

BK PRECISION®

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Instruction Manual

Model 2860A Digital Multimeter



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©1998 B&K Precision Corp.

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WARRANTY INFORMATION

LIMITED FIVE-YEAR WARRANTY

MAXTEC INTERNATIONAL CORPORATION warrants to the original purchaser that its **B+K Precision** Model 2860A "Survivor" Digital Multimeter will be free from defects in workmanship and materials for a period of five 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 **B+K Precision**, 6470 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.

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 sent 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.

OPTIONAL ACCESSORIES

Carrying Case	Model LC-29A
Replacement test leads	Model TL-1
Deluxe test leads	Model TL-2
Accessory tip kit (for TL-2)	Model TL-3
High voltage probe (40 kVDC)	Model PR-28
High voltage probe (6 kVDC)	Model HV-6
Temperature adapter, Type K thermocouple	Model TP-30

SYMBOLS



Do not exceed maximum ratings listed with this symbol.



High voltage terminal: up to 1500 volts may be present if connected to high voltage.

COM

Common input terminal.



Diode test.



Continuity buzzer.

1500V
MAX

Connect COM to earth ground or reference point. COM may be floated to a voltage point, but the float voltage plus the measured voltage must not exceed 1500 V.

1500V ---
1000V --
MAX

Maximum input rating of V-Ω → terminal with respect to COM input terminal or earth ground. (For voltage measurement functions only.)

200 mA MAX

Maximum input rating of mAμA terminal with respect to COM input terminal.

10A Cont.
20A 30 sec.

Maximum input rating of 20A terminal with respect to COM input terminal.

FEATURES

- Heavy duty 1500 V DC, 1000 VAC rating.
- Ruggedized construction.
- Water Resistant.
- Auto Power Off extends battery life.
- Withstands 5-foot drop.
- 3½ digit extra large (0.8" digits) high contrast LCD display.
- Designed to stringent IEC348 safety standards.
- Basic accuracy: DCV $\pm 0.5\%$.
- Resolution of 100 μV , 0.1 Ω , 0.1 μA .
- Single function and range control.
- Five dc voltage ranges: 200 mV to 1500 V.
- Five ac voltage ranges: 200 mV to 1000 V.
- Five dc current ranges: 200 μA to 200 mA and 20 A.
- Five ac current ranges: 200 μA to 200 mA, and 20 A.
- Six resistance ranges: 200 Ω to 20 M Ω .
- Diode test function: measures forward voltage drop.
- Audible continuity buzzer.
- Auto polarity, auto zero.
- Overrange indication on all ranges.
- High energy fused.
- Safety type test leads.
- Protective holster with probe holders for probe storage or one hand operation.
- Holster with tilt stand and wall hanger cutout.
- Non-slip grip.
- Non-skid rubber feet.

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	$\pm (0.5\% \text{ rdg} + 1 \text{ dgt})$	500 V peak
2 V	1 mV		
20 V	10 mV		
200 V	100 mV		
1500 V	1 V		

Input impedance 10 M Ω

AC VOLTS Manual ranging, average responding, rms reading

Range	Resolution	Accuracy	Overvoltage Protection
200 mV	100 μV	$\pm (1.25\% \text{ rdg} + 4 \text{ dgt})$ 40 Hz–500 Hz	500 V peak
2 V	1 mV		
20 V	10 mV		
200 V	100 mV		
1000 V	1 V		

Input impedance 10 M Ω

DC CURRENT Manual ranging

Range	Resolution	Accuracy
200 μA	0.1 μA	$\pm (1.0\% \text{ rdg} + 1 \text{ dgt})$
2 mA	1 μA	
20 mA	10 μA	
200 mA	100 μA	
20 A*	10 mA	$\pm (2.0\% \text{ rdg} + 3 \text{ dgt})$

Overload protection high energy 600 V fuse. 20 A unfused.

SPECIFICATIONS

AC CURRENT manual ranging, average responding, rms reading

Range	Resolution	Accuracy
200 μA	0.1 μA	$\pm (1.5\% \text{ rdg} + 3 \text{ dgt})$ 40–500 Hz
2 mA	1 μA	
20 mA	10 μA	
200 mA	100 μA	
20 A*	10 mA	$\pm (2.5\% \text{ rdg} + 4 \text{ dgt})$ 40–500 Hz

Overload protection high energy 600 V fuse. 20 A unfused.

* 10 A continuous; 20 A duty cycle on for 30 seconds maximum, off for 3 minutes minimum.

RESISTANCE Manual ranging

Range	Resolution	Accuracy
200 Ω	0.1 Ω	$\pm (0.75\% \text{ rdg} + 4 \text{ dgt})$
2 k Ω	1 Ω	
20 k Ω	10 Ω	$\pm (0.75\% \text{ rdg} + 1 \text{ dgt})$
200 k Ω	100 Ω	
2 M Ω	1 k Ω	
20 M Ω	10 k Ω	$\pm (1.5\% \text{ rdg} + 5 \text{ dgt})$

Overload protection high energy 600 V fuse. 20 A unfused.

CONTINUITY CHECK

Buzzer Threshold Approx. 100 Ω
Overload Protection 500 V DC/AC

DIODE CHECK

Range	Resolution	Max. Open Circuit Voltage
→	1 mV	3.2 V


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

GENERAL SPECIFICATIONS

Display. 3½ digit 0.8" liquid crystal display (LCD) with a maximum reading of 1999.

Polarity. Automatic, (–) negative polarity indication.

Overrange Indication. "1" or "–1"

Low Battery Indication.  Symbol displayed.

Sampling Rate. 2.5 measurements per second, nominal.

Temperature.

Full operation: 0 to 50° C, <80% R.H.

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

Power. Single standard 9V battery, NDEA 1604 or equivalent.

Auto Power Off. Approx. 30 minutes.

Battery Life. 250 hours typical (alkaline).

Dimensions. (H x W x D) 6-7/8" 3-1/2" x 1-1/2" (175 mm x 89 mm x 38 mm)


Weight. 12 oz. (345 g).

Supplied Accessories. Rubber holster, test leads (pair), 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.

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

	DC VOLTS	1500 V (dc + ac peak)
	AC VOLTS	1000 V rms
	OHMS	500 VDC or ACrms
	mA	200mA (fuse protected)
	20A	10A continuous, 20A up to 30 seconds (no fuse protection)
	COM	Float voltage plus measured voltage must not exceed 1500 V (dc + ac peak).

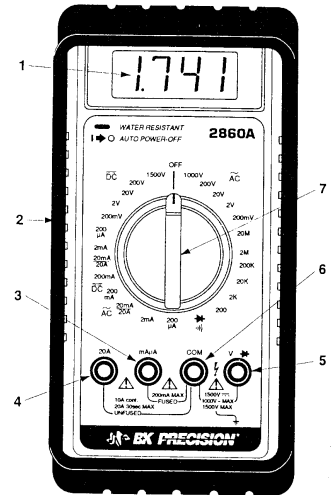
2. Never use the multimeter unless the case is closed.
3. Remove test leads before replacing batteries or fuses, and before performing any servicing on the multimeter.
4. Use only safety type test leads like those supplied with the multimeter.
5. Turn off equipment while making test connections in high-voltage 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. 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.

SAFETY

8. 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.
9. 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.
10. When using a probe, touch only the insulated portion. Never touch the exposed tip portion.
11. 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.
12. 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.
13. Never work alone. Someone should be nearby to render aid if necessary. Training in CPR (cardiopulmonary resuscitation) first aid is highly recommended.

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.
2. **Protective holster.**
3. **mA/μA Jack.** Input for dc or ac current up to 200 mA.
4. **20 A Jack.** Input for dc or ac current from 200mA to 20A.
5. **V-Ω → Jack.** Input for dc and ac voltage, resistance, continuity, or diode test.
6. **COM Jack.** Input for common or reference test lead for all measurements. Connect to earth ground or reference point. May be floated to a voltage point, but the float voltage plus the measured voltage must not exceed 1500 V from earth ground.
7. **Function/Range Switch.** Selects function and range, OFF, DC Volts (200 mV, 2 V, 20 V, 200 V, 1500 V), AC Volts (200mV, 2 V, 20 V, 200 V, 1000 V), DC Amps (200μA, 2mA, 20mA, 200mA, 20A), AC Amps (200μA, 2mA, 20mA, 200mA, 20A), → (diode test), → (continuity buzzer), or Ohm (200Ω, 2kΩ, 20kΩ, 200kΩ, 2MΩ, 20MΩ).
8. **Tilt Stand** (not shown, on rear).



AUTO POWER OFF

1. Turning the function switch from OFF to the desired range turns on the meter.
2. If the function switch position is not changed for approximately 30 minutes, the meter will automatically shut off.
3. The meter can be restarted by changing the function switch position.

RANGE SELECTION

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

VOLTAGE MEASUREMENTS

1. To measure dc voltage, set function switch to the desired $\overline{\text{---}}$ DC range.
2. To measure ac voltage, set function switch to the desired \sim AC range.
3. Connect red test lead to V- Ω \rightarrow 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- Ω \rightarrow jack and black test lead to COM jack. Red lead is (+) polarity.
4. Connect test leads to points of measurement.

OPERATING INSTRUCTIONS

CONTINUITY MEASUREMENTS

1. Set function switch to \rightarrow \rightarrow position.
2. Buzzer sounds when resistance is less than approximately 100 Ω .

DIODE TEST

1. Set function switch to \rightarrow \rightarrow position
2. Connect red test lead to V- Ω \rightarrow 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 1.6 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.

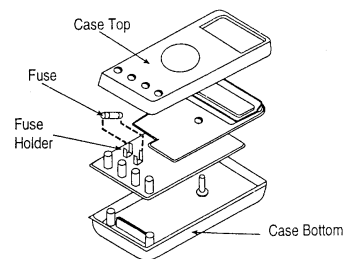
CURRENT MEASUREMENTS

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 20 A 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 $\overline{\text{---}}$ DC range.

2. To measure ac current, set the function switch to the desired \sim AC range.
3. For current measurements under 200 mA, connect the red test lead to the mA/ μ A jack and the black test lead to the COM jack.
4. For current measurements above 200 mA, connect the red test lead to the 20 A jack and the black test lead to the COM jack (set the Function/Range switch to the 20 mA/20 A 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 value from the display.



Battery and fuse replacement

MAINTENANCE

WARNING

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

BATTERY REPLACEMENT

The low battery 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 the three screws from the case back, unsnap the case bottom from the case top of the LCD end, and lift off the case back. Replace the battery with a fresh 9 volt "transistor" battery. Make sure the gaskets are properly seated and the two snaps on the case top are engaged when reassembling.

FUSE REPLACEMENT

If no current measurements are possible, check for blown overload protection fuse F1.

To replace the fuse, remove the case back as for battery replacement, and lift the circuit board from the case top (do not remove the screws from the circuit board). Replace the fuse only with the original type high energy 1A, 600V fuse. When reassembling, make sure the rotary switch knob and circuit board switch are both set to the OFF position. Make sure the gaskets are properly seated and the two snaps on the case top are engaged.

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 keep these areas free from dirt and corrosion. Use shrouded safety type replacement test leads.