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Model 389A Test Bench® Handheld Digital Multimeter

Instruction Manual



**BK PRECISION®**

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## MAINTENANCE

### WARNING

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

#### 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.

- Remove two screws from back of unit securing the tilt stand.
- Remove tilt stand.
- Remove two screws securing case back, then carefully lift back off to gain access to battery. Remove and save the battery insulator.
- Replace the dead battery with a fresh 9V battery. Replace the battery insulator. Use alkaline batteries for longer life. To prolong battery life set the **Function/Range** switch to the OFF position when not making measurements.
- Reinstall back cover, tilt stand.

#### FUSE REPLACEMENT

If no current measurements are possible, check for a blown overload protection fuse. Two fuses are used; F1 for the mA input and F2 for the 20 A input. A quick check for a blown 20 A fuse can be performed by inserting the probe into the 20 A jack and setting the function switch to any other position except 20 A or OFF. If no warning tone is heard the fuse is probably blown. This procedure can also be used for the mA jack fuse by inserting the test lead into the mA jack and setting the function switch to any position other than the OFF or one of the mA positions. Replace F1 only with the original type 0.5A, 500 V, fast blow ceramic fuse (B+K Precision Part No. 194-045-9-001). Replace F2 only with the original type 20 A, 600 V, fast blow ceramic fuse (B+K Precision Part No. 194-043-9-001).

#### 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 receptacles and fuseholder, and keep these areas free from dirt and corrosion.

## SPECIFICATIONS

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

#### DC VOLTAGE Auto/Manual ranging.

Range	Resolution	Accuracy	Over voltage Protection	Input Impedance
400 mV	100 µV	±(0.25 % rdg + 2 dgts)	1000 VDC or peak AC	100 MΩ
4 V	1 mV			10 MΩ
40 V	10 mV			9.1 MΩ
400 V	100 mV			
1000 V	1 V			

#### AC VOLTS Auto/Manual ranging. Average sensing, RMS Indicating.

Range	Resolution	Accuracy (50 Hz to 500 Hz)	Accuracy (500 Hz to 1 kHz)	Overvoltage Protection
400 mV	100 µV	± (1.2 % rdg + 5 dgts)*	Unspecified	1000 VDC or peak AC
4 V	1 mV	± (1.0 % rdg + 3 dgts)	± (1.5 % rdg + 5 dgts)	
40 V	10 mV		± (1.2 % rdg + 5 dgts)	
400 V	100 mV		± (1.5 % rdg + 5 dgts)	
750 V	1 V			

Input Impedance ..... Same as DCV/less than 100 pF

\* Freq. response for 400 mV range is 50 - 100 Hz

- 3-3/4 digit LCD display with functional annunciators.
- Analog Bar graph.
- Basic accuracy: DCV ±0.25%.
- Resolution of 100 µV, 1 µA, 0.1 Ω, 1 pF
- Autoranging.
- Auto power off prolongs battery life.
- Five dc voltage ranges: 400 mV to 1000 V.
- Five ac voltage ranges: 400 mV to 750 V.
- Four dc current ranges: 400 µA to 20 A.
- Four ac current ranges: 400 µA to 20 A.
- Six resistance ranges: 400 Ω to 40 MΩ.
- Five capacitance ranges: 4 nF to 40 mF.
- Five frequency ranges 4 kHz to 40 MHz.
- Diode test function: measures forward voltage drop.
- Audible continuity tester.
- Audible warning buzzer if probe inserted into wrong jack.
- Data hold function freezes value on display.
- Max/Min reading recorder.
- Relative mode measurements.
- Auto polarity, auto zero.
- Overrange indication on all ranges.
- Fused mA range.
- Fused 20 A range.
- Safety type test leads.
- Shock resistant case in holster withstands 10-foot drop.
- Tilt stand. Hanger clip.

#### DC CURRENT Manual ranging.

Range	Resolution	Accuracy	Burden Voltage
400 µA	0.1 µA	± (1.0 % rdg + 1 dgt)	500 mV max.
4 mA	1 µA		2.0 V max.
40 mA	10 µA		500 mV max.
400 mA	100 µA		2.0 V max.
* 20 A	10 mA		± (2.0 % rdg + 3 dgts)

Overload Protection ..... 0.5 A (500 V) fast blow ceramic fuse on mA input

20 A (600 V) fast blow ceramic fuse on 20 A input.

\* 20 A Range Maximum Current ..... 10 A continuous, 20 A for 30 sec. max.

#### AC CURRENT Manual ranging. Average sensing, RMS Indicating.

Range	Resolution	Accuracy	Burden Voltage
400 µA	0.1 µA	± (1.5 % rdg + 4 dgts)	500 mV max.
4 mA	1 µA		2.0V max.
40 mA	10 µA		500 mV max.
400 mA	100 µA		2.0V max.
* 20 A	10 mA		± (2.5 % rdg + 4 dgts)

Overload Protection ..... 0.5 A (500 V) fast blow ceramic fuse on mA input

20 A (600 V) fast blow ceramic fuse on 20 A input.

\* 20 A Range Maximum Current ..... 10 A continuous, 20 A for 30 sec. max.

### 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 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	1000 V rms
OHMS	500 V (dc + ac peak)
mA	500 mA (fuse protected)
20 A	20 A (fuse protected)
COM	Do not float more than 500 volts from earth ground.
LOGIC	500 V (dc or peak ac)

- 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.
- 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.

#### RESISTANCE Auto/Manual ranging.

Range	Resolution	Accuracy	Max Open Circuit Voltage
400 Ω	0.1 Ω	± (0.5 % rdg + 4 dgts)	-1.2V DC
4 kΩ	1 Ω	± (0.5 % rdg + 2 dgts)	-0.45V DC
40 kΩ	10 Ω		
400 kΩ	100 Ω		
4 MΩ	1 kΩ	± (1.0 % rdg + 4 dgts)	
40 MΩ	10 kΩ	± (2.0 % rdg + 4 dgts)	

Overload Protection ..... 500 V DC or peak AC

#### FREQUENCY COUNTER Auto ranging.

Range	Resolution	Accuracy	Sensitivity
4 kHz	1 Hz	± (0.1 % rdg + 3 dgts)	> 1.0 V rms
40 kHz	10 Hz		
400 kHz	100 Hz		> 2.0 V rms, < 5 V rms
4 MHz	1 kHz		
40 MHz	10 kHz		

Minimum Pulse Width: >25 ns

Duty Cycle Limits: > 30% and <70%

Overload Protection ..... 500 V DC or peak AC

#### DIODE CHECK

Range	Resolution	Accuracy	Max Test Current	Max Open Circuit Voltage
4.0 V	1 mV	± (1.5 % rdg + 3 dgts)	1.2 mA	3.0 V DC

Audible Indication: <0.2 V

Overload Protection ..... 500 V DC or peak AC

- 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 Moder 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.

#### CONTINUITY TEST

Range	Response Time	Description	Open Circuit Voltage
400 Ω	Approx. 100 ms	Buzzer sounds below approx. 40 Ω	-1.2 V DC

Overload Protection ..... 500 V DC or peak AC

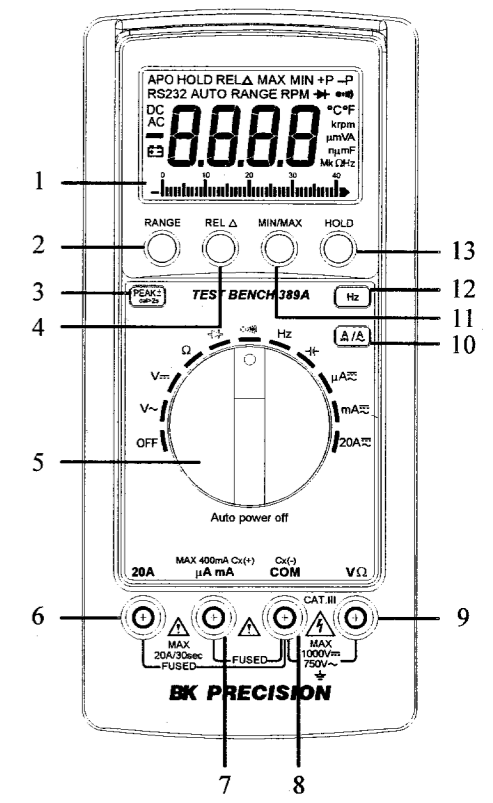
#### CAPACITANCE Auto/Manual Ranging

Range	Resolution	Accuracy *
4 nF	1 pF	± (3.0 % rdg + 20 dgts)
40 nF	10 pF	± (3.0 % rdg + 5 dgts)
400 nF	100 pF	
4 µF	1 nF	
40 µF	10 nF	± (5.0 % rdg + 10 dgts)
400 µF	0.1 µF	
4 mF	1 µF	
40 mF	10 µF	

Overload Protection ..... 500 V DC or peak AC

\* Accuracy using relative mode to zero meter.

- Display.** 3-3/4 digit (3999 maximum) with automatic decimal point analog bar graph, low battery and full annunciators for function and unit of measurement.
- RANGE Switch.** Select manual ranging mode or changes ranges.
- PEAK Switch.** Record the peak+ or peak- value, on ACV, ACA ranges.
- REL  $\Delta$  Switch.** Sets present reading as the zero reference.
- Function/Range Switch.** Selects function for autoranging modes and function and range for manual ranging modes:  $\sim$  V,  $\equiv$  V,  $\Omega$ ,  $\rightarrow$  (continuity),  $\rightarrow$  (diode), Hz, Cx,  $\equiv$  /  $\sim$   $\mu$ A, mA, 20 A.
- 20 A Jack.** Input for up to 20 A dc or ac current range. For measurements greater than 3 A high current test leads are recommended.
- mA Jack.** Input for dc or ac current up to 400 mA, Cx.
- 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 + ac peak) from earth ground.
- $\rightarrow$  V $\Omega$ Hz.** Input for dc and ac voltage, resistance, frequency, continuity or diode test.
- A  $\equiv$  / A  $\sim$  Switch.** Shift DCA and ACA ranges.
- MIN/MAX Switch.** Activates maximum and minimum record feature.
- Hz Switch.** ACV/DCV or ACA/DVA measurement, push Hz switch to read frequency on display.
- HOLD Switch.** Activates data hold feature.



- 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.
- Double insulation.
- 1000V  $\equiv$  MAX Maximum input rating or V- $\Omega$  terminal with respect to COM input terminal.
- Continuity test.
- V  $\sim$  ACV.
- V  $\equiv$  DCV.
- A  $\sim$  ACA.
- A  $\equiv$  DCA.

- OPTIONAL ACCESSORIES**
- Replacement Test Leads ..... Model TL-1
  - Deluxe Test Leads ..... Model TL-2A
  - Accessory Tips for Deluxe Test Leads ..... Model TL-3
  - High Voltage Probe (40 k VDC) ..... Model PR-28A
  - Temperature Adapter. Type K thermocouple ..... Model TP-30B

**OPERATING INSTRUCTIONS**

- CAPACITANCE MEASUREMENTS**
- CAUTION**
- Never apply an external voltage when in the Cx position. Damage to the meter may result. Always short capacitor leads together before connecting to meter.*
- Set the **Function/Range** switch to Cx (capacitance).
  - Connect the COM and the Cx (+)  $\mu$ A mA leads to the capacitor. Observe polarity when measuring polarized capacitors.
  - Read the capacitance directly from the display. A shorted capacitor will indicate an overrange. An open capacitor will indicate near zero on all ranges.
  - For maximum accuracy, step to the desired range in manual ranging, then press the REL  $\Delta$  button to zero out test lead capacitance before the measurement.

**USEFUL CONVERSION**

pF	nF	$\mu$ F	mF
1,000	1.0	0.001	
10,000	10.0	0.01	
100,000	100.0	0.1	
1,000,000	1,000.0	1.0	0.001
	10,000.0	10.0	0.01
	100,000.0	100.0	0.1
		1000.0	1.000

- pF = picofarads ( $10^{-12}$ ), nF = nanofarads ( $10^{-9}$ ),  $\mu$ F = microfarads ( $10^{-6}$ ), mF = millifarads ( $10^{-3}$ ).
- The bar graph is disabled in capacitance measurement mode.
  - In 4mF and 40mF ranges, the bar graph on LCD will be in action back and forth. This is a charging mode during, not a indication of the measured reading.
  - When the capacitor to be tested is connected, if "disc" symbol indicates on LCD, it means there is voltage existing the tested capacitor and need to be discharged before testing.

- 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*

B&K Precision Corp. warrants to the original purchaser that its 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. B&K Precision Corp. will, without charge, repair or replace, at its' option, defective product or component parts. Returned product must be accompanied by proof of the purchase date in the form a sales receipt. To obtain warranty coverage in the U.S.A., this product must be registered by completing and mailing the enclosed warranty card to B&K Precision Corp., 1031 Segovia Circle, Placentia, CA 92870 within fifteen (15) days from proof of purchase.

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

B&K Precision Corp. 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.

Model Number: \_\_\_\_\_ Date Purchased: \_\_\_\_\_

**Warranty Service:** Please return the product in the original packaging with proof of purchase to the below address. Clearly state in writing the performance problem and return any leads, connectors and accessories that you are using with the device.

**Non-Warranty Service:** Return the product in the original packaging to the below address. Clearly state in writing the performance problem and return any leads, connectors and accessories that you are using with the device. Customers not on open account must include payment in the form of a money order or credit card. For the most current repair charges contact the factory before shipping the product.

Return all merchandise to B&K Precision Corp. with pre-paid shipping. The flat-rate repair charge includes return shipping to locations in North America. For overnight shipments and non-North America shipping fees contact B&K Precision Corp.

B&K Precision Corp. Phone: 714-237-9220  
1031 Segovia Circle Facsimile: 714-237-9214  
Placentia, CA 92870 Email: service@bkprecision.com

**Include with the instrument your complete return shipping address, contact name, phone number and description of problem.**

- Connect red test lead to  $\rightarrow$  V  $\Omega$  Hz jack and black test lead to COM jack.
- Connect test leads to points of measurements.
- For dc, a (-) sign is displayed for negative polarity; (+) positive polarity is implied.

- RESISTANCE MEASUREMENTS**
- Set the function switch to  $\Omega$ .
  - Remove power from equipment under test.
  - Connect red test lead to  $\rightarrow$  V  $\Omega$  Hz jack and the black test lead to the COM jack. Red lead is (+) polarity.
  - Connect test leads to the points of measurements.

- CONTINUITY MEASUREMENTS**
- Set the function switch to  $\rightarrow$  position.
  - Perform "Resistance Measurements" procedure, steps 2 thru 4. Buzzer sounds when resistance is less than about 40 $\Omega$ .

- FREQUENCY MEASUREMENTS**
- Set the Function/Range switch to Hz for frequency measurements.
  - Connect the red test lead to the  $\rightarrow$  V  $\Omega$  Hz jack and the black test lead to the COM jack.
  - Connect the test leads to the point of measurement and read the frequency from the display.

- DIODE TEST**
- Set function switch to  $\rightarrow$  position.
  - Connect red test lead to the  $\rightarrow$  V  $\Omega$  Hz jack and black test lead to COM jack. Red lead is (+) polarity.
  - To check forward voltage (Vf), connect the red test lead to anode and the black test lead to the cathode of the diode. Diodes and semiconductor junctions with normal Vf of less than approximately 3.0 V can be checked.
  - Display indicates the 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 open diode reads approximately 3 V. A shorted diode reads near 0 V.
  - Reverse test lead connections to diode. Reading should be the same as with open test leads (approximately 3 V). Lower readings indicate a leaky diode.

Display: 3-3/4 digit liquid crystal display (LCD) with a maximum reading of 3999, 9999 for frequency.

Analog Bar Graph: 42 segments with measurements 20 times per second.

Polarity: Automatic (-) negative polarity indication.

Overrange Indication: OL or -OL is displayed.

Low Battery Indication: " " is displayed.

Sampling rate: 2 measurements per second, nominal, 1 time per second for capacitance and frequency measurements.

Temperature.  
Full Operation ..... 0 to +50°C <70% R.H.  
Storage ..... -20°C to 60°C at <80% R.H.

Power: 9V (NEDA 1604).

Battery life: 500 hours typical (alkaline).

Auto Power Off: Meter automatically shuts down after approx. 30 minutes of inactivity.

Dimensions (H x W x D): 7.8" x 3.6" x 1.7" (198 x 90 x 44 mm).

Weight: 14.1 oz. (400 g) including battery.

Supplied Accessories: Test leads (pair), battery, instruction manual.

**RANGE SELECTION**

- Autoranging mode is automatically selected when unit is turned on.
- To change ranges manually, momentarily depress RANGE button. "MANU" annunciator on display indicates that the meter is in the manual ranging mode. Press again to advance to next higher range.
- To return to autoranging mode, depress and hold RANGE button for one second or longer.
- If quantity to be measured is unknown start with highest range, or use autoranging mode.
- When an overrange is indicated (OL or -OL and a beep signal) switch to the next highest range.

**CAUTION**

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

**AUTO POWER OFF**

- The meter will automatically shut off if the Function/Range switch position is not changed within 30 minutes.
- The auto power off mode is activated with an "APO" symbol indicating on LCD.
- After auto power off, press any button on DMM (except HOLD button), or change range position of the rotary knob to turn the DMM back on again.
- Disable auto power off, set the DMM to off position, press any button (except the HOLD button) on DMM, and hold the button while turning the rotary knob to the desired range position. Release the button when LCD displays normally. Note "APO" annunciator is missing from the LCD.

**NOTE ON ANALOG BARGRAPH**

The analog bargraph feature is activated for measurements of voltage, current, resistance, frequency, and capacitance. Its update speed of 20 measurements/sec is 10 times that of the digital display. This makes it suitable for measuring coarse adjustments of these parameters, or indicating the direction of change of a varying quantity.

**VOLTAGE MEASUREMENTS**

- To measure dc voltage, set function switch to V  $\equiv$ .

**DATA HOLD**

Data hold can be used when making voltage, current, or frequency measurements. When switched to the ON position the display will freeze. The test leads can then be disconnected without affecting the data display.

**PEAK  $\pm$  HOLD**

Record the peak+ or peak- value in a measurement. It is usable with AC/DC voltage, AC/DC current measurements. If the pressed time >2 sec, the PEAK function will enter to calibration mode, the LCD will show "CAL" and the internal buffer will remember the internal OP off set voltage then back to the measure mode.

**Hz Button Sensitivity**

Minimum input range: More than 400 digits. The accuracy is same as frequency mode, the measuring frequency is from 40 Hz up to 1 kHz.

**RELATIVE**

When the REL  $\Delta$  button is pressed the present reading become the zero reading and all subsequent readings are displayed relative to this value. This function is cleared by pressing the REL  $\Delta$  button >1 sec which returns the meter to normal operation.

**MAX/MIN HOLD MODE**

- MAX/MIN mode will store and display the maximum or minimum values measured by the meter.
- Select the desired function (MAX/MIN is not operational in "Hz" function).
- Connect the meter to the point to be measured.
- To observe the minimum value recorded, momentarily depress the MAX/MIN button. The "MIN" annunciator will be displayed along with the minimum recorded reading. The meter will record and hold any new minimum that occurs during the measurement.
- To observe the maximum value recorded, momentarily depress the MAX/MIN button again. The "MAX" annunciator will be displayed along with the maximum recorded reading. The meter will record and hold any new maximum that occurs during the measurement.