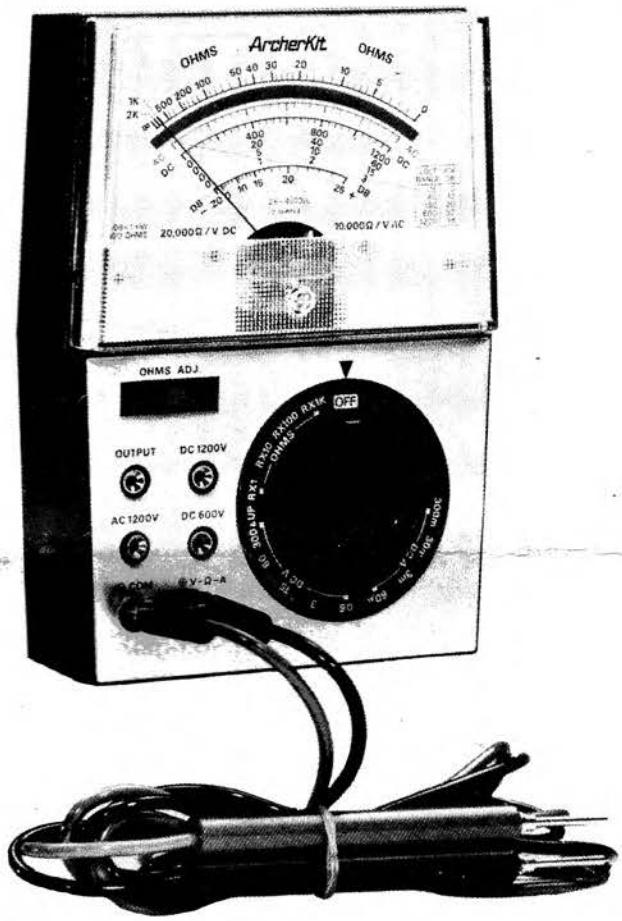
ArcherKit®



MULTIMETER

20,000 Ohms-per-Volt VOLT-OHM-METER

Catalog Number 28-4013A

WARNING: USE EXTREME CAUTION IN THE USE OF THIS DEVICE. IMPROPER USE OF THIS DEVICE CAN RESULT IN INJURY OR DEATH. FOLLOW ALL SAFEGUARDS SUGGESTED IN THE OWNER'S MANUAL IN ADDITION TO NORMAL SAFETY PRECAUTIONS IN DEALING WITH ELECTRICAL CIRCUITS. **DO NOT** USE THIS DEVICE IF YOU ARE UNFAMILIAR WITH ELECTRICAL CIRCUITS AND TESTING PROCEDURES.

This compact, sensitive Volt-Ohm-Meter/Multitester is designed to measure AC and DC voltages, DC currents and resistance with accuracy and ease. The single knob function control is easy to use and read. The 4" (10cm) sensitive meter incorporates a mirrored scale for accurate readings and uses 2 colors for rapid scale identification. An "off" position is incorporated for meter protection during transit. Small and light, this instrument will provide many years of accurate voltage, current and resistance measurements.

SPECIFICATIONS

Ranges:	25
DC Voltage	0–0.6–3–15–60–300–600–1200V
AC Voltage	0–15–60–150–600–1200V
DC Current	0–60μA–3–30–300 mA
Resistance	0–2K, 0–20K, 0–200K, 0–2 Meg. (center scale 24)
Decibels	–20 to +63 dB in 5 ranges.
Output	0–15–60–150–600V
Accuracy:	±3% of full-scale, DC voltage and current ±4% of full-scale, AC voltage ±3% of scale-length, Resistance
Sensitivity:	20,000 ohms/volt DC 10,000 ohms/volt AC
Meter Movement:	4" (10 cm), 2-color, mirrored scale, 37 μA movement
Battery:	Requires one type AA battery for Ohms function
Leads:	42" (107 cm) tip jack
Size:	5-19/32" x 3-15/16" x 1-1/2" (14.2 cm x 10 cm x 3.8 cm) (HWD)
Weight:	8 ounces (227g)

WE DESIGNED YOUR METER PRIMARILY TO MEASURE HOUSEHOLD AC AND LOW-VOLTAGE DC. WHEN MEASURING 3-PHASE CIRCUITS LINE-TO-LINE, THE VALUE OF THE VOLTAGE IS ACTUALLY HIGHER THAN THE RATED LINE-TO-GROUND 3-PHASE VOLTAGE. IT IS IMPORTANT THAT YOU DO NOT EXCEED THE MAXIMUM RATING OF THIS METER. TO DETERMINE THE HIGHEST POSSIBLE VOLTAGE ON A 3-PHASE LINE, MULTIPLY THE STATED VOLTAGE BY THE SQUARE ROOT OF THREE (APPROXIMATELY 1.75). SEVERE DAMAGE, AS WELL AS A DANGEROUS SHOCK HAZARD, COULD RESULT IF YOU CONNECT YOUR METER TO A CIRCUIT THAT EXCEEDS THE VOLTAGE RATING OF THE METER.

OPERATION

GENERAL

Reading – To obtain the most accurate reading, lay the meter on a flat, non-magnetic, surface. Look down on the needle so that the image in the mirrored scale coincides with the meter needle. This ensures that you are looking straight on with the needle.

Zero Adjust – The needle normally should align with the 0 on the DC scale and the ∞ on the ohms scale. If it does not, insert a screwdriver into the plastic screw, located in the textured area of the meter face and slowly rotate the screw left or right until the needle aligns as indicated.

Cautions – Always exercise care when measuring voltages above household AC. Always be sure the leads are connected correctly into their respective jacks and with correct polarity. If you are not sure, check all related instructions and labeling. Never take a guess. When not in use, set the range switch to OFF.

DC VOLTAGE MEASUREMENTS

Below 300 Volts DC

1. Plug the black test lead into the ⊖ COM jack. Plug the red lead into the ⊕ V-Ω-A jack.
2. Set the range switch to the highest DC V position.
3. Touch the probes, observing correct polarity, to the circuit under test. Read the voltage on the black DC scales.
4. If the range is incorrect, rotate the range switch to the next lower setting and repeat the test.

Measuring High DC Voltages

300 to 600 volts DC – Current the red test lead to the DC 600V jack. Connect the black test lead to the ⊖ COM jack. Set the range switch to the 300 & UP position.

600 to 1200 volts DC – Connect the red test lead to the DC 1200V jack. Connect the black test lead to the ⊖ COM jack. Set the range switch to the 300 & UP position.

Always exercise caution when measuring the above voltage ranges. Be sure of all connections and switch settings before touching the circuit under test.

AC VOLTAGE MEASUREMENTS

Below 600 Volts AC

1. Plug the black test lead into the ⊖ COM jack. Plug the red lead into the ⊕ V-Ω-A jack.
2. Set the range switch to the highest AC V position.
3. Touch the probes to the circuit under test. Note the position of the needle on the red AC scale. Follow the index marks of the scale to the DC scale below it. Read the actual value from the DC scale.
4. If the range is incorrect, rotate the range switch to the next lower setting and repeat the test.

Measuring High AC Voltages

600 to 1200 volts AC – Connect the red test lead to the AC 1200V jack. Connect the black test lead to the ⊖ COM jack. Set the range switch to the 600 & UP position.

Always exercise caution when measuring the above voltage ranges. Be sure of all connections and switch settings before touching the circuit under test.

RESISTANCE MEASUREMENTS

Before taking any resistance measurements, disconnect power to the unit under test and discharge any capacitors. It is best to remove any batteries in the circuit and unplug all line cords.

1. Plug the test leads into the ⊖COM and ⊕ V-Ω-A jacks.
2. Set the range switch to one of the OHMS positions; touch the test probes together and adjust the OHMS ADJ. control to bring the pointer to the "0" on the OHMS scale.
3. Touch the probe tips across the circuit or part under test.
4. Read the resistance on the OHMS scale. Use the proper multiplier to obtain the correct value (R "times" 1, 10, 100 or 1000, depending on the position of the range switch).

NOTES: When you are unable to adjust the pointer to "0" on the OHMS scale, replace the battery. When measuring resistance, disconnect one side of the part under test. The remainder of the circuit can not interfere with the readings.

DC CURRENT MEASUREMENTS

1. Plug the black test lead into the ⊖ COM jack. Plug the red lead into the ⊕ V-Ω-A jack.
2. Set the range switch to the highest DC A (300 m) position.
3. To measure current, you must place the meter in series with the circuit, at the point where you want to measure the current flow.
4. Turn off power to the circuit under test. Then, cut or break the circuit at the desired point in the circuit. Touch the probe from the ⊕ V-Ω-A jack to the positive side of the circuit. And, touch the probe from the ⊖ COM jack to the negative or ground side of the circuit.
   Apply power to the circuit and read the black DC scale value. Refer to "How To Read The Meter Scales."
5. If the range is incorrect, rotate the range switch to the next lower setting and repeat the test.

DECIBEL MEASUREMENTS

1. Plug the black test lead into the ⊖ COM jack. Plug the red lead into the ⊕ V-Ω-A jack.
2. Set the range switch to the 15 AC V position. Connect the test probes to the circuit under test.
3. Read the dB directly from the dB scale.

Note: If you set the range switch to any other AC position, be sure to add the appropriate dB factor from the chart in the lower right corner of the meter face to the value on the dB scale.
For absolute dB measurements, the circuit impedance must be 600 ohms. 0 dB is defined as 1 milliwatt of power dissipated in a 600 ohm impedance circuit. This is equivalent to 0.775 V across a 600 ohm load.

OUTPUT VOLTAGE MEASUREMENTS

You can measure up to 630 AC volts when it is mixed with DC voltage. The output jack has a built-in DC blocking capacitor rated at 630 volts. Do not attempt to measure a voltage when you suspect that it might be greater than this value.

1. Connect the black lead to the ⊖ COM jack. Connect the red lead to the OUTPUT jack.
2. Set the range switch to an AC V position and measure the voltage in the circuit.
3. Read the voltage using the same method for AC voltage only.

ALLIGATOR CLIPS P/N 270-394

HOW TO READ THE METER SCALES

The following chart may help you as you read the Meter for each range of your VOM.

	Range Setting	Scale to Read	Each Division Equals
DC VOLTAGE	0.6 DC V	Black 60	20 millivolts (0.02 volts)
	3 DC V	Black 3	100 millivolts (0.1 volts)
	15 DC V	Black 15	0.5 volts
	60 DC V	Black 60	2 volts
	300 DC V	Black 3	10 volts
	300 & Up (600V Jack)	Black 60	20 volts
	300 & Up (1200V Jack)	Black 1200	40 volts
AC VOLTAGE	15 AC V	Red 15*	0.5 volts
	60 AC V	Red 60*	2 volts
	150 AC V	Red 15*	5 volts
	600 & Up	Red 60*	20 volts
	600 & Up (1200V Jack)	Red 1200*	40 volts
RESISTANCE	R x 1 (0-2K)	OHMS	Read directly
	R x 10 (20K)	OHMS	Multiply by 10
	R x 100 (200K)	OHMS	Multiply by 100
	R x 1K (2MEG)	OHMS	Multiply by 1,000
DC CURRENT	60μ DC A	Black 60	2 microamps
	3m DC A	Black 3	100 microamps
	30m DC A	Black 3	1 milliampere
	300m DC A	Black 3	10 milliamperes
DECIBELS	15 Volts AC		Read dB Scale directly
	60 Volts AC		Add 12 to dB Scale reading
	150 Volts AC		Add 20 to dB Scale reading
	600 Volts AC		Add 32 to dB Scale reading
	1200 Volts AC		Add 38 to dB Scale reading

* When making AC voltage measurements, read voltage on the RED scale, but you have to follow the **black** numbers which indicate the voltage range.

MAINTENANCE AND CALIBRATION

Your VOM is a very rugged test instrument, so it will withstand a fair amount of abuse—but don't make it a habit! Take care with it—don't subject it to shock or excessive heat or humidity.

When transporting the VOM, leave the Range Switch set to OFF. This places an electrical short across the meter—effectively damping the movement.

If you don't intent to use the VOM for a few months, remove the batteries. Never leave weak or dead batteries in the VOM.

The calibration pots have been preset at the factory for most precise readings. They never need to be reset unless major changes are made in the shunt and/or multiplier resistors. If you have precision calibration equipment, you can check and adjust calibration as follows:

Step	Calibration Input	Range Setting	Adjust
1.	60 volts DC	60 DC V	VR-2
2.	30 mA DC current	30m DC A	VR-1
3.	150 volts AC	150 AC V	VR-3

IF METER DOESN'T WORK IN ALL RANGES MAKE SURE RANGE SELECTOR SWITCH WIPER'S PROPERLY ALIGNED & TIGHT ON SHAFT. (SCREW MAY STRIP OUT OR PLASTIC SHAFT MAY BREAK—BAD NEWS!)

PARTS LIST

Symbol	Description	Part Number

DIODES

D-1	Germanium diode (TC2050A or Equiv.) (Mounted) 1N60 — AC RECT.	
D-2	Silicon diode (1S1146S or Equiv.) (Mounted)	
D-3	Silicon diode (1S1146S or Equiv.) } MTR. PROT. } 1N4448 TYP.	
D-4	Silicon diode (1S1146S or Equiv.)	

CAPACITOR

C-1	0.047 μF, 630 volts	

RESISTORS

All resistors are 1/4-watt, 1% unless otherwise noted.

R-1	4.5 meg	
R-2	900K	
R-3	450K	
R-4	1 ohm	
R-5	10 ohms	
R-6	102 ohms	
R-7	30K	
R-8	48K	
R-9	240K	
R-10	900K	
R-11	4.8 meg	
R-12	24 ohms	
R-13	242 ohms	
R-14	2.67K	
R-15	18.3K	
R-16	145K	
R-17	6K	
R-18	7.5K	
R-19	6 meg	
R-20	12 meg	
R-21	6 meg	

VR-1	3K, Semi-adjustable resistor, Current cal. (mounted and pre-set)	P-0751
VR-2	3K, semi-adjustable resistor, DC V cal. (mounted and pre-set)	P-0752
VR-3	2K, semi-adjustable resistor, AC V cal. (mounted and pre-set)	P-0753
VR-4	10K, variable resistor, OHMS ADJUST (mounted)	

MISCELLANEOUS

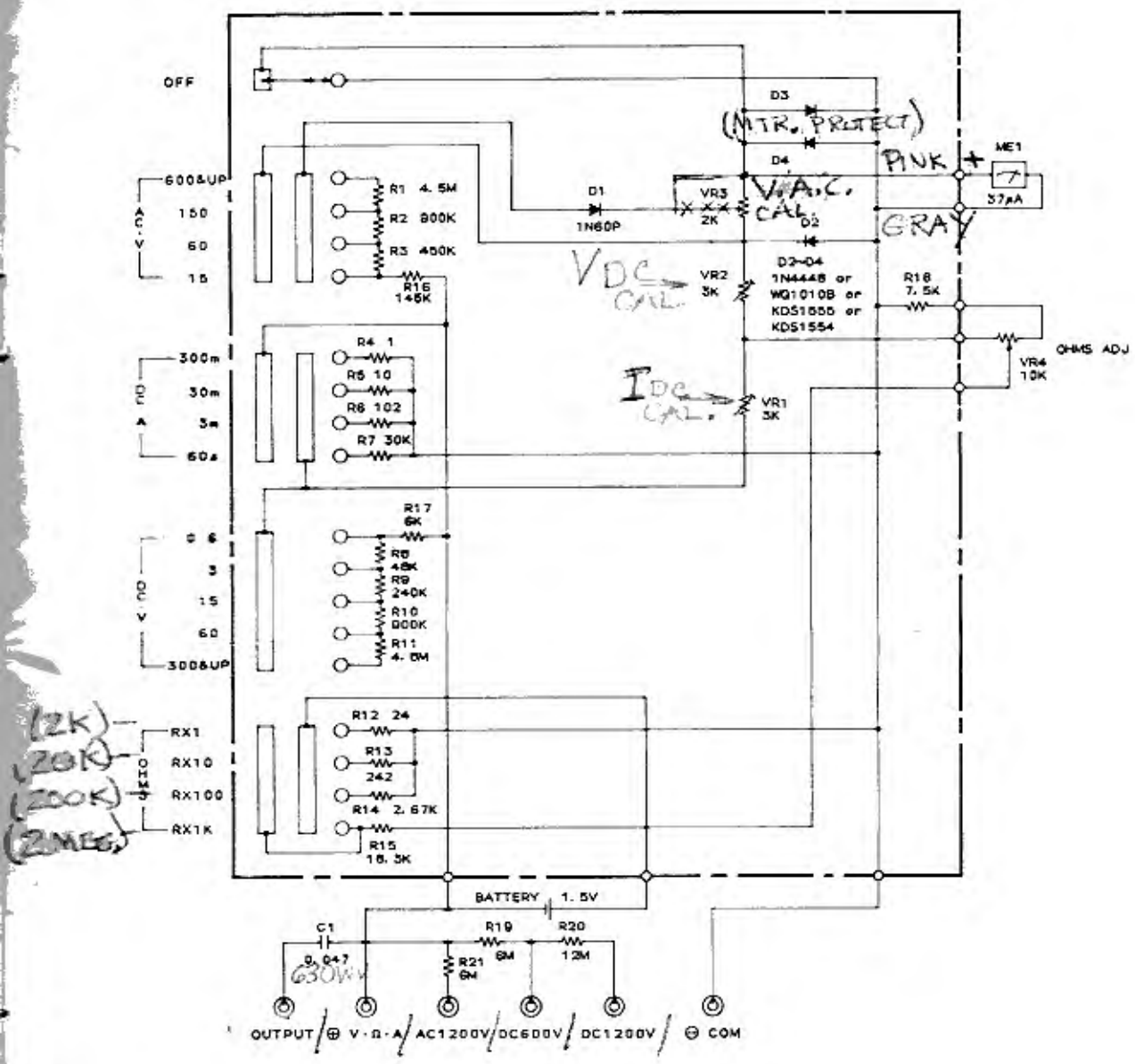
Description	Quantity	Part Number
Battery terminals, + and –	1 pair	HB-1013
Cap, plastic, for back of meter (mounted)		HB-1014
Case Back	1	Z-1962
Jacks	6	J-4353
Knob, OHMS ADJUST (mounted)	1	K-1627
Nut	6	HN-0244
Panel assembly with Meter*	1	M-0443
Printed Circuit Board	1	X-4757
Screw, long (for case)	2	HS-1579
Screw, short (for wiper assembly)	1	HS-1580
Solder	1 length	
Solder lug	6	HB-1015
Test leads	1 pair	W-1725
Washer, large flat (for jacks)	6	HW-0821
Washer, plastic (for wiper assembly)	1	HW-0822
Washer, small flat (for wiper assembly)	1	HW-0823
Washer, lock (for jacks)	6	HW-0824
Wiper assembly for switch	1	HB-1016
Wire		
Black	1	HB-1017
Brown	1	HB-1018
Red	1	HB-1019
Orange	2	HB-1020
Yellow	1	HB-1021
Blue	1	HB-1022

* Replacement **window face** (only) for Meter can be ordered under part number G-0159

The resistors in your kit may be color-coded for value and tolerance instead of numerical markings. In this case, use the following chart to identify the resistors. Keep it handy and always refer to it when you mount the resistors.

REF. NO.	VALUE	COLOR CODE
R-1	4.5MΩ	Yellow, Green, Black, Yellow, Brown
R-2	900K	White, Black, Black, Orange, Brown
R-3	450K	Yellow, Green, Black, Orange, Brown
R-5	10Ω	Brown, Black, Black, Gold, Brown
R-6	102Ω	Brown, Black, Red, Black, Brown
R-7	30K	Orange, Black, Black, Red, Brown
R-8	48K	Yellow, Gray, Black, Red, Brown
R-9	240K	Red, Yellow, Black, Orange, Brown
R-10	900K	White, Black, Black, Orange, Brown
R-11	4.8MΩ	Yellow, Gray, Black, Yellow, Brown
R-12	24Ω	Red, Yellow, Black, Gold, Brown
R-13	242Ω	Red, Yellow, Red, Black, Brown
R-14	2,67K	Red, Blue, Violet, Brown, Brown
R-15	18.3K	Brown, Gray, Orange, Red, Brown
R-16	145K	Brown, Yellow, Green, Orange, Brown
R-17	6K	Blue, Black, Black, Brown, Brown
R-18	7.5K	Violet, Green, Black, Brown, Brown
R-19	6MΩ	Blue, Black, Black, Yellow, Brown
R-20	12MΩ	Brown, Red, Black, Green, Brown
R-21	6MΩ	Blue, Black, Black, Yellow, Brown

SCHEMATIC DIAGRAM



NOTES:
(1) ALL RESISTANCE VALUES ARE INDICATED IN " OHM " (K=10^3 OHM M=10^6 OHM)
(2) ALL CAPACITANCE VALUES ARE INDICATED IN "μF" (P=10^{-6} μF)

NOTE: RED LEAD IS NEG. ON OHMS RANGES