

Pt. No. 972750
9/93

**OPERATING
INSTRUCTIONS**
for
AMPROBE®
Digital Multimeters
Models
AM-20
AM-21
AM-22

See "Precautions for Personal and
Instrument Protection" on Page 3

See "Limited Warranty" on Page 2



LIMITED WARRANTY

Congratulations! You are now the owner of an AMPROBE® instrument. It has been quality crafted according to quality standards and contains quality components and workmanship. This instrument has been inspected for proper operation of all of its functions. It has been tested by qualified factory technicians according to the long-established standards of AMPROBE INSTRUMENT.

Your AMPROBE instrument has a limited warranty against defective materials and/or workmanship for one year from the date of purchase provided that, in the opinion of the factory, the instrument has not been tampered with or taken apart.

Should your instrument fail due to defective materials, and/or workmanship during the one-year warranty period, return it along with a copy of your dated bill of sale which must identify instrument by model number and serial number.

For your protection, please use the instrument as soon as possible. If damaged, or should the need arise to return your instrument, it must be securely wrapped (to prevent damage in transit) and sent prepaid via Air Parcel Post insured or UPS where available to:

Service Division
AMPROBE INSTRUMENT
630 Merrick Road (For U P S) • P.O. Box 329 (For P.P.)
Lynbrook, NY 11563-0329

Outside the U S A the local Amprobe representative will assist you. The above limited warranty covers repair and replacement of instrument only and no other obligation is stated or implied.

WARNING PRECAUTIONS FOR PERSONAL AND INSTRUMENT PROTECTION

- 1) Read these instructions thoroughly and follow them carefully.
- 2) In many instances, you will be working with dangerous levels of voltage and/or current; therefore, it is important that you avoid direct contact with any uninsulated, current-carrying surfaces. Appropriate insulating gloves, clothing and eye protection should be worn.
- 3) To avoid electrical shock to the user and/or damage to the instrument, do not apply more than 1000V between any terminal and earth ground.
- 4) Before applying test leads to circuit under test, make certain that leads are plugged into proper jacks and switches are set to proper range and function.
- 5) Before using any electrical instruments or tester for actual testing, the unit should be checked on a low energy high impedance source. **Do not use power distribution lines or any other high energy sources.**
- 6) If the instrument should indicate that voltage is not present in circuit, do not touch circuit until you have checked to see that all instrument switches are in proper position and instrument has been checked on a known live line.
- 7) Make certain no voltage is present in circuit before connecting ohmmeter to circuit.

SAFETY

This Instruction Manual has warnings and safety precaution information which must be followed in order to ensure safe operating conditions.

CAUTION

To avoid damage to the meter:

- 1) Disconnect the test leads from circuit under test before changing functions.
- 2) Never connect instrument to a voltage source with the rotary switch in the Ohms position.
- 3) Always use the correct replacement fuse. Check manual for proper fuse rating.

INTRODUCTION

Amprobe's Model's AM-20, AM-21 and AM-22 Digital Multimeters are designed for use in the field, laboratory and the home. These compact instruments give the user all the job rated functions to get the job done.

In addition to measuring Volts, Ohms and Amps, etc. some models can measure frequency, perform diode and continuity tests.

The units are equipped with a tilt stand for ease of readability.

Model	DCV	ACV	DCA	ACA	Hz	▶	•	Ohms
AM-20	✓	✓	✓			✓	✓	✓
AM-21	✓	✓	✓		✓	✓	✓	✓
AM-22	✓	✓	✓	✓	✓	✓	✓	✓

Unpacking and Inspection of Contents

Included with each Multimeter should be the following items:

1. Two test leads; one black and one red.
2. Instruction booklet.

SPECIFICATIONS

Type of Display: 3½ digit, 0.55 inch (14mm) height
2000 count

Ranging: Manual

Automatic Polarity Indication: "—" display for negative input.

Overload Indication: LCD displays "OL".

Auto Zero on all Ranges

Low Battery Indication: Battery replacement is required when LCD displays "BAT"

Sampling Rate: 3 times/sec

Operating Temperature & Humidity:
0° to 45°C (+32°F to 113°F) @ 80% RH

Storage Temperature & Humidity:
0° to 50°C (+32°F to 122°F) @ 80% RH

Overload Protection:
Diode and 2A, 550 volt fuse

Case Breakdown Voltage: 3000 VAC

Dimensions: 12cm (L) x 7.5cm (W) x 3.0cm (H)
4.72" (L) x 2.95" (W) x 1.18" (H)

Weight: 220 gm (7.7 oz.)

Battery Life: Greater than 200 Hrs.

Power Source: 9V battery. P/N (MN1604)

Circuit Protection:

Micro-amp (μA) and milliamp (mA) ranges are fuse protected up to 550 volts AC/DC maximum with a 6.3X25-2-12 two amp fuse. Do not use substitute fuses.

All resistance ranges are overload protected against momentary misapplication of up to maximum of 500 AC/DC for no longer than ten seconds.

The 10 ampere range is overload protected up to 10 amperes maximum. All voltage ranges are overload protected up to 600 VAC and 1100VDC.

IMPORTANT: Use of instrument and/or accessories on circuits with higher voltages and/or currents than the indicated overload limits may result in personal injury and/or damage to the instrument and/or accessories.

DC Voltage:

Range: 200mV, 2V, 20V, 200V, 1000V

Resolution: 0.1 mV to 1V

Accuracy: $\pm 1.0\%$ rdg + 2 digits on all ranges

Overload Protection: 1100 VDC

Input Impedance: 1 M Ω on all ranges

AC Voltage for AM-20, AM-21: @ 50Hz-500Hz

Range: 200V, 500V

Resolution: 0.1V, 1V

Accuracy: $\pm 2\%$ rdg + 5 digits on all ranges

Overload Protection: 600VAC

Input Impedance: 750K on all ranges

AC Voltage for AM-22: @50 Hz-500Hz

Range: 2V 20V, 200V, 500V

Resolution: 1mv to 1v

Accuracy $\pm 1.5\%$ rdg + 4 digits on all ranges

Overload Protection: 600VAC on all ranges

Input Impedance: 10M Ω on all ranges

DC Current:

Range: 200 μA , 20mA, 2000mA, 10A

Resolution: 1 μA to 10mA

Accuracy: $\pm 1.5\%$ rdg + 2 digits on μmA ranges

$\pm 3\%$ rdg to + 2 digits on 10A range

Circuit Protection: 550 VAC/VDC by 600V fuse.

Voltage Burden: 0.3V max.

AC Current for AM-22: @ 50Hz - 500Hz

Range: 200 μA , 20mA, 2000mA, 10A

Resolution: 1 μA to 10mA

Accuracy: $\pm 2\%$ rdg + 5 digits on μmA ranges

$\pm 4\%$ rdg + 5 Digits on 10 A range

Circuit Protection: 550 VAC/VDC by 600 volt fuse

10 A input unfused

Voltage Burden: 0.3V max

Resistance:

Range: 200 Ω , 2k Ω , 20k Ω , 200k Ω , 2M Ω , 20M Ω

Resolution: 0.1 Ω to 10k Ω

Accuracy: $\pm 2.5\%$ rdg + 3 digits on 20M Ω range

$\pm 0.8\%$ rdg + 2 digits on other ranges

Overload Protection: 500 VAC/VDC for 10 sec.

Test Voltage: 200 Ω range 3.2V max

other ranges 1.0V max

Diode Test:

Test Current: 1.0 \pm 0.6 mA

Test Voltage: 3.2V max

Overload Protection: 500 VAC/VDC for 10 sec.

Continuity Test: (Audible) \rightarrow

Threshold: < 4 Ω

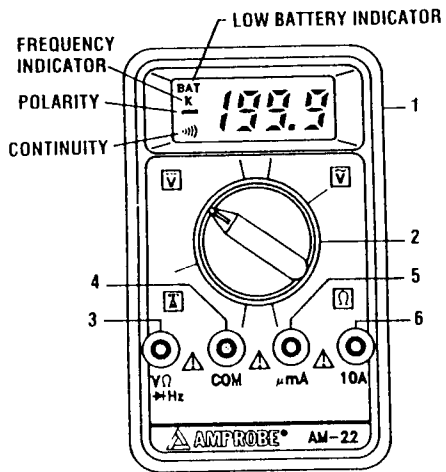
Frequency Measurement for AM-21, AM-22:

Range: 1 Hz to 20 MHz autorange. TTL level

Accuracy: $\pm 0.1\%$ rdg + 2 digits

Overload Protection: 500 VDC/VAC for 10 sec

INPUT TERMINALS AND CONTROLS



1. Digital Display — 3 1/2 digit LCD readout. (max. rdg 1999) K. ✱, "—" POLARITY. "BAT" Low Battery.
2. ROTARY SWITCH
3. V, Ω, ✱, Hz — Positive terminal for volts, ohms, diode and frequency measurements. (red)
4. COM — Common input terminal (black)
5. μmA — Positive Terminal for current measurements
6. 10 A — Positive Terminal for current measurements.

BATTERY REPLACEMENT

To install a new battery:

1. Disconnect the test leads from any circuit under test and turn off the meter.
2. Remove the test leads from the meter.
3. Lay the meter face down on a work surface that will not damage its' face.
4. Remove the two screws on the case bottom.
5. Gently lift the end of the case bottom from which the screws were removed.
6. Remove the old 9 volt battery and replace with a new one. Be careful not to break barrier.
7. Replace the case bottom, secure both screws.

FUSE REPLACEMENT

1. Follow steps 1 through 5 from the "Battery Replacement" procedure.
2. Remove the defective fuse and replace it with a new one of the same size and rating. Catalog Number 6.3X25-2-12.
3. Replace bottom case and secure both screws.

MAKING MEASUREMENTS

Preparation & Caution Before Measurement

1. Wait 10 seconds after turning on the meter before making a measurement.
2. The rotary switch should be set to the function which you want to use before connecting the probes to the device being tested. Be sure to remove the test leads from the equipment being measured before switching the rotary switch to a new function.
3. If the meter is used near equipment that generates electro-magnetic interference, the display may be unstable or indicate incorrect measurement values.
4. Inspect the test leads periodically for breaks in the insulation or the wire. Make a continuity check whenever in doubt. Replace leads if found defective.

Diode and Transistor Test Measurements

The special Diode Test Function \blacktriangleright allows relative measurements of forward voltage drops across diodes and transistor junctions. This function also permits measurement of in-circuit semiconductor junctions.


Diode Test

1. Connect red test lead to the $V/\Omega/\blacktriangleright$ input connector and black test lead to the COM input connector.
2. Set Function/Range Switch to the diode test \blacktriangleright position.
3. If the semiconductor junction being measured is connected to a circuit, turn off power to circuit being tested and discharge all capacitors.
4. Connect test leads to the device.
5. Read forward value on the LCD display.
6. If the LCD display reads overrange (1) reverse the lead connections. The placement of the test leads

when the forward reading is displayed indicates the orientation of the diode. The red lead is positive and the black lead is negative. If overrange (1) is displayed with both lead connections, the junction is open. If a low reading (less than 1,000) is obtained with both lead connections, the junction is shorted internally or (if junction is measured in a circuit) the junction is shunted by a resistance less than $1K\Omega$. In the latter case the junction must be disconnected from the circuit in order to verify its operation.

Transistor Junction Tests

1. Bipolar transistors can be tested in the same manner as a diode. Junctions are formed between the base and emitter and between the base and collector of the transistor. Measurement between the collector and emitter also should be made to determine if a short is present.

 Do not apply more than 1100 VDC or 600 VAC to input. Do not apply more than 500 volts between any input terminal and earth ground. Exceeding these limits creates a shock hazard and may damage the instrument.

DC/AC Voltage Ranges

All voltage measurements are read directly from the digital display.

AC Voltage Measurement (See Operating Precautions on page 3)

1. Move rotary switch to desired AC voltage range.
2. Plug the Black test lead into "COM" jack.
3. Plug the Red test lead into " $V/\Omega/\blacktriangleright$ " jack.


4. Place one test probe on each side of the AC voltage.
5. If meter reading falls within the range of a lower scale, move selector switch to the lower range.

DC Voltage Measurement (See Operating Precautions on page 3).

1. Move rotary switch to desired DC voltage range.
2. Plug the Black test lead into "COM" jack.
3. Plug the Red test lead into "V/Ω ±" jack.
4. If Negative and Positive sides of the circuit to be tested are known:
 - a) connect the Black test probe to the Negative side of the circuit.
 - b) connect the Red test probe to the Positive side of the circuit.
 If the Negative and Positive sides of the circuit are not known:
 - a) connect the Black and Red probes to the circuit.
 - b) If "-" sign appears in the left of display, reverse the Black and Red probes.
5. If meter reading falls within the range of a lower scale, move selector switch to the lower range.

WARNING

Do not apply voltage between "10A", μ A and COM terminals

 Do not exceed the current rating of current ranges. If current range is not known, start at the highest range and work down.

AC/DC Current Measurement (See Operating Precautions on page 3).

A milliampere is one thousandth (1/1000) of an ampere and may be written as 1 mA or 0.001 ampere.

A microampere is one millionth (1/1,000,000) of an ampere and may be written as 1 μ A or 0.000001 ampere.

Meter must be connected in series with the circuit under test.

1. Using rotary switch, select appropriate function and range. When current is unknown, use the highest current range.
2. Plug Black test lead into "COM" jack.
3. Plug Red test lead into the μ A jack for measurements up to 200 μ A; for readings above 200 μ A up to 10A, plug Red test lead into "10A" jack
4. Using the Red and Black test leads connect the meter in series with the circuit under test.
5. If "-" sign appears to the left of the reading when measuring DC, reverse the Red and Black test probes.
6. If meter reading falls within the range of a lower scale, move switch to a lower range.

Resistance Measurements (See Operating Precautions on page 3).

1. Move rotary switch to desired ohms range.
2. Plug the Black test lead into "COM" jack.
3. Plug the Red test lead into "V/Ω ±" jack.
4. When the test lead tips are shorted together, the display should indicate zero resistance on all ohmmeter ranges, except for 200 Ω range. This range will indicate resistance of test lead, which is less than 1 Ω .

5. Connect test leads across the resistance to be measured. **Caution: Resistance to be measured must be disconnected from all power before applying ohm-meter test leads.**
6. If meter reading falls within the range of a lower scale, reset selector switch to the lower range.

Continuity Measurement

1. Set selector switch to the \rightarrow position.
2. Continuity between probe tips will be indicated by the audible beeper when resistance is below $<4\Omega$.

Frequency Measurement

1. Connect the Red lead to the "Hz" jack and the Black lead to the "COM" jack.
2. Set the range switch to the "Hz" position.
3. Connect test leads to device or circuit to be measured.
4. Read frequency on the Display.

REPLACEMENT PARTS

<u>Description</u>	<u>Catalog/Part No.</u>
Test Leads	MTL-20
Battery (9V)	MN-1604
Fuse	6.3X25-2-12
Carry Case	SV

TROUBLESHOOTING

If there appears to be a malfunction during the operation of the meter, the following steps should be performed in order to isolate the cause of the problem.

1. Check the battery.
2. Review operating instructions for possible mistakes in operating procedure.
3. Inspect and test the Test Probes for a broken or intermittent connection.
4. Inspect and test the fuse. If it necessary to replace the fuse, be sure to install the one noted in this booklet. If the instrument still malfunctions, place it with packing slip along with a brief description of the problem in sufficient cushioning material in a shipping carton. Be sure to indicate the serial number located on the back of the instrument. Amprobe is not responsible for damage in transit. Make certain your name and address also appears on the box as well as packing slip; ship prepaid via U.P.S. (where available) or Air Parcel Post insured to:

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