SUPER COUPON

FREE

WITH ANY PURCHASE

CEN-TECH

7 FUNCTION DIGITAL MULTIMETER

- 3.5" LCD Display
- Battery Included

COMPARE TO PROSKIT MODEL: MT-1210 $13.51

ITEM 63604/63758
98025/69096/63759/90899 shown

LIMIT 1 - Cannot be used with other discount, coupon or prior purchase. Coupon good at our stores, HarborFreight.com or by calling 800-423-2567. Offer good while supplies last. Shipping & Handling charges may apply if not picked up in-store. Non-transferable. Original coupon must be presented. Valid through 3/19/18. Limit one FREE GIFT coupon per customer per day.

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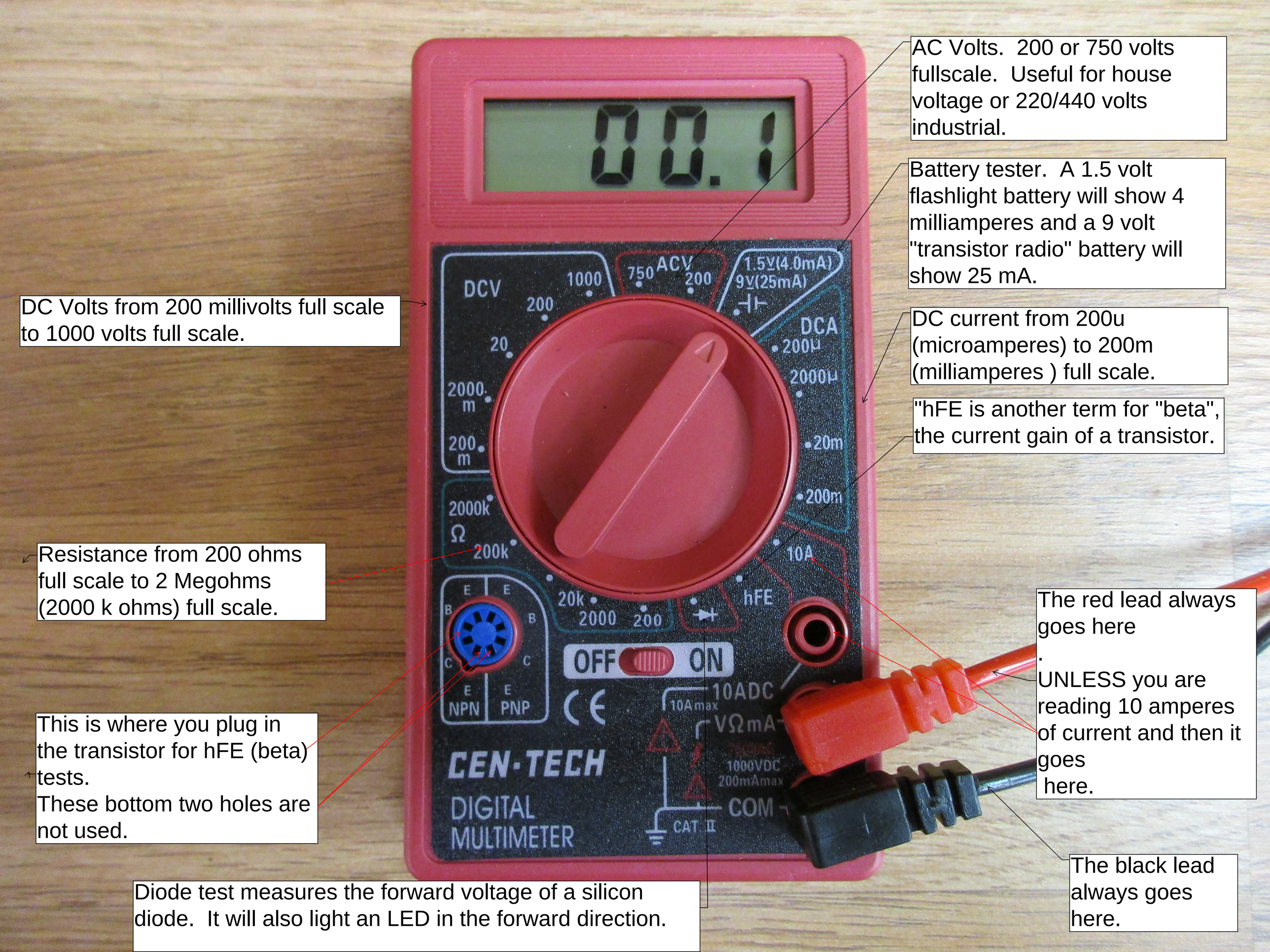


AC Volts. 200 or 750 volts fullscale. Useful for house voltage or 220/440 volts industrial.

Battery tester. A 1.5 volt flashlight battery will show 4 milliamperes and a 9 volt "transistor radio" battery will show 25 mA.

DC Volts from 200 millivolts full scale to 1000 volts full scale.

DC current from 200u (microamperes) to 200m (milliamperes) full scale.

"hFE is another term for "beta", the current gain of a transistor.

Resistance from 200 ohms full scale to 2 Megohms (2000 k ohms) full scale.

The red lead always goes here

.

UNLESS you are reading 10 amperes of current and then it goes here.

This is where you plug in the transistor for hFE (beta) tests.
These bottom two holes are not used.

The black lead always goes here.

Diode test measures the forward voltage of a silicon diode. It will also light an LED in the forward direction.

CEN-TECH®

SEVEN FUNCTION DIGITAL MULTIMETER

Model 98025

SET UP AND OPERATING INSTRUCTIONS

Distributed exclusively by Harbor Freight Tools®.

3491 Mission Oaks Blvd., Camarillo, CA 93011

Visit our website at: http://www.harborfreight.com

Read this material before using this product. Failure to do so can result in serious injury. SAVE THIS MANUAL.

Copyright© 2008 by Harbor Freight Tools®. All rights reserved. No portion of this manual or any artwork contained herein may be reproduced in any shape or form without the express written consent of Harbor Freight Tools. Diagrams within this manual may not be drawn proportionally. Due to continuing improvements, actual product may differ slightly from the product described herein. Tools required for assembly and service may not be included.

For technical questions or replacement parts, please call 1-800-444-3353.

SAVE THIS MANUAL

Keep this manual for the safety warnings and precautions, assembly, operating, inspection, maintenance and cleaning procedures. Write the product's serial number in the back of the manual near the assembly diagram (or month and year of purchase if product has no number). Keep this manual and the receipt in a safe and dry place for future reference.

IMPORTANT SAFETY INFORMATION

In this manual, on the labeling, and all other information provided with this product:

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠DANGER **DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.**

⚠WARNING **WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.**

⚠CAUTION **CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**

NOTICE **NOTICE is used to address practices not related to personal injury.**

CAUTION **CAUTION, without the safety alert symbol, is used to address practices not related to personal injury.**

General Safety Rules

WARNING Read all safety warnings and instructions. *Failure to follow the warnings and instructions may result in electric shock, fire and/or serious injury.* **Save all warnings and instructions for future reference.**

1. Electrical shock can cause death or injury! NEVER TOUCH exposed conductors of electricity.
2. Inspect the Multimeter before use. In addition to a general inspection, look specifically for:
   a. Pay special attention to the insulation protecting the connectors.
   b. Check the leads for exposed metal, damaged insulation, and continuity.
   c. Replace damaged test lead immediately, before use.
3. Do not use the multimeter if:
   a. The test lead is damaged in any way.
   b. The battery is low.
   c. Near any explosive gasses or fumes.
   d. Any abnormal operation is detected.
   (If in doubt about the condition of the meter, have it serviced.)
   e. The battery cover is open.

4. This meter should be powered only by a single, correctly installed 9V battery.
5. Use caution when working near voltages above 30 VAC rms, 42 VAC peak, or 60 VDC. Voltages this high present a risk of electric shock.
6. Disconnect the circuit's power before connecting the meter in series, when measuring current.
7. Connect the common (COM) test lead first and disconnect it last.
8. Hold the probes with fingers behind guards.
9. Avoid electrical shock. Use extreme caution when working near uninsulated conductors or bus bars. Prevent body contact with grounded surfaces such as pipes, radiators, ranges, and cabinet enclosures when testing voltages.
10. Observe work area conditions. Do not test voltages in damp or wet locations. Don't expose to rain. Keep work area clean and well lit.
11. Keep children away. Children must never be allowed in the work area.
12. Stay alert. Watch what you are doing, use common sense. Do not operate any meter when you are tired.
13. Do not operate meter if under the influence of alcohol or drugs. Read warning labels on prescriptions to determine if your judgment or reflexes are impaired while taking drugs. If there is any doubt, do not operate the meter.
14. Due to the danger inherent in such work, we strongly recommend that only a licensed electrician work on high-voltage or other potentially dangerous circuits.
15. This product contains or produces chemicals, including lead, known to the State of California to cause cancer and birth defects (or other reproductive harm).
(California Health & Safety Code § 25249.5, et seq.)
16. Do not test voltage on circuits higher than 750 volts AC or 1000 volts DC. This type of testing should only be done by a qualified electrician.
17. Do not test current on circuits higher than 200 mA.
18. Store idle equipment. When not in use, meters must be stored in a dry location to decrease exposure to moisture. Lock up meters and keep out of reach of children.
19. Dress properly. Protective, electrically nonconductive clothes and nonskid footwear are recommended when working.
20. Wear ANSI-approved impact safety goggles.
21. Only use accessories intended for use with this meter.
22. The warnings, cautions, and instructions discussed in this instruction manual cannot cover all possible conditions and situations that may occur. It must be understood by the operator that common sense and caution are factors which cannot be built into this product, but must be supplied by the operator.
23. Avoid damaging meter. Use only as specified in this manual.
24. Prior to testing, resistance, diodes, or continuity; disconnect all power to the circuit and discharge all high-voltage capacitors.

25. Performance of this meter may vary depending on battery condition.

26. Use the proper settings, terminals, techniques, and range for the tests performed. Always start with the range stated in the instructions.

27. Do not apply voltage to the Test Leads when the Multimeter is in the Ohms testing setting. Damage can occur to the multimeter.

28. Do not switch between testing modes with the multimeter connected to a circuit.

29. Never attempt to use the meter at a setting combination marked as blank on the scale.

30. Prior to testing capacitors, resistance, diodes, or continuity; disconnect all power to the circuit and discharge all high-voltage capacitors.

31. Check fuse before testing current.

32. Use the proper settings, terminals, techniques, and range for the tests performed. Always start with the range stated in the instructions.

33. Have the Multimeter calibrated by a qualified technician every year. A multimeter that is not calibrated yearly will not yield accurate results.

SAVE THESE INSTRUCTIONS.

SPECIFICATIONS

Power Requirements	9V Battery
Frequency	45 to 450 Hz
DC Amps	Ranges: 200mA/2000mA/ 20mA/ 10A
Accuracy	(@0mA-200mA) 1.2%±2D; (@10A) 3%±2D
DC Voltage	Ranges: 200mV/2000mV 20/200/1000V
Accuracy	(@200mV) 0.5%±1D (@2000mV-200V) 1%±2D (@1000V) 1%±2D
AC Voltage	Ranges: 200/750V
Accuracy	(45-450 Hz) 1.2%±10D
Resistance	Ranges: 200/2000/20K/ 200K/2000K Ohm

UNPACKING

When unpacking, check to make sure that the item is intact and undamaged. If any parts are missing or broken, please call Harbor Freight Tools at the number shown on the cover of this manual as soon as possible.

OPERATING INSTRUCTIONS

Read the ENTIRE IMPORTANT SAFETY INFORMATION section at the beginning of this manual including all text under subheadings therein before set up or use of this product.

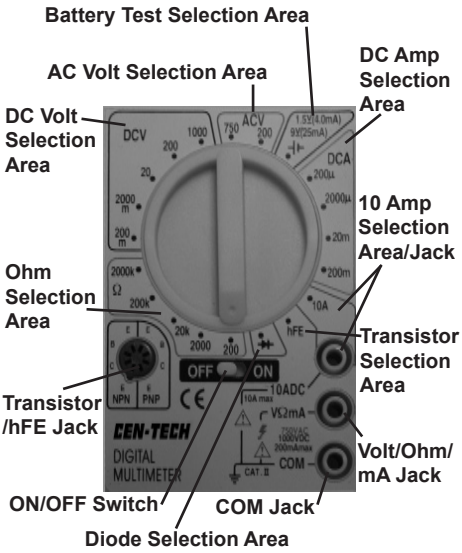
WARNING **TO PREVENT SERIOUS INJURY FROM ACCIDENTAL OPERATION: ELECTRICAL SHOCK CAN CAUSE DEATH OR INJURY. AVOID TOUCHING EXPOSED CONDUCTORS OF ELECTRICITY.**

Do not test voltage on AC circuits higher than 750 volts.

Do not test voltage on DC circuits higher than 1000 volts.

Do not test current on circuits higher than 10 amps.

1. Disconnect Test Leads. Use a screwdriver to remove both screws on the rear of the unit. Observe polarity, and attach a 9V battery to the posts. Replace and secure the cover.



2. Do not apply voltage to the Test Leads when they are connected to the COM (Bottom) and VWmA (Center) Jacks and the Multimeter is in an Ohms testing setting. Damage can occur to the multimeter or the fuse may blow.

3. Do not switch between testing modes with the multimeter connected to a circuit.

AC Voltage Measurements

1. Measure AC conductors carrying up to 750 VAC, 45-450 Hz.

2. Turn the Range Selector Switch to 750 ACV setting. Always start with the highest range if the voltage is unknown.

3. Plug the red lead into the VWmA (Center) Jack. Plug the black lead into the COM (Bottom) Jack. Switch the Multimeter ON.

4. Carefully touch the exposed conductors with the tips of the probes to measure the voltage (not amperes).

5. Read measurement.

6. If the voltage is less than 200 volts, set the Range Selector Switch to the lower range.

7. When testing is complete, remove Test Leads and store with multimeter.

DC Voltage Measurements

1. Measure DC conductors carrying up to 1000 VDC.

2. Turn the Range Selector Switch to 1000 DCV setting.

3. Follow the directions above under “AC Voltage Measurements”, only use the DC settings instead.

DC Current Measurements

1. Measure DC conductors carrying up to 10 amperes.

2. Turn the Range Selector Switch to the 10A position.

3. Always start with the highest range if the amperage is unknown.

4. Plug the red lead into the 10A (Top) Jack. Plug the black lead into the

COM (Bottom) Jack. Switch the Multimeter ON.

5. Carefully touch the exposed conductors with the tips of the probes to measure the amperage.

Note: Amperage is always tested in series with the circuit under test.

6. Read measurement.

7. If the reading is less than .2 AMPs, switch the red lead to the VWmA (Center) Jack and set the Range Selector Switch to the 200 mA setting.

8. When testing is complete, remove Test Leads and store with multimeter.

Resistance Measurements

1. Measure circuit resistance up to 2000K Ohms.

2. Warning: Never measure resistance on a circuit with voltage running through it.

3. Turn the Range Selector Switch to the 200 W position.

4. Plug the red Test Lead into the VWmA (Center) Jack. Plug the black Test Lead into the Com (Bottom) Jack. Switch the Multimeter ON.

5. Short the Test Leads together. The meter should read “0” Ohms.

6. Touch the exposed conductors with the tips of the Test Leads.

7. Read measurement.

8. If the reading is “1”, set the Range Selector Switch to the next higher Ohm (W) position.

Transistor (hFE) Measurements

1. Test transistors to ensure proper function.

2. Turn the Range Selector Switch to the hFE position.

3. Switch the Multimeter ON.

4. Insert the transistor pins into the appropriate hFE jack (NPN or PNP) according to the EBC (Emitter, Base, Collector) sequence.

5. The meter will show the approximate hFE value.

Diode Measurement

1. Test the voltage drop in diodes.

2. Turn the Range Selector Switch to the Diode (→|–) position.

3. Plug the red Test Lead into the VWmA (Center) Jack. Plug the black Test Lead into the Com (Bottom) Jack. Switch the Multimeter ON.

4. Connect the red probe to the anode of the diode and the black to the cathode.

5. The approximate forward voltage drop of the diode will be displayed in mV. If the connection is reversed only “1” will be shown.

Battery Charge Measurement

1. Test the amount of charge left in batteries.

NOTE: This setting is for testing the charge of small 9V or 1.5V batteries only. Never use this setting to test automotive or lead-acid batteries. **The high current could cause damage to the meter and/or cause severe personal injury.** Use the appropriate DC Voltage setting to test the open circuit voltage of such batteries instead.

2. Turn the Range Selector Switch to the Battery (⊣|–) position.

3. Plug the red Test Lead into the VWmA (Center) Jack. Plug the black Test Lead into the Com (Bottom) Jack. Switch the Multimeter ON.
4. Connect the red probe to the positive terminal of the battery and the black to the negative terminal.
5. The battery amperage under a load of 370 mW will be displayed to a resolution of .1mA.
6. Normal amperage:
   For a standard 9V (6LR61) battery = 25 mA
7. For a 1.5 V “AA” (LR6) battery = 4 mA
8. To prevent accidents, turn off the tool and disconnect its power supply after use. Clean, then store the tool indoors out of children’s reach.User-Maintenance Instructions

Procedures not specifically explained in this manual must be performed only by a qualified technician.

⚠WARNING **TO PREVENT SERIOUS INJURY FROM ACCIDENTAL OPERATION:**
Turn the Power Switch of the tool to its “OFF” position and remove the test leads before performing any inspection, maintenance, or cleaning procedures.

Cleaning, Maintenance, and Lubrication

1. **BEFORE EACH USE,** inspect the general condition of the tool. Check for loose screws, misalignment or binding of moving parts, cracked or broken parts, damaged electrical wiring, and any other condition that may affect its safe operation.
2. **AFTER USE,** clean external surfaces of the tool with clean cloth.
3. Replace battery as necessary.
4. No replaceable parts.

LIMITED 90 DAY WARRANTY

Harbor Freight Tools Co. makes every effort to assure that its products meet high quality and durability standards, and warrants to the original purchaser that this product is free from defects in materials and workmanship for the period of 90 days from the date of purchase. This warranty does not apply to damage due directly or indirectly, to misuse, abuse, negligence or accidents, repairs or alterations outside our facilities, criminal activity, improper installation, normal wear and tear, or to lack of maintenance. We shall in no event be liable for death, injuries to persons or property, or for incidental, contingent, special or consequential damages arising from the use of our product. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation of exclusion may not apply to you. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS.

To take advantage of this warranty, the product or part must be returned to us with transportation charges prepaid. Proof of purchase date and an explanation of the complaint must accompany the merchandise. If our inspection verifies the defect, we will either repair or replace the product at our election or we may elect to refund the purchase price if we cannot readily and quickly provide you with a replacement. We will return repaired products at our expense, but if we determine there is no defect, or that the defect resulted from causes not within the scope of our warranty, then you must bear the cost of returning the product.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

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If you are making any measurement, selecting "MAX" will hold the meter at the largest measurement that you have made.

There is a "hold" button that keeps the current meter reading until you release the hold.

This multimeter has a voltage function much as the little HF voltmeter, but it has an AC/DC pushbutton to change from AC voltage to DC voltage.

The ammeter measures currents from 400 microamps to 20 amps full scale. If you have the probes in the current socket(s) the meter will buzz if you select any other function.

You can read the frequency of the AC signal directly in kilohertz.

Here you can test beta (hFE) of transistors, both pnp and npn. The transistor socket is a little easier to use than the HF meter

This function tells you "high" or "low" digital signals in a 5 volt logic circuit

You can test both silicon and LEDs here.

This ohmmeter measures resistance from 400 ohms full scale to 40 Megohms full scale.

This is a buzzer that will sound when the resistance between the test leads is less than 100 ohms.

This will measure the capacitance from 1 picofarad to 40 microfarads. THe capacitor must be placed in THIS connector

The red lead goes HERE for all functions except current, when it goes HERE or HERE

Instruction Manual

Model 388B Test Bench® Handheld Digital Multimeter

CE

B+K PRECISION®

1031 Segovia Circle
Placentia, CA 92870-7137
USA
TEL: 714-237-9220
FAX: 714-237-9214
www.bkprecision.com

P/N: 481-318-9-001
Printed in Taiwan
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FEATURES

- Complete Handheld Test Bench
- 11 Functions, 41 Ranges.
- Auto power off extends battery life.
- Five dc voltage ranges: 400 mV to 1000 V.
- Five ac voltage ranges: 400 mV to 750 V.
- Six dc current ranges: 400 µA to 20 A.
- Six ac current ranges: 400 µA to 20 A.
- Six resistance ranges: 400 Ω to 40 MΩ.
- Five capacitance ranges: 4 nF to 40 µF.
- Four autoranging frequency ranges: 4 kHz to 4 MHz.
- hFE transistor test function; measures dc gain (hFE) of NPN and PNP transistors.
- Logic probe function: indicates logic high or logic low for TTL circuitry.
- Diode test function; measures forward voltage drop.
- Audible continuity buzzer.
- Audible warning buzzer if probe inserted into wrong jack.
- Extra large, easy to read 3-3/4 digit display with annunciators for polarity, decimal, frequency, ac/dc, capacitance, and low battery.
- Basic accuracy: ±0.5% (DCV).
- Resolution of 100 µV, 0.1 µA, 0.1 Ω, 1 pF, 1 Hz.
- Auto polarity, auto zero.
- Overrange indication on all ranges.
- Overload protection.
- High energy fuses.
- Fused 20 A range.
- Safety type test leads.
- Tilt stand.
- Hanger strap
- Protective holster (withstands 10 ft drop on concrete).
- Built-in probe storage.

SAFETY

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.

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

DC VOLTS	1000 V (dc + ac peak)
	500 V (dc + ac peak) on 400 mV range
AC VOLTS	750 V rms
	500 V (dc + ac peak) on 400 mV range
⚠ OHMS	500 V (dc + ac peak)
mA µA	2000 mA (fuse protected)
20 A	10 A continuous, 20 A for 60 seconds max
COM	Do not float more than 500 volts from earth ground.

2. Remove test leads before replacing batteries or fuses and before performing any servicing on the instrument.
3. Use only the safety type test leads supplied with the instrument.
4. Turn off equipment while making test connections in high voltage circuits. Discharge high voltage capacitors after removing power.
5. For voltage or current measurements in high voltage equipment, do not touch equipment, meter or test leads while power is applied.
6. Never apply an external signal to the Cx or hFE input jacks. Damage to the meter will result.
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.
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, in 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.
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.

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.

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

FUSE REPLACEMENT

If no current measurements are possible, check for a blown overload protection fuse. There are two fuses; F1 for the mA/µA jack and F2 for the 20 A jack. 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 be used for the µA/mA jack fuse by inserting the probe in the µA/mA jack and setting the function switch to any position other than the OFF, µA or mA positions. For access to fuses, remove the case back as described for battery replacement. Replace F1 only with the original type 2 A, 600 V, fast acting ceramic fuse (**B+K Precision** Part No. 194-044-9-001). Replace F2 only with the original type 20 A, 600 V, fast acting ceramic fuse (**B+K Precision Part** No. 194-043-9-001).

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

SPECIFICATIONS

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

DC VOLTAGE Manual ranging.

Range	Resolution	Accuracy	Over voltage Protection
400 mV	100 µV	± (0.5 % rdg + 1 dgt)	500 VDC or peak AC
4 V	1 mV		1000 VDC or peak AC
40 V	10 mV		
400 V	100 mV		
1000 V	1 V		

Input Impedance ..... 20 MΩ
Normal Mode Rejection ..... Greater than 50 dB (50/60 Hz)
Common Mode Rejection ..... Greater than 100 dB (50/60 Hz)

AC VOLTAGE Manual ranging. Average responding, rms reading.

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

Input Impedance ..... 20 MΩ/less than 100 pF

DC CURRENT Manual ranging.

Range	Resolution	Accuracy	Burden Voltage
400 µA	0.1 µA	± (1.0 % rdg + 1 dgt)	600 mV max.
4 mA	1 µA		
40 mA	10 µA		
400 mA	100 µA		
2000 mA	1 mA	± (1.5 % rdg + 1 dgt)	900 mV max.
* 20 A	10 mA	± (2.0 % rdg + 3 dgts)	

Overload Protection ..... 2 A (600 V) fast blow ceramic fuse and 20 A (600 V) fast blow ceramic fuse.
* 20 A Range Maximum Current ..... 10 A continuous, 20 A for 60 sec. max.

AC CURRENT Manual ranging. Average responding rms reading.

Range	Resolution	Accuracy (50 Hz to 500 kHz)	Burden Voltage
400 µA	0.1 µA	± (1.5 % rdg + 4 dgts)	600 mV rms max.
4 mA	1 µA		
40 mA	10 µA		
400 mA	100 µA		
2000 mA	1 mA	± (2.0 % rdg + 4 dgts)	900 mV rms max.
* 20 A	10 mA	± (2.5 % rdg + 4 dgts)	

Overload Protection ..... 2 A (600 V) fast blow ceramic fuse and 20 A (600 V) fast blow ceramic fuse.
* 20 A Range Maximum Current ..... 10 A continuous, 20 A for 60 sec. max.

RESISTANCE Manual ranging.

Range	Resolution	Accuracy	Max Open Circuit Voltage
400 Ω	0.1 Ω	± (1.0 % rdg + 4 dgts)	3.2 V
4 kΩ	1 Ω	± (0.75 % rdg + 4 dgts)	0.6 V
40 kΩ	10 Ω		
400 kΩ	100 Ω		
4 MΩ	1 kΩ		
40 MΩ	10 kΩ	± (2.0 % rdg + 5 dgts)	

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

CAPACITANCE Manual ranging.

Range	Resolution	Accuracy	Test Frequency
4 nF	1 pF	± (3.0 % rdg + 4 dgts)	180 Hz
40 nF	10 pF		
400 nF	100 pF		
4 µF	1 nF		
40 µF	10 nF		

FREQUENCY COUNTER Auto ranging.

Range	Resolution	Accuracy	Sensitivity
4 kHz	1 Hz	± (0.1 % rdg + 2 dgts)	250 mV rms (10 Hz to 1 MHz) 500 mV rms (1 MHz to 4 MHz)
40 kHz	10 Hz		
400 kHz	100 Hz		
4000 kHz	1 kHz		

Overvoltage Protection ..... 500 V DC or peak AC
Duty Cycle ..... at >30% and <70%

DIODE CHECK

Range	Resolution	Accuracy	Max Test Current	Max Open Circuit Voltage
⏩	1 mV	± (1.5 % rdg + 1 dgt)	1.0 mA	3.2 V DC

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

CONTINUITY TEST

Range	Response Time	Description	Max Open Circuit Voltage
•))	Approx 100 ms	Buzzer sounds below approx. 100 Ω	3.2 V DC

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

LOGIC

LCD Displays Number "**OL**" when selected
Detector ..... AC coupled
Logic Threshold
Logic 1 (high) ..... 2.8 V ±0.8 V
Logic 0 (low) ..... 0.8 V ±0.5 V
Duty Cycle ..... at >20% and <80%
Indications ..... 40 ms beep at logic low
Pulse Width ..... 25 ns min.
Pulse Rep Rate ..... 1 Mpps max.
Pulse Rise Time ..... 10 µs max.
Input Impedance ..... 120 kΩ/100 pF
Input Overvoltage Protection ..... 500 V DC or peak AC

TRANSISTOR hFE (DC GAIN) MEASUREMENT

Base Current ..... 10 µA
Vce ..... 3.2 V
Gain Measurement Range ..... 0 - 1000

Display: 3-3/4 digit liquid crystal display (LCD) with a maximum reading of 3999 counts. Large 0.7" digits.

Polarity: automatic (-) negative polarity indication.

Overrange Indication: "OL".

Functional Annunciator: AC, DC, V, A, F, kHz, Ω, hFE, and Logic ◆ on LCD display.

Low Battery Indication: " " is displayed when the battery drops below minimum operating voltage.

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

Operating temperature: 0°C to +50°C, 0 to 70% relative humidity.

Power: Single 9V battery, NEDA 1604.

Battery life: 500 hours typical (alkaline).

Auto Power Off: Automatic ally shuts down after 45 minutes inactivity.

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

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

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

Warranty and Service Information

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.
1031 Segovia Circle
Placentia, CA 92870

Phone: 714-237-9220
Facsimile: 714-237-9214
Email: service@bkprecision.com

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

SYMBOLS

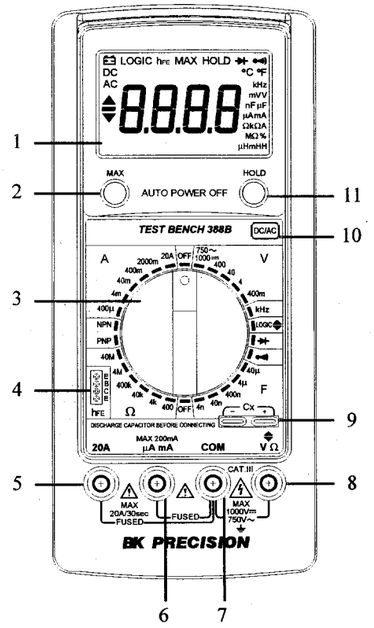
⚠	See instruction manual for further precautionary information.
⚠	High voltage terminal; up to 1000V may be present if connected to high voltage.
COM	Common input terminal.
▶|	Diode test.
▣	Double insulation.
1000 VDC 750 VDC MAX	Maximum input rating or V-Ω-Hz terminal with respect to earth ground.
•))	Continuity test.
▲	Logic high.
▼	Logic low.
hFE	Transistor gain test.

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

CONTROLS AND INDICATORS

1. **Display.** 3-3/4 digit display (3999 maximum) with automatic decimal point, polarity indication, high-low logic indicators, and low battery indicator. Indicates measured value, unit of measurement, and whether dc or ac is selected (for current and voltage readings). Overrange is indicated by displaying OL.
2. **MAX Switch.** Selects maximum hold or normal mode.
3. **Function/Range/Power Switch.** Selects function and range; V(1000 DCV/750 ACV, 400 V, 40 V, 4 V, or 400 mV), kHz ◆ LOGIC, and •)) continuity) F (40 µF, 4 µF, 400 nF, 40 nF or 4 nF), Ω (400 Ω, 4 kΩ, 40 kΩ, 400 kΩ, 4 MΩ, or 40 MΩ), hFE (PNP or NPN) ▶| (diode). A (400 µA, 4 mA, 40 mA, 400 mA, 2000 mA, or 20 A) ac or dc. When knob is pointing left or right, TEST BENCH power is off.
4. **hFE Jacks.** Input for direct insertion of NPN and PNP transistor leads. Emitter, collector, and base sockets are labeled.
5. **20 A Jack.** Input for dc or ac current measurements on the 20 A range (currents greater than 10 A not to be connected to TEST BENCH for longer than 60 seconds). For measurements greater than 3 A, high current test leads are recommended.
6. **mA/µA Jack.** Input for dc or ac current up to 2 A.
7. **COM Jack.** Input for common or reference test lead for measurements except Cx (capacitance) and hFE (transistor gain). Connect to earth ground or reference point not more than 500 V (dc + ac peak) from earth ground.
8. **◆ ▶| VΩHz Jack.** Input for voltage, resistance, frequency, hFE, Logic, and continuity/diode test functions.
9. **Cx Socket.** Input for capacitance measurements. Inputs are polarized for measuring polarized capacitors.
10. **AC/DC Switch.** Selects ac or de 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.
11. **Hold Switch.** Activates data hold feature.



RANGE SELECTION

1. If the quantity to be measured is unknown, start with the highest range.
2. When an overrange is indicated (OL displayed) switch to the next highest range.

CAUTION

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

AUTO POWER OFF

1. The meter will automatically shut off if the Function/Range switch position is not changed within 45 minutes.
2. To restore operation, rotate the Function/Ranges switch to any other position.

VOLTAGE MEASUREMENTS

1. The annunciators in the lower left comer of the display indicate whether the ac or dc function is selected. The mV or V annunciator on the right indicates that voltage is selected.
   a. To measure ac voltage, set the **AC/DC** switch to the **AC** position.
   b. To measure dc voltage, set the **AC/DC** switch to the **DC** position.
2. **Set the Function/Range** switch to the desired voltage range.
3. Connect the red test lead to the ▶| ◆ **V Ω Hz** jack and the black test lead to the **COM** jack.
4. Connect the test leads to the points of measurements.
5. For dc, a (-) sign is displayed for negative polarity: (+) positive polarity is implied.

RESISTANCE MEASUREMENTS

1. Set the **Function/Range** switch to the desired resistance range.
2. Remove power from the equipment under test.
3. Connect the red test lead to the ▶| ◆ **V Ω Hz** jack and the black test lead to the **COM** jack. The red lead is (+) polarity.
4. Connect the test leads to the points of measurements and read the value from the display.

CONTINUITY MEASUREMENTS

1. Set the **Function/Range** switch to the •)) position.
2. Connect the red test lead to the ▶| ◆ **V Ω Hz** jack and the black test lead to the **COM** jack.
3. Touch the test leads to the desired test point.
4. The buzzer will sound when resistance is less than 150 Ω.

DIODE TEST

1. Set the **Function/Range** switch to the ▶| position.
2. Connect the red test lead to the ▶| ◆ **V Ω Hz** jack and the black test lead to the **COM** jack.
3. To check forward voltage (Vf), connect the red test lead to the anode and the black test lead to the cathode of the diode. Diodes and semiconductor junctions with normal Vf of less than approximately 3.000 V can be checked.
4. The display indicates the forward voltage. Normal diode voltages are approximately 0.300 V for germanium diodes, 0.700 V for silicon diodes, and 1.600 V for light emitting diodes (LED's). A reading of approximately 3.45 V indicates an open diode. A shorted diode reads near 0 V.
5. To check reverse voltage, reverse the test lead connections to the diode. The reading should be the same as with open test leads (approx. 3.45 V). Lower readings indicate a leaky diode.

CURRENT MEASUREMENTS

WARNING

For current measurements, the meter must be connected in series with the load, If incorrectly connected on 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.

NOTE

A warning tone will be heard if the test lead is connected to µA mA input jack while the knob is not set to mA or µA range. A warning tone will also be heard if the test lead is connected to 20 A input jack while the knob is not set to 20 A range.

1. The annunciators in the lower left corner of the display indicate whether the ac or dc function is selected. The µA or mA annunciator on the lower right indicates that current is selected.
   a. To measure ac current, set the **AC/DC** switch to the **AC** position.
   b. To measure dc current, set the **AC/DC** switch to the **DC** position.
2. For current measurements less than **2 A**, connect the red test lead to the **mA/µA** jack and the black test lead to the **COM** jack.
3. For current measurements of **2 A** or greater, connect the red test lead to the **20 A** jack and the black test lead to the **COM** jack. For current measurements greater than 3 A, high current test leads are recommended.

NOTE

Maximum continuous input current is 10 A. For current measurements higher than 10 A, the current should not be connected to the inputs for longer than 60 seconds.

4. 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.
5. Apply power and read the value from the display.

CAPACITANCE MEASUREMENTS

CAUTION

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

1. Set the **Function/Range** switch to the desired **Cx** (capacitance) range.
2. Insert the capacitor leads directly into the slotted **Cx** test jacks. Observe polarity when measuring polarized capacitors. Insert one lead into the (+) jack and the other lead into the (-) jack.
3. Read the capacitance directly from the display. A shorted capacitor will indicate an overrange. An open capacitor will indicate near zero on all ranges.

USEFUL CONVERSIONS

pF	nF	µF
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
	10,000.0	10.0
	100,000.0	100.0
	1,000,000.0	1000.0

pF = picofarads (10^{-12})
nF = nanofarads (10^{-9})
µF = microfarads (10^{-6})

FREQUENCY MEASUREMENTS

1. Set the **Function/Range** switch to the kHz function.
2. Connect the red test lead to the ▶| ◆ **V Ω Hz** jack and the black test lead to the **COM** jack.
3. Connect the test leads to the point of measurement and read the frequency from the display.

TRANSISTOR GAIN MEASUREMENTS

CAUTION

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

1. Set the **Function/Range** switch to the desired **hFE** (dc transistor gain) range (**PNP** for pnp type transistors and **NPN** for npn type transistors).
2. Plug the transistor directly into the **hFE** socket. The sockets are labeled E, B, and C for emitter, base, and collector.
3. Read the transistor **hFE** (dc gain) directly from the display.

LOGIC MEASUREMENTS

1. Set the **Function/Range** switch to **LOGIC** ◆ position.
2. Connect the red test lead to the ▶| ◆ **V Ω Hz** jack and the black test lead to the **COM** jack.
3. Connect the black test lead to the circuit ground (common).
4. Connect the red test lead to the test point.
5. A ▲ on the display indicates TTL logic high and a ▼ indicates a TTL logic low. Both indicators are on when the point of measurement is toggling high and low.

MAX MEASUREMENTS

MAX is used to measure the maximum value of a changing voltage or current such as surge current when power is first turned on or peak audio.

1. Set the meter to the desired function and range (MAX applies to all voltage and current measurement functions).
2. Connect test leads to read voltage or current. Set the MAX switch to the On (right) position. A MAX should be on the top of the display. Red lead must be connected to the more positive point of the current or voltage measurement points when reading dc values.
3. Read the measured value from the display.
4. To take another maximum measurement turn the MAX switch off to clear the previous maximum reading, then repeat steps 2 and 3.

NOTE: While the MAX switch is on, avoid touching the probes to fingers or any object that may hold a static charge. The maximum function is particularly susceptible to noise pickup when test leads are open circuited and the function range switch is in the 400 mV or 4 V range.

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