

FEATURES

- True RMS reading.
- 4-1/2 digit LCD display with large 0.7" digits.
- Basic accuracy: DCV $\pm 0.05\%$.
- Resolution of 10 μ V, 10 nA, 0.01 Ω .
- Single function and range control.
- Auto power off prolongs battery life.
- Five dc voltage ranges: 200 mV to 1000 V.
- Five ac voltage ranges: 200 mV to 750 V.
- Five dc current ranges: 200 μ to 20 A.
- Five ac current ranges: 200 μ to 20 A.
- Six resistance ranges: 200 Ω to 20 M Ω .
- Logic probe functions: indicate logic high or low.
- Diode test function: measures forward voltage drop.
- Visual and audible continuity tester.
- Data hold function freezes value on display.
- Auto polarity, auto zero.
- Overrange indication on all ranges.
- High energy fuses.
- Fused 20 A range.
- Safety type test leads.
- Shock resistant case in holster withstands 10-foot drop.
- Tilt stand. Hanger strap.

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INSTRUCTION MANUAL

MODEL 391



- 4-1/2 Digits
- True RMS
- Multimeter
- Frequency Counter
- Logic Probe
- Duty Cycle Tester
- Diode Tester
- Continuity Tester

TEST BENCH®
Hand-held Multifunction Instrument

BK PRECISION®

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

DC VOLTS Manual ranging.

| Range | Resolution | Accuracy | Overvoltage Protection |
|--------|-------------|--|------------------------|
| 200 mV | 10 μ V | $\pm (0.05\% \text{ rdg} + 3 \text{ dgt})$ | 500 VDC or peak AC |
| 2 V | 100 μ V | | 1200 VDC or peak AC |
| 20 V | 1 mV | | |
| 200 V | 10 mV | | |
| 1000 V | 100 mV | | |

Input Impedance 10 M Ω
 Normal Mode Rejection Greater than 50 dB (50/60 Hz)
 Common Mode Rejection Greater than 100 dB (50/60 Hz)

AC VOLTS Manual ranging. True RMS, AC Coupled

| Range | Resolution | Accuracy (50 Hz to 500 Hz) | Accuracy (50 Hz to 2 kHz) | Overvoltage Protection |
|--------|-------------|--|--|------------------------|
| 200 mV | 10 μ V | $\pm (1.0\% \text{ rdg} + 10 \text{ dgt})$ | $\pm (2.0\% \text{ rdg} + 20 \text{ dgt})$ | 500 VDC or peak AC |
| 2 V | 100 μ V | | | 1200 VDC or peak AC |
| 20 V | 1 mV | | | |
| 200 V | 10 mV | | | |
| 750 V | 100 mV | | | |

Input Impedance 10 M Ω less than 100 pF
 Crest Factor 3

DC CURRENT Manual ranging.

| Range | Resolution | Accuracy | Burden Voltage |
|-------------|------------|--|----------------|
| 200 μ A | 10 nA | $\pm (0.5\% \text{ rdg} + 5 \text{ dgt})$ | 600 mV max. |
| 2 mA | 100 nA | | |
| 20 mA | 1 μ A | | |
| 200 mA | 10 μ A | $\pm (0.5\% \text{ rdg} + 10 \text{ dgt})$ | 900 mV max. |
| 20 A | 1 mA | | |

Overload Protection 0.5 A (600 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 60 sec. max.

AC CURRENT Manual ranging. True RMS, AC Coupled.

| Range | Resolution | Accuracy (50 Hz to 1 kHz) | Burden Voltage |
|-------------|-------------|--|-----------------|
| 200 μ A | 10 nA | $\pm (0.8\% \text{ rdg} + 10 \text{ dgt})$ | 600 mV rms max. |
| 2 mA | 100 nA | | |
| 20 mA | 10 μ A | | |
| 200 mA | 100 μ A | $\pm (1.5\% \text{ rdg} + 20 \text{ dgt})$ | 900 mV rms max. |
| 20 A | 1 mA | | |

Overload Protection 0.5 A (600 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 60 sec. max.

SPECIFICATIONS

RESISTANCE Manual ranging.

| Range | Resolution | Accuracy | Max Open Circuit Voltage |
|----------------|---------------|--|--------------------------|
| 200 Ω | 10 m Ω | $\pm (0.2\% \text{ rdg} + 10 \text{ dgt})$ | 3.3 V |
| 2 k Ω | 0.1 Ω | $\pm (0.15\% \text{ rdg} + 3 \text{ dgt})$ | |
| 20 k Ω | 1 Ω | | |
| 200 k Ω | 10 Ω | $\pm (0.25\% \text{ rdg} + 3 \text{ dgt})$ | |
| 2 M Ω | 100 Ω | | |
| 20 M Ω | 1 k Ω | $\pm (1.0\% \text{ rdg} + 10 \text{ dgt})$ | |

Overload Protection 500 VDC or peak AC

FREQUENCY COUNTER Manual ranging.

| Range | Resolution | Accuracy | Sensitivity (sine wave) | Min Input Freq. |
|---------|------------|---|---|------------------------------------|
| 2 kHz | 0.1 Hz | $\pm (0.5\% \text{ rdg} + 3 \text{ dgt})$ | 50 mV rms 100 mV rms for 100 kHz and higher. | > 10 Hz at pulse width > 2 μ s |
| 20 kHz | 1 Hz | | | |
| 200 kHz | 10 Hz | | | |

Sensitivity at >30% and < 70% duty cycle: 400 mV rms
 Overvoltage Protection 500 V DC or peak AC

DUTY CYCLE

| Range | Resolution | Pulse Width | Accuracy (5V Logic) |
|------------|------------|--------------|--|
| 0 to 90.0% | 0.1% | > 10 μ s | $\pm (1.0\% \text{ rdg} + 10 \text{ dgt})$ |

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. |
| 1000 V MAX 750 V | Maximum input rating of V-Ω terminal with respect to COM input terminal. |
| | Continuity test. |
| V | ACV. |
| V | DCV. |
| A | ACA. |
| A | DCA. |

OPTIONAL ACCESSORIES

| | |
|--|-------------|
| 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 Adapter, semiconductor type | Model TP-28 |
| Temperature Adapter, Type K thermocouple | Model TP-30 |

OPERATING INSTRUCTIONS

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.

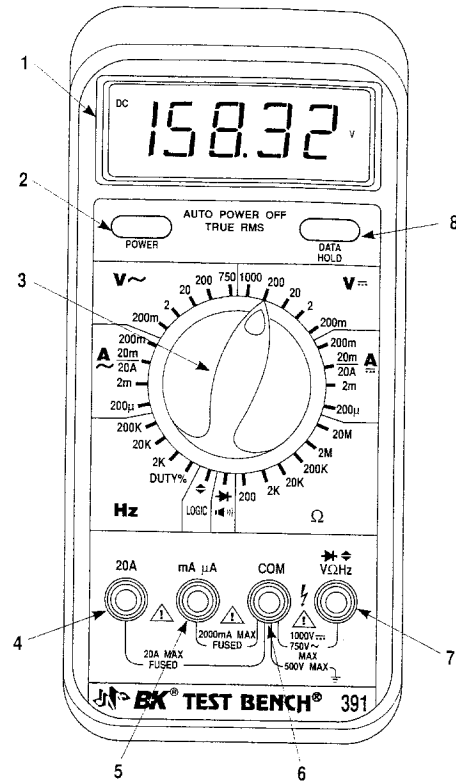
- To measure dc current, set the function switch to the desired A range.
- To measure ac current, set the function switch to the desired A range.
- For current measurements under 200 mA, connect the red test lead to the mA/μA jack and the black test lead to the COM jack.
- For current measurements above 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 A position). For current measurements greater than 3 A, high current test leads are recommended.
- 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.

LOGIC MEASUREMENTS

- Set the function switch to LOGIC position.
- Connect red test lead to VΩ Hz jack.
- Connect black test lead to COM jack.

CONTROLS AND INDICATORS

- Display.** 4-1/2 digit display (19999 maximum) with automatic decimal point, high and low logic indicators, (-) sign and low battery. Indicates measured value and whether dc or ac is selected (for current and voltage readings).
- POWER Switch.** Turns instrument on and off.
- Function/Range Switch.** Selects function and range: V~ (200 mV, 2 V, 20 V, 200 V, or 750 V), V (200 mV, 2 V, 20 V, 200 V, or 1000 V), A (200 μA, 2 mA, 20 mA/20 A, or 200 mA), Ω (200 Ω, 2 kΩ, 20 kΩ, 200 kΩ, 2 MΩ, or 20 MΩ), LOGIC, (or) Hz (DUTY %, 2 kHz, 20 kHz, 200 kHz), or A (200 μA, 2 mA, 20 mA/20 A, or 200 mA).
- 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 μA Jack.** Input for dc or ac current up to 200 mA.
- 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.
- VΩ Hz.** Input for dc or ac diode, logic, voltage, resistance, or frequency.
- DATA HOLD Switch.** Selects data hold.



- Connect black test lead to circuit ground.
- Connect red test lead to point of logic test.
- A arrow (HI) indicates high logic level. A arrow (LO) indicates low logic level. A high logic level will also have an audio tone. When both indicators are on, the point of measurement is toggling between HI and LO.

FREQUENCY OR DUTY CYCLE MEASUREMENTS

- Set the Function/Range switch to the desired Hz frequency range for frequency measurements or DUTY % for duty cycle measurement.
- Connect the red test lead to the VΩ Hz jack and the black test lead to the COM jack.
- Connect the test leads to the point of measurement and read the frequency or duty cycle % from the display.

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.

LEAD STORAGE

The holster provides a means of storing the test leads when not in use. Refer to Figure 1 and proceed as follows:

- 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.
- Press the leads into the lead slots to prevent the leads from unwrapping.

- Wrap both test leads together in the storage channel near the bottom of the holster leaving about a foot of test lead.
- Turn the unit over, then plug the end of the test leads into the COM and VΩ Hz connectors on the front of the unit.

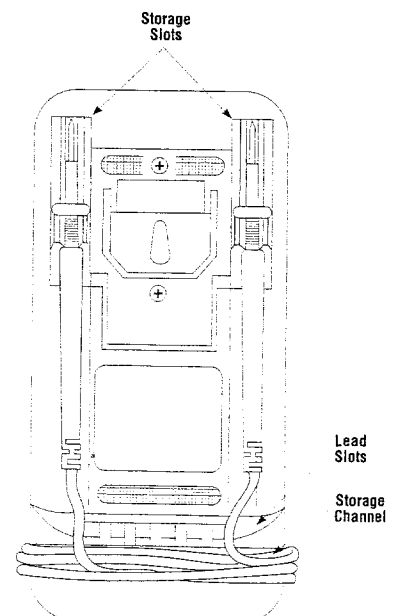



Figure 1.

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.

1. Remove rubber holster.
2. Remove two screws from back of unit securing the tilt stand assembly.
3. Remove tilt stand assembly.
4. Remove two screws securing case back, then carefully lift back off to gain access to battery.
5. Replace the dead battery with a fresh 9 volt "transistor" battery. 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 making measurements.
6. Reinstall back cover, tilt stand assembly and holster.


FUSE REPLACEMENT

If no current measurements are possible, check for a blown overload protection fuse. There are two fuses; F1 for the mA/ μ A input and F2 for the 20A input. For access to fuses, remove the case back as described for battery replacement, then lift off the case front. Replace F1 only with the original type 0.5A, 600V, fast acting ceramic fuse (B+K Precision Part No. 194-045-9-001). Replace F2 only with the original type 20 A, 600 V, fast acting ceramic fuse (B+K Precision Part No. 194-043-9-001). When reassembling the case, make sure the rotary knob on the case front properly aligns with the switch mechanism on the circuit board assembly.

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 exist at the test receptacles and fuseholder, and keep these areas free from dirt and corrosion.

DIODE CHECK

| Range | Resolution | Accuracy | Max Test Current | Max Open Circuit Voltage |
|---|------------|---|------------------|--------------------------|
|  | 0.1 mV | $\pm (0.5\% \text{ rdg} + 1.0 \text{ dgt})$ | 1.0 mA | 3.3 VDC |

Overload Protection 500 V DC or peak AC

CONTINUITY TEST

| Range | Response Time | Description | Max Open Circuit Voltage |
|---|----------------|--|--------------------------|
|  | Approx. 100 ms | Buzzer sounds below approx. 150 Ω | 3.3 VDC |

Overload Protection 500 V DC or peak AC

LOGIC LEVEL

LCD Displays Number "1" when selected

- Test voltage 5 V DC
- Detector AC coupled
- Logic Threshold
- Logic 1 (high) 2.8 V \pm 0.8 V
- Logic 0 (low) 0.8 V \pm 0.5 V
- Duty Cycle >20% and <80%
- Indications 40 ms beep at logic high
- Pulse Width 25 ns min.
- Pulse Rep Rate 1 Mpps max.
- Pulse Rise Time 10 μ s max.
- Input Impedance 120 k Ω /100 pF
- Input Overvoltage Protection 500 V DC or peak AC

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, 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 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 products which it sells.

GENERAL SPECIFICATIONS

Display: 4-1/2 digit liquid crystal display (LCD) with a maximum reading of 19999.

Polarity: Automatic (-) negative polarity indication.

Overrange Indication: "1" or "-1".

Low Battery Indication:  displayed.

Sampling rate: 2.5 measurements per second, nominal, 1 time per second for frequency measurements.

Temperature.

Full Operation 0 to +50°C <70% R.H.

Power: Single standard 9V battery, NEDA 1604.

Battery life: 500 hours typical (alkaline).

Auto Power off: Meter automatically shuts down after approx. 45 minutes of inactivity.

Dimensions (H x W x D): 7.5" x 3.4" x 1.5" (189 mm x 87 mm x 37 mm).

Weight: 12.9 oz. (370 g) including battery.

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