NAVSHIPS 92051

INSTRUCTION BOOK

for

MULTIMETER AN/PSM-4A

Manufactured by

THE SIMPSON ELECTRIC COMPANY,

DIVISION OF AMERICAN GAGE AND MACHINE COMPANY

Chicago 44, Illinois

DEPARTMENT OF THE NAVY

BUREAU OF SHIPS

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DEPARTMENT OF THE NAVY
BUREAU OF SHIPS
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From: Chief, Bureau of Ships
To: All Activities concerned with the Installation, Operation and Maintenance of the Subject Equipment

Subj: Instruction Book for Multimeter AN/PSM-4A NAVSHIPS 92051

1. This is the instruction book for the subject equipment and is in effect upon receipt.

2. When superseded by a later edition, this publication shall be destroyed.

3. Extracts from this publication may be made to facilitate the preparation of other Department of Defense Publications.

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W. D. LEGGETT, JR.
Chief of Bureau

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ORDERING PARTS

All requests or requisitions for replacement material should include the following data:

1. Federal stock number or, when ordering from a Marine Corps or Signal Corps supply depot, the Signal Corps stock number.
2. Name and short description of part.

If the appropriate stock number is not available the following shall be specified:

1. Equipment model or type designation, circuit symbol, and item number.
2. Name of part and complete description.
3. Manufacturer's designation.
4. Contractor's drawing and part number.
5. JAN or Navy type number.

SAFETY NOTICE

The attention of officers and operating personnel is directed to Chapter 67 of the *Bureau of Ships Manual* or superseding instructions on the subject of radio-safety precautions to be observed.

The use of this equipment involves voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working on equipment employing high voltages.

While every practicable safety precaution has been incorporated in ship and shore electronic equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors. To avoid casualties always remove power and discharge and ground circuits prior to touching them.

DON'T SERVICE OR ADJUST ALONE

Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS

Do not depend upon door switches or interlocks for protection but always shut down motor generators or other power equipment. Under no circumstances should any access gate, door, or safety interlock switch be removed, short-circuited, or tampered with in any way, by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

Figure 1-1. Multimeter AN/PSM-4A, Front and Rear Views with Cover Closed.

Figure 1-2. Multimeter AN/PSM-4A, Front View with Cover Open.

SECTION 1
GENERAL DESCRIPTION

1. PURPOSE.

Multimeter AN/PSM-4A is a complete portable volt-ohm-milliammeter. It can be used to make DC current, DC resistance, and DC, AC, and Output voltage measurements. The complete unit includes test probes which may be used with their prod tips, or the tips can be fitted with alligator clips or with a telephone plug to simplify all contact arrangements and connections. A high voltage probe is also included, which makes it possible to read voltages up to 5000 VDC. This probe contains a warning light to indicate the presence of high voltage.

2. BRIEF DESCRIPTION.

a. PHYSICAL.—Multimeter AN/PSM-4A, as shown in figures 1-1 and 1-2, is enclosed in a black cast plastic case. The cover of the instrument can be clamped either over the face of the meter, or over its back. When the cover is clamped over the face of the meter for storage, a gasket seals the case so that it is waterproof. When the cover is removed, a hinged door can be lifted up to provide access to a storage compartment for leads and accessories. There is a set of condensed operating instructions on the hinged door for the convenience of the operator. After the operator has obtained the necessary accessories from the storage compartment, the door should be closed and the cover can then be clamped in place over the back of the meter while the instrument is being used. This keeps the cover with the instrument so it is not likely to be lost.

There is a pair of standard test leads (one red and one black) which will be used for most applications of the instrument. These test leads have elbow prods on one end, to connect the lead into the circuit jacks on the instrument. They have probe tips on the other end, which have threaded shoulders to accept the screw-on alligator clips. For measuring electrical characteristics in a telephone jack, the telephone plug accessory can be used to terminate the test leads. All these parts are used as required for making all measurements except DC voltages over 1000 volts.

The high voltage probe, complete with its own lead, is to be used with the standard black test lead for measuring DC voltages on the 5000 volt range. One end of the lead has a threaded tip which screws on over the post in the face of the instrument labeled +5000 VDC MULTIPLIER. The other end of the lead has a high voltage multiplier assembly made of red plastic with a clear plastic end, and terminates in a crocodile clip at the end of a short piece of flexible wire. The clear plastic end allows a glow from the neon lamp to be seen when there is high voltage applied to the lead and to the instrument circuit through it. This is a warning to the operator that there is dangerous high voltage present at the crocodile clip, and that he should not touch the clip while the voltage is still present. The short piece of flexible wire between the housing and the crocodile clip allows the clip to be connected to a high voltage point in a crowded space without clearing space for the multiplier housing in a direct physical line with the test point. There is a 100 megohm resistor and a neon glow lamp in series within the housing. When a high voltage is being measured, the current will pass through the lamp, making it glow, and then through the resistor and the armature of the meter.

There are three controls on the face of the instrument. There is a ten-position rotary switch in the lower left hand corner which is used as a function switch. However, five of these positions set up ohmmeter connections within the instrument. For these resistance positions, the function switch acts also as a range selector. The eight-position switch in the lower right hand corner selects ranges of current and voltage. The ZERO OHMS control is continuously variable and is used to adjust the meter circuit sensitivity to compensate for battery aging in ohmmeter circuits. It is used to set the pointer at full scale (indicating zero ohms) when the function switch is set at any resistance range and the test probes are shorted together.

There are spaces for two batteries in a battery compartment on the back of the meter case. Access can be made to this compartment by removing the four screws which hold its cover in place. The cover and its screws can be seen in figure 1-3. They are located just above the small meter nameplate. This compartment is not waterproof when the cover of Multimeter AN/PSM-4A is in its storage position, over the face of the meter. The leads are sealed where they pass through the rear of the compartment and into the meter case to prevent moisture leakage into the meter through the battery compartment.

b. FUNCTIONAL. — Multimeter AN/PSM-4A is designed to make the following electrical measurements:

(1) It will measure direct currents up to 10 amperes.

(2) It will measure resistances up to 300 megohms.

(3) It will measure DC voltages up to 5000 volts.

(4) It will measure AC voltages up to 1000 volts (RMS).

(5) It will measure Output voltages up to 500 volts (RMS).

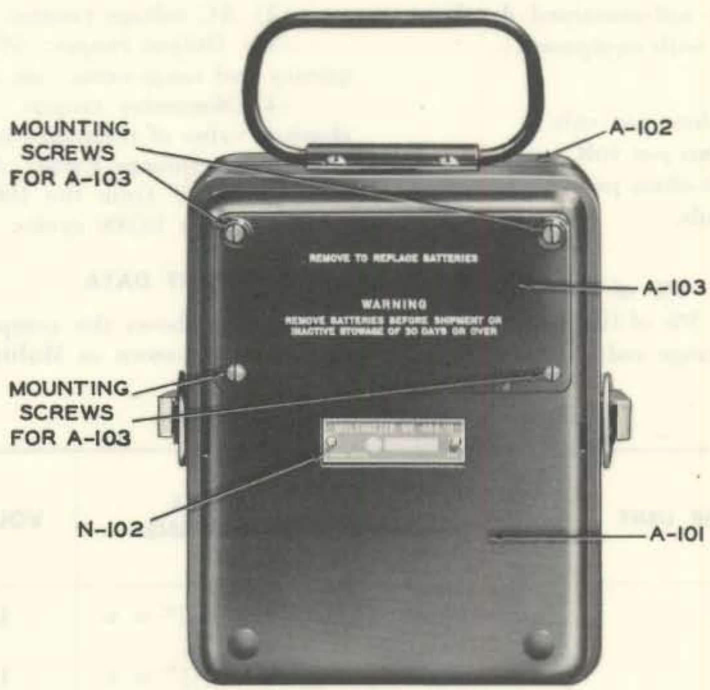

Figure 1-3. Multimeter AN/PSM-4A, Rear View.

c. ELECTRICAL.—Multimeter ME-48A/U, which is the major portion of the complete Multimeter AN/PSM-4A, requires no external source of power. There are two batteries which are self contained and which furnish the required power for resistance measurements. The meter movement has a basic sensitivity of 50 microamperes DC.

(1) Each DC Current range uses a separate shunt resistor. The maximum voltage drop across the meter circuit for current measurements is 250 millivolts.

(2) DC voltage measurements are made with ranges which have 20,000 ohms-per-volt input resistance. The maximum current through the meter for voltage measurements is 50 microamperes.

(3) AC voltage measurements are made with ranges which have 1,000 ohm-per-volt input resistance. The maximum current through the instrument for AC voltage measurements is 1 milliampere (RMS). The frequency response is flat from 20 cycles per second to over 10,000 cycles per second.

(4) Output voltages are read as AC voltages. They use the 1,000 ohms-per-volt ACV circuits and place a blocking capacitor in series with the AC voltage circuits. The purpose of this type of measurement is to determine the strength of the AC portion of voltage when there is a combination of AC and DC voltage present in the circuit which is being measured.

(5) Resistances are measured with a basic circuit which has 30 ohms of internal resistance, and which uses a 1.5 volt battery source. For the Rx10 and Rx100 ranges, circuit resistances are increased to 300 and 3000 ohms, respectively, and the same 1.5 volt battery is used. For the Rx1000 and Rx10000 ranges, the resistances are 30,000 and 300,000 ohms, respectively, and power is furnished from a 22.5 volt dry battery. Maximum circuit current for each range is as follows:

Range	Maximum Current
Rx1	50 milliamperes
Rx10	5 milliamperes
Rx100	500 microamperes
Rx1000	750 microamperes
Rx10000	75 microamperes

3. REFERENCE DATA.

a. Nomenclature: Multimeter AN/PSM-4A

b. Contract Numbers: NObsr-52559. Date: 21 June, 1951. NObsr-57514. Date: 30 June, 1952. NObsr-59581. Date: 12 December, 1952.

c. Contractor: Simpson Electric Company, Division of American Gage and Machine Company, Chicago, Illinois

d. Cognizant Naval Inspector: Inspector of Naval Material, Chicago, Illinois.

e. Number of Packages Involved per Complete Shipment of Equipment: One.

f. Total Cubical Content: Crated: 1960 cu. in.
Uncrated: 210 cu. in.

g. Total Weight: Crated: 19.5 lbs.
Uncrated: 5.75 lbs.

h. Characteristics of Power Supply Required for Operation:

(1) 1.5 volts DC (one self-contained dry battery BA-30, not supplied with equipment).

(2) 22.5 volts DC (one self-contained dry battery BA-261/U, not supplied with equipment).

i. Input Impedance:

(1) DC volts: 20,000 ohms per volt.

(2) AC volts: 1,000 ohms per volt.

(3) Output volts: 1,000 ohms per volt in series with 500,000 micro-microfarads.

j. Overall Accuracies:

(1) DC current ranges: 3% of full scale.

(2) DC voltage ranges: 3% of full scale (4% of full scale for 5000 volt DC range only).

(3) AC voltage ranges: 5% of full scale.

(3a) Output ranges: 5% of full scale, plus frequency and range error (see figure 2-8).

(4) Ohmmeter ranges: Within 3° of arc from absolute value of resistance indicated on meter scale.

(5) Frequency Error: AC voltages do not vary more than 2% from the 1000 cycle value from 20 cycles through 10,000 cycles.

4. EQUIPMENT DATA.

Table 1-1 shows the component parts which collectively are known as Multimeter AN/PSM-4A.

TABLE 1-1. EQUIPMENT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	JAN NOMENCLATURE	OVERALL DIMENSIONS	VOLUME	WEIGHT
1	Multimeter	ME-48A/U	$7\frac{15}{32}$″ h x $5\frac{15}{16}$″ w x $2\frac{7}{8}$″ d	127	4
1	Cover	CW-328/ PSM-4A	$7\frac{15}{32}$″ h x $5\frac{15}{16}$″ w x $2\frac{3}{8}$″ d	105	1.5
1	Lead, Test, Red	CX-2353/ PSM-4A	48″ long		
1	Lead, Test, Black	CX-2354/ PSM-4A	48″ long		
1	Lead, Test, High Voltage	CX-2355/ PSM-4A	55″ long		
2	Clip, Alligator		$2\frac{15}{16}$″ lg x $\frac{3}{8}$″ w x $\frac{15}{16}$″ h		
1	Plug, Telephone		$2\frac{5}{8}$″ lg x 1″ od		
	Total, less Instruction Book and Batteries	AN/PSM-4A	$7\frac{15}{32}$″ h x $5\frac{15}{16}$″ w x $4\frac{23}{32}$″ d	208	5.75
2	Instruction Book NAVSHIPS 92051		11″ h x $8\frac{1}{2}$″ w x $\frac{1}{4}$ d	23	.4 approx.

Dimensions are inches, volume cubic inches, weight pounds.

TABLE 1-2. EQUIPMENT REQUIRED BUT NOT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	JAN NOMENCLATURE	STANDARD NAVY STOCK NUMBER
1	Battery	BA-30	N-17-B-7210
1	Battery	BA-261/U	N-17-B-59177-3036

TABLE 1-3. SHIPPING DATA

SHIPPING BOX NO.	CONTENTS		OVERALL DIMENSIONS			VOLUME	WEIGHT
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	Multimeter	AN/PSM-4A	$10\frac{1}{2}$	12	$15\frac{1}{2}$	1.13	19.5

Dimensions are inches, volume cubic feet, weight pounds.

SECTION 2
THEORY OF OPERATION

1. GENERAL.

The following paragraphs each have a block diagram with which you can see the general layout of the circuit within the instrument part of Multimeter AN/PSM-4A, as it is arranged when you use it to measure voltage, current, or resistance. The Red Test Lead and the Black Test Lead are the probes which you will connect into the circuit which you are measuring, and the current which passes through the meter movement causes the meter to indicate the values on the dial. When you are measuring high DC voltages, you will use the High Voltage Probe and the Black Test Lead.

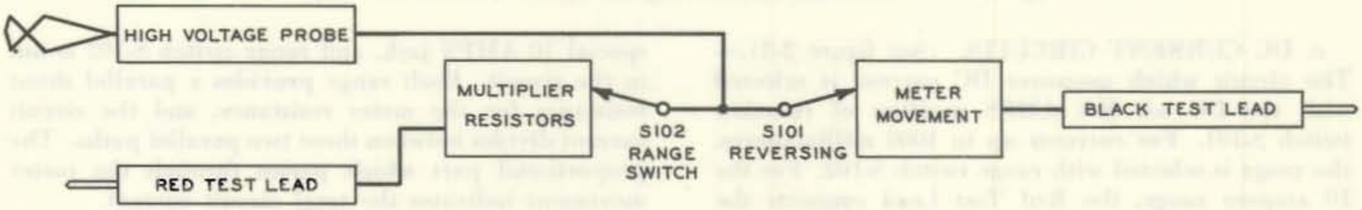

Figure 2-1. Functional Block Diagram of DC Voltage Circuits.

a. DC VOLTMETER CIRCUITS.—Figure 2-1 shows the block diagram of the circuit in Multimeter AN/PSM-4A for measuring DC voltages. The circuit is selected with function switch S-101, in either its DIRECT or REVERSE DCV position. For voltages up through 500 volts, a range is selected with range switch S-102. For the 1000 volt range, the Red Test Lead connects the special 1000 V.D.C. jack, and the range switch is not in the circuit. For the 5000 volt range, the High Voltage Probe connects the special 5000 V.D.C. jack, and places its resistance in series with the meter movement. For any range, the total resistance of the meter movement and the multiplier resistance in series with it will regulate the meter current to provide a proportional current to indicate the amount of voltage in the circuit.

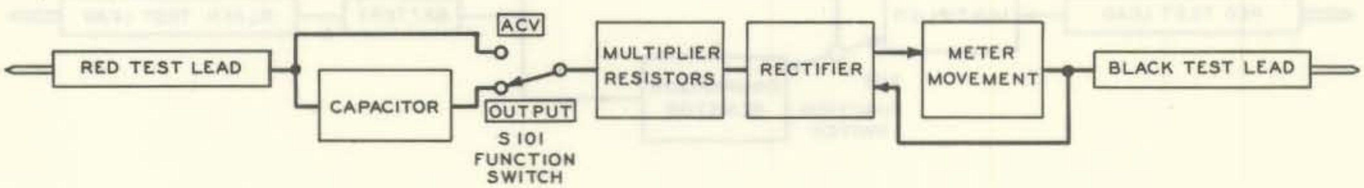

Figure 2-2. Functional Block Diagram of AC and Output Voltage Circuits.

b. AC AND OUTPUT VOLTAGE CIRCUITS. (See figure 2-2).—The circuits which measure AC and Output voltages are selected with the ACV and OUTPUT positions of function switch S-101. For voltages up through 500 volts, a range is selected with range switch S-102. For the 1000 volt range, the Red Test Lead connects the special 1000 V.A.C. jack, and the range switch, S-102, is not in the circuit. The AC voltage impressed across the circuit between the Red and Black Test Leads sends current through the resistance of the circuit in both directions, but the rectifier, CR-101, allows only one direction of current flow through the meter movement. Current passing in the opposite direction flows in an alternate circuit around the meter movement. The meter is calibrated to indicate the RMS value of the AC voltage applied to the instrument circuit.

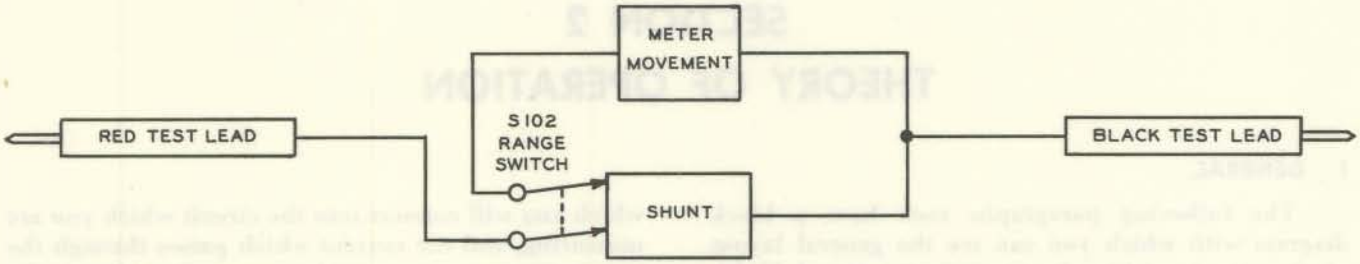

Figure 2-3. Functional Block Diagram of DC Current Circuits.

c. DC CURRENT CIRCUITS. (See figure 2-3).—The circuit which measures DC current is selected with the DC uA MA AMPS position of function switch S-101. For currents up to 1000 milliamperes, the range is selected with range switch S-102. For the 10 ampere range, the Red Test Lead connects the special 10 AMPS jack, and range switch S-102 is not in the circuit. Each range provides a parallel shunt resistance for the meter resistance, and the circuit current divides between these two parallel paths. The proportional part which passes through the meter movement indicates the total circuit current.

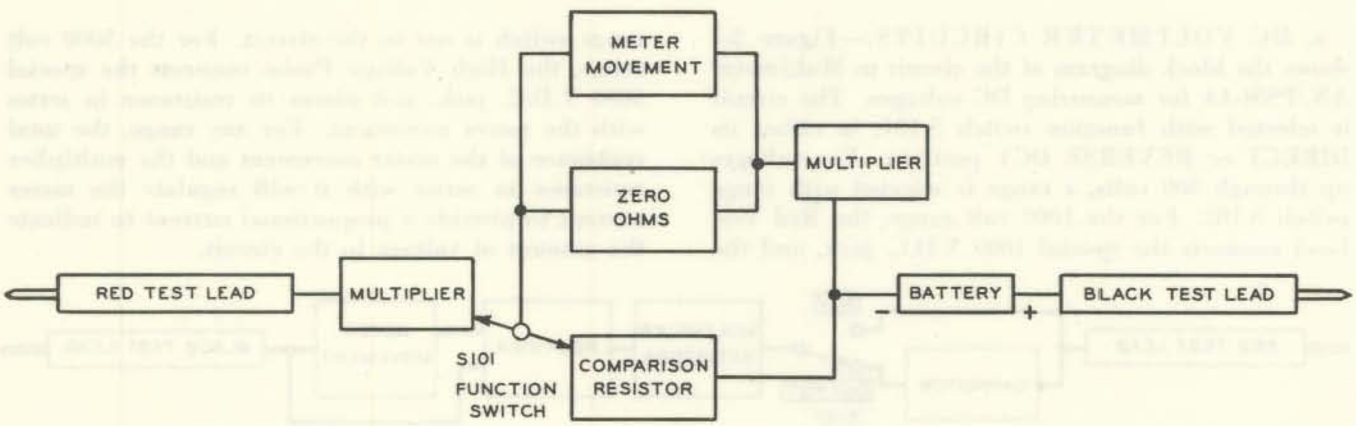

Figure 2-4. Functional Block Diagram of Ohmmeter Circuits.

d. OHMMETER CIRCUITS. (See figure 2-4).—The ohmmeter circuit and its ranges are selected with function switch S-101. Its positions are Rx1, Rx10, Rx100, Rx1000, and Rx10000. An internal battery furnishes the power for all resistance measurements. For each range, the circuit is arranged so the meter will indicate zero ohms, and full scale deflection, whenever the Red Test Lead and the Black Test Lead are shorted together. When you connect any resistance between the test leads, this resistance will be in series with the instrument circuit, and less current will flow through the meter movement. The amount of reduced meter deflection indicates how much resistance is between the test leads.

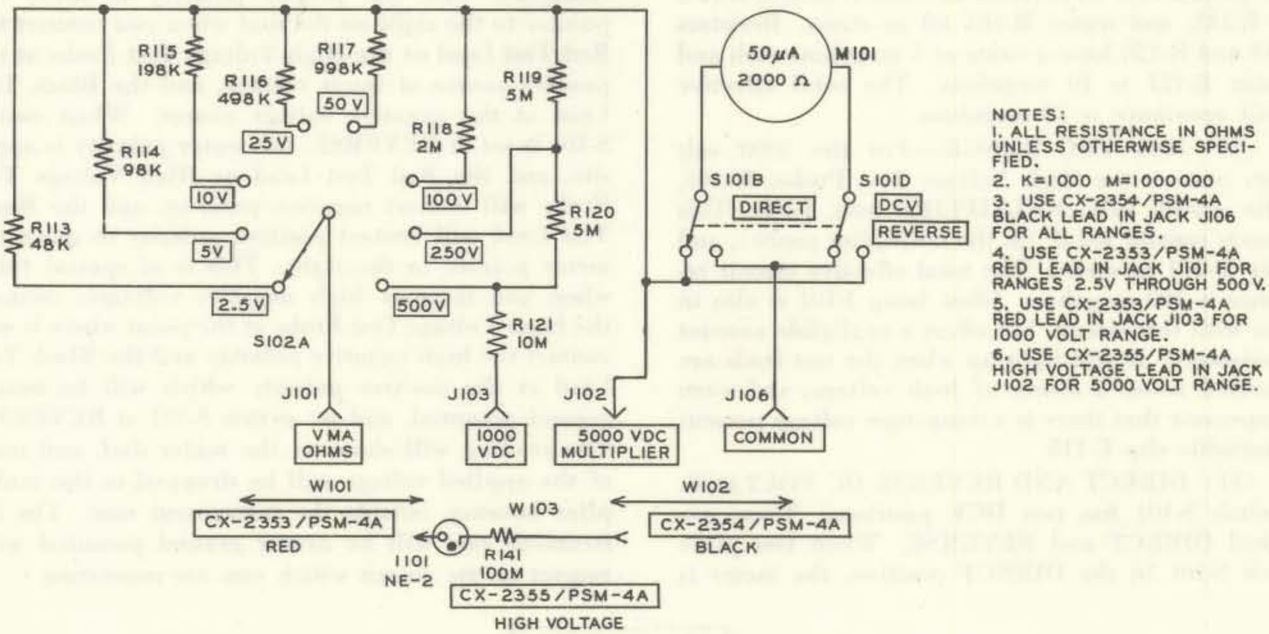

Figure 2-5. DC Voltmeter Schematic Diagram.

2. CIRCUIT ANALYSIS.

a. DC VOLTMETER CIRCUIT. (See figures 2-5 and 6-9).—The portion of the circuits which you use for measuring DC voltages with Multimeter AN/PSM-4A are shown in figure 2-5. The overall schematic diagram, of which this is a part, is shown in figure 6-9. The DC voltage ranges each have 20,000 ohms-per-volt total circuit resistance, so when you connect the test leads across the amount of voltage which is equal to the range value, there will be a 50 microampere current flowing through the meter movement. This will deflect the pointer to full scale, and indicate the voltage present. If you connect the test leads across some fraction of the full scale voltage of any range, there will be a proportional fraction of 50 microamperes flowing through the meter movement, and the pointer will be deflected a proportional fraction of the distance across the dial.

(1) 2.5 VDC RANGE.—Referring to figure 2-5, function switch S-101 is shown in the DCV DIRECT position, and range switch S-102 is shown in the 2.5V position. Resistor R-113, 48K, is in series with the meter movement resistance, M-101, 2000 ohms. The total circuit resistance between jacks J-101 and J-106 is 50,000 ohms. When you connect the test leads, plugged into these jacks, across 2.5 volts DC, there will be 50 microamperes of current flowing through meter M-101. This will cause full scale deflection on the meter and indicate 2.5 volts DC on the dial.

(2) 5 VDC RANGE.—When you place range switch S-102 at 5V, you connect resistor R-114, 98K, in series with meter M-101, 2000 ohms. The total circuit resistance is 100,000 ohms. Five volts applied between the test leads will cause 50 microamperes of current to flow through meter M-101, and the meter will indicate 5 volts on its dial.

(3) 10 VDC RANGE.—When you place range switch S-102 at 10V, you connect resistor R-115, 198K, in series with meter M-101, 2000 ohms. The total circuit resistance is 200,000 ohms.

(4) 25 VDC RANGE.—When you place range switch S-102 at 25V, you connect resistor R-116, 498K, in series with the 2000 ohms of meter M-101. The total circuit resistance is 500,000 ohms.

(5) 50 VDC RANGE.—When you place range switch S-102 at 50V, you connect resistor R-117, 998K, in series with the 2000 ohms in meter M-101. The total circuit resistance is 1,000,000 ohms.

(6) 100 VDC RANGE.—Beginning with the 100 volt range, the total resistance of the circuit is so great that the 2000 ohms in the meter, M-101, is insignificant by comparison. It is neglected in calculating total circuit resistance. So when you place range switch S-102 at 100V, you connect resistor R-118, 2 megohms, in series with the meter, M-101. The total effective circuit resistance is 2 megohms.

(7) 250 VDC RANGE.—When you place range switch S-102 at 250V, you connect resistor R-119, 5 megohms, in series with meter M-101. The total effective circuit resistance is 5 megohms.

(8) 500 VDC RANGE.—When you place range switch S-102 at 500V, you connect resistors R-119 and R-120, 5 megohms each, in series with meter M-101. The total effective circuit resistance is 10 megohms.

(9) 1000 VDC RANGE.—For the 1000 volt DC range, connect the Red Test Lead in the special 1000

VDC jack, J-103. This connects resistors R-119, R-120, and R-121, and meter M-101 all in series. Resistors R-119 and R-120 have a value of 5 megohms each and resistor R-121 is 10 megohms. The total effective circuit resistance is 20 megohms.

(10) 5000 VDC RANGE.—For the 5000 volt range, connect the High Voltage Test Probe, W-103, to the +5000 VDC MULTIPLIER post, J-102. This connects resistor R-141 (in the multiplier probe), and meter M-101 in series. The total effective circuit resistance is 100 megohms. Glow lamp I-101 is also in series with this circuit, but offers a negligible amount of resistance. It will light up when the test leads are connected across a source of high voltage, and warn the operator that there is a dangerous voltage present at crocodile clip E-115.

(11) DIRECT AND REVERSE DC VOLTAGE.—Switch S-101 has two DCV positions. These are marked DIRECT and REVERSE. When you place switch S-101 in the DIRECT position, the meter is connected with the proper polarity to move the pointer to the right on the dial when you connect the Red Test Lead or the High Voltage Test Probe at the positive source of input voltage, and the Black Test Lead at the negative voltage source. When switch S-101 is set at REVERSE, the meter polarity is opposite, and the Red Test Lead or High Voltage Test Probe will contact negative polarity, and the Black Test Lead will contact positive polarity to move the meter pointer to the right. This is of special value when you measure high negative voltages; connect the High Voltage Test Probe at the point where it will contact the high negative polarity and the Black Test Lead at the positive polarity which will be nearer ground potential, and set switch S-101 at REVERSE. The reading will show on the meter dial, and most of the applied voltage will be dropped in the multiplier housing, outside the instrument case. The instrument case will be nearer ground potential with respect to the circuit which you are measuring.

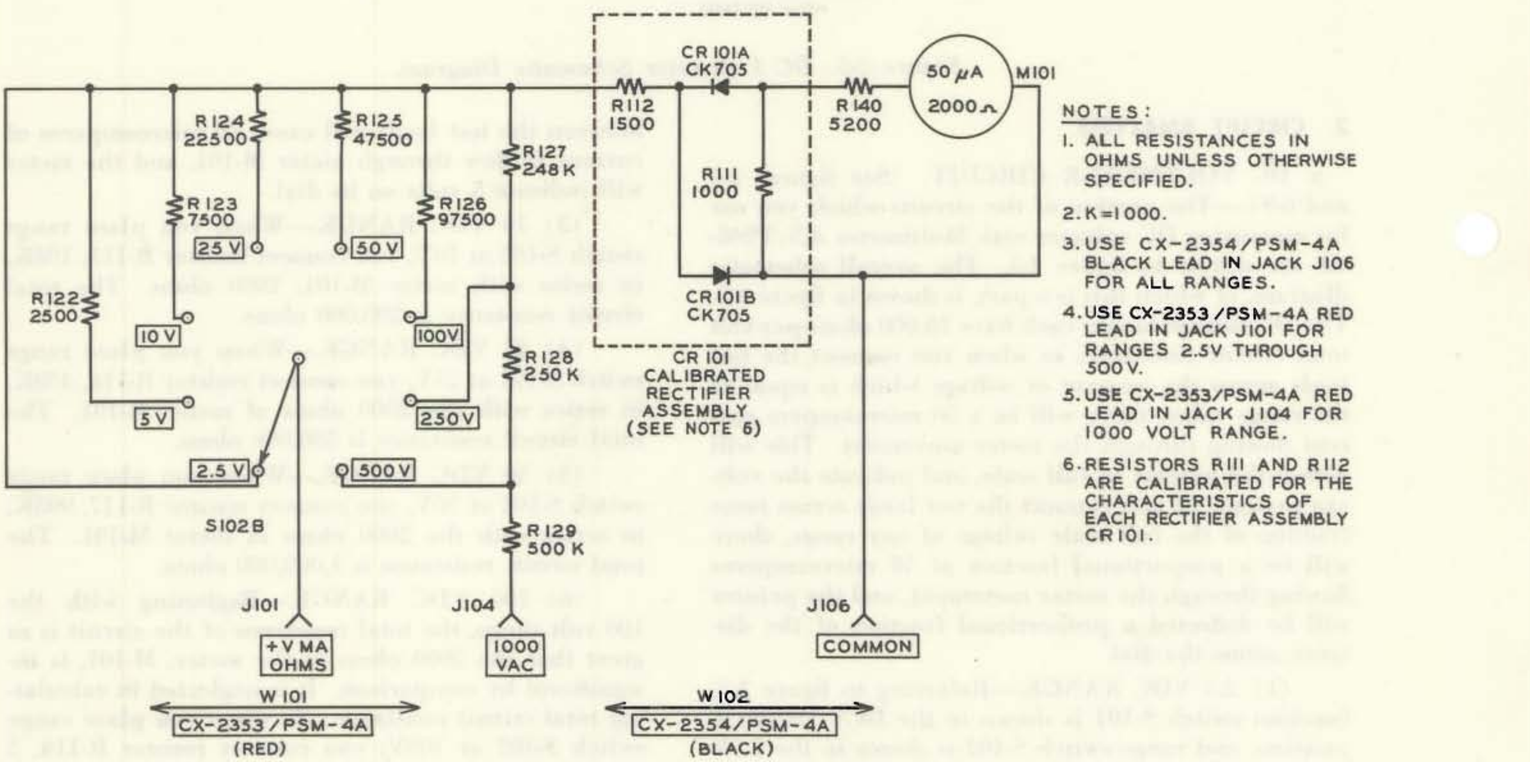

Figure 2-6. AC Voltmeter Schematic Diagram.

b. AC VOLTMETER CIRCUIT. (See figures 2-6 and 6-9).—The portion of the circuits in Multimeter ME-48A/U which you will use for measuring AC voltage is shown in figure 2-6. This is a portion of the entire circuit which is shown in figure 6-9. The total circuit resistance of the voltmeter circuit for measuring AC voltage is 1000 ohms per volt. All readings are RMS values of sine wave AC voltages, and are based on peak values. For all ranges through 500 volts, the Red Test Lead, W-101, connects the +V MA OHMS jack, J-101, and Black Test Lead W-102 connects the COMMON jack, J-106. The circuit through which current passes during the half cycle when it passes through meter movement M-101 places resistor R-140, 5200 ohms, in series with meter M-101, 2000 ohms. Parallel resistor R-111 has a nominal value of 1000 ohms, and is calibrated to match the forward resistance of the conducting rectifier, CR-101A. Resistor R-112, 1500 ohms, is in series with the meter circuit, and the total resistance is 2500 ohms.

During the alternate half cycle, the polarity of applied voltage is such that current will not pass through rectifier CR-101A and the meter movement, but will pass through CR-101B instead.

(1) 2.5 VAC RANGE.—Figure 2-6 shows the circuit in use when range switch S-102 is set at 2.5V. The total circuit resistance on the conducting half cycle is the 2500 ohm circuit described in paragraph *b* above.

(2) 5 VAC RANGE.—When you set range switch S-102 at 5V, you connect resistor R-122, 2500 ohms, in series with the 2500 ohm meter circuit. The total instrument resistance is 5000 ohms for this range.

(3) 10 VAC RANGE.—When you set the range switch, S-102, at 10V, you connect resistor R-123, 7500 ohms, in series with the 2500 ohm meter circuit. The total circuit resistance is 10,000 ohms.

(4) 25 VAC RANGE.—When you set range switch S-102 at 25V, you connect resistor R-124, 22,500 ohms, in series with the 2500 ohm meter circuit. The total circuit resistance is 25,000 ohms.

(5) 50 VAC RANGE.—When you set range switch S-102 at 50V, you connect resistor R-125, 47,500 ohms, in series with the 2500 ohm meter circuit. The total resistance is 50,000 ohms.

(6) 100 VAC RANGE.—When you set range switch S-102 at 100V, you connect resistor R-126, 97,500 ohms, in series with the meter circuit. The total circuit resistance is 100,000 ohms.

(7) 250 VAC RANGE.—When you set range switch S-102 at 250V, you connect resistor R-127 in series with the meter circuit. Resistor R-127 has a value of 248,000 ohms. The actual total circuit resistance is 250,500 ohms, but 500 ohms is such a small part of the total resistance that the total effective circuit resistance is considered to be 250,000 ohms.

(8) 500 VAC RANGE.—When you set range switch S-102 at 500V, you connect resistors R-127, 248K, and R-128, 250K, in series with the meter circuit. The total effective circuit resistance for this range is 500,000 ohms.

(9) 1000 VAC RANGE.—For the 1000 volt AC range, place Red Test Lead W-101 in the special 1000 VAC jack, J-104. This places resistors R-127, 248K, R-128, 250K, and R-129, 500K, all in series with the meter circuit. The total effective circuit resistance for this range is 1 megohm.

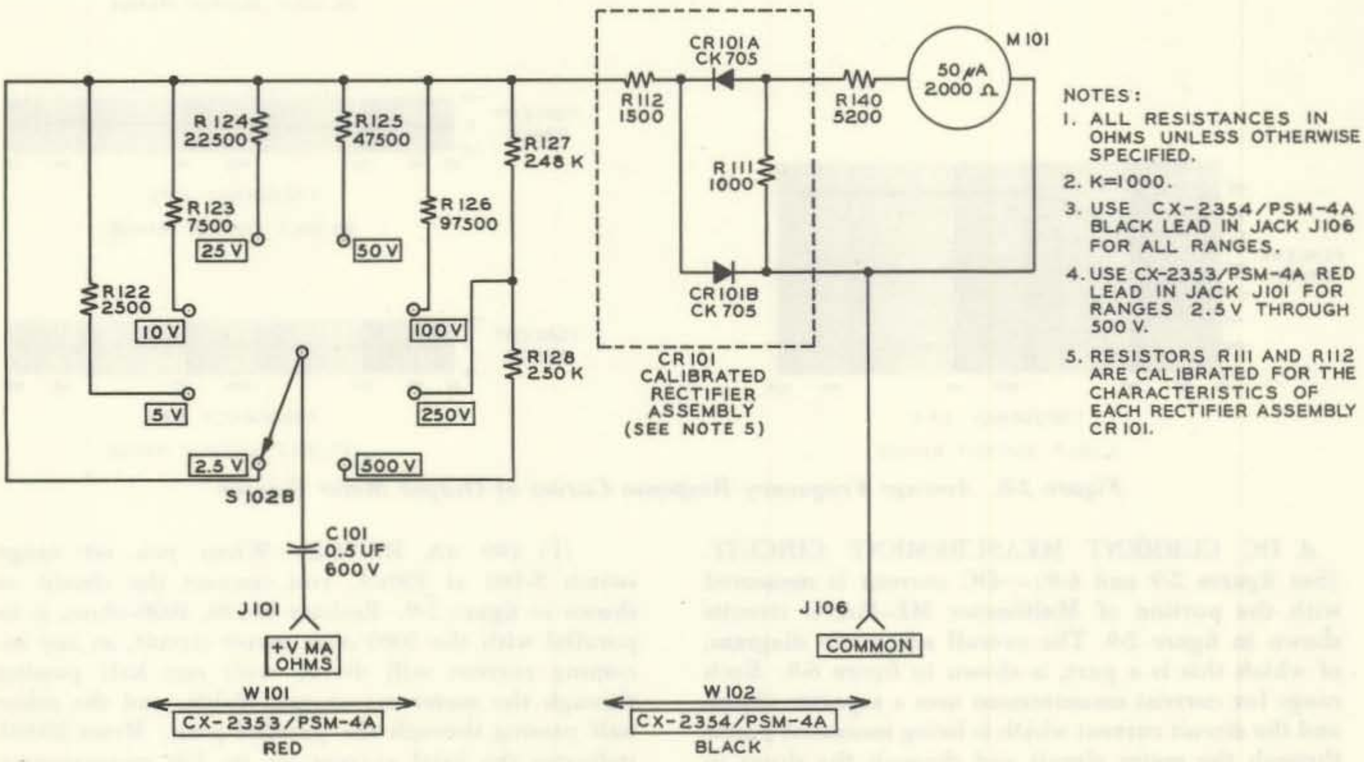

Figure 2-7. Output Voltmeter Schematic Diagram.

c. OUTPUT VOLTMETER CIRCUIT. (See figures 2-7 and 6-9).—Output voltages are read on the portion of Multimeter ME-48/U circuits shown in figure 2-7. The overall circuit diagram, of which this is a part, is shown in figure 6-9. Output voltage measurements are made to determine the amount of AC voltage alone which is present in a mixture of AC and DC voltages. Capacitor C-101 prevents any direct current from flowing through the meter circuit, but allows the AC voltage to send a current through the meter. Most of the AC circuit discussed in paragraph *b* above is used for the AC meter circuit for output measurements. The

1000 volt range is not used. Each of the other ranges is the same as the similar AC range described in paragraph *b* above, with capacitor C-101, 0.5 uf, in series with the circuit. Since capacitor C-101 is in series with the input voltage, some part of the AC voltage will be dropped across it, and the meter indication will be affected for all readings. The amount of error which the capacitor introduces into the circuit varies with the input frequency and with the instrument range which you are using. Higher frequencies and higher ranges produce less error. Figure 2-8 shows the correction factors to be applied to readings which you make with the Output circuit.

CAUTION: Do not apply any voltage which has a total strength, DC plus peak AC, greater than 600 volts to the output meter circuit. You will damage the input capacitor, C-101, if this amount is exceeded.

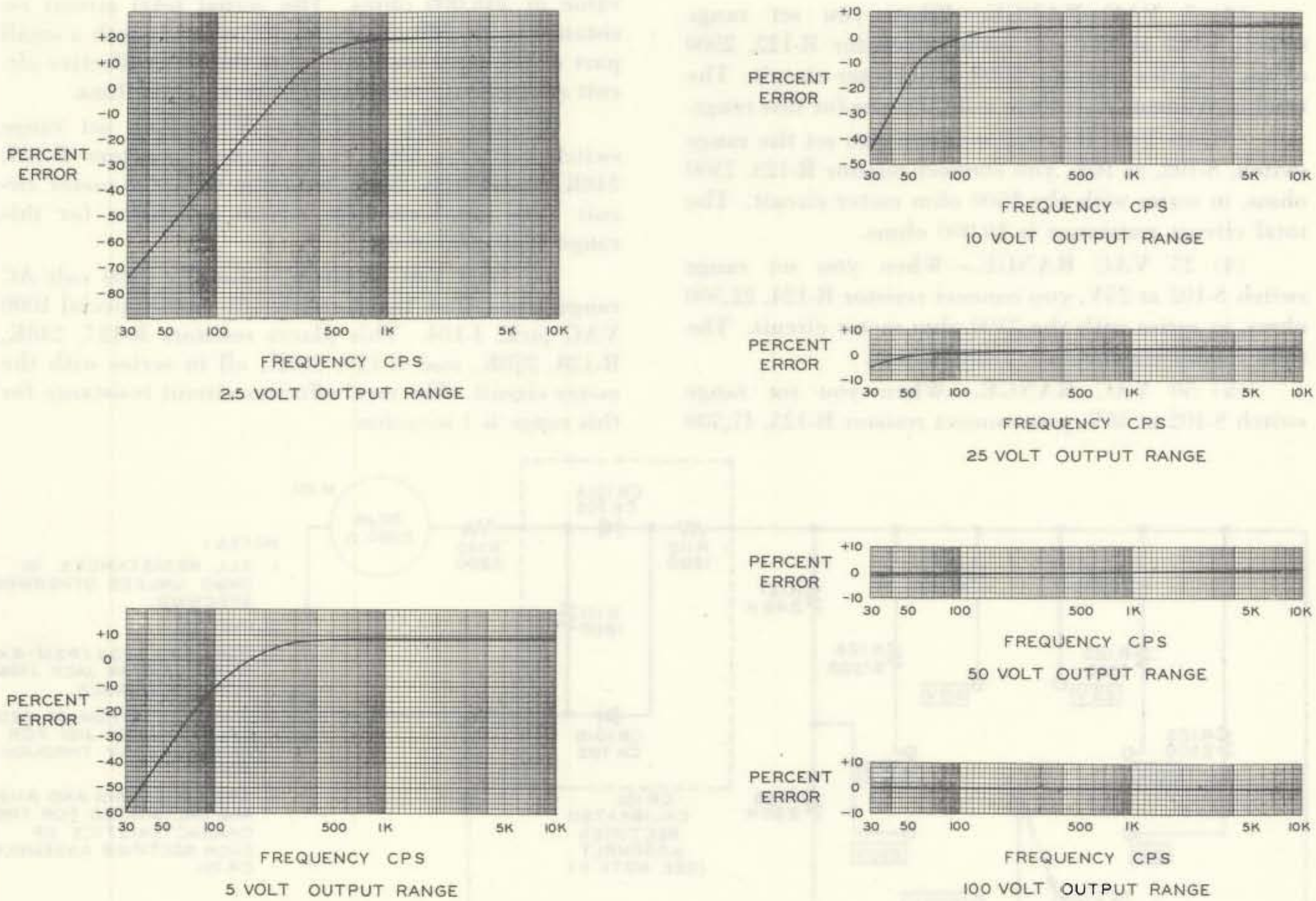

Figure 2-8. Average Frequency Response Curves of Output Meter Ranges.

d. DC CURRENT MEASUREMENT CIRCUIT. (See figures 2-9 and 6-9).—DC current is measured with the portion of Multimeter ME-48A/U circuits shown in figure 2-9. The overall schematic diagram, of which this is a part, is shown in figure 6-9. Each range for current measurement uses a separate shunt, and the circuit current which is being measured passes through the meter circuit and through the shunt in parallel. Only a portion of the total current passes through the meter movement. The division of incoming current is in inverse proportion to the resistance of the two parallel paths. Resistor R-105 is in series with meter movement M-101, and effectively increases the meter resistance to 5000 ohms. When 50 microamperes pass through the armature of the movement, the pointer indicates full scale.

(1) 100 uA RANGE.—When you set range switch S-102 at 100uA, you connect the circuit as shown in figure 2-9. Resistor R-130, 5000 ohms, is in parallel with the 5000 ohm meter circuit, so any incoming current will divide with one half passing through the meter movement, M-101, and the other half passing through the parallel path. Meter M-101 indicates the total current on its 100 microampere range. The equivalent circuit resistance is 2500 ohms, and 100 microamperes of current passing through 2500 ohms of resistance causes a voltage drop of 250 millivolts across the instrument circuit.

(2) 1 MA RANGE.—When you set range switch S-102 at 1 MA, you connect resistor R-131, 263 ohms, in parallel with the meter circuit. The equivalent circuit resistance is 250 ohms. When 1 milliampere of

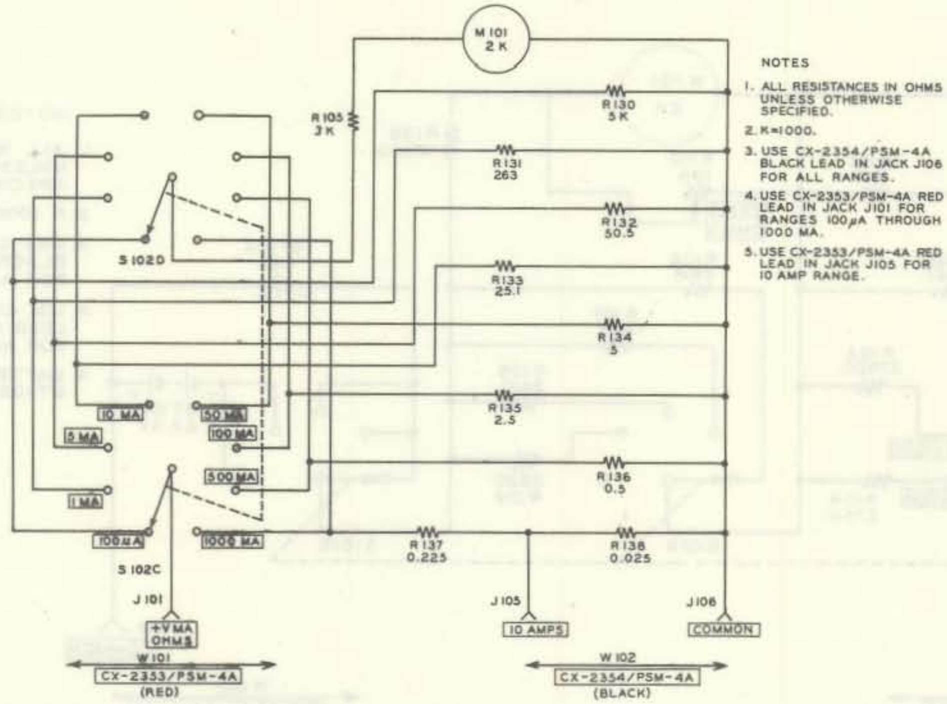

Figure 2-9. DC Microammeter, Milliammeter, and Ammeter Schematic Diagram.

current flows through the circuit, there is a 250 millivolt drop across the circuit, and the meter will indicate full scale, which you read as 1 milliampere.

(3) 5 MA RANGE.—When you set range switch S-102 at 5 MA, you connect resistor R-132, 50.5 ohms, in parallel with the 5000 ohm meter circuit. The equivalent circuit resistance is 50 ohms. When the circuit current is 5 milliamperes, there is a 250 millivolt drop across the circuit, and the meter, M-101, will indicate full scale.

(4) 10 MA RANGE. — When you set range switch S-102 at 10 MA, you connect resistor R-133, 25.1 ohms, in parallel with the meter circuit. The equivalent circuit resistance is 25 ohms. When the total circuit current is 10 milliamperes, there will be a 250 millivolt drop across the instrument circuit, and the meter, M-101, will read full scale.

(5) 50 MA RANGE. — When you set range switch S-102 at 50 MA, you connect resistor R-134, 5 ohms, in parallel with the meter circuit. The 5 ohm resistance is so small compared to the meter circuit resistance of 5000 ohms that the total effective circuit resistance is 5 ohms. When the circuit current is 50 milliamperes, it will cause a 250 millivolt drop across the instrument circuit. Meter M-101 will indicate full scale.

(6) 100 MA RANGE. — When you set range switch S-102 at 100 MA, you connect resistor R-135, 2.5 ohms, in parallel with the meter circuit. The total effective circuit resistance is 2.5 ohms. When the current is 100 milliamperes, the voltage drop is 250 millivolts, and the meter, M-101 reads full scale.

(7) 500 MA RANGE.—When you set range switch S-102 at 500 MA, you connect resistor R-136, 0.5 ohm, in parallel with the meter circuit. The effective equivalent circuit resistance is 0.5 ohm. When there is a total current of 500 milliamperes flowing through the circuit, there is a voltage drop of 250 millivolts across the instrument circuit. The meter, M-101, will indicate full scale.

(8) 1000 MA RANGE.—When you set range switch S-102 at 1000 MA, you connect resistors R-137, 0.225 ohm, and R-138, 0.025 ohm, in series with each other and in parallel with the meter circuit. The total effective circuit resistance is 0.250 ohm. When the circuit current is 1000 milliamperes (1 ampere), it will cause 250 millivolts drop across the instrument circuit. Meter M-101 will indicate full scale.

(9) 10 AMPS RANGE.—Place Red Test Lead W-101 in the special 10 AMPS jack, J-105, for the 10 ampere range. This connects resistor R-137, 0.225 ohm, in series with the 5000 ohm meter circuit. Effectively, the meter circuit resistance is not affected by this small addition. Resistor R-138, 0.025 ohm, is in parallel with the meter circuit. The total effective circuit resistance is 0.025 ohm. When there is a current with a value of 10 amperes passing through the circuit, there is a drop of 250 millivolts across the instrument circuit. The meter, M-101, will indicate full scale.

e. OHMMETER CIRCUIT. (See figures 2-10 and 6-9).—Resistance is measured with the portion of Multimeter AN/PSM-4A circuits shown in figure 2-10. The overall schematic diagram, of which this is a part,

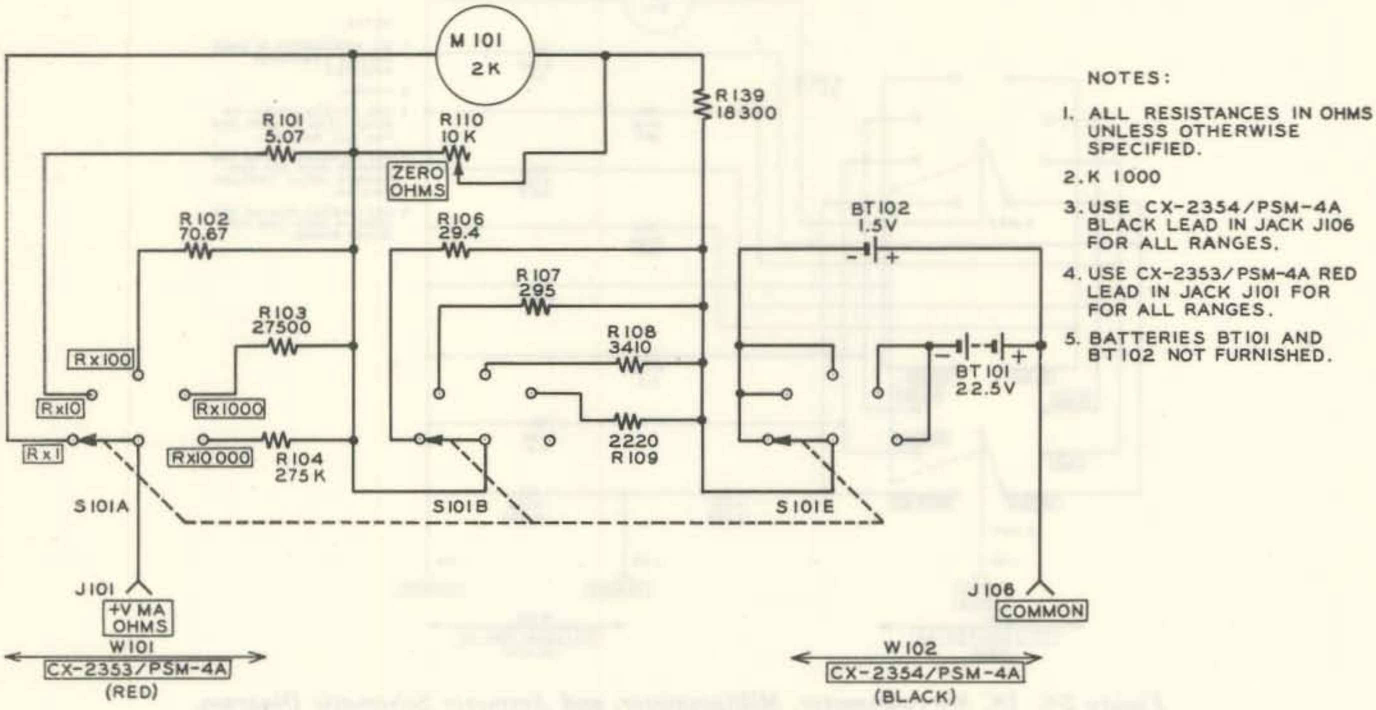

Figure 2-10. Ohmmeter Circuit Schematic Diagram.

is shown in figure 6-9. There are two batteries which are used to furnish power for resistance measurements. Battery BT-101 is a JAN type BA-261/U, 22.5 volts, and is used to furnish power for the Rx1000 and Rx10000 ranges. Battery BT-102 is a JAN type BA-30, 1.5 volts, and is used to furnish power for the Rx1, Rx10, and Rx100 ranges. The meter circuit consists of meter M-101 with variable resistor R-110, ZERO OHMS, in parallel, and resistor R-139, 18,300 ohms, in series with the parallel circuit. The total equivalent circuit resistance will depend on the setting of the ZERO OHMS control, R-110, and will be in the range from 18,300 ohms to 19,728 ohms. The ZERO OHMS control is set so the meter indicates full scale for zero resistance when the test leads are shorted together on each range. As the battery ages, its internal resistance will be increased and its terminal voltage will be reduced. Larger values of resistance in the settings of potentiometer R-110 will allow the meter, M-101, to continue to read full scale when you short the test leads together throughout a long period of battery aging. Note that the batteries are connected in such a way that the positive polarity is connected to jack J-106, COMMON, and to the Black Test Lead, W-102, which you connect in that jack. The negative polarity is applied through jack J-101, +V MA OHMS, and to the Red Test Lead, W-101, which you connect in that jack. This polarity is important only when you measure resistance through a unit or circuit which has more resistance in one direction than in the opposite direction, such as metallic rectifier.

(1) Rx1 RANGE.—Figure 2-10 shows the circuit connections in Multimeter ME-48A/U when you set function switch S-101 at Rx1. Switch section S-101B connects resistor R-106, 29.4 ohms, in parallel with the meter circuit. Switch section S-101E selects battery BT-102, 1.5 volts. The normal internal resistance in a new type BA-30 battery is about .6 ohm. This is in series with the parallel circuit, so the total circuit resistance is 30 ohms. When the test leads are shorted together, potentiometer R-110 is set so the meter reads full scale to indicate zero ohms. When any resistance is added between the test leads, the circuit current is reduced and the meter does not deflect as far. The markings on the OHMS scale of the meter indicate the amount of resistance which has been added between the test leads.

(2) Rx10 RANGE. — When you set function switch S-101 at Rx10, you connect resistor R-101, 5.07 ohms, in series with the meter circuit, and resistor R-107, 295 ohms, in parallel with the meter circuit. Switch section S-101E selects battery BT-102 for power. The total circuit resistance is 300 ohms for this range. Since the maximum current flow through battery BT-102 is less than it was for the Rx1 range, the terminal voltage will be more than for the lower range. Resistor R-101 drops the difference between the two terminal voltage values so the ZERO OHMS control, R-110, does not have to be reset when the

function switch is set for the new range. To measure resistance values with this range, read the indicated value on the dial and multiply it by 10.

(3) Rx100 RANGE.—When you set function switch S-101 at Rx100, you connect resistor R-102, 70.67 ohms, in series with the meter circuit, and resistor R-108, 3410 ohms, in parallel with the meter circuit. The total equivalent circuit resistance is 3000 ohms. Resistor R-102 drops the difference in terminal voltage which is furnished by battery BT-102 with less current flowing through it. To measure resistance values with this range, read the indicated value on the OHMS scale and multiply it by 100.

(4) Rx1000 RANGE.—When you set function switch S-101 at Rx1000, you connect resistor R-103, 27500 ohms, in series with the meter circuit, and resistor R-109, 2220 ohms, in parallel with the meter circuit. Switch section S-101E selects battery BT-101, 22.5 volts, for power for this range. The normal internal resistance for a new type BA-261/U battery is about 500 ohms. This is in series with the rest of the circuit. The total equivalent circuit resistance is 30,000 ohms. Resistor R-103 drops enough of the terminal battery voltage that the amount across the meter circuit is the same as it was for the lower ranges when the test leads were shorted together. To measure resistance values with this range, read the indicated value on the OHMS scale and multiply the reading by 1000.

(5) Rx10000 RANGE.—When you set function switch S-101 at Rx10000, you connect resistor R-104, 275K, in series with the meter circuit and battery BT-101. The total circuit resistance is 300,000 ohms. To measure resistance values with this range, read the indicated value on the OHMS scale and multiply the reading by 10000.

SECTION 3
INSTALLATION AND ADJUSTMENT

1. COMPONENT PARTS.

Each complete Multimeter AN/PSM-4A consists of the following parts:

1 Multimeter ME-48A/U
1 Cover CW-328/PSM-4A
1 Red Test Lead CX-2353/PSM-4A
1 Black Test Lead CX-2354/PSM-4A
1 High Voltage Test Lead CX-2355/PSM-4A
1 Telephone Plug Adaptor
2 Alligator Clips (for optional test lead termination)
2 Instruction Books

All these parts, except the instruction books, are packed into a single portable case. The case cover clamps over the instrument face to protect the meter when it is not in use. Within the cover there is a storage compartment, as shown in figure 1-2, in which all other accessory items are placed when they are not in use. The hinged access door over the accessory compartment is latched in place when the door is closed. To open the door, reach through the two finger holes and lift; the catch will release and the door will lift up for easy access to the entire compartment. After you have obtained the accessories which are to be used for an application of the instrument, close the access door and place the cover over the back of Multimeter ME-48A/U. Snap the spring catches to lock the cover over the back of the meter.

2. UNPACKING.

Each Multimeter AN/PSM-4A is packed in a substantial wooden case which is sufficiently sturdy and protective to the equipment to permit it to be exposed to the weather for an indefinite time. The unpacking procedure is shown in the cutaway drawing, figure 3-1. When you unpack an instrument, be careful to prevent damage to the case of the instrument or to its movement.

3. BATTERY INSTALLATION.

Before you use Multimeter AN/PSM-4A for resistance measurements, install batteries in the compartment in the back of the Multimeter, ME-48A/U. Remove the battery compartment cover, A-103, by removing the four screws through the corners of the cover. The battery compartment is shown in figure 3-3 with cover A-103 removed. Place one battery, type BA-30, in the large pocket at the left, and one battery, type BA-261/U, in the smaller pocket at the right. Observe polarity when you install new batteries; place them so the positive polarity of each battery is at the center of the case, and the negative polarity is away from the center. These polarities are marked next to each battery compartment. Replace cover A-103 and secure it with the four corner screws which hold it in place.

4. INSTALLING TEST LEADS AND ACCESSORIES. (See figures 3-4 and 3-5).

Figure 3-4 shows test leads W-101, W-102, and W-103, alligator clips E-101 and E-102, and telephone plug E-103. Connect the test leads to the jacks, shown in figure 3-5, according to the type of measurement which you are going to make, and the range for that measurement. For all measurements, connect the Black Test Lead, W-102, in the COMMON jack, J-106. For DC voltage measurements in all ranges up through 500 volts, AC voltage measurements in all ranges up through 500 volts, all output voltage ranges, DC current measurements in all ranges up through 1000 MA, and all resistance ranges, connect Red Test Lead W-101 in the +V MA OHMS jack, J-101. For the 1000 volt DC range, connect Red Test Lead W-101 in the 1000 VDC jack, J-103. For the 1000 volt AC range, connect Red Test Lead W-101 in the 1000 VAC jack, J-104. For the 10 ampere DC range, connect Red Test Lead W-101 in the 10 AMPS jack, J-105. For the 5000 volts DC range, connect High Voltage Test Lead W-103 to the +5000 VDC MULTIPLIER post, J-102. If you wish to use alligator clip terminations on either or both test leads W-101 or W-102 for any range, screw one clip, E-101 or E-102, over the probe end of each test lead. To make electrical measurements within a standard telephone jack which has a sleeve and a tip contact, use telephone plug E-103. Insert the prod tip of Red Test Lead W-101 in the red insulated receptacle and the prod tip of Black Test Lead W-102 in the black insulated receptacle in the rear of the case of E-103. The Red Test Lead will be connected to the tip contact and the Black Test Lead will be connected to the sleeve contact.

5. OPERATING LOCATION.

This equipment is completely self-contained and portable. It can be used in any operating location

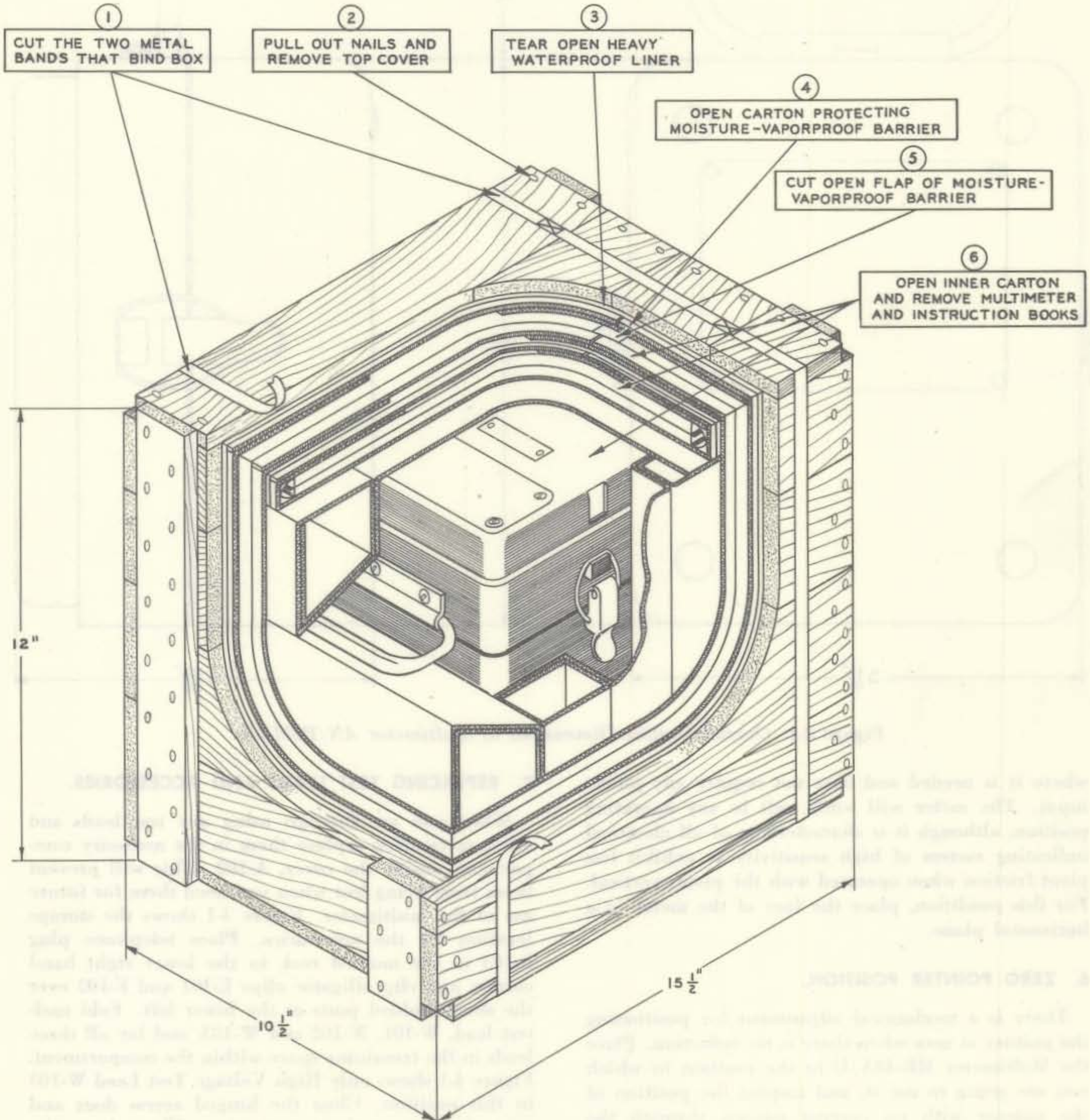

Figure 3-1. Cutaway View of Export Packing.

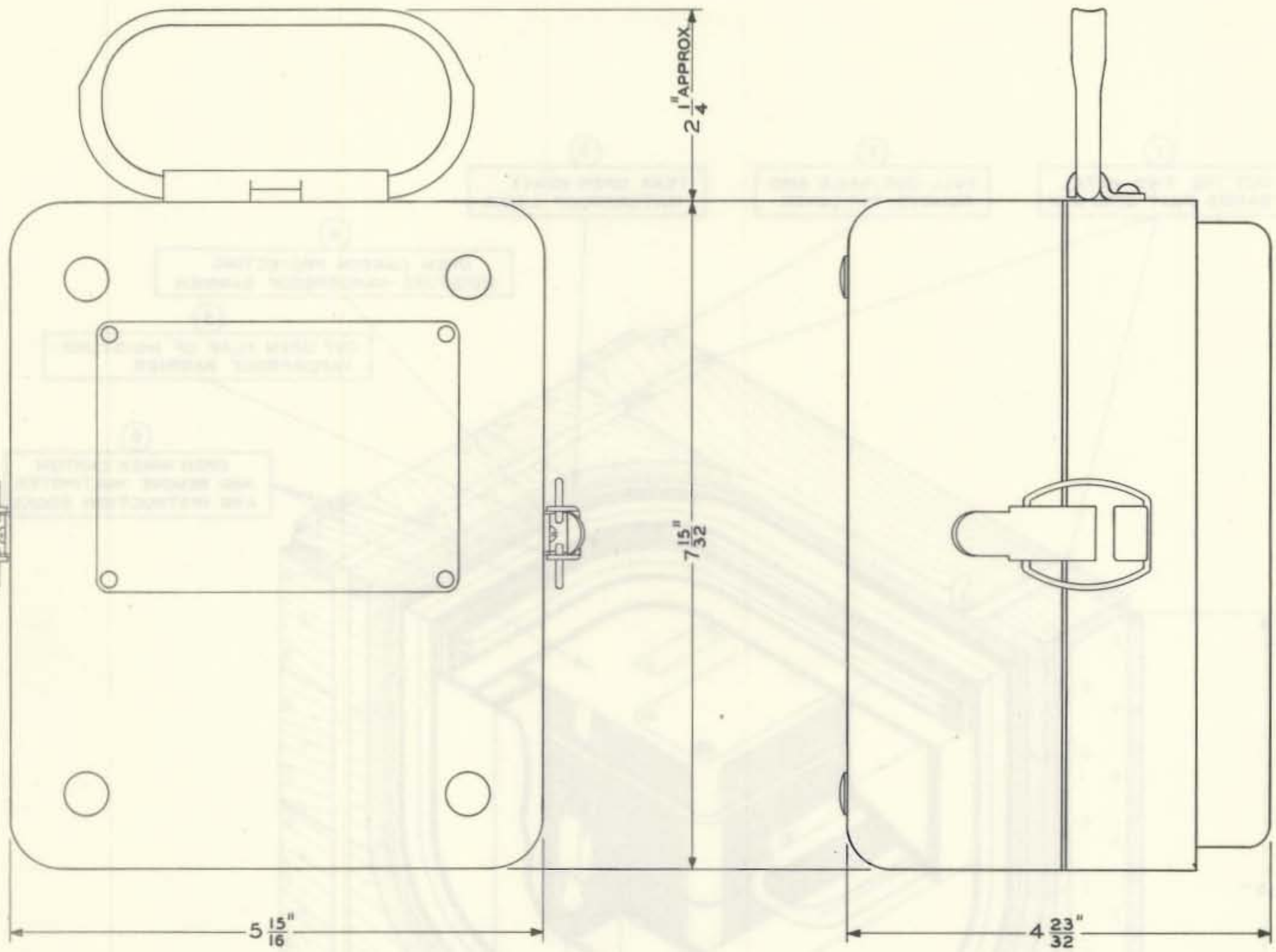

Figure 3-2. Overall Outline Dimensions of Multimeter AN/PSM-4A.

where it is needed and does not require any power input. The meter will work well in any operating position, although it is characteristic of all electrical indicating meters of high sensitivity to exhibit less pivot friction when operated with the pivots vertical. For this condition, place the face of the meter in a horizontal plane.

6. ZERO POINTER POSITION.

There is a mechanical adjustment for positioning the pointer at zero when there is no deflection. Place the Multimeter ME-48A/U in the position in which you are going to use it, and inspect the position of the pointer with no current passing through the armature. If it does not indicate zero, use a small screw driver and turn the zero adjusting screw located over the armature near the center of the front panel. This screw is shown in figure 3-5. Turn the screw slowly in either direction to obtain a zero indication with the pointer.

7. REPLACING TEST LEADS AND ACCESSORIES.

When you are through using any test leads and other accessories, replace them in the accessory compartment inside the cover, A-102. This will prevent them from being lost when you need them for future use of the multimeter. Figure 4-1 shows the storage location for the accessories. Place telephone plug E-103 in the molded rack in the lower right hand corner, and clip alligator clips E-101 and E-102 over the short molded posts at the lower left. Fold each test lead, W-101, W-102 and W-103, and lay all three leads in the remaining space within the compartment. Figure 4-1 shows only High Voltage Test Lead W-103 in this position. Close the hinged access door and press down to catch it in position. Then clamp the entire cover in place over the face of Multimeter ME-48A/U. When you snap the two cover clamps down tightly, you form a watertight case for the instrument and its accessories. The entire unit will float. However, the battery compartment is not included in the watertight enclosure.

Figure 3-3. Battery Compartment, Cover A-103 Removed.

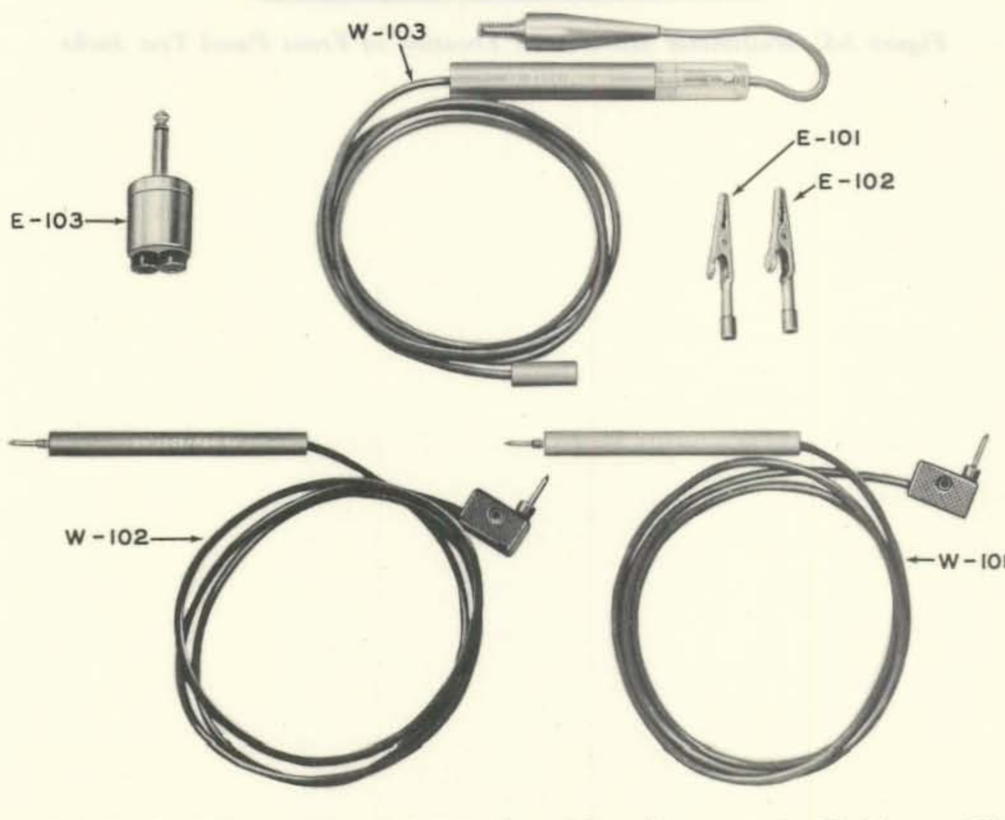

Figure 3-4. Test Leads, Alligator Clips, and Telephone Plug; Accessories for Multimeter ME-48A/U.

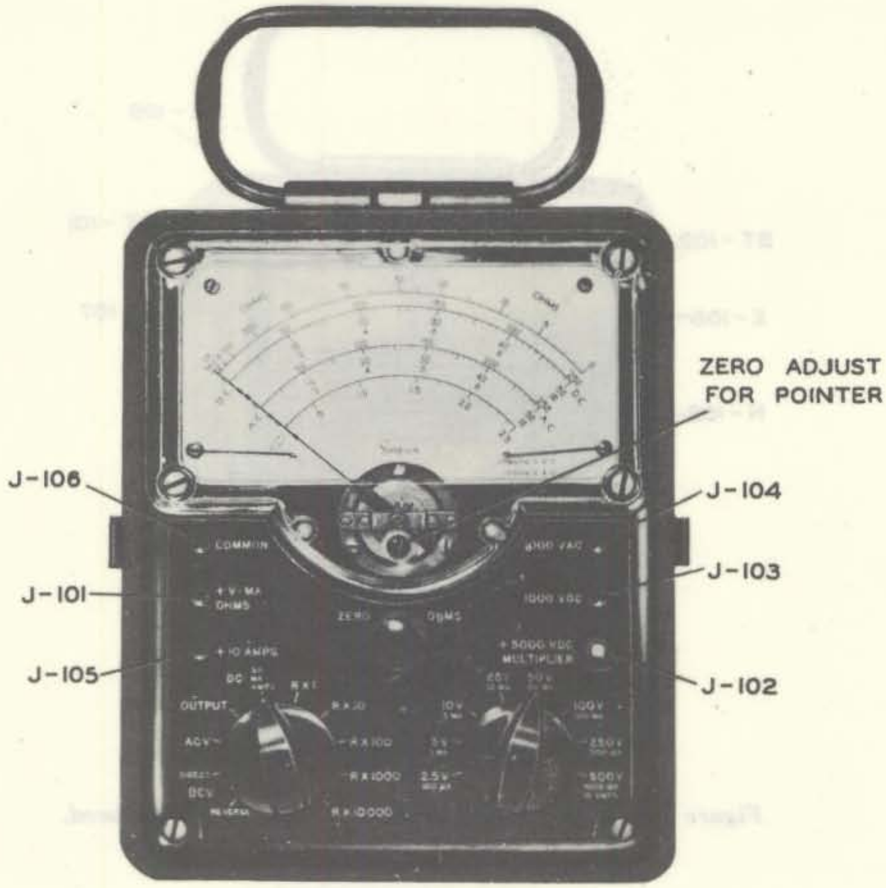

Figure 3-5. Multimeter ME-48A/U; Location of Front Panel Test Jacks

SECTION 4
OPERATION

1. FUNCTIONS OF EQUIPMENT.

Multimeter AN/PSM-4A is designed to permit the technician to make measurements of voltage, resistance, and current with a completely self-contained and portable instrument. It will measure either AC or DC voltage, Output voltage, DC resistance, and DC current in a wide range of values which cover the basic requirements for a portable tester for measuring electrical and electronic circuit values. All the accessories for use with the multimeter are contained in an accessory compartment within the cover. The cover remains with the instrument at all times. The cover forms a watertight seal when it is clamped in storage position over the face of the meter. While the instrument is in use, the cover clamps over the back of the meter to keep the accessory compartment convenient to the operator.

a. The RMS value of AC voltages are indicated on the dial of the meter. Nine convenient ranges provide for measurements of voltage values up to 1000 volts. The input impedance for AC voltage measurements is 1000 ohms-per-volt. Output voltage measurements, which indicate only the RMS value of the AC portion of mixed AC and DC voltages, are measured on the AC circuits with a series capacitor, C-101, to block the DC voltage.

b. DC voltages are read on 10 ranges for values up to 5000 volts. Up to 1000 volts, standard Black and Red Test Leads connect the instrument to the voltage source. For the 5000 volt range, there is a special High Voltage Test Lead which is used in combination with the Black Test Lead. All DC voltage ranges have an input resistance of 20,000 ohms per volt.

c. There are five resistance ranges. Resistance values as low as 1 ohm and as high as 30 megohms can be measured with these ranges. The center scale value for the Rx1 range is 30 ohms.

d. There are nine DC current ranges. Current values are indicated in convenient steps from 2 microamperes through 10 amperes. The lowest full scale value of current is 100 microamperes (uA).

2. FUNCTIONS OF CONTROLS AND TEST LEADS.

a. FUNCTION SWITCH S-101 (See figure 4-1).—Function switch S-101, located in the lower left hand corner of the front panel, selects the type of circuit for which the instrument is connected. There are two positions for DC volts: DIRECT and REVERSE. The normal position is DIRECT. If you connect the instrument for a DC voltage measurement and find that you have a polarity connection which makes the meter read backwards (pushes the pointer to the left), set switch S-101 at REVERSE and the pointer will be deflected up-scale. The meter will read a negative polarity of DC voltage with the switch in this position. Set switch S-101 at ACV to read alternating current voltages. A rectifier within the instrument will change the AC voltage to an equivalent DC value and apply this to the meter. The instrument will indicate the RMS value of the applied voltage. Set switch S-101 at OUTPUT to read the AC portion of mixed AC and DC voltages. Set switch S-101 at DC uA MA AMPS to read direct current. Set switch S-101 at Rx1, Rx10, Rx100, Rx1000, or Rx10000 to read resistance. Switch S-101 also serves as a range switch for resistance measurements.

b. RANGE SWITCH S-102 (See figure 4-1).—This eight position switch in the lower right corner of the front panel permits the selection of voltage and current ranges. The full scale value for each range switch position is marked on the front panel of Multimeter ME-48A/U.

c. ZERO OHMS CONTROL R-110 (See figure 4-1).—The ZERO OHMS control is located near the center of the front panel as shown in figure 4-1. Each time you place function switch S-101 in a position to read resistance, short the test leads together and rotate the ZERO OHMS control knob to make the pointer read full scale, or zero ohms. If you cannot bring the pointer to full scale, replace a weak battery in the battery compartment in the rear of case A-102. See paragraph 6-2 for instructions.

d. TEST LEADS AND TEST JACKS (See figure 4-1).—There are two test leads, W-101 and W-102, which you will need for all measurements except those which require the 5000 VDC range. Test lead W-101 is red and test lead W-102 is black. Unless otherwise specified, connect Black Test Lead W-102 in the COMMON jack, J-106, and connect Red Test Lead W-101 in the +V MA OHMS jack, J-101. For the 1000 volt DC range, place Red Test Lead W-101 in the 1000 VDC jack, J-103. For the 1000 volt AC range, place Red Test Lead W-101 in the 1000 VAC jack, J-104. For the 10 ampere DC current range, place Red Test Lead W-101 in the 10 AMPS jack, J-105. Use the Red Test Lead to contact positive polarity for DC measurements and the Black Test Lead to contact negative polarity. For the 5000 volt DC range, use Black Test Lead W-102 in the COMMON jack, J-106, and use the High Voltage Test Lead, W-103, screwed on over recessed post J-102, +5000 VDC MULTIPLIER.

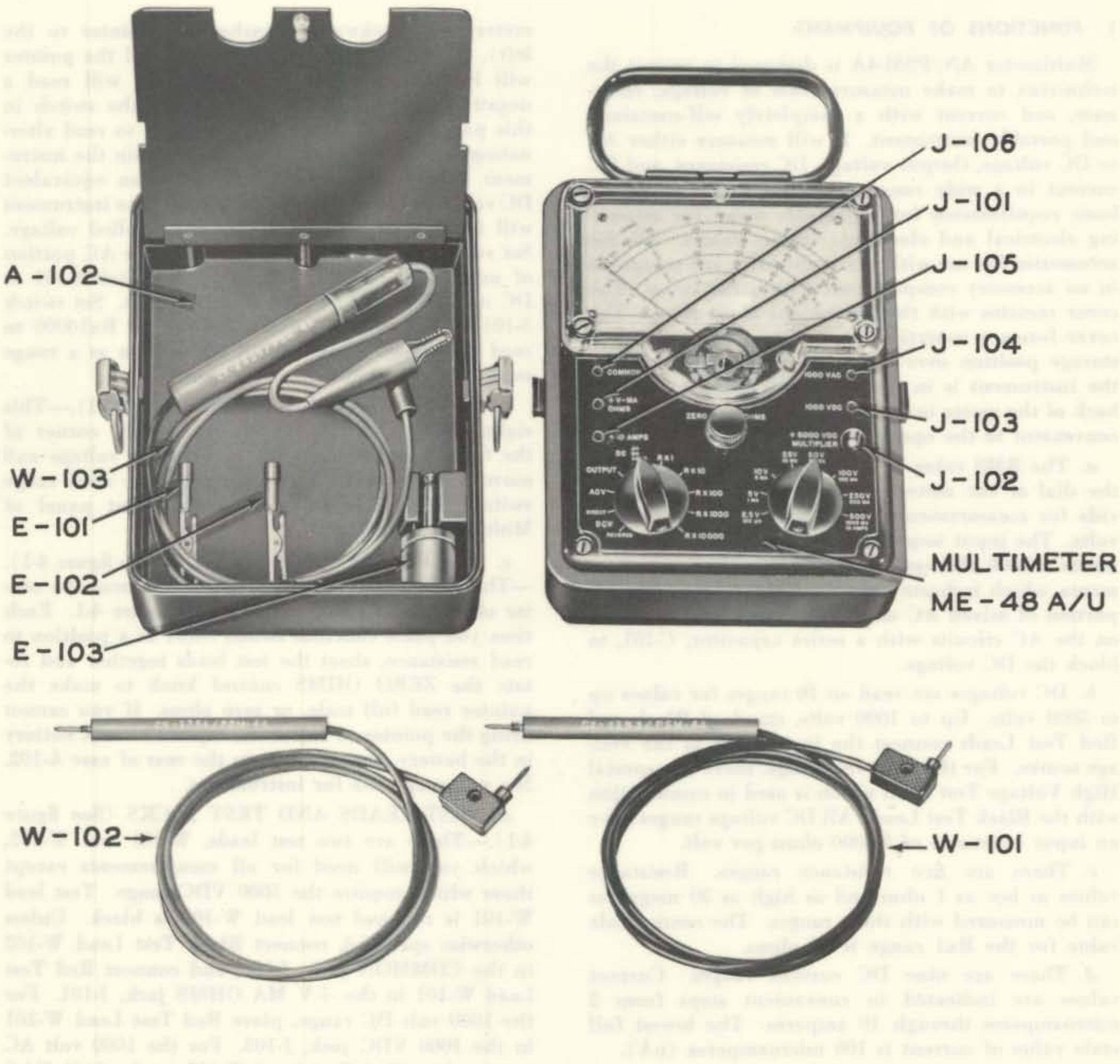

Figure 4-1. Front Panel and Cover; Location of Controls, Jacks, Leads and Accessories.

e. ACCESSORIES E-101, E-102, AND E-103 (See figure 4-1).—There are two alligator clips, E-101 and E-102, which the operator may use to screw on over the end of test leads W-101 and W-102. This is for the convenience of the operator. There is a telephone plug, E-103, which may be used to connect both the test leads, W-101 and W-102, to contacts within a two-contact telephone jack. This permits easier connection to the jack contacts for any electrical measurement because the operator can make the measurement directly through an equipment panel without opening the case of the equipment. The Red Test Lead, W-101, connected in the red insulated jack on the rear of telephone plug E-103, contacts the tip of the plug. The Black Test Lead, W-102, connected in the black insulated jack on the rear of the telephone plug, E-103, contacts the sleeve of the plug.

3. PRELIMINARY OPERATION.

a. Remove the cover, A-102, from the face of Multimeter ME-48A/U. Open the hinged access door within the cover to reach the lead compartment. To do this, place two fingers in the access holes and pull straight out to release the catch which locks the door in place.

b. Obtain the leads and accessories which will be used for measurements from the lead compartment inside cover A-102. Close the access door and press it into position to lock the catch.

c. Place the cover, A-102, over the rear of the case of Multimeter ME-48A/U and clamp it in place with the two pull catches.

d. Place the instrument in its operating position and observe the indication of the pointer. If it does not indicate zero, use a small screwdriver to turn the mechanical zero adjustment located over the meter movement until the pointer rests exactly over the zero marks at the left hand side of the dial.

e. When you finish using any lead or accessory, remove the cover, A-102, from the rear of the instrument and return the lead or accessory to the compartment within the cover. This will assure you of having the part available when you need to use it again.

f. When you have finished using the instrument, return all leads and accessories to the lead compartment within the cover, A-102, and clamp the cover over the face of Multimeter ME-48A/U. This will protect all the components by placing them within the watertight case for storage between uses.

4. WARNINGS.

Be sure to observe the following warnings when you are using this equipment.

WARNING

Voltages over 300 volts shall be measured as follows:

(1) Deenergize the equipment. Ground terminals to be measured to discharge any capacitors connected to these terminals. (See Note F).

(2) Connect meter to terminals to be measured using a range higher than the expected voltage.

(3) WITHOUT TOUCHING METER OR TEST LEADS, energize the equipment and read the meter.

(4) Deenergize the equipment. Ground the terminals connected to the meter before disconnecting the meter.

NOTES:

(A) MAKE SURE you are NOT GROUNDED whenever you are adjusting equipment or using measuring equipment.

(B) In general, USE ONE HAND ONLY when servicing live equipment.

(C) If test meter must be held or adjusted while voltage is applied, GROUND the case of the meter before starting measurement and DO NOT touch the live equipment or personnel working on live equipment while you are holding the meter.

(D) DO NOT FORGET that high voltages MAY BE PRESENT across terminals that are normally low voltage, due to equipment breakdown. Be careful even when measuring low voltages.

(E) DO NOT use test equipment known to be in poor condition.

(F) High voltage capacity capacitors should be discharged with a grounding stick with approximately 10 ohms in series with the grounded line. Where neither terminal of a capacitor is grounded, short the capacitor terminals to each other.

(G) The attention of officers and operating personnel is directed to Chapter 67 of Bureau of Ships Manual or superceding instructions on the subject of radio-safety precautions to be observed.

5. DC VOLTAGE MEASUREMENTS.

a. UP TO 500 VOLTS DC.—Use the following steps to measure DC voltages which are less than 500 volts:

(1) Obtain test leads W-101 and W-102 from lead compartment in cover A-102. Obtain alligator clips E-101 and E-102, or telephone plug E-103 if these are needed. Connect the alligators clips or telephone plug at the probe end of the test leads.

(2) Place Red Test Lead W-101 in the +V MA OHMS jack, J-101, and Black Test Lead W-102 in COMMON jack, J-106.

(3) Rotate switch S-101 to its DIRECT DCV position.

(4) Rotate switch S-102 to the desired range of voltage. If the voltage is not known, use the highest range as a protection to the instrument. After you make a reading, reset the switch, S-102, to a lower range if the voltage value is within the lower range.

(5) Turn off the power in the equipment in which a voltage is to be measured. Discharge any capacitors.

(6) Connect test lead W-102 (black) to the negative source of voltage which is to be measured.

(7) Connect test lead W-101 (red) to the positive source of voltage which is to be measured.

(8) Turn on the power in the equipment in which you are measuring voltage.

(9) Read the value of voltage present in the equipment. If the meter pointer tends to read backwards (deflects to the left), set switch S-101 at REVERSE DCV. The polarity of DC voltage between

the test leads is such that the red lead, W-101, contacts the negative source, and the black lead, W-102, contacts the positive source.

(10) Turn off the power in the circuit which was measured. Discharge any capacitors.

(11) Remove the test leads from the circuit.

b. FROM 500 VDC TO 1000 VDC.—Use the following steps to measure voltages which are greater than 500 volts, but not more than 1000 volts:

(1) Obtain test leads W-101 and W-102 and alligator clips E-101 and E-102 from lead compartment in cover A-102. Connect the alligator clips over the ends of test probes.

(2) Place Red Test Lead W-101 in the 1000 VDC jack, J-103, and Black Test Lead W-102, in the COMMON jack, J-106.

(3) Rotate switch S-101 to its DIRECT DCV position.

(4) Turn off the power in the equipment which is to be measured. Discharge any capacitors.

(5) Connect Black Test Lead W-102 to the negative source of voltage.

(6) Connect Red Test Lead W-101 to the positive source of voltage.

(7) Turn on the power in the equipment in which you are measuring the voltage. DO NOT TOUCH THE TEST LEADS.

(8) Read the value of voltage present in the equipment. If the meter pointer tends to read backwards (deflects to the left), set switch S-101 at REVERSE DCV. The polarity of DC voltage between the test leads is positive at the black probe and negative at the red probe.

(9) Turn off the power in the circuit which was measured. Discharge any capacitors.

(10) Remove the test leads from the circuit.

c. FROM 1000 VDC to 5000 VDC.—Use the following steps to measure voltages which are greater than 1000 volts, but not more than 5000 volts:

(1) Obtain test leads W-102 and W-103 and alligator clip E-101 from the lead compartment in cover A-102. Connect the alligator clip over the probe end of Black Test Lead W-102.

(2) Plug Black Test Lead W-102 in the COMMON jack, J-106, and screw the High Voltage test lead, W-103, in place on the +5000 VDC MULTIPLIER post, J-102.

(3) To measure a high positive voltage, set switch S-101 at DIRECT DCV. To measure a high negative voltage set switch S-101 at REVERSE DCV.

(4) Turn off the power in the circuit which is to be measured. Discharge any capacitors.

(5) Connect Black Test Lead W-102 to the source of voltage which is nearer ground potential.

(6) Connect the High Voltage test lead, W-103, to the source of high voltage.

(7) Turn on the power in the equipment in which you are measuring voltage. DO NOT TOUCH THE TEST LEADS. Glow lamp I-101 in the transparent head of the multiplier housing will glow to indicate that a dangerous voltage is present.

(8) Read the value of voltage present in the circuit. If the meter tends to read backwards (deflects to the left), the test leads are connected in reverse. Turn off the power in the circuit and discharge its capacitors. Then set switch S-101 to reverse the instrument polarity, (from DIRECT to REVERSE, or from REVERSE to DIRECT), and turn on the power in the circuit again.

(9) Turn off the power in the circuit which was measured. Discharge any capacitors.

(10) Remove the test leads from the circuit.

6. AC VOLTAGE MEASUREMENTS.

a. UP TO 500 VOLTS RMS.—Use the following steps to measure AC voltages which have RMS values up to 500 volts:

(1) Obtain test leads W-101 and W-102 and alligator clips E-101 and E-102 or telephone plug E-103 from the lead compartment in cover A-102 if you wish to use them. Connect the alligator clips or the telephone plug at the probe end of the test leads.

(2) Plug Black Test Lead W-102 in the COMMON jack, J-106, and the Red Test Lead, W-101 in the +V MA OHMS jack, J-101.

(3) Set the function switch, S-101, at ACV.

(4) Set the range switch, S-102, for the desired range of voltage. If the voltage is not known, use the highest range as a protection to the instrument. After you make a reading, reset the range switch, S-102, for a lower range if the voltage is within the lower range.

(5) Turn off the power in the circuit which is to be measured. Discharge any capacitors.

(6) Connect the test leads, W-101 and W-102, across the source of voltage which is to be measured. The polarity of the leads will not matter unless there is some DC voltage present. When this is true, measure the AC component of the mixed voltage with an Output circuit (see paragraph 4-8 below).

(7) Turn on the power in the circuit which is to be measured.

(8) Read the RMS value of voltage on the meter scale.

(9) Turn off the power in the circuit in which voltage was measured.

(10) Remove the test leads from the circuit.

b. FROM 500 VOLTS TO 1000 VOLTS RMS.—Use the following steps to measure AC voltage which has an RMS value between 500 and 1000 volts:

(1) Obtain test leads W-101 and W-102 and alligator clips E-101 and E-102 from the lead compart-

ment. Screw the alligator clips over the probe end of the test leads.

(2) Plug Red Test Lead W-101 in the 1000 VAC jack, J-104, and Black Test Lead W-102 in the COMMON jack, J-106.

(3) Set the function switch, S-101, at ACV.

(4) Turn off the power in the circuit which is to be measured. Discharge any capacitors.

(5) Connect the test leads, W-101 and W-102, across the source of voltage which is to be measured. The polarity of the test leads will not make any difference for AC voltage measurements.

(6) Turn on the power in the circuit which is to be measured. DO NOT TOUCH THE TEST LEADS.

(7) Read the voltage on the meter scale. This will be the RMS value of AC circuit voltage.

(8) Turn off the power in the circuit in which voltage was measured. Discharge any capacitors.

(9) Remove the test leads from the circuit.

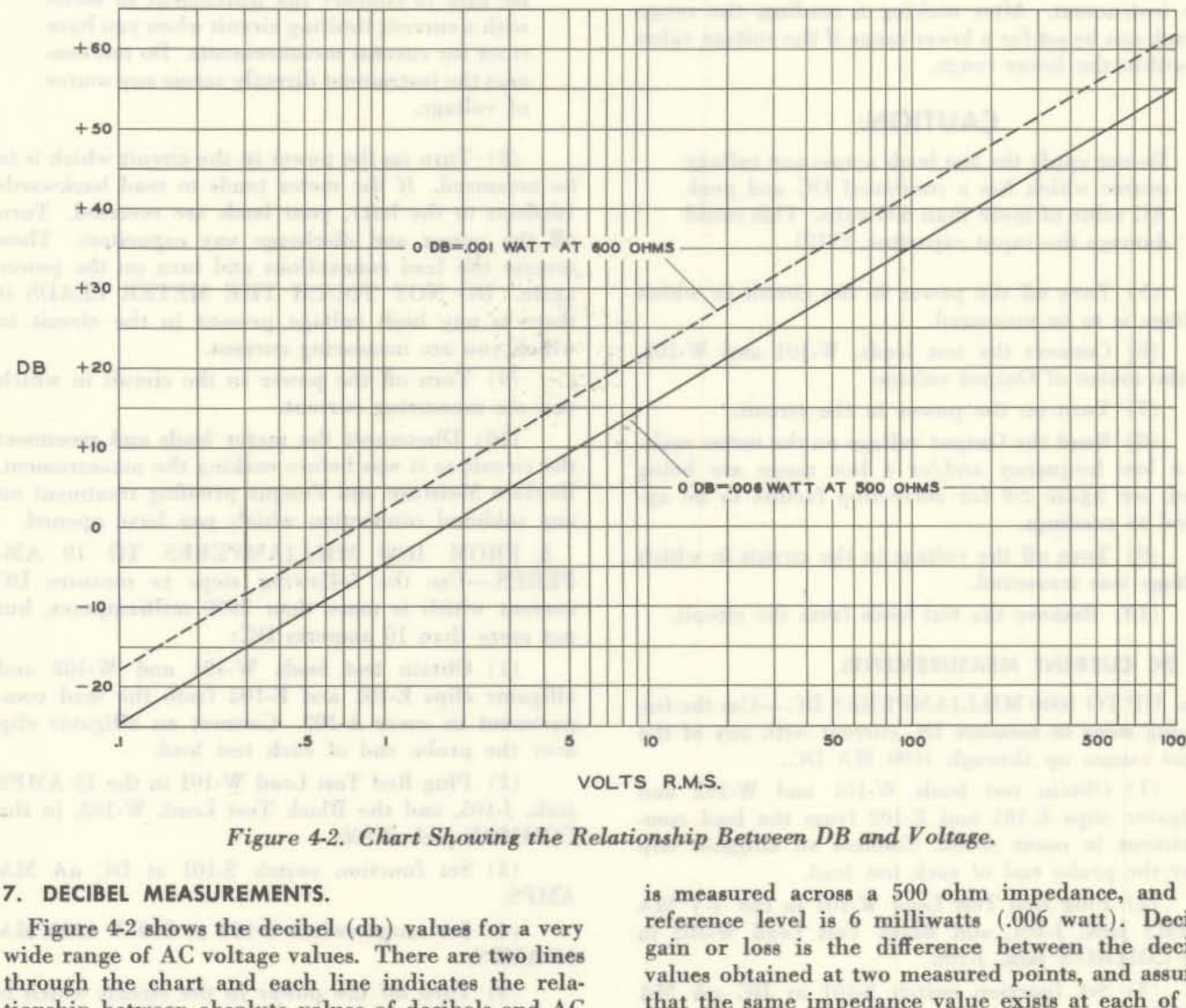

Figure 4-2. Chart Showing the Relationship Between DB and Voltage.

7. DECIBEL MEASUREMENTS.

Figure 4-2 shows the decibel (db) values for a very wide range of AC voltage values. There are two lines through the chart and each line indicates the relationship between absolute values of decibels and AC voltage with respect to a defined zero reference level. There are two such zero reference levels in common use, therefore each line represents the relationships with one of the defined zero reference levels. The upper, or broken, line shows the absolute decibel values which correspond to AC voltage when the AC voltage is measured across a 600 ohm impedance, and the reference level is 1 milliwatt (.001 watt). The lower, or solid, line shows the absolute decibel values which correspond to AC voltage when the AC voltage is measured across a 500 ohm impedance, and the reference level is 6 milliwatts (.006 watt). Decibel gain or loss is the difference between the decibel values obtained at two measured points, and assumes that the same impedance value exists at each of the two measured points.

8. OUTPUT VOLTAGE MEASUREMENTS.

Measuring Output voltage consists of measuring the AC voltage only when there is both AC and DC voltage present in the circuit to which the leads are connected. Use the following steps to measure output voltages:

(1) Obtain test leads W-101 and W-102 from the lead compartment in cover A-102. Obtain alli-

gator clips E-101 and E-102 or telephone plug E-103 if these are to be used in the measurements. Connect the alligator clips or the telephone plug at the end of the test leads.

(2) Plug Red Test Lead W-101 into the +V MA OHMS jack, J-101, and Black Test Lead W-102 into the COMMON jack, J-106.

(3) Set the function switch, S-101, at OUTPUT.

(4) Set the range switch, S-102, at a convenient range. If the value of voltage is not known, set the range switch for the highest range as a protection to the instrument. After making a reading, the range switch can be set for a lower range if the voltage value is within the lower range.

CAUTION:

Do not apply the test leads across any voltage source which has a combined DC and peak AC value of more than 600 volts. This could damage the input capacitor, C-101.

(5) Turn off the power in the circuit in which voltage is to be measured.

(6) Connect the test leads, W-101 and W-102, to the source of Output voltage.

(7) Turn on the power in the circuit.

(8) Read the Output voltage on the meter scale. If a low frequency and/or a low range are being used, see figure 2-8 for correction factors to be applied to readings.

(9) Turn off the voltage in the circuit in which voltage was measured.

(10) Remove the test leads from the circuit.

9. DC CURRENT MEASUREMENTS.

a. UP TO 1000 MILLIAMPERES DC.—Use the following steps to measure DC current with any of the eight ranges up through 1000 MA DC:

(1) Obtain test leads W-101 and W-102 and alligator clips E-101 and E-102 from the lead compartment in cover A-102. Connect an alligator clip over the probe end of each test lead.

(2) Plug Red Test Lead W-101 in the +V MA OHMS jack, J-101, and Black Test Lead W-102 in the COMMON jack, J-106.

(3) Set function switch S-101 at DC uA MA AMPS.

(4) Set range switch S-102 at a range position which is convenient for the current which is to be measured. If the current value is not known, set the range switch at a high value as a protection to the instrument. After you make a reading, reset the range switch to a lower range if the current value is within the lower range.

(5) Turn off the power in the circuit which is to be measured. Discharge any capacitors.

(6) Open the circuit in which current is to be measured. If necessary unsolder a lead to obtain this open circuit.

(7) Connect the test leads to place the Multimeter ME-48A/U in series with the circuit in which you are measuring current. Connect Black Test Lead W-102 on the side towards the negative polarity, and Red Test Lead W-101 on the side towards the positive polarity.

CAUTION:

Be sure to connect the instrument in series with a current limiting circuit when you have it set for current measurements. Do not connect the instrument directly across any source of voltage.

(8) Turn on the power in the circuit which is to be measured. If the meter tends to read backwards (deflects to the left), your leads are reversed. Turn off the power and discharge any capacitors. Then reverse the lead connections and turn on the power again. DO NOT TOUCH THE METER LEADS if there is any high voltage present in the circuit in which you are measuring current.

(9) Turn off the power in the circuit in which you are measuring current.

(10) Disconnect the meter leads and reconnect the circuit as it was before making the measurement. Replace Moisture and Fungus proofing treatment on any soldered connection which you have opened.

b. FROM 1000 MILLIAMPERES TO 10 AMPERES.—Use the following steps to measure DC current which is more than 1000 milliamperes, but not more than 10 amperes DC:

(1) Obtain test leads W-101 and W-102 and alligator clips E-101 and E-102 from the lead compartment in cover A-102. Connect an alligator clip over the probe end of each test lead.

(2) Plug Red Test Lead W-101 in the 10 AMPS jack, J-105, and the Black Test Lead, W-102, in the COMMON jack, J-106.

(3) Set function switch S-101 at DC uA MA AMPS.

(4) Set range switch S-102 at 500 V 1000 MA 10 AMPS.

(5) Turn off the power in the circuit which is to be measured. Discharge any capacitors.

(6) Open the circuit in which current is to be measured. If necessary, unsolder a lead to obtain this open circuit.

(7) Connect the test leads to place Multimeter ME-48A/U in series with the circuit in which you are measuring current. Connect Black Test Lead W-102 on the side towards the negative polarity, and Red Test Lead W-101 on the side towards the positive polarity.

CAUTION:

Be sure to connect the instrument in series with a current limiting circuit when you have it set for current measurements. Do not connect the instrument directly across any source of voltage.

(8) Turn on the power in the circuit which is to be measured. If the meter tends to read backwards (deflects to the left), your leads are reversed. Turn off the power and discharge any capacitors. Then reverse the lead connections and turn the power on again. DO NOT TOUCH THE METER LEADS if there is any high voltage present in the circuit in which you are measuring current.

(9) Turn off power in the circuit in which you are measuring current.

(10) Disconnect the meter leads and reconnect the circuit as it was before you made the measurement. Replace Moisture and Fungus proofing treatment on any soldered connection which you have opened.

10. RESISTANCE MEASUREMENTS.

Use the following steps to measure resistance values in ohms:

(1) Obtain test leads W-101 and W-102 from the lead compartment in cover A-102. Obtain alligator clips E-101 and E-102 or telephone plug E-103 if you wish to use them. Connect the alligator clips or the telephone plug to the end of the test leads.

(2) Plug Red Test Lead W-101 in the +V MA OHMS jack, J-101, and Black Test Lead W-102 in the COMMON jack, J-106.

(3) Set function switch S-101 in any of the five resistance range positions desired. These are marked Rx1, Rx10, Rx100, Rx1000, and Rx10000.

(4) Short the two test leads together. Rotate the ZERO OHMS control, R-110, until the meter pointer indicates full scale, or zero ohms. If you cannot obtain full scale deflection with the aid of the ZERO OHMS control, see Section 6, paragraph 2, for instructions.

(5) Be sure there is no voltage existing across any resistor or circuit in which you are to make any resistance measurements.

(6) Separate the test leads and apply one to each side of the circuit or resistor which you wish to measure. If there is any difference between a forward or backward resistance within the circuit (such as in a copper oxide rectifier), consider the polarity of voltage present at the test probes; the black lead, W-102, is connected to positive battery polarity, and the red lead, W-101, is connected to the negative battery polarity.

(7) Read the resistance value indicated on the upper, or OHMS, arc of the meter scale. Note that it reads from right to left. If you can obtain a readable deflection on two or more ranges, use the reading which is closer to the center of the scale. Note: reset the ZERO OHMS control, R-110, each time you change switch S-101 to a new range position.

(8) Multiply the value which you obtained in step 7 above by the multiplier factor indicated at the position of switch S-101. The result is the total value of resistance for the resistor or circuit.

SECTION 5
PREVENTIVE MAINTENANCE

1. DEFINITION OF PREVENTIVE MAINTENANCE.

Preventive maintenance is work performed on the equipment, usually when the equipment is not in use, to keep it in such good working order that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair since its object is to prevent certain troubles before they occur. The importance of preventive maintenance cannot be over-emphasized. Therefore, it is important that the equipment be maintained properly.

2. PREVENTIVE MAINTENANCE PROCEDURE.

Preventive maintenance on Multimeter AN/PSM-4A consists of periodically checking in the following manner to determine that there is, or is not, a fault which is developing in the instrument which can be remedied before it causes repair to be necessary:

FEEL the knobs, cover clamps, and front panel jacks to check for looseness or other evidence of deterioration.

INSPECT the surface appearance of the watertight gasket around the face of the Multimeter ME-48A/U, and of the resistors and the condenser within the case for evidence of deterioration, dirt accumulation, overheating, or other trouble.

TIGHTEN any loose fittings in the cover, on the face of the instrument, or within the case of the meter, including the inside of the battery compartment.

CLEAN away all dirt accumulation, corrosion, or other evidence of chemical action. Replace Moisture and Fungus protection whenever it is necessary.

ADJUST any looseness noted in the instrument by tightening all loose nuts and screws, the ring nuts around the front panel switches, the pin jacks, and any other parts which have become loose during the use of the instrument. Reset mechanical zero on the meter movement if it is off zero.

No lubrication is required in Multimeter AN/PSM-4A.

3. ROUTINE MAINTENANCE CHECK CHARTS.

The check-charts which follow this paragraph show the operator how to maintain the equipment so that trouble shooting and repair will be reduced to a minimum. They indicate what to check, how to check, and the precautions which should be taken before, during, and after checking the equipment. The check-charts are self-explanatory.

NOTE: GASOLINE WILL NOT BE USED AS A CLEANING FLUID FOR ANY PURPOSE.

TABLE 5-1. MAINTENANCE CHECK CHART.

WHAT TO CHECK	WHEN TO CHECK	HOW TO CHECK	PRECAUTIONS
Panel	Weekly	Inspect outside of front panel. Check panel screws, switch and control knobs, jacks for lead connections, and meter dial cover. Clean with dry cloth. Use dry compressed air to blow out dust and dirt which have accumulated. Tighten loose screws and knobs as necessary.	Do not use gasoline as a cleaning fluid.
Cover	Weekly	Inspect outside and inside of cover and lead compartment. Clean with dry cloth. Use dry compressed air to blow out accumulated dust and dirt. Tighten door latch for lead compartment door as necessary.	Do not damage the watertight sealing track around the edge of the cover. (See figure 5-1).
Test leads and accessories	Weekly	Inspect test leads and accessories for tightness and cleanliness. Clean with dry cloth. Remove any corrosion of metal parts with crocus cloth and wipe with a clean cloth.	
Batteries and Battery Compartment	Weekly	Inspect the batteries and the battery compartment for any dirt or corrosion, or any swelling of the battery cases. Clean with a dry cloth. Use crocus cloth to remove any corrosion. Replace any battery which shows discoloration or swelling.	When replacing any battery, note the polarity indications marked in the compartment.
Resistors	Monthly	Inspect the resistors for dirty surfaces, corrosion on leads, and discoloration showing overheating. Clean with a dry cloth. Use dry compressed air to blow out accumulated dirt and dust. Check security of all mountings.	Do not attempt to move resistors with axial leads. The connection may break at the point where it enters the body of the resistor. Such defects cannot be repaired.

WHAT TO CHECK	WHEN TO CHECK	HOW TO CHECK	PRECAUTIONS
Capacitor	Monthly	Inspect the fixed capacitor for signs of discoloration, leaks, bulges, dirt, corrosion, loose mounting and connections. Clean with a dry cloth. Use dry compressed air to blow out accumulated dirt or dust.	
Switches	Monthly	Inspect for dirt accumulation on surface of insulators and in contacts. Clean with a dry cloth. If there is any dust or dirt inside switch contacts, flow a small amount of solvent inside the contact. Use dry compressed air to blow out the cleaning fluid.	Always set switch at full counter-clockwise position before disassembling any switch. Be sure the rotor is not turned before the switch is reassembled. Do not use gasoline as a cleaning fluid.

NOTE: In the event of use in tropical areas where fungus growth may be encountered, frequent inspection of the Multimeter should be observed, especially if the Multimeter has been stored. Components showing any signs of fungus growth should be cleaned and then coated with a fungus resistant lacquer. Do not cover switch contacts with lacquer.

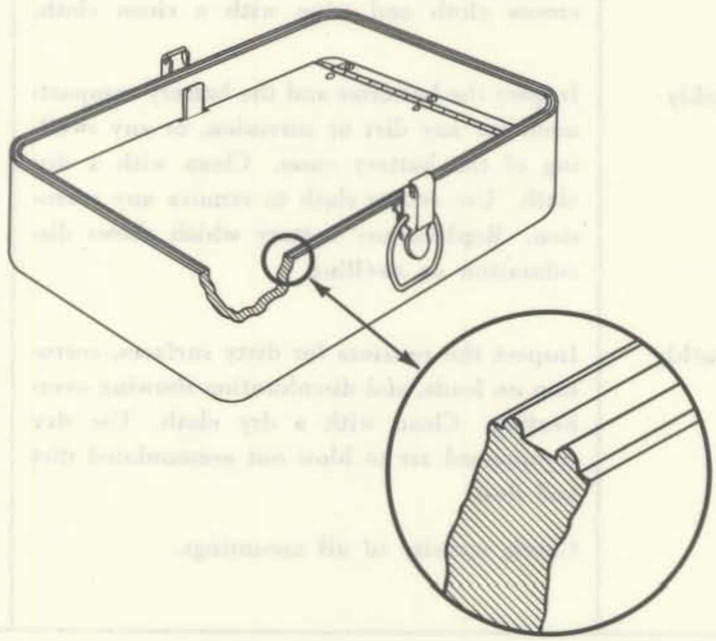

Figure 5-1. Watertight Sealing Track on Cover A-102.

FAILURE REPORTS

A FAILURE REPORT must be filled out for the failure of any part of the equipment whether caused by defective or worn parts, improper operation, or external influences. It should be made on Failure Report, form NAVSHIPS 383, which has been designed to simplify this requirement. The card must be filled out and forwarded to BUSHIPS. Full instructions are to be found on each card.

Use great care in filling the card out to make certain it carries adequate information. For example under "Circuit Symbol" use the proper circuit identification taken from the schematic drawings, such as T-803, in the case of a transformer, or R-207, for a resistor. Do not substitute brevity for clarity. Use the back of the card to completely describe the cause of failure and attach an extra piece of paper if necessary.

The purpose of this report is to inform BUSHIPS of the cause and rate of failures. The information is used by the Bureau in the design of future equipment and in the maintenance of adequate supplies to keep the present equipment going. The cards you send in, together with those from hundreds of other ships, furnish a store of information permitting the Bureau to keep in touch with the performance of the equipment of your ship and all other ships of the Navy.

This report is not a requisition. You must request the replacement of parts through your Officer-in-Charge in the usual manner.

Make certain you have a supply of Failure Report cards and envelopes on board. They may be obtained from the nearest District Printing and Publication Office.

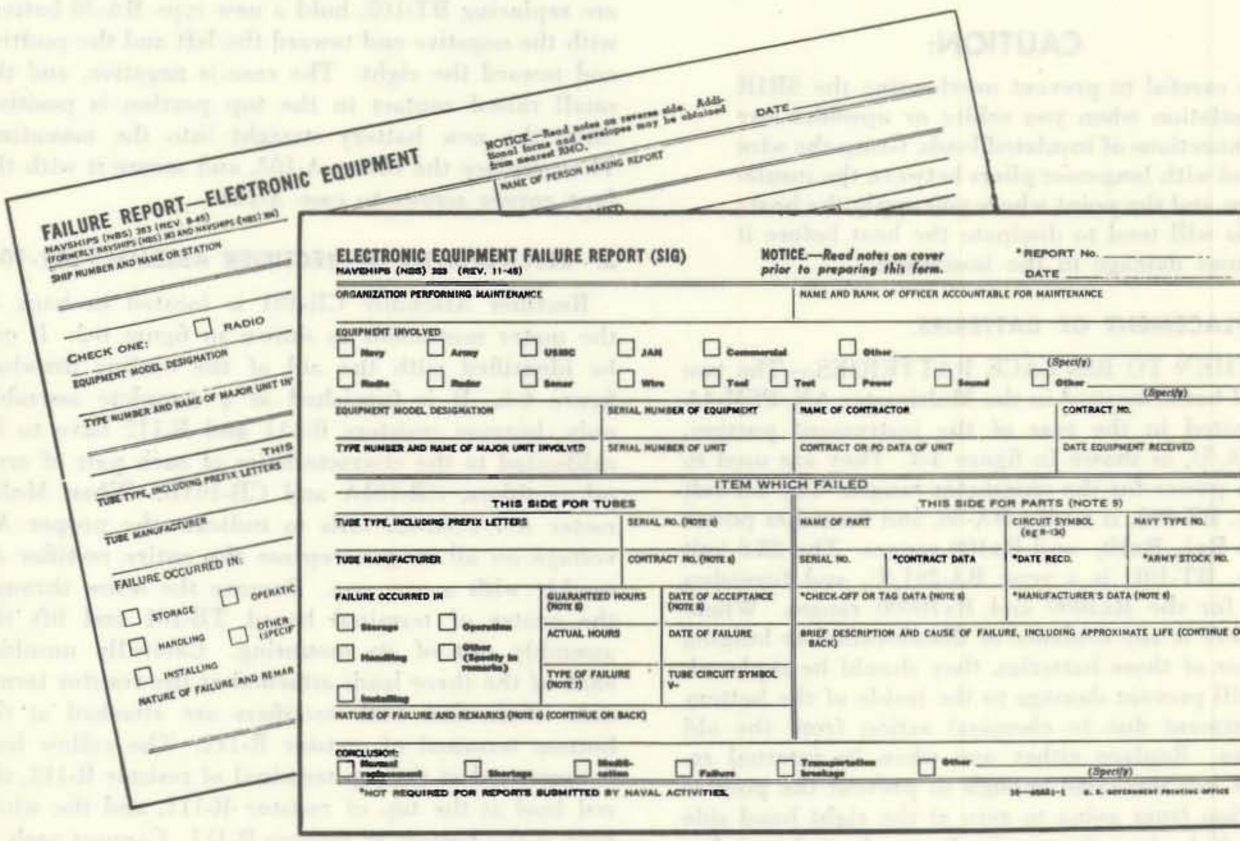

Figure 6-1. Failure Report.

SECTION 6
CORRECTIVE MAINTENANCE

1. THEORY OF LOCALIZATION.

Because of the fact that each range and type of circuit uses a special group of component parts, localization and trouble shooting are simplified for Multimeter AN/PSM-4A. The Trouble Shooting Chart shown in Table 6-1 should be used as a guide to help locate a source of trouble. It is not necessarily an all inclusive list of the parts which may be involved in a trouble, but it does indicate the probable location of a fault in accordance with the behavior which the instrument exhibits. This chart is progressively dependent from the top down. For example, if the AC voltage ranges are all indicating satisfactorily, but there are no indications for the Output circuits, the trouble is definitely in Capacitor C-101, or in the circuit and leads which are connected only to this part. When the trouble occurs only on one range, use the referenced figure in Section 2 to help determine which part is involved in the trouble.

CAUTION:

Be careful to prevent overheating the SRIR insulation when you solder or unsolder any connections of insulated leads. Grasp the wire lead with long-nose pliers between the insulation and the point where you apply the heat; this will tend to dissipate the heat before it causes damage to the insulation.

2. REPLACEMENT OF BATTERIES.

a. WHEN TO REPLACE BATTERIES.—The two dry cell batteries used in the Multimeter AN/PSM-4A are located in the rear of the instrument portion, ME-48A/U, as shown in figure 3-3. They are used to furnish power for the ohmmeter ranges. The 1.5 volt battery, BT-102, is a type BA-30, and furnishes power for the Rx1, Rx10, and Rx100 ranges. The 22.5 volt battery, BT-101, is a type BA-261/U, and furnishes power for the Rx1000 and Rx10000 ranges. Whenever there is any evidence of discoloration or bulging of either of these batteries, they should be replaced. This will prevent damage to the inside of the battery compartment due to chemical action from the old batteries. Replace either one when its internal resistance has increased enough to prevent the pointer indication from going to zero at the right hand side of the dial when the test leads are shorted together and the ZERO OHMS knob, R-110, is rotated fully clockwise. Remove the batteries when the equipment is to be stored for a period of 30 days or more, and place new batteries in the compartment when the unit is removed from storage. Since the instrument is supplied without batteries, you will also have to place new batteries in the case when it is originally placed in service.

b. HOW TO REPLACE BATTERIES.—Remove the four screws in the corners of the cover, A-103, over the battery compartment in the rear of case A-101. This cover is stamped REMOVE TO REPLACE BATTERIES. Lift the cover out of the case. Grasp the battery which you are replacing and pull it out of the compartment. If you are replacing BT-101, hold a new type BA-261/U battery with the negative end toward the right and the positive end toward the left: the polarity is marked on the battery case. Insert the negative end first and press it against the spring contact. Then slide the positive end down on the contact face on the center wall which separates the two parts of the battery compartment. If you are replacing BT-102, hold a new type BA-30 battery with the negative end toward the left and the positive end toward the right. The case is negative, and the small raised contact in the top portion is positive. Slide the new battery straight into the mounting. Then replace the cover, A-103, and secure it with the four corner screws to case A-101.

3. REPLACEMENT OF RECTIFIER ASSEMBLY CR-101.

Rectifier Assembly CR-101 is located in back of the meter movement as shown in figure 6-2. It can be identified with the aid of the outline drawing, figure 6-6. It is furnished as a complete assembly only, because resistors R-111 and R-112 have to be calibrated to the characteristics of each pair of crystal rectifiers, CR-101A and CR-101B. When Multimeter AN/PSM-4A fails to indicate the proper AC voltage on all ranges, replace the entire rectifier assembly with a new one. Remove the screw through the center of terminal board TB-101 and lift the assembly out of its mounting. Carefully unsolder each of the three leads attached at the resistor terminals. Note that both rectifiers are attached at the bottom terminal of resistor R-112. The yellow lead is connected at the top terminal of resistor R-112, the red lead at the top of resistor R-111, and the white lead at the bottom of resistor R-111. Connect each of these three leads to the same terminals in a new rectifier assembly. Seat the new assembly in the panel mounting, and secure it with the screw through the center.

TROUBLE SHOOTING CHART

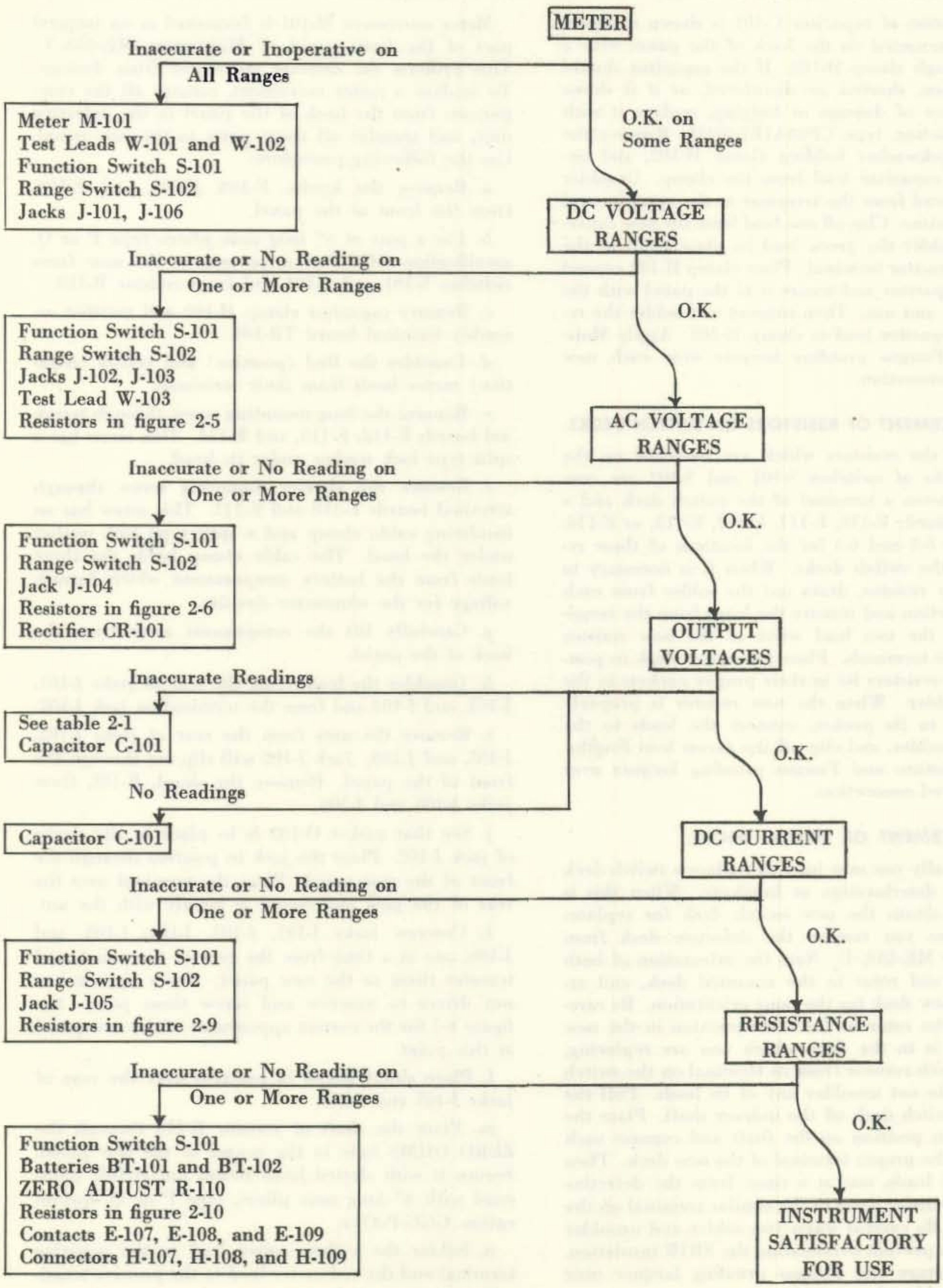

TABLE 6-1. TROUBLE SHOOTING CHART

4. REPLACEMENT OF CAPACITOR C-101.

The location of capacitor C-101 is shown in figure 6-2. It is mounted on the back of the panel with a screw through clamp H-102. If the capacitor should become open, shorted, or discolored, or if it shows any evidence of damage or bulging, replace it with a new capacitor, type CP26A1EF504M. Remove the nut and lockwasher holding clamp H-102, and unsolder the capacitor lead from the clamp. Unsolder the green lead from the terminal at the opposite end of the capacitor. Clip off one lead from the new capacitor and solder the green lead in place right at the clipped capacitor terminal. Place clamp H-102 around the new capacitor and secure it to the panel with the lockwasher and nut. Then connect and solder the remaining capacitor lead to clamp H-102. Apply Moisture and Fungus proofing lacquer over each new soldered connection.

5. REPLACEMENT OF RESISTORS ON SWITCH DECKS.

Most of the resistors which are mounted on the switch decks of switches S-101 and S-102 are connected between a terminal of the switch deck and a terminal board; E-110, E-111, E-112, E-113, or E-114. See figures 6-4 and 6-5 for the locations of these resistors on the switch decks. When it is necessary to replace any resistor, drain out the solder from each lead connection and remove the leads from the terminals. Slip the two lead wires of the new resistor through the terminals. Place the switch deck in position so the resistors lie in their proper pockets in the resistor holder. When the new resistor is properly positioned in its pocket, connect the leads to the terminals, solder, and clip off the excess lead lengths. Apply Moisture and Fungus proofing lacquer over each soldered connection.

6. REPLACEMENT OF SWITCH DECKS.

Occasionally you may have to replace a switch deck because of deterioration or breakage. When this is necessary, obtain the new switch deck for replacement before you remove the defective deck from Multimeter ME-48A/U. Note the orientation of both the stator and rotor in the mounted deck, and arrange the new deck for the same orientation. Be careful to set the rotor in the same position in the new deck as it is in the deck which you are replacing. Unsolder each resistor from its terminal on the switch deck, but do not unsolder any of its leads. Pull the defective switch deck off the indexer shaft. Place the new deck in position on the shaft and connect each resistor to the proper terminal of the new deck. Then remove the leads, one at a time, from the defective deck and transfer them to the similar terminal on the new deck. Be careful when you solder and unsolder the leads to prevent overheating the SR1R insulation. Apply Moisture and Fungus proofing lacquer over each new soldered connection.

7. REPLACEMENT OF METER MOVEMENT M-101.

Meter movement M-101 is furnished as an integral part of the front panel of Multimeter ME-48A/U. This protects the delicate movement from damage. To replace a meter movement, remove all the components from the back of the panel in the defective unit, and transfer all those parts to the new panel. Use the following procedure:

a. Remove the knobs, E-104, E-105, and E-106, from the front of the panel.

b. Use a pair of 6″ long nose pliers, type P or Q, specification GGG-P-471a, to remove the nuts from switches S-101 and S-102 and from resistor R-110.

c. Remove capacitor clamp H-102 and rectifier assembly terminal board TB-101.

d. Unsolder the Red (positive) and yellow (negative) meter leads from their terminals.

e. Remove the long mounting screw through terminal boards E-112, E-113, and E-114. This screw has a split type lock washer under its head.

f. Remove the shorter mounting screw through terminal boards E-110 and E-111. This screw has an insulating cable clamp and a split type lock washer under the head. The cable clamp holds the three leads from the battery compartment which furnish voltage for the ohmmeter circuits.

g. Carefully lift the components away from the back of the panel.

h. Unsolder the leads from the rear of jacks J-101, J-103, and J-104 and from the terminal on jack J-102.

i. Remove the nuts from the rear of jacks J-102, J-105, ond J-106. Jack J-102 will slip out through the front of the panel. Remove the shunt, R-138, from jacks J-105 and J-106.

j. See that gasket O-102 is in place in the sleeve of jack J-102. Place the jack in position through the front of the new panel. Place the terminal over the rear of the jack and secure it loosely with the nut.

k. Unscrew jacks J-101, J-103, J-104, J-105, and J-106, one at a time from the rear of the panel, and transfer them to the new panel. Use a ¼-inch hex nut driver to unscrew and screw these jacks. See figure 6-7 for the correct appearance of the new panel at this point.

l. Place shunt R-138 in position over the rear of jacks J-105 and J-106.

m. Place the shaft of resistor R-110 through the ZERO OHMS hole in the center of the new panel. Secure it with slotted head round nut H-105, tightened with 6″ long nose pliers, type P or Q, specification GGG-P-471a.

n. Solder the yellow meter lead to the negative terminal and the red meter lead to the positive terminal at the rear of the movement.

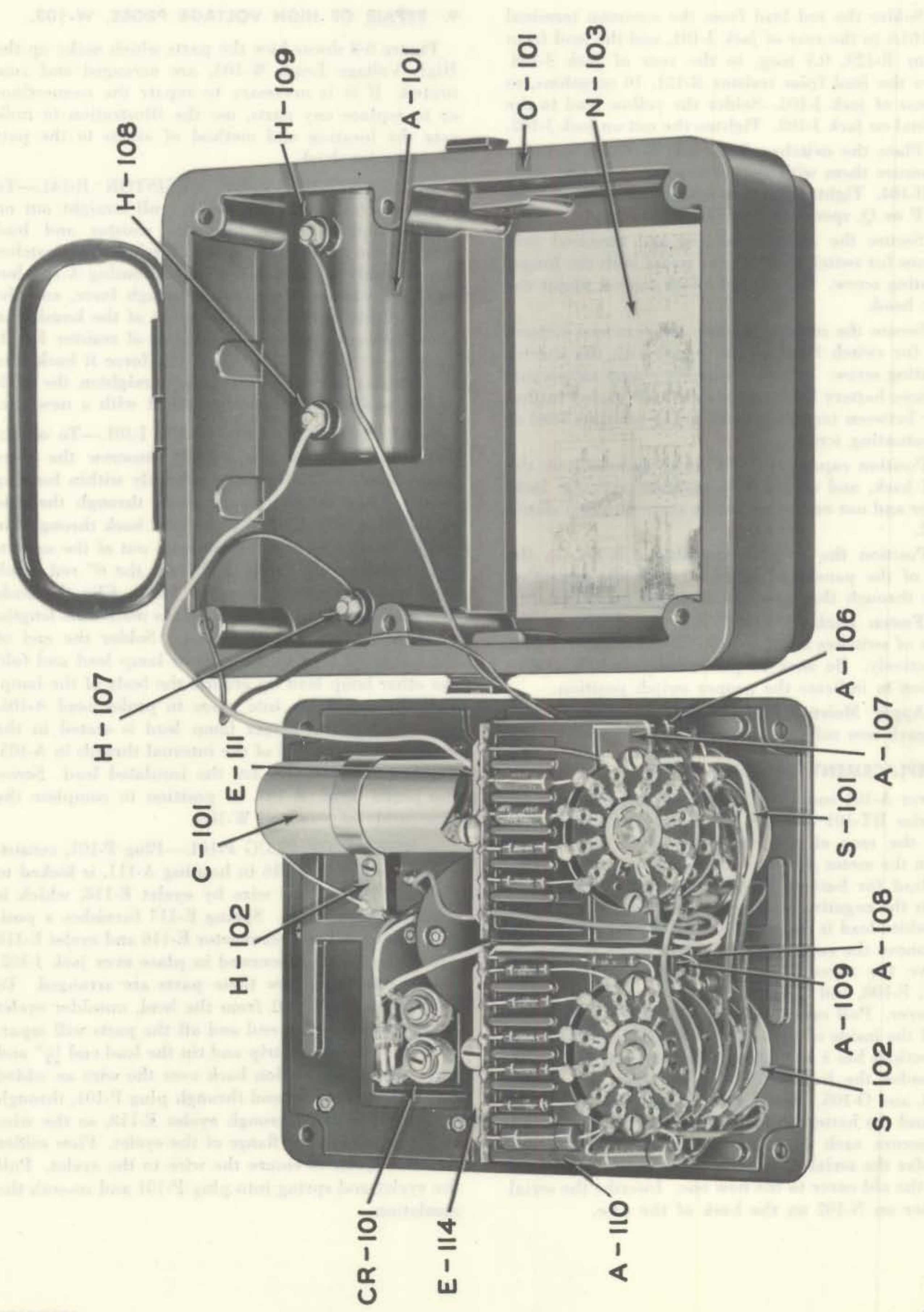

Figure 6-2. Multimeter ME-48A/U, Rear View with Case A-101 Removed.

o. Solder the red lead from the common terminal of S-101A to the rear of jack J-101, and the lead from resistor R-129, 0.5 meg, to the rear of jack J-104. Solder the lead from resistor R-121, 10 megohms, to the rear of jack J-103. Solder the yellow lead to the terminal on jack J-102. Tighten the nut on jack J-102.

p. Place the switches, S-101 and S-102, in position and secure them with slotted head round nuts H-103 and H-104. Tighten the nuts with 6″ long nose pliers, type P or Q, specification GGG-P-471a.

q. Secure the resistor holders and terminal connections for switch S-102 to the panel with the longer mounting screw. Use the split lock washer under the screw head.

r. Secure the resistor holders and terminal connections for switch S-101 to the panel with the shorter mounting screw. Include the cable clamp supporting the three battery leads and a split lock washer in that order between terminal board E-111 and the head of the mounting screw.

s. Position capacitor C-101 in its mounting on the panel back, and secure it in position with the lock-washer and nut on the mounting screw through clamp H-102.

t. Position the rectifier assembly, CR-101, in the back of the panel and secure it with the mounting screw through the center of terminal board TR-101.

u. Fasten knobs E-104, E-105, and E-106 to the shafts of switches S-101 and S-102 and resistor R-110, respectively. Be sure to place the switch knobs in position to indicate the proper switch position.

v. Apply Moisture and Fungus proofing lacquer over each new soldered connection.

8. REPLACEMENT OF COVER A-101.

Cover A-101 contains the battery compartment for batteries BT-101 and BT-102. There are three leads from the rear of the compartment to connections within the meter portion. The black lead is the negative lead for battery BT-101, 22.5 volts. The green lead is the negative lead for battery BT-102, 1.5 volts. The white lead is the positive lead for both batteries. To remove the cover which you are going to replace, remove the three screws through battery contacts E-107, E-108, and E-109, and take the contacts out of the cover. Pull connections H-107, H-108, and H-109 out of the inside of the cover. Note that each of these connections has a neoprene gasket for watertight sealing under the hex head. These gaskets are O-103, O-104, and O-105. Transfer the connections with gaskets and the battery contacts to the new cover, A-101, and secure each in place with a mounting screw. Transfer the serial number of Multimeter ME-48A/U from the old cover to the new one. Inscribe the serial number on N-102 on the back of the case.

9. REPAIR OF HIGH VOLTAGE PROBE, W-103.

Figure 6-8 shows how the parts which make up the High Voltage Lead, W-103, are arranged and connected. If it is necessary to repair the connections or to replace any parts, use the illustration to indicate the location and method of access to the part or parts involved.

a. REPLACEMENT OF RESISTOR R-141.—To obtain access to resistor R-141, pull straight out on probe head A-105 to pull the resistor and lead through the red housing, A-104. Washer H-101 catches the assembly to the inside walls of housing A-104, but will give when you pull with enough force, and the entire inside assembly will slip out of the housing to allow access to both end terminals of resistor R-141. To secure this assembly when you force it back into the housing after repair, either straighten the ends of the washer, H-101, or replace it with a new one.

b. REPLACEMENT OF LAMP I-101.—To obtain access to the glow lamp, I-101, unscrew the clear probe head, A-105 from the assembly within housing A-104. Then loosen the set screw through the side at the front of A-105. Slip the lead back through the probe head to force the glow lamp out of the mounting. Unsolder the lamp lead from the 6″ red insulated lead and remove the glow lamp. Clip the leads of a new glow lamp, I-101, NE-2, to match the lengths of those on the defective lamp. Solder the end of the insulated lead to the shorter lamp lead and fold the other lamp lead up around the body of the lamp. Pull the new lamp into place in probe head A-105, and see that the longer lamp lead is seated in the small hole at the end of the internal threads in A-105. Tighten the set screw for the insulated lead. Screw the probe head, A-105, in position to complete the reassembly of test lead W-103.

c. REPAIR OF PLUG P-101.—Plug P-101, consisting of connector E-116 in housing A-111, is locked to the end of the lead wire by eyelet E-118, which is soldered to the wire. Spring E-117 furnishes a positive contact between connector E-116 and eyelet E-118 when plug P-101 is screwed in place over jack J-102. Figure 6-8 shows how these parts are arranged. To disconnect plug P-101 from the lead, unsolder eyelet E-118 from the wire end and all the parts will separate. To reassemble, strip and tin the lead end ½″ and force the red insulation back over the wire an added ¼″. Insert the wire end through plug P-101, through spring E-117, and through eyelet E-118, so the wire end is flush with the flange of the eyelet. Flow solder into the eyelet to secure the wire to the eyelet. Pull the eyelet and spring into plug P-101 and smooth the insulation.

Figure 6-3. Multimeter ME-48A/U, Front Panel Mounting.

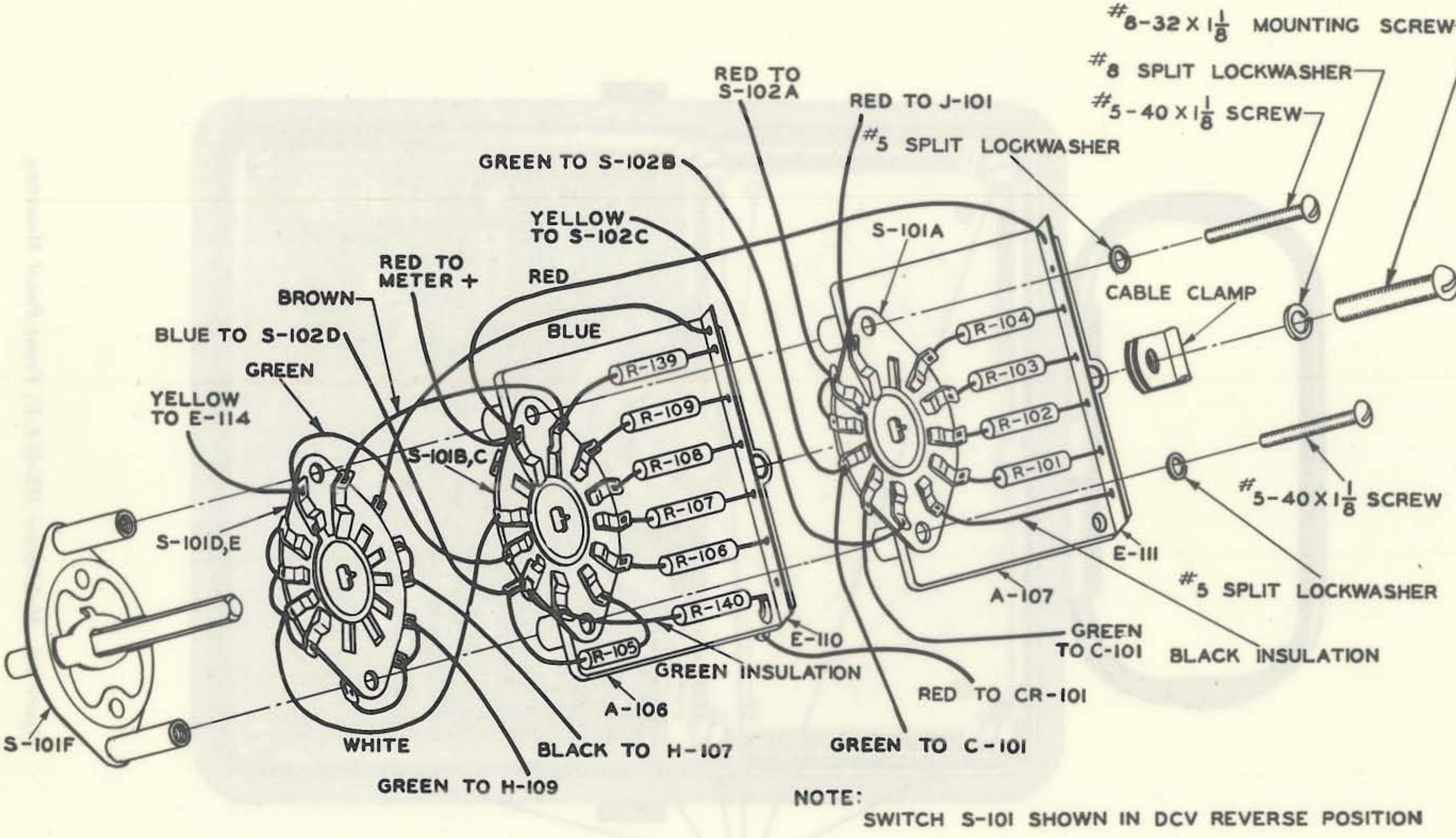

Figure 6-4. Location of Resistors on Decks of Switch S-101.

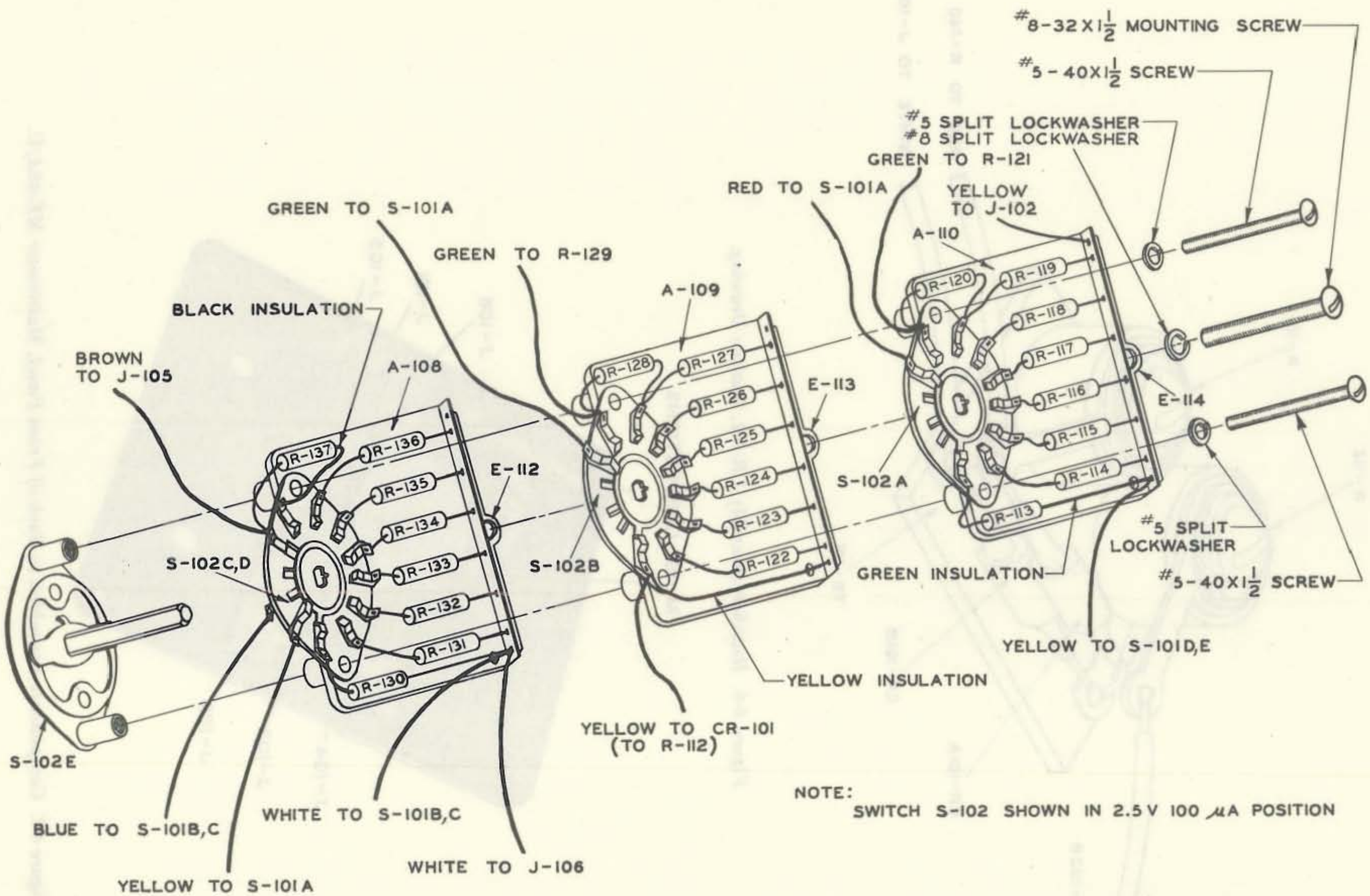

Figure 6-5. Location of Resistors on Decks of Switch S-102.

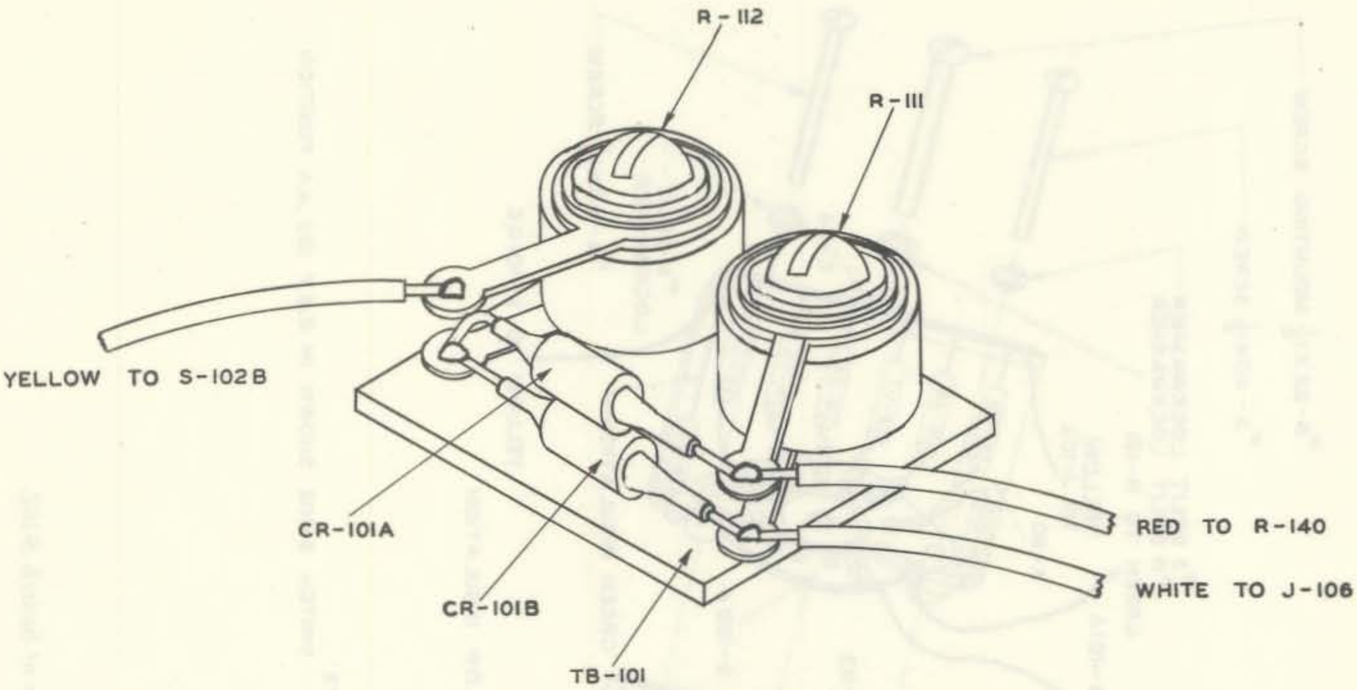

Figure 6-6. Rectifier Assembly CR-101, Outline Drawing.

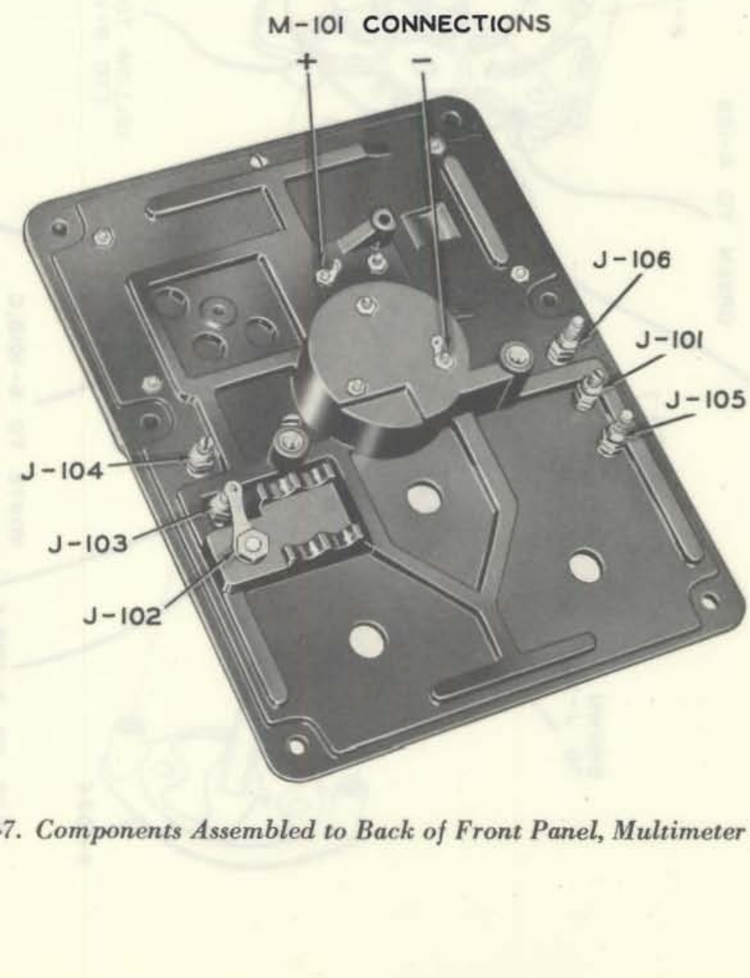

Figure 6-7. Components Assembled to Back of Front Panel, Multimeter ME-48A/U.

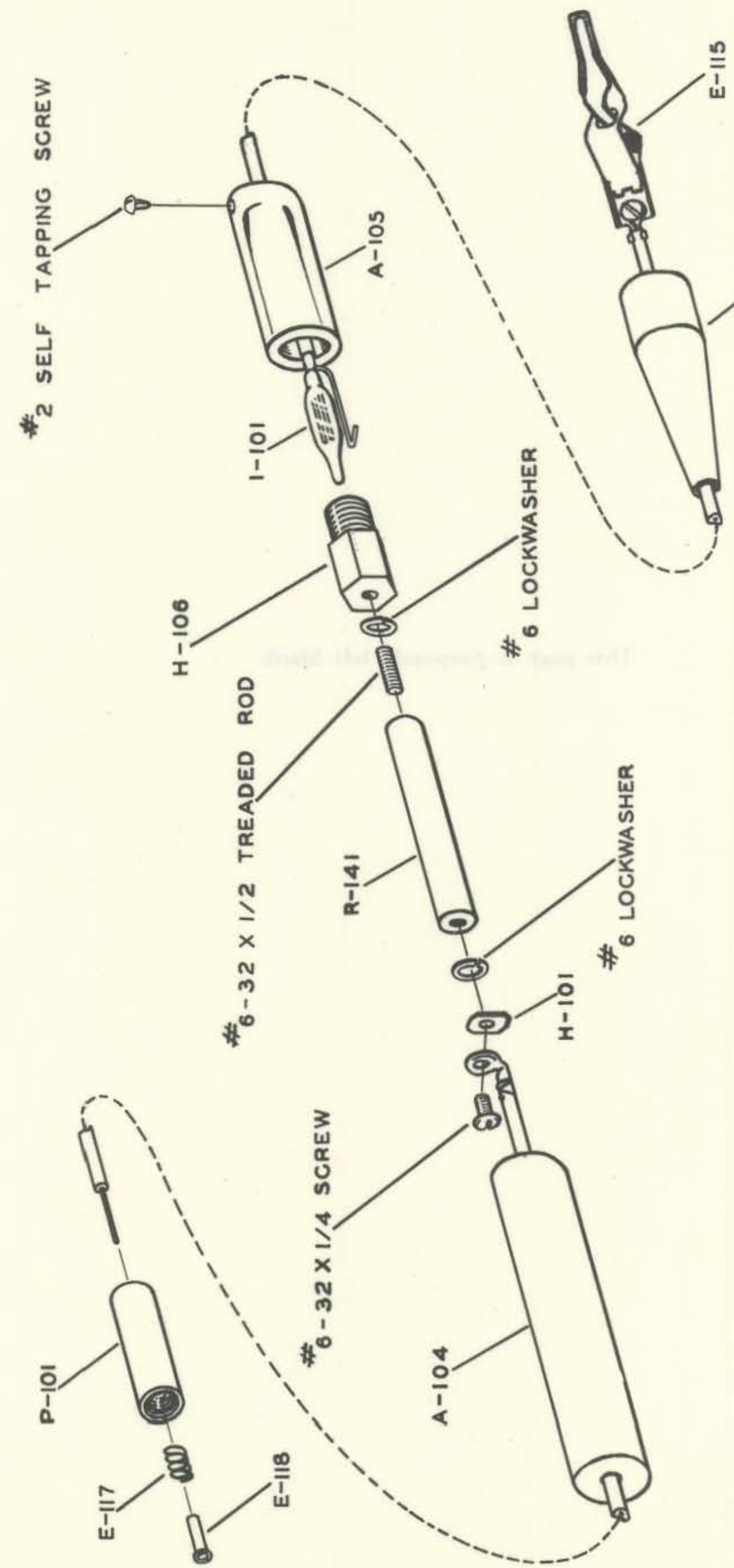

Figure 6-8. Exploded View of High Voltage Multiplier Housing.

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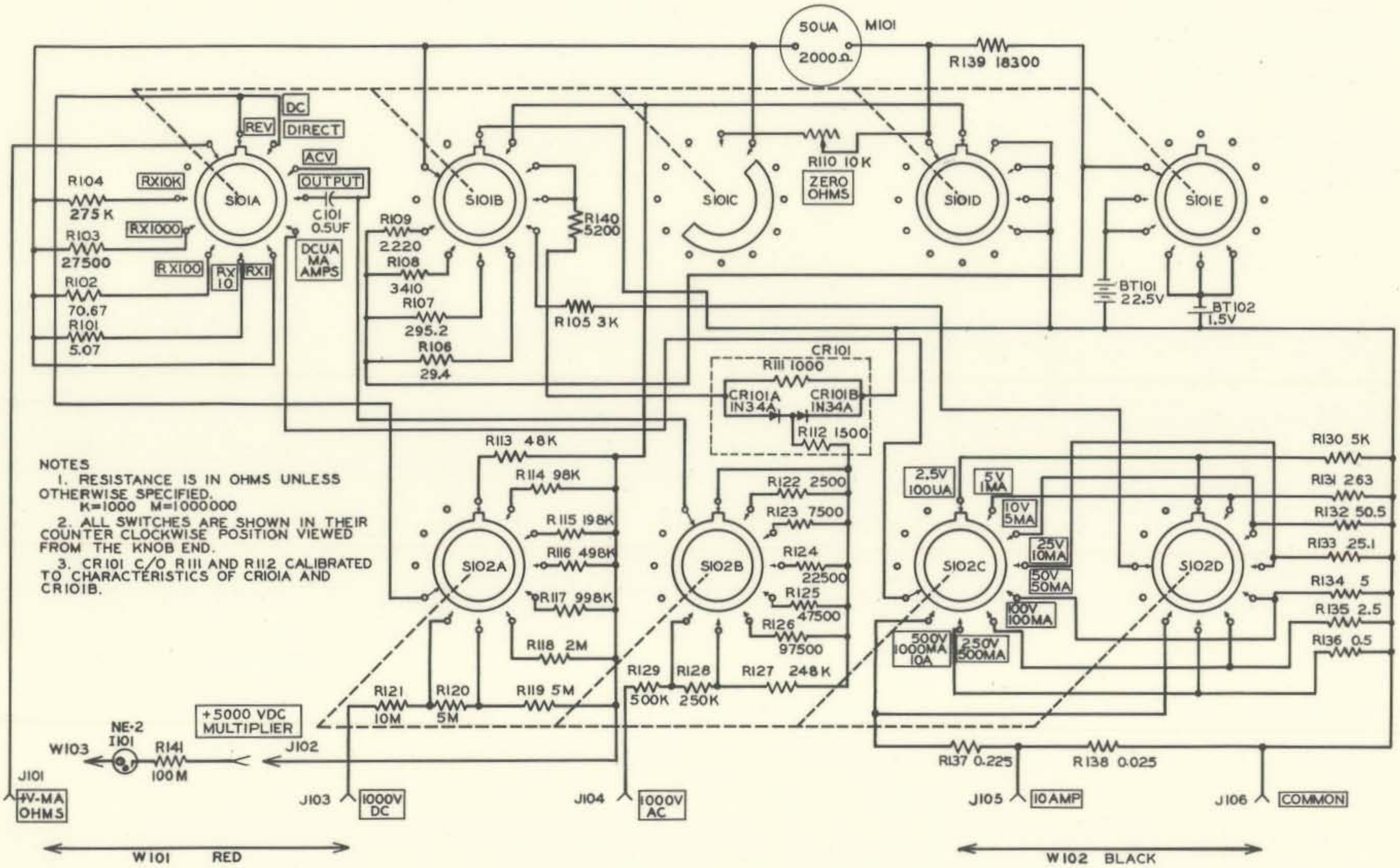

Figure 6-9. Multimeter AN/PSM-4A, Overall Schematic Diagram.

SECTION 7

PARTS LIST

TABLE 7-1. PARTS LIST

SYMBOL DESIG-NATION	STANDARD NAVY STOCK NO.	NAME OF PART AND DESCRIPTION	FUNCTION	MFGR. AND MFGR'S. DESIG.	SIMPSON DWG. AND PART NO.	ALL SYMBOL DESIG. INVOLVED	NO. OF TIMES IN UNIT
A-101	If failure occurs, requisition a replacement part from ESO, referencing NAVSHIPS 900,180a as authority.	CASE, METER: black plastic; over-all dim. 7 15/32" high x 5 15/16" w x 2 5/16" deep excluding feet, handle, and cover latch catches; 1 handle located on top	Houses instrument portion ME-48A/U of Multimeter AN/PSM-4A		10-890155	A-101	1
A-102	N17-C-945002-544	COVER, MULTIMETER: black plastic, natural finish; dim. 7 15/32" lg. x 5 15/16" w x 2 3/8" deep excluding feet and draw pull catches; includes lead compartment w/ hinged cover; condensed operating instructions on hinged cover; JAN type CW-328/PSM-4A	Cover for either the face or back of Multimeter ME-48A/U, and contains lead and accessory compartment		10-890156	A-102	1
A-103	N17-C-945002-543	COVER BATTERY HOLDER: 1 bakelite plate; dim. 2.546" lg. x 4.984" w x 5/32" deep	Covers battery compartment in rear of case A-101		3-310800	A-103	1
A-104	N17-S-99999-0218	SHELL, ELECTRICAL CONNECTOR: red polystyrene, natural finish; cylindrical shape; over-all dim. 3 1/4" lg x 5/8" dia.	p/o high voltage lead W-103, houses resistor R-141		3-310818	A-104	1
A-105	N17-H-750001-346	SHELL, ELECTRICAL CONNECTOR: clear polystyrene, natural finish; cylindrical shape; over-all dim. 1 1/2" lg. x 5/8" dia.	p/o high voltage lead W-103, houses lamp I-101		3-310811	A-105	1
A-106	N16-H-99999-0020	HOLDER, RESISTOR: for 6 resistors; pockets 1/4" w., separators 1/8" w.; overall dim. approx. 2 1/2" w. x 2 1/2" lg. x 11/32" deep	Spacer between sections C and D of switch S-101; holds resistors R-105; R-106; R-107, R-108, R-109, R-139, R-140		3-260274 (issue #2)	A-106, A-107, A-108, A-109, A-110	5
A-107		HOLDER, RESISTOR: (same as A-106)	Spacer between sections A and B of switch S-101, holds resistors R-101, R-102, R-103, R-104				
A-108		HOLDER, RESISTOR: (same as A-106)	Spacer between sections D and E of switch S-102, holds resistors R-130, R-131, R-132, R-133, R-134, R-135, R-136, R-137				
A-109		HOLDER, RESISTOR: (same as A-106)	Spacer between sections B and C of switch S-102, holds resistors R-122, R-123, R-124, R-125, R-126, R-127, R-128				

A-110		HOLDER, RESISTOR: (same as A-106)	Spacer between sections A and B of switch S-102, holds resistors R-113, R-114, R-115, R-116, R-117, R-118, R-119, R-120				
A-111	N17-S-99999-0222	SHELL, ELECTRICAL CONNECTOR: red fibre, natural finish; cylindrical shape; overall dim. 1" lg. x 3/8" od.	Houses E-116, E-117, E-118; p/o P-101 and W-103		3-310804	A-111	1
BT-101	N17-B-59177-3036	BATTERY, DRY: 22.5 v.; dim. 1 1/32 lg. x 5/8" w. x 2" high including terminals; BA-261/U per JAN-B-18	Power for high resistance ranges	CBR U-15E	1-114844	BT-101	1
BT-102	N17-B-7210	BATTERY, DRY: 1.5 v.; dim. 1 5/16" dia. x 2 3/8" lg.; BA-30 per JAN-B-18	Power for low resistance ranges	CBR #2 cell	1-111798	BT-102	1
C-101	N16-C-47328-1002	CAPACITOR, FIXED, PAPER DIELECTRIC: 500,000 mmf p/m 20%; 600 v DC; dim. 2 3/16" lg. x 1 1/16" dia. excluding terminals and mtg. bracket; CP26A1EF-504M per JAN-C-25	Blocks DC for output voltage ranges	CAN CP26A1 EF504M	1-114907	C-101	1
CR-101	N-16-C-99999-0514	CRYSTAL UNIT SET, RECTIFYING: calibrated assembly c/o CR-101A, CR-101B, R-111, R-112, and TB-101; resistors calibrated to the individual characteristics of CR-101A and CR-101B in each assembly; over-all dim. 1 3/16" lg. x 1 1/32" w x 23/32" deep approx.	Changes AC to DC for AC voltage measurements		0-008590	CR-101	1
CR-101A	For reference only	CRYSTAL UNIT, RECTIFYING: germanium crystal; over-all dim excluding terminals, .390" lg x .160" dia; p/o CR-101	Allows current to pass through meter during one half of input AC cycle	CRP CK-705	1-113852	CR-101A, CR-101B	2
CR-101B		CRYSTAL UNIT, RECTIFYING: (same as CR-101A)	Bypasses current around meter during one half of input AC cycle				
E-101	Modified G17-C-52581-108	CLIP, ELECTRICAL: modified alligator style #1, MBCA Ref Dwg Group 37; steel; cadmium plated finish; dim 2 5/16" lg x 3/8" w x 5/16" high; SNSN G17-C-52581-103 plus threaded bushing tapped internally 5/32 x 1/4" deep approx.	Screws over end of test probe W-101 or W-102	CBIT #60 plus modification	10-890122	E-101, E-102	2
E-102		CLIP, ELECTRICAL: (same as E-101)	Same as E-101				
E-103	N17-P-99999-0043	PLUG, TELEPHONE: 2 conductors; single shank, dim 1/4" dia x 1 3/16" lg; brass shell, nickel plated, tubular, 1" dia; overall length of plug 2 5/8"; non-repairable	Adapts both test leads, W-101 and W-102, to make contacts in telephone jacks	CBIM 2P-1053	1-114865	E-103	1
E-104	N17-K-99999-0022	KNOB: phenolic; black; natural finish; dim excluding skirt approx 1 3/8" lg x 7/16" w x 9/16" deep; skirt dim 1 1/4" dia x 3/32" deep, plastic integrally molded; w/o shank; designed to accommodate unthreaded shaft, flatted rd 1/4" dia w/1/2" height of removed segment, set screw fastening w" 1 set screw hole tapped 8-32, w/set screw	Knob for switch S-101	ROB RB-31	1-114728	E-104, E-105	2
E-105		KNOB: (same as E-104)	Knob for switch S-102				
E-106	N16-K-700271-547	KNOB: bakelite; black; natural finish; dim 11/16" dia x 13/32" deep; set screw fastening, 1 set screw, 8-32 thread size, w/ set screw	Knob for ZERO OHMS R-110	DAV #1450	1-111756	E-106	1
E-107	Shop manufacture	CONTACT, ELECTRICAL: battery contact; phosphor bronze contact surface; nickel plated finish; over-all dim approx 5/16" lg x 11/32" w x 29/64" high; special shape for spring contact	Negative contact for BT-101		3-160061	E-107, E-108	2

All parts for which no manufacturer is designated are made by Simpson Electric Co.

SYMBOL DESIG-NATION	STANDARD NAVY STOCK NO.	NAME OF PART AND DESCRIPTION	FUNCTION	MFGR. AND MFGR'S. DESIG.	SIMPSON DWG. AND PART NO.	ALL SYMBOL DESIG. INVOLVED	NO. OF TIMES IN UNIT
E-108		CONTACT, ELECTRICAL: (same as E-107)	Negative contact for BT-102				
E-109	Shop manufacture	CONTACT, ELECTRICAL: battery contact; brass contact surface; nickel plated finish; over-all dim approx 1/2" lg x 11/32" w x 1 5/16" high	Positive contacts for BT-101 and BT-102		3-160060	E-109	1
E-110	If required, will be procured by nearest Navy Shore Supply Activity on demand.	TERMINAL BOARD: brass; nickel plated finish; 8 terminal holes shorted together; over-all dim 2 7/16" lg x 7/32" w x 7/16" high; two .093" dia placement holes spaced 1.50" c to c; designed to fit part A-106	Termination and support for resistors R-106, R-107, R-108, R-109, R-139		3-160059	E-110, E-111, E-112, E-113, E-114	5
E-111		TERMINAL BOARD: (same as E-110)	Termination and support for resistors R-101, R-102, R-103, R-104				
E-112		TERMINAL BOARD: (same as E-110)	Termination and support for resistors R-130, R-131, R-132, R-133, R-134, R-135, R-136				
E-113		TERMINAL BOARD: (same as E-110)	Termination and support for resistors R-122, R-123, R-124, R-125, R-126, R-127				
E-114		TERMINAL BOARD: (same as E-110)	Termination and support for resistors R-113, R-114, R-115, R-116, R-117, R-118, R-119				
E-115	N17-C-803186-101	CLIP, ELECTRICAL: crocodile style #1, MBCA Ref Dwg Group 37; steel; cadmium plated finish; dim 2 1/8" lg x 3/8" w x 1/2" high	p/o high voltage test lead W-103	CBIT #85	1-111875	E-115	1
E-116	N17-C-99999-0517	CONNECTOR, PLUG: 1 contact, female, round; straight type; over-all dim 17/32" lg x .289" dia; cylindrical shape, brass, cadmium plated finish, locking type; .096" dia max cable opening; knurled outer surface 3/8" lg x 35 teeth per inch; internally threaded one end 10-32 x .218" deep	Connects W-103 to J-102; p/o P-101 and W-103		1-114853	E-116	1
E-117	Shop manufacture	SPRING, HELICAL, COMPRESSION: hard drawn steel spring wire .015" dia; cadmium plated finish; dim data 3/16" overall free length, .150" od, .120" id	Contact from wire end to E-116; p/o W-103		1-114876	E-117	1
E-118	Shop manufacture	EYELET, METALLIC: brass; cadmium plated finish; rolled flange, open end, MBCA Ref Dwg Group 32; tubular shape; dim, MBCA Ref Dwg Group 32, A-.156", B-.343", C-.093"	Locks wire end in P-101; p/o W-103	CBIX E-3166	1-114859	E-118	1
E-119	N17-C-99999-0518	COVER, ELECTRICAL CONNECTOR: red polyvinyl acetate; overall dim approx 2" lg x 5/8" od	Insulator over E-115; p/o W-103	CBIT #47	1-111873	E-119	1

H-101	N17-W-180001-197	WASHER, KEY: phosphor bronze; nickel plated; .145" hole dia; dim .390" lg x .234" w x .008" thick	Locks parts in housing A-104; p/o W-103		3-310745	H-101	1
H-102	Shop manufacture	CLAMP, ELECTRICAL: brass; nickel plated finish; fastens w/ screw through 1 mtg hole .125" dia; over-all dim approx $1\frac{15}{16}$" lg x $1\frac{1}{8}$" w x $\frac{3}{8}$" deep; designed to hold material $1\frac{1}{16}$" dia	Holds C-101 to M-101		1-114906	H-102	1
H-103	If required, will be procured from nearest Navy Shore Supply Activity on demand.	NUT, PLAIN, ROUND: brass; black nickel plated finish; thread size $\frac{3}{8}$-32; spanner drive, face slot type, Section K, MBCA Ref Dwg Group 29, 2 drive points .125" w x .032" deep; overall dim $\frac{1}{2}$" od x .186 to 189" high	Fastens S-101F to front panel, M-101		1-111210	H-103, H-104, H-105	3
H-104		NUT, PLAIN, ROUND: (same as H-103)	Fastens S-102E to M-101				
H-105		NUT, PLAIN, ROUND: (same as H-103)	Fastens R-110 to M-101				
H-106	N17-T-28198-4501	CONNECTOR, PLUG (TERMINAL STUD): not multiple type receptacle; 1 contact, female, round, and 1 contact, male, round; not polarized; not grounded; straight type; not angle type; over-all dim $\frac{53}{64}$" lg x hex cross section $\frac{3}{8}$" across flats; contacts not electrically rated; not radio frequency connector; cylindrical shape, brass, nickel plated finish, non-locking type, not split shell; no insert; w/o cable opening; 1 mtg hole tapped 6-32 x $\frac{9}{32}$" deep and 1 mtg stud threaded $\frac{3}{8}$-24 x $\frac{5}{16}$" lg	p/o test lead W-103		1-114854	H-106	1
H-107	N17-T-28270-3576	CONNECTOR, PLUG (TERMINAL STUD): similar to style 73, MBCA Ref Dwg group 21; not multiple type receptacle; 1 contact, female, round, and 1 contact, male, round; not polarized; not grounded; straight type; not angle type; over-all dim $\frac{29}{64}$" lg x hex cross ection $\frac{9}{32}$" across flats; contacts not electrically rated; not radio frequency connector; cylindrical shape, brass, cadmium plated finish, non-locking type, not split shell; no insert; w/o cable opening; 1 mtg hole, tapped 4-36 x $\frac{7}{32}$" deep; has round solder lug on end opposite threaded mtg hole	Watertight connection for negative terminal of BT-101		1-115140	H-107, H-108, H-109	3
H-108		CONNECTOR, PLUG (TERMINAL STUD): (same as H-107)	Watertight connection for positive terminals of BT-101 and BT-102				
H-109		CONNECTOR, PLUG (TERMINAL STUD): (same as H-107)	Watertight connection for negative terminal of BT-102				
I-101	G17-L-6806-120	LAMP, GLOW: neon gas; 1/25 w, 90 v DC striking voltage; $1\frac{1}{16}$" max over-all height	High voltage indicator, p/o W-103	CG NE-2	1-112497	I-101	1
J-101	N17-C-99999-0512	CONNECTOR, RECEPTACLE: not multiple type receptacle; 1 contact, female, round; not polarized; not-grounded; straight type; over-all dim $\frac{31}{64}$" lg x hex cross section $\frac{1}{4}$" across flats; contacts not electrically rated; not radio frequency connector; cylindrical shape, brass, nickel plated finish, non-locking type, not split shell; w/o cable opening; externally threaded $\frac{1}{4}$-32 x $\frac{1}{4}$" lg on one end for mounting	+V MA OHMS connection		10-890158	J-101, J-105	2

All parts for which no manufacturer is designated are made by Simpson Electric Co.

SYMBOL DESIG-NATION	STANDARD NAVY STOCK NO.	NAME OF PART AND DESCRIPTION	FUNCTION	MFGR. AND MFGR'S. DESIG.	SIMPSON DWG. AND PART NO.	ALL SYMBOL DESIG. INVOLVED	NO. OF TIMES IN UNIT
J-102	N17-T-28101-6484	CONNECTOR, RECEPTACLE (TERMINAL STUD): not multiple type receptacle; 1 contact, male, round; not polarized; not grounded; straight type; over-all dim. 0.797" lg x hex cross section 1/4" across flats; contacts not electrically rated; not radio frequency connector; cylindrical shape, brass, nickel plated finish, non-locking type, not split shell; w/o cable opening; 1 mtg. stud, threaded 6-32 x 5/16" lg; male contact end threaded 10-32 x 1/8" to accept W-103	Jack for +5000 VDC connection		1-114864	J-102	1
J-103	N17-C-78446-3551	CONNECTOR, RECEPTACLE: not multiple type receptacle; 1 contact, female, round; not polarized; not grounded; straight type; over-all dim 51/64" lg x hex cross section 1/4" across flats; contacts not electrically rated; not radio frequency connector; cylindrical shape, brass, nickel plated finish, non-locking type, not split shell; w/o cable opening; externally threaded 1/4-32 x 1/4" lg on one end for mounting	Jack for 1000 VDC connection		10-890015	J-103, J-104, J-106	3
J-104		CONNECTOR, RECEPTACLE: (Same as J-103)	Jack for 1000 VAC connection				
J-105		CONNECTOR, RECEPTACLE: (Same as J-101)	Jack for 10 AMP connection				
J-106		CONNECTOR, RECEPTACLE: (Same as J-103)	Jack for COMMON				
M-101	N17-M-38201-1028	MULTIMETER, REPLACEMENT: O through 10K to infinity ohms graduated logarithmically ccw, 0 to 10/50/250 DC v and DC current in 50 equally spaced scale divisions, 0 to 10/50/250 AC v w/ scale divisions not equally spaced, 0 to 2.5 AC v w/ scale divisions not equally spaced; scale markings black for DC, purple-blue for AC, green for OHMS, white background; 50 microamperes for full scale deflection, 2000 ohms internal resistance; integral part of front panel	Multimeter movement for replacement only		15-803809	M-101	1
N-101	For reference only	PLATE, IDENTIFICATION: 1 plate; aluminum; aluminum lettering on orange background; inscribed AN/PSM-4A MULTIMETER; over-all dim 4" lg x 3" w x .020" thick; four 1/8" mtg holes on 2 3/4" x 3 3/4" centers	Name plate attached to cover A-102		1-114894	N-101	1
N-102	For reference only	PLATE, IDENTIFICATION: 1 plate; aluminum; aluminum lettering on orange background; inscribed MULTIMETER ME-48A/U; over-all dim 2" lg x 5/8" w x .020" thick; two 1/8" mtg holes spaced 1 3/4" c to c	Name plate attached to back of case A-101		1-114893	N-102	1

N-103	For reference only	PLATE, IDENTIFICATION: 1 plate; aluminum; aluminum lettering on black background; circuit diagram of Multimeter AN/PSM-4A; over-all dim 4¾" lg x 3¼" w x .020" thick; no mtg holes; adhesive back for mounting	Circuit diagram inside case A-101		1-114919	N-103	1
O-101	Shop manufacture	GASKET: neoprene; plate finish; nom dim data, MBCA Ref Dwg Group 75, shape 12, C-6$\frac{13}{16}$", D-5$\frac{9}{32}$", G-$\frac{31}{64}$"; $\frac{1}{16}$" thick; #40 Durometer	Watertight seal between ME-48A/U and cover A-102		3-310799	O-101	1
O-102	Shop manufacture	GASKET: neoprene; plate finish; nom dim data, MBCA Ref Dwg Group 75, shape 1, A-147", B-221"; $\frac{1}{32}$" thick; #60 Durometer	Watertight seal under J-102		3-220050	O-102	1
O-103	Shop manufacture	GASKET: neoprene; plate finish; nom dim data, MBCA Ref Dwg Group 75, shape 1, A-$\frac{11}{64}$", B-$\frac{9}{32}$", $\frac{1}{32}$" thick; #60 Durometer	Watertight seal under H-107		3-220053	O-103, O-104, O-105	3
O-104		GASKET: (same as 0-103)	Watertight seal under H-108				
O-105		GASKET: (same as 0-103)	Watertight seal under H-109				
O-106	Shop manufacture	GASKET: neoprene; plate finish; nom dim data, MBCA Ref Dwg Group 75, shape 1, A-.240", B-$\frac{31}{32}$"; $\frac{1}{16}$" thick; #40 Durometer	Watertight seal under E-104		3-220052	O-106, O-107, O-108	3
O-107		GASKET: (same as 0-106)	Watertight seal under E-105				
O-108		GASKET: (same as 0-106)	Watertight seal under E-106				
P-101	For reference only	CONNECTOR, PLUG: assembly c/o part E-116 forced into A-111	Meter termination for W-103		10-890153	P-101	1
R-101	N16-R-79893-3798	RESISTOR, FIXED, WIRE WOUND: inductive winding; 5.07 ohms p/m 1%; 2 w, 300 deg C max continuous operating temp; body dim ⅝" lg x ¼" dia	p/o R x 10 ohmmeter circuit	TOM type "S" Silicohm	SK-322 1-115098	R-101	1
R-102	N16-R-80073-6956	RESISTOR, FIXED, WIRE WOUND: inductive winding; 70.67 ohms p/m 1%; 2 w, 300 deg C max continuous operating temp; body dim ⅝" lg x ¼" dia	p/o Rx100 ohmmeter circuit	TOM type "S" Silicohm	SK-322 1-115099	R-102	1
R-103	N16-R-73123-5401	RESISTOR, FIXED, FILM: 27,500 ohms p/m 1%; ½ w; resistance temp characteristics 320 PPM/°C approx from 0° to +100° C; body dim, excluding terminals, $\frac{9}{16}$" lg x $\frac{5}{32}$" dia	p-o Rx1000 ohmmeter circuit	CIR DCC	SK-321 1-115108	R-103	1
R-104	N16-R-73234-5876	RESISTOR, FIXED, FILM: 275,000 ohms p/m 1%; ½ w; resistance temp characteristics 350 PPM/° C approx from 0° to +100° C; body dim $\frac{9}{16}$" lg x $\frac{5}{32}$" dia	p/o Rx10000 ohmmeter circuit	CIR DCC	1-115107	R-104	1
R-105	N16-R-73023-2609	RESISTOR, FIXED, FILM: 3000 ohms p/m 1%; ½ w; resistance temp characteristics 320 PPM/°C approx from 0° to +100°C; body dim $\frac{9}{16}$" lg x $\frac{5}{32}$" dia	Meter series for current ranges	CIR DCC	SK-321 1-115112	R-105	1
R-106	N16-R-80015-2945	RESISTOR, FIXED, WIRE WOUND: inductive winding; 29.4 ohms p/m 1%; 2 w, 300 deg C max continuous operating temp; body dim ⅝" lg x ¼" dia	Meter shunt for Rx1 range	TOM type "S" Silicohm	SK-322 1-115097	R-106	1

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SYMBOL DESIG-NATION	STANDARD NAVY STOCK NO.	NAME OF PART AND DESCRIPTION	FUNCTION	MFGR. AND MFGR'S. DESIG.	SIMPSON DWG. AND PART NO.	ALL SYMBOL DESIG. INVOLVED	NO. OF TIMES IN UNIT
R-107	N16-R-72926-8501	RESISTOR, FIXED, FILM: 295 ohms p/m 1%; 1/2 w; resistance temp characteristics 300 PPM/°C approx from 0° to +100°C; body dim 9/16" lg x 5/32" dia	Meter shunt for Rx10 range	CIR DCC	SK-321 1-115111	R-107	1
R-108	N16-R-73026-7651	RESISTOR, FIXED, FILM: 3410 ohms p/m 1%; 1/2 w; resistance temp characteristics 300 PPM/°C approx from 0° to +100° C; body dim 9/16" lg x 5/32" dia	Meter shunt for Rx100 range	CIR DCC	SK-321 1-115110	R-108	1
R-109	N16-R-73014-3351	RESISTOR, FIXED, FILM: 2220 ohms p/m 1%; 1/2 w; resistance temp chacarteristics 300 PPM/°C approx from 0° to +100°C; body dim 9/16" lg x 5/32" dia	Meter shunt for Rx1000 range	CIR DCC	SK-321 1-115109	R-109	1
R-110	N16-R-87680-9426	RESISTOR, VARIABLE: composition element; 1 section, 10000 ohms resistance, p/m 20%; 1/4 w nom power dissipation; not tapped	Ohmmeter ZERO OHMS adjustment	CTC 45	1-114875	R-110	1
R-111	For reference only	RESISTOR, FIXED, WIRE WOUND: nom value 1000 ohms, calibrated to the needs of each rectifier assembly; not furnished as a separate item for replacement; p/o CR-101	AC voltage rectifier calibration	RPC AFB	1-114857	R-111	1
R-112	For reference only	RESISTOR, FIXED, WIRE WOUND: nom value 1500 ohms, calibrated to the needs of each rectifier assembly; not furnished as a separate item for replacement; p/o CR-101	AC voltage rectifier calibration	RPC AFB	1-114858	R-112	1
R-113	N16-R-88009-4721	RESISTOR, FIXED, FILM: 48000 ohms p/m 1%; 1/2 w; resistance temp characteristics 300 PPM/°C approx from 0° to +100°C; body dim 9/16" lg x 5/32" dia	2.5 v DC multiplier	CIR DCC	SK-321 1-114736	R-113	1
R-114	N16-R-73187-8212	RESISTOR, FIXED, FILM: 98000 ohms p-m 1%; 1/2 w; resistance temp characteristics 300 PPM/°C approx from 0° to +100° C; body dim 9/16" lg x 5/32" dia	5 v DC multiplier	CIR DCC	SK-321 1-115115	R-114	1
R-115	N16-R-73217-6605	RESISTOR, FIXED, FILM: 198000 ohms p/m 1%; 1/2 w; resistance temp characteristics 350 PPM/°C approx from 0° to +100° C; body dim 9/16" lg x 5/32" dia	10 v DC multiplier	CIR DCC	SK-321 1-115116	R-115	1
R-116	N16-R-73269-9601	RESISTOR, FIXED, FILM: 498000 ohms p/m 1%; 1/2 w; resistance temp characteristics 350 PPM/°C approx from 0° to +100°C; body dim 9/16" lg x 5/32" dia	25 v DC multiplier	CIR DCC	SK-321 1-115117	R-116	1
R-117	N16-R-73307-3931	RESISTOR, FIXED, FILM: 998000 ohms p/m 1%; 1/2 w; resistance temp characteristics 300 PPM/° C approx from 0° to +100°C; body dim 9/16" lg x 5/32" dia	50 v DC multiplier	CIR DCC	SK-321 1-115118	R-117	1
R-118	N16-R-73328-1359	RESISTOR, FIXED, FILM: 2 megohms p/m 1%; 1/2 w; resistance temp characteristics 450 PPM/°C approx from 0° to +100° C; body dim 9/16" lg x 5/32" dia	100 v DC multiplier	CIR DCC	SK-321 1-115119	R-118	1
R-119	N16-R-73357-6500	RESISTOR, FIXED, FILM: 5 megohms p/m 1%; 1 w; resistance temp characteristics—.07% /° C approx from —55° to +105° C; body dim 15/16" lg x 5/32" dia	250 v DC multiplier, also p/o 500/1000 v DC multipliers	CIR DCF	SK-321 1-115127	R119, R120	2

R-120		RESISTOR, FIXED, FILM: (same as R-119)	p/o 500/1000 v DC multipliers				
R-121	N16-R-73377-4338	RESISTOR, FIXED, FILM: 10 megohms p/m 1%; 1 w; resistance temp characteristics—.07%/°C approx from —55° to +105° C; body dim 15/16" lg x 3/32" dia	p/o 1000 v DC multiplier	CIR DCF	SK-321 1-115128	R-121	1
R-122	N16-R-73018-4210	RESISTOR, FIXED, FILM: 2500 ohms p/m 1%; ½ w; resistance temp characteristics 300 PPM/°C approx from 0° to +100° C; body dim 9/16" lg x 3/32" dia	5 v AC multiplier	CIR DCC	SK-321 1-115120	R-122	1
R-123	N16-R-73073-7851	RESISTOR, FIXED, FILM: 7500 ohms p/m 1%; ½ w; resistance temp characteristics 300 PPM/° C approx from 0° to +100° C; body dim 9/16" lg x 3/32" dia	10 v AC multiplier	CIR DCC	SK-321 1-115121	R-123	1
R-124	N16-R-73115-8281	RESISTOR, FIXED, FILM: 22500 ohms p/m 1%; ½ w; resistance temp characteristics 325 PPM/°C approx from 0° to +100° C; body dim 9/16" lg x 3/32" dia	25 v AC multiplier	CIR DCC	SK-321 1-115122	R-124	1
R-125	N16-R-73147-9148	RESISTOR, FIXED, FILM: 47500 ohms p/m 1%; ½ w; resistance temp characteristics 350 PPM/°C approx from 0° to +100°C; body dim 9/16" lg x 3/32" dia	50 v AC multiplier	CIR DCC	SK-321 1-115123	R-125	1
R-126	N16-R-73187-6087	RESISTOR, FIXED, FILM: 97500 ohms p/m 1%; ½ w; resistance temp characteristics 350 PPM/°C approx from 0° to +100°C; body dim 9/16" lg x 3/32" dia	100 v AC multiplier	CIR DCC	SK-321 1-115124	R-126	1
R-127	N16-R-99999-0317	RESISTOR, FIXED, FILM: 248000 ohms p/m 1%; ½ w; resistance temp characteristics 375 PPM/°C approx from 0° to +100° C; body dim 9/16" lg x 3/32" dia	250 v AC multiplier, also p/o 500/1000 v AC multipliers	CIR DCC	SK-321 1-115126	R-127	1
R-128	N16-R-99999-0292	RESISTOR, FIXED, FILM: 250000 ohms p/m 1%; ½ w; resistance temp characteristics 375 PPM/°C approx from 0° to +100° C; body dim 9/16" lg x 3/32" dia	p/o 500/1000 v AC multipliers	CIR DCC	SK-321 1-115130	R-128	1
R-129	N16-R-73271-3576	RESISTOR, FIXED, FILM: 500000 ohms p/m 1%; 1 w; resistance temp characteristics approx —.05%/°C from —55° to +105°C; body dim 15/16" lg x 3/32" dia	p/o 1000 v AC multiplier	CIR DCF	SK-321 1-115129	R-129	1
R-130	N16-R-99999-0302	RESISTOR, FIXED, FILM: 5000 ohms p/m 1%; ½ w; resistance temp characteristics 320 PPM/°C approx from 0° to +100°C; body dim 9/16" lg x 3/32" dia	100 uA DC shunt	CIR DCC	SK-321 1-115125	R-130	1
R-131	N16-R-80147-7001	RESISTOR, FIXED, WIRE WOUND: inductive winding; 263 ohms p/m 1%; 2 w; 300°C max continuous operating temp; body dim ⅝" lg x ¼" dia	1 MA DC shunt	TOM type "S" Silicohm	SK-322 1-115106	R-131	1
R-132	N16-R-80036-7177	RESISTOR, FIXED, WIRE WOUND: inductive winding; 50.5 ohms p/m 1%; 2 w; 300°C max continuous operating temp; body dim ⅝" lg x ¼" dia	5 MA DC shunt	TOM type "S" Silicohm	SK-322 1-115105	R-132	1
R-133	N16-R-80005-8508	RESISTOR, FIXED, WIRE WOUND: inductive winding; 25.1 ohms p/m 1%; 2 w; 300°C max continuous operating temp; body dim ⅝" lg x ¼" dia	10 MA DC shunt	TOM type "S" Silicohm	SK-322 1-115104	R-133	1
R-134	N16-R-79892-7565	RESISTOR, FIXED, WIRE WOUND: inductive winding; 5 ohms p/m 1%; 2 w; 300°C max continuous operating temp; body dim ⅝" lg x ¼" dia	50 MA DC shunt	TOM type "S" Silicohm	SK-322 1-115103	R-134	1
R-135	N16-R-79863-1540	RESISTOR, FIXED, WIRE WOUND: inductive winding; 2.5 ohms p/m 1%; 2 w; 300°C max continuous operating temp; body dim ⅝" lg x ¼" dia	100 MA DC shunt	TOM type "S" Silicohm	SK-322 1-115102	R-135	1

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SYMBOL DESIG-NATION	STANDARD NAVY STOCK NO.	NAME OF PART AND DESCRIPTION	FUNCTION	MFGR. AND MFGR'S. DESIG.	SIMPSON DWG. AND PART NO.	ALL SYMBOL DESIG. INVOLVED	NO. OF TIMES IN UNIT
R-136	N16-R-79788-9639	RESISTOR, FIXED, WIRE WOUND: inductive winding; 0.5 ohm p/m 1%; 2 w; 300°C max continuous operating temp; body dim 5/8" lg x 1/4" dia	500 MA DC shunt	TOM type "S" Silicohm	SK-322 1-115101	R-136	1
R-137	N16-R-79752-1128	RESISTOR, FIXED, WIRE WOUND: inductive winding; 0.225 ohm p/m 1%; 2 w; 300°C max continuous operating temp; body dim 5/8" lg x 1/4" dia	p/o 1000 MA/ 10 A DC shunts	TOM type "S" Silicohm	SK-322 1-115100	R-137	1
R-138	N17-S-40203-3001	SHUNT, INSTRUMENT: internal type; 250 millivolts, 10 amps DC; over-all dim approx 1 5/8" lg x 3/4" w x 3/8" deep	p/o 1000 MA/ 10 A DC shunts		0-008049	R-138	1
R-139	N16-R-99999-0313	RESISTOR, FIXED, FILM: 18300 ohms p/m 1%; 1/2 w; resistance temp characteristics 350 PPM/°C approx from 0° to +100°C; body dim 9/16" lg x 5/32" dia	Ohmmeter multiplier	CIR DCC	SK-321 1-115113	R-139	1
R-140	N16-R-99999-0316	RESISTOR, FIXED, FILM: 5200 ohms p/m 1%; 1/2 w; resistance temp characteristics 320 PPM/°C approx from 0° to +100°C; body dim 9/16" lg x 5/32" dia	p/o AC voltmeter circuits	CIR DCC	SK-321 1-114743	R-140	1
R-141	N16-R-93053-8506	RESISTOR, FIXED, COMPOSITION: 100 megohms p/m 2%; body dim 2" lg x 21/64" dia	5000 v DC multiplier, in housing A-104	RPC BBF, matched pair	1-114852	R-141	1
S-101	For reference only	SWITCH, ROTARY: c/o S-101A, S-101B,C, S-101D,E, S-101F, and H-103	Function selector				
S-101A	N17-S-99999-0221	SWITCH SECTION, ROTARY: sectional type; 12 positions max number possible, adjustable stop not included, no momentary position; 1 moving contact, 11 fixed contacts; not electrically rated; non-shorting type contracts; dim per MBCA Ref Dwg Group 8, 1-9/16" w x 1-7/8" lg x 5/16" h	Section A of switch S-101	COC (use Simpson number)	1-114922	S-101A	1
S-101 B, C	N17-S-91715-1052	SWITCH SECTION, ROTARY: sectional type; 12 positions max number possible, adjustable stop not included, no momentary position; 2 moving contacts, 14 fixed contacts; not electrically rated; non-shorting type contacts; dim per MBCA Ref Dwg Group 8, 1-9/16" w x 1-7/8" lg x 7/16" h	Sections B and C of switch S-101	COC (use Simpson number)	1-114921	S-101B, C	1
S-101 D, E	N17-S-91700-2824	SWITCH SECTION, ROTARY: sectional type; 12 positions max number possible, adjustable stop not included, no momentary position; 2 moving contacts, 12 fixed contacts; not electrically rated; non-shorting type contacts; dim per MBCA Ref Dwg Group 8, 1-9/16" w x 1-7/8" lg x 5/16" h	Sections D and E of switch S-101	COC (use Simpson number)	1-114920	S-101D, E	1
S-101F	N17-S-99999-0219	SWITCH DRIVE SUBASSEMBLY: shaft and index mechanism w/2 hex spacers, .703" lg x 3/16" across flats; 10 positions max number possible, stop included, no momentary position; over-all dim 2-11/16" lg x 1-33/64" w x 1-7/8" h	Mounts and drives function switch, sections A, B, C, D & E	COC (use Simpson number)	1-114860	S-101F	1

ORIGINAL

S-102	For reference only	SWITCH, ROTARY: c/o S-102A, S-102B, S-102C, D, S-102E, and H-104	Range selector				
S-102A	N17-S-91677-5704	SWITCH SECTION, ROTARY: sectional type; 12 positions max number possible, adjustable stop not included, no momentary position; 1 moving contact, 9 fixed contacts; not electrically rated; non-shorting type contacts; dim per MBCA Ref Dwg Group 8, 1-9/16" w x 1-7/8" lg x 5/16" h	Section A of switch S-102	COC (use Simpson Number)	1-114924	S-102A, S-102B	2
S-102B		SWITCH SECTION, ROTARY: (same as S-102A)	Section B of switch S-102				
S-102 C, D	N17-S-99999-0213	SWITCH SECTION, ROTARY: sectional type; 12 positions max number possible, adjustable stop not included, no momentary position; 2 moving contacts 19 fixed contacts; not electrically rated; non-shorting type contacts; dim per MBCA Ref Dwg Group 8, 1-9/16" lg x 1-7/8" w x 5/16" h	Sections C and D of switch S-102	COC (use Simpson number)	1-114923	S-102-C, D	1
S-102E	N17-S-99999-0220	SWITCH DRIVE SUBASSEMBLY: shaft and index mechanism w/ 2 hex spacers 3/8" lg x 3/16" across flats; 8 positions max number possible, stop included, no momentary position; over-all dim 2-11/16" lg x 1-33/64" w x 1-7/8" h	Mounts and drives range switch, sections A, B, C & D	COC (use Simpson number)	1-114861	S-102E	1
TB-101	For reference only	TERMINAL BOARD: (for reference only) p/o CR-101	Mounting for CR-101				
W-101	N17-L-63205-7777	LEAD, TEST: 1 conductor; stranded copper, 41/36, #20 AWG, w/ cotton wrap and rubber insulation, red satin finish, 10,000 v test voltage; wire type Alpha Wire Corp. #1635 red; approx 48" lg overall; terminal fitting on instrument end, red elbow prod w/ phone tip; terminal fitting on probe end, probe tip w/ red fiber handle; probe tip has threaded shoulder 8-32 x 3/32" lg; probe handle marked w/JAN number CX-2353/PSM-4A	Positive test lead for all measurements except 5000 v DC		0-008457	W-101	1
W-102	N17-L-63205-7776	LEAD, TEST: 1 conductor; stranded copper, 41/36, #20 AWG, w/ cotton wrap and rubber insulation, black satin finish, 10000 v test voltage; wire type Alpha Wire Corp. #1635 black; approx 48" lg over-all; terinal fitting on instrument end, black elbow prod w/ phone tip; terminal fitting on probe end, probe tip w/ black fiber handle; probe tip has threaded shoulder 8-32 x 3/32" lg; probe handle marked w/JAN number CX-2354/PSM-4A	Negative test lead for all measurements		0-008456	W-102	1
W-103	Assemble from component parts	LEAD, TEST: 1 conductor stranded copper, 41/36, #20 AWG, w/ cotton wrap and rubber insulation, red satin finish, 10000 v test voltage; wire type Alpha Wire Corp #1635 red, 1 pc 43-3/4" lg and 1 pc 6" lg; approx 55" over-all lg; c/o A-104, A-105, E-115, E-117, E-118, E-119, H-101, I-101, P-101, R-141, and above wire; JAN type CX-2355/PSM-4A	Positive test lead for 5000 v DC range		10-890152	W-103	1

All parts for which no manufacturer is designated are made by Simpson Electric Co.

TABLE 7-2
LIST OF MANUFACTURERS

CODE	NAME AND ADDRESS
CG	General Electric Company, Schenectady, N. Y.
CAN	Sangamo Electric Company, 1935 Funk St., Springfield, Ill.
CBR	Burgess Battery Company, Freeport, Ill.
CIR	International Resistance Company, 401 N. Broad St., Philadelphia, Pa.
COC	Oak Manufacturing Company, 1200 N. Clybourn, Chicago, Ill.
CRP	Raytheon Manufacturing Company, 190 Willow St., Waltham, Mass.
CTC	Chicago Telephone Supply Company, Elkhart, Ind.
CBIM	Switchcraft Company, 1328 N. Halsted St., Chicago, Ill.
CBIT	Mueller Electric Company, 1597 E. 31st St., Cleveland, Ohio
CBIX	American Brass Company, 414 Meadow St., Waterbury, Conn.
DAV	Harry Davies Molding Company, 1428 N. Wells St., Chicago, Ill.
ROG	Rogan Brothers Company, 2001 S. Michigan Ave., Chicago, Ill.
RPC	Resistance Products Company, 714 Race St., Harrisburg, Pa.
TOM	Tomore Electric Company, 131 Gould St., Rochester, N. Y.