TECHNICAL MANUAL

OPERATION AND MAINTENANCE INSTRUCTIONS

MULTIMETER AN/PSM-37

PART NUMBER 910
NSN 6625-00-161-4204

Q.V.S. INC.
F41608-71-D-5442

F41608-90-D-1819

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AIR FORCE 30 June 93 - 538 - REPRINT

31 JANUARY 1976

CHANGE 7 — 1 JULY 1991

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Change	1	15 Sep 78	Change	5	10 Jun 81
Change	2	15 Jun 79	Change	6	1 Feb 83
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SECTION I

INTRODUCTION AND GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. GENERAL. This technical manual contains operation and maintenance instructions for the AN/PSM-37 multimeter, part numbers 910 and 960, manufactured by Q.V.S. Inc., E. Orange, New Jersey.

1-3. RELATED PUBLICATIONS. T.O. 33A1-12-933-4, Technical Manual, Illustrated Parts Breakdown, MULTIMETER, AN/PSM-37.

1-4. PURPOSE. Multimeter AN/PSM-37 is a general purpose, ruggedized multimeter used for measuring resistance, AC and DC voltage, and AC and DC current. The maximum values that can be measured are as follows:

a. Voltage - 1000 volts, 5000 volts with MX-1410/U

b. Current - 1 ampere, 10 amperes with MX-9127/PSM-37

c. Resistance - 100 megohms

1-5. GENERAL INFORMATION.

WARNING

Multimeter, AN/PSM-37 overload protection circuit can fail, causing damage to the multimeter. Extreme care should be taken by all users to insure strict adherence to technical order CAUTIONS and WARNINGS with specific attention to selection of correct function and range, prior to connection to unit under test. Failure to comply could result in injury to personnel and/or damage to equipment.

NOTE

- Electrical measuring capabilities of the AN/PSM-37, models 910, and 960, are essentially identical. For operational purposes T.O. 33A1-12-933-1 will be utilized for both models.
- To insure that the AN/PSM-37 being used is covered by this manual, check the contract number and part number printed on the upper right hand corner of the face plate. The contract number must end with the numerals -5442 or -0052, or the part number must be engraved 911 or 961. If none of these numbers are present, this manual is not to be used.

1-6. . MULTIMETER, AN/PSM-37. The multimeter (see figure 1-1) consists of the following items in a self-contained combination case:

a. Multimeter, ME-418/PSM-37

b. Test Lead Set, CX-2140A/U for part number 910. Universal Test Lead Set for part number 960.

c. Shunt, Instrument, Multirange, MX-9127/PSM-37

d. Prod, Test, MX-1410/U

e. Adapter, Test, MX-9128/PSM-37

1-7. MULTIMETER, ME-418/PSM-37 is the basic instrument of the AN/PSM-37. It contains a 50 microampere meter mounted on a plastic panel in a plastic case and connected via three selector switches to precision measuring and metering circuits. All measurements are made with the test leads connected to the two jacks at the bottom center of the panel, with the RANGE, FUNCTION, and POLARITY switches at the appropriate settings. The multimeter is watertight with the cover on or off. The overall size of the equipment is 8 1/2 by 7 by 5 inches and the total weight is 7.5 pounds. The accuracies attained are printed on the data plate of the multimeter cover. Generally, at room temperature, accuracy is within ±3% on all DC ranges and ±4% on all AC ranges. The maximum available ohmmeter output voltages and currents are printed on the data plate for reference, particularly for when making in-circuit measurements. The multimeter requires four "AA" size 1.5 volt cells for proper operation.

1-8. The multimeter is protected against accidentally applied overload, and against polarity and function selection errors, by an overload protection system which opens the input circuit when necessary. The overload circuit does not depend on the battery condition and functions even with the multimeter in the OFF position.

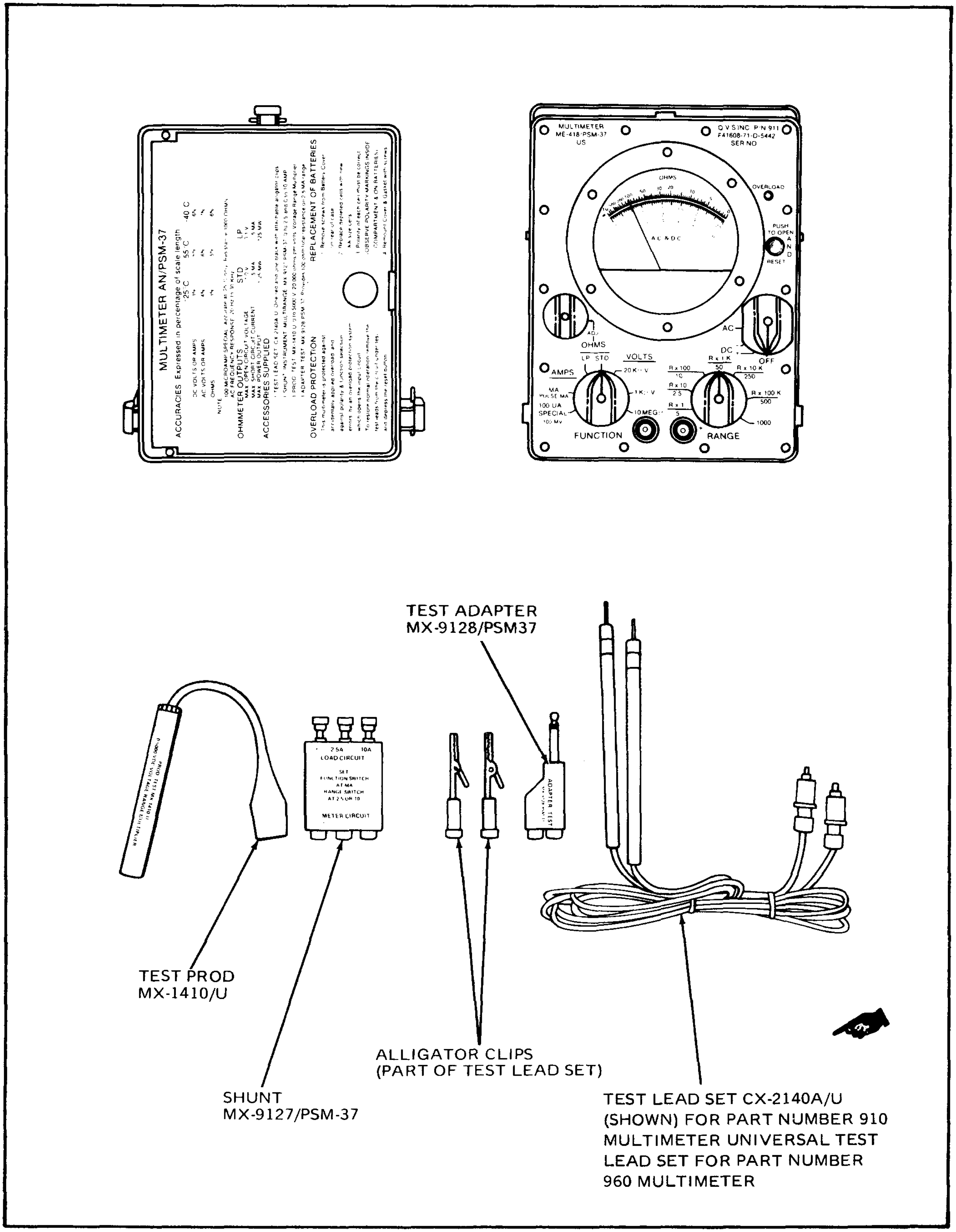
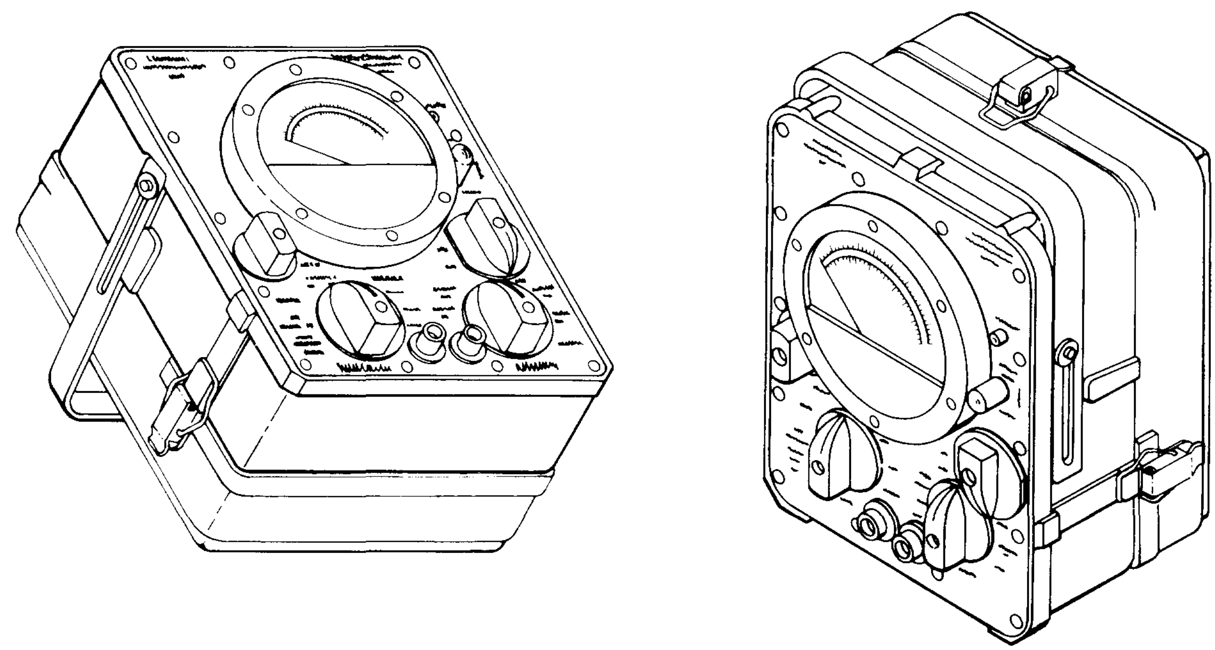


Figure 1-1. Multimeter AN/PSM-37.



EASEL POSITION STOWED POSITION

Figure 1-2. Handle Positions.

1-9. The multimeter handle serves multiple functions. It can be used to carry or suspend the multimeter, may be stowed in a collapsed position, or may be pivoted in its extended position to form a fixed easel by sliding the handle ends into the notches in the case lip. (See figure 1-2.)

1-10. The multimeter cover mounts on the front or rear of the multimeter case and does not interfere with use of the handle as an easel. (See figure 1-2). The multimeter cover will fit on the front of the case only when the POLARITY switch is in the OFF position.

CAUTION

Observe the instructions of paragraph 1-10 when closing multimeter cover to prevent damage. Do not use undue force when closing cover.

1-11. The data plate in the cover opens to provide access to accessories in the stowage space behind the data plate. To open, slide the data plate towards the hinged side so that it moves out of the slotted catch. The data plate will hold in the open position until pushed closed.

1-12. SHUNT, INSTRUMENT, MULTIRANGE MX-9127/PSM-37. (See figure 1-1). This shunt is supplied to extend the current-measuring range of the multimeter to a maximum of 10 amperes. It consists of two low-resistance shunt sections within a plastic case, to be used for either the 0 to 2.5 ampere or 0 to 10 ampere range. The shunt, together with the other items described below, is stowed in a compartment under the data plate in the cover when not in use.

1-13. PROD, TEST MX-1410/U (See figure 1-1). This test prod is a sealed external high voltage divider which extends (multiplies) the voltage range of the meter to 5000 volts and the input impedance to 100 megohms. It is used with the 500 volt range of the 20,000 ohms/volt function and with all ranges of the 10 megohm function.

1-14. ADAPTER, TEST, MX-9128/PSM-37. (See figure 1-1) The test adapter is designed to adapt a phone plug output to the test leads of the multimeter, and contains a built-in resistor to provide a total meter impedance of 100 ohms when the adapter is used on the 2.5 millampere range and MA function. This circuit is used to make standard crystal current measurements.

1-15. TEST LEAD SET CX-2140A/U. (See figure 1-1). Four feet of cable is used to couple the circuit under test to the multimeter. The plugs which connect into the meter jacks are of the interlock type. To connect plug to multimeter, slide the front part of the plug backwards and insert the plug into the jack. The plug will lock automatically and cannot be disengaged until the rear portion is slid forward to meet the front portion again. Two detachable insulated alligator clips are furnished with the multimeter for use as desired.

1-16. UNIVERSAL TEST LEAD SET. Four feet of cable is used to couple the circuit under test to the multimeter. The plugs which connect into the meter jacks are of the right angle banana plug type. The prods have internal threads and can be used with screw in phone tips or needle chucks provided. Two detachable insulated alligator clips are furnished with the multimeter.

SECTION II

SPECIAL TOOLS AND TEST EQUIPMENT

2-1. GENERAL. The test equipment listed in table 2-1 is required to service the multimeter. Equivalent item(s) may be used if the recommended item is not available.

TABLE 2-1. TEST EQUIPMENT REQUIRED FOR SERVICING

EQUIPMENT NO.	FIGURE NO.	NOMENCLATURE	USE AND APPLICATION
AN/PSM-37 or equivalent	1-1	Multimeter	Input impedance and component checks
HP6012A or Equiv.		DC Power Supply	DC Voltage Source
Weston Model 931 or Equivalent		DC Milliammeter	Current Monitor
Fluke 8300A or Equivalent		Digital VM	Monitor Supply Voltage
20980 or Equiv.		Test Leads	Interconnections

SECTION III

PREPARATION FOR USE AND SHIPMENT

3-1. PREPARATION FOR USE.

3-2. GENERAL. The entire AN/PSM-37 is packaged in one unit container. The accessories are stowed in the compartment behind the data plate in the multimeter cover. The batteries and a copy of this manual are packaged in the unit container but external to the multimeter case.

3-3. UNPACKING. Open the unit container and remove the batteries, which are located just inside the carton top-closure. Remove the manual which is between the cushioning and the carton wall. Do not cut deeper than the carton closure or damage to batteries or manual may result. Remove the multimeter from the carton and take the multimeter cover off. Open the data plate and check that the listed accessories are all included.

3-4. BATTERY INSTALLATION. Follow the instructions on the data plate to install batteries. The battery compartment has raised markings showing the proper battery polarities. The multimeter is protected against accidental reverse battery installation but will not function properly unless all batteries are properly installed.

3-4A. MECHANICAL ZERO. The mechanical zero adjustment screw is located at the bottom center of the meter panel just above the mounting screw. Adjust the meter for mechanical zero by turning the screw with a small standard screwdriver.

3-5. CHECK OUT. After batteries are installed, connect test leads, short together at the tips, and set the multimeter for OHMS LP FUNCTION, RX10 RANGE and DC+ POLARITY. Check that the overload circuit has been set by pressing the rubber reset button and releasing. The meter should now read up-scale and can be made to read full-scale, or zero ohms, by turning the OHMS ADJ knob as needed. When full-scale is obtained, check that the meter continues to read approximately full-scale with the POLARITY switch set to DC- and with the FUNCTION switch set to OHMS STD. If the above performance is not obtained, either the batteries are weak or improperly installed or the OVERLOAD is not reset.

NOTE

> The OHMS STD function does not operate on the RX1 range because of the maximum allowed ohmmeter output current of 5 milliamperes.

3-6. PREPARATION FOR SHIPMENT.

3-7. Remove the batteries and pack the multimeter in accordance with current packing and shipping directives.

SECTION IV

OPERATION INSTRUCTIONS

4-1. GENERAL.

4-2. This section contains the theory of operation and operating procedures for the multimeter.

4-3. THEORY OF OPERATION.

4-4. INTRODUCTION. The multimeter is a precision general-purpose test instrument which combines the functions of an AC and DC voltmeter (with 10 Megohm, 20K Ω /V and 1K Ω /V meter sensitivities), an ammeter, and an ohmmeter. The settings of the FUNCTION, RANGE, and POLARITY switches control the characteristics and range of the meter circuit, and the discussion of the theory of operation will therefore be divided into the individual circuits resulting from each combination of switch settings. The complete schematic diagram is shown in figure 6-1.

4-5. FUNCTIONAL OPERATION.

4-6. DC VOLTAGE - 20,000 OHMS PER VOLT. With the FUNCTION switch set at VOLTS - 20K Ω/V, and the RANGE switch at any position, the circuit reduces to the simplified diagram shown in figure 4-1. Resistors R35 through R43 comprise the 20,000 ohms-per-volt series resistance string. The series resistance values are chosen to provide the required ranges.

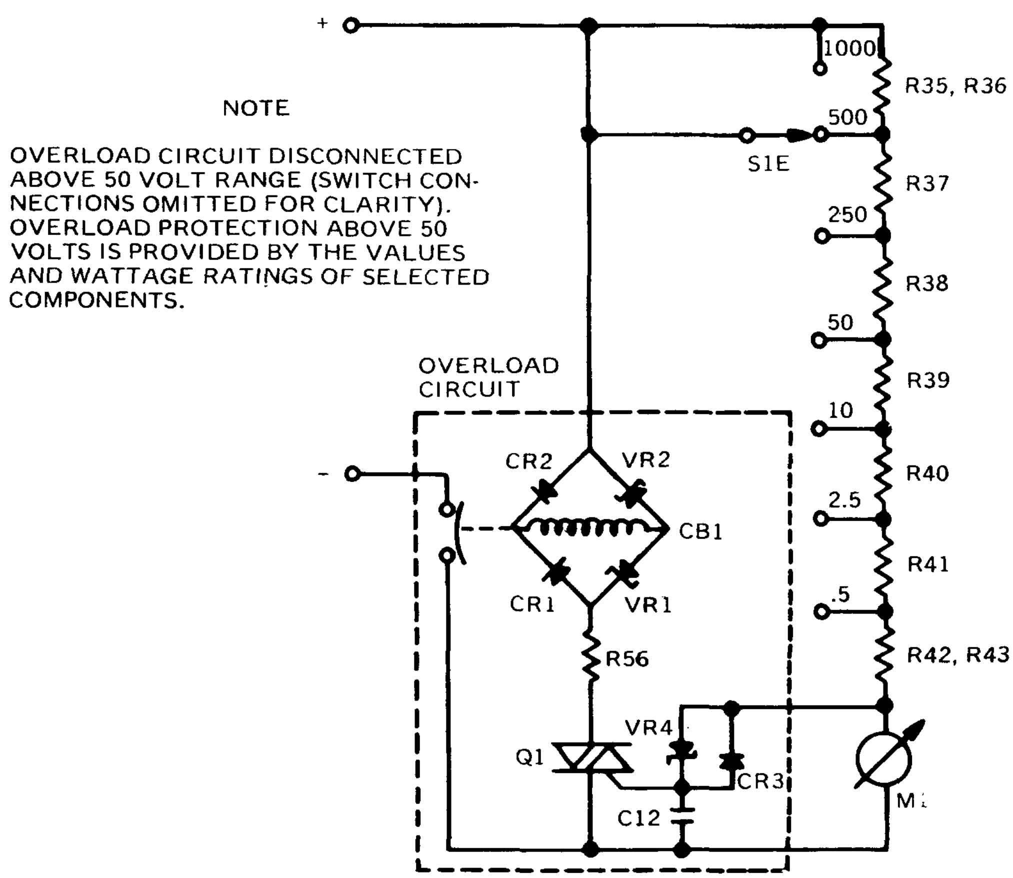


Figure 4-1. Simplified Circuit, DC Volts - 20K Ohms/Volt

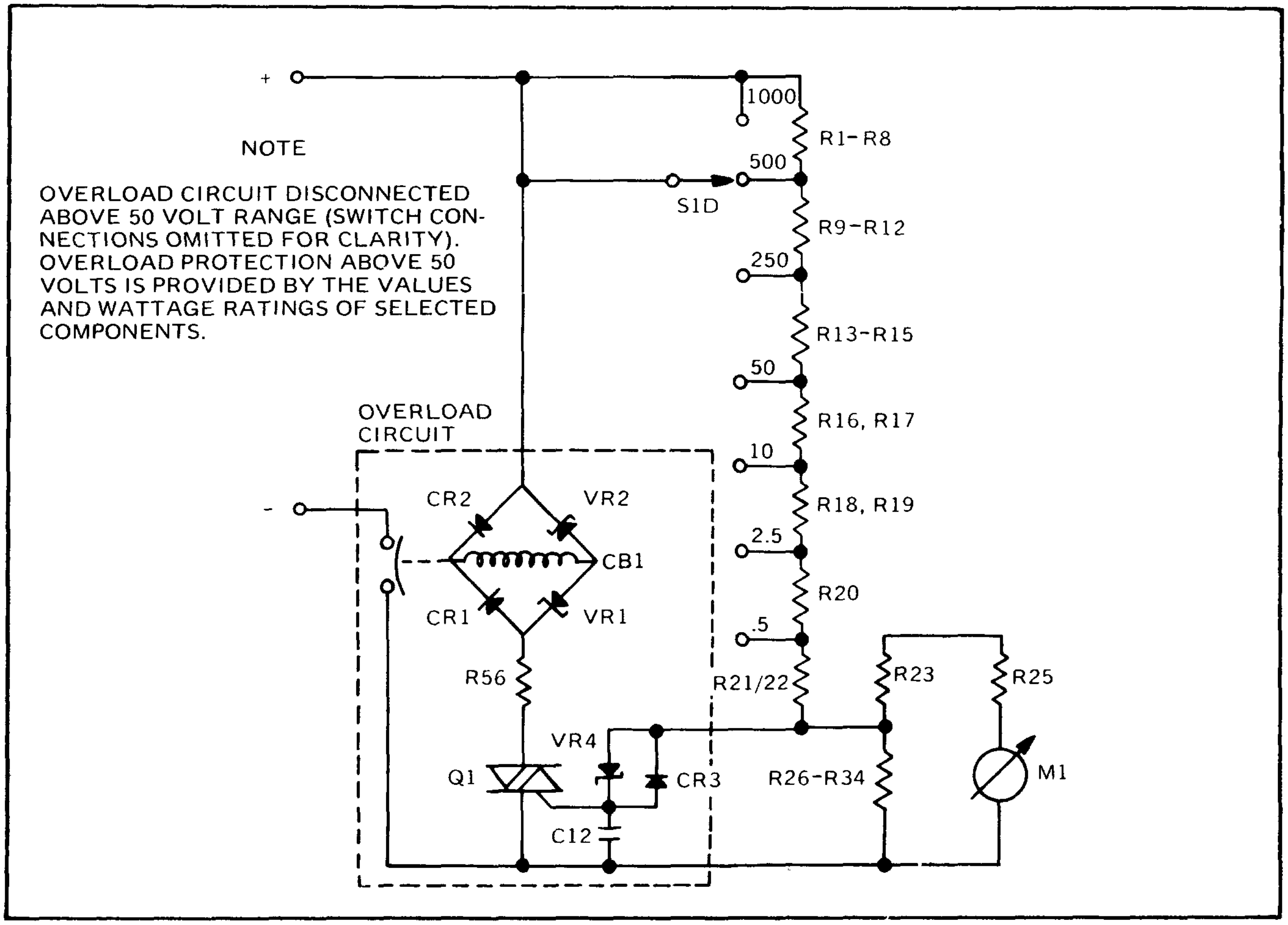


Figure 4-2. Simplified Circuit, DC Volts - 1K Ohms/Volt

NOTE

The circuit shown within the screened area provides overload protection and is discussed later in this section.

4-7. DC VOLTAGE - 1,000 OHMS PER VOLT. With the FUNCTION switch set at VOLTS - 1K Ω/V and the RANGE switch at any position, the simplified circuit is shown in figure 4-2. Resistors R1 through R34 comprise a combination 1000 ohms-per-volt series resistance string and a universal current shunt. The current shunt is tapped at one milliampere to provide the beginning of the 1000 ohms/volt string. The series resistance values are chosen to provide the proper ranges. Series/parallel combinations such as R1 through R8 provide the wattage rating needed for operating or overload conditions.

4-8. DC VOLTAGE - 10 MEGOHMS. The simplified circuit for part number 910 (911) is shown in figure 4-3. Resistors R44 through R53 and capacitors C2 through C8 comprise the 10 Megohm input voltage divider. The divider is tapped at values corresponding to the 10 Megohm input impedance voltage ranges. The divider has capacitive input frequency compensation on the 0.5 through 50 volt ranges. AR1 amplifies the applied voltage to 0.85 volts full scale so that the variations of M1 meter resistance due to temperature are small in relation to the large value of series resistor R66. Amplification is set at 8.5 to one by feedback resistors R64 and R65. Figure 4-2A shows the circuit for part number 960.

4-9. AMPLIFIER AR1. All AC measurements and the DC measurements on OHMS and 10 MEGOHM input impedance functions use Amplifier AR1. AR1 is a high input impedance integrated circuit operational amplifier selected and trimmed for low input bias current and low input offset voltage. For 10 MEGOHM impedance measurements the AR1 input is connected to the selected tap on the 10 MEGOHM voltage divider by switch S1C. For OHMS measurements the AR1 input is connected via R54 to the negative input terminal. All other functions use AR1 only for AC signals and the AR1 input is connected via R62 across the meter substitution resistor R61, with diodes CR5 and CR7 providing input protection for AR1. Capacitor C10 reduces the effects of AC signals when measuring DC values on OHMS and 10 MEGOHM functions by preventing the amplifier input from exceeding its input voltage swing limits.

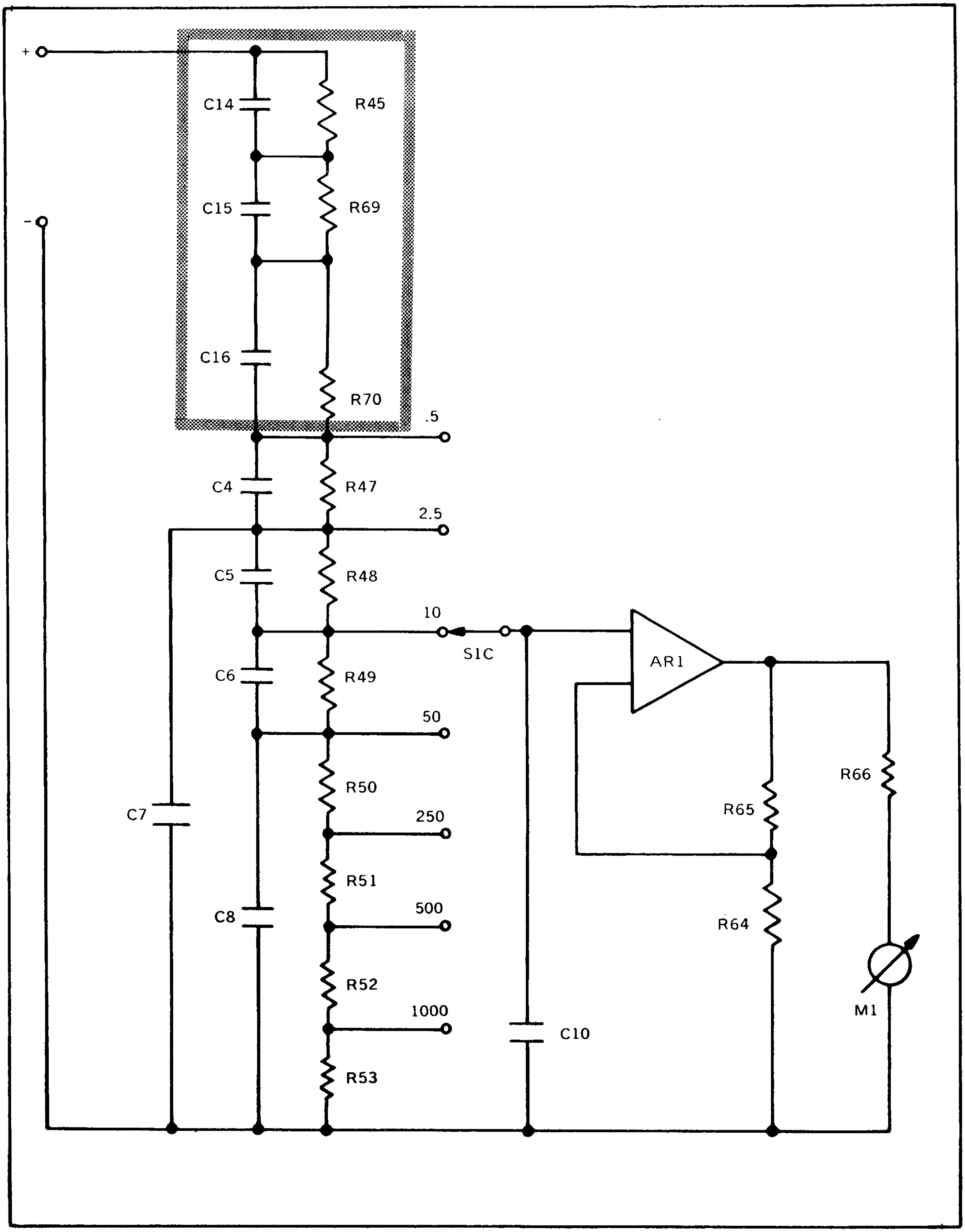


Figure 4-2A. Simplified Circuit, DC Volts - 10 Megohms (Part Number 960 Only)

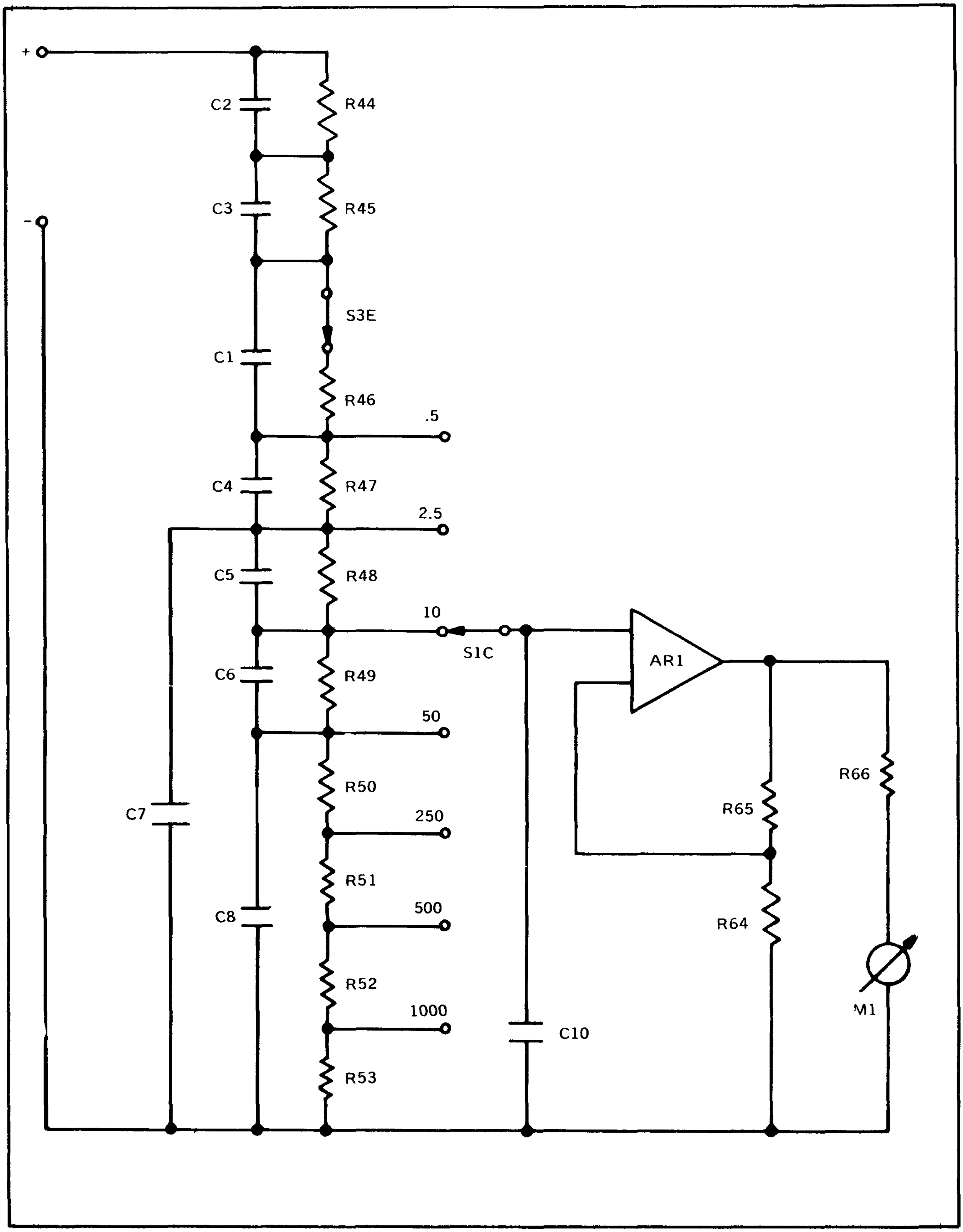


Figure 4-3. Simplified Circuit, DC Volts - 10 Megohms (Part Number 910 Only)

C10 is always supplied by a high resistance so that a high RC constant results. The high input impedance of AR1 does not load the input circuits and thus does not affect the accuracy. AR1 is encapsulated and requires no adjustment.

4-10. AC VOLTAGE - 20,000 OHMS PER VOLT. With the POLARITY switch at AC and the FUNCTION switch at VOLTS - 20K Ω/V, the simplified circuit is shown in figure 4-4. Diodes CR8 through CR11 form a full-wave bridge circuit with M1 connected so that all current through the bridge passes through M1 in the positive direction for upscale readings. The current leaves the bridge and generates a feedback voltage across R63 by passing through R63 to ground. The value of R63 is such that scale readings of sinusoidal signals are equal to the RMS value even though the actual detection circuit measures average values. Capacitor C1 serves to block DC voltage when making measurement of AC signals. R46 limits the discharge current when C1 is bypassed for DC measurements.

4-11. AC VOLTAGE - 1000 OHMS PER VOLT. With the POLARITY switch at AC and the FUNCTION switch at VOLTS - 1K Ω/V, the simplified circuit is shown in figure 4-5. This circuit is essentially the same as the 20K Ω/V function, except that the 1K Ω/V resistance string of R1 through R23, with R25 in series, has been switched in as the input to AR1.

4-12. AC VOLTAGE - 10 MEGOHMS. With the POLARITY switch at AC the simplified circuit for part number 910 is as shown in figure 4-6. Resistors R44 through R53 (except R46) and capacitors C2 through C8 comprise the input impedance voltage divider. Capacitor C1 blocks DC voltages. (Resistor R46 limits the discharge current when C1 is bypassed for DC measurements). The simplified circuit for part number 960 is shown in figure 4-6A.

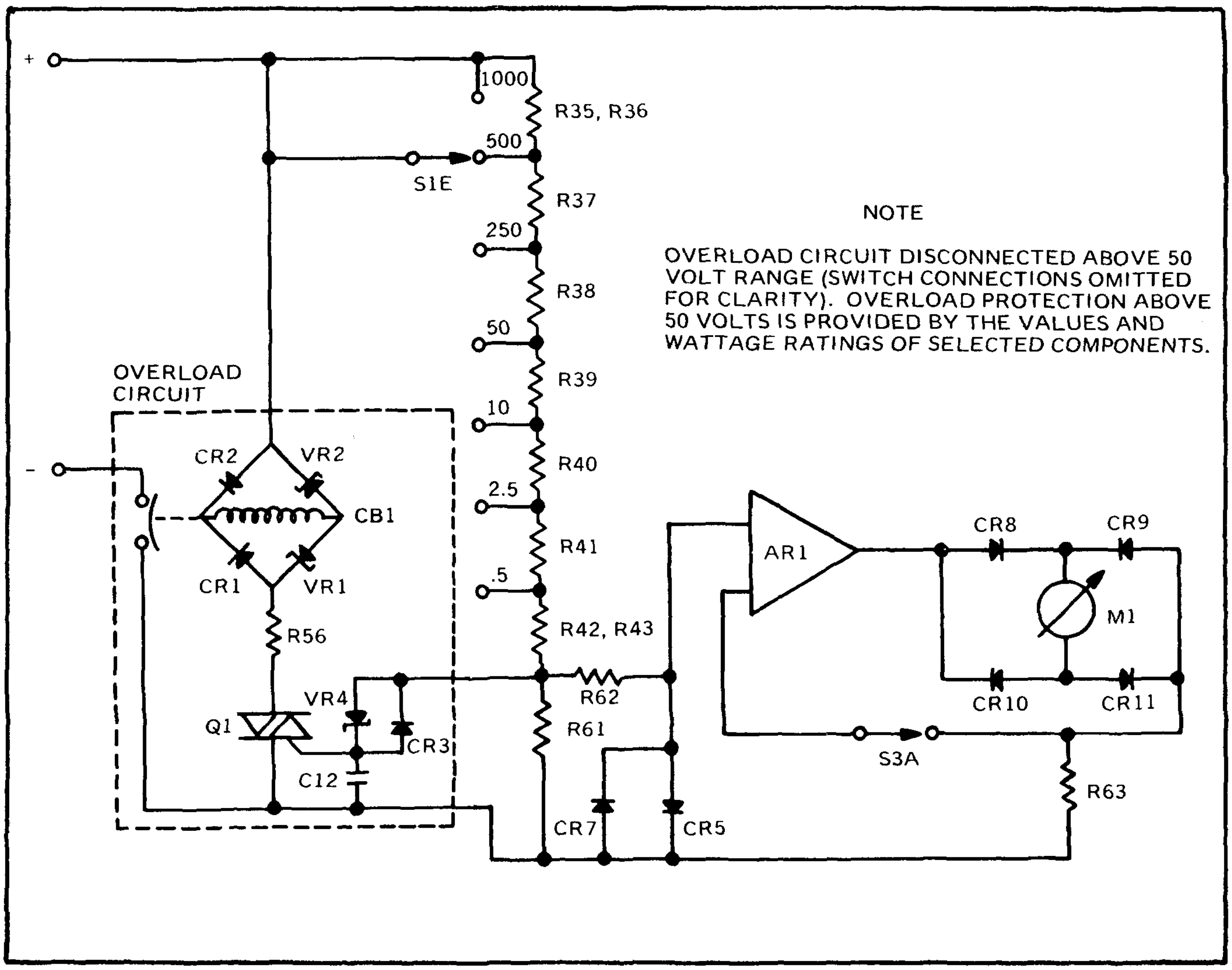


Figure 4-4. Simplified Circuit, AC Volts - 20K Ohms/Volt

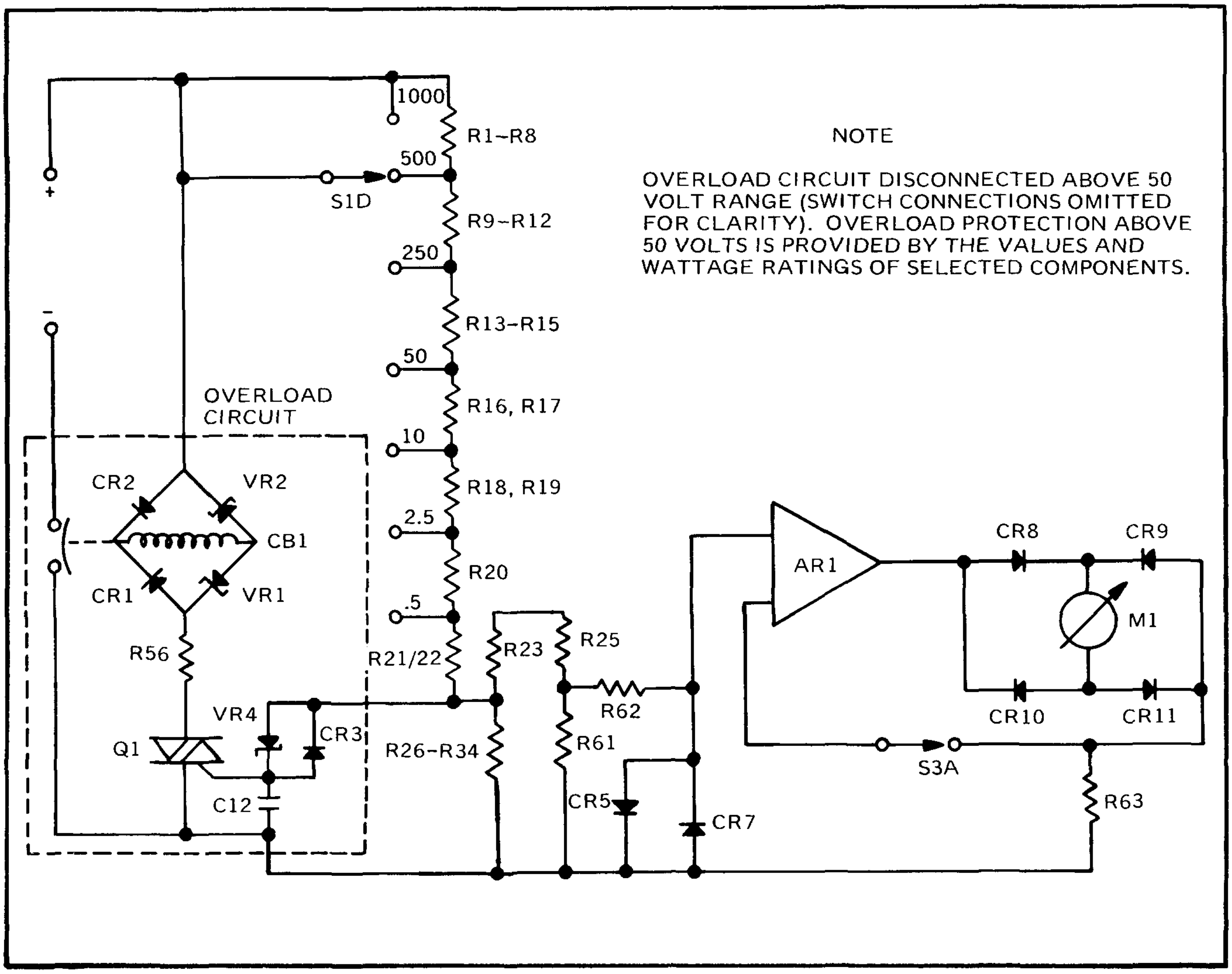


Figure 4-5. Simplified Circuit, AC Volts - 1K Ohms/Volt

4-13. AMPERES - MILLIAMPERES. With the FUNCTION switch at AMPS - MA/PULSE MA and the RANGE switch at any position, the simplified circuits are shown in figure 4-7 for both AC and DC modes. The current shunt is tapped at values from 100 microamperes to one ampere to provide the ranges for the MA and SPECIAL functions. For pulsating direct currents, with pulse amplitudes not greater than 20 times the full-scale value of the selected range and a repetition rate from 20Hz to 30 KHz, the multimeter indicates the average value of the current within the range and accuracy limits specified for DC current.

4-14. SPECIAL. With the FUNCTION switch at SPECIAL and the RANGE switch at any position, the simplified circuits are shown in figure 4-8 for both AC and DC modes. The circuits shown are essentially the same as those shown for the AMPS-MA/PULSE MA function (figure 4-7) except that R25 is no longer in series with the meter input but has become part of the shunt string.

4-15. OHMS. With the FUNCTION switch at OHMS, the simplified circuit is shown in figure 4-9. Taps from the current shunt and series string (R1 through R34) provide Rx1 through Rx10K resistance scale standards. The Rx100K resistance scale standard is taken from the 10 MEGOHM divider (R44 through R53). Amplifier AR2 serves as a regulated bipolar voltage source for OHMS functions. U1 is a field effect transistor (FET) connected as a variable current source and controlled by OHMS ADJUST potentiometer R68. U1 delivers constant current to R60 regardless of actual battery voltage and generates either +95 or −95 millivolts across R60, depending on whether the current source is connected to the positive or negative battery terminal. For unity gain, R59 is a series feedback resistor. CR4 and CR6 in conjunction with CR5 and CR7 protect AR2 from input overloads if a hot circuit is measured instead of a passive resistance.

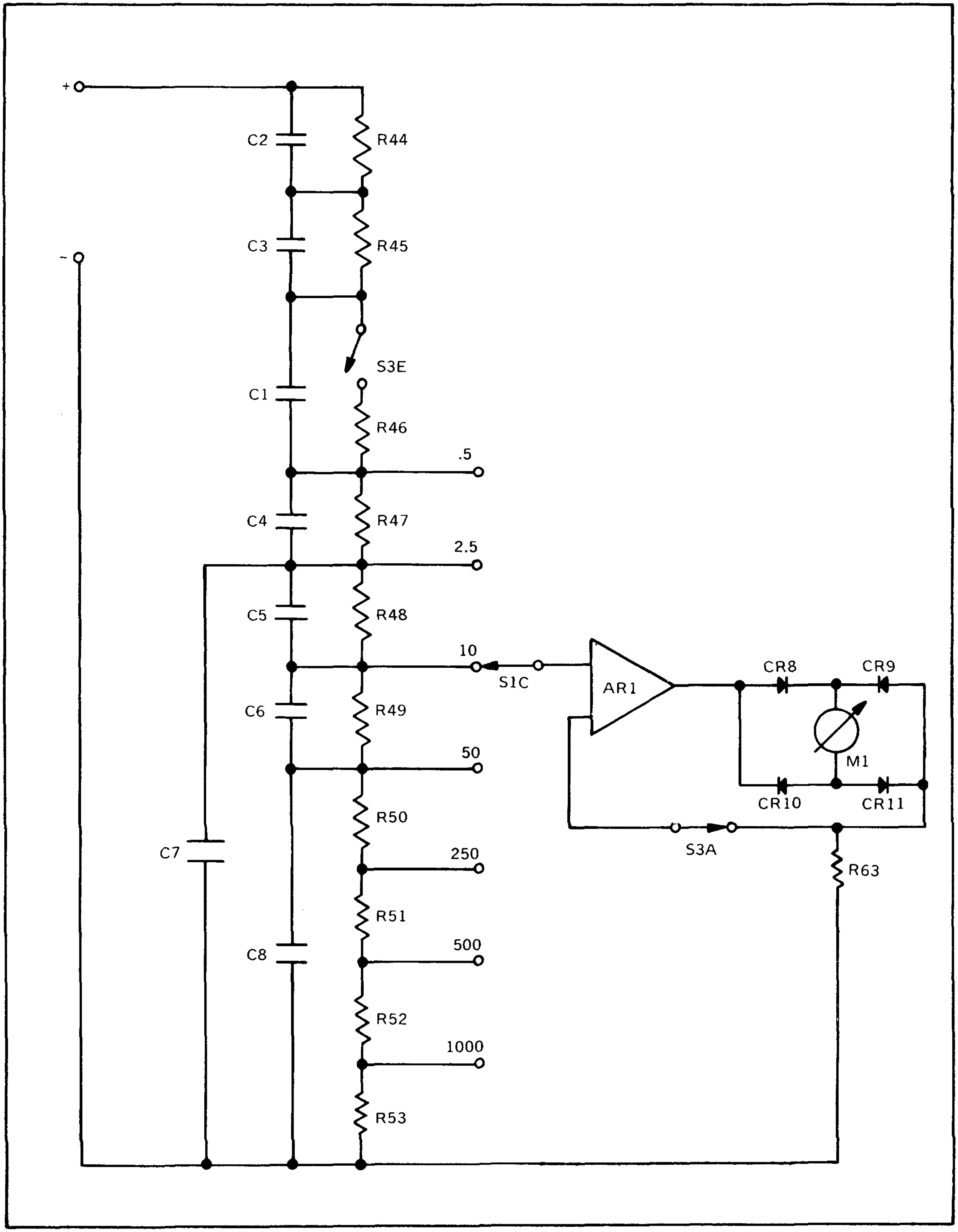


Figure 4-6. Simplified Circuit, AC Volts - 10 Megohms (Part Number 910 Only)

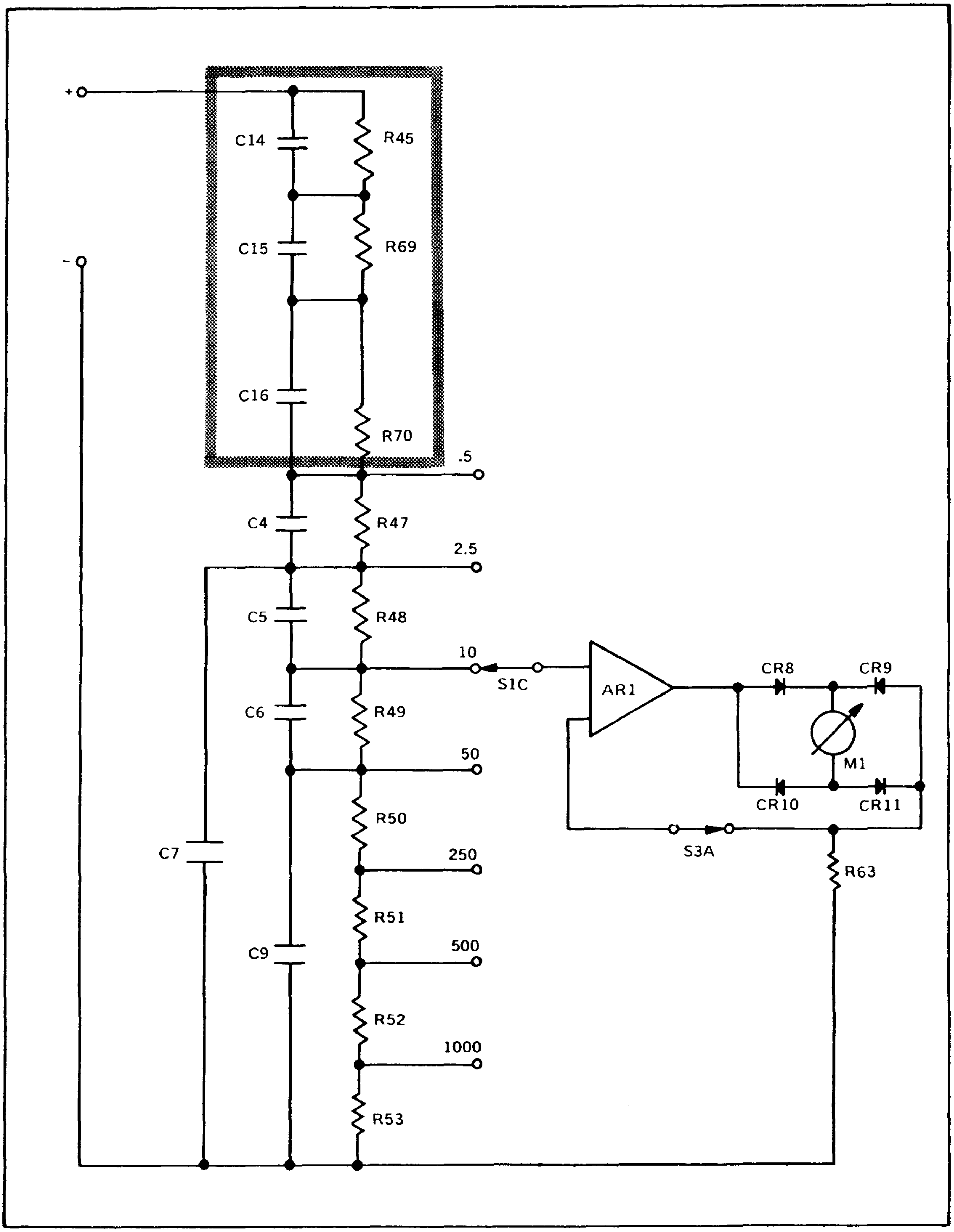


Figure 4-6A. Simplified Circuit, AC Volts - 10 Megohms (Part Number 960 Only)

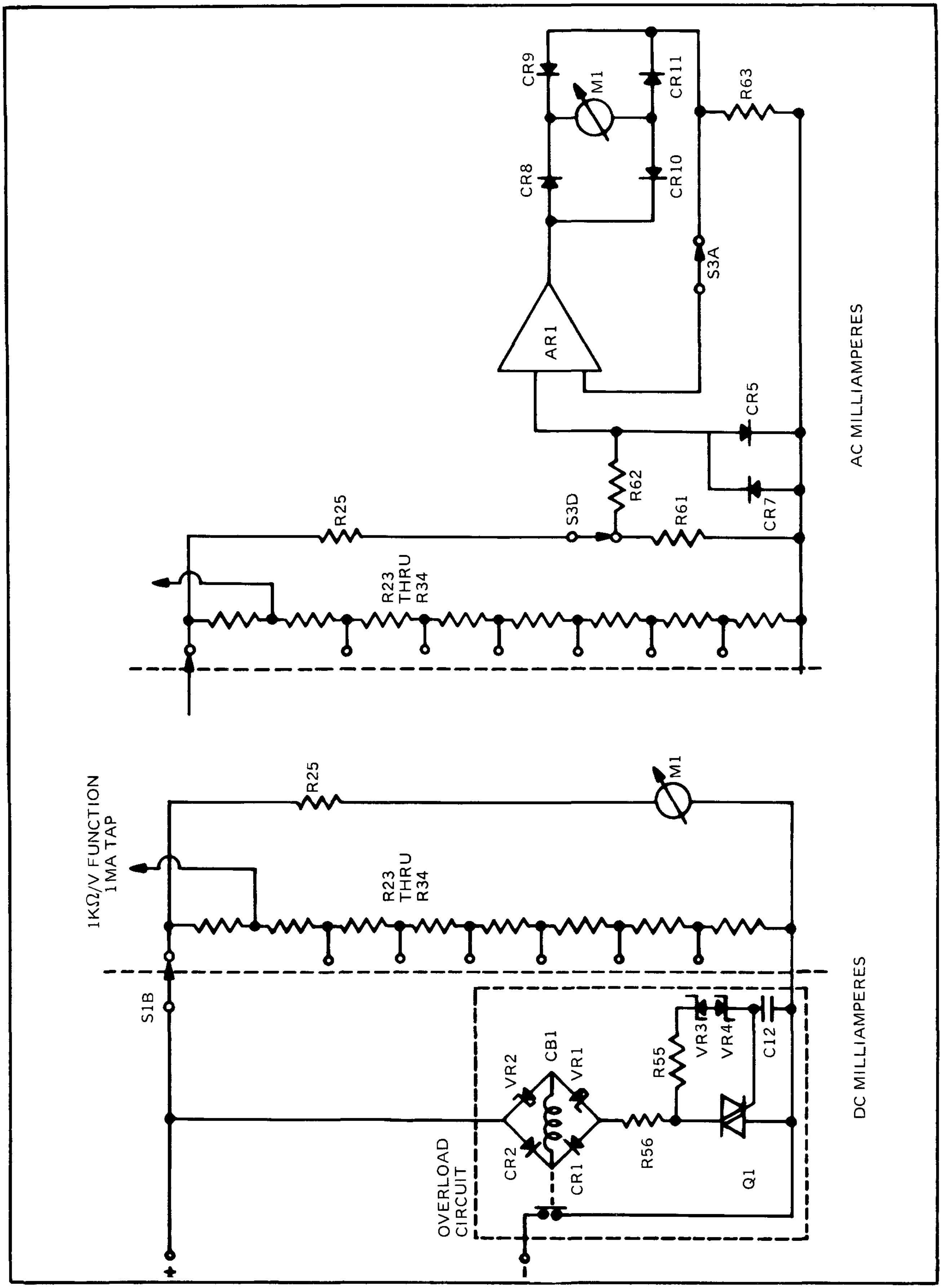


Figure 4-7. Simplified Circuit, AMPS - MA

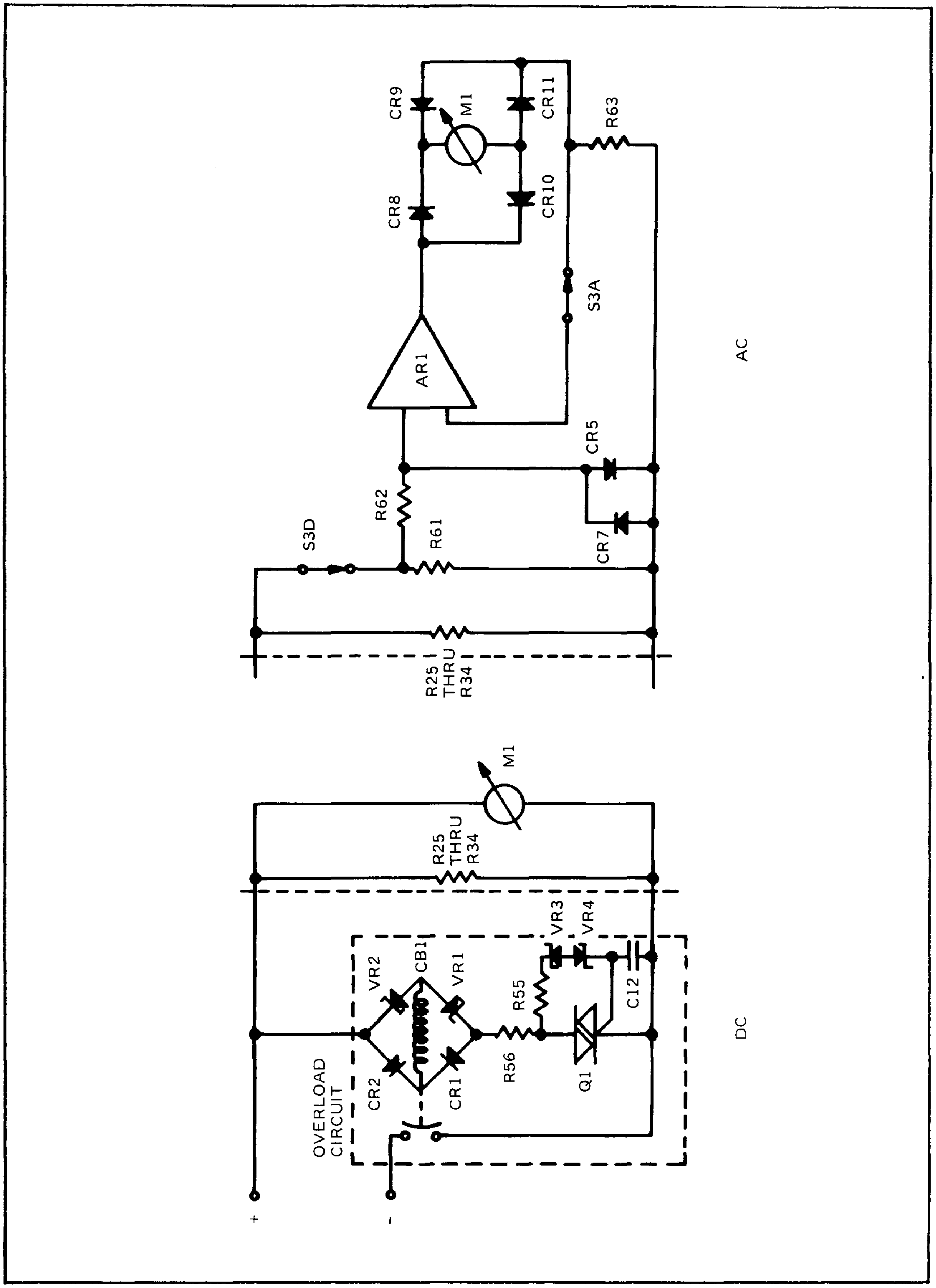


Figure 4-8. Simplified Circuit, SPECIAL (100UV/100 MV)

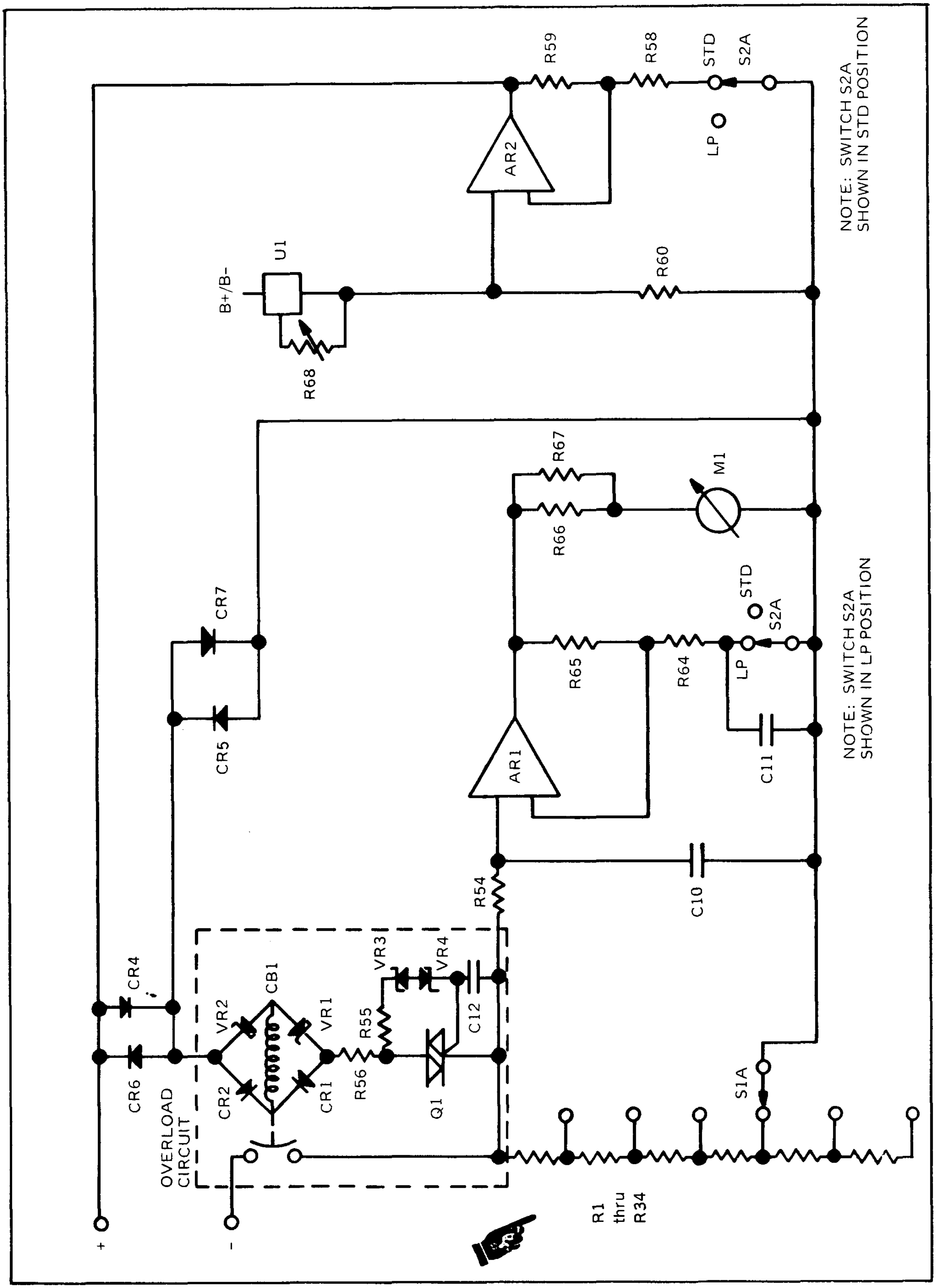


Figure 4-9. Simplified Circuit, Ohms

4-16. OHMS - LP. With the FUNCTION switch in the OHMS - LP position, the maximum input voltage to AR1 is 95.3 millivolts, which is amplified by AR1 to 0.81 volts full scale. M1 reads full scale under these conditions because R67 shunts R66 for ohms measurements. AR2 serves as a unity gain voltage follower connected to the positive multimeter terminal and delivers 95 millivolts regardless of the current delivered.

4-17. OHMS - STD. The STD OHMS maximum input voltage is 0.81 volts and the AR1 gain is set to unity DC gain. By placing feedback capacitor C11 between R64 and ground AC gain remains at 8.5 to one for amplifier stability since C11 does not block AC feedback currents from ground. AR2 is set at 8.5 to one gain by feedback resistors R58 and R59 and delivers 0.81 volts to the positive multimeter terminal.

4-18. OVERLOAD PROTECTION.

4-19. Overload protection is provided for all input circuits. The 10 MEGOHM function and the 20K Ω/Volt and 1K Ω/Volt functions above the 50 volt range are inherently protected by the values and wattage ratings of the components used and do not trigger the overload relay under any circumstances.

4-20. The SPECIAL, MA, and OHMS functions all use a common overload circuit, whereby the positive multimeter terminal is connected to the full-wave bridge circuit comprised of CR1, CR2, VR1, and VR2, then via R56 to thyristor (TRIAC) Q1. When Q1 is blocking, no current flows through it and the relay coil has insufficient current to trigger. The voltage blocked by Q1 is passed via limiting resistor R55 through zener diodes VR3 and VR4, which set a minimum threshold for conduction, into the gate of Q1. No gate current flows until the blocking voltage reaches about 3 volts, whether AC or DC. Once gate current reaches about 1 milliampere the blocking action of Q1 collapses and the relay is triggered. Capacitor C12 prevents triggering due to short duration spikes or transients. The bridge circuit is used to insure triggering when higher frequency AC overloads are encountered.

4-21. The 1K and 20K OHMS/VOLT functions utilize a similar circuit to that above but take the Q1 gate current from a tap on the respective voltage series strings, through CR3 and VR4 as a parallel diode combination. When no overload exists the tap voltage is insufficient to pass CR3 or VR4.

4-22. METERING CIRCUITS. DC measurements, except for OHMS and 10 MEGOHM input impedance, are made by direct connections of meter M1 to the appropriate input circuit at the proper place and will operate with or without batteries, thus enabling the AN/PSM-37 to check its own batteries. M1 has internal temperature compensation and diode overload protection but will not clip forward pulses of less than twenty times full scale. M1 is shorted when the multimeter is OFF.

4-23. BATTERIES. BT1 through BT4 supply the power for the amplifiers and the constant current source but are <u>not</u> utilized for overload switching. Resistor R39 limits current into AR1 and AR2 for protection from damage which would otherwise result from reverse battery insertion.

4-24. CONTROLS

4-25. RANGE SWITCH. S1 is the RANGE selector switch and is used to select the correct measurement range. The proper range for voltage or current is normally that which gives the greatest scale deflection without going overscale. The proper ohms range is normally that which produces a reading within the wide-band part of the green arc on meter M1. Pulsating signals may require reading on ranges above the value obtained above.

a. S1A is the OHMS range selector. It connects metering neutral through standard resistances of 20, 200, 2K, 20K, 200K, or 2 Meg ohms to the negative input terminal. It also grounds the S2C side of R54 in position 7 to avoid erroneous readings and in position 1 of STD OHMS to disable this range because its output current would exceed that allowed.

b. S1B is the MA range selector switch. It connects the positive input terminal to taps on the universal current shunt which are 400, 80, 20, 4, 0.8, 0.4, or 0.2 ohms above the negative input terminal, for full scale deflections of 0.5 through 1000 milliamperes respectively. The circuit is so arranged that the contact resistances of CB1, S1B, S2F, S2A, and S2B do not affect measuring accuracy.

c. S1C is the 10 MEGΩ input impedance range selector switch. It connects the input to AR1 via S2C to the appropriate tap on the 10 MEGΩ voltage divider. The reverse side of the wafer containing S1C is blank to prevent pickup of unwanted signals.

d. S1D is the 1K Ω/V range selector switch. It connects the positive input terminal to points 500, 2500, 10K, 50K, 250K, 500K, and 1 Meg ohms above the negative input. On the 0.5, 2.5, 10, and 50 volt ranges it also connects the positive input terminal to the S2D overload source selector switch.

e. S1E is the 20K Ω/V range selector switch. It connects the positive input terminal to points 10K, 50K, 200K, 1Meg, 5Meg, 10Meg, and 20Meg ohms above the negative input terminal. It also connects the positive input to the S2D overload source selector switch on the 0.5, 2.5, 10, and 50 volt ranges.

4-26. FUNCTION SWITCH. S2 is the FUNCTION selector switch and is used to interconnect the input, amplifier, overload, and metering circuits to obtain the proper circuit for each function

a. S2F is the input function selector switch and connects the positive multimeter terminal to the appropriate input circuit according to the function selected. This switch is alone on the rear deck of the function switch and is constructed so that the high overloads applied to one function will not break down to other input circuits incapable of tolerating such overload.

b. S2D is the overload drive selector switch and connects the overload bridge input to the appropriate drive source. On the 10 MEG Ω function there is no connection for the drive since the input section of the 10MEG Ω function is inherently protected. On the SPECIAL, MA, 1K Ω/V and 20K Ω/V functions the overload drive is connected directly to the positive multimeter terminal. S1D and S1E are such that the 1K Ω/V and the 20K Ω/V functions are connected to overload drive for ranges up to 50 volts only, since components used in the higher ranges are inherently protected, as in the 10 MEGOHM function. On LP and STD OHMS the overload drive is connected to the midpoint of diode network CR4-CR7. CR4 and CR6 effectively clamp this point to the positive multimeter terminal when an overload is experienced; otherwise, the voltage at the midpoint is approximately one-half the output of AR2 and the leakage currents through Q1 are reduced by a factor of ten. This is very important on the Rx100K range since total output current is only 50 nanoamperes on the LP OHMS function and any leakage through the overload circuitry could affect accuracy.

c. S2E is the overload circuit gate drive selector switch and connects the gate of Q1 to the appropriate drive source. This source is selected so that no gate current will flow unless the multimeter input is overloaded, and such that overload switching will occur before any components become overloaded to a degree that could cause damage. For SPECIAL, MA, and OHMS functions this is the voltage blocked by the triac Q1, which is dropped across two back-to-back zener diodes and through a current limiting resistor which provides triac gate protection. For the 1K Ω/V and 20K Ω/V functions the gate drive is taken from the low end of the respective series resistor strings.

d. S2A is the amplifier ground selector switch. For all functions except OHMS this switch connects amplifier ground (battery mid-point) to the negative multimeter terminal. For OHMS functions the amplifier ground is connected to a resistor which in turn is connected to the negative multimeter terminal. S2A also supplies ground connections to make the OHMS functions inoperative in the 1000 RANGE position and to make STD OHMS inoperative in the Rx1 RANGE position. S2A is also used to set the gain of AR1 and AR2 for DC measurements on OHMS and 10 MEGΩ functions.

e. S2B is the metering source selector switch, and connects M1 or meter substitution resistor R61 to the appropriate place, either an input string or the amplifier output circuit.

f. S2C is the amplifier AR1 input selector switch. On the 10 MEGΩ function this switch connects the amplifier input to S1C. On all other AC functions it connects the amplifier input to meter substitution resistor R61. On OHMS functions it connects the amplifier input through R54 to the negative multimeter terminal. The clips on the rear side of the S2C wafer are used to remove the effect of wiring capacitance on 10 MEGΩ AC readings but do not affect the circuit schematic.

4-27. POLARITY SWITCH. S3 is the polarity switch used to turn the multimeter on and off and to select DC polarity and AC mode.

a. S3A is the amplifier feedback selector switch. In OFF and DC polarities it connects the amplifier feedback input (inverting) to the tap between R64 and R65, resulting in an amplifier gain of 8.5 when R64 is grounded and unity gain when R64 is not grounded. Capacitor C11 maintains AC gain at 8.5 in either event for amplifier stability. In AC polarity S3A connects the amplifier feedback input to AC feedback resistor R63 and grounds the OHMS functions to avoid readings on AC Ohms setting.

b. S3B is the OHMS function source polarity selector switch. It places R60, R68, and U1 in proper sequence and polarity to generate either +95 or -95 millivolts across R60, according to the polarity selected. Switching is such that output transients are precluded. The arrangement used makes adjustment of R68 unnecessary except for extreme accuracy. S3B also connects the amplifier positive battery inputs to the positive battery connection when in DC or AC positions.

c. S3C is the meter polarity switch. It shorts the meter out when S3C is set to OFF for transit to provide high meter damping and protection. When in DC polarity it connects the meter either in forward or reverse polarity so that upscale readings can be obtained, and when in AC polarity it connects the meter into the AC bridge formed by CR8 - CR11.

d. S3D connects the negative amplifier battery inputs to the negative battery connection when in AC or DC polarities, acts as an adjunct to S3B for ohms polarity selection, and places meter substitution resistor R61 in place of meter M1 for AC measurements where M1 is connected to the AR1 amplifier output bridge.

e. S3E bypasses DC blocking capacitor C1 when set to DC. This deck affects only the 10 MEGOHM function and is used only on part number 910.

4-28. OPERATING CONTROLS.

4-29. FUNCTION SWITCH. The FUNCTION switch (see figure 4-10) is located at the lower left of the multimeter panel and provides the means for setting the instrument for the particular electrical characteristic to be measured.

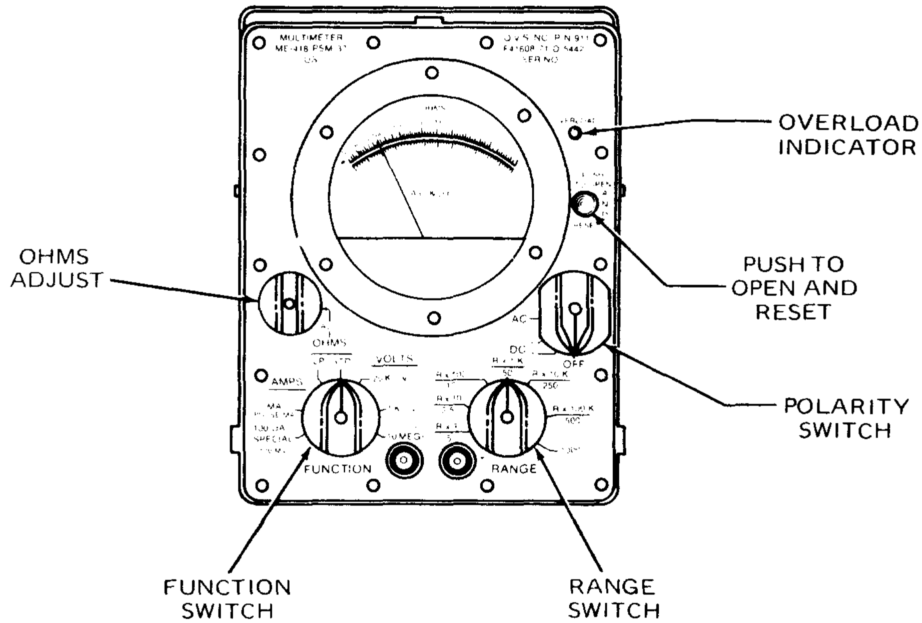


Figure 4-10. AN/PSM-37 Operating Controls

4-30. RANGE SWITCH. The RANGE switch (see figure 4-10) is located at the lower right of the panel. Once the FUNCTION switch has been set, the correct instrument range to provide an accurate scale indication is set with the RANGE switch.

4-31. POLARITY SWITCH. The polarity switch (see figure 4-10) is located centrally on the right side of the panel but is not marked as such. It turns the multimeter on and off and selects the nature of the measurement to be made, DC+, DC–, or AC. The "+" and "–" polarity indicates the polarity applied to the red jack when the meter reads upscale on DC measurements, and the output polarity of the red jack when making OHMS measurements.

4-32. OHMS ADJ. The OHMS ADJUST control (see figure 4-10) is located centrally on the left side of the panel and is used only to set full-scale deflection with the test leads shorted prior to making resistance measurements. This control adjusts for variations due to battery condition, temperature, and range and function settings.

4-33. PUSH TO OPEN AND RESET. This control is located adjacent to the meter on the right side of the panel (see figure 4-10). The overload circuit breaker is manually opened when this button is depressed, permitting changes in range and function settings without disconnecting the test leads from the circuit. Depressing this button also resets the overload breaker if it has been actuated.

4-34. OVERLOAD. The overload indicator is located just above the overload reset button (see figure 4-10). When an overload has occured which has caused the overload breaker to open, a red indicator shaft appears in the transparent plastic dome. The red indicator retracts when the PUSH TO OPEN AND RESET button is depressed, and remains retracted upon release of the button if the overload has properly reset.

4-35. OPERATING PROCEDURES.

4-36. GENERAL. Prior to making any measurements, check that the overload protector is not tripped, as indicated by the OVERLOAD indicator. If an overload is indicated, or when in doubt, reset the meter by depressing and releasing the PUSH TO OPEN AND RESET button. Check that the meter is mechanically zeroed, if not, adjust in accordance with paragraph 5-6.

4-37. VOLTAGE MEASUREMENTS. AC and DC voltages may be measured directly on the ME-418/PSM-37 in the range of 0 to 1000 volts at input impedances of 1000 ohms/volt, 20,000 ohms/volt, or at a fixed 10 megohms. These impedance functions are marked on the panel under the VOLTS caption around the FUNCTION switch. Measurements of small signals up to 100 millivolts at 1000 ohms (10,000 ohms/volt) is available under the SPECIAL function marked on the panel under the AMPS caption. To measure voltages in the range of 0 to 1000 volts the procedure is as follows:

a. Set FUNCTION switch to 20KΩ/V, 1KΩ/V, or 10 MEGΩ as desired.

NOTE

The 10 MEG Ω function is inherently protected against overload and is recommended for initial measurements. If erratic readings or no readings are obtained in the 10 MEG Ω function, reset the overload before attempting to troubleshoot.

b. Set RANGE switch to desired full-scale range.

CAUTION

Whenever taking an unknown voltage measurement always set range switch to the highest range and decrease until the proper range is reached.

c. Turn POLARITY switch to DC+, DC–, or AC as desired.

d. Connect test leads to meter jacks, red lead to red (+) jack.

e. Connect test lead tips to circuit being measured, with black lead to ground or lower voltage point, if known. If meter reads reverse on DC measurements change POLARITY switch to opposite polarity.

WARNING

The lack of a meter reading does not mean the circuit is safe since dangerous levels of voltages of other polarities may be present. The overload circuit may activate due to the presence of undetected voltage and must be checked before concluding no voltage is present.

f. If a voltage below 100 millivolts is indicated, the FUNCTION switch may be set to SPECIAL and measurements taken. The position of the RANGE switch does not affect full scale value of the SPECIAL FUNCTION.

NOTE

Part Number 910 Only

The 10 MEGΩ function employs a blocking capacitor when set on AC polarity and permits the reading of low level AC signals present on higher level DC voltages.

4-38. HIGH VOLTAGE or HIGH IMPEDENCE DC VOLTAGE MEASUREMENTS. The use of test prod, MX-1410/U permits DC voltage measurements up to 5000 volts at an input impedance of 100 megohms. When used with the 500 volt range of the 20KΩ/V function a full-scale value of 5000 volts is obtained. When used with the 10 MEGΩ function it becomes a ten times voltage divider and will produce full-scale values from 5 to 10,000 volts. Do not make measurements over 5000 volts. To make high voltage or high impedance measurements the procedure is as follows:

a. Set FUNCTION switch to 20K Ω/V or 10 MEGΩ as desired.

WARNING

Be sure equipment is turned off when connecting or disconnecting where high voltage may be present. Do not change FUNCTION switch setting while equipment is energized.

b. Set RANGE switch to 500 for 5000 volt full-scale reading. Other full-scale values may be selected only on the 10 MEGΩ function, and will have a full-scale value equal to ten times the switch setting.

c. Set POLARITY switch to DC +.

d. Plug red test lead tip into MX-1410/U.

e. Connect MX-1410/U clip to high voltage or high impedance test point. Connect black test lead to low side or ground. Turn on high voltage. If meter reads reverse, change POLARITY switch to DC–.

4-39. HIGH VOLTAGE or HIGH IMPEDANCE AC VOLTAGE MEASUREMENTS. The procedure of paragraph 4-38 above may be used for making AC measurements up to 5000 volts peak but with the POLARITY switch set to AC. The very high impedance of the MX-1410/U is affected by shunting capacitance of test leads, power lines, etc., and measurements are not recommended above power line frequencies except for the purpose of monitoring changes or fluctuations.

4-40. CURRENT MEASUREMENTS. AC and DC currents (including pulsed DC) from 0 to 1 ampere may be measured directly on the multimeter, and currents up to 10 amperes may be measured with the use of the multirange instrument shunt, MX9127/PSM-37. The procedure is as follows:

a. Set FUNCTION switch to MA/PULSE MA.

b. For measurements up to 1 ampere set RANGE switch to desired range.

c. Set POLARITY switch to DC +, DC−, or AC as desired.

d. Plug test leads into meter jacks. Connect other end of leads in series with circuit under test while the power is off. Turn on power and read meter.

e. For measurements above 1 ampere, connect test lead tips to pin jacks in shunt MX-9127/PSM-37. Connect circuit under test to appropriate load circuit binding posts. Set the RANGE switch to 2.5 or 10 to correspond with the shunt section used.

f. Turn on power and read meter. For a 2.5 ampere shunt section the meter is set for 2.5 and reads 2.5 amperes full-scale. Use of the 10 ampere shunt section results in a full-scale value of 10 amperes.

g. If a current below 100 microamperes is indicated, the FUNCTION switch may be set to SPECIAL and a full-scale value of 100 microamperes obtained. This function is also useful for standard external shunts.

4-41. RESISTANCE MEASUREMENTS. To measure resistance from 0 to 100 megohms the procedure is as follows:

a. Set FUNCTION switch to OHMS LP or OHMS STD depending on whether 100 millivolts or 850 millivolts output is desired. OHMS LP is generally used to measure in-circuit resistance where semiconductor junctions will block out the effect of other components. OHMS STD is best to check semiconductors for forward and reverse conduction and to minimize the effects of thermal,chemical, or leakage voltage.

CAUTION

With the function selector switch in the ohms position, the overload circuit may be damaged if the presence of over 50 volts or 1.5 milliamps exists.

b. Set POLARITY switch to DC +.

c. Set RANGE switch at proper multiplier so that the resistance measured falls in the broader portion of the green OHMS scale on the meter.

NOTE

The OHMS STD function is disabled on the Rx1 range to prevent delivery of excessive current into test items.

d. Plug test leads into meter jacks, short circuit the free ends of the test leads and adjust OHMS ADJ until full-scale deflection (0 ohms) is obtained.

e. Clip the test leads across the item to be measured. Read resistance on the OHMS scale and multiply by the range setting.

f. If resistance in the opposite direction is also desired, change POLARITY switch to DC− and read. The polarity of the red jack matches the setting of the POLARITY switch. An internal regulator circuit precludes resetting zero for routine range-to-range, function-to-function, or battery discharge effects. This permits rapid in-circuit measurements at LP and STD, forward and reverse polarity, without disconnecting the leads during test to rezero. Different forward and reverse readings will be obtained on a known passive device only if outside power is passing through the device.

NOTE

The overload is active at all times on OHMS functions to indicate presence of unexpected voltage when making resistance measurements.

4-42. CRYSTAL CURRENT MEASUREMENTS. To make standard measurements of crystal current, test adapter MX-9128/PSM-37 is used as follows:

a. Set FUNCTION switch to MA.

b. Set RANGE switch to 2.5.

c. Set POLARITY to DC+.

d. Plug test leads into meter jacks and connect test lead tips to pin jacks on adapter.

e. Connect phone plug to test circuit and read meter.

4-43. TURNING MULTIMETER OFF. Upon completion of measurements turn POLARITY switch to OFF position. The internal amplifiers draw battery current whenever the POLARITY switch is not OFF. The batteries when fresh will operate the multimeter for at least 500 hours at mid-scale on the OHMS functions and for several thousand hours on all other functions. The multimeter must be OFF before the cover will fit properly, due to a mechanical interference interlock incorporated into the POLARITY switch knob.

SECTION V

MAINTENANCE

5-1. MINIMUM PERFORMANCE STANDARDS.

5-2. The accuracies which this instrument is designed to meet are marked on the inside cover lid of the multimeter and in tables 5-1 and 5-2. These measurement accuracies constitute the minimum performance standards and may be checked by comparing the readings of the multimeter against another AN/PSM-37 or other standard multimeter with accuracies as good or better than the AN/PSM-37 under test. Overload limits are given in Table 5-3.

5-3. INSPECTION AND PREVENTIVE MAINTENANCE.

5-4. No periodic maintenance is required beyond replacement of the batteries, adjustment of the mechanical zero, oiling the handle hinge pivots, and visual inspection and cleaning of the multimeter exterior and accessories. The High Voltage Test Prod, Current Shunt, and Test Adapter are precision components which cannot be repaired in the field but must be replaced in their entirety if defective.

5-5. BATTERY TESTING AND REPLACEMENT.

a. Remove the four mounting screws from the battery cover on the rear of the case and lift off the cover and **gasket. Remove the four batteries.**

b. Set the AN/PSM-37 for + POLARITY, 2.5 RANGE and 1KΩ/V FUNCTION.

c. Measure the voltage of each individual cell, observing polarity.

NOTE

Fully charged batteries will read above 1.4 volts each. Although proper meter readings may be obtained with batteries reading above 1.1 volts each, batteries under 1.25 volts have little remaining service life and should not be retained except in special circumstances.

d. Replace weak or defective cells with new "AA" size alkaline cells, observing proper polarity as marked on **battery compartment. Ensure that four serviceable batteries are installed.**

e. Replace battery cover and gasket and tighten the four mounting screws.

5-6. MECHANICAL ZERO. The mechanical zero adjustment screw is located at the bottom center of the meter panel just above the mounting screw. Adjust the meter for mechanical zero by turning the screw with a small standard screwdriver.

5-7. TEST LEAD SET. In the event that a test lead or pin breaks or an interlocking plug becomes defective, a replacement plug or pin may be attached as follows:

a. Test Pin.

(1) Grip the two plastic cap screws firmly and pull the test lead holder straight back and away from the serrated pin holder.

(2) Unscrew the two cap screws and remove the pin and pin holder from the test lead.

(3) Strip approximately 1/2 inch of insulation from the lead end.

(4) Insert the test lead wire into the pin holder, through the hole, and crimp it around the hole.

(5) Insert the pin into the pin holder and screw the two cap screws onto the pin holder.

(6) Slide the test lead holder firmly back onto the serrated pin holder.

b. Interlocking Plug.

(1) Unscrew the rear plastic cap of the plug and slide it back on the lead.

(2) Remove the front plastic cap by pressing the plug tip against a flat surface while pushing the cap toward the surface.

(3) Pull the threaded nut away from the eyelet and remove the test lead from the eyelet.

(4) Strip approximately 1/2 inch of insulation from the test lead.

(5) Insert the test lead wire into the eyelet and crimp it around the hole.

(6) Allow the threaded nut to slide back over the eyelet and wire.

(7) Push the front plastic cap back onto the metal portion of the plug and screw the rear cap onto the threaded nut.

5-8. EXTERIOR CLEANING. The multimeter is completely enclosed; no entry for dirt, dust or lint is provided. Consequently, it is only necessary to clean the exterior, using a cloth moistened with mild soap and water, and rinse.

5-9. LUBRICATION. The only lubrication required is the oiling of the handle hinge pivots with a light grade of machine oil, Federal Specification VV - 0 - 526, or equivalent.

5-10. INSPECTION. Under conditions of normal use, only periodic routine visual inspection is necessary to determine mechanical condition, evidence of corrosion, etc.

5-11. TROUBLE ANALYSIS.

5-12. GENERAL. The particular circuit or component causing the trouble may be isolated by following the procedures given below and by referring to the Troubleshooting Flow Chart (figure 5-1) and the schematic diagram (figure 6-1).

5-13. PROCEDURE. Measure the input impedance as described in table 5-4 using an operational AN/PSM-37 connected to the test jacks of the unit under test/repair.

NOTE

The AN/PSM-37 is unshielded and pickup from adjacent high voltage lines onto the test leads or into the multimeter may degrade performance under some circumstances. It is suggested that a record of performance of the AN/PSM-37 in a given situation be made when it is known that the equipment being checked by the AN/PSM-37 is operating correctly.

Complete all steps and determine that range of any given function which reads off value by the largest percentage from the listed reading.

a. If all impedances are correct or within the allowed tolerances, perform the operational checks listed in paragraph 5-14.

b. If only one function has incorrect readings, the probable cause of defect is that component listed in table 5-4 for the lowest range of the incorrect function. Also see table 5-6 for isloation and verification of the defective component.

c. If more than one function reads incorrectly, proceed as follows:

(1) If only the 10 MEGΩ function reads correctly, the problem is probably in the overload circuit, which is unconnected for the 10MEGΩ function. The overload also is not connected above the 50-volt ranges of the 1K Ω/V and 20K Ω/V functions, and this diagnosis can thus be verified. Refer to table 5-5 steps 1 through 7. Defective components usually will be either open or shorted. The readings in table 5-5 are typical and may vary from component to component. Isolate and confirm suspected defective component by referring to table 5-6.

(2) If both MA and SPECIAL functions read incorrectly, the problem is in resistors R23 through R34, and the 1K Ω/V function will also read incorrectly. (See table 5-6.)

(3) If both the 1K Ω/V and the 20K Ω/V functions read incorrectly, the problem is likely in the trigger tap blocking diode(s) CR3 and/or VR4. (See tables 5-5 and 5-6.)

d. If all ranges are off accuracy, replace meter M1.

5-14. OPERATIONAL CHECKS.

a. Set meter zero with POLARITY switch OFF.

b. Set meter to 10 MEGΩ, 0.5 Volt, + POLARITY. Short test leads together. Meter should read within one division of zero.

(1) If meter reads correctly proceed to step c.

(2) If meter reads in excess of one division off zero or drifts slowly up or down scale, open multimeter case and short AR1 non-inverting input (blue wire) to amplifier ground (solid white wire).

(a) If meter continues to read in excess of one division off zero, AR1 has excessive offset voltage and is defective.

(b) If meter now reads correctly, remove short and check the contacts on S2A, S2C, and S1C for good contact, using a jumper from the non-inverting input to the junction of R64 and R47, etc. If all contacts are conducting properly, AR1 has excessive bias current and is defective.

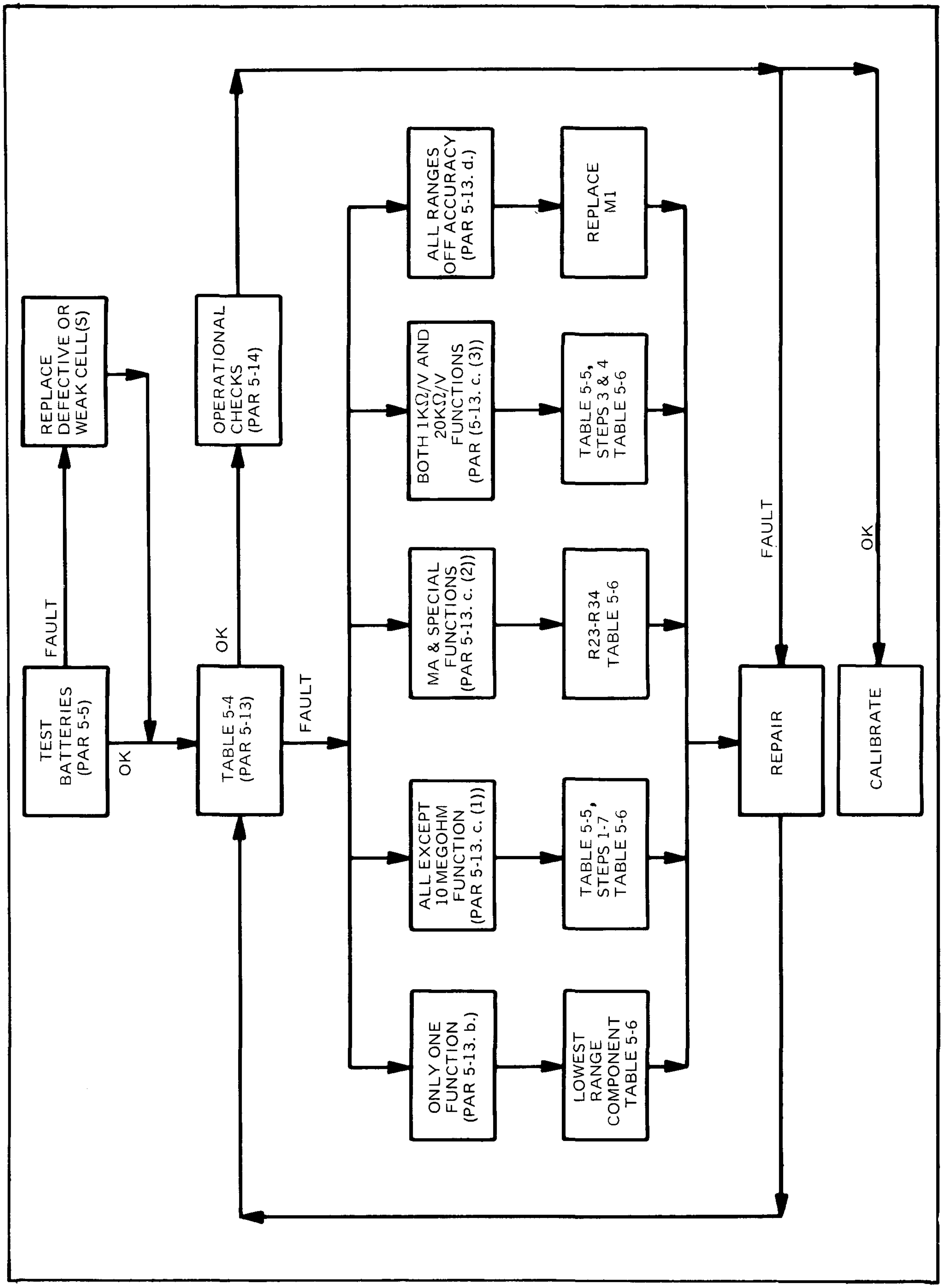


Figure 5-1. Troubleshooting Flow Chart

c. Set meter to STD OHMS, RANGE Rx 1K, + POLARITY. Short input leads together. Meter should deflect upscale and be capable of being set for full scale using the OHMS ADJ control.

(1) If meter reads correctly proceed to step d.

(2) If meter reads overscale or below scale, measure output of meter with operational AN/PSM-37 set to read 2.5 volts, + POLARITY, 10 MEG FUNCTION. Meter should read between 0.6 and 1.5 volts and be capable of being set to read 0.81 volts. If output cannot be set, measure voltage across R60, using the .5 volt range of 10 MEG FUNCTION. Value should be between 0.07 and 0.15 volts and be capable of being set to read 0.095 volts. If so, AR2 is defective or CR4 or CR6 is shorted. If unable to set to 0.095 volts, R60 itself is defective or U1/R68 is defective. Read values of R60 and R68 on operational AN/PSM-37 set for OHMS LP and RANGE Rx1K, with unit under repair set to OFF.

(3) If meter output is on scale but cannot be set to full scale, check CR4 through CR7 (table 5-5, Steps 8 and 10).

d. Set meter to LP OHMS, RANGE Rx1K, +POLARITY. Short leads together. Meter should read within one division of reading taken in step c.

(1) If correct, perform calibration verification checks according to paragraph 5-23.

(2) If incorrect, check that voltage across R60 is same as voltage across R64, on 0.5 Volt RANGE, 10 MEG FUNCTION, + POLARITY. If different, R65 or R64 is off value. If the same. R59 or R58 is off value or AR2 is defective.

(3) To check AR2, jumper R60, short the input leads, and read the meter. Defective AR2 will cause the meter to read in excess of one division up or down scale.

5-15. After isolation and repair of impedance errors, complete all steps of table 5-4, the operational checks of paragraph 5-14, and the calibration verification procedures of paragraphs 5-23 through 5-44.

NOTE

Part Number 910 Only

There is no provision for calibration adjustment except for high-frequencies on the 10 MEG function, which is affected by the length of the shield on the input wire connecting S2F to R44/C2. (This is the only shielded wire in the AN/PSM-37 and is readily accessible when the meter is out of its case.) A change in the length of shield of one-half inch causes a change of approximately 1% in high-frequency accuracy. (An increase in shield length increases the meter readings.) It has been found that the initial shift due to physical changes after unreeling, mounting, and soldering may be expected. Any shielded approximately 1% in high-frequency accuracy. wire of equivalent dimensions may be used, but care must be taken to keep the shield electrically away from the center conductor since one-half of any overload voltage will appear across the shield.

5-16. REPAIR.

5-17. GENERAL. Field repair primarily consists of replacing defective components such as resistors, capacitors, switches and integral assemblies. AR1, AR2, U1, CB1, M1, and the case (except for the handle) are not repairable and must be replaced. The accuracy of measurement depends completely upon the precision of the component parts; therefore, it is necessary that each defective part be replaced by its exact equivalent, both in nominal value and in tolerance. Refer to the Illustrated Parts Breakdown, T.O. 33A1-12-933-4, for parts numbers and nomenclatures.

5-18. REPAIR TECHNIQUES.

a. Do not use a soldering iron which does not have automatic temperature control when removing or replacing any AR, CR, or VR components or on capacitors C10 through C13. Temperature setting of soldering equipment should not exceed 750°F.

b. Use only 60/40 or 63/37 solder with resin or organic flux. Never use acid flux on electrical connections.

c. If a part is known to be defective it is recommended that the lead be cut at one end of the part to facilitate removal.

d. Insure that all replacement parts have a stress-relief bend similar to that of the part replaced.

e. Mount parts with the markings showing where possible.

f. Use only plastic screws when mounting switch knobs, since the switch shafts are electrically connected to the negative multimeter terminal.

WARNING

The use of metal screws for mounting switch knobs will create a hazard if the ground or low side of the potential being measured is removed. This hazard could result in serious injury or death if the potential being measured is great enough.

5-19. DISASSEMBLY. The following procedure is to be used to gain access to various parts of the multimeter:

a. The meter may be removed without removing the case from the chassis as follows:

(1) Remove the six round head machine screws from the meter panel.

(2) Lift the meter and gasket off the front panel.

(3) Unsolder the two leads from the meter.

b. Case.

(1) Remove the 14 round head machine screws from the front panel of the meter.

(2) Place the meter face down and lift the bottom case and gasket from the chassis.

c. Circuit boards.

(1) Remove the four nuts, with lockwashers, from the main circuit board standoff posts.

(2) Gently lift the main circuit board straight up and off the standoff posts and the side circuit board.

(3) Lift the side circuit board straight up and out of the front panel slots.

(4) Turn the side circuit board face down to allow access to its inside components and freer access to the inside components of the main circuit board.

d. The front panel controls (FUNCTION, RANGE and POLARITY switches and the OHMS ADJUST potentiometer) may be removed as follows:

(1) Remove knob retaining screw.

(2) Pull knob off shaft.

(3) Remove shaft nut.

(4) Gently push switch out from panel, being careful not to disturb attached or adjacent wiring.

5-20. INTERIOR CLEANING. If it becomes necessary to clean the interior, a hot, deionized or distilled water rinse followed by a thorough drying is recommended. Drying temperatures shall not exceed 160°F.

CAUTION

Solvents, particularly keytones, shall not be used for cleaning because of possible damage to the dielectric materials in the multimeter.

CAUTION

Always remove batteries before cleaning to avoid shorting components.

5-21. INTERIOR INSPECTION. The following inspection will be performed to evaluate the physical condition of the multimeter:

a. Inspect front panel and case interior to ensure that labeling and the schematic diagram are legible.

b. Inspect for cleanliness to ensure that no dust or dirt is present that could deteriorate components, connections, and grounding.

c. Inspect all wiring for charring, strength, and uniform bonding of soldered connections.

d. Inspect all components for physical tightness and evidence of charring or burning.

e. Inspect the circuit boards for charring, burning, cracks, or warping. Inspect all soldered connections for proper bonding.

f. Inspect rubber gaskets for deterioration and proper fit.

5-22. ASSEMBLY. Assembly is in the reverse order of disassembly.

5-23. CALIBRATION.

5-24. FREQUENCY. This equipment shall be scheduled for calibration as required.

5-25. GENERAL. Except for the shielded input wire on part number 910, there are no calibration adjustments on the AN/PSM-37. Verification of calibration consists of full scale accuracy checks on each range of each function of current or voltage, and mid-scale accuracy checks on each range of the OHMS functions. AC accuracy at 60 Hz is ± 4 percent of full-scale deflection on all ranges and functions and with all accessories.

5-26. TEST EQUIPMENT REQUIRED. The test equipment listed in table 5-7, or equivalents, are requred to calibrate the AN/PSM-37. Less sophisticated equipment may be used, provided a basic AC or DC accuracy of 0.5 percent or better is obtained. The equipment listed provides the entire spectrum of calibration requirements except for verification of frequency response.

5-27. PROCEDURES.

5-28. DC MICROAMPERES - SPECIAL CALIBRATION PROCEDURE.

a. Connect test leads from test jacks of Mulitmeter AN/PSM-37 to appropriate jacks of test instrument.

b. Set FUNCTION switch of multimeter to SPECIAL, POLARITY SWITCH to DC +, and RANGE switch to any position.

c. Apply 100 microamperes from test instrument and compare with multimeter reading.

d. If multimeter does not indicate within ±3 percent of test instrument reading, refer to table 5-4 for probable cause of defect.

5-29. DC MILLIVOLTS - SPECIAL CALIBRATION PROCEDURE.

a. Connect test leads from test jacks of Multimeter AN/PSM-37 to appropriate jacks of test instrument.

b. Set FUNCTION switch of multimeter to SPECIAL, POLARITY switch to DC +, and RANGE switch to any position.

c. Apply 100 millivolts from test instrument and compare with multimeter reading.

d. If multimeter does not indicate within ±3 percent of test instrument reading, refer to table 5-4 for probable cause of defect.

5-30. DC MILLIAMPERES CALIBRATION PROCEDURE.

a. Connect test leads from test jacks of Multimeter AN/PSM-37 to appropriate jacks of test instrument.

b. Set FUNCTION switch of multimeter to AMPS-MA, POLARITY switch to DC +, and RANGE switch to .5.

c. Apply full-scale value of current from test instrument and compare with multimeter reading.

d. Repeat step c for the 2.5, 10, 50, 250, 500 and 1000 ranges.

e. If multimeter indications are not within ±3 percent of test instrument readings, refer to table 5-4 for probable cause of defect.

5-31. DC VOLTS - 20K Ω/V CALIBRATION PROCEDURE.

a. Connect test leads from test jacks of Multimeter AN/PSM-37 to appropriate jacks of test instrument.

b. Set FUNCTION switch of multimeter to VOLTS - 20K Ω/V, POLARITY switch to DC +, and RANGE switch to .5.

c. Apply full-scale value of voltage from test instrument and compare with multimeter reading.

d. Repeat step c for the 2.5, 10, 50, 250, 500 and 1000 ranges.

e. If multimeter indications are not within ±3 percent of test instrument readings, refer to table 5-4 for probable cause of defect.

5-32. DC VOLTS - 1K Ω/V CALIBRATION PROCEDURE.

a. Connect test leads from test jack of Multimeter AN/PSM-37 to appropriate jacks of test instrument.

b. Set FUNCTION switch of multimeter to VOLTS - 1K Ω/V, POLARITY switch to DC +, and RANGE switch to .5.

c. Apply full-scale value of voltage from test instrument and compare with multimeter reading.

d. Repeat step c for the 2.5, 10, 50, 250, 500 and 1000 ranges.

e. If multimeter indications are not within ±3 percent of test instrument readings, refer to table 5-4 for probable cause of defect.

5-33. DC VOLTS - 10 MEGΩ CALIBRATION PROCEDURE.

a. Connect test leads from test jacks of Multimeter AN/PSM-37 to appropriate jacks of test instrument.

b. Set FUNCTION switch of multimeter to VOLTS - 10 MEGΩ, POLARITY switch to DC +, and the RANGE switch to .5.

c. Apply full-scale value of voltage from the test instrument and compare with multimeter readings.

d. Repeat step c for the 2.5, 10, 50, 250, 500 and 1000 ranges.

e. If multimeter indications are not within ±3 percent of test instrument readings, refer to table 5-4 for probable cause of defect.

5-34. AC VOLTS - 10 MEGΩ CALIBRATION PROCEDURE.

a. Connect test leads from test jacks of Multimeter AN/PSM-37 to appropriate jacks of test instrument.

b. Set FUNCTION switch of multimeter to VOLTS - 10 MEGΩ, POLARITY switch to AC, and RANGE switch to .5.

c. Apply full-scale value of voltage from test instrument and compare with multimeter reading.

d. Repeat step c for the 2.5, 10, 50, 250, 500 and 1000 ranges.

e. If multimeter indications are not within ±4 percent of test instrument readings, refer to table 5-4 for probable cause of defect.

5-35. AC VOLTS - 1K Ω/V CALIBRATION PROCEDURE.

a. Connect test leads from test jacks of multimeter AN/PSM-37 to appropriate jacks of test instrument.

b. Set FUNCTION switch of multimeter to VOLTS - 1K Ω/V, POLARITY switch to AC, and RANGE switch to .5.

c. Apply full-scale value of voltage from test instrument and compare with multimeter reading.

d. Repeat step c for the 2.5, 10, 50, 250, 500 and 1000 ranges.

e. If multimeter indications are not within ±4 percent of test instrument readings, refer to table 5-4 for probable cause of defect.

5-36. AC VOLTS - 20K Ω/V CALIBRATION PROCEDURE.

a. Connect test leads from test jacks of Multimeter AN/PSM-37 to appropriate jacks of test instrument.

b. Set FUNCTION switch of multimeter to VOLTS - 20 K Ω/V, POLARITY switch to AC, and RANGE switch to .5.

c. Apply full-scale value of voltage from test instrument and compare with multimeter reading.

d. Repeat step c for the 2.5, 10, 50, 250, 500 and 1000 ranges.

e. If multimeter indications are not within ±4 percent of test instrument readings, refer to table 5-4 for probable cause of defect.

5-37. AC MILLIAMPERES CALIBRATION PROCEDURE.

a. Connect test leads from test jacks of Multimeter AN/PSM-37 to appropriate jacks of test instrument.

b. Set FUNCTION switch of multimeter to AMPS-MA, POLARITY switch to AC, and RANGE switch to .5.

c. Apply full-scale value of current from test instrument and compare with multimeter reading.

d. Repeat step c for the 2.5, 10, 50, 250, 500 and 1000 ranges.

e. If multimeter indications are not within ±4 percent of test instrument readings, refer to table 5-4 for probable cause of defect.

5-38. AC MILLIVOLTS - SPECIAL CALIBRATION PROCEDURE.

a. Connect test leads from test jacks of Multimeter AN/PSM-37 to appropriate jacks of test instrument.

b. Set FUNCTION switch of multimeter to SPECIAL, POLARITY switch to AC, and RANGE switch to any position.

c. Apply 100 millivolts from test instrument and compare with multimeter reading.

d. If multimeter does not indicate within ±4 percent of test instrument readings, refer to table 5-4 for probable cause of defect.

5-39. AC MICROAMPERES - SPECIAL CALIBRATION PROCEDURE.

a. Connect test leads from test jacks of Multimeter AN/PSM-37 to appropriate jacks of test instrument.

b. Set FUNCTION switch of multimeter to SPECIAL, POLARITY switch to AC, and RANGE switch to any position.

c. Apply 100 microamperes from test instrument and compare with multimeter reading.

d. If multimeter does not indicate within ±4 percent of test instrument readings, refer to table 5-4 for probable cause of defect.

5-40. OHMS - LP CALIBRATION PROCEDURE.

a. Plug test leads into Multimeter AN/PSM-37 test jacks and short the test lead tips together.

b. Set FUNCTION switch of multimeter to OHMS - LP, POLARITY switch to DC +, and RANGE switch to Rx1.

c. Adjust OHMS ADJUST knob until multimeter reads zero.

d. Repeat step c for the Rx10, Rx100, Rx1K, Rx10K, and Rx100K ranges.

NOTE

If pointer cannot be adjusted on all ranges, the battery voltage is low. Refer to paragraph 5-5 for battery testing and replacement instructions.

e. Connect test leads from multimeter to appropriate jacks of test instrument.

f. Set mid-scale reading on multimeter with test instrument.

g. Repeat step f for the Rx10, Rx100, Rx1K, Rx10K, and Rx100K ranges.

h. If multimeter readings are not within ±3 percent of test instrument reading, refer to table 5-4 for probable cause of defect (s).

5-41. OHMS - STD CALIBRATION PROCEDURE. Repeat the procedure outlined in paragraph 5-40, except for the Rx1 RANGE position which is not connected in this function.

5-42. OVERLOAD TESTS.

5-43. GENERAL. Overload tests consist of applying 12 volts DC in each polarity to the ranges and functions given below. All the given ranges must trigger between 0 to +12 volts and 0 to -12 volts (maximum +12V and -12V) applied voltage, except the .5 volt range of the 20KΩ/V function, which is acceptable if it trips at 50 volts AC 400Hz.

5-44. PROCEDURE.

a. Connect test leads from test jacks of Multimeter AN/PSM-37 to appropriate jacks of test instrument.

b. Set FUNCTION switch of multimeter to SPECIAL, POLARITY switch to DC +, AND RANGE switch to any position.

c. Apply 12 volts from the test instrument and observe OVERLOAD indicator on multimeter, which should indicate an overload condition.

d. Set FUNCTION switch to AMPS-MA, POLARITY switch to DC +, and RANGE switch to .5.

e. Push RESET button on multimeter and repeat step c.

f. Repeat step c for the 1K Ω /V position of the function switch. For the 20K Ω /V position of the function switch apply 50 volts AC 400Hz. Reset the multimeter as necessary, always using the .5 range.

g. Set FUNCTION switch to OHMS - LP and RANGE switch to Rx100K and repeat step e.

h. Set FUNCTION switch to OHMS-STD and repeat step e.

i. Reverse multimeter test leads and repeat steps a through h for the DC– position of the POLARITY switch.

j. Repeat steps a through h for the AC position of the POLARITY switch.

k. If the overload does not trip on any of the above tests, refer to tables 5-5 and 5-6 for probable cause of defect. 20K Ω /V will not normally trip on 12 volts, see paragraph 5-43.

l. Set polarity switch on AC and function switch on 20K Ω /V function and range switch on .5 volt, apply 1 50 volts, AC 400Hz observe overload indicator for tripped condition, if overload does not trip, refer to tables 5-5 and 5-6 for probable cause of defect.

5-45. TEST OF THE OVERLOAD RELAY ASSEMBLY.

NOTE

This information is necessary to assure the serviceability of the overload relay assembly and is performed on the bench.

a. Test Procedure.

b. Preliminary Set-up.

c. Obtain equipment called out in figure 5-2 from Section II, Table 2-1.

d. Set AN/PSM-37 controls as follows:

FUNCTION	(100 UA) (100 MV) Special
RANGE	.5
AC - DC - OFF	DC^+
OVERLOAD SW	Push to reset

e. Make connections as shown in figure 5-2.

f. Set all test equipment switches to minimum, zero, or CCW positions.

g. Energize all test equipment.

5-46. CHECK-OUT PROCEDURE.

a. Observing correct polarity of connections, monitor output of Direct Current Power Supply (DCPS) with digital voltmeter.

b. Observing digital voltmeter, increase DCPS output (do not exceed 12 VDC) until overload relay pops.

NOTE

If step 5-46.b. is met, proceed with overload test, paragraph 5-42. If not, proceed with following steps.

c. Reduce DCPS output to 0 volts and reset overload relay switch of AN/PSM-37 multimeter.

d. Remove digital voltmeter from DCPS and connect to PSM-37 amplifier circuit board assembly as follows: (Reference figures 5-3 and 5-4.)

VM (+) lead TP-4
VM (-) lead TP-3

e. Slowly increase DCPS approximately 3 volts (typical value is 3 ±.5 VDC); at this value thyristor Q-1 shall fire and voltmeter indication shall drop to less than 1 volt.

f. Repeat step 5-46.c.

NOTE

If step 5-46.e. is met, proceed to step 5-47.a. If not, perform step 5-47 before proceeding forward.

5-47. If thyrister Q-1 fires with a voltage considerably less or considerably more than 3 volts, remove Q-1 from TP-3 and TP-5 and measure its internal resistance between the points disconnected. It shall be 1300 ±200 ohms. Replace if out of this range.

a. Remove digital voltmeter from previous connections and connect to following points as follows:

VM (+) lead	to	TP-1
VM (-) lead	to	TP-2

b. Slowly increase DCPS (do not exceed 7 VDC) until overload relay energizes. This shall occur between 4 to 6 volts.

NOTE

If overload energizes but fails to activate, reset button. The problem could be mechanical. Resistor R-56 is also a prime cause and is checked between TP-6 and TP-4. It shall measure 33 ±5% ohms. (Reference figures 5-3 and 5-4.)

c. Components R-56, R-55, VR-3, VR-4 and C-12 should be checked for correct values as specified.

d. End of test procedure. Secure all test equipment.

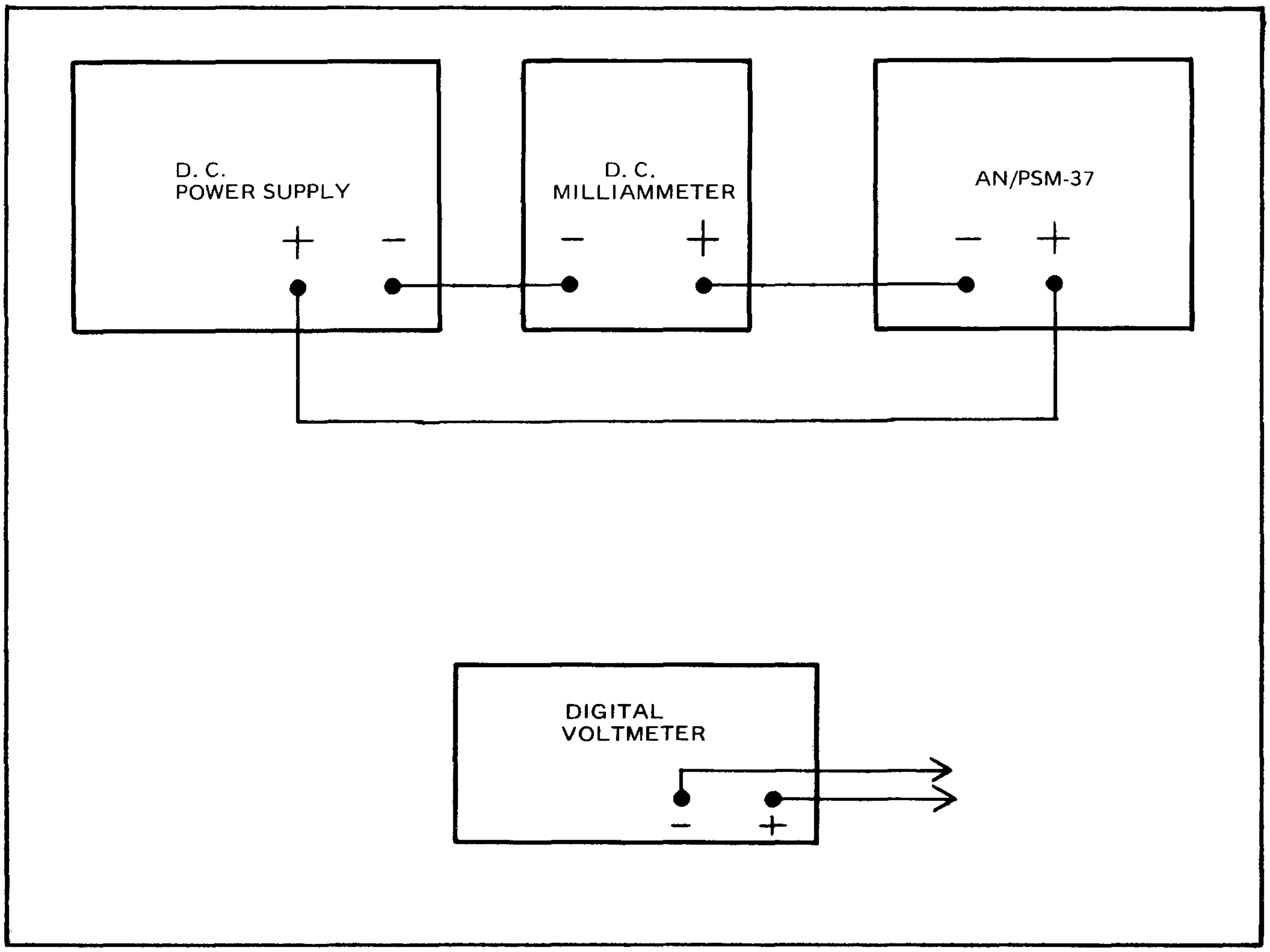


Figure 5-2. Test Equipment

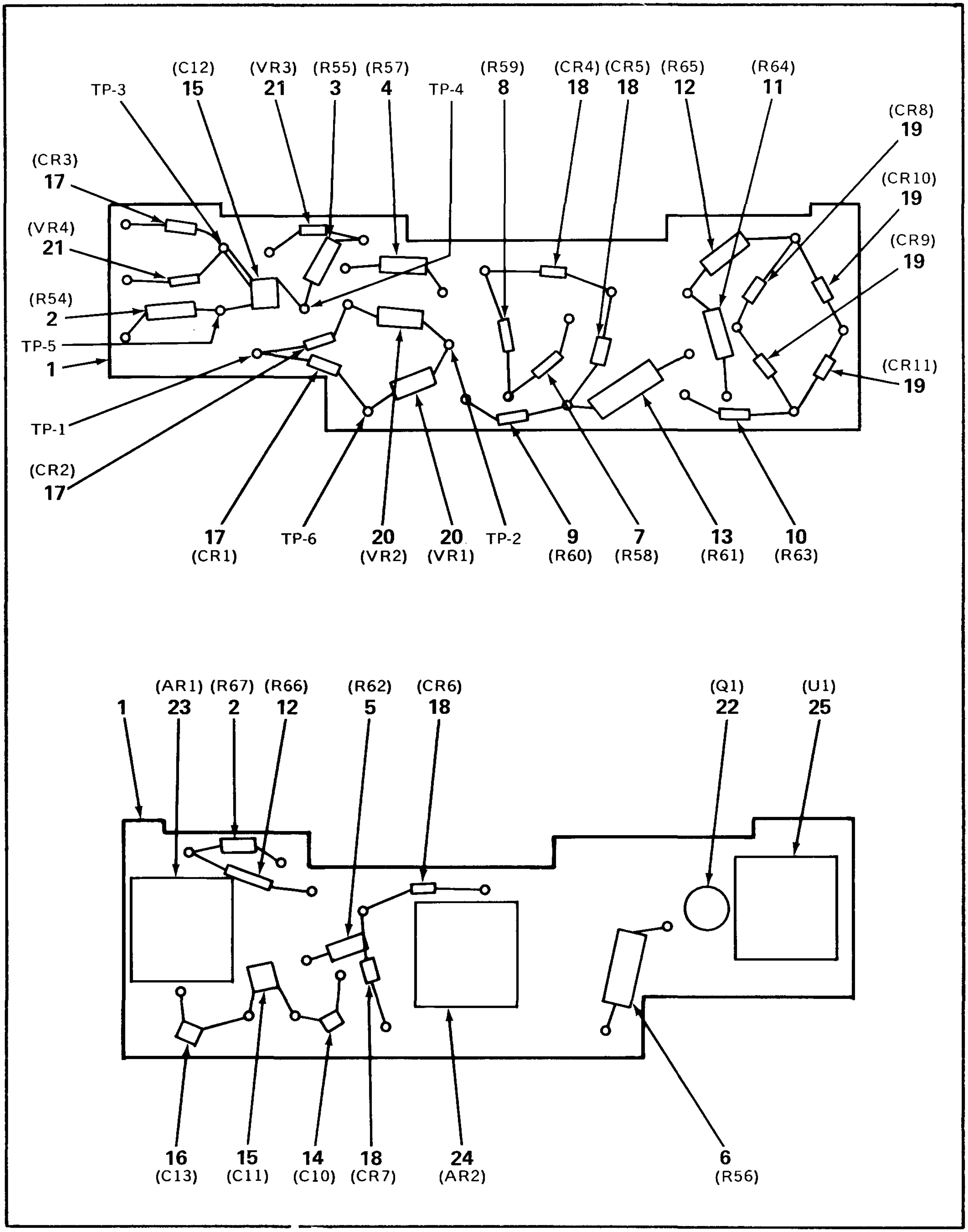


Figure 5-3. Amplifier Circuit Board Assembly

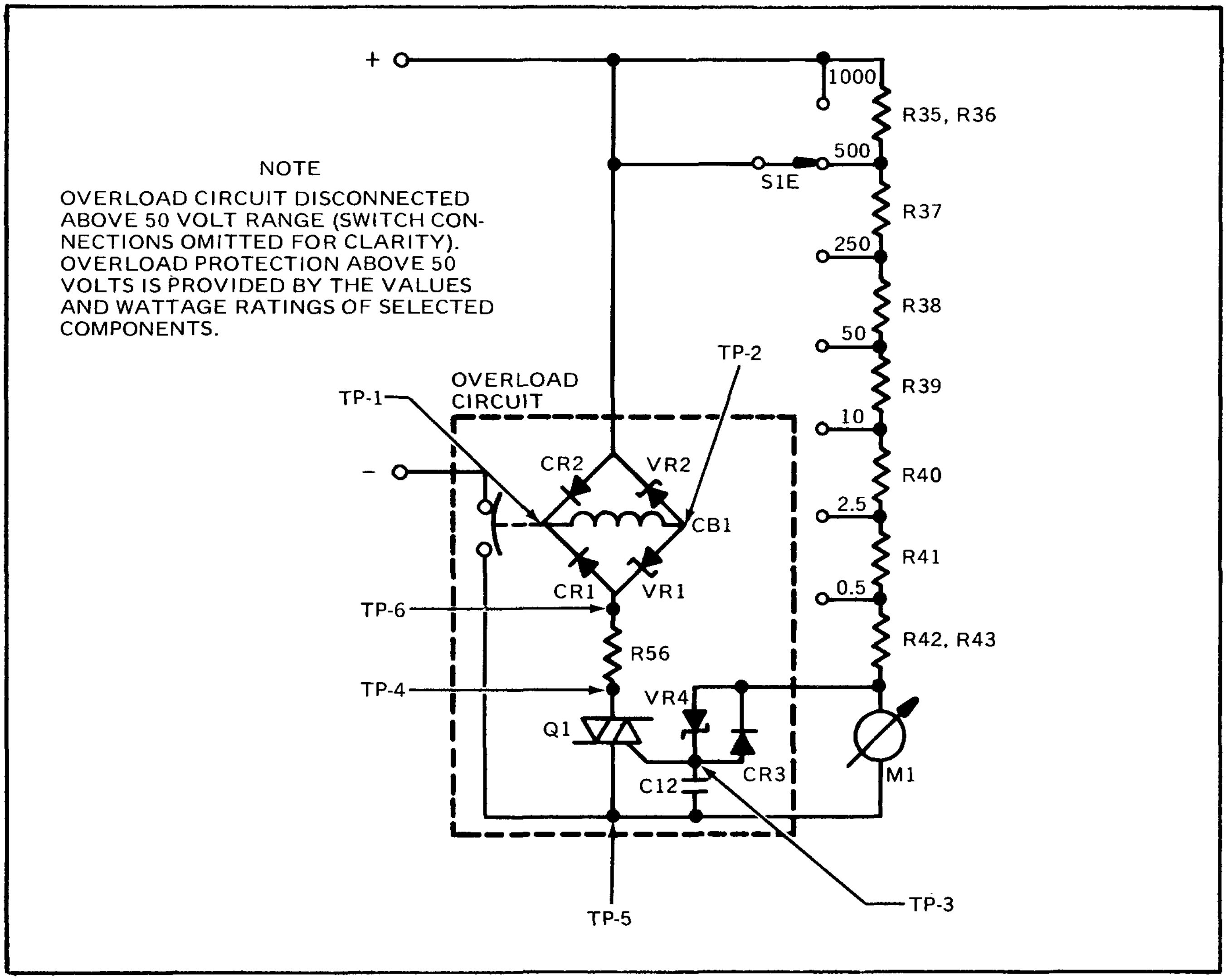


Figure 5-4. Overload Circuit

TABLE 5-1. MULTIMETER BASIC ACCURACIES

FUNCTION	77°F (25°C)	131°F (55°C)	-40°F (-40°C)
DC VOLTS or AMPS	± 3%	± 5%	± 6%
AC VOLTS or AMPS	± 4%	± 6%	± 7%
OHMS	± 3%	± 5%	± 6%

NOTE: 100 MICROAMP SPECIAL: ACCURATE AT 77°F (25°C) ONLY. RESISTANCE 1000 OHMS.
AC FREQUENCY RESPONSE: 20 Hz to 30 KHz
(ACCURACIES EXPRESSED IN PERCENTAGE OF SCALE LENGTH)

TABLE 5-2. AC FREQUENCY RESPONSE ACCURACIES

	PERCENT OF FULL SCALE ACCURACY	
FUNCTION/RANGE	**20 Hz to 400 Hz**	**400 Hz to 30 KHz**
SPECIAL, ALL MA RANGES	**±4%**	**±10%**
VOLTS UP TO AND INCLUDING 10 VOLTS (ALL VOLTAGE FUNCTIONS)	**±4%**	**±10%**
50 VOLT RANGE (1K OHMS/V, 10 MEG OHMS)	**±4%**	**±10%**
50 VOLT RANGE AND HIGHER (20K OHMS/V)	**±4%**	**±10%**
250 VOLT RANGE (1K OHMS/V, 10 MEG OHMS)	**±4%**	**±10%**
500 AND 1000 VOLT RANGES	**±4%**	**±10%**

NOTE: All ranges/functions usable from 20Hz to 30 KHz

TABLE 5-3. OVERLOAD LIMITS

RANGES	OVERLOAD LIMITS
All voltage ranges except 1000 volt ranges	1000 volt AC 1000 volts DC, either polarity
1000 volt ranges	5000 volts AC 5000 volts DC, either polarity
All current ranges	10 amperes DC, either polarity 1000 volts DC, either polarity 1000 volts AC
All ohms ranges	1000 volts AC 1000 volts DC, either polarity 220 volts AC, 30 amperes 300 volts DC, 30 amperes, either polarity

NOTE: Limits apply within the frequency range of 20 Hz to 30KHz.

TABLE 5-4. MULTIMETER INPUT IMPEDANCE CHECKS

UNIT UNDER REPAIR				OPERATIONAL AN/PSM-37				PROBABLE CAUSE OF DEFECT
STEP	FUNCTION	RANGE	POLARITY	FUNCTION	RANGE	POLARITY	READING	IF READING NOT OBTAINED
1	SPECIAL	ANY	OFF	LP OHMS	Rx100	+	2000 (20)	R25 OFF VALUE
2	SPECIAL	ANY	+	LP OHMS	Rx100	+	1000 (10)	METER OFF RESISTANCE
3	MA	.5	+	LP OHMS	Rx10	+	a. 400 (40) b. 360 (36)	R23 OFF VALUE
4	MA	2.5	+	LP OHMS	Rx10	+	80 (8)	R29 OFF VALUE
5	MA	10	+	LP OHMS	Rx1	+	20	R30 OFF VALUE
6	MA	50	+	LP OHMS	Rx1	+	4	R31 OFF VALUE
7	MA	250	+	LP OHMS	Rx1	+	0.85	R32 OFF VALUE
8	MA	500	+	LP OHMS	Rx1	+	0.45	R33 OFF VALUE
9	MA	1000	+	LP OHMS	Rx1	+	0.25	R34 OFF VALUE
10	20KΩ/V	.5	+	STD OHMS	Rx1K	+	10K (10)	R42 or R43 OFF VALUE
11	20KΩ/V	2.5	+	STD OHMS	Rx1K	+	50K (50)	R41 OFF VALUE
12	20KΩ/V	10	+	STD OHMS	Rx10K	+	200K (20)	R40 OFF VALUE
13	20KΩ/V	50	+	STD OHMS	Rx100K	+	1MEG (10)	R39 OFF VALUE
14	20KΩV	250	+	STD OHMS	Rx100K	+	5MEG (50)	R38 OFF VALUE
15	20KΩ/V	500	+	STD OHMS	Rx100K	+	10MEG (100)	R37 OFF VALUE
16	20KΩ/V	1000	+	STD OHMS	Rx100K	+	20MEG (200)	R36 or R35 OFF VALUE
17	1KΩ/V	.5	+	STD OHMS	Rx100	+	500 (5)	R21 or R22 OFF VALUE
18	1KΩ/V	2.5	+	STD OHMS	Rx100	+	2500 (25)	R20 OFF VALUE
19	1KΩ/V	10	+	STD OHMS	Rx1K	+	10K (10)	R18 or R19 OFF VALUE

a, b: See last page of Table 5-4 for notes.

TABLE 5-4. MULTIMETER INPUT IMPEDANCE CHECKS (Cont)

UNIT UNDER REPAIR				OPERATIONAL AN/PSM-37				PROBABLE CAUSE OF DEFECT
STEP	FUNCTION	RANGE	POLARITY	FUNCTION	RANGE	POLARITY	READING	IF READING NOT OBTAINED
20	1KΩ/V	50	+	STD OHMS	Rx1K	+	50K (50)	R16 or R17 OFF VALUE
21	1KΩ/V	250	+	STD OHMS	Rx10K	+	250K (25)	R14 or R15 OFF VALUE
22	1KΩ/V	500	+	STD OHMS	Rx10K	+	500K (50)	R9, R10, R11, or R12 OFF VALUE
23	1KΩ/V	1000	+	STD OHMS	Rx100K	+	1MEG (10)	R1 THROUGH R8OFF VALUE
24	10 MEGΩ	ANY	+	STD OHMS	Rx100K	+	a. **10 MEG (100)** b. **10 MEG (100)**	R44 or R45 OFF VALUE **R69 or R70 OFF VALUE**
25	10 MEGΩ	ANY	AC	STD OHMS	Rx100K	+	Infinite	C1 SHORTED
26	10MEGΩ	ANY	+ *	STD OHMS	Rx100K	+	Infinite	DEFECTIVE CB1

* PUSH RESET BUTTON
NUMBERS IN PARENTHESIS ARE METER SCALE NUMBERS FOR VALUE SHOWN

a - Applies to part number 910 (911) only
b - Applies to part number 960 (961) only

TABLE 5-5. COMPONENT IMPEDANCE CHECKS

SET UNIT UNDER REPAIR TO: 10 MEGΩ FUNCTION, 1000 VOLT RANGE, OFF POLARITY
TAKE ALL READINGS WITH + (RED) LEAD CONNECTED TO UNBANDED END OF COMPONENT UNDER TEST.

STEP	MEASURE	OPERATIONAL AN/PSM-37			READING	EFFECT OF DEFECTIVE COMPONENT
		FUNCTION	RANGE	POLARITY		
1	CR1, CR2	STD OHMS	Rx100	+	4500 (45) *	OVERLOAD WILL ONLY SWITCH ON ONE POLARITY OF APPLIED OVERLOAD. CR1 AFFECTS FORWARD POLARITY IF SHORTED, REVERSE POLARITY IF OPEN. CR2 IS CONVERSE.
2	VR1, VR2	STD OHMS	Rx100	+	3500 (35) *	SAME AS CR1, CR2. VR1 AFFECTS FORWARD OVERLOAD IF OPEN, REVERSE OVERLOAD IF SHORTED. VR2 IS CONVERSE.

TABLE 5-5. COMPONENT IMPEDANCE CHECKS (Cont)

SET UNIT UNDER REPAIR TO: 10 MEGΩ FUNCTION, 1000 VOLT RANGE, OFF POLARITY
TAKE ALL READINGS WITH + (RED) LEAD CONNECTED TO UNBANDED END OF COMPONENT UNDER TEST.

STEP	MEASURE	OPERATIONAL AN/PSM-37			READING	EFFECT OF DEFECTIVE COMPONENT
		FUNCTION	RANGE	POLARITY		
3	VR3, VR4	STD OHMS	Rx100	+	7000 (70) *	SPECIAL, MA, & OHMS OVERLOAD WILL NOT TRIGGER IF EITHER VR3 or VR4 IS OPEN, WILL TRIGGER PREMATURELY IF SHORTED. VR4 ALSO AFFECTS TRIGGER ON 1K Ω/V FUNCTIONS.
4	CR3	STD OHMS	Rx100	+	5000 (50) *	SAME EFFECT AS VR3 ABOVE, BUT ONLY ON 1KΩ/V & 20K Ω/V FUNCTIONS, 50V AND BELOW.
5	Q1 (R56 to ground)	STD OHMS	Rx100K	+	OVER 10 MEG (100) *	OVERLOAD WILL TRIGGER PREMATURELY IF SHORTED, WILL AFFECT INPUT IMPEDANCE OF 20K Ω/V IF BELOW 10 MEGOHMS.
6	Q1 (Across C12)	STD OHMS	Rx100	+	1500 (15) *	OVERLOAD WILL NOT TRIGGER IF OPEN OR SHORTED.
7	CB1 READ FROM CR1/CR2 TO VR1/VR2	STD OHMS	Rx10	+	200 (20)	OVERLOAD WILL NOT TRIGGER IF OPEN OR SHORTED.
8	CR4, CR5 CR6, CR7	STD OHMS	Rx100	+	2500 (25) *	CR4 AND CR6 AFFECT OHMS OVERLOAD, WILL NOT TRIGGER IF OPEN OR HIGH RESISTANCE. ALL AFFECT OHMS OUTPUT, AR-2 WILL NOT SUPPLY SUFFICIENT CURRENT FOR SHORTED CR4-CR7. OPEN CR5 OR CR7 LEAVES AR-1 UNPROTECTED ON AC SPECIAL, MA, 1K Ω/V, OR 20K Ω/V.
9	CR8, CR9 CR10, CR11	LP OHMS	Rx1K	+	20K (20) TO 40K (40) *	OPEN CR8-CR11 WILL CAUSE 1/2 SCALE AC READING. SHORTED CR8-CR11 WILL CAUSE VERY LOW SCALE READING. NOTE: LEAKY CR4-CR7 CAN CAUSE LOW AC READINGS OF 4% - 20%.
10	CR4, CR6 CR5, CR7	LP OHMS LP OHMS	Rx100 Rx100	+ +	INFINITE 3000 (30)	LEAKY CR4-CR7 WILL AFFECT AC ACCURACY ON ALL BUT 10 MEGΩ FUNCTION.

* MEANS THAT VALUE IS AFFECTED BY TEMPERATURE. COMPARE WITH VALUE OF OTHER IDENTICAL PARTS.

TABLE 5-6. PRIMARY EFFECT OF DEFECTIVE PART

COMPONENT	EFFECT
R1-R8	ERROR ON 1000V RANGE, 1K Ω/V FUNCTION
R9-R12	ERROR ON 500V RANGE, 1K Ω/V FUNCTION
R13	ERROR ON 250V RANGE, 1K Ω/V FUNCTION
R14, R15	ERROR ON 250V RANGE, 1K Ω/V FUNCTION AND OHMS FUNCTIONS, Rx10K RANGE
R16	ERROR ON 50V RANGE, 1K Ω/V FUNCTION
R17	ERROR ON 50V RANGE, 1K Ω/V FUNCTION AND OHMS FUNCTIONS, Rx1K RANGE
R18, R19	ERROR ON 10V RANGE, 1K Ω/V FUNCTION
R20	ERROR ON 2.5V RANGE, 1K Ω/V FUNCTION
R21, R22	ERROR ON .5V RANGE, 1K Ω/V FUNCTION
R23	ERROR ON .5V RANGE, MA FUNCTION
R24	ERROR ON .5V RANGE, MA FUNCTION (MV DROP ONLY)
R25	ERROR ON ANY RANGE, SPECIAL FUNCTION, UA AND MV
R26	ERROR ON ALL RANGES, 1K Ω/V FUNCTION, AND ON OHMS FUNCTION, Rx10 RANGE
R27, R28	ERROR ON 2.5V RANGE, MA FUNCTION (MV DROP ONLY)
R29	ERROR ON 2.5V RANGE, MA FUNCTION
R30	ERROR ON 10V RANGE, MA FUNCTION AND OHMS FUNCTIONS, Rx1 RANGE
R31	ERROR ON 50V RANGE, MA FUNCTION
R32	ERROR ON 250V RANGE, MA FUNCTION
R33	ERROR ON 500V RANGE, MA FUNCTION
R34	ERROR ON 1000V RANGE, MA FUNCTION

TABLE 5-6. PRIMARY EFFECT OF DEFECTIVE PART (Cont)

COMPONENT	EFFECT
R35, R36	ERROR ON 1000V RANGE, 20K Ω/V FUNCTION
R37	ERROR ON 500V RANGE, 20K Ω/V FUNCTION
R38	ERROR ON 250V RANGE, 20K Ω/V FUNCTION
R39	ERROR ON 50V RANGE, 20K Ω/V FUNCTION
R40	ERROR ON 10V RANGE, 20K Ω/V FUNCTION
R41	ERROR ON 2.5V RANGE, 20K Ω/V FUNCTION
R42, R43	ERROR ON .5V RANGE, 20K Ω/V FUNCTION
R44, R45, R69, R70	ERROR ON ALL RANGES, 10 MEGΩ FUNCTION, ERROR IN 10 MEGΩ INPUT IMPEDANCE
R46	NONE - REDUCES ARCING ON SWITCHING C1 OUT WHEN CHARGED.
R47	ERROR ON .5V RANGE, 10 MEGΩ FUNCTION AND OHMS FUNCTIONS, Rx100K
R48	ERROR ON 2.5V RANGE, 10 MEGΩ FUNCTION AND OHMS FUNCTIONS, Rx100K
R49	ERROR ON 10V RANGE, 10 MEGΩ FUNCTION AND OHMS FUNCTIONS, Rx100K
R50	ERROR ON 50V RANGE, 10 MEGΩ FUNCTION AND OHMS FUNCTIONS, Rx100K
R51	ERROR ON 250V RANGE, 10 MEGΩ FUNCTION AND OHMS FUNCTIONS, Rx100K
R52	ERROR ON 500V RANGE, 10 MEGΩ FUNCTION AND OHMS FUNCTIONS, Rx100K
R53	ERROR ON 1000V RANGE, 10 MEGΩ FUNCTION AND OHMS FUNCTIONS, Rx100K
R54	VALUE NOT CRITICAL, FOR PROTECTION ONLY. OPEN WOULD AFFECT ALL OHMS FUNCTIONS.
R55	OVERLOAD TRIGGER FOR SPECIAL, MA, LP & STD OHMS. WILL NOT TRIGGER IF OPEN.
R56	ALL OVERLOAD TRIGGERING (THERE IS NO 10 MEGΩ FUNCTION OVERLOAD). WILL NOT TRIGGER IF OPEN.

TABLE 5-6. PRIMARY EFFECT OF DEFECTIVE PART (Cont)

COMPONENT	EFFECT
R57	ALL AMPLIFIER CIRCUITS DRAW – DC BATTERY SUPPLY THROUGH R57, WILL NOT WORK IF OPEN.
R58, R59	ERROR IN STD OHMS OUTPUT VOLTAGE IF OFF VALUE, OHMS FUNCTIONS WILL REQUIRE REZEROING WHEN SWITCHED
R60	OHMS RANGES WILL NOT ZERO IF SIGNIFICANTLY OFF VALUE.
R61	AC MEASUREMENTS ACCURACY ON SPECIAL, MA, 1K Ω/V, 20K Ω/V FUNCTIONS (NOT ON 10 MEGΩ FUNCTION)
R62	SAME AS R61, BUT FOR PROTECTION ONLY, VALUE NOT CRITICAL. NO AC READINGS IF OPEN.
R63	ALL AC READINGS ACCURACY.
R64, R65	LP OHMS, 10 MEGΩ , DC VOLTAGES ACCURACY DETERMINED BY RATIO OF R64 TO R65
R66	LP AND STD OHMS, 10 MEGΩ, DC VOLTAGES, ACCURACY DETERMINED BY RATIO OF R66 TO M1 RESISTANCE
R67	AFFECTS LP AND STD OHMS OUTPUT VOLTAGE ONLY.
R68	AFFECTS VOLTAGE ACROSS R60 FROM U1 CURRENT GENERATOR, REQUIRES RESETTING IF ERRATIC
C1	DC BLOCKING ON 10 MEGΩ, AC VOLTAGES ONLY. DC INPUT WILL READ ON AC IF SHORTED, AC WILL HAVE LOW READINGS IF OPEN.
C2, C3, C14-16	AC ACCURACY ON ALL RANGES, 10 MEGΩ FUNCTION, ABOVE 400Hz. AFFECTS DC VOLTAGES IF LEAKY
C4, C17	AC ACCURACY ON .5V RANGE, 10 MEGΩ FUNCTION, ABOVE 400Hz. AFFECTS DC VOLTAGES IF LEAKY
C5	AC ACCURACY ON 2.5V RANGE, 10 MEGΩ FUNCTION, ABOVE 400Hz. AFFECTS DC VOLTAGES IF LEAKY
C6, C7	AC ACCURACY ON 10V RANGE, 10 MEGΩ FUNCTION, ABOVE 400Hz. AFFECTS DC VOLTAGES IF LEAKY
C8, C9	AC ACCURACY ON 50 RANGE, 10 MEGΩ FUNCTION, ABOVE 400Hz. AFFECTS DC VOLTAGES IF LEAKY
C10	LP & STD OHMS AC REJECTION CAPACITOR, 10 MEGΩ FUNCTION REJECTION ON DC POLARITY ONLY. GREATEST EFFECT IF LEAK IS ON .5 VOLT RANGE, 10 MEGΩ FUNCTION AND Rx100K RANGE, LP & STD OHMS FUNCTIONS.

TABLE 5-6. PRIMARY EFFECT OF DEFECTIVE PART (Cont)

COMPONENT	NOTE	EFFECT
C11		STD OHMS FUNCTION ONLY. OPEN PART WILL CAUSE AR1 TO OSCILLATE. SETS AC GAIN STABILITY ON UNITY GAIN DC WHEN MEASURING STD OHMS.
C12		ALL OVERLOAD CIRCUITS. BLOCKS TRANSIENT TRIGGERING PULSES TO MEET SPECIFICATIONS.
C13	a.	**.5 VOLT AC RANGE OF 10 MEG Ω FUNCTION WILL READ HIGH BY ABOUT 10% IF OPEN, LESSER EFFECT ON 2.5 VAC.**
CR1		AFFECTS FORWARD POLARITY OVERLOADS IF SHORTED, REVERSE POLARITY OVERLOADS IF OPEN.
CR2		AFFECTS FORWARD POLARITY OVERLOADS IF OPEN, REVERSE POLARITY OVERLOADS IF SHORTED.
CR3		BLOCKS OVERLOAD TRIGGER ON REVERSE POLARITY OVERLOADS ON THE 1K Ω/V AND 20K Ω/V FUNCTIONS IF OPEN, TRIGGERS PREMATURELY ON AND AFFECTS ALL ACCURACIES OF THESE FUNCTIONS IF SHORTED.
CR4		BLOCKS OVERLOAD TRIGGER ON FORWARD POLARITY OVERLOADS ON OHMS FUNCTIONS IF OPEN, LOADS AR2 AND AFFECTS AC ACCURACY IF SHORTED.
CR5		LOADS AR2 AND AFFECTS AC ACCURACY OF SPECIAL, MA, 1K Ω/V AND 20K Ω/V FUNCTIONS IF SHORTED.
CR6		BLOCKS OVERLOAD TRIGGER ON REVERSE POLARITY OVERLOADS ON OHMS FUNCTIONS IF OPEN, LOADS AR2 AND AFFECTS AC ACCURACY IF SHORTED.
CR7		SAME AS CR5.
CR8-CR11		READS HALF OF PROPER VALUE ON ALL AC IF OPEN, READS LESS THAN HALF IF SHORTED.
VR1		SAME AS CR2.
VR2		SAME AS CR1.
VR3		OVERLOAD WILL NOT TRIGGER IN THE SPECIAL, MA OR OHMS FUNCTIONS IF OPEN, AFFECTS ACCURACIES IF SHORTED.
VR4		BLOCKS OVERLOAD TRIGGER ON FORWARD POLARITY OVERLOADS ON 1KΩ/V AND 20K Ω/V FUNCTIONS IF OPEN, TRIGGERS PREMATURELY IF SHORTED. SAME AS VR3 IN SPECIAL, MA OR OHMS FUNCTIONS.
Q1		ALL OVERLOADS. NO TRIGGER IF OPEN, PREMATURE TRIGGER IF SHORTED
		a - USED IN PART NUMBER 910 (911) ONLY

TABLE 5-6. PRIMARY EFFECT OF DEFECTIVE PART (Cont)

COMPONENT	EFFECT
U1	LP AND STD OHMS ADJUST WILL NOT ADJUST SMOOTHLY OR OVER FULL RANGE
AR1	ALL AC WILL READ WRONG, LP & STD OHMS WILL READ WRONG, 10 MEGΩ DC WILL READ WRONG
AR2	LP & STD OHMS WILL READ WRONG. CAN ALSO AFFECT AC READINGS ON SPECIAL, MA, 1K & 20K Ω/V.

TABLE 5-7. TEST EQUIPMENT REQUIRED FOR CALIBRATION

PART NUMBER	NOMENCLATURE	ALTERNATE (s)	RANGE	ACCURACY
Fluke 760A	Meter Calibrator	Weston 166S Rotek 350 (or equivalent)	0.001 - 1000 volts dc	± (0.1 % +25 μv)
			(1mv, 4mv, 10 mv dc)	± 0.33%
			1μa - 10 amps dc	± (0.25% + 0.25 μa)
			0.001 - 1000 volts ac	± (0.25% + 25 μv)
			(1 mv, 3 mv, 10 mv ac)	± 0.33%
			1μa - 10 amps ac	± (0.25% + 0.025 μa)
			0 - 10 megohms	± (0.1% + 0.5 ohm)

SECTION VI

DIAGRAMS

6-1. GENERAL. The schematic diagrams depicted in figures 6-1 and 6-2 may be used in conjunction with the individual circuits depicted in Section IV and the tables in Section V for troubleshooting and/or maintenance.

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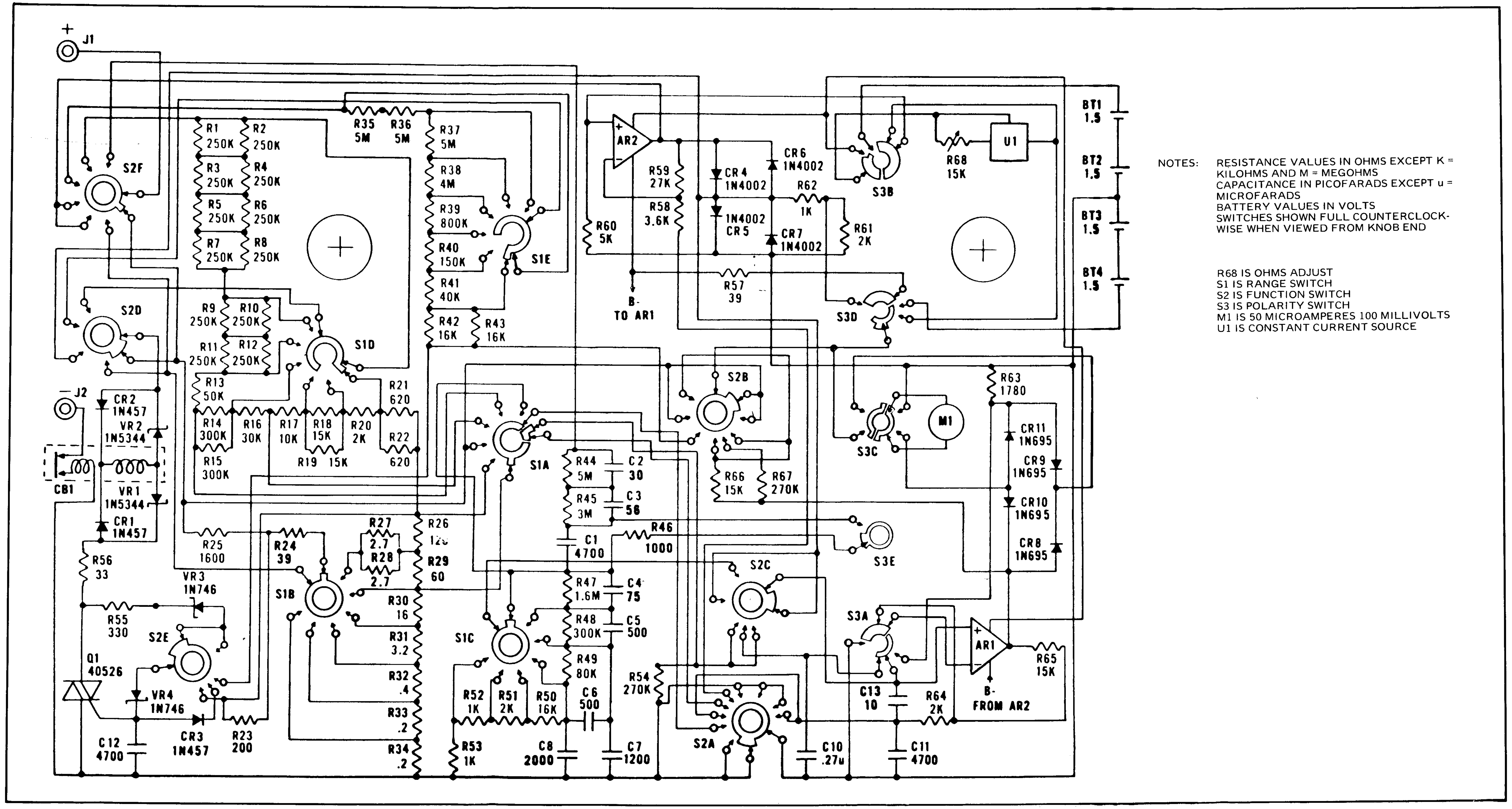
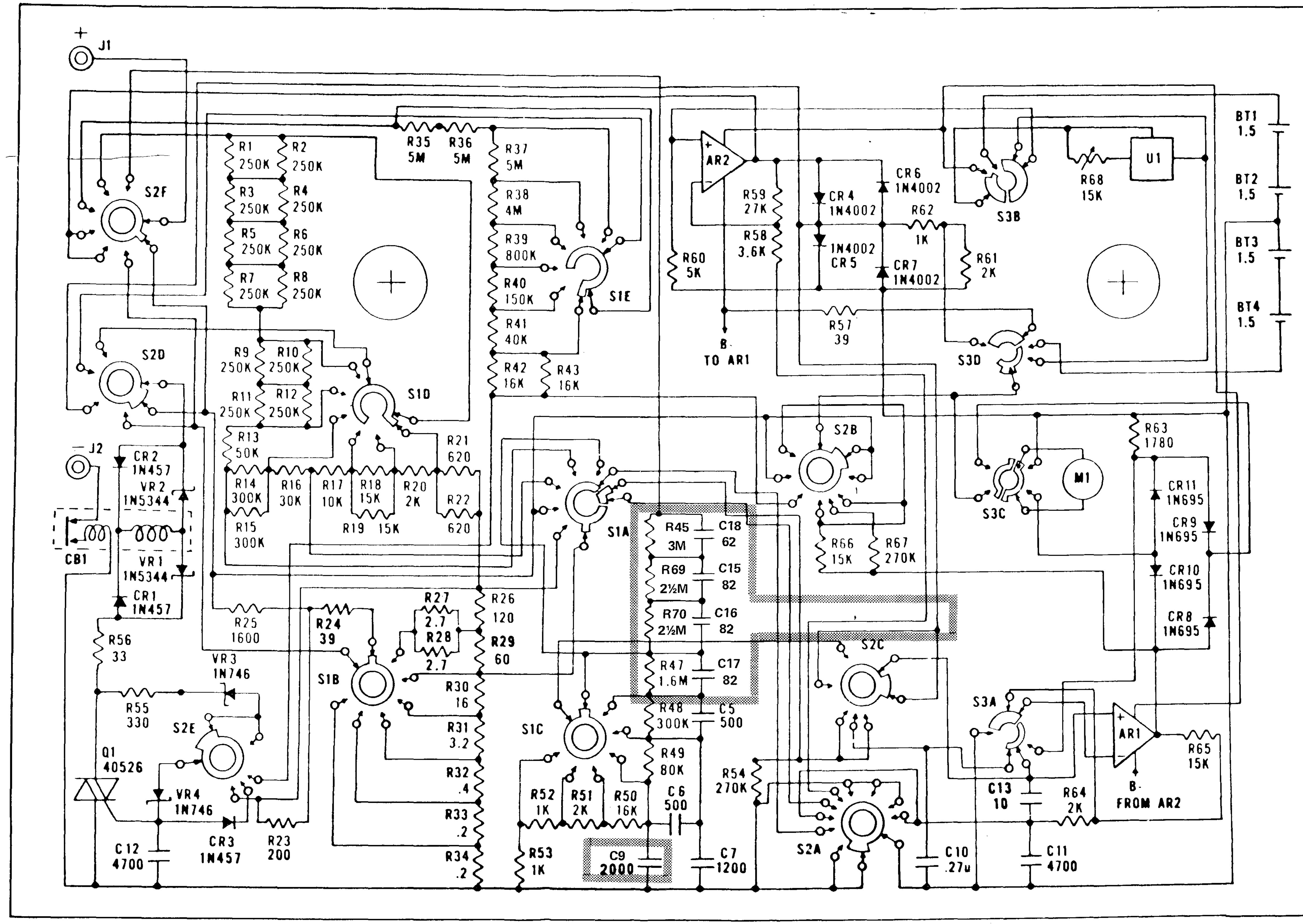


NOTES: RESISTANCE VALUES IN OHMS EXCEPT K = KILOHMS AND M = MEGOHMS
CAPACITANCE IN PICOFARADS EXCEPT u = MICROFARADS
BATTERY VALUES IN VOLTS
SWITCHES SHOWN FULL COUNTERCLOCKWISE WHEN VIEWED FROM KNOB END

R68 IS OHMS ADJUST
S1 IS RANGE SWITCH
S2 IS FUNCTION SWITCH
S3 IS POLARITY SWITCH
M1 IS 50 MICROAMPERES 100 MILLIVOLTS
U1 IS CONSTANT CURRENT SOURCE

Figure 6-1. Schematic Diagram, Multimeter AN/PSM-37 Part Number 910



NOTES: RESISTANCE VALUES IN OHMS EXCEPT K = KILOHMS AND M = MEGOHMS
CAPACITANCE IN PICOFARADS EXCEPT u = MICROFARADS
BATTERY VALUES IN VOLTS
SWITCHES SHOWN FULL COUNTERCLOCKWISE WHEN VIEWED FROM KNOB END

R68 IS OHMS ADJUST
S1 IS RANGE SWITCH
S2 IS FUNCTION SWITCH
S3 IS POLARITY SWITCH
M1 IS 50 MICROAMPERES 100 MILLIVOLTS
U1 IS CONSTANT CURRENT SOURCE

Figure 6-2. Schematic Diagram, Multimeter AN/PSM-37 Part Number 960