mA (fuse protected)
10 A	10 A (no fuse protection)
COM	Do not float more than 500 volts from earth ground.
- Never use the multimeter unless the battery compartment is closed.
- Remove test leads before replacing batteries or fuses, and before performing any servicing on the multimeter.
- Use only the safety type test leads supplied with 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.

- 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.
- POWER Switch.** Turns instrument ON and OFF.
- Function/Range Switch.** Selects function and range. DCV (200 mV, 2 V, 20 V, 200 V, or 1000 V), ACV (200 mV, 2 V, 20 V, 200 V, or 750 V), Cx (2 nF, 20 nF, 200 nF, 2  $\mu$ F, or 20  $\mu$ F), ACA (20 mA, 200 mA, or 10 A), DCA (200  $\mu$ A, 20 mA, 200 mA, or 10 A), hFE,  $\rightarrow$  (diode test) or  $\bullet$ ) (continuity buzzer), or  $\Omega$  (200  $\Omega$ , 2 k $\Omega$ , 20 k $\Omega$ , 200 k $\Omega$ , 2 M $\Omega$ , or 20 M $\Omega$ ).
- V- $\Omega$  Jack.** Input for dc and ac voltage, resistance, continuity, or diode 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.
- 10A Jack.** Input for 10A dc or ac current range. For measurements greater than 2 A, high current test leads are recommended.
- hFE Sockets.** Input jacks for transistor test. Left jack is for NPN transistors. Right jack is for PNP transistors. E, B, and C identify emitter, base, and collector pins.
- Cx Socket (Capacitor Test Socket).** Allows for measurement of small axial-lead or PC-lead capacitors. Polarized for testing polarized capacitors.
- Tilt Stand (not shown, on rear).** Converts to hanger strap if removed and reattached to holes at top rear of case.

**OPERATING INSTRUCTIONS****RANGE SELECTION**

- If quantity to be measured is unknown start with highest range.
- When an overrange is indicated (most significant digit "1" on and all other digits blank) switch to the next highest range.

**VOLTAGE MEASUREMENTS**

- To measure dc voltage, set function switch to the desired DCV range.
- To measure ac voltage, set function switch to the desired ACV range.
- Connect red test lead to V- $\Omega$  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- $\Omega$  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  $\bullet$ ) position.
- Perform "Resistance Measurements" procedure, steps 2 thru 4.
- Buzzer sounds when resistance is less than approximately 200  $\Omega$ .

**DIODE TEST**

- Set function switch to  $\rightarrow$   $\bullet$ ) position.
- Connect red test lead to V- $\Omega$  jack and black test lead to COM jack. Red lead is (+) polarity.

- 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 3.0 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.

- Set function switch to hFE position.
- Plug transistor directly into proper (NPN or PNP) hFE socket on meter. Sockets are labeled E, B, and C for emitter, base, and collector.
- 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 DCA range.

- To measure ac current, set the function switch to the desired ACA range.
- 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 slotted Cx capacitor test socket. Observe polarity. Insert one lead into + and one lead into - portion of socket.
- Read capacitance directly from the display. A shorted capacitor will indicate an overrange. An open capacitor will indicate near zero on all ranges.

**MAINTENANCE****WARNING**

Remove test leads before changing batteries or fuse or performing any servicing. Never operate instrument unless battery compartment cover is closed.

**BATTERY REPLACEMENT**

The LO BAT 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. Open the battery compartment and 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 over-load protection fuse F1. This fuse is located in the battery compartment. Replace only with original type 250 mA, 250 V, 5 x 20 mm fast acting fuse (B & K Part No. 194-019-9-001).

The unit also includes a high energy fuse to protect against accidental connection to high energy sources (power lines, etc.). The high energy fuse is located inside the meter near the input terminals. Replace only with original type 4 A high energy fuse (B & K Part No. 194-008-9-001). Under normal operation, this device should not require replacement for the life of the instrument. If you suspect a blown fuse, always check F1 first.

**TEST LEADS**

Use only safety type leads, like those supplied. 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 and corrosion.