TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST (INCLUDING DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS)

FOR

VOLTMETER, ELECTRONIC AN/URM-145B

(NSN 6625-00-437-4865)

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OPERATOR'S ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

VOLTMETER, ELECTRONIC AN/URM-145B (NSN 6625-00-437-4865)

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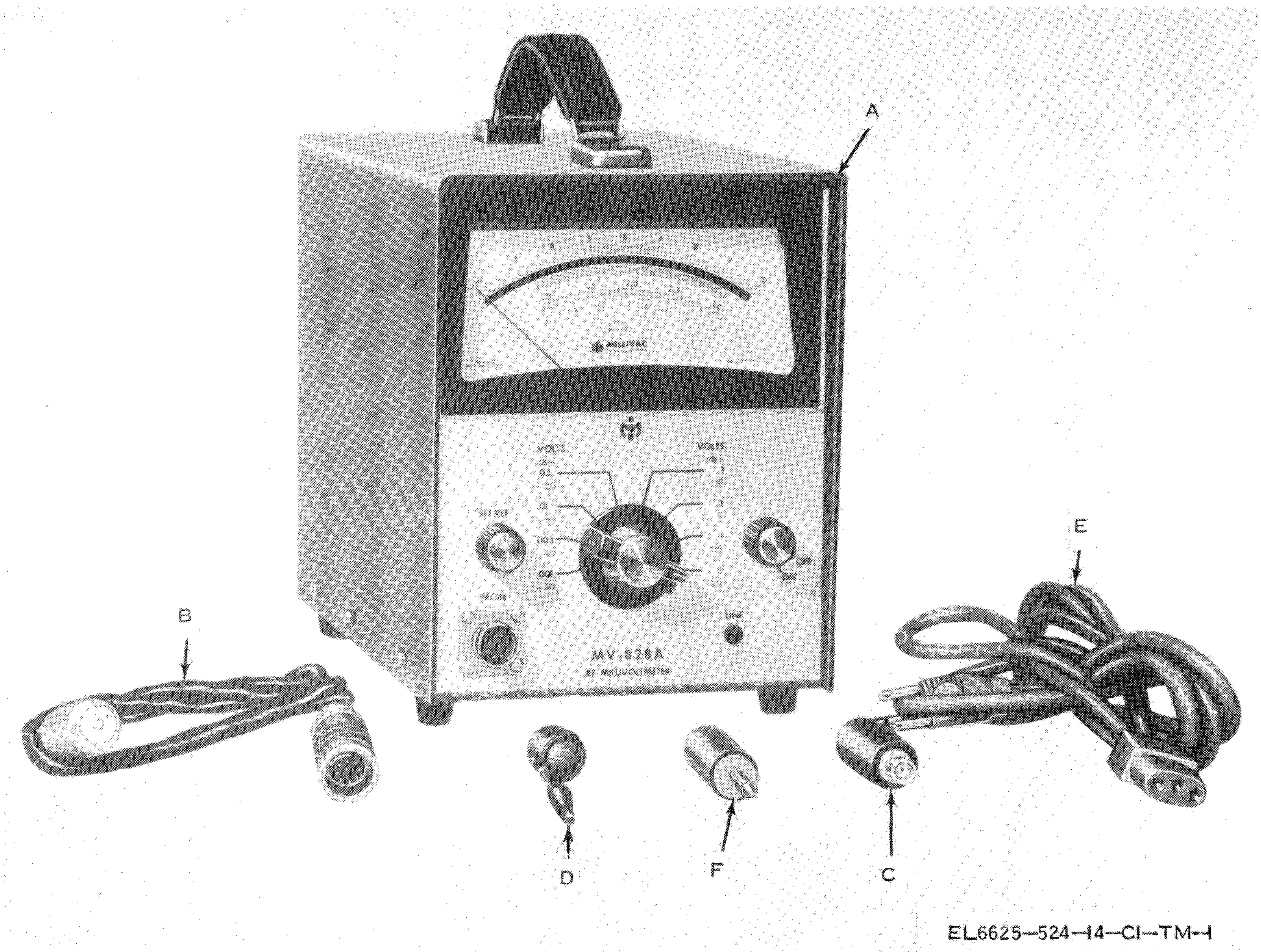

Figure 1-1. Voltmeter, Electronic AN/URM-145B.

CHAPTER 1
INTRODUCTION

Section 1. GENERAL

1-1. Scope

This manual describes Voltmeter, Electronic AN/URM-145B (fig. 1-1) and provides instructions for operation and organizational, direct support, and general support (GS) maintenance. Instructions are provided for the operator and the organizational maintenance personnel for installation, operation, preventive maintenance, and replacement of parts available at organizational maintenance. Circuit functioning is included for general support maintenance, together with instructions appropriate to this category of maintenance for troubleshooting, testing, adjusting, aligning and repairing the equipment and replacing maintenance parts.

1-2. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are Modification Work Orders (MWO'S) pertaining to the equipment.

1-3. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DSAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33A/AFR 75-18/MCO P4610.19B, and DSAR 4500.15.

1-3.1. Administrative Storage

Administrative storage of equipment issued to and used by Army activities shall be in accordance with TM 740-90-1.

1-3.2. Destruction of Army Electronics Materiel.

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

1-4. Reporting of Errors.

You can help improve this manual by calling attention to errors and by recommending improvements and stating your reasons for the recommendations. Your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) should be mailed direct to Commander, US Army Electronics Command, ATTN: DRSEL-MA-Q, Fort Monmouth, New Jersey 07703. A reply will be furnished direct to you.

1-4.1. Reporting Equipment Improvement Recommendations (EIR).

EIR's will be prepared using DA Form 2407 (Maintenance Request). Instructions for preparing EIR's are provided in TM 38-750, The Army Maintenance Management System. EIR's should be mailed direct to Commander, US Army Electronics Command, ATTN: DRSEL-MA-Q, Fort Monmouth, New Jersey 07703. A reply will be furnished direct to you.

Section II. DESCRIPTION AND DATA

1-5. Description and Use

a. Voltmeter, Electronic AN/URM-145B (voltmeter) is a sensitive instrument for the measurement of voltages of 300 microvolt (uv) to 3 volts spanning a frequency range of 20 kilohertz (KHz) to 600 megahertz (MHz). In addition to conveniently measuring voltage levels in a diversity of radiofrequency (rf) circuits, the instrument has application for many associated tests. Such measurements include the frequency response of both active and passive networks; that is, amplifiers, and filters; voltage standing wave ratio (vswr) anti return loss on transmission lines and attendant systems; attenuation and insertion loss of rf attenuators; and high frequency parameters of transistors. With true root mean square (rms) response below *0.03* volt, wide hand noise can be measured, and by use of suitable null networks, measurement of the harmonic distortion of rf waveforms can be performed without the attendant errors of average-type meters. The voltmeter is also useful as an rf null detector for bridge measurements and analogous techniques when a sensitivity in the order of 200 uv will suffice.

b. Supplied with each instrument is a general purpose rf probe, 50-ohm adapter and probe tip. The adapter is fitted with a type bnc coaxial connector and provides a 50-ohm termination with a low vswr up to 600 MHz. The probe tip is useful for direct measurement to approximately 250 MHz. However, a short wire should be substituted for the ground lead when using above 100 MHz to minimize the effects of ground lead inductance. Above 250 MHz, the probe may be used directly without the tip, but the connecting leads must be extremely short to avoid resonant effects. Normally, the rf probe is used with the 50-ohm adapter in a coaxial system for accurate measurements above 100 MHz.

c. The rf probe with its full-wave crystal detecting circuit produces a true rrns response without turnover, or harmonic errors for all voltage levels below 0.03 volt, gradually changing to peak-to-peak reading (calibrated in rms) at approximately 1.0 volt. The probe has a shunt capacitance of approximately 2.2 water holding energy (pF) at levels of 0.3 volt or higher, decreasing slightly at levels of 0.1 volt or less (fig. 1-2). The shunt resistance component shown in figure 1-3 is a variable factor, depending on the voltage and frequency. A decibel (db) scale in red on the panel meter and range switch provides a convenient means of expressing relative voltage measurements.

d. A screwdriver zero control on front of the meter provides zero adjustment of the meter pointer.

e. The main controls required to operate the voltmeter are on the front panel. Several minor controls are on the rear panel.

1-6. Technical Characteristics

Measurement range	300 uv to 3 volt.	
Frequency range.....	20 KHz to 600 MHz.	
Full scale ranges	0.001.0.003.0.01, 0.03,0.1, 0.3, 1.3 volt.	
Accuracy	0.001 range only	10 percent of full scale to 200 MHz
		15 percent of full scale above 200 MHz.
	0.00:3 range and above	5 percent of full scale to 200 MHz
		10 percent of full scale above 200 MHz.
Input inpedance	See figure 1-3.	
Decibel range (red scale) ..	0 to 70 db in 10 db steps.	
Maximum vswr ...	1.2 up to 600 MHz.	
Power requirements ...	115/230 volt, 55 to 65 Hz. 12 watts.	
Dimensious	9 inch H x 6½ inchW x 11¼ inch Doverall (handle folded).	
Weight	10lb.	

1-7. Items Comprising an Operable Equipment

a. Voltmeter, Electronic ME-247C/U.
b. Probe, P/N 900-2000B.
c. 50-ohm Adapter, PIN 900-2050A.
d. Probe tip, P/N 900-2002.
e. Power cord, P/N 800-5121.
f. output plug, Switchcraft Inc., P/N 60.

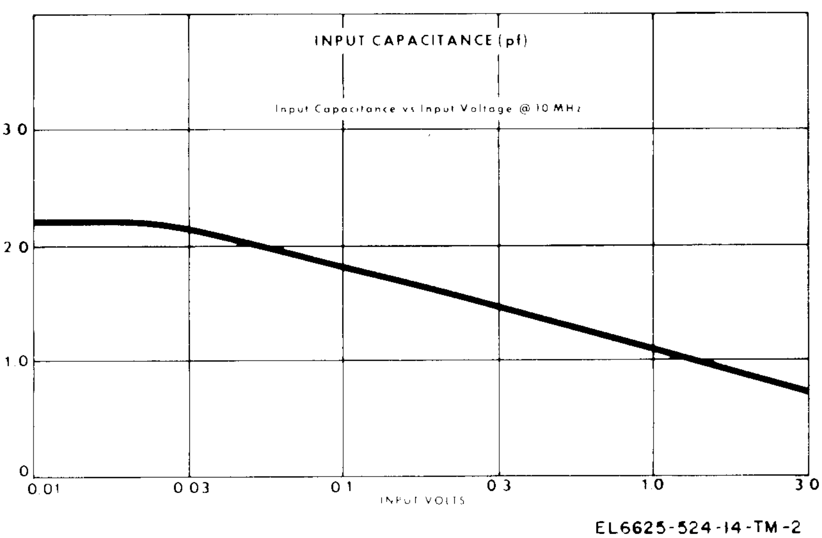

Figure 1-2. Input capacitance of rf probe (measured at 10 MHz).

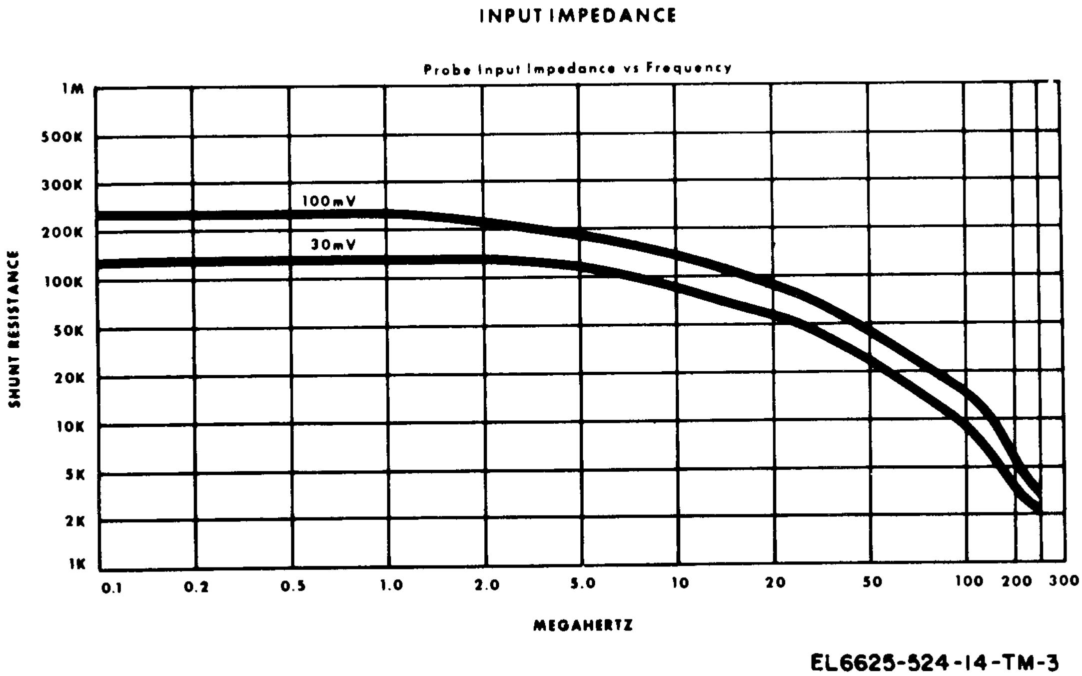

Figure 1-3. Input resistance of rf probe.

CHAPTER 2

INSTALLATION

2-1. Unpacking

a. Packaging Data. When packed for shipment, Voltmeter, Electronic A-N/URM - 145B is placed in a waterproof carton and packed in a corrugated cardboard box. A typical packing case and its contents are shown in figure 2-1.

b. Removing Contents. Perform all the procedures in (1) through (4) below when unpacking equipment.

(1) Open the outer corrugated carton and moistureproof barrier.

(2) Remove the inner carton.

(3) Open the inner corrugated carton.

(4) Remove the voltmeter.

2-2. Checking Unpacked Equipment

a. Inspect the equipment for damage incurred during shipment.

b. Check to see that the equipment is complete (paragraph 1-6). Report all discrepancies in accordance with TM 38-750. Shortage of a minor assembly or part that does not affect proper functioning of the equipment should not prevent use of the equipment.

c. If the equipment has been used or reconditioned, see whether it has been changed by a modification work order (MWO). If the equipment has been modified, the MWO number will appear on the side near the nomenclature. Check to see whether the MWO number (if any) and appropriate notations concerning the modification have been entered in the equipment manual.

NOTE

Current MWO's applicable to the equipment are listed in DA Pam 310-7.

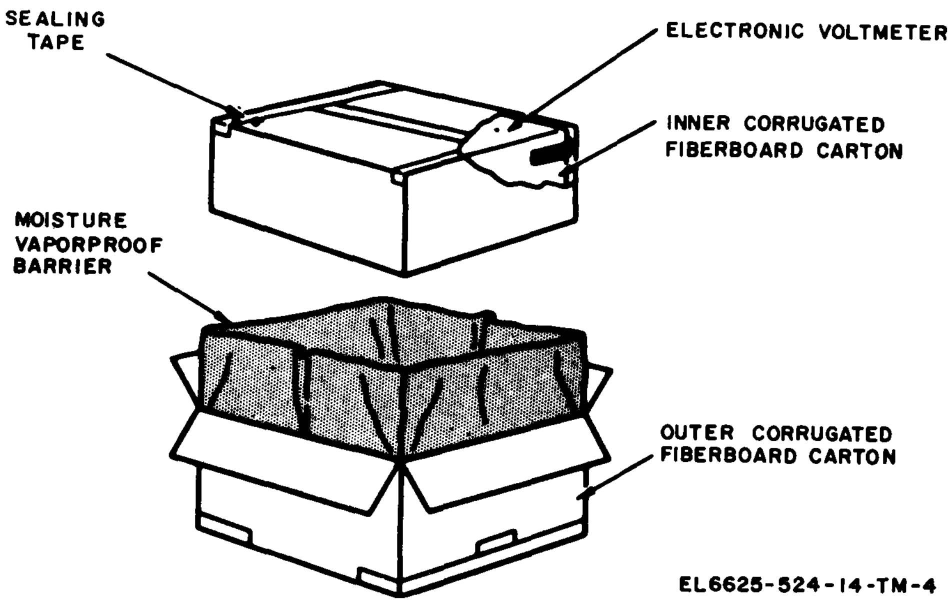

Figure 2-1. Typical packaging diagram.

2-3. Cable Connections

Connect the cables and adapters as follows:

a. Insert the power cord plug into the three-prong receptacle on the rear panel.

b. Insert the rf probe plug into the receptacle on the front panel.

c. Screw the 50-ohm adapter on the rf probe when a 50-ohm termination is required.

d. Screw the probe tip on the rf probe for direct measurements up to 100 MHz. Above 100 MHz, the probe may be used without the tip.

CAUTION

Above 250 MHz, connecting leads must be extremely short to avoid resonant effects.

CHAPTER 3

OPERATING INSTRUCTIONS

3-1. General

This section should be read carefully before using the voltmeter. It contains information necessary for proper operation of the voltmeter. To achieve valid readings, proper switch settings are required. Controls and indicators, with the function of each, are listed in paragraph 3-3. Operating procedures are described in paragraph 3-4. The controls are shown in figures 3-1 and 3-2.

3-2. Preliminary Operating Instructions

a. Set 115/230 volts switch, on the rear panel, for the input voltage to be used.

b. Set LINE switch at OFF.

c. Turn the adjusting screw on the front panel meter until the pointer is at SET REF.

3-3. Controls and Indicators

The controls for the voltmeter are on the front and rear panels. Their functions are described in table 3-1.

Table 3-1. Controls and Indicators

Control or indicator	Function
Range selector switch	Selects one of eight voltage ranges.
SET REF control	Adjusts the meter pointer to the reference point with zero input signal. Should perferably be adjusted on the lowest range.
LINE switch	A two position ON-OFF switch. Connect AC power to the voltmeter at the ON position.
LINE lamp	Indicates that ac power is applied when lit.
PROBE connector	A nine pin receptacle which accepts the rf probe connector.
Mechanical zero adjust screw (rear panel controls).	Provided for mechanical zero adjustment of the meter pointer.
DC OUTPUT jack	A tip, ring, sleeve phone-type jack for dc output.
POWER connector	A three pin receptacle which accepts the power cord connector.
115/230 VOLTS switch	Selects transformer connections for 115 or 230 volts input.

3-4. Operating Procedures

a. General. Before operating the voltmeter, check the meter to see if the pointer falls on the SET REF mark. It it does not, turn the SET REF control until the pointer is exactly over the SET REF mark. At the low end of the 0.001 scale of the meter, 100 uv and 200 uv points are provided. These are designated by the small numerals 1 and 2 and should be used only on this range.

CAUTION

Damage to the diode cartridge in the probe may result if the input exceeds 500 volts dc or 40 volts peak-to-peak.

b. Measurement Procedure.

(1) Set LINE switch to ON.

(2) Connect the probe tip to the probe for direct measurement or the 50-ohm adapter for measurements in 50-ohm systems or above 100 MHz. Above 250 MHz, the probe may be used directly without the adapter.

(3) If the approximate voltage to be measured is known, set the range selector switch to the appropriate scale. Otherwise, set switch at 3 volts scale and turn switch to lower scales until a proper meter reading is obtained.

(4) To obtain readings in db, add db meter reading (red scale on meter) to the db setting of the range selector switch.

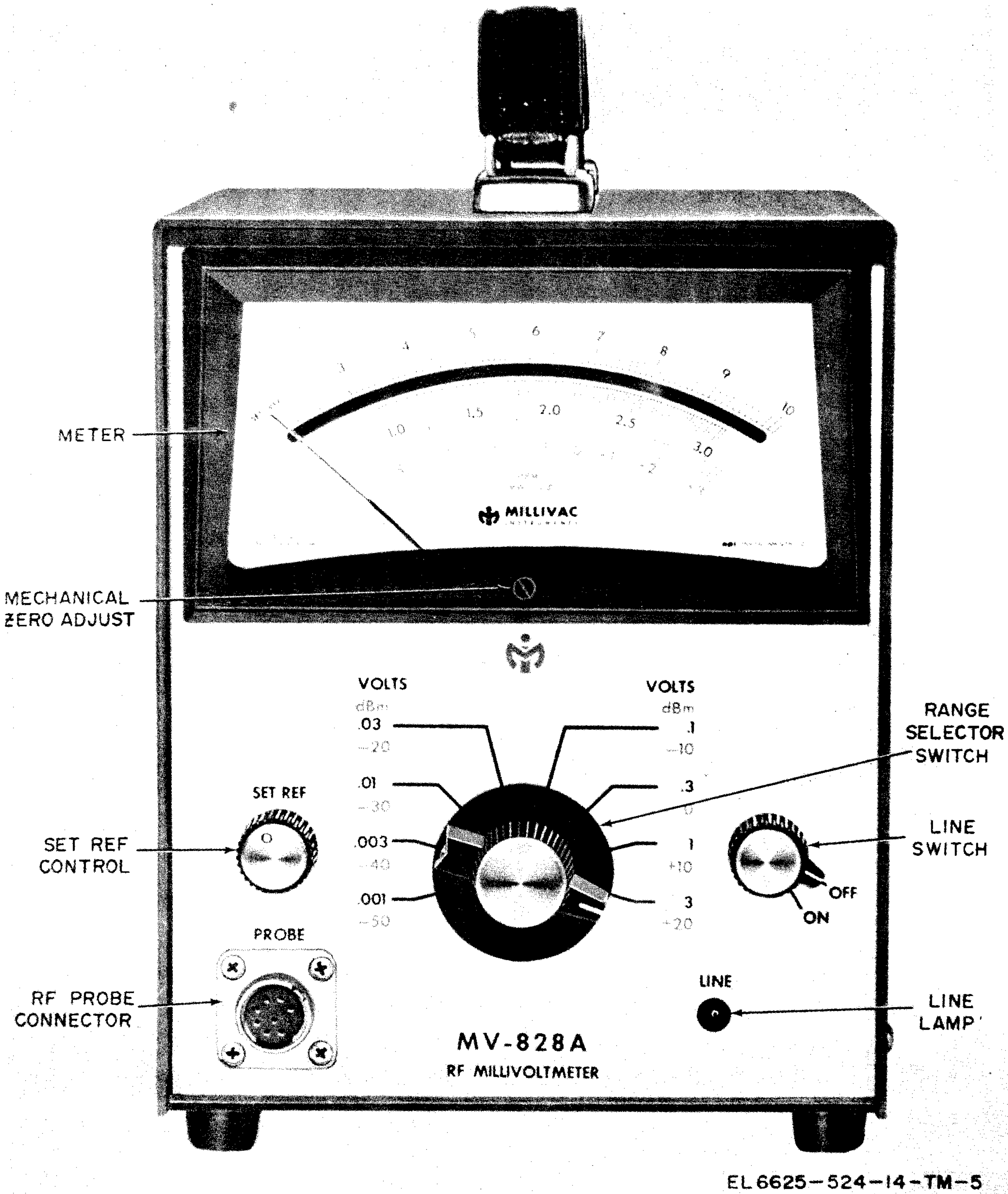

Figure 3-1. Front panel controls.

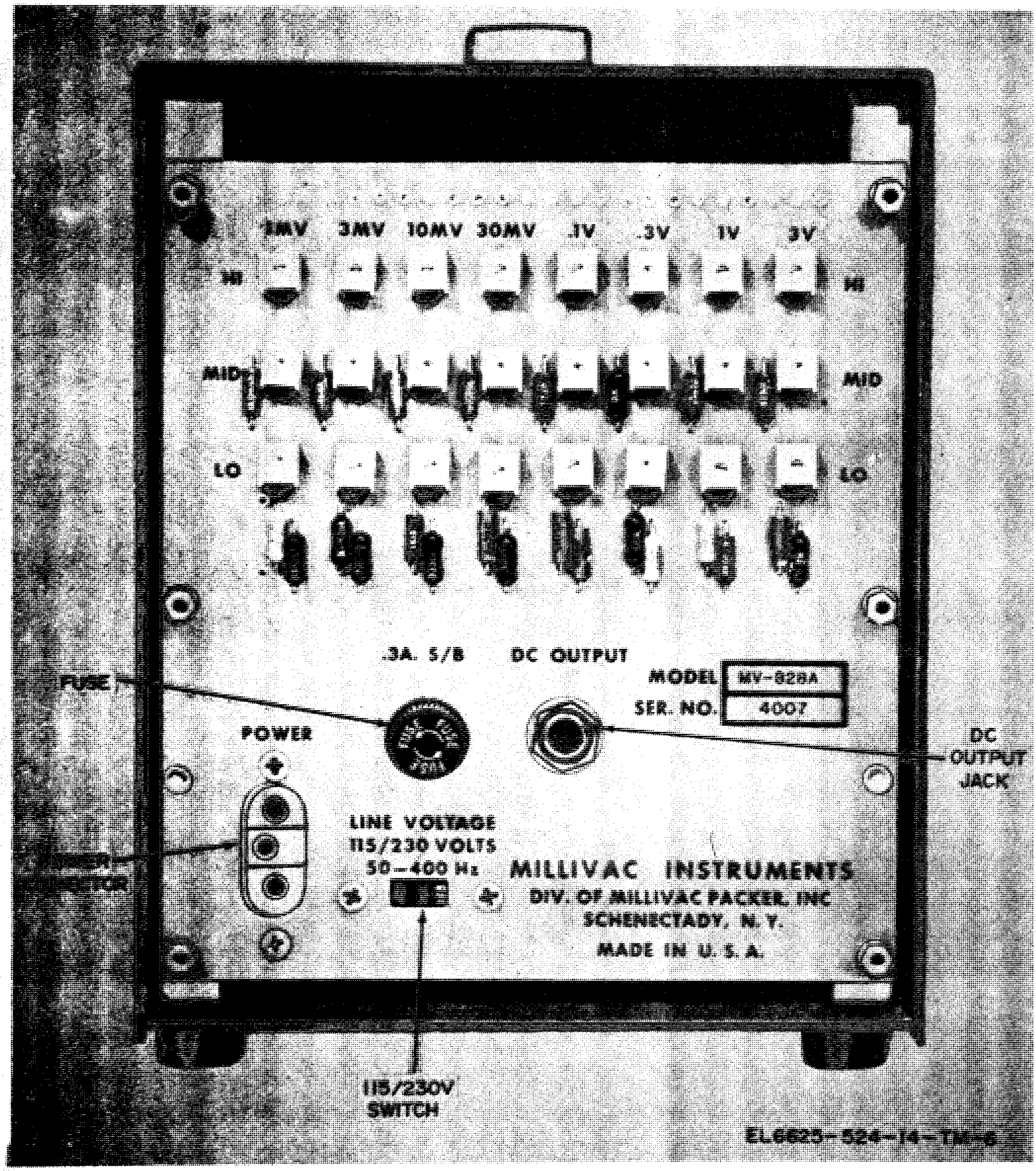

Figure 3-2. Rear panel controls.

WARNING

Do not exceed 5w rf when using any of the adapters with the probe.

c. Hum, Noise, and Spurious Pickup. When measuring low level rf voltages, always take precautions to avoid the possibility of erroneous readings resulting from hum, noise, or stray rf pickup. Although all low frequency hum and noise is attenuated at the input by 60 db, it is still possible for high level unwanted signals to get through and cause errors. The best test for this condition is to reduce the test signal to zero level and note whether the voltmeter continues to read some spurious signal level. In some cases, extra shielding may be necessary around the probe connections to reduce stray field pickup. Typical sources of spurious radiation are induction or dielectric heating units, diathermy machines, local radio transmitters, grid dip meters, and amplifiers with parasitic oscillations.

d. Magnetic Fields. Operation of the voltmeter in strong 60 Hertz (Hz) magnetic fields, such as those surrounding unshielded power transformers, should be avoided. The magnetic field induces small 60 Hz currents in the amplifier section of the instrument which, due to the extremely high gain at this frequency, appear as an indication on the meter.

CHAPTER 4

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE

4-1. Scope of Maintenance

a. The maintenance duties assigned to the operator of the voltmeter are listed below together with a reference to the paragraphs covering the specific maintenance functions. The duties assigned do not require tools or test equipment other than those issued with the equipment.

(1) Cleaning (para 4-4).

(2) Rustproofing and painting.

b. The maintenance duties assigned to the organizational maintenance repairman of the voltmeter are shown in table 4-1. The duties assigned do not require tools or test equipment other than those issued with the equipment.

4-2. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of the equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable. The procedures given in table 4-1 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

4-3. Preventive Maintenance Checks and Services Periods

Preventive maintenance checks and services of the AN/URM-145B/U are required daily, weekly, monthly, and quarterly as shown in table 4-1 and under the special conditions listed below.

a. Before the voltmeter is taken on a mission.

b. When the voltmeter is initially installed.

c. When the voltmeter is reinstalled after removal for any reason.

d. At least once a week, if the equipment is maintained in standby condition. Perform the maintenance functions indicated in the organizational monthly preventive maintenance checks and services table once each month. A month is defined as approximately 30 calendar days of 8-hour-per-day operation. If the equipment is operated 16 hours a day, the monthly preventive maintenance checks and services should be performed at 15-day intervals. Adjustment of the maintenance interval must be made to compensate for any unusual operating conditions. Equipment maintained in a standby (ready for immediate operation) condition must have monthly preventive maintenance checks and services. Equipment in limited storage (requires service before operation) does not require monthly maintenance.

Table 4-1. Preventive Maintenance Checks and Services

Interval: Operator (B, Daily D, A, W); Org. (M, Q)

B - Before Operation, D-During Operation, A-After Operation, W-weekly, M-Monthly, Q-Quarterly

Item Number	B	Daily D	A	W	M	Q	Item to be Inspected	Procedure	Reference
1	x						Voltmeter	Check for completeness and general condition.	
2	x						Exterior surfaces	Check exterior surfaces.	(Para 4-7).
3	x						External receptacles	Inspect external receptacles for breakage and looseness.	
4	x						Meter glass	Inspect glass window for breaks, physical damage, dust, or moisture.	
5		x					Knobs, controls, and switches	During operation, check knobs, controls, and switches for proper mechanical action.	
6		x					Operation	Be alert for any abnormal indications.	
7			x				Voltmeter	Check for any peculiar odors which would indicate overheated components.	
8				x			Cables	Inspect cables for cuts, cracked or gouged jackets, fraying, or kinks.	
9				x			Hardware	Inspect all exterior hardware for looseness and damage.	
10				x			Preservation	Inspect equipment for bare spots, rust and corrosion.	(Para 4-7 and 4-8).
11					x		Publications	Inspect manual for completeness and usable condition. Be sure that all changes are on hand.	DA Pam 310-4
12					x		MWO's	Check to see that all URGENT MWO'S have been applied and that all NORMAL MWO'S have been scheduled.	DA Pam 310-7
13						x	Completeness	Same as item 1.	
14						x	Exterior surfaces	Same as item 2.	
15						x	External receptacles.	Same as item 3.	
16						x	Preservation	Same as item 10.	
17						x	Meter glass	Same as item 4.	
18						x	Cables	Same as item 8.	
19						x	Operation	Same as item 6.	

4-4. Cleaning

Inspect the exterior surfaces of the voltmeter. The exterior surfaces should be free of dirt, grease, and fungus.

a. Remove the dust and other loose dirt with a clean, soft cloth.

WARNING

The fumes of trichloroethane are toxic. Provide thorough ventilation whenever used. DO NOT use near an open flame. Trichloroethane is not flammable, but exposure of the fumes to an open flame converts the fumes to highly toxic dangerous gases.

b. Remove grease, fungus, and ground-in dirt from the cases; use a cloth dampened (not wet) with trichloroethane.

c. Remove dirt from plugs and jacks with a brush.

CAUTION

Do not press on the meter face (glass) when cleaning; the meter may become damaged.

d. Clean the front panel meter, and control knobs; use a soft, clean cloth. If necessary, dampen the cloth with water; mild soap may be used for more effective cleaning.

4-5. Rustproofing and Painting

a. Rustproofing. When the finish on the voltmeter has become badly scarred or damaged, rust and corrosion can be prevented by touching up the bare spots. Use No. 000 sandpaper to clean the surface down to the bare metal. Obtain a bright, smooth finish.

b. Painting. Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it. Refer to the applicable cleaning and refinishing practices specified in TB 43-0118.

CHAPTER 5

CIRCUIT FUNCTIONING

5-1. Block Diagram

The basic circuitry of the voltmeter is best understood by reference to the block diagram (fig. 5-1).

a. The input signal is sampled and detected by the rf probe. The direct current (dc) output signal from the probe, after passing through the attenuator section of the range selector switch, goes through an input filter which rejects power line frequency components which might cause a measuring error.

b. A single-pole, double-throw dc modulator (3G1) then converts the dc signal into a nearly symmetrical square wave.

c. The square wave is impedance matched and amplified by a high impedance, narrow band preamplifier (3A2Q9 through Q12). Its narrow bandwidth also improves the signal-to-noise ratio.

d. The preamplifier output is further amplified in the driver and output stage (3A2Q13 and 3A2Q14).

e. The alternating current (ac) signal from the output stage is rectified by a synchronous demodulator (3A2Q7 and 3A2Q8) and the resultant dc output is used to provide heavy overall dc feedback and temperature compensation. The dc output is also linearized in the output circuit and connected to the indicating meter.

f. The dc modulator output is also connected to a driver (3A2Q1 and 3A2Q2) which drives a reference amplifier (3A2Q3 and 3A2Q4).

g. The output from the reference amplifier is fed to the synchronous demodulator. The phase relationship between the reference amplifier and the input signal determines the polarity of the dc output which is connected to the indicating meter.

h. An electronically regulated power supply (3A1CR1 and 3A1CR2) plus transistors delivers -14.5 volts to the amplifier. The amplifier divides the power supply voltage to - 6 volts and +8.5 volts.

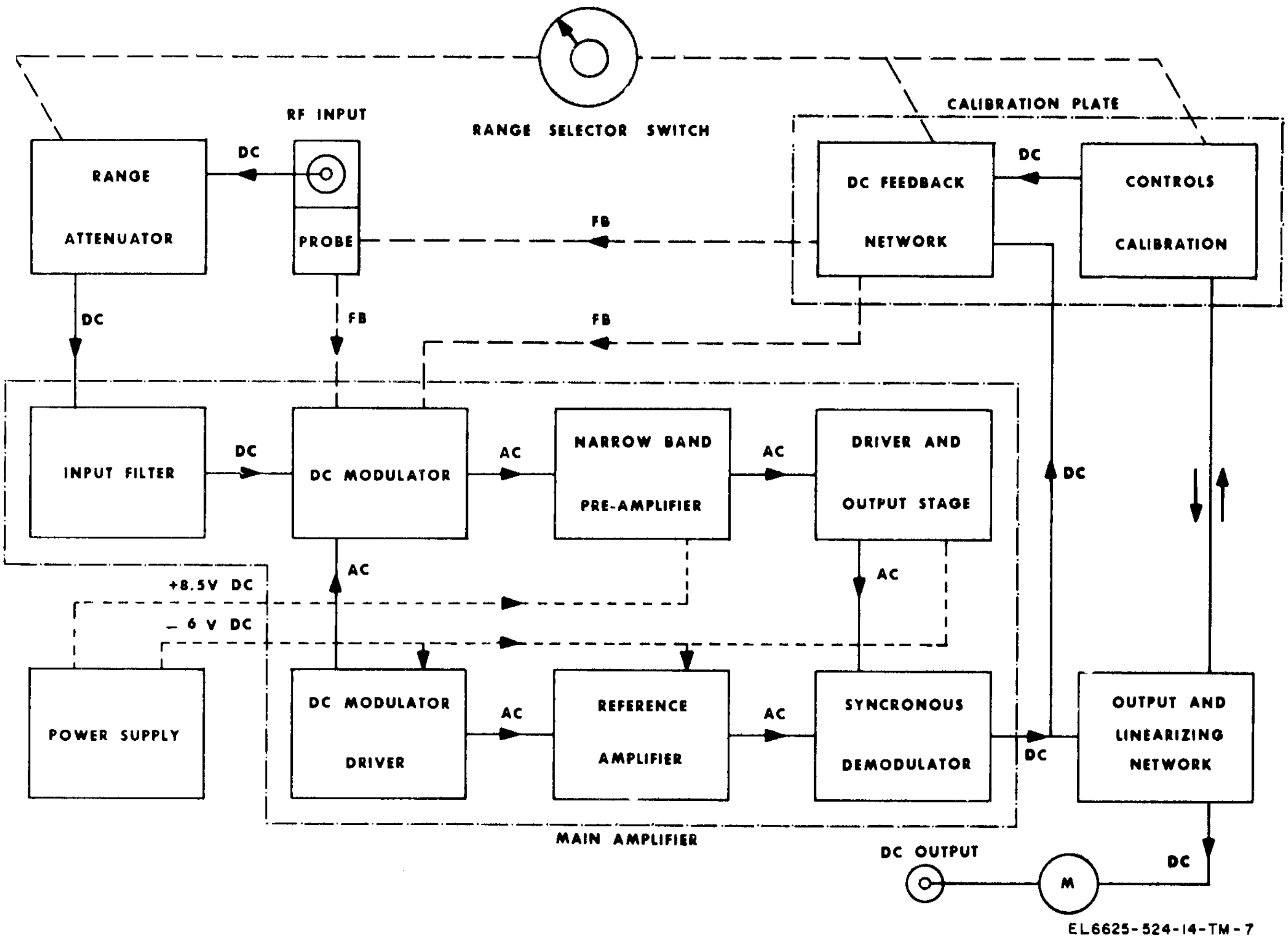

Figure 5-1. Block diagram.

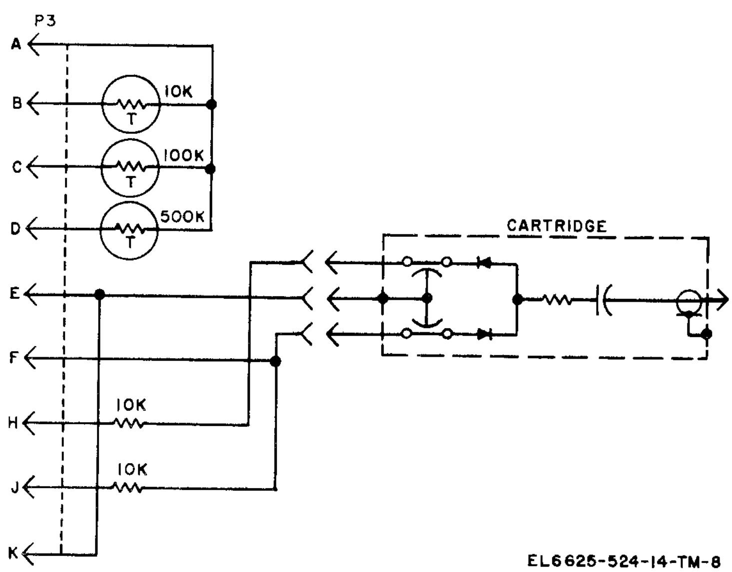

Figure 5-2. Rf probe, simplified schematic diagram.

5-2. Rf Probe

The rf probe (fig. 5-2) contains a diode cartridge assembly. The cartridge assembly contains a coupling capacitor, two matched diodes, a pair of filter capacitors and a pellet resistor. The sealed section of the rf probe housing contains two filter resistors connected in series with the output terminals of the diode cartridge, and a tern-perature sensing thermistor network connected in the dc feedback loop of the amplifier. The ther-mistors are connected to the individual ranges by means of sections C and E of the range selector switch 3S2. The individual pins of connector 3J1 are bypassed to ground by filter capacitors and thus prevent any possible error introduced by stray rf pickup in the probe cable.

5-3. Range Selector Switch

a. The range selector switch consists of sec-tions A through H. Sections A and B (range attenuator) contain resistive dividers supplying the full or partial voltage to the input of the amplifier. This voltage, when modulated, am-plified, and demodulated, will indicate on the meter a reading corresponding to the value of the input signal within the accuracy rating of the range being used.

b. Section D disconnects 3R55 to provide additional gain on the two 10 west ranges.

c. Sections C and E, in conjunction with section H, form part of the dc feedback loop. Section H contains individual resistors and potentiometers to control the main feedback loop of each midrange control. The thermistors, located in the rf probe, sense and correct for any thermal errors occurring as a result of the tem-perature characteristics of the rf diodes and are switched into the circuit through sections C and E.

d. Sections F and G switch in both resistors and potentiometers for correcting the nonlinearity of the rf diodes.

5-4. Input Filter

The input filter consists of RC networks and a tuned parallel T-network providing an effective ac filter with a minimum of 60-db rejection at powerline. frequency.

5-5. Dc Modulator

A 94-Hz printed circuit plug-in dc modulator (3G1), is employed. It modulates the dc input signal, and the resultant ac component is im-pedance matched to the narrow band pream-plifier.

5-6. Narrow Band Preamplifier

The narrow band preamplifier features a low noise, high impedance input achieved by the use of a high quality field effect transistor 13A2Q9). Diodes 3A2CR3 and 3A2CR4 form a clamp circuit to protect the input transistor from excessive overload. A three-stage conventional RC-coupled, common-emitter amplifier, consisting of 3A2Q10, Q11, and Q12, with the input transistor 3A2Q9, develop a gain of approximately 80 db. A tuned parallel T-network in a negative feedback loop from the collector of 3A2Q12 to the base of 3A2Q10 narrows the amplifier bandwidth and thus improves the signal-to-noise ratio. The supply voltage is held at +8.5 volts by Zener diode 3A2VR1.

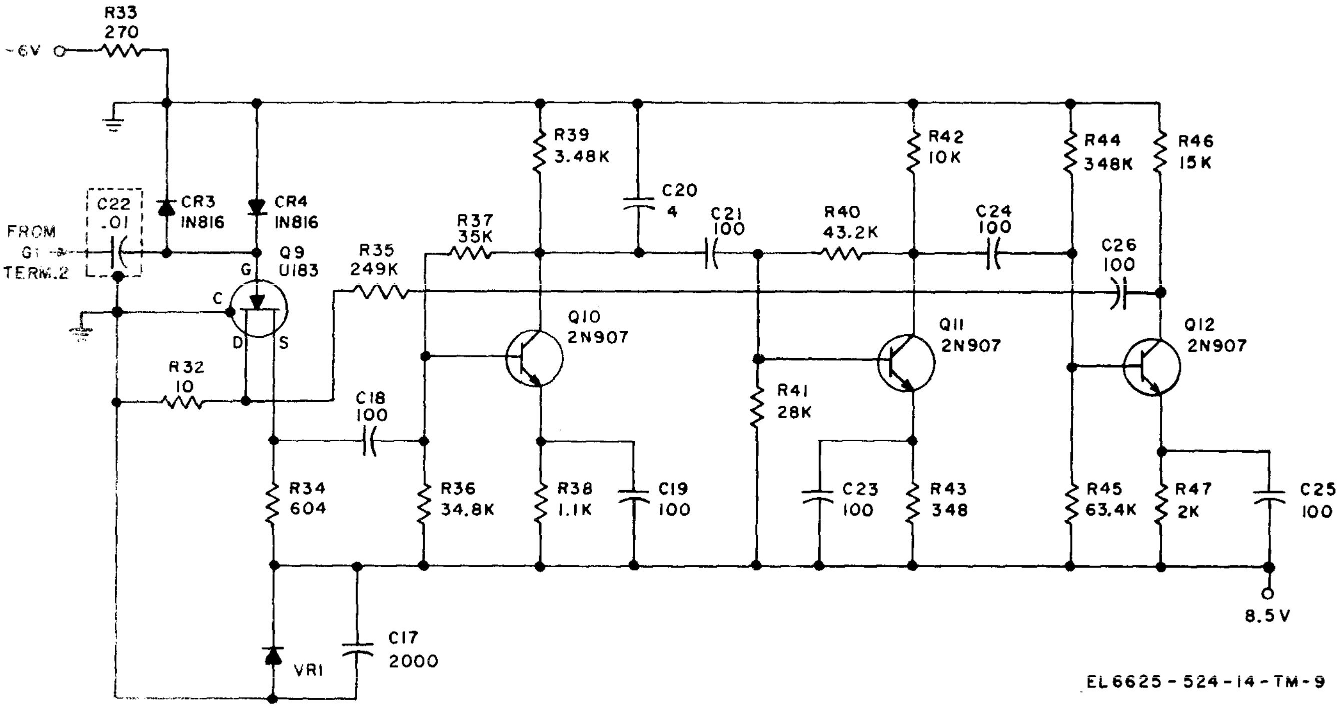

Figure 5-3. Narrow band preamplifier, schematic diagram.

5-7. Driver and Output Circuit

The driver (3A2Q13) and output stage (3A2Q14) are conventional capacitor-coupled stages. Amplifier gain control 3A2R53 adjusts the level of signal applied to the base of the driver. Amplifier gain control 3A2R55 is disconnected on the two lowest ranges to allow additional gain. The signal developed in the output stage is applied to the synchronous demodulator.

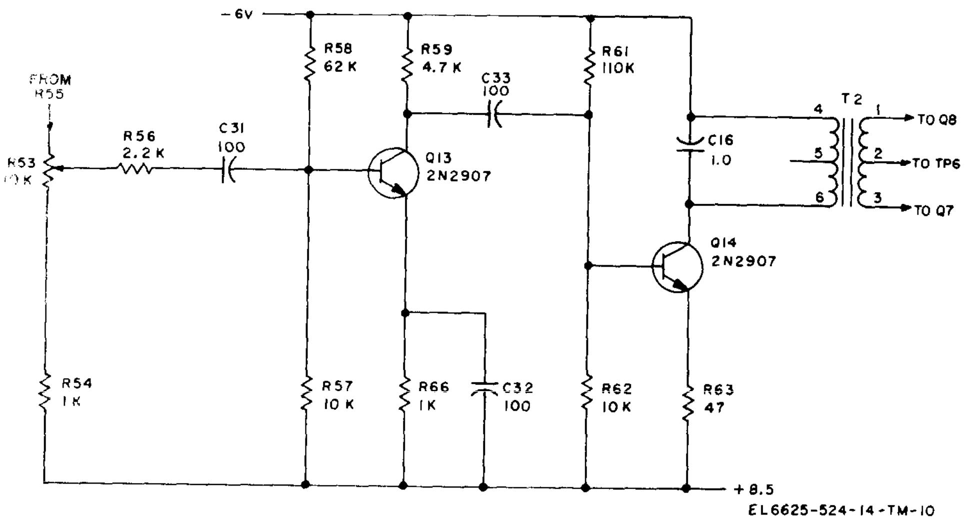

Figure 5-4. Driver and output, schematic diagram.

5-8. Synchronous Demodulator

Transistors 3A2Q7 and 3A2Q8 are utilized in this phase-sensitive rectifying circuit. The signal from the output stage (3A2Q14) is compared with the reference signal from 3A2Q5 and 3A2Q6. The resultant dc output signal from this demodulator has a polarity corresponding to the original input signal polarity. In this operation the collector current is a function of collector voltage only, and is essentially independent from other transistor parameters. The voltage applied to the base of the transistor acts only as a phase-sensitive reference.

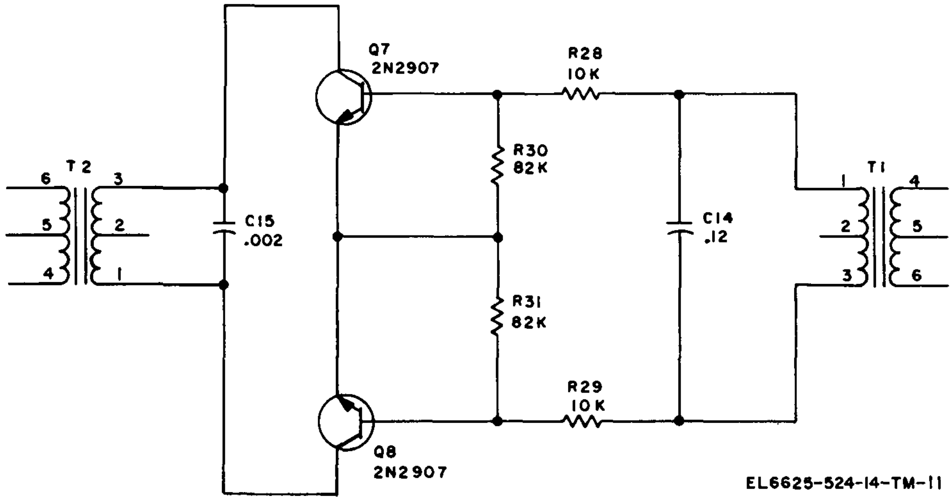

Figure 5-5. Synchronous demodulator, simplified schematic diagram.

5-9. Driver

The driver, 3A2Q1 and 3A2Q2, is a two-transistor multivibrator circuit, the frequency of which is adjusted by 3A2R11. The frequency is factory adjusted to 94 Hz.

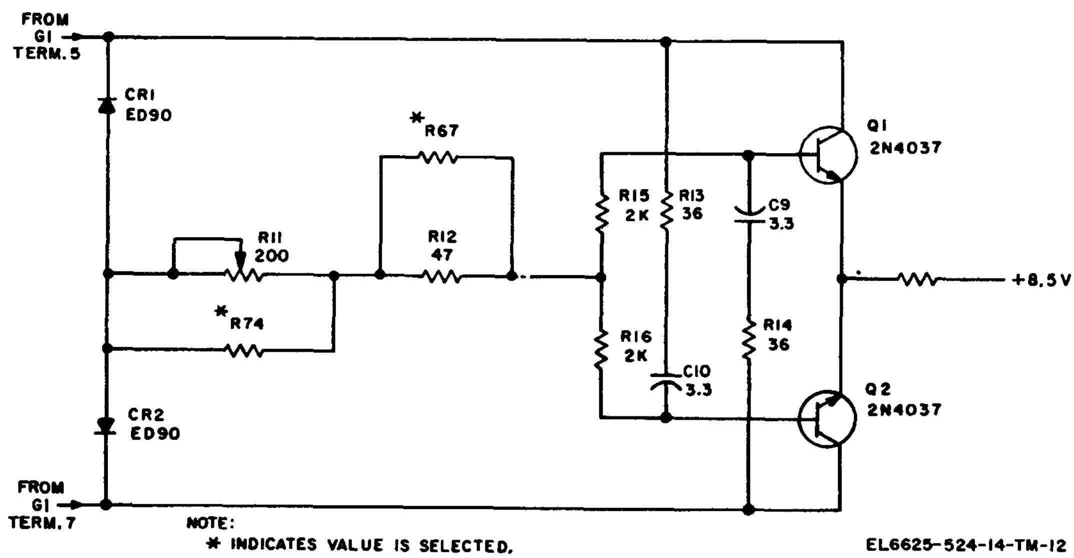

Figure 5-6. Driver, simplified schematic diagram.

5-10. Reference Amplifier

The 94-Hz square wave from the modulator driver is sampled by the amplifier stages via emitter followers 3A2Q3 and 3A2Q4. The amplifiers 3A2Q5 and 3A2Q6 amplify this square wave, and it is coupled to the synchronous demodulator via 3A2T1 .

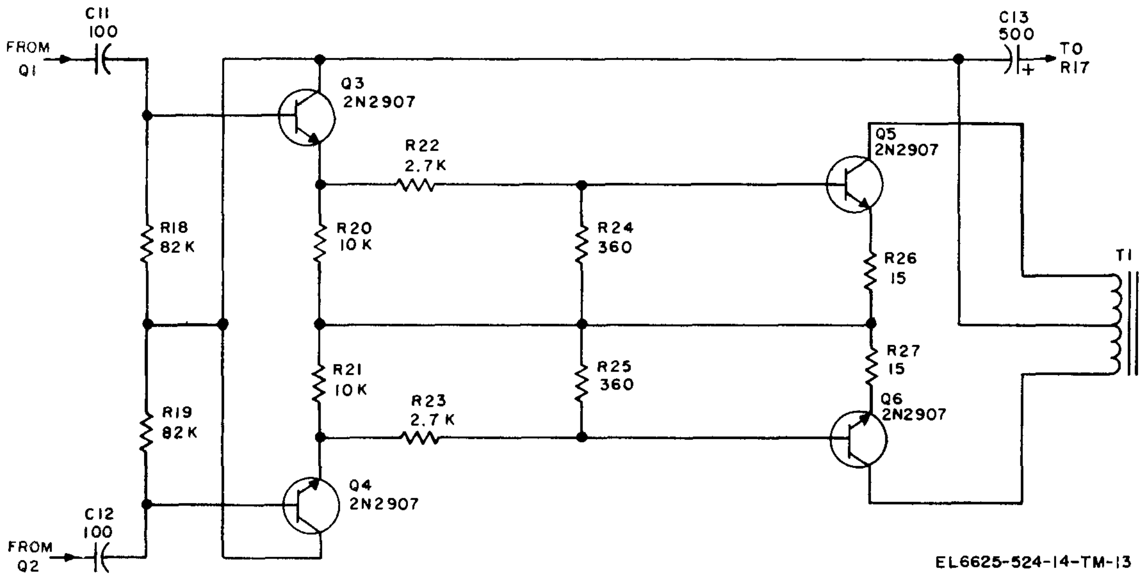

Figure 5-7. Reference amplifier, simplified schematic diagram.

5-11. Dc Feedback and Calibration Controls

A portion of the dc output voltage from the synchronous demodulator is fed back to the dc modulator to provide the excellent gain stability of the voltmeter. This feedback ratio is determined by values of a resistor and potentiometer connected in series and switched through section H of range selector switch 3S2. One of the three thermistors mounted in the rf probe is switched in series with the previous combination by means of sections C and E of 3S2. The dc feedback controls, marked mid on the calibration plate, are used for accurate calibration of the midscale for each range. The appropriate feedback ration is selected when switched to the desired range.

5-12. Output, Linearizing Networks, and Meter Circuit

The dc output of the diodes in the probe is basically nonlinear with respect to the rf input level. In order to achieve a linear output characteristic, correction networks are employed. Their function is to expand the lower end and compress the upper end of the meter scale. Refer to figure 5-8 for better understanding of the circuit. The switch is at the 0.001 volt scale.

a. The rectified dc, proportional to the dc input signal, appears at the center tap of the secondary of 3A2T2 and filter capacitor 3A1C6. For low input levels, 50 percent of full scale and lower, the signal passes through 3A3R22, 3A3R21, 3A3CR6, 3M1, and 3A3R5. At low levels, the resistance of 3A3CR6 is fairly high and the current through the circuit is limited. By paralleling 3A3R21 and 3A3CR6 with 3A3R17 and 3A3R25, an exact adjustment of the meter to a point corresponding with the input voltage is possible. For higher levels, 70 percent through 100 percent of full scale, 3A3R1, 3A3R35, and 3A3VR2 paralleled with 3M1 and 3A3R5 provide adjustment of the meter to correspond with the incoming signal. To adjust the midscale point, the main dc feedback resistors are utilized.

b. Indicating meter 3M1 employes a taut band movement that is rated at 0-500 microampere (ua) dc. It also utilizes a mirror-backed scale to minimize parallax errors.

c. Resistor 3A3R5, in series with 3M1, is connected to the circuit via 3J2. For external monitoring purposes, when a plug is inserted in 3J2, 3A3R5 is switched out of the circuit and the external monitor must provide the 2K ohms series load. This value should be within 1 percent to maintain the rated calibration accuracy of the voltmeter.

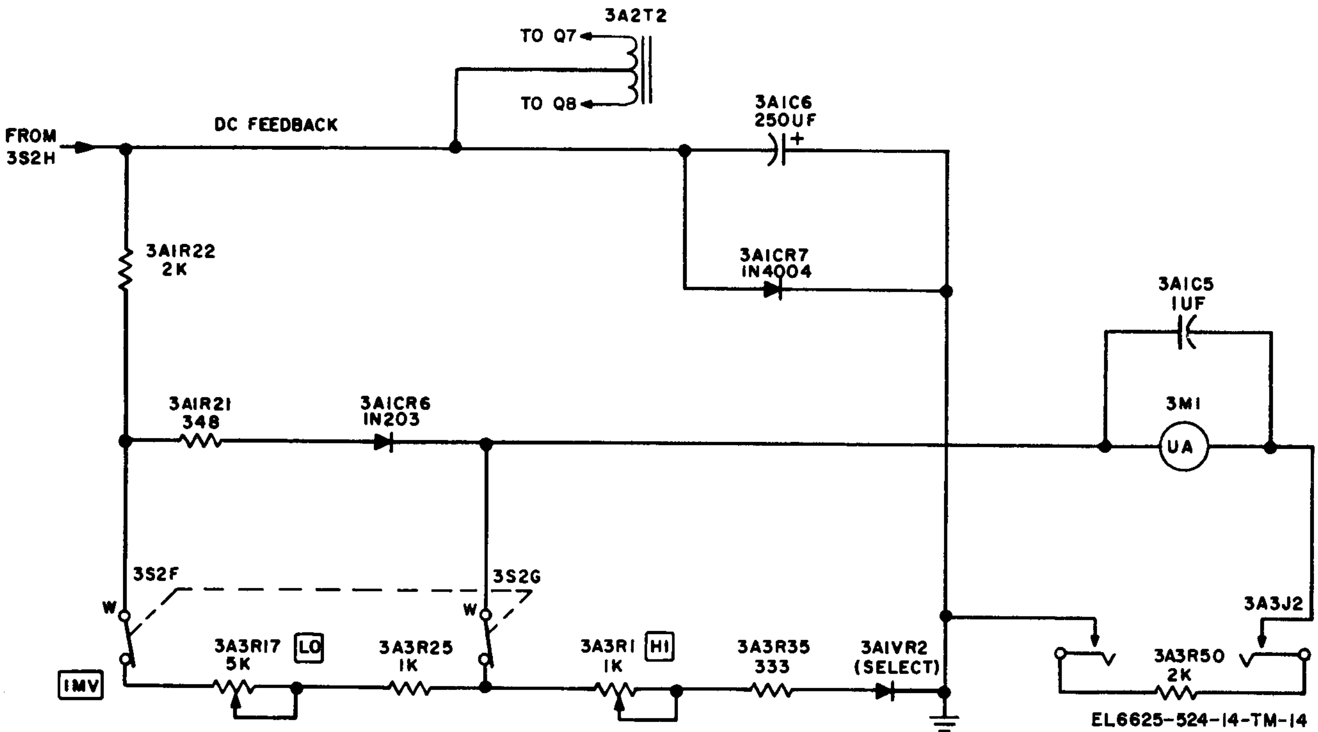

Figure 5-8. Scale correction network, schematic diagram.

5-13. Regulated Power Supply

The electronically regulated power supply includes a 115/230 volt ac, 55 to 65 Hz dual primary, power transformer (3A1T1). Its secondary, in conjunction with rectifiers (3A1CR1 and 3A1CR2), is weed in a full-wave rectifying circuit. The rectifier output is applied to the emitter of series regulator transistor 3A1Q1. The base of 3A1Q1 is biased by the reference amplifier via inverting-amplifier 3A1Q2. Transistor 3A1Q3 and its associated circuitry provide a constant current of 1 milliampere (ma) to the reference amplifier and output stages. The regulated output voltage appears at the collector of 3A1Q1 An adjustable voltage divider across the output, consisting of 3A1R12, 3A1R13, and 3A1R14, permits adjustment of the output voltage.

Figure 5-9. Regulated power supply, simplified schematic diagram.
(Located in back of manual)

Figure 5-10. Voltmeter, Electronic AN/URM-145B, schematic diagram.
(Located in back of manual)

CHAPTER 6

GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. TROUBLESHOOTING

6-1. Troubleshooting Techniques.

a. General. The first procedure in servicing a defective voltmeter is to sectionalize the fault. Sectionalization consists of tracing the fault to a printed circuit board or chassis. Once the defective board is located, isolation to the defective part is accomplished. Troubleshooting ia performed by the general support repairman.

b. Sectionalization. Listed in (1) through (4) below is a group of tests arranged to help locate the defect.

(1) *Visual inspection.* When the voltmeter is brought in for repair, remove the top cover and inspect as follows:

(a) Check to see that all confections and pc boards are properly seated. Repair or replace any connections or leads that are broken or otherwise defective.

(b) Check all switches and controls for ease of operation.

(c) Inspect for loose or missing screws,

(2) *Operational tests.* Operational tests frequency indicate the general location of trouble. In many instances, the test will determine the exact nature of the fault. The operating procedures (para 3-4), preventive maintenance checks (para 4-4 to 4-6), and the alignment procedure (para 6-6) provide a good operational test.

(3) *Voltage and resistance measurements.* Voltage and resistance measurement are shown in figure 6-1. Several waveforms at critical points are shown in figure 5-10. Use these to localize trouble to a component.

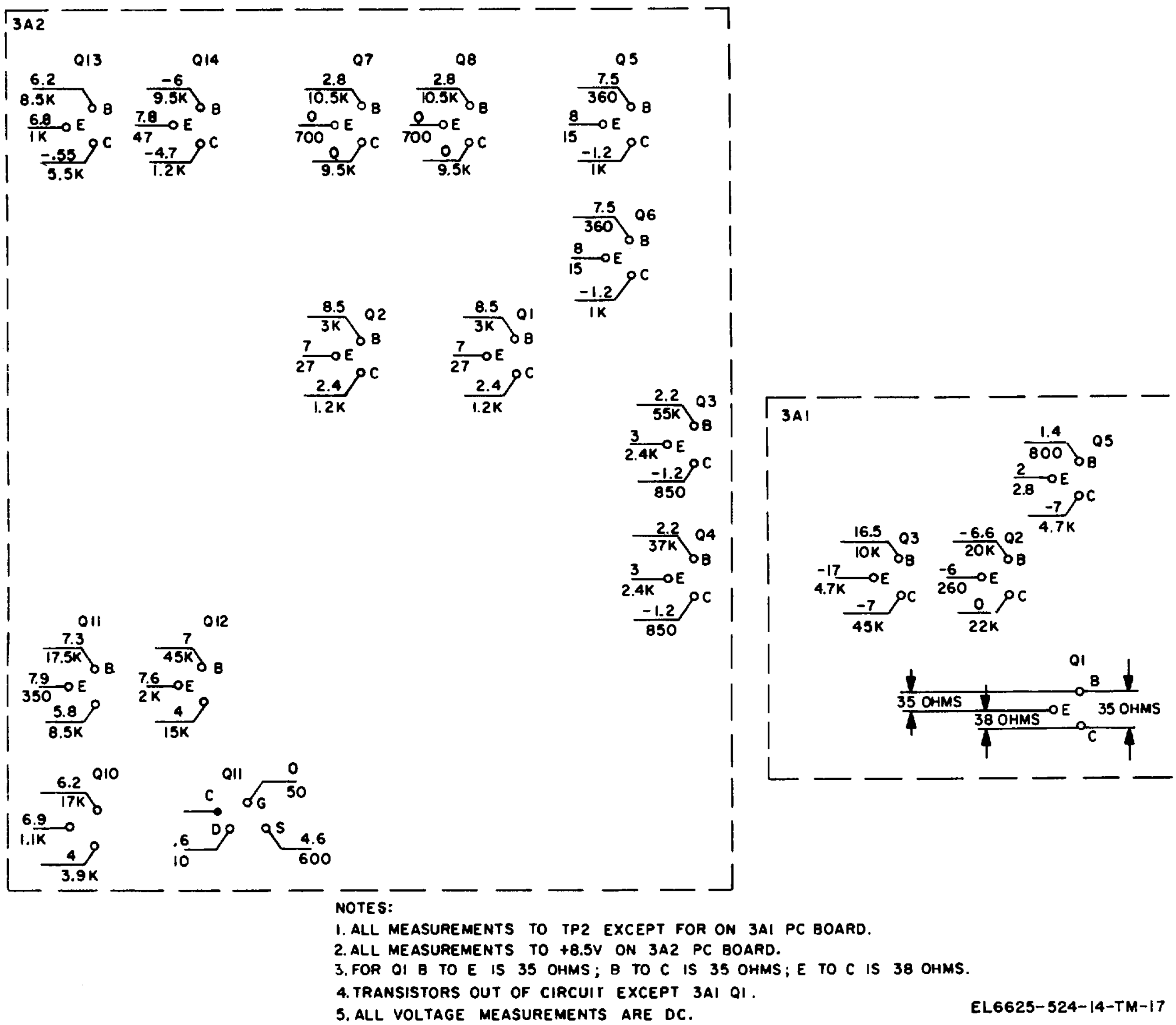

Figure 6-1. Voltage and resistance measurements.

(4) *Dc resistance of transformers.* Dc resistance of transformers are shown in paragraph 6-6.

(5) *Tools and test equipment.* Tools and test equipment required for troubleshooting are shown in section II.

(6) *Troubleshooting chart.* The meter indications, or lack of meter indications and operational checks provide a systematic method of localizing trouble to the faulty circuit. The trouble symptoms listed in the troubleshooting chart (para 6-3) provide additional information for localizing troubles.

Section II. TOOLS AND TEST EQUIPMENT

6-2. Tools and Test Equipment Required for Troubleshooting

a. Tools. No special tools are required.

b. Test Equipment. The test equipment required for troubleshooting is listed below:

Test equipment	*Technical manual*	*Common name*
Electronic Voltmeter ME-30(*)/U	TM 11-5511	Vtvm
Oscilloscope AN/USM-281	TM 11-6625-1703-15	Scope
AC Meter, Millivac Model MV-45A		Ac meter
Signal Generator AN/GRM-50	TM 11-6625-573-15	Signal Generator

NOTE. (*) indicates all models.

6-3. Troubelshooting Chart

The following chart is supplied as an aid in locating trouble in the voltmeter. This chart lists the symptoms observed during normal operation to localize the trouble to a pc board or component. (In chart below, V & R stands for voltage and resistance.) Use the parts location illustrations (figs. 6-2 to 6-4) and schematic diagram (fig. 5-10) during troubleshooting.

Step	*Symptom*	*Probable trouble*	Correction
1	LINE lamp does not light when line switch is turned to ON.	*a.* Fuse 3A3F1 is burned out.	*a.* Replace fuse. If new fuse blows, check steps 2 and 3 below.
		b. LINE lamp 3DS1 defective.	*b.* Replace lamp.
		c. Defective power cord.	*c.* Check power cord; repair or replace.
		d. Line switch 3S1 defective.	*d.* Check switch and replace, if necessary.
		e. 115/230 volt switch 3A3S1 defective.	*e.* Check switch and replace, if necessary.
		f. Transformer 3A1T1 defective.	*f.* Check transformer and replace, if necessary.
2	Fuse 3A3F1 blows when LINE switch is turned to ON,	Short circuit on power supply board.	Make V & R checks and replace faulty part.
3	LINE lamp lights, voltmeter does not indicate on all ranges.	a. Defect on power supply board.	a. Make V & R checks and replace faulty part.
		b, Defective range selector switch 3S2.	*b.* Check switch at defective ranges. Repair or replace.
		c. Defective meter 3 M 1	c. Repair or replace.
4.	Meter indications abnormal on all ranges.	a. Defective modulator 3G1.	a. Listen for a 94Hz hum. Replace if no hum.
		b. Defective amplifier board 3A2.	*b.* Make V & R checks, Use signal tracing (para 6-4). Replace defective part.
5.	Meter normal on all ranges but one.	a. Check resistor on switch 3S2 for defective range.	a. Replace defective resistor.
		b. Check calibration resistors on 3A3 board for defective range.	*b. Replace* defective resistor.
6	Meter indication unstable or erratic.	*a.* Defective cartridge in R F probe.	*a.* Remove and check cartridge. Replace if necessary.
		b. Power supply 3A1 defective.	*b.* Repeat step 3 above.
		c. Amplifier 3A2 defective.	*c.* Repeat step 4 above.

6-4. Signal Tracing

NOTE

When operating the voltmeter removed from the cabinet, be careful to avoid powerline hum pickup in the dc modulator and preamplifier circuits. Excessive pickup will prevent making correct gain and waveshape measurements. If pickup is a problem, shield the voltmeter by placing aluminum plates at the bottom.

top, and sides. Set the power supply voltage at - 14.5 volts before making any gain measurements.

a. Checking Waveshapes of 3A2 Amplifier. Perform the following steps to check the amplifier.

(1) Set the range selector switch at 0.001 range.

(2) With no input, adjust the SET REF control until the meter pointer is at the SET REF mark. The waveshape from 3A2TP5 to ground is shown in figure 5-10.

(3) Connect the H-P 606A signal generator to the rf probe.

(4) Set the signal generator output for 1 mv at 200 KHz. The waveshape is shown in figure 5-10. Any drastic deviation indicates a faulty amplifier.

b. Checking Modulator and Narrow Band Preamplifier. Perform the following steps to check the modulator and narrow band preamplifier:

(1) Disconnect the jumper between 3A2TP8 and TP9.

(2) With no input, the waveshape at 3A2TP8 is shown in figure 5-10.

(3) Connect the H-P 606A signal generator to the rf probe.

(4) Set the signal generator output for 1 mv at 200 KHz. The waveshape is shown in figure 5-10. If the peak-to-peak output is low, adjust 3A2R11.

c. Checking Output Amplifier. Perform the following steps to check the output amplifier.

(1) Disconnect the wire from 3A2TP12 and connect it to 3A2TP11.

(2) Disconnect the jumper from 3A2TP8 and connect it to 3A2TP10.

(3) Set the LINE switch at ON,

(4) The voltage from 3A2TP11 to ground shall measure 1.5 volts DC ± 10 percent. If not, adjust 3A2R53.

6-5. Dc Resistance of Transformers

The dc resistance of transformers is shown below. When using the data, observe the following:

a. Before making resistance measurements of the windings, determine that the faulty operation is due to a defective transformer. To do this, follow the troubleshooting procedure in paragraph 6-4.

b. Because of the rather broad winding tolerances during manufacture, resistances may vary from one transformer to another; the values shown are typical average values.

c. The normal resistance of replacement transformers may differ greatly from the values given below.

Transformer 3A1T1		*Transformers 3A2T1 and T2*	
Terminals	*Ohms*	*Terminals*	*Ohms*
1-3		1.3	
2-3		2-3	
4-6			
		4-6	
5-6			

Section III. MAINTENANCE

6-6. Alignment

Perform the following steps to align the voltmeter.

a. Connect the negative lead of the vtvm to 3A1TP1 and the positive lead to 3A1TP2.

b. Adjust 3A1R13 (VOLTS ADJUST) for 14.5 volts indication on the vtvm.

c. With the power off, adjust the mechanical zero adjust screw to bring the meter pointer to the SET REF mark.

d. Terminate the rf probe in 50 ohms and attach the probe to the voltmeter.

e. Set the LINE switch at ON.

f. Turn the SET REF control until the meter pointer is at the SET REF mark.

6-7. Removal of Pc Board

Perform the following steps to remove a printed circuit (pc) board.

a. Remove the six screws and washers located at lower sides of the top cover and lift the cover up *b.* clear the voltmeter.

b. Remove the five screws and washers on the 3A1 and 3A2 boards and lay the boards flat.

c. Unsolder and tag all wires connected to the pc board and remove the board.

d. On the 3A3 pc board, perform the following steps:

(1) Remove six screws and washers holding the rear plate.

(2) Remove six hexagon headscrews and washers holding the board and lay the board flat.

(3) Unsolder and tag all wires connected to the pc board and components and remove the board.

6-8. Replacement of Pc Board

Perform the following steps to replace a pc board:

a. Resolder all wires to the 3A1 and 3A2 pc boards.

b. Fasten the pc board to the chassis with five screws and washers removed in paragraph 6-7 *b.*

c. To replace the 3A3 board, perform the following steps:

(1) Resolder all wires to the pc board and components.

(2) Fasten the pc board to the chassis with six hexagon headscrews and washers removed in paragraph 6-7 *d* (2).

(3) Fasten the rear plate to the pc board with the six screws and washers that were removed (para *6-7d* (1).

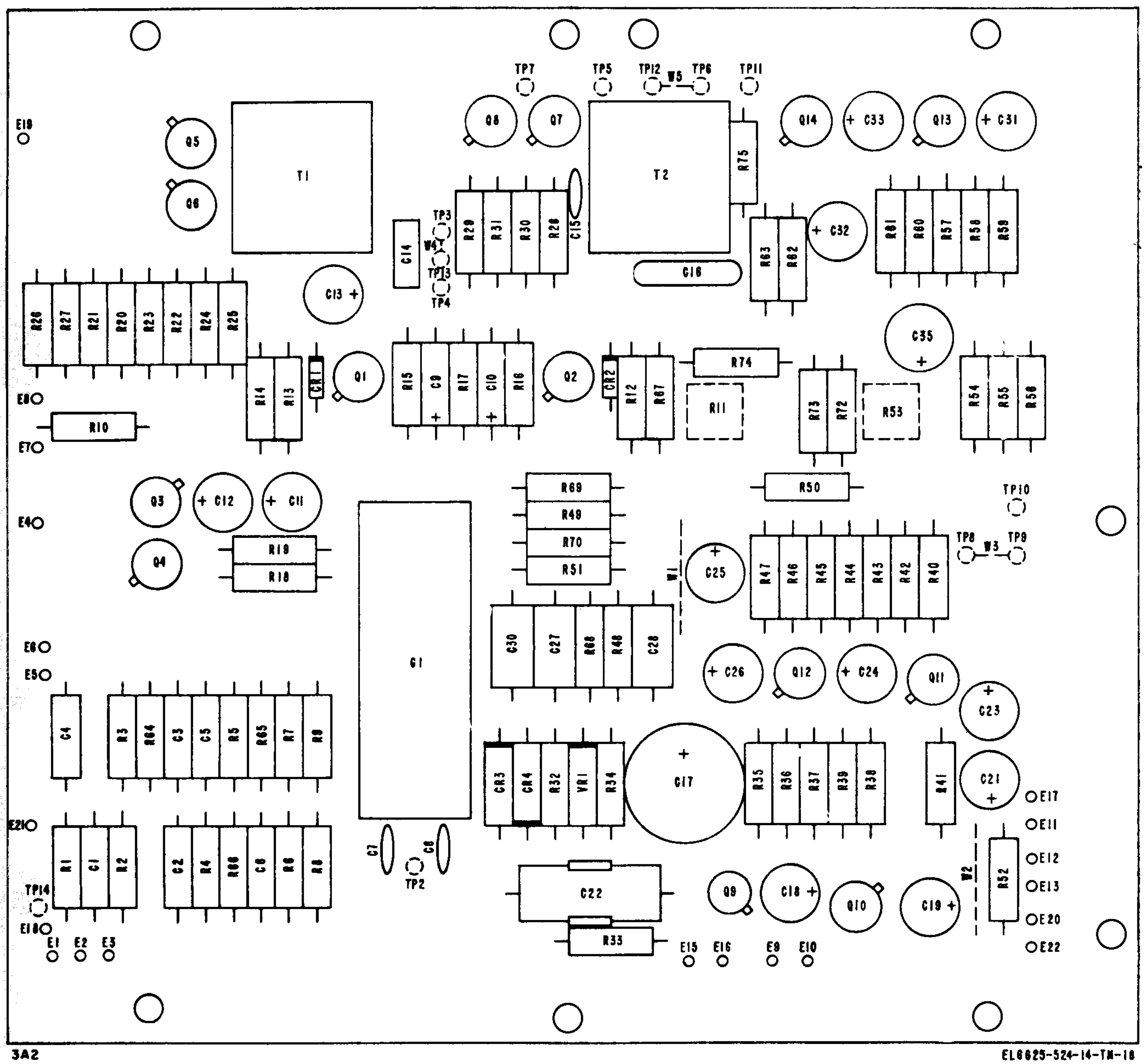

Figure 6-2. Amplifier board 3A2, location of parts.

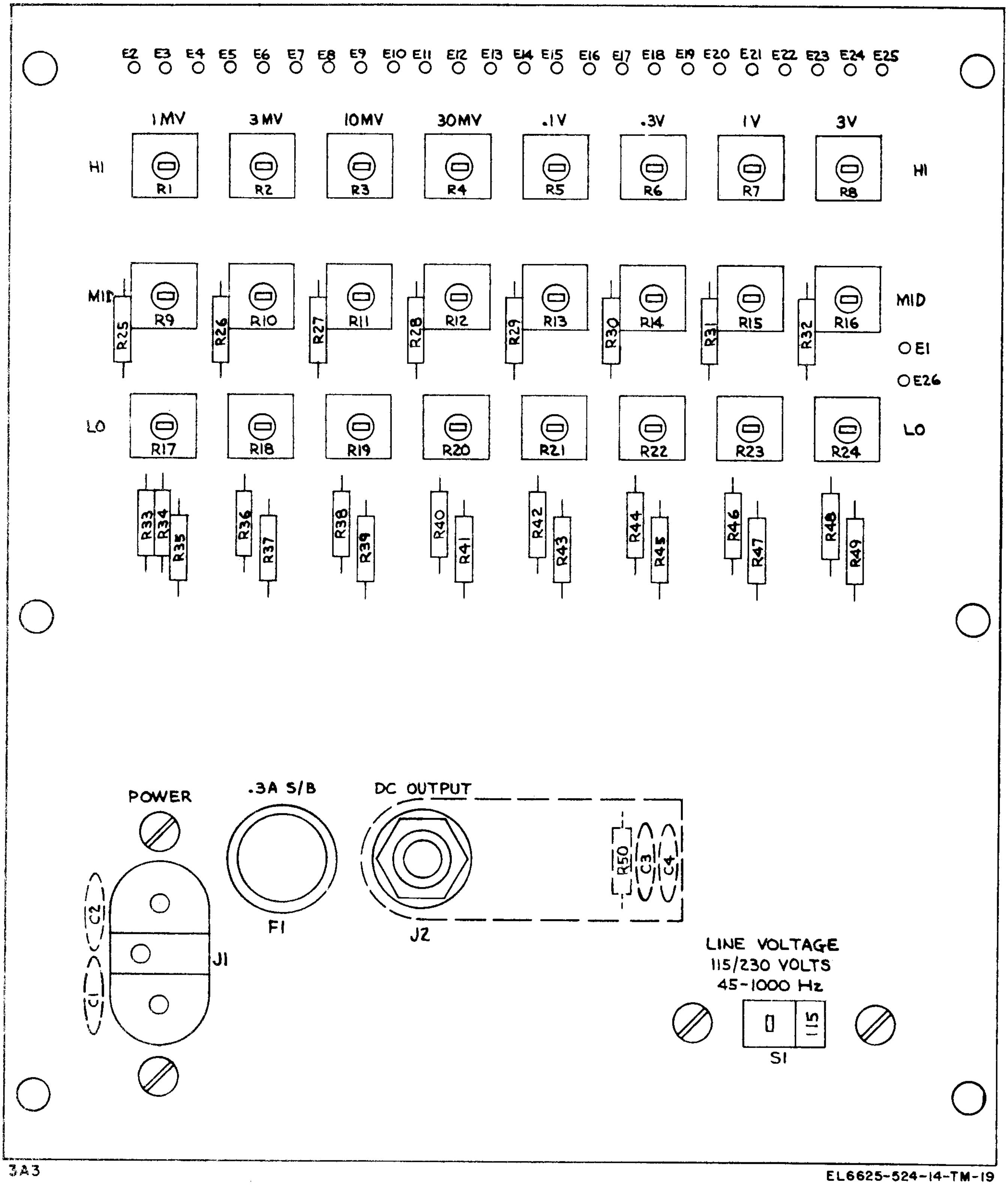

Figure 6-3. Calibration board 3A3, location of parts.

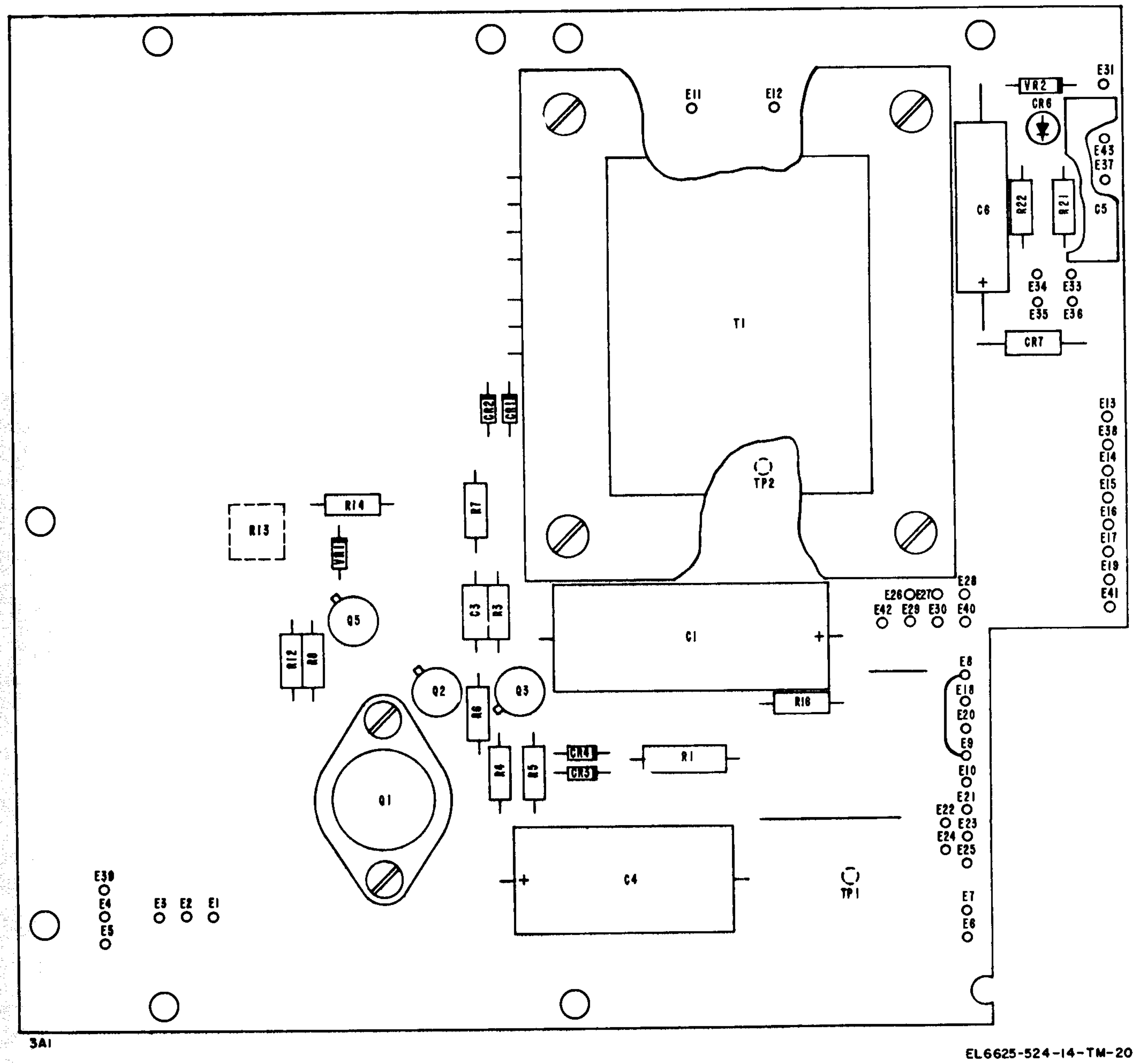

Figure 6-4. Regulated power supply 3A1, location of parts.

CHAPTER 7

GENERAL SUPPORT TESTING PROCEDURES

7-1. General Testing Procedures

a. Testing Procedures. The testing procedures are prepared for use by Electronic Field Maintenance Shops and Electronic Service Organizations responsible for general support maintenance of electronic equipment to determine the acceptability of repaired equipment. These procedures set forth specific requirements that repaired equipment must meet before it is returned to the using organization.

b. Preliminary Instructions. Follow the instructions preceding each procedure before proceeding to the procedure. Perform each step in sequence. Do not vary the sequence.

7-2. Test Equipment Required

The test equipment required for general support testing is shown in table 7-1.

Table 7-1. Test Equipment

Test equipment	*Technical manual*
Oscillator AN/URM-127	T. O. 33A1-8176
Oscilloscope AN/USM-281	TM 11-6625-1703-15
Variable Transformer CN-16B/U	
Voltmeter ME-30B/U	TM 11-6625-320-12
Adapter. Millivac So. 900-2100	
Cable Assembly. RF CG-409H /U (2 ea)	

7-3. Power Supply Test

a. Test Equipment.

(1) Oscilloscope AN/USM-281.

(2) Variable Transformer CN-16B/U.

(3) Voltmeter ME-30B/U.

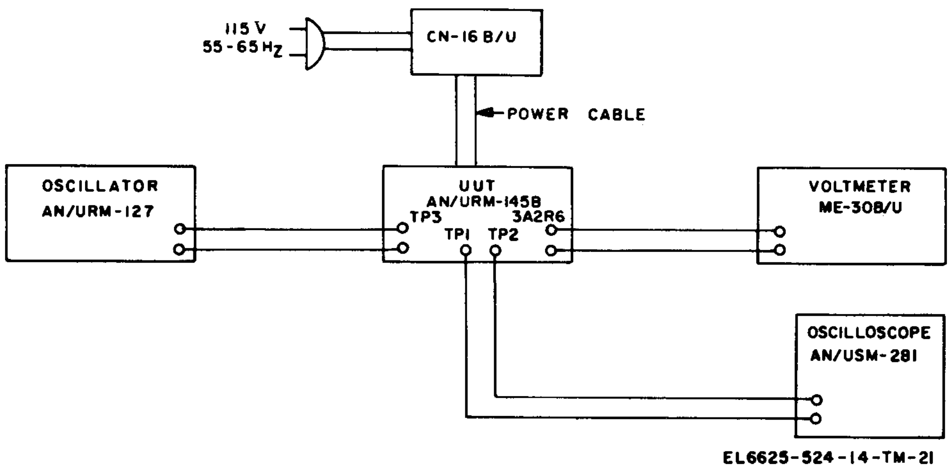

Figure 7-1. Power supply test setup.

b. Test Connections. Connect the unit under test (UUT) to the CN-16B/U which is connected to a 115-volt, 60-Hz source.

c. Procedure.

(1) Turn the range selector switch on the UUT to the 3 VOLTS range.

(2) Using the ME-30B/U, measure the voltage and adjust the CN-16B/U for a 115-volt output .

(3) On the UUT, turn the LINE switch to ON.

(4) Connect the ME-30B/U to 3A1TP1 and 3A1TP2 on the UUT (3A1TP2 is the negative side).

(5) Adjust 3A1R13 until the ME-30B/U reads 14.5-volt dc.

(6) Connect the ME-30B/U from 3A1TP2 to chassis. A reading of - 8.6-volt ± 5 percent should be obtained.

(7) Connect the ME-30B/U from the center tap of the chopper driver coil (3G1) to the chassis. A reading of - 2.5-volt ± 20 percent should be indicated.

(8) Allow UUT to operate for 24 hours and recheck (5), (6), (7) above.

(9) Connect the AN/USM-281 between 3A1TP1 and 3A1TP2 with vertical gain at 1 millivolt/centimeter (rev/cm). Ripple shall be from 0.5 to 1 microvolt (rev) at 120 Hz.

(10) Adjust CN-16B/U for 103.5 volt output. There shall be no noticeable change in ripple amplitude.

(11) Adjust CN-16B/U for a 126.5-volt output. No noticeable change in ripple amplitude should occur.

7-4. Preamplifier and Amplifier Test

a. Test Equipment.

(1) Oscilloscope AN/URM-281.

(2) Oscillator AN/URM-127.

(3) Voltmeter ME-30B/U.

(4) Adapter, Millivac No. 900-2100.

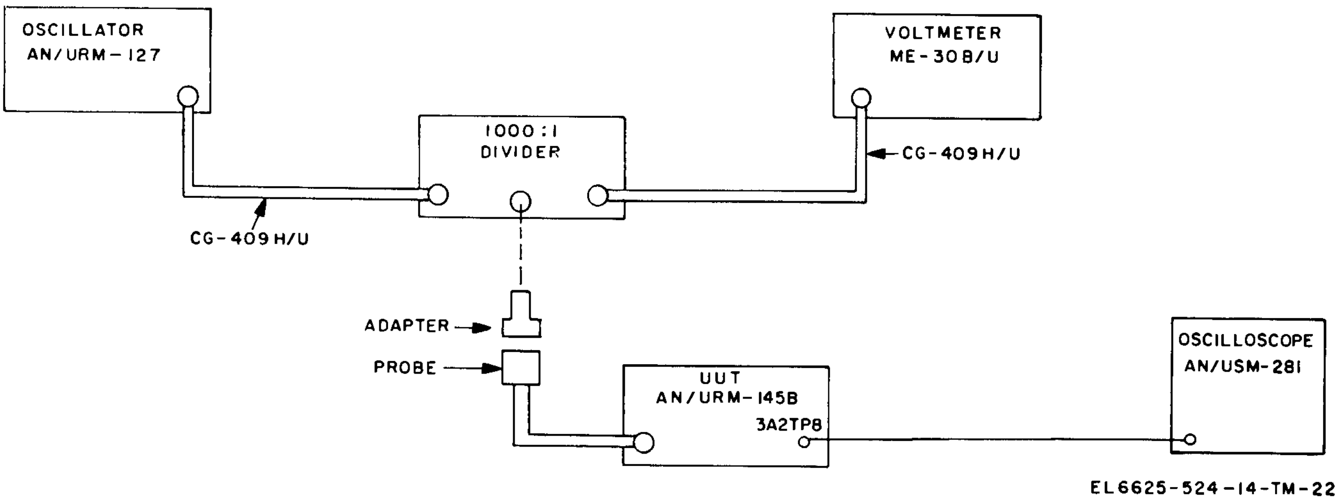

Figure 7-2. Preamplifier and amplifier test setup.

b. Test Connections.

(1) Connect the AN/URM-127 to the divider.

(2) Connect the ME-30B/U to measure the divider output voltage.

(3) Connect the adapter to the output of the divider.

(4) Connect the UUT probe to the adapter.

c. Procedure.

(1) On the AN/URM-127, setthe output to 0 db on the 10 volt range at 60 Hz.

(2) With the UUT out of the case, use aluminum shields on the bottom and left side to shield the unit from stray signals. Connect the shields to the unit chassis.

(3) Connect the ME-30B/U at the junction of 3A2R6 and C7 and ground. The reading on the ME-30B/U shall he greater than 60 db.

(4) Adjust the mechanical zero on the front panel meter to SET REF.

(5) Set the range selector switch at 0.001 range.

(6) Set the LINE switch at ON.

(7) Connect the AN/USM-281 between 3A2TP8 and ground.

(8) Adjust the SET REF control for minimum noise on the AN/USM-281. The reading shall be approximately 30 mvPP.

(9) On the AN/URM-127, set the output for 1 volt. The AN/USM-281 shall read approximately 300 mvPP and the waveshape shall be sinusoidal.

7-5. Voltage Accuracy Test

a. Test Equipment.

(1) oscillator AN/URM-127.

(2) Voltmeter ME-30B/U.

(3) Cable Assembly, RF CG-409H/U (4 FT) (2 each).

(4) BNC tee.

b. Test Connections.

(1) Connect the 50-ohm termination to the rf probe and connect the probe to the UUT.

(2) Connect one end of the CG-409H/U to the AN/URM-127 output.

(3) Connect the second end of the CG-409H/U to one side of the BNC Tee.

(4) Connect one end of the second CG - 409H/U to the second side of the BNC Tee.

(5) Connect the second end of the CG-409H/U to the ME-30B/U.

(6) Connect the rf probe to the BNC tee output .

c. Procedure. Adjust the AN/URM-127 frequency to 500 KHz and the output amplitude to the values shown below. The UUT readings will be within tolerance.

UUT		*ME-30B/U*	
range selector position	*meter indication (volts)*	min	*max*
.001	.003	.000285	.000315
.001	.006	.000570	.000630
.001	.001	.000950	.001050
.003	.001	.000970	.001030
.003	.002	.00194	.00206
.003	.003	.00291	.00309
.01	.003	.00291	.00309
.01	.006	.00582	.00618
.01	.01	.0097	.0103
.03	01	.0097	.0103
.03	.02	.0194	.0206
.03	.03	.0291	.0309
.1	.03	.0291	.0309
.1	.06	.0582.	.0618
.1	.1	.097	.103
.3	.1	.097	.103
.3	.2	.194	.206
.3	.3	.291	.309
1	.3	.291	.309
1	.6	.582	.618
1	1	.97	1.03
3	1	.97	1.03
3	2	1.94	2.06
3	3	2.91	3.09

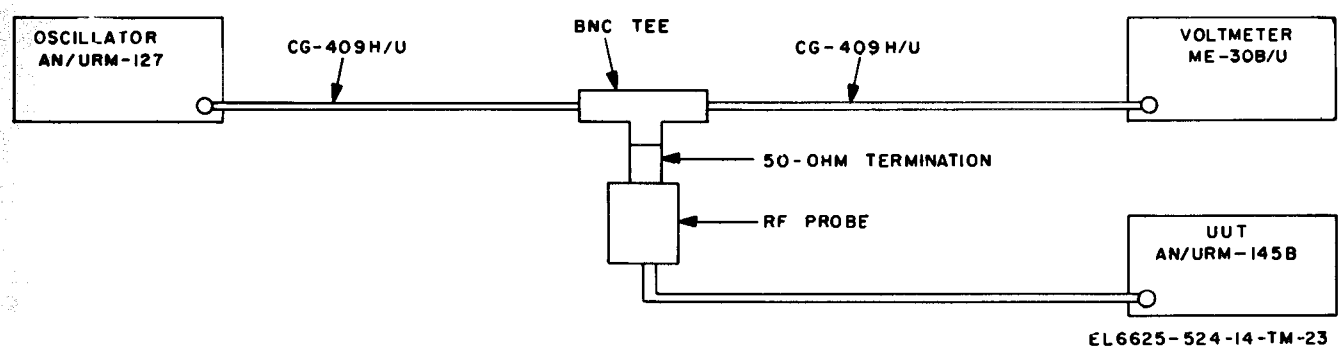

Figure 7-3. Voltage accuracy test setup.

APPENDIX A
REFERENCES

The following is a list of references that are available to the operator, and organizational and general support maintenance personnel for the AN/URM-145B.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	Military Publications: US Army Equipment Index of Modification Work Orders.
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.
TM 11-6625-320-12	Operator's and Organizational Maintenance Manual: Voltmeter, Meter ME-30A/U and Voltmeters, Electronic ME-30B/U, ME-30C/U, and ME-30E/U.
TM 11-6625-524-24P-2	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for Voltmeter, Electronic AN/URM-145B.
TM 11-6625-573-14-1	Operator's, Organizational, Direct Support, and General Support Maintenance Manual Including Repair Parts and Special Tools Lists (Including Depot Repair Parts and Special Tools List): Generator, Signal AN/GRM-50C.
TM 11-6625-683-15	Operator's, Organizational, Direct Support, General Support, and Depot Maintenance Manual: Signal Generator AN/URM-127.
TM 11-6625-1703-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual Including Repair Parts and Special Tool Lists: Oscilloscope AN/USM-281A.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 740-90-1	Administrative Storage of Equipment.
TM 750-244-2	Procedure for Destruction of Electronics Materiel Equipment to Prevent Enemy Use (Electronics Command).

APPENDIX C
MAINTENANCE ALLOCATION

Section I. INTRODUCTION

C-1. General

This appendix provides a summary of the maintenance operations for AN/URM-145B. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

C-2. Maintenance Function

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system. This function does not include the trial and error replacement of running spare type items such as fuses, lamps, or electron tubes.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components.

C-3. Column Entries

a. Column 1, Graup Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a “work time” figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate, “work time” figures will be shown for each category. The number of task-hours specified by the “work time” figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C - Operator/Crew
O - Organizational
F - Direct Support
H - General Support
D - Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

C-4. Tool and Test Equipment Requirements (Sect. III)

a. Tool or *Test Equipment Reference Code.* The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool *Number.* This column lists the manufacturer’s part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

C-5. Remarks (Sect. IV)

a. Reference Code. This code refers to the appropriate item in section II, column 6.

b. Remaks. This column provides the required explanatory information necessary to clarify items appearing in section II.

SECTION II MAINTENANCE ALLOCATION CHART
FOR

VOLTMETER, ELECTRONIC AN/URM-145B

(1) GROUP UMBER	(2) COMPONENT/ASSEMBLY	(3) IAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O		H	D	(5) OOLS AND QPT.	(6) REMARKS
00	'OLTMETER, ELECTRONIC AN/URM-145B								
01	'oltmeter, Electronic ME-247 C/U	nspect		.2				ual	A
		ervice		.5				9	B
		epair		.2				9	C
		nspect				).3		ual	D
		eplace				).2		8	E
		'est				).6		-4, 7	F
		lign				).2		1, 5	G
		epair				).5		8	
		)verhaul					3.0	-8	
02	Power Supply 828-02	'est				).4		,2,5	H
		Repair				).8		-8	
		ldjust				).1		1,5	I
03	Preamplifier and Amplifier 828-03	Test				0.6		,2,4,6	J
		Repair				).8		-8	
		ld just				0.2		,2,4	
04	Adapter Test 900-2050A	Replace				0.1			
		Repair				0.5		8	
05	Cable Assembly, Special Purpose Electrical 900-2000B	Replace				0.1			
		Repair				0.5		8	

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
VOLTMETER, ELECTRONIC AN/URM-145B

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	H,D	VOLTMETER, ELECTRONIC ME-30 ( )/U	6625-00-643-1670	
2	H,D	OSCILLOSCOPE , AN/USM-281A	6625 -00-228-2201	
3	H,D	GENERATOR, SIGNAL AN/GRM-50C	6625 -00-003-3238	
4	H,D	OSCILLATOR AN/URM-127	6625-00-783-5965	
5	H,D	VARIABLE TRANSFORMER CN-16/U	5950-00-688-5722	
6	H,D	ADAPTER, MILLIVAC #900-2100		
7	H,D	CABLE ASSEMBLY, RF - CG-409H/U (2 ea)	5995-00-933-5783	
8	H,D	TOOL KIT , ELECTRONIC, EQUIPMENT TK-100/G	5180-00-605-0079	
9	O	TOOLS AVAILABLE TC THE ORGANIZATIONAL USER BECAUSE OF ASSIGNED MISSION .		

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SECTION IV. REMARKS
VOLTMETER, ELECTRONIC AN/URM-145B

REFERENCE CODE	REMARKS
A	External Receptacles, meter glass, knobs, controls, and switches for proper action, cables for cuts, cracks or fraying external hardware, rust and corrosion.
B	Clean exterior surfaces, remove dirt, grease end fungus, rust and corrosion. Apply touchup paint.
C	Repair through replacement of burned out fuse, defective knobs and switches.
D	Loose or missing hardware check switches, controls, connections and PC boards.
E	Replace missing or defective hardware.
F	Operational checks to localize troubles. Voltage & resistance measurements, voltage accuracy tests.
G	Voltage adjustments.
H	Voltage and ripple tests.
I	Output voltage adjustments.
J	Noise, Voltage and Waveshape Tests.

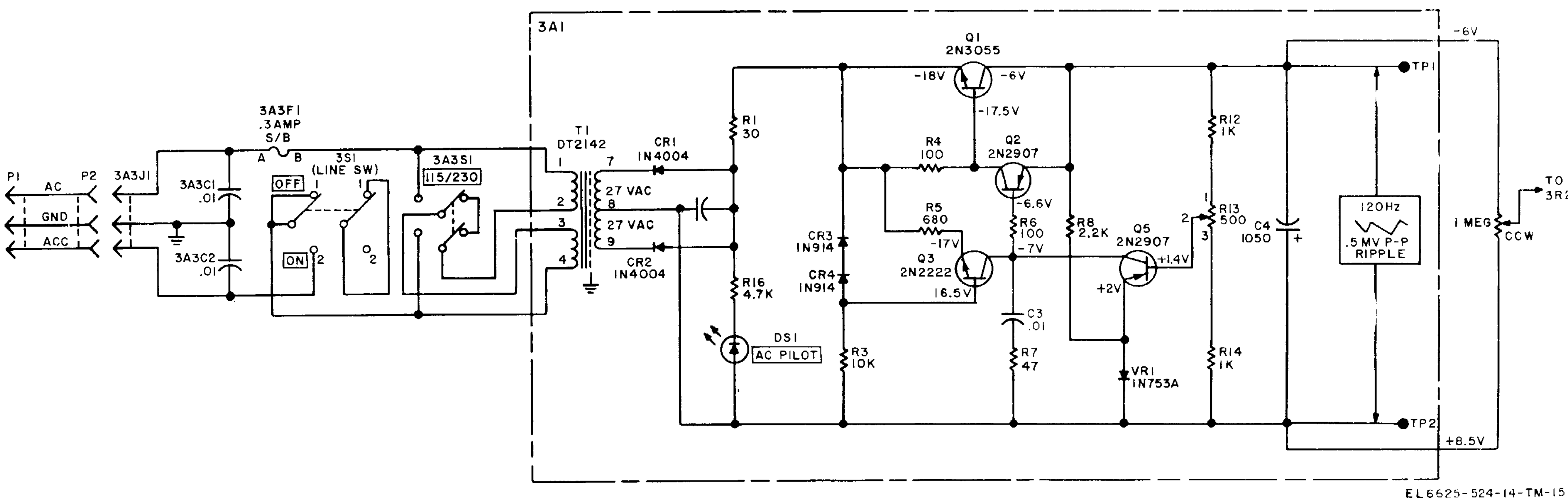

Figure 5-9. Regulated power supply, simplified schematic diagram

NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTORS ARE 1/2 WATT, 10 % ; SHOWN IN OHMS. CAPACITORS ARE SHOWN IN MICROFARADS.
2. * DENOTES SELECT AT TEST COMPONENT.
3. VOLTAGE MEASUREMENTS:
   WITH INPUT LINE VOLTAGE OF 115 VAC.
   VALUES INDICATED ARE ± 10 % WITH RESPECT TO CHASSIS GROUND.
4. WAVEFORMS SHOWN ARE TYPICAL AT 94 Hz.
5. P3, A1, AND A2 SHALL BE SERVICED BY MILLIVAC INSTRUMENTS.
6. REFERENCE DESIGNATION PREFIXES:
   3 — FRONT PANEL.
   3A1 — POWER SUPPLY.
   3A2 — MAIN AMPLIFER BOARD.
   3A3 — CALIBRATION PLATE BOARD.

Figure 5-10. Voltmeter, Electronic AN/URM-145B, schematic diagram.

By Order of the Secretary of the Army:

FRED C. WEYAND
Geneml, United States Army,
Vice Chief of Staff.

Official:
VERNE L. BOWERS
Major General, United States Army,
The Adjutant General.

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THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'/EIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

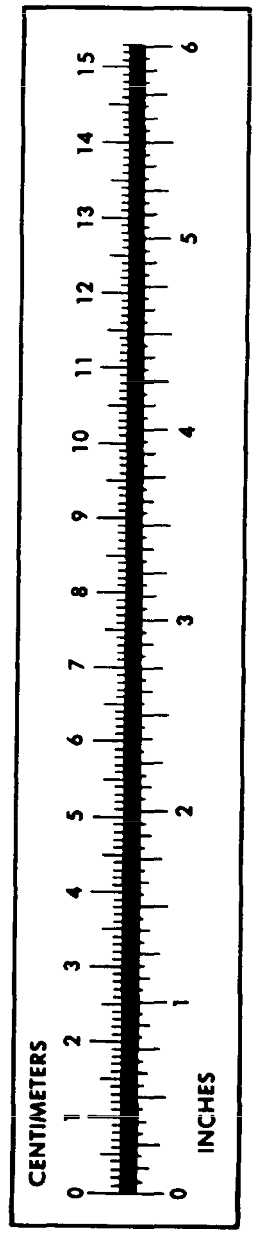
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
.allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
'ers	Gallons	0.264
.ms	Ounces	0.035
.ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
''lometers per Liter	Miles per Gallon	2.354
›meters per Hour	Miles per Hour	0.621



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