

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

FIELD AND DEPOT
MAINTENANCE
RADIO TEST SET
AN/URM-113



HEADQUARTERS, DEPARTMENT OF THE ARMY
JUNE 1959

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the 250-volt and 150-volt plate and power supply circuits, or on the 115-volt ac line connections. Serious injury or death may result from contact with these points.

DON'T TAKE CHANCES

Change
No. 4

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 16 December 1969

**DS, GS, and Depot Maintenance' Manual
RADIO TEST SETS AN/URM-113 AND AN/URM-113A**

TM 11-6625-206-35, 18 June 1959, is changed as follows:

NOTE

The parenthetical reference to a previous change (example: (page 5 of C 2)) indicates that pertinent material was published in that change.

Page 14, paragraph 18c (1). Delete the second sentence and substitute:
Use resistor and capacitor color codes (fig. 25) to find the value of the components.
Page 15, paragraph 19 (page 8 of C 3). Delete the chart and substitute:

Test equipment	Technical manual	Common name
Test Set, Electron Tube TV-7(*) /Ua	TM 11-6625-274-12	Tube Tester
Multimeter ME-26(*) /Ub	TM 11-6625-200-15	Multimeter
Power (Variable) Transformer CN-16/U		Variable Power transformer

^a Indicates TV-7 /U, TV-7A /U TV-7B /U, and TV-7D U.
^b Indicates ME-26A /U, ME-26B /U ME-26C /U, and ME-2D /U.

Page 22, paragraph 25 (page 11 of C 3). Delete the chart and substitute:

Test equipment and special tools	Technical manual	Common name
Multimeter ME-26B /U	TM 11-6625-200-15	Multimeter
Resistors, Decade ZM-16(*) /U ^a	TM 11-5102	Decade resistance box
Test Set, Meter TS-682A/GSM-1	TM 11-2535B	Meter test set
Digital Readout, Electronic Counter AN/USM-207	TM 11-6625-700-10	Frequency counter
Oscilloscope AN/USM-281A	TM 11-6625-1703-15	Oscilloscope
Voltmeter, Electronic ME-30(*) /Ub	TM 11-6625-320-12	Ac voltmeter
Adapter, Tube Socket UG-104/U		Adapter
(part of Tube Socket Adapter MX-1258/U)		
Cable RF RG-58C/U (3 feet)		Cable
Test Lead Set CX-1331A/U		Test lead set

^a Indicates ZM-16 /U, ZM-16A /U and ZM-IBB /U.
^b Indicates ME-30B/U, ME-30C/U, ME-30E/U, and Voltmeter, Meter ME-30A/U.

Page 23, figure 22.2 (page 20 of C 3).
 Delete figure 22.2 and substitute the new figure 22.2.

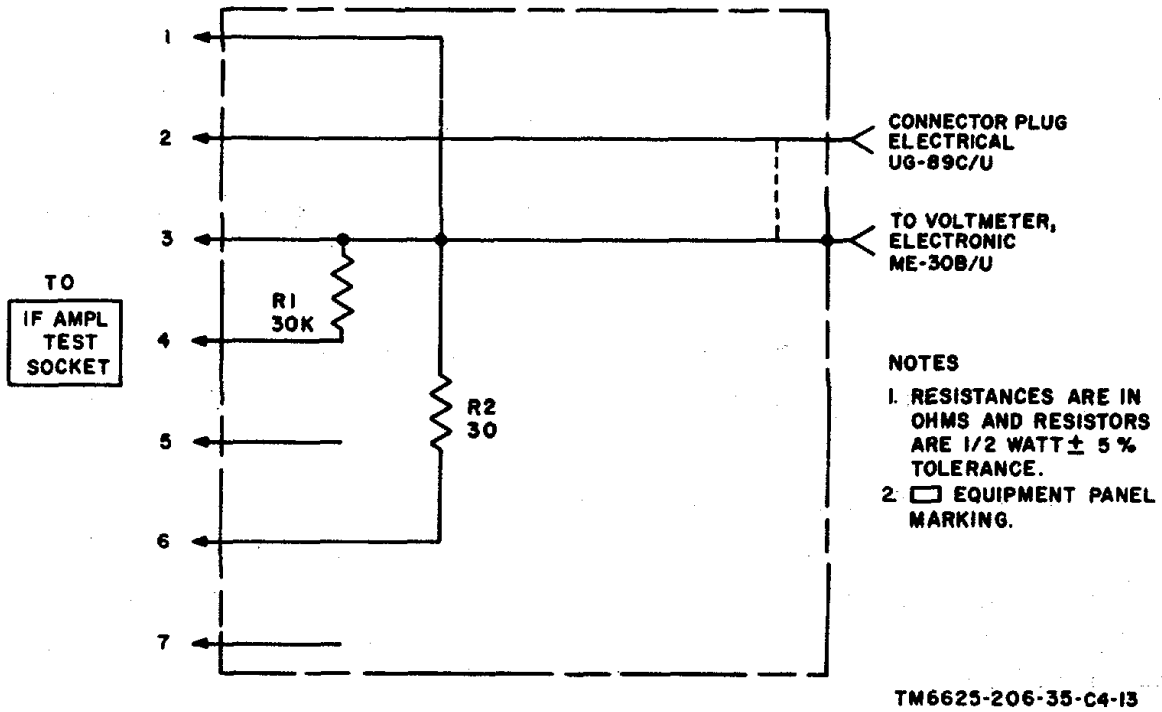


Figure 22.2. Special test plug (AN/URM-113A).

Add figure 22.3 after figure 22.2.

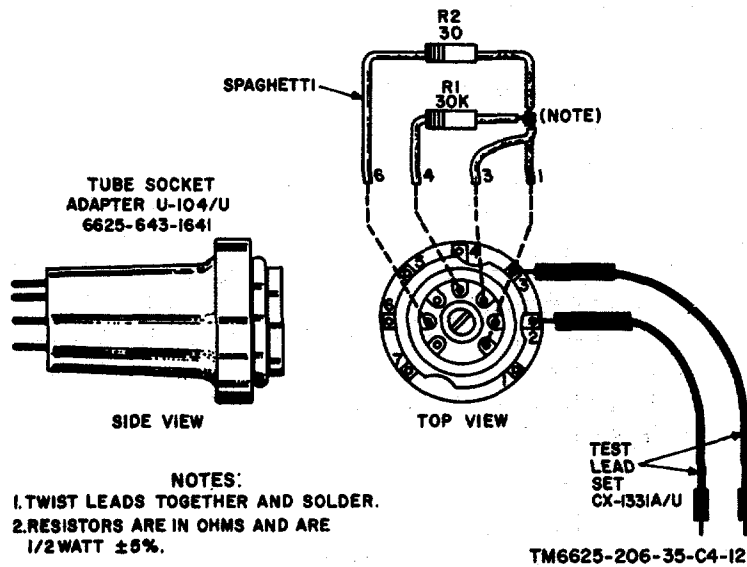


Figure 22.3. Fabricated test plug for TEST SOCKETS.

CHAPTER 4 DEPOT OVERHAUL STANDARDS

Section I. INTRODUCTION

34. Applicability of Depot Overhaul Standards

The tests outlined in this chapter are designed to measure the performance capability of a repaired equipment. Equipment that is returned to stock should meet the standards given in these tests.

35. Applicable References

a. Repair Standards. Applicable procedures of the Army depots performing these tests and its general standards for repaired electronic equipment given in TB SIG 355-1, TB SIG 355-2, and TB SIG 355-3 form a part of the requirements, for testing this equipment.

b. Technical Publications. The technical publications applicable to this equipment are TM 11-6625206-12 and TM 11-6625-206-35.

c. Modification Work Orders. Perform all modification work orders applicable to this equipment

before making tests specified. DA Pam 310-7 lists all available MWO's.

36. Test Conditions

a. All tests shall be performed at normal room temperature.

b. The equipment shall be energized for at least 30 minutes before tests are made, unless otherwise indicated.

c. Unless otherwise indicated, the power supply shall be 105 to 125 volts alternating current (ac), 50 to 400 cycles per second (cps), single phase. Connect the equipment through Power (Variable) Transformer CN-16/U to facilitate adjustment of the line input voltage when other than 115 volts ac is indicated.

Section II. DEPOT OVERHAUL TESTS FOR AN/URM-113

37. Testing Overhauled AN/URM-113

Use the ac voltmeter and the TF-204/U to test an overhauled AN/URM-113. Test the AN/URM-113 as indicated in a through n below:

a. Set the AN/URM-113 FUNCTION SELECTOR switch to ZERO ADJ, and rotate the ZERO ADJ control fully clockwise. The meter pointer should deflect upscale at least 5 divisions.

b. Set the FUNCTION SELECTOR switch to DC CENTER ADJ, and rotate the DC CENTER ADJ control fully counterclockwise. The meter pointer should not deflect less than 1 1/2 divisions upscale from DC CENTER.

c. With the FUNCTION SELECTOR switch still at DC CENTER ADJ, rotate the DC CENTER ADJ control fully clockwise. The meter pointer should not deflect less than 1 divisions upscale from DC CENTER.

d. Set the AN/URM-113 FUNCTION SELECTOR to CAL LEVEL and FREQUENCY SELECTOR to CTR, and adjust the RF CAL control until the meter pointer rests at CAL LEVEL. Set the FREQUENCY SELECTOR switch at L, and then to H. The meter pointer should remain at the CAL LEVEL line $\pm 1/2$ division in all three positions of the FREQUENCY SELECTOR switch.

e. Set the FUNCTION SELECTOR switch at INT IF BAL and the FREQUENCY SELECTOR to CTR. Insert test plug P2 in test socket X2; then rotate the RF CAL control fully clockwise. The indication on the meter should not be less than 50 on the numerical scale.

f. Set the FUNCTION SELECTOR switch at INT IF BAL and the FREQUENCY SELECTOR switch to L (keep test plug P2 in test socket X2). Adjust the RF CAL control so that the meter pointer rests at 32, and then set the FUNCTION SELECTOR switch at H. The meter pointer should remain at $32 \pm 1/2$ division.

g. Set the FUNCTION SELECTOR switch at INT IF BAL and the FREQUENCY SELECTOR switch at CTR. Test plug P2 is in test socket X2. Adjust the RF CAL control so that the meter pointer rests at 50. Remove test plug P2 and use the special test setup of figure 22.1 to measure the voltage at pin 2 of the IF AMPL TEST SOCKET. The voltage at pin 2 should be 150 millivolts (mv) ± 5 .

h. Set the FUNCTION SELECTOR switch at CAL LEVEL and the FREQUENCY SELECTOR switch at CTR. Adjust the RF CAL control for a CAL LEVEL indication on the meter. Set the FUNCTION SELECTOR switch at IF TEST. Use the special test setup of figure 22.1. Measure the voltage at pin 2 of the IF AMPL TEST SOCKET. The voltage at pin 2 should be 10 ± 0.5 mv.

i. Set the FUNCTION SELECTOR switch at INT DISCR BAL and the FREQUENCY SELECTOR switch at L. Adjust the RF CAL control to 30 on the numerical scale. Set the FREQUENCY SELECTOR switch at H. The meter pointer should remain at 30 ± 1 division.

j. Set the FUNCTION SELECTOR switch at CAL LEVEL and the FREQUENCY SELECTOR switch at CTR. Adjust the RF CAL control for a CAL LEVEL indication on the meter. Use the special test setup of figure 22.1 to measure the voltage at pin 2 of the : DISCR TEST SOCKET. The voltage at pin 2 should be 275 mv ± 10 .

k. Set the FUNCTION SELECTOR switch at

DISCR TEST and the FREQUENCY SELECTOR switch at L. Adjust the DC CENTER ADJ control until the meter pointer rests at DC CENTER. Insert Transformer Discriminator TF-204/U and adjust the RF CAL control until the meter pointer rests at 10 on the scale. Measure the voltage between pins 3 and 7 of test socket X4 (fig. 20). The voltage should be +4.4 volts +5 percent (0.22 volt).

l. With the FUNCTION SELECTOR switch at DISCR TEST, set the FREQUENCY SELECTOR switch at H. Adjust the DC CENTER ADJ control until the meter pointer rests at DC CENTER. Insert the TF-204/U and adjust the RF CAL control until the meter pointer rests at 50 on the scale. The voltage should measure -4.4 +5 percent (0.22 volt).

m. Set the FUNCTION SELECTOR switch at EXT XTAL TEST and the FREQUENCY SELECTOR switch at EXT XTAL. Insert a good 1.0-megacycle (mc) crystal (FSN 5955-160-4029) from a radio set into the external crystal socket, and rotate the RF CAL control. The meter pointer should move upscale with a clockwise rotation of the RF CAL control.

n. With the FREQUENCY SELECTOR switch at EXT XTAL TEST and the FREQUENCY SELECTOR switch at EXT XTAL, press the PRESS FOR FILAMENT CAL switch and rotate the FILAMENT CAL control completely clockwise. The meter pointer should deflect to 2 divisions above center scale, ± 1 division.

38. Completion of Testing

a. Turn off the power and disconnect the power source.

b. Place the chassis back in its case, and secure all screws.

Section III. DEPOT OVERHAUL TESTS FOR AN/URM-113A

39. Test Facilities Required

The following equipment, or suitable equivalents, will be

used to determine compliance with the required standards given in this section.

a. Test Equipment.

Equipment	Technical Manual	Common name
Multimeter ME-26B/U	TM 11-6625-200-15	Multimeter
Digital Readout, Electronic Counter AN/USM-207	TM 11-6625-700-10	Frequency counter
Voltmeter, Electronic ME-30B/U	TM 11-6625-320-12	RF voltmeter
Audio Oscillator TS-421/U	TM 11-6625-355-12	AF oscillator
Test Set, Meter TS-628A/GSM-1	TM 11-253B	Meter test set
Power (Variable) Transformer CN-16/U		Variable power transformer

b. Additional Equipment.

Equipment	Common name
Plug, test (connects Connector Plugs, Electrical UG-88C/U and UG-89C/U, fig. 22.2).	Special test plug
Plug P2, Hickok (Supplied with AN/URM-113A)	Test plug.
Cable assembly (3 feet of Cable RF RG-58C/U with Connector Plug Electrical UG-88C/U on each end).	Special counter cable.
1.0-mc crystal	Test crystal.
Transformer Discriminator TF-204/	

When Test Lead Set CX-1331A/U is used, fabricate test plug as shown on figure 22.3.

40. Preliminary Checks

a. Check the operation of all controls and switches.

They shall operate freely, without binding, and switches shall index correctly with panel markings.

b. Check to see that the PILOT amp glows when the POWER switch is ON and power is connected.

41. Resistance Checks

Turn the AN/URM-113A ON for 1 minute to polarize the electrolytic capacitors, and then turn it OFF. With power disconnected from the AN/URM-113A, use the multimeter to make the resistance checks listed below.

the AN/URM-113A controls may be in any position during these tests. Refer to figure 24. The chassis must be removed from the carrying case to reach test points for this test. Be sure to connect the negative side of the multimeter to ground when it is used to measure ohms.

a. Check the resistance between pin 7 of XVS and chassis ground. The resistance shall be 150K ohms or greater.

b. Check the resistance between the + output terminal of CR8 and chassis ground. The resistance shall be 8 to 12 ohms.

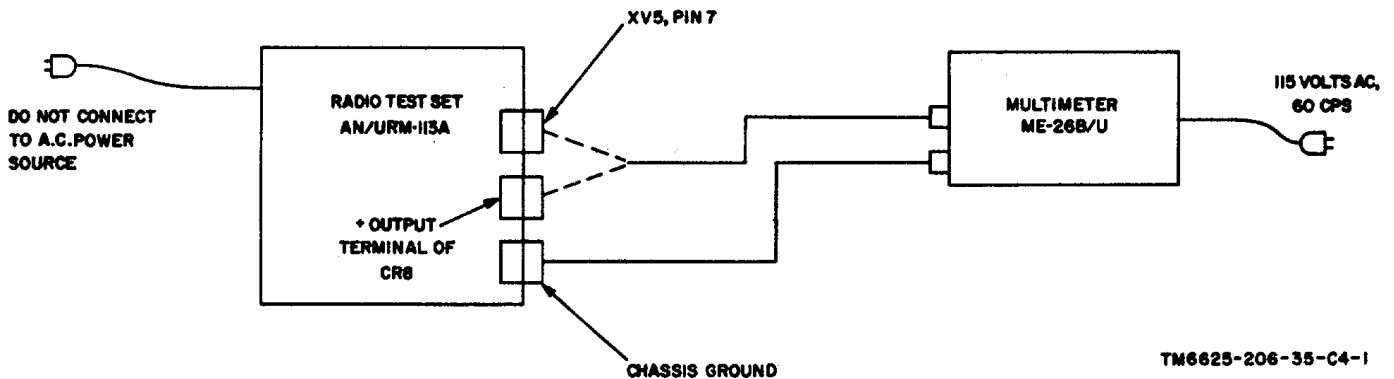


Figure 24. Resistance check, test setup.

42. Low Line Voltage Power Checks

With the equipment set up as shown in figure 24.1, make the checks described below. No warmup is necessary for these tests. The AN/URM-113A controls may be in any position during these tests. The chassis must be removed from the carrying case to reach the test points.

a. Adjust the variable power transformer to provide a 60-volt input to the AN/URM-113A. Set the POWER switch at ON.

b. Use the multimeter to check the ac voltage between terminal 9 of the power transformer and chassis ground. The voltage shall be 2.8 volts ac minimum.

c. Check the dc output between the + output (red) terminal of rectifier CR8 and ground. The output shall be 1.5 volts minimum.

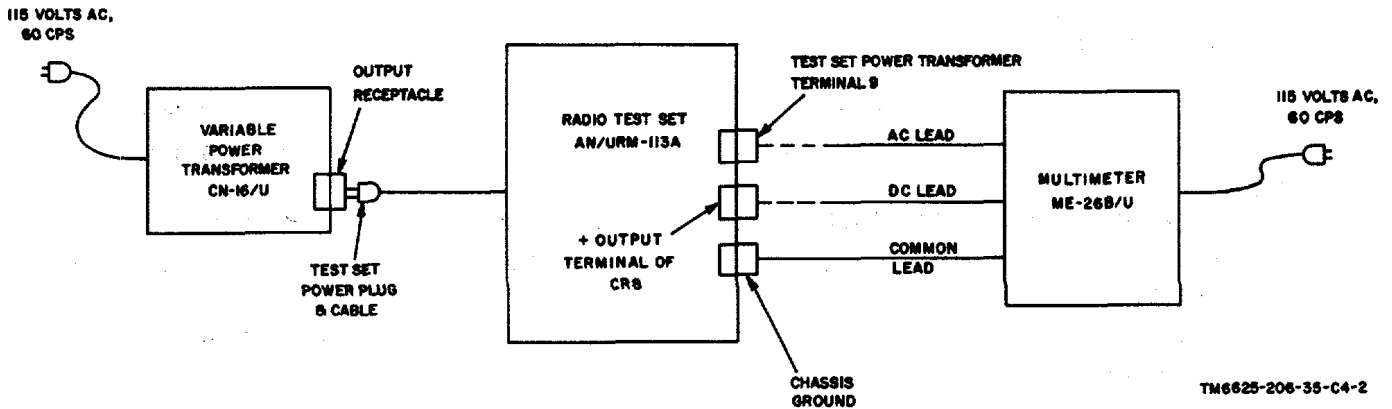


Figure 24.1. Low line voltage power checks, test setup.

43. Plug 150-Volt Regulated Dc Check

With the equipment set up as shown in figure 24.2, make the high voltage check described below. The chassis must be removed from the carrying case to reach the test points. At the beginning of the test, the POWER switch must be at OFF and all other controls can be in any position. Adjust the variable power transformer to 50 volts ac.

a. Connect the multimeter to pin 5 of regulator tube socket XV6, and the ground lead to any convenient chassis ground of the AN/URM-113A. Adjust the multimeter to the +300-volt dc, range.

b. Set the AN/URM-113A POWER switch at ON. After a few seconds, observe the gradual upscale deflection of the multimeter pointer. Increase the variable power transformer output voltage slowly, and observe the increase in upscale deflection of the multimeter pointer and then the abrupt downscale deflection which occurs when the gas in the voltage regulator becomes ionized. The ionization of the voltage regulator tube will occur well below the minimum operating line voltage of 105. Increase the voltage to 115 volts. The regulated dc voltage between pin 5 of socket XVR6 and ground will be between 140 and 174 volts.

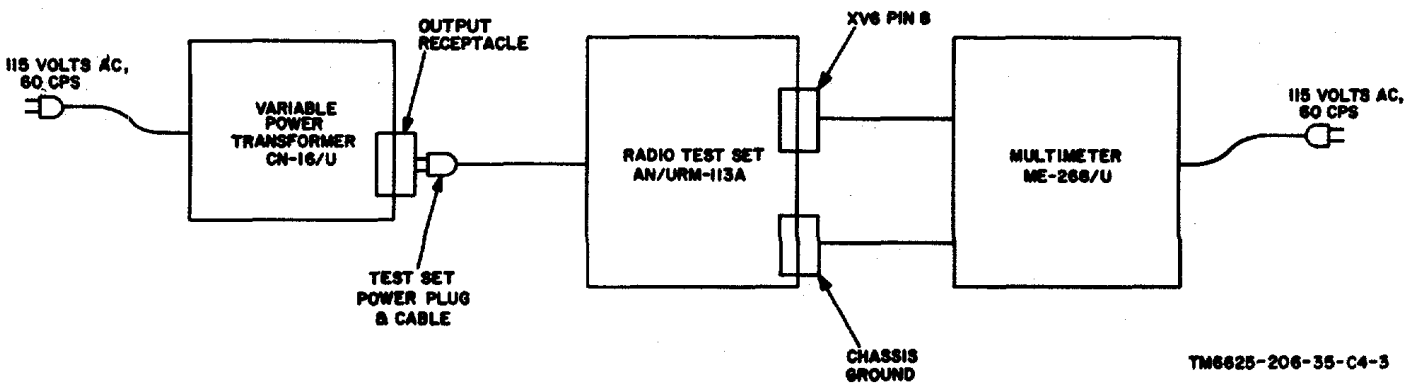


Figure 24.2. High-voltage power checks, test setup.

44. Warmup and Preliminary Alignment

Before performing the checks and tests described in paragraphs 45 through 52, make sure that the AN/URAM-113A is plugged into a 115-volt, 60-cycle power source. Set the POWER switch at ON, and allow the AN/URM113A to warm up for 30 minutes. Make the following adjustments after warmup:

a. Set the FUNCTION SELECTOR switch at ZERO ADJ and rotate the ZERO ADJ control until the AN/URM-113A meter indicates O SET.

b. Set the FUNCTION SELECTOR switch at DC CENTER ADJ and rotate the DC CENTER ADJ control until the AN/URM-113A meter indicates DC CENTER.

c. Press and hold the PRESS FOR FILAMENT CAL pushbutton and rotate the FILAMENT CAL control until the AN/URM 113A meter indicates CAL LEVEL. Release the pushbutton.

d. Set the FUNCTION SELECTOR switch at CAL LEVEL and the FREQUENCY SELECTOR switch at L.

Adjust the RF CAL control for a CAL LEVEL indication on the meter. Set the FREQUENCY SELECTOR switch at CTR and adjust the CTR OSC ADJ for a CAL LEVEL indication on the meter. Set the FREQUENCY SELECTOR switch at H and adjust the H OSC ADJ for a CAL LEVEL indication on the meter.

e. Return the FREQUENCY SELECTOR switch at CTR and adjust the RF CAL control fully counterclockwise.

45. Filament Voltage Level Check

Use the test setup as shown in figure 24.3 to check for test socket filament voltage. With the AN/URM113A aligned as described in paragraph 44, check the voltage between pin 6 of the IF AMPL TEST SOCKET and ground with the multimeter. The Voltage shall be +1.5 volts ± 0.075 .

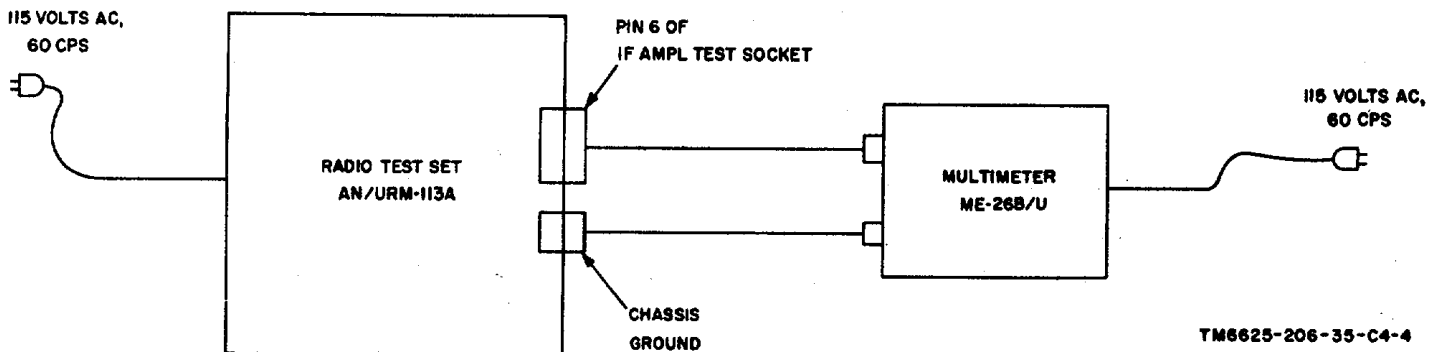


Figure 24.3. Filament voltage check, test setup.

46. Checking for +65 Volts Dc

With the AN/URM-113A warmed up and aligned as described in paragraph 44, test the +65-volt direct current (dc) output. Refer to figure 24.4 and proceed as follows:

a. Insert a special test plug (fig. 22.3) into the IF AMPL TEST SOCKET. Use the multimeter to check the dc voltage between pin 4 of the IF AMPL TEST SOCKET and chassis ground. Pin 4 is positive.

b. The multimeter shall indicate 65 volts ± 1 .

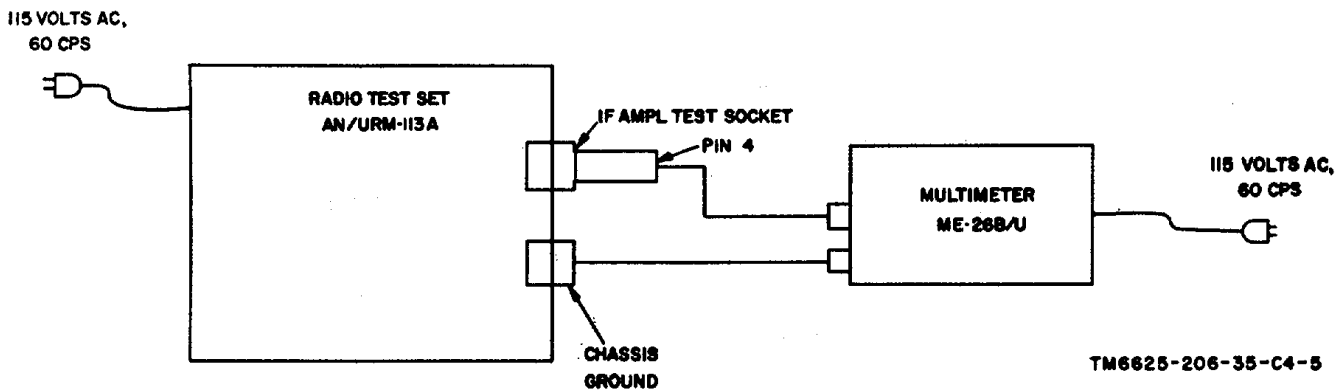


Figure 24.4. Test Setup for +65-vdc check.

47. Crystal Oscillator Frequency Check

With the AN/URM-113A warmed up and aligned as described in paragraph 44, check the oscillator frequency. Refer to figure 24.5 and proceed as follows:

a. Set the FUNCTION SELECTOR switch at CAL LEVEL and adjust the RF CAL control until the radio test set meter indicates CAL LEVEL, and then position the FUNCTION SELECTOR switch at DISCR TEST.

b. Connect the frequency counter to a special test plug (fig. 22.2) with the use of a 3-foot long Cable RF RG-58C/U equipped with UG-88C/U fittings at each end.

Connect the special plug to the AN/ URM-113A DISCR TEST SOCKET.

c. Turn the FREQUENCY SELECTOR switch to L. The frequency indicated by the frequency counter shall be 4.26 megacycles per second (mcs) + 0.005 percent.

d. Turn the FREQUENCY SELECTOR to CTR.

The frequency indicated by the frequency counter shall be 4.30 mcs + 0.005 percent.

e. Turn the FREQUENCY SELECTOR to H. The frequency indicated by the frequency meter shall be 4.34 mcs \pm 0.005 percent.

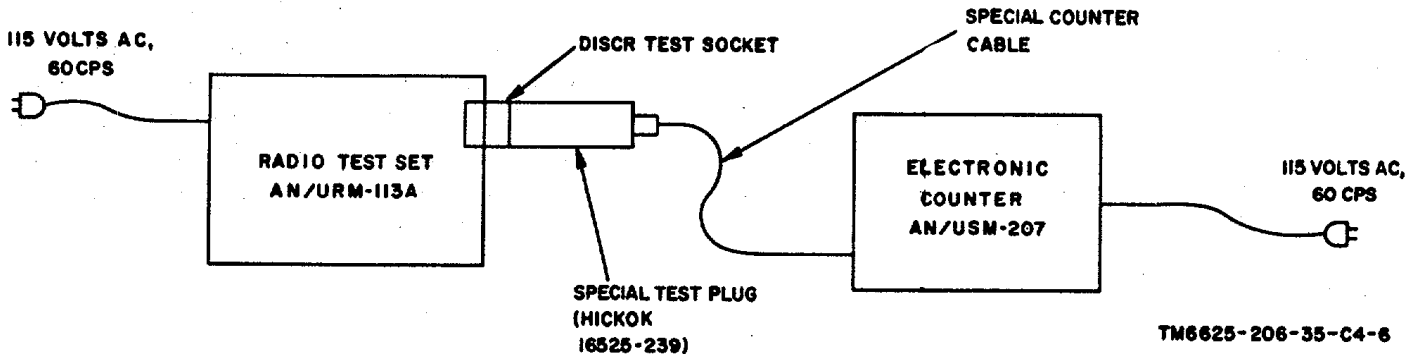


Figure 24.5. Test setup for crystal oscillator frequency check.

48. Discriminator Test Signal Level and Output Balance Check

With the AN/URM-113A warmed up and aligned as indicated in paragraph 44, check the discriminator test signal level. Refer to figure 24.6 and proceed as follows:

a. Set the FREQUENCY SELECTOR switch at CTR, and the FUNCTION SELECTOR switch at CAL LEVEL.

b. Adjust the RF CAL control for a CAL LEVEL reading on the AN/URM-113A meter.

c. Insert the special test plug into the DISCR TEST SOCKET and use the RF voltmeter to check the voltage level in d at right.

d. Set the FUNCTION SELECTOR at INT DISCR BAL. Check the voltage level indicated by the RF voltmeter. The voltage level shall be 400 millivolts \pm 20.

e. Observe the RF voltmeter indication when the FREQUENCY SELECTOR switch is switched to L and then H. The RF voltage should be identical. If it is not, adjust INT DISCR BAL control T3, using the alignment tool supplied with the AN/URM-113A, until identical voltages are indicated in both L and H positions of the FREQUENCY SELECTOR switch.

f. Return the FREQUENCY SELECTOR switch to CTR and note the ME-30B/U reading. It should be 400 millivolts \pm 20.

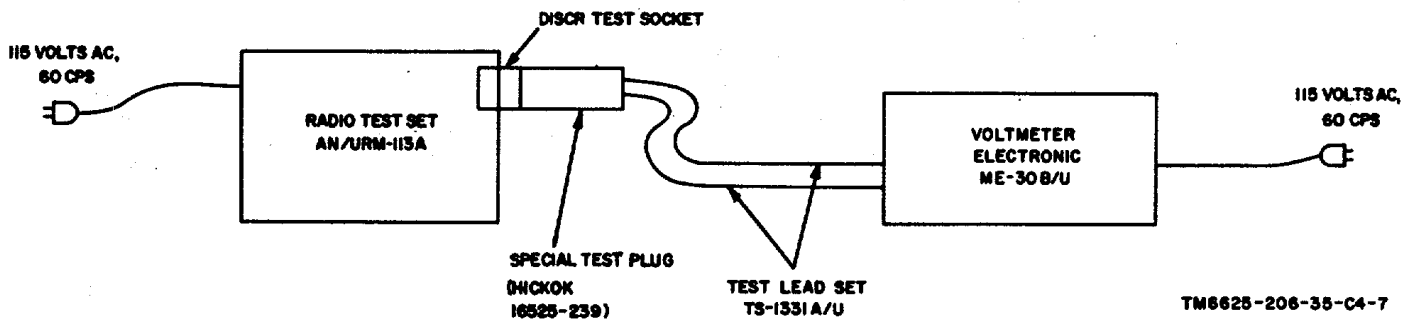


Figure 24.6. Discriminator test signal level, test setup.

49. Discriminator Test Sensitivity Check

With the radio test set warmed up and aligned as indicated in paragraph 44, check the discriminator test sensitivity. Refer to figure 24.7 and proceed as follows:

- Set the FUNCTION SELECTOR switch at DISCR TEST.
- Connect the meter test set to pin 7 of the DISCR TEST SOCKET and to chassis ground.
- Adjust the meter test set to provide approximately +7.2 volts dc to the AN/URM-113A, and

check the indication on the AN/URM-113A meter. Adjust the voltage until the pointer rests at the right edge of the blue block at the left of the meter. The voltage input must be +7.2 volts dc ± 0.4 .

- Apply approximately a -7.2 volts dc to the AN/URM-113A. Adjust the voltage from the meter test set until the AN/URM-113A pointer rests at the left edge of the blue block of the right of the meter. The voltage input must be -7.2volts dc ± 0.4 .

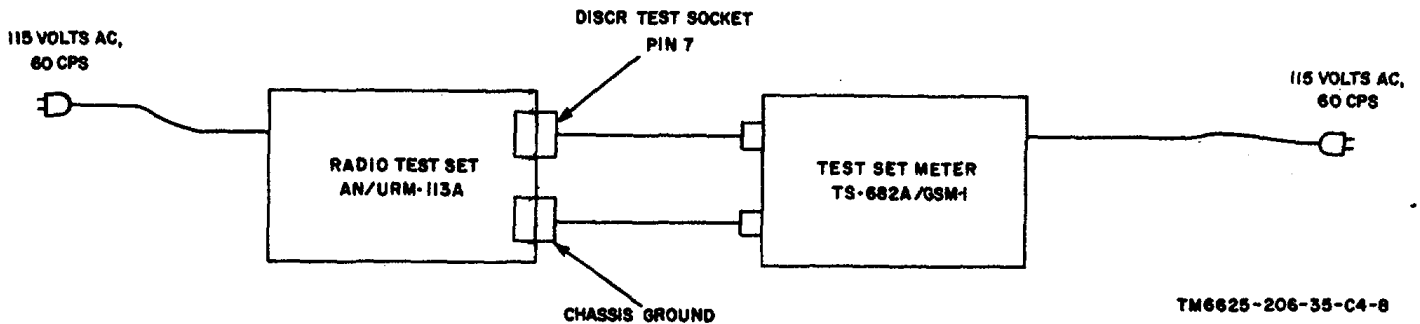


Figure 24.7. Discriminator test sensitivity, test setup.

50. IF Amplifier Test Signal Level Check

With the AN/URM-113A warmed up and aligned as indicated in paragraph 44, check the IF amplifier test signal level. Refer to figure 24.8 and proceed as follows:

- Set the FUNCTION SELECTOR switch at CAL LEVEL and adjust the RF CAL control until the AN/URM-13A meter indicates 24 DB, and then set the FUNCTION SELECTOR switch at IF TEST. Set the FREQUENCY SELECTOR switch at CTR.
- Connect the RF voltmeter to the special test plug and connect the special test plug to the IF AMPL TEST SOCKET. The RF voltmeter shall indicate 10.5 millivolts ± 0.5 .

- If the RF voltmeter is indicating above or below the level specified in b above, adjust INT BAL transformer T2 (can be reached through the front panel opening to the right of the IF AMPL TEST SOCKET) with the alignment tool for a reading of 10.5 millivolts ± 0.5 . The RF voltage monitored with the FREQUENCY SELECTOR switch at L should be identical with that of the RF voltage monitored with the FREQUENCY SELECTOR switch at H. If identical RF voltage readings are not obtained, adjust the INT IF BAL transformer (to the right of the IF AMPL TEST SOCKET) to obtain identical voltage measurements. Set the FREQUENCY SELECTOR switch at CTR and again check for an RF voltmeter indication of 10.5 millivolts ± 0.5 .

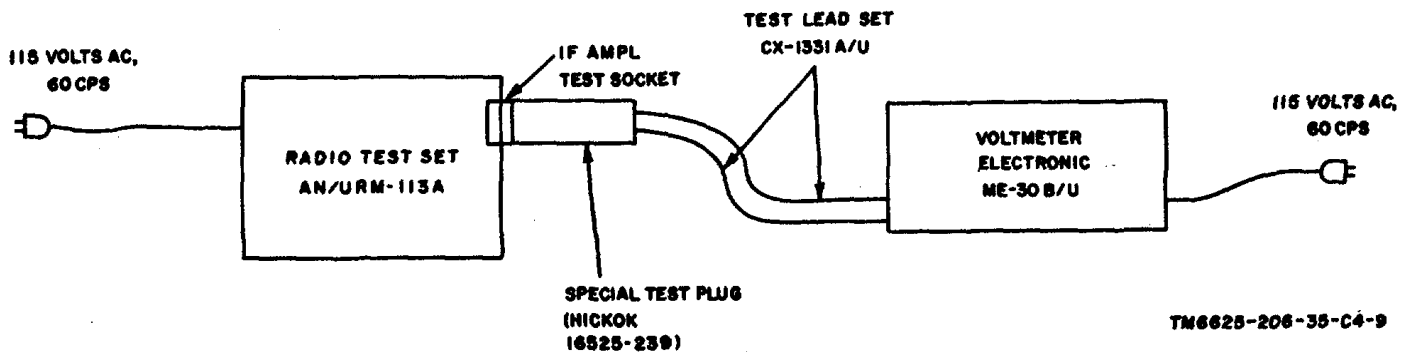


Figure 24.8. IF amplifier test signal level, test setup.

51. IF Amplifier Output Balance and Level Check

With the AN/URM-113A warmed up and aligned as indicated in paragraph 44, check the IF amplifier balance and level. Refer to figure 24.9 and proceed as follows:

- Set the FREQUENCY SELECTOR switch at L.
- Set the FUNCTION SELECTOR switch at INT IF BAL.
- Insert test plug P2 (supplied with Radio Test Set AN/URM-113A) in the IF AMPL TEST SOCKET and adjust the RF CAL control until the pointer of the AN/URM-113A meter aligns with the black line in the center of the left-hand green segment on the meter scale.
- Set the FREQUENCY SELECTOR switch at H.

The meter pointer shall indicate within the limits of the DC centerline and the 23 DB mark.

e. If the meter pointer does not indicate within limits prescribed in d above, adjust INT IF BAL output inductance L1 (can be reached through the front panel opening to the left of the IF AMPL TEST SOCKET) until the meter test set response is identical in the FREQUENCY SELECTOR L and H positions.

f. Set the FREQUENCY SELECTOR switch at CTR and adjust the RF CAL control for a CAL LEVEL indication on the meter.

g. Remove test plug P2 and connect the special test plug to the RF voltmeter and the IF AMPL TEST SOCKET.

h. The RF voltmeter shall indicate 150 millivolts ± 5 .

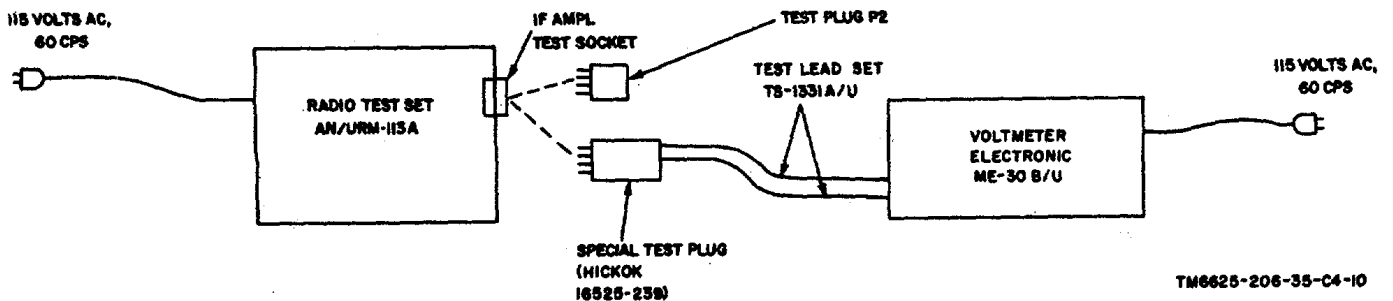


Figure 24.9. IF amplifier balance and level check, test setup.

52. Pulse Sweep Generator Calibration Check

With the AN/URM-113A warmed up and aligned as indicated in paragraph 44, check the pulse sweep generator calibration. Refer to figure 24.10 and proceed as follows:

- Turn the FILAMENT CAL control maximum counterclockwise.
- Set the FUNCTION SELECTOR switch at INT IF BAL.

c. Insert test plug P2 (supplied with Radio Test Set AN/URM-113A) in the IF AMPL TEST SOCKET and adjust the RF CAL control for a CAL LEVEL reading.

d. Connect the AF oscillator to the special test plug with Test Lead Set CX-1331A/U. Insert the special test plug in the PULSE SW GEN TEST SOCKET. The meter reading will drop to zero.

e. Adjust the AF oscillator to provide a 5-volt (verify voltage with the Multimeter) 500-cps signal, and then measure the voltage across resistor R12. This voltage shall be 1.25 volts ac ± 0.125 .

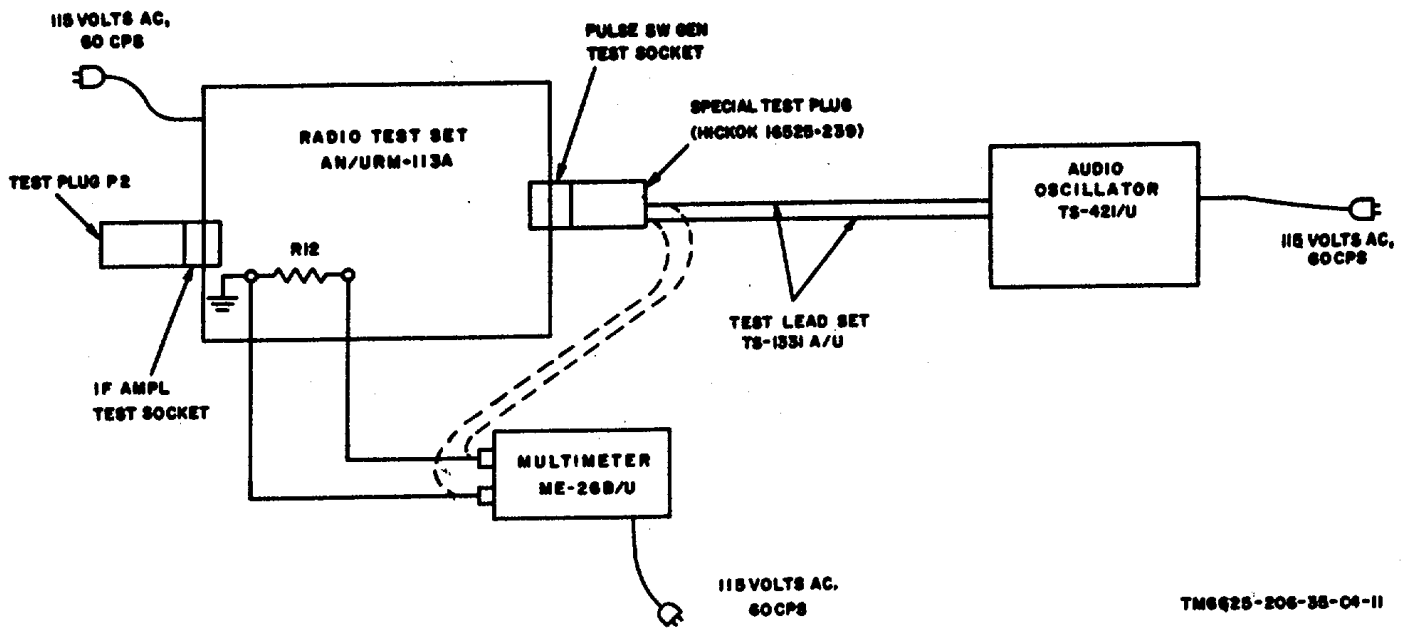


Figure 24.10. Pulse sweep generator calibration check, test setup.

53. External Crystal Set

With the AN/URM-113A warmed up and aligned as indicated in paragraph 44, check the external crystal circuits as follows:

- a. Set the FUNCTION SELECTOR switch at EXT XTAL TEST.
- b. Set the FREQUENCY SELECTOR switch at EXT XTAL.
- c. Insert a 1.0-mc test crystal into the EXT XTAL socket.

d. Rotate the RF CAL control clockwise and note the direction of movement of the radio test set meter pointer. It shall move upscale as the RF CAL control is rotated clockwise.

e. Remove the 1.0-mc crystal from the EXT XTAL socket. The meter pointer shall fall to zero.

Page 27, figure 24. Delete figure 24.

Page 28, figure 25. Delete and substitute:

Page 29, appendix (page 24 of C 3). Delete and substitute:

APPENDIX REFERENCES

The following is a list of applicable references that are available to the DS, GS, and depot maintenance personnel of Radio Test Sets AN/URM-113 and AN/URM- 113A.

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	U.S. Army Equipment Index of Modification Work Orders.
SC 5180-91-CL-R07	Sets, Kits, and Outfits Components List Tool Kit: Electronic Equipment. TK-105/G (FSN 5180-610-8177).
SC 5180-91-CL-R13	Sets, Kits, and Outfits Component List Tool Kit: Electronic Equipment TK-101/G (FSN 5180-064-5178).
TB SIG 355-1	Depot Inspection Standard for Repaired Signal Equipment.
TB SIG 355-2	Depot Inspection Standard for Refinishing Repaired Signal Equipment.
TB SIG 355-3	Depot Inspection Standard for Moisture and Fungus Resistant Treatment.
TM 11-2535B	Meter Test Set TS-682A/GSM-1.
TM 11-5102	Resistors, Decade ZM-16/U, ZM-16A/U, and ZM-16B/U.
TM 11-5820-292-10	Operator's Manual: Radio Sets AN/PRC-8, -8A, -9, -9A, -10, 10A, and -28.
TM 11-5820-292-20	Organizational Maintenance Manual: Radio Sets AN/PRC-8, -8A, -9, -9A, -10, -10A, and -28.
TM 11-5820-292-35	DS, GS, and Depot Maintenance Manual: Radio Sets AN/PRC-8, -8A, -9, -9A, -10, -10A.
TM 11-6625-200-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual: Multimeters ME-26A/U, ME-26B/U, ME-26C/U, and ME-26D/U.
TM 11-6625-206-12	Operator and Organizational Maintenance Manual: Radio Test Sets AN/URM-113 and AN/URM-113A.
TM: 11-6625-274-12	Operator's and Organizational Maintenance Manual: Test Sets, Electron Tube TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U.
TM: 11-6625-316-12	Operator and Organizational Maintenance Manual: Test Sets, Electron Tube TV-2/U, TV-2A/U, TV-2B/U, and TV-2C/U.
TM 11-6625-320-12	Operator and Organizational Maintenance Manual: Voltmeter, Meter ME-30A/U, and Voltmeters, Electronic ME-30B/U, ME-30C/U, and ME-30E/U.
TM 11-6625-355-12	Organizational Maintenance Manual: Audio Oscillators TS-421/U and TS-421A/U.
TM 11-6625-700-10	Operator's Manual: Digital Readout, Electronic Counter AN/USM-207.
TM 11-6625-1703-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual Oscilloscope AN/USM-281A Including Repair Parts and Special Tool Lists:
TM 38-750	Army Equipment Record Procedures.

Figure 26.1 (page 27 of C 3). Delete figure 26.1 and substitute the new figure 26.1.

By Order of the Secretary of the Army

W. C. WESTMORELAND
General, United States Army
Chief of Staff

Official:

KENNETH G. WICKHAM
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-51, direct and general support maintenance requirements for the AN/PRC-8, AN/PRC-9 and AN/PRC-10 radio sets.

U.S. GOVERNMENT PRINTING OFFICE: 1969 - 390-931i/12?6

804-213-1

CHANGE

No. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C, 26 August 1969

DS, GS, and Depot Maintenance Manual

RADIO TEST SETS AN/URM-113 AND AN/URM-113A

TM 11-6625-206-35, 18 June 1959, is changed as follows:

This change indicates that the manual also applies to the following equipment:

Nomenclature	Order No.
Radio Test Set AN/URM-113A	DAAB 05-68-C-0941 DAAB-05-68-C-0941
Radio Test Set AN/URM-113	36427-PC-62 (as added by C 2, 28 Nov 62)

The title of this manual is changed as shown above. Page 2, chapter 1. Add the following note below the title of chapter 1.

NOTE

Radio Test Set AN/URM-11,3A is similar to Radio Test Set A,N/URM'1'13. Information in this manual applies to both test sets ,unless otherwise specified.

Paragraph 1. Make the following changes:

Subparagraph a, line 2. After "AN/ URM-1: 13," add: -and AN/URM-11!3A.

Subparagraph b, line 4. After "AN/ URM-113," add: and AN/URM-113A.

Subparagraph c. Delete and substitute:

c. The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding General, U. S. Army Electronics Command, ATTN: AMSEL-ME-NMP-AD, Fort Monmouth, N. J., 07703.

Paragraph 2. Make the following changes:

Last line. Change "(fig. 1)" to: (fig. 1 or 1.1).

Add paragraph 2.1 after paragraph 2.

2.1. 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 PA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equip ment.

Paragraph 3. Make the following changes:

Line 3. After "figure 26," add: or 26.1.

Subparagraph b. Add the following between the 3rd and 4th sentence. On the AN/URM-113A only, an external test signal may be fed into the EXT SIG IN jack, land -this signal will appear at the output of the oscillator.

Page 3, paragraph 3. Make the following changes:

Subparagraph k. Delete and substitute:

k. *Internal Discriminator Balance Detector.* A detector consisting of CR4 and CR5 detects the output ,o(f V4 and applies this voltage to the vtm bridge through the FUNCTION SELECTOR switch. This voltage is used to check the alignment of discriminator driver stage V4 when the FUNCTION SELECTOR switch is set in INT DISCR BAL (position 8, fig. 1 or 1.1).

Add the following to subparagraph 1: On AN/URM-113A, the input to the bridge

***This change supersedes C 2, 28 November 1962.**

circuit is accessible at VTVM jacks E8 and E9.

Delete the last four sentences of subparagraph m and substitute: A type OA2WA tube, V6, provides a regulated 150 volts for all stages in the test sets, except the cathode follower stage of AN/URM-113. In the AN/URM-113, the second voltage regulator is a : type NEI4'8 neon lamp, VR'1, that provides a regulated 65 volts which is used mrhen testing if. amplifiers. In the AN/ URM-113A, this regulated 65 volts is provided by a type 1N981B Zener diode CR9 (fig. 1.1). Selenium rectifier CR8 is used in a full-wave bridge rectifier circuit that supplies 1.5 volts direct current (dc) to the filaments : of the -units under test.

Paragraph 4. Make the following changes: Add the following sentence to subparagraph a. In the AN/URM-113A, the oscillator is inoperative when an external signal is applied at J1 (EXT SIG IN) and FREQUENCY SELECTOR switch S1 is in the EXT XTAL position.

Subparagraph b, line 1. Change "(fig. 2)" to: (fig. 2 or 2.1).

Delete line 16 and substitute: Resistor RX, switched in by S1, is used to

Paragraph 5, heading. After "fig. 3," add: or 3.1.

Page 4, figure 1. Make the following changes:

Delete figure 1 and substitute the new figure 1.

Add figure 1.1 after figure 1:

Page 5, figure 2. Make the following changes:

Delete figure 2 and substitute the new figure 2.

Add figure 2.1 after figure 2:

Paragraph 5a. Make the following changes:

Line 3. Change "(fig. 2)" to: (fig. 2 or 2.1).

After the third sentence, add: On the AN/URM-113A, this latter contact is also connected to EXT SIG IN jack J1.

Paragraph 6, line 8 (as changed by C 2, 28 Nov 62).

Add before the last sentence: Resistor R15 is not used on the AN/URM-113 oin order No. 36427-PC-62 nor on the AN/URM113A.

Page 6, figure 3. Add the following to the caption: (AN/URM-113).

Add figure 3.1, after -figure 3:

Figure 4 (as changed by C2, 28 Nov 62).

Delete figure 4 and substitute the new figure 4.

Figure 5. Delete figure 5 and substitute the new figure 5.

Paragraph 9b. Delete and substitute:

b. *Limiter Operation.* The input signal from the if. amplifier under test is impressed across L1 and C4. This circuit is tuned to a center frequency of 4.3 me. Resistor R7 broadens the response characteristic ,f this tuned circuit. The positive alternations of the input signal drive the grid of V2 positive, causing grid current to flow. This current charges C8 to a dc voltage proportional to the peak amplitude of the input signal. A portion of this voltage is taken from the movable contact of calibration control R20 and is applied through the FUNCTION SELECTOR switch to the vtm bridge. Resistor R17 and series-connected R16 and R20 provide the discharge path for C8. Resistor R18, bypassed for if. frequencies by C37, is the cathode-bias resistor; R4 is the plate load; and' RS8 and C91 are the screen-grid voltage-dropping resistor and screen-grid bypass capacitor, respectively.

Page 8, paragraph 11, heading. Change "(fig. 10)" ;to: (fig. 110,or .1: 0,.1).

Figure 10. Add to the figure caption: (AN/URM-113).

Add figure 10.1 after figure 10:

Page 9, paragraph 13. Make the following changes:

After paragraph title, change "(fig. 13)" to: (fig. 13 or 13.1).

Subparagraph d, line 9. After "R57," add: (AN/URM-113 only).

Page 10, figure 13. Add to the figure caption: (AN/URM-113).

Add figure 13.1 after figure 13:

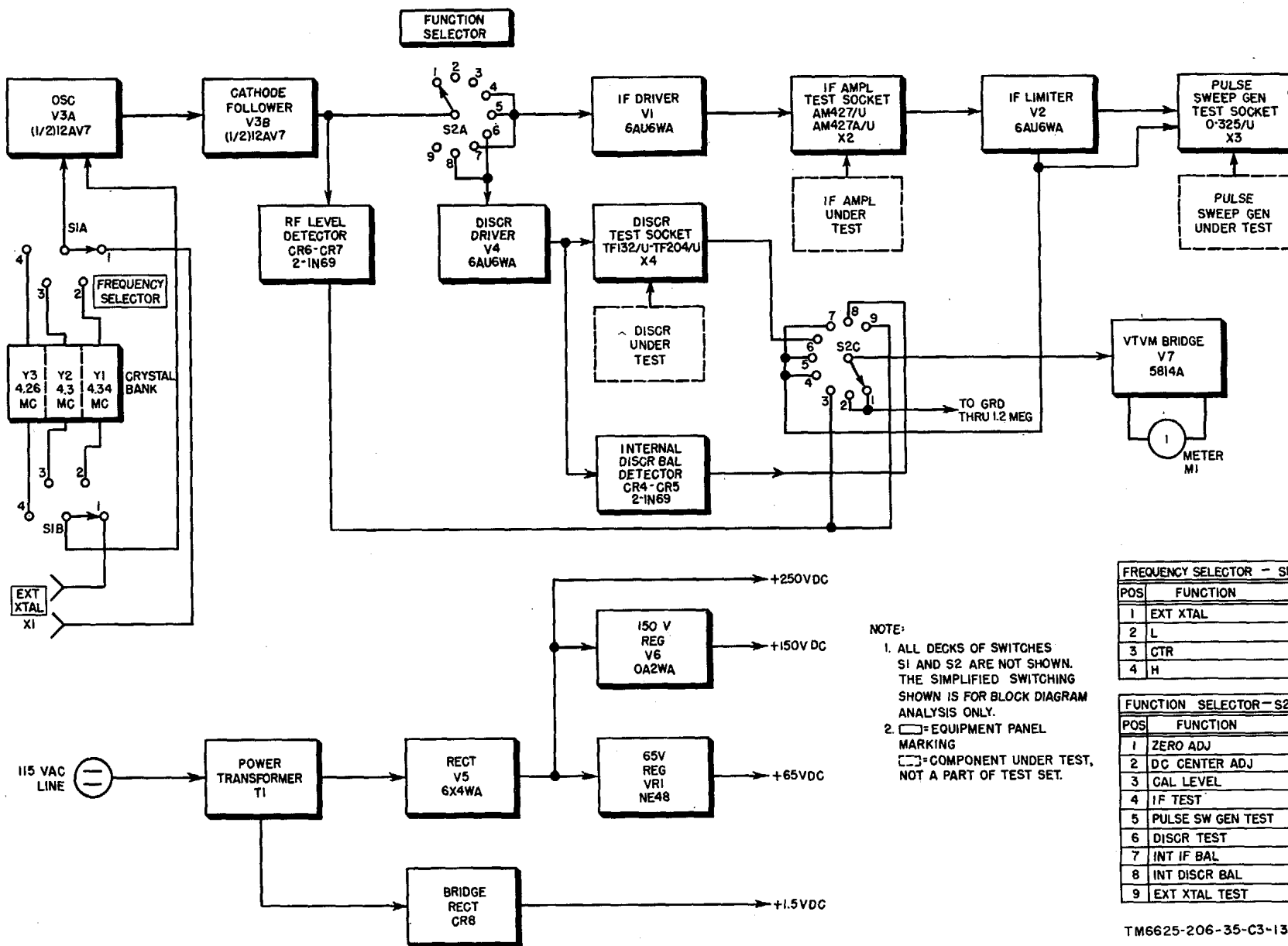
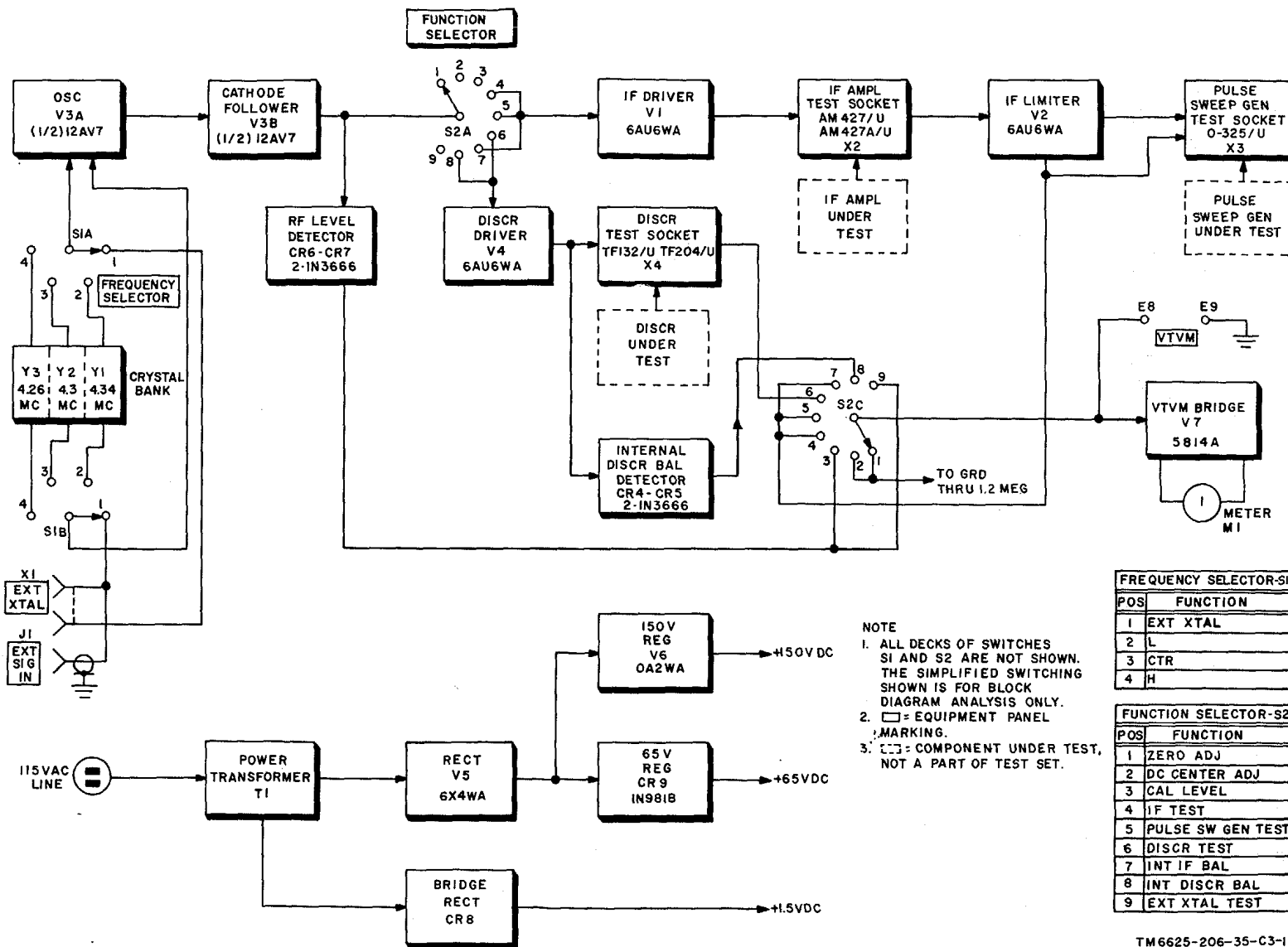


Figure 1. Block diagram (AN/URM-1S1).



TM6625-206-35-C3-1

Figure 1.1. Block diagram (AN/URM-113A).

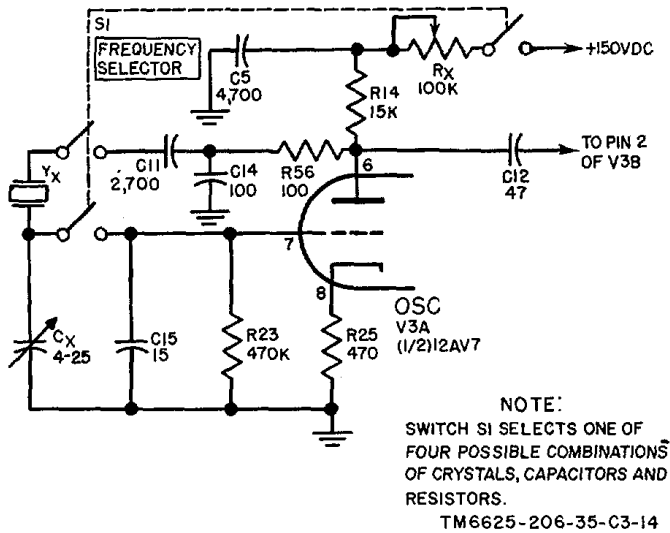


Figure 2. Oscillator stage, simplified diagram (AN/URM-113).

Paragraph 14, subparagraph d, line 3. Change "C1" to: C19.

Page 11, paragraph 15. After paragraph title, change "(figs. 14 and 1'5)" to: (fig. 14 and 15 or 15.1).

Subparagraph a, line 8. After "R57," add: (AN/URM-113 only).

Subparagraph b, line 11. Change "(fig. 13) to: (fig. 13 or 13.1).

Paragraph 16. Add the following to the ,paragraph title: (AN/URM-113).

Page 12, paragraph 16. Make the following changes:

Subparagraph d, line 1 (as changed by C2, 28 Nov 62).

Change 250 volt to: 150-volt.

Delete subparagraph e and substitute:

e. 1.5-Volt Supply. One 6.3-volt winding on power transformer T1 is connected across bridge rectifier CR8. The rectified output of the bridge rectifier is applied across a pi-type filter consisting of C35, R51, and C36. Resistors R52 and R54 form a voltage divider across the output. Resistor R52 permits adjustment of the voltage. applied across FILAMENT CAL control R54. FILAMENT CAL control R54 permits calibration of the output at 1.5 volts.

Add paragraphs 16.1 and 16.2 after paragraph 16:

16.1. Power Supply (AN/URM-1 13A)

a. General. The power supply (fig. 16.1) provides all of the necessary dc voltages required in the operation of 'the test set. The ac

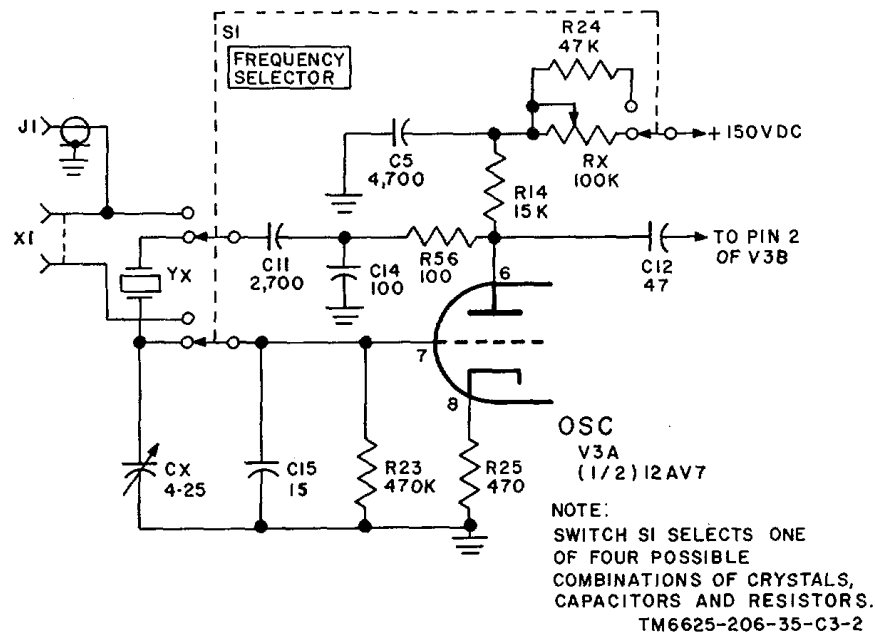


Figure 2.1. Oscillator stage, simplified diagram (AN/URM-113A).

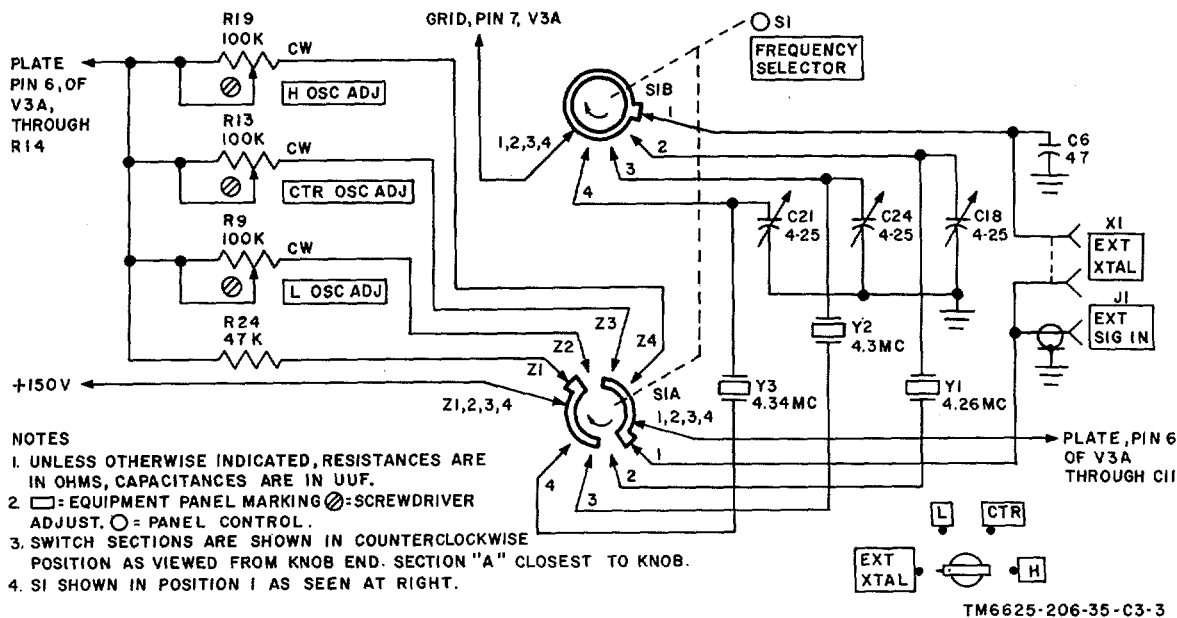


Figure 3.1. FREQUENCY SELECTOR switch S1 (AN/URM-113A).

line voltage is impressed across the primary of T1 through POWER switch S3 and fuses F1 and F2. Two regulated B+ voltages are used for plate and screen requirements. A +1.5-volt supply is required for the filaments of if. amplifiers and pulse-sweep generators under test; 6.3 volts ac is required for tube filaments.

b. *150-Volt Regulated Supply.* The ac voltage across the high-voltage secondary (winding 3-5) of T1 is impressed across rectifier tube Vk5. The output of the full-wave rectifier is applied to a capacitor input pi-type filter. Ca-

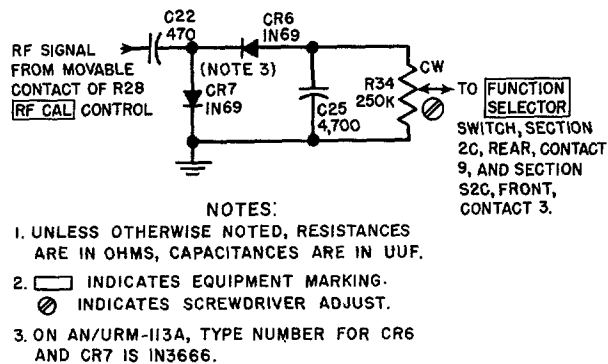


Figure 5. Rf detector and voltage doubler.

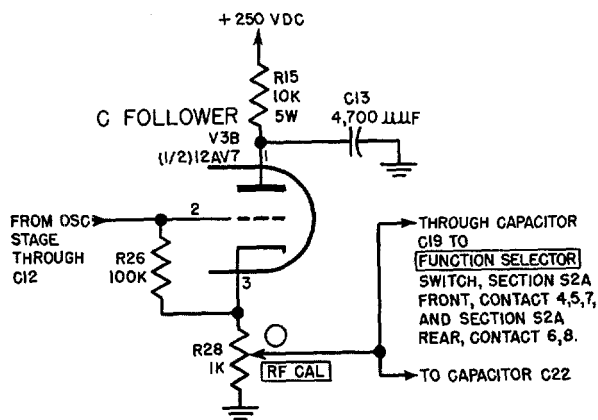
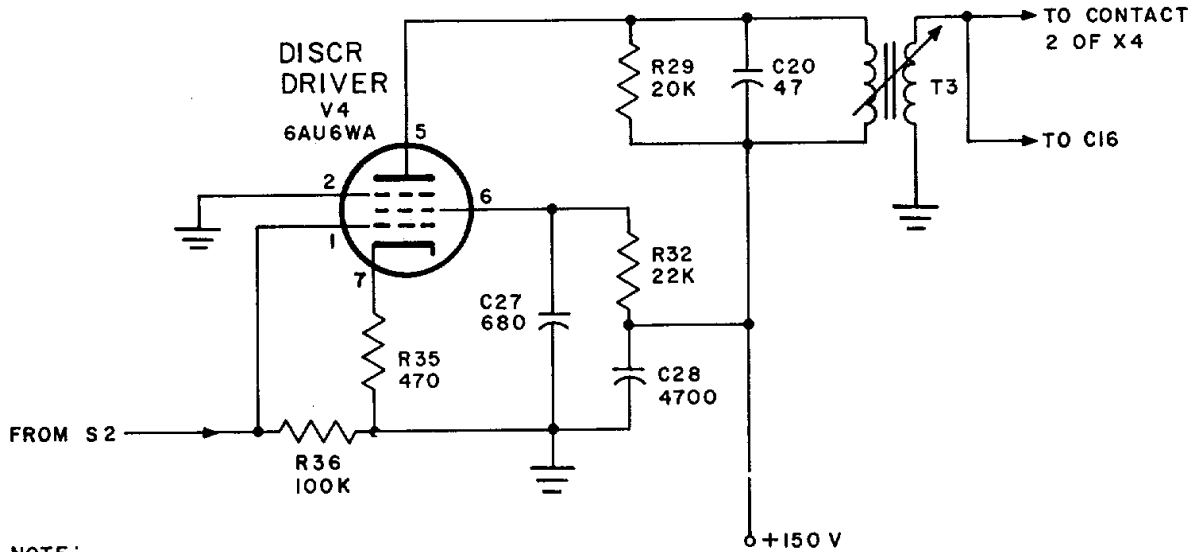


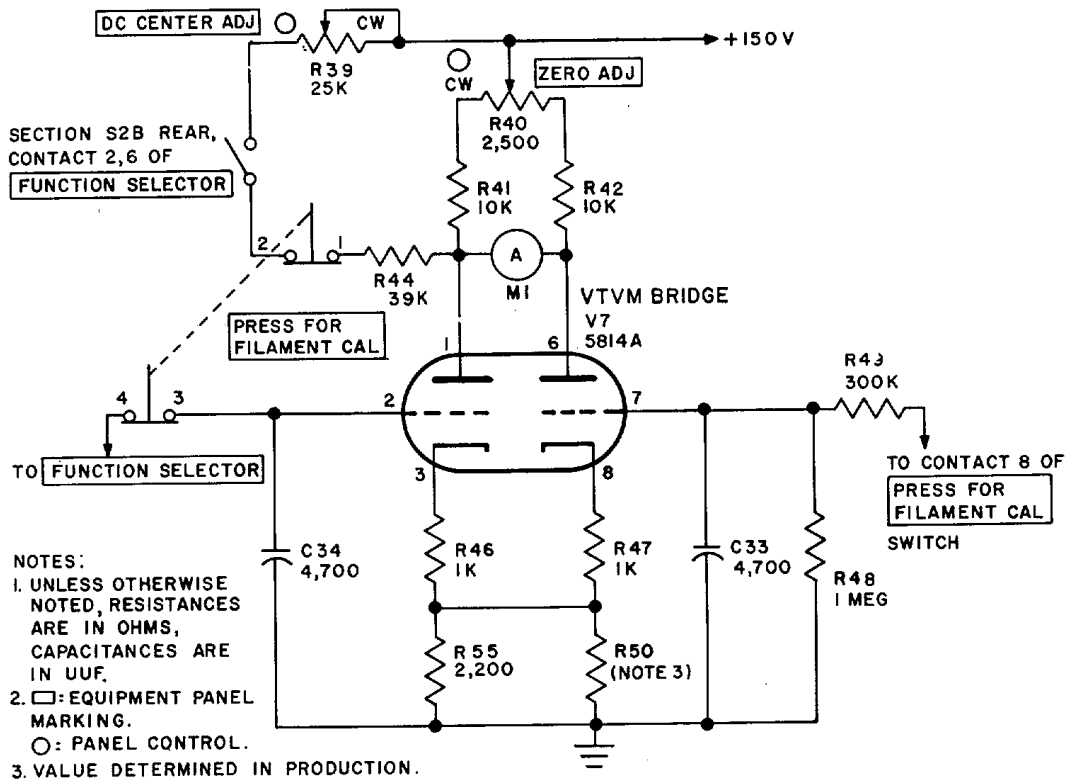
Figure 4. Cathode follower.



NOTE:
UNLESS OTHERWISE NOTED, RESISTANCES ARE IN OHMS,
CAPACITANCES ARE IN UUF.

TM6625-206-35-C3-4

Figure 10.1. Discriminator driver V4 (AN/URM-113A).



TM6625-206-35-C3-5

Figure 13.1. Vtvm bridge V7 (AN/URM-113A).

capacitor C30A is the input filter. Inductor L2 and capacitor C30B complete the filter circuit. The voltage at the output of the filter is connected to the voltage regulator tube, V6, through dropping resistor R43. This voltage is sufficient to fire regulator V6 which clamps at 150 volts, regulating the output voltage. Capacitor C32 bypasses V6 to prevent regulator hash from entering the power supply.

c. *65-Volt Supply.* The filter output voltage supply is /also applied across dropping resistor R45 in series with Zener diode CR9. This series combination maintains approximately 65 volts at the junction of R45 and CR9. Resistor R58 is selected to trim the voltage on the +65volt bus to +65 volts when an if. amplifier is plugged in for test.

d. *1.5-Volt Supply.* One 6.3-volt winding on power transformer T1 is connected across bridge rectifier CR8. The rectified output of the bridge : rectifier is applied across a pi-type filter consisting of C35, R51, and C36. Resistors R5;2 and RI54 form a voltage divider across the output. Resistor R52 permits adjustment of the voltage applied across FILAMENT CAL control R15,4. FILAMENT CAL control R54 permits calibration of the output voltage at 1.5 volts.

16.2. Differences in Models

Radio Test Set AN/URM-113A differs from earlier : models in the following significant de tails.

a. EXT SIG IN jack is provided on the front panel to facilitate connection of additional frequencies into the test set (fig. 3.1, TM 116625-206-12).

b. A Zener diode has replaced a neon lamp for voltage regulation of the internal 65-volt supply (fig. 16.1).

c. Minor changes have been made on the dial face of the test set meter (fig. 4.1 and 5.1, TM 11--6625-206-12).

d. VTVM jack is provided on the front panel to facilitate connection of a de voltmeter into the test set meter circuit (fig. 3.1, TM 11-6625-206-12).

Page 13, figure 15. Make the following changes:

Add the following to the figure caption: (AN/URM- 113).

Add figure 15.1 after figure 15:

Figure 16 (as changed by C 2, 28 Nov 62). Make the following changes:

Delete figure 16 and substitute the new figure 16.

Add figure 16.1 after figure 16:

Page 14, section I. Delete the warning under the section heading and substitute:

WARNING

When servicing the test set, be careful to avoid bodily contact with the 117-volt ac supply, and the +2.50-volt (AN/URM-113 supplied on early procurements), +150-volt, +65-volt de supply voltage, and the unregulated dc supply on the AN/URM-113 procured on order No. 316427-P'C-62 or the AN/URM-113A. Remove the line ,cord from the supply before attempting removal of any tubes.

Paragraph 18c(1), line 7. Change "(fig. 18)" to: (fig. 18 or 18.1).

Page 15, paragraph 19, chart. Make the following changes:

"Technical manual" column. Delete "TM 11-5038" and substitute: TM 11-6625-27412.

"Test equipment" column. After the last item, add: Transformer, Variable CN-16/U.

"Common name" column. After the last item, add: Variable transformer.

Paragraph 20. Make the following changes:

Subparagraph c. Delete the title and substitute: *Resistance Measurements.*

Chart. After both items listed under "Point of measurement," add: (Connect negative side of ohmmeter to ground.).

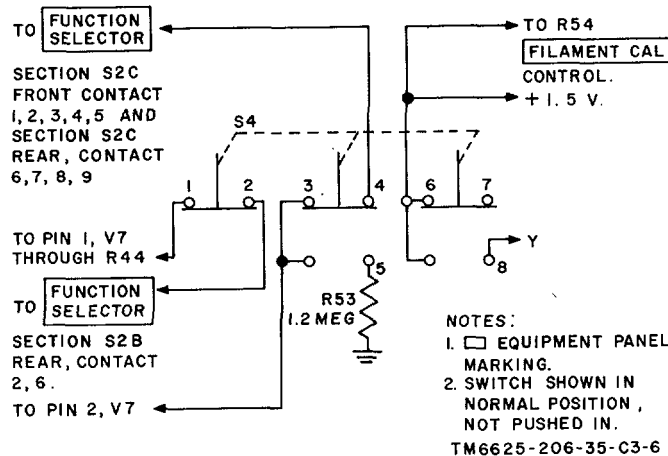


Figure 15.1. PRESS FOR FILAMENT CAL switch S4, partial diagram (AN/URM-113A).

Add the following to the chart:

Point of measurement	Normal indication	Isolating procedure
Between + output terminal of CR8 and ground (connect negative side of ohmmeter to ground).	8 to 12 ohms (depends on setting of R52).	If resistance is less than 8 ohms, check for shorted selenium rectifier CR8 or filter C35 or C36. If resistance is greater than 12 ohms, check for open R51 or R52.

Add subparagraph *d* after subparagraph *c*.

d. Voltage Measurement (Low Line). Using a variable transformer, apply 60 volts ac, 60 cps to the test set power plug. Make the voltage measurements

indicated in the chart below. If abnormal results are obtained, make the additional isolating checks outlined. When the faulty part is found, turn the power off and replace it before applying full power to the unit.

Point of measurement	Normal indication	Isolating procedure
Between power transformer terminal 9 and ground.	6 volts ac or more	If voltage is low, check for defective rectifier tube V5, or defective power transformer.
Between + output terminal of CR8 and ground.	+ 2.5 volts dc or more	If voltage is low, check for defective rectifier CR8.

Paragraph 21a. Make the following changes:

Line 6. Change "figures 19 through 21" to: figures 19, 19.1, 20, 21, and 21.1.

Line 8. Change "(fig. 18)" to: (fig. 18 or 18.1).

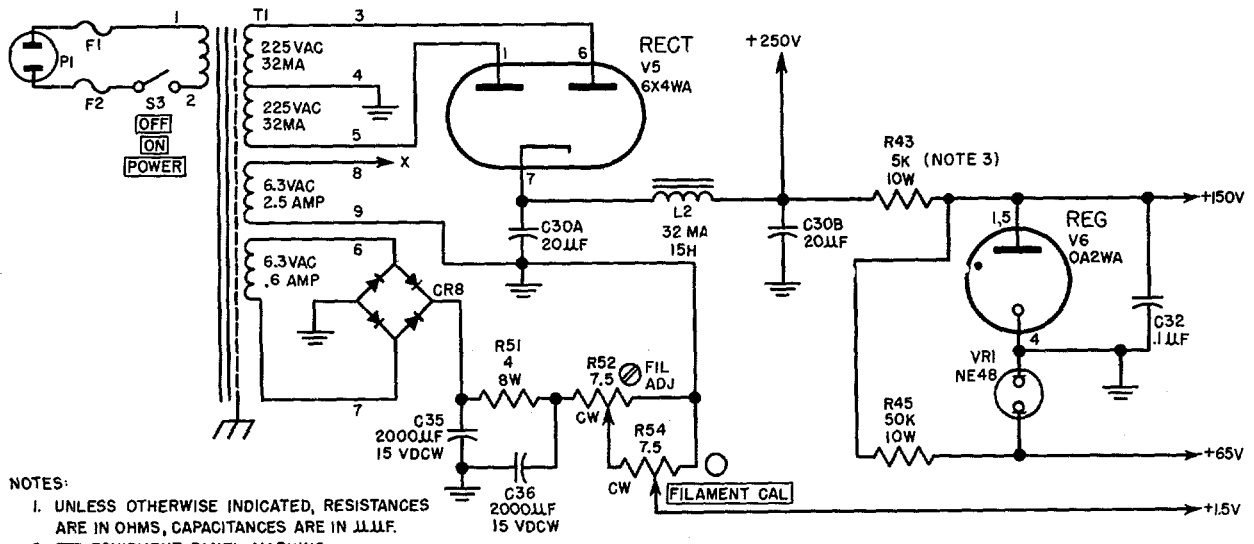
Page 16, paragraph 21d, chart. Make the following changes in the "Correction" column of the troubleshooting chart:

Item 2, line 3. After "figure 18," add: or 18.1.

Item 3, line 1. At the beginning of the line, add: On AN/URM-113.

At the end of line 3, add: On AN/URM-113A, check for +65 volts at the junction of R45 and CR9 (fig. 19.1). Check resistor R45 and Zener diode CR9.

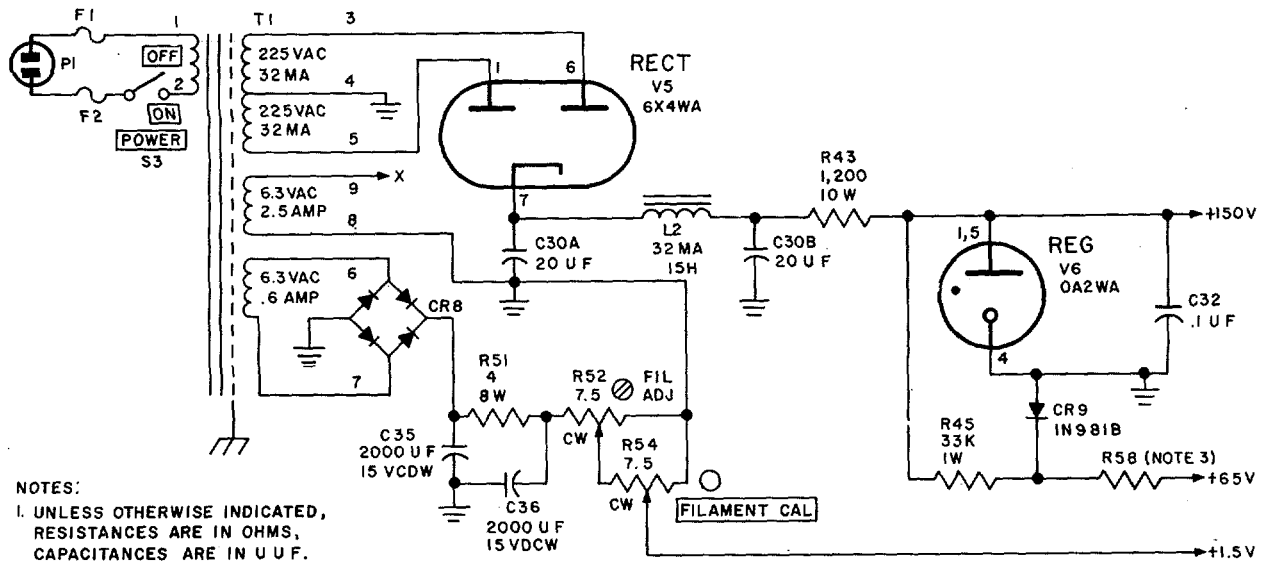
Item 3, lines 11 and 16. After "figure 18," add: or 18.1.



- NOTES:
1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN µUF.
 2. □ = EQUIPMENT PANEL MARKING.
○ = PANEL CONTROL. ⊗ = SCREWDRIVER ADJUST.
 3. FOR EQUIPMENT ON ORDER NO.36427-PC-62, CHANGE R43 FROM 5K TO 1.2K AND DELETE THE +250V LINE.

TM6625-206-35-C3-17

Figure 16. Power supply (AN/URM-113).



- NOTES:
1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN µUF.
 2. □ = EQUIPMENT PANEL MARKING.
○ = PANEL CONTROL ⊗ = SCREWDRIVER ADJUST.
 3. VALUE DETERMINED IN PRODUCTION.

TM6625-206-35-C3-7

Figure 16.1. Power supply (AN/URM-113A).

Item 4, line 2. After "fig. 19," add: or 19.1.
Line 4 Change "(var. 27)" to: (para. 27 or 27.1).
Item 5, line 10. Change "(para. 31 and 32)" to: (para 31 and 32 or 30.2).
Page 17, paragraph 21*d*, chart, "Correction" column. Make the following changes:
Item 7, line 3. Change "(para. 30)" to: (para 30 or 30.1).
Item 8, line 2. After "figure 18," add: or 18.1.
Item 10, line 1. After "R57." add: (AN/URM-113 only).
(Figure 17. Delete figure 17 and substitute the new figure 17.
Page 18, figure 18. Make the following changes:
Delete figure 18 and substitute the new figure 18.
Add figure 18.1 after figure 18.
Paragraph 22*b*, line 2. After "figs. 17 and 18," add: or 18.1.
Paragraph 23, chart, "Ohms" column, for transformer T1. Make the following changes:
Lines 2 and 3. Change "450" to: 375.
Line 5. Change ".5" to: 0.2.

Page 19, figure 19 (as changed by C 2, 28 Nov 62). Make the following changes:
Delete figure 19 and substitute the new figure 19.
Add figure 19.1 after figure 19:
Page 20, figure 20. Delete figure 20 and substitute the new figure 20.
Page 21, figure 21. Make the following changes:
Add to the figure caption: (AN/URM-113).
Add figure 21.1 after figure 21.
Page 22, paragraph 24*a*, lines 4 and 5.
Change "(para. 26-32)" to: (para. 26 through 32.2).
Paragraph 25 (as changed by C 2, 28 Nov 62). Make the following changes:
Delete the paragraph heading and substitute: Test Equipment and Special Tools Required for Calibration.
Delete the introductory sentence and substitute: This chart lists test equipment and special tools required for calibrating the test set.
Delete the chart and substitute:

Test equipment	Technical manual	Common name
Multimeter ME-26B/U.....	TM 11-6625-200-15	Multimeter.
Decade Resistors ZM-16/U and ZM-16A/U.	TM 11-5102	Decade resistance box.
Meter Test Set TS-682A/GSM-1.	TM 11-2535B .....	.Meter test set.
Frequency Meter AN/USM-26	TM 11-5057	Frequency meter.
Oscilloscope AN/USM-50	TM 11-5129	Oscilloscope
Voltmeter, Meter ME-30(*)/U Adapter, Tube Socket UG-104/U Part of Tube Socket Adapter Kit MX-1258/U. ^a	TM 11-6625-320-12	Low-frequency ac voltmeter. Adapter.
Connector, Adapter UG-514/ U Part of Audio Oscillator TS-382(*)/U. ^{bc}	.....	Connector.
Cord RG-58C/U (3 feet). ^c	.....	Cable.
Plug, Test, Hickok 16525-239. ^d	.....	Plug.
Voltmeter, Meter AN/URM- 55	.....	Rf voltmeter.
Audio Oscillator TS-382(*)/U.	TM 11-6625-261-12	Audio oscillator.
IF Amplifier AM-427/U. ^d	.....	If. amplifier

^a Indicates ME-80A/U. ME-30B/U, and ME-30C/U.

^b Indicates TS-382A/U, TS-382B/U, TS-382D/U, TS-382E/U, and TS-382F/U.

^c Test equipment used only with AN/URM-113.

^d Test equipment used only with AN/URM-113A.

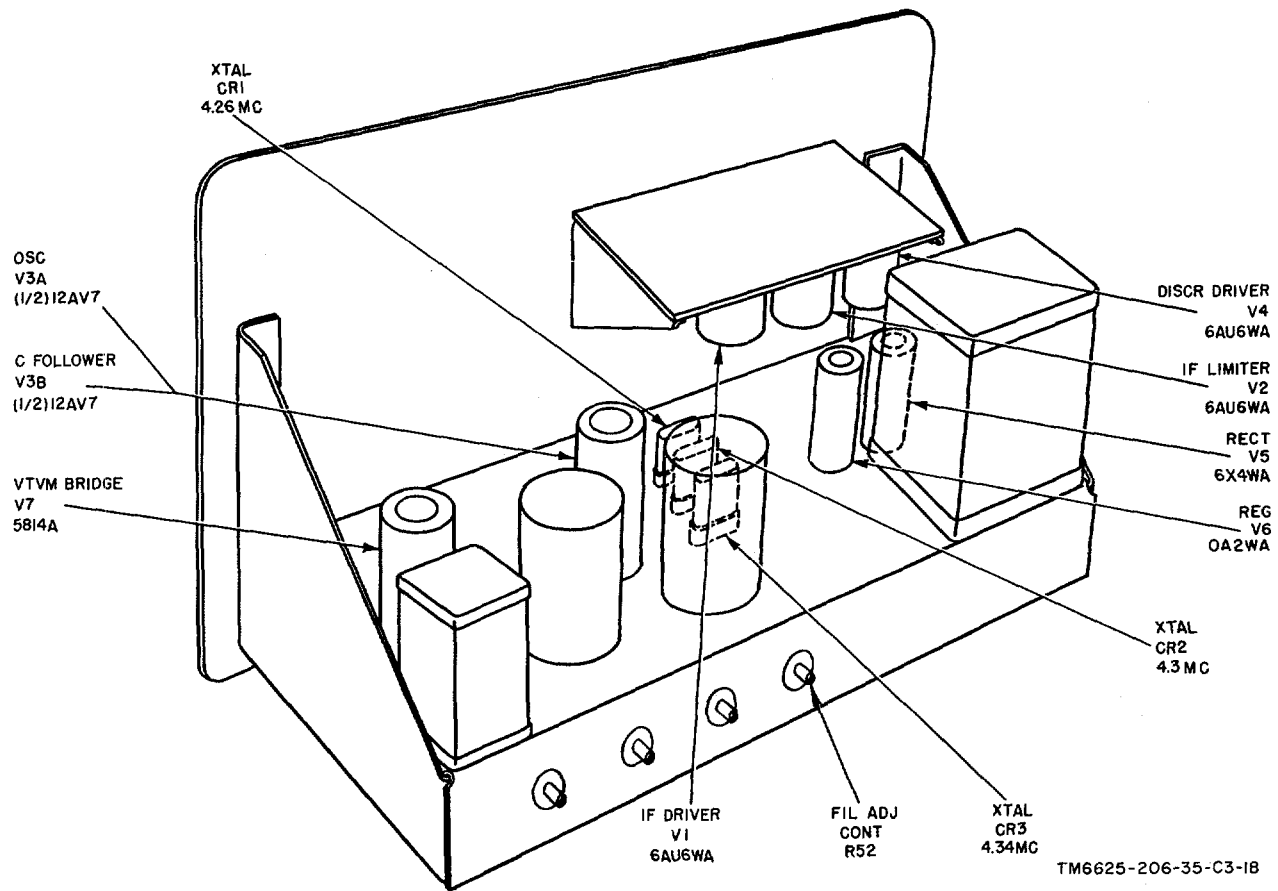


Figure 17. Tube and crystal location diagram.

Paragraph 26a, line 4. Change "(fig. 19)" to: (fig. 19 or 19.1).

Paragraph 26b, line 2. Change "(fig. 19)" to: (fig. 19 or 19.1).

Paragraph 27, heading. Add the following: (AN/URM-113).

Paragraph 27a, line 1. Delete "Using the meter test set." Add paragraph 27.1 after (paragraph 27:

27.1. Filament Adjust Control (AN/URM-113A)

a. Reduce the input voltage to the test set to 100 volts ac. Rotate FILAMENT CAL control R54 fully clockwise.

b. Plug the special test plug (fig. 22.2) into the IF AMPL TEST SOCKET; this places a 30-ohm load on the +1.5-volt dc bus.

c. Allow 5 minutes for the vtvm bridge to stabilize and adjust the ZERO ADJ control for a zero indication on meter M1.

d. Press the PRESS FOR FILAMENT CAL button and adjust R52 (fig. 20) until the meter pointer rests at the CAL LEVEL line.

Paragraph 28, line 3. Change "(fig. 19)" to: (fig. 19 or 19.1).

Page 23, paragraph 29. Add to the paragraph heading: (AN/URM-113).

(As changed by C 2, 28 Nov 62) Delete subparagraphs b, c, d, e, and f and substitute:

b. Set the FUNCTION SELECTOR to CAL LEVEL and the FREQUENCY SELECTOR to L. Adjust the RF CAL control and rf level calibration control R34 (fig. 20) to indicate 310 on the numerical scale of the test set meter

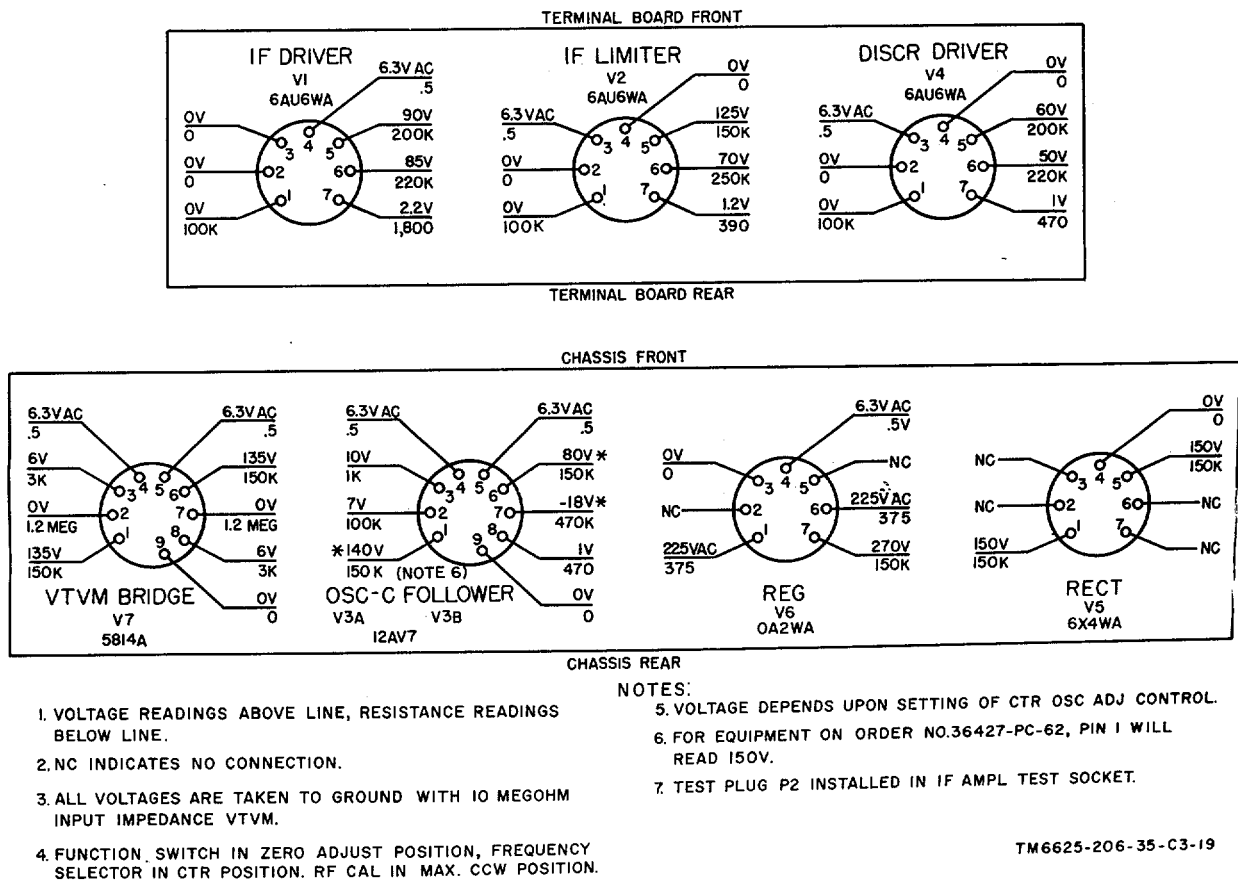


Figure 18. Voltage and resistance data (AN/URM-113).

(fig. 4, TM 11-6625-206-12). Switch the FREQUENCY SELECTOR to CTR, then H, and adjust all three oscillators (H OSC ADJ, CTR OSC ADJ, and H OSC ADJ) to the same reference level.

c. Set the FUNCTION SELECTOR switch to DISCR TEST and the FREQUENCY SELECTOR switch to CTR.

d. Monitor the voltage between: pins 1 (grd) and 2 of the DISCR TEST SOCKET with the low-frequency ac voltmeter. Adjust the RF CAL control for 275 mv.

e. Align the INT DISCR BAL transformer by adjusting for equal ac voltmeter indication in the FREQUENCY SELECTOR L and H positions, and maximum indication in the CTR position. Check and readjust the RF CAL control for 275 mv in the CTR position.

f. Switch the FUNCTION SELECTOR switch to CAL LEVEL and adjust rf level calibration control R34 until the test set meter indicates at 30 on the numerical scale.

Add paragraph 29.1 after paragraph 29:

29.1. RF CAL Level Setting (AN/URM-113A)

a. Connect the rf voltmeter (.set to 1 volt range) to the special test plug (fig. 22.2) and insert the plug into the DISCR TEST SOCKET.

b. Set the FREQUENCY SELECTOR to CTR and the RF CAL control maximum clockwise.

c. Adjust the INT DISCR BAL coil for a maximum ac voltage indication on the rf voltmeter.

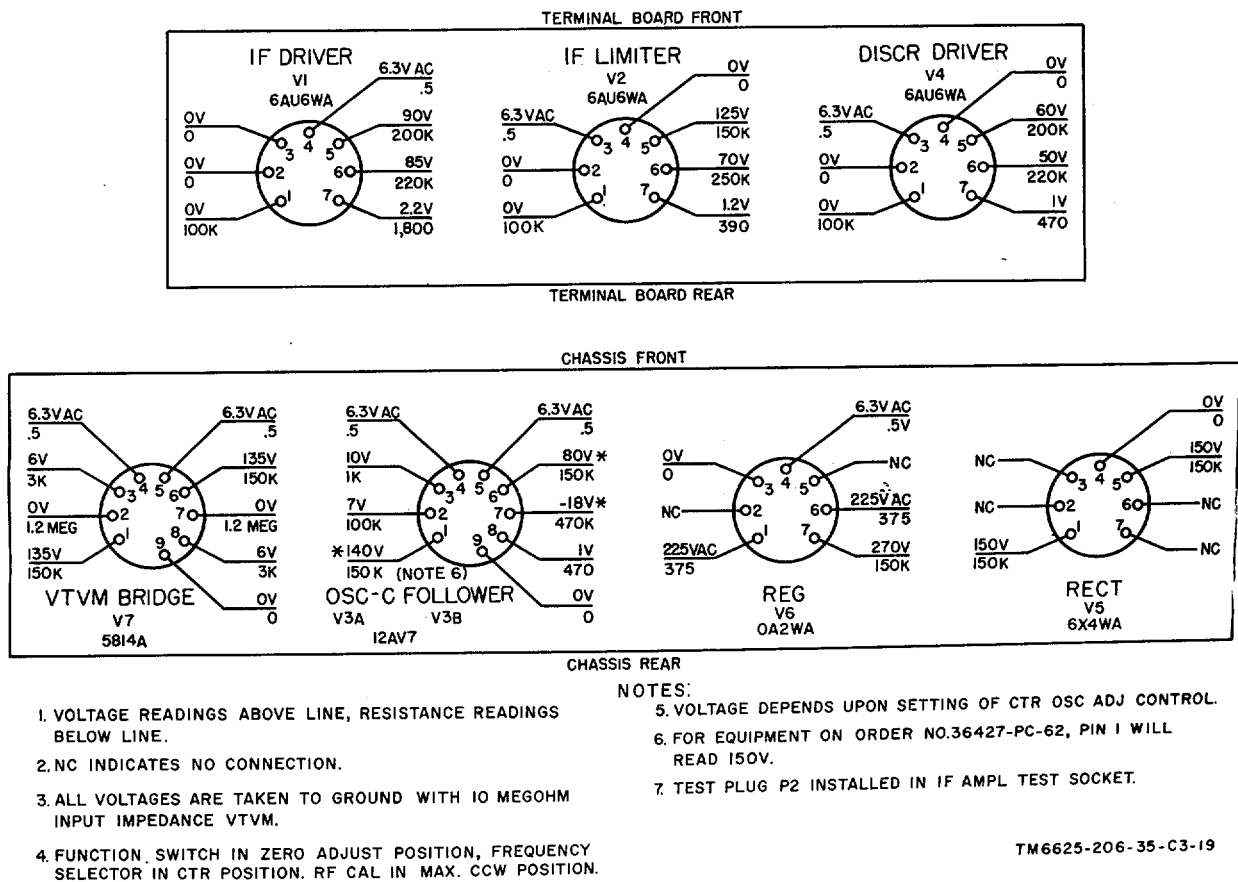


Figure 18.1. Voltage and resistance data (AN/URM-113A).

Adjust the CTR OSC ADJ control so that the ac voltage level is 500 mv.

d. Adjust the RF CAL control for a 400-mv level indication on the rf voltmeter.

e. Set the FUNCTION SELECTOR switch to ZERO ADJ and readjust ZERO ADJ control as required to position the meter test set pointer over 0 SET line.

f. Set the FUNCTION SELECTOR switch to CAL LEVEL and adjust R34 (fig. 20) until the meter test set indicates at CAL LEVEL.

g. Set the FREQUENCY SELECTOR to L and adjust the L OSC ADJ for a CAL LEVEL indication on the meter test set. Set the FREQUENCY SELECTOR to H and adjust the H OSC CONTROL for an identical CAL LEVEL indication on the meter test set.

h. Set the FUNCTION SELECTOR switch to INT DISCR BAL. Note the test set meter indication. Set the FREQUENCY SELECTOR to L and again note the meter test set indication. It should not have changed. Adjust the INT DISCR BAL transformer as required to obtain identical meter test set responses in both the L and H positions of the FREQUENCY SELECTOR.

i. Remove the special test plug and the rf voltmeter.

Paragraph 30, heading. Add the following: (AN/URM-113).

30: Add paragraphs 30.1 and 30.2 after paragraph

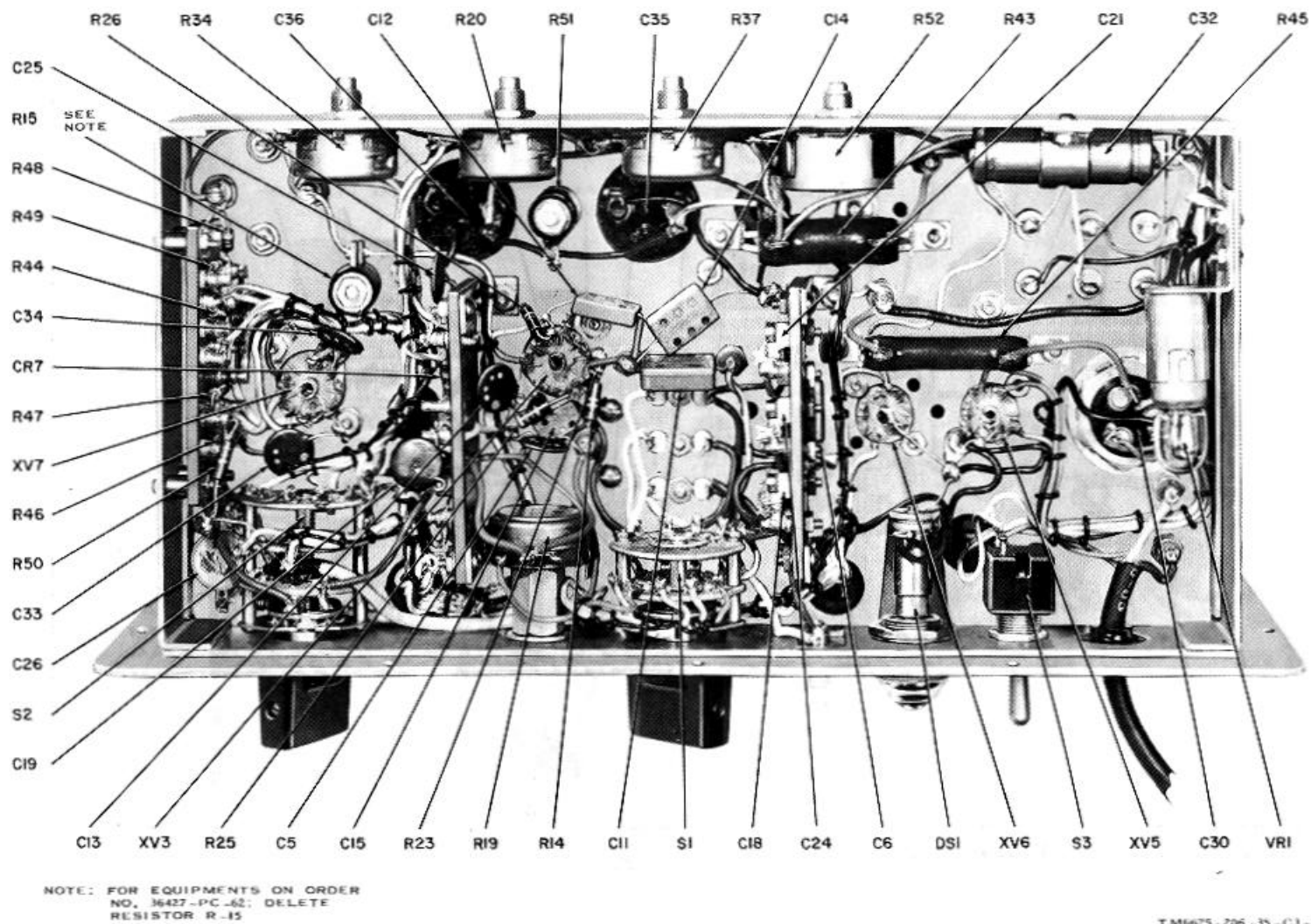


Figure 19. Test set, bottom view (AN/URM-113).

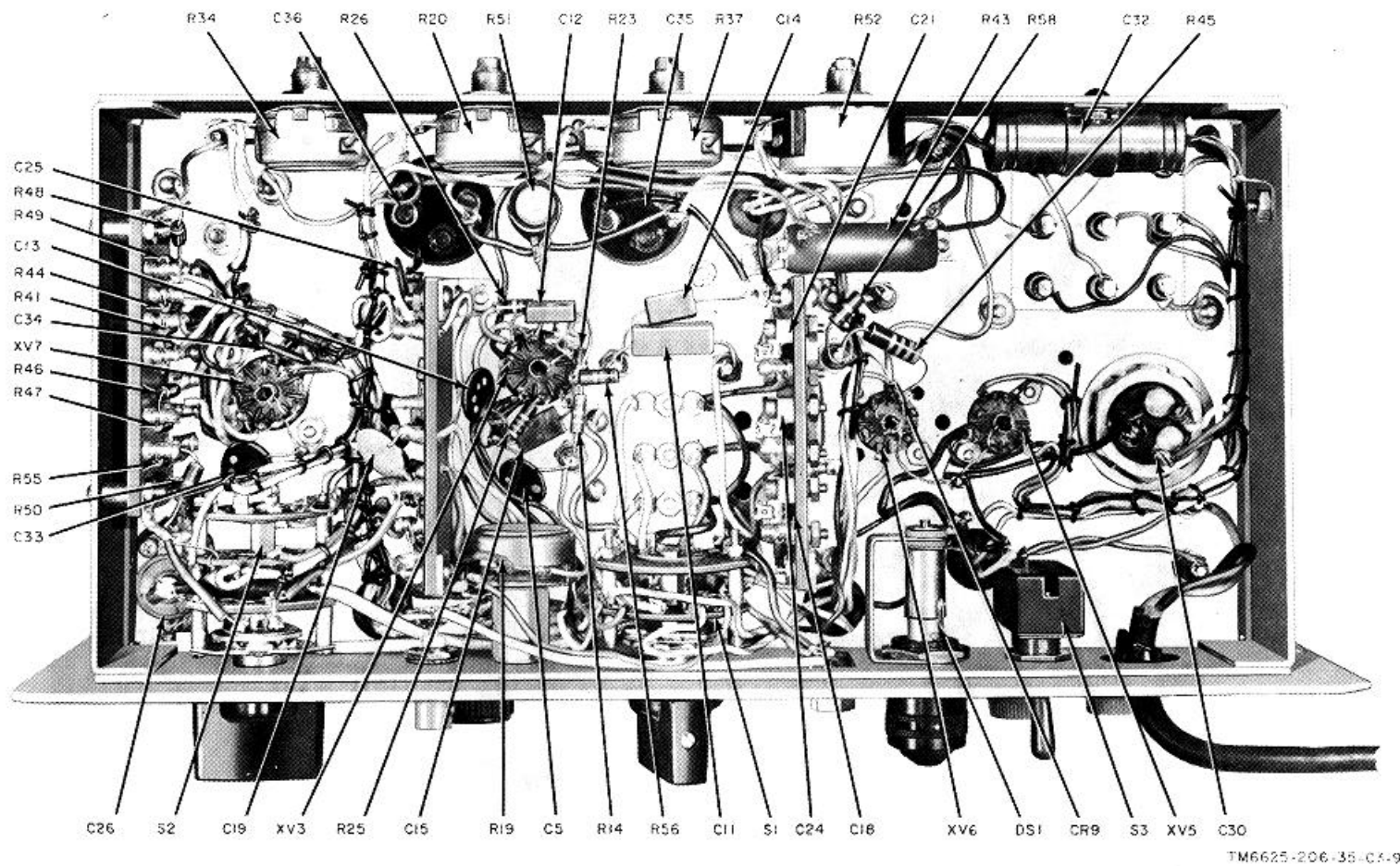


Figure 19.1. Test set, bottom view (AN/URM-113A).

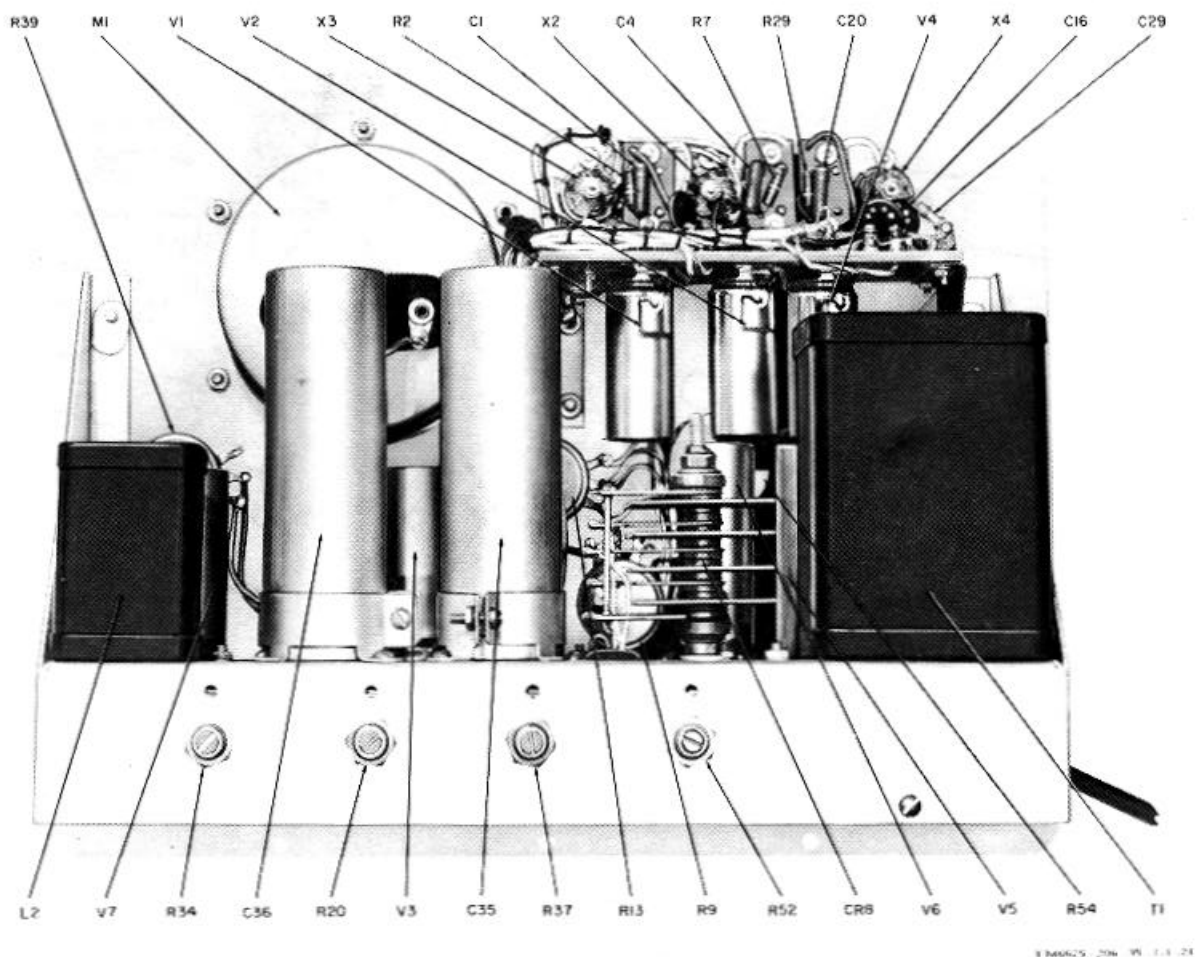


Figure 20. Test set, rear view.

30.1. Discriminator Sensitivity Adjustment (AN/URM-113A)

a. The discriminator sensitivity is calibrated for equal positive and negative deflection on the test -set meter.

b. Set the FUNCTION SELECTOR switch to DISCR TEST and adjust the DC CENTER ADJ control until the meter pointer rests at the DC CENTER line. If this adjustment cannot be made, refer to paragraph 21*d*, item 10.

c. Apply -7.2 volts from the meter test set to pin 7 of test socket X4 (fig. 20). Adjust discriminator calibration control R37 (fig. 20) until the meter pointer

rests at the left edge of the blue block at the right of the meter.

d. Apply +7.2 volts to the same point as in *c* above, and observe the indication on the meter. The meter pointer should rest at the right edge of the blue block at the left of the meter.

e. If the meter pointer does not rest at the right edge of the blue block at the left of the meter, divide the error equally by readjusting as directed in *c* and *d* above.

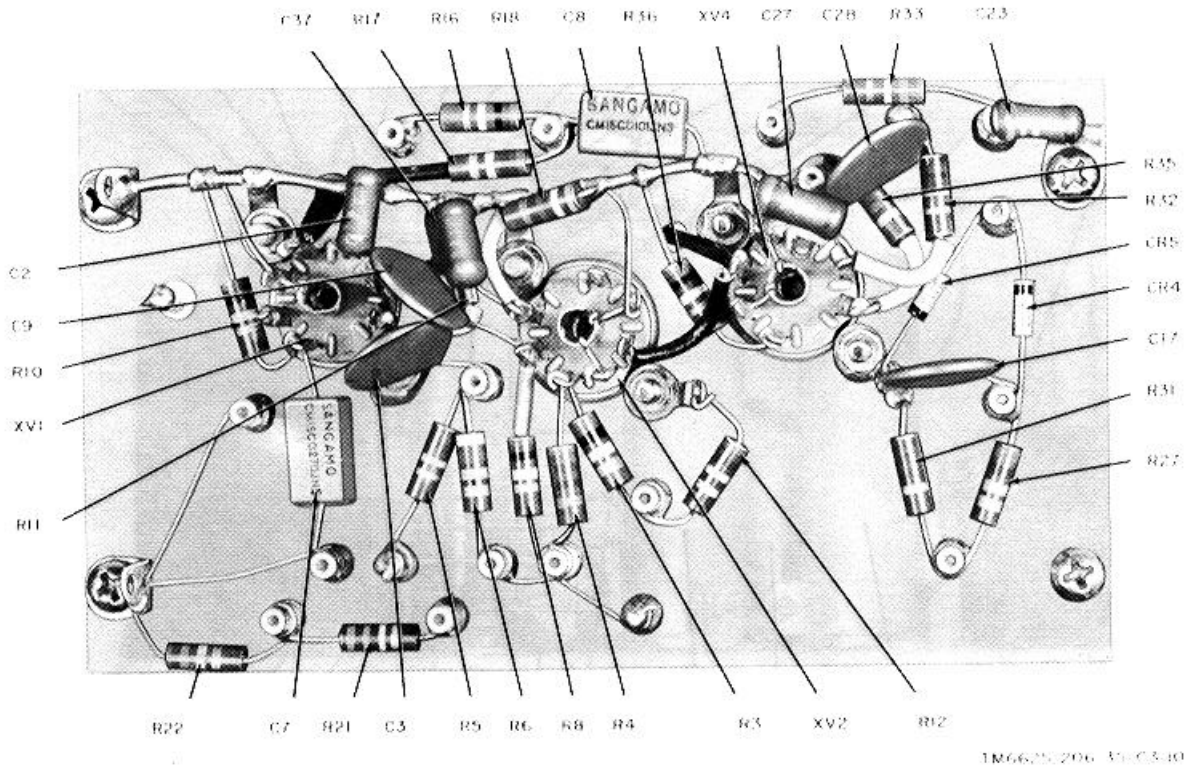


Figure 21.1 Test set subchassis, top view (AN/URM-113A)

30.2. If. Signal Input Calibration (AN/URM-113A)

a. The signal level applied to the if. driver stage is adjusted by trimmer capacitor C26 (fig. 19.1).

b. Set the FUNCTION SELECTOR switch to ZERO ADJ, and adjust the ZERO ADJ control : for a 0 SET indication on the meter test set

c. Set the FUNCTION SELECTOR switch to CAL LEVEL and the FREQUENCY SELECTOR switch to CTR. Adjust the RF CAL control for a 24 DB indication on the meter test set.

d. Set the FREQUENCY SELECTOR switch to L and adjust the L OSC ADJ control for a 24 DB indication on the meter test set. Set the FREQUENCY SELECTOR switch to H and adjust the H OSC ADJ control for an identical 24 DB indication.

e. Set the FREQUENCY SELECTOR switch to CTR. Connect the rf voltmeter (set to 30 mv range) to the special test plug (fig. 22.2) and insert the test plug into the IF AMPL TEST SOCKET.

f. Check the meter test set to be sure that it is still indicating -at 24 DB; then set the FUNCTION SELECTOR switch to IF TEST.

g. Tune the INT IF BAL transformer (.can be reached through the front panel opening to the right of the IF AMPL TEST SOCKET) for a maximum ac voltage indication on the rf voltmeter.

h. Adjust capacitor C26 (fig. 19.1) for an rf voltmeter indication of 10.5 mv.

i. Set the FREQUENCY SELECTOR switch to L, and then to H. Observe the rf voltmeter

indication at each of these FREQUENCY SELECTOR settings. The rf voltage monitored with the FREQUENCY SELECTOR in the L position should be identical with that rf voltage monitored with the FREQUENCY SELECTOR switch set to the H position. Adjust the INT IF BAL transformer (same one as in g above) to obtain identical ac voltage measurements. The L and H signal levels should be down about 0.75 db from the CTR signal level (c above).

j. Set the FREQUENCY SELECTOR switch to CTR and readjust capacitor C26 (fig. 19.1), as required, for an rf voltmeter indication of 10.5 mv.

k. Set the FUNCTION SELECTOR switch to CAL LEVEL and note whether the test set meter still indicates at 24 DB. If it does, the calibration is completed; if not, repeat the procedures given in c and h above.

l. Remove the special test plug.

Paragraph 31 (as changed by C 2, 28 Nov 62). Delete and substitute:

31. If. Amplifier Sensitivity

a. Set the FUNCTION SELECTOR switch to INT IF BAL and the FREQUENCY SELECTOR switch to CTR; check the zero setting of the meter test set with the ZERO ADJ control.

b. Monitor the voltage at pin 2 of the IF AMPL TEST SOCKET (use the special test setup as shown in fig. 22.1 or 22.2) and adjust the RF CAL control for 150 mv.

c. Align the (AN/URM-113) INT IF BAL transformer (located to the right of the IF AMPL TEST SOCKET) by adjusting for equal ac voltmeter indication in the FREQUENCY SELECTOR L and H positions and maximum indication in the CTR position. Check and readjust the RF CAL control for 150 mv while the FREQUENCY SELECTOR is set to, CTR.

d. Remove the special test setup (fig. 22.1 or 22.2) and insert TEST PLUG P2 (fig. 1, TM 11-6625-206-12) in the IF AMPL TEST SOCKET. Adjust IF calibration control R20 (fig. 20) so that the test set meter of the AN/URM-113 indicates at 50 on the numerical scale, or the test set meter of the AN/URM-113A indicates at the CAL LEVEL line. Remove TEST PLUG P2 and reinstall the special test setup (fig. 22.1 or 22.2). Recheck with the rf voltmeter for 150 mv. Remove the test setup and ,reinsert TEST PLUG P2.

e. Set the FREQUENCY SELECTOR switch to L and adjust the RF CAL control so that the test set meter indicates at 32 on the numerical scale of the AN/URM-113 or at 23 on the DB scale of the AN/URM-113A. Switch to H and note the indication. Turn the FUNCTION SELECTOR switch to CAL LEVEL and check to see that the CTR, L, and H readings are the same. Set the FUNCTION SELECTOR switch to INT IF BAL and align the INT IF BAL transformer, on the left of the IF AMPL TEST SOCKET, by adjusting for equal meter indication in the L and H positions and maximum indication at CTR.

(As added by C 2, 28 Nov 62). Add figure 22.1 after paragraph 31:

Add figure 22.2 after figure 22.1:

Paragraph 32. Make the following changes:

Add the following to the heading: (AN/URM-113).

Delete subparagraphs b through e and substitute:

b. Set the FUNCTION SELECTOR switch to ZERO ADJ and adjust the ZERO ADJ control to zero the meter test set.

c. Set the FUNCTION SELECTOR switch to CAL LEVEL and the FREQUENCY SELECTOR switch to CTR. Adjust the RF CAL control until the meter pointer rests at the CAL LEVEL line.

d. Set the FUNCTION SELECTOR switch to IF TEST and monitor the voltage at pin 2 of the IF AMPL TEST SOCKET; use the special test setup as shown in figure 22.1.

e. Adjust capacitor C26 (fig. 19) for an rf voltmeter indication of 10.0 mv.

Add paragraphs 32.1 and 32.2 after paragraph 32:

32.1. 65 VDC Calibration (AN/URM-113A)

Proper calibration of the 65-volt dc supply is accomplished by selecting the proper resistance value for R58.

a. Plug the special test plug (fig. 22.2) into the IF AMPL TEST SOCKET. This places a

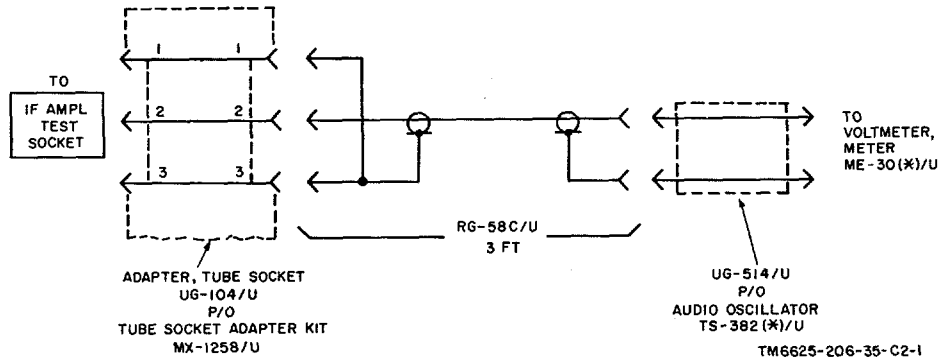


Figure 22.1. If. amplifier sensitivity special test setup, schematic diagram (AN/URM-113).

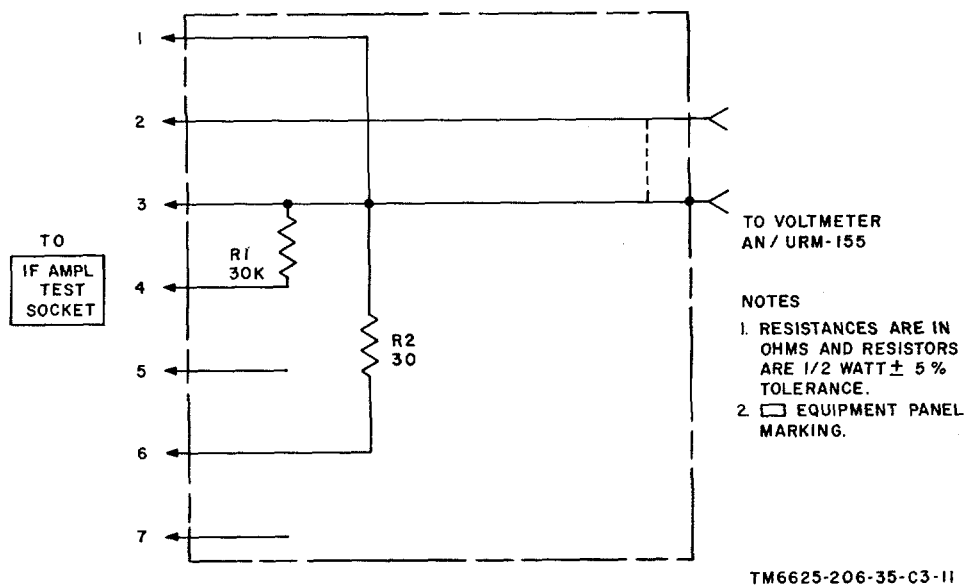


Figure 22.2. Special test plug (Hickok part No. 16525-239), schematic diagram (AN/URM-113A).

30K ohm load on the +65-volt dc bus. Connect a dc voltmeter from pin 4 of the IF AMPL TEST SOCKET to ground.

b. Remove resistor R58 (fig. 19.1) and connect a decade resistance box : in its place.

c. Adjust the decade resistance box until the dc voltmeter indicates 65 volts dc ± 0.65 . Remove the

decade resistance box and install a fixed resistor of equivalent value in the test set.

32.2. Pulse Sweep Generator Test Calibration (AN/URM-113A)

Pulse sweep generator test calibration is accomplished by selecting the proper resistance value for R59.

a. Set the FREQUENCY SELECTOR

switch to CRT and to the FUNCTION SELECTOR switch to ZERO ADJUST. Adjust the ZERO ADJUST control for a 0 SET indication on the meter test set, and adjust the RF CAL control maximum counterclockwise.

b. Set the FUNCTION SELECTOR switch to PULSE SW GEN TEST and plug an if. amplifier (AM-427A/U) into the IF AMPL TEST SOCKET. Press the PRESS FOR FILAMENT CAL button and adjust the FILAMENT CAL control for a CAL LEVEL indication on the meter test set.

c. Release the PRESS FOR FILAMENT CAL button and adjust the RF CAL control for a CAL LEVEL indication on the meter test set.

d. Adjust the audio oscillator for a 5-volt rms, 500-cps output. Connect the audio oscillator to the special test plug (fig. 22.2) and insert the plug into the PULSE SW GEN TEST SOCKET (meter test set indication will change to 0 SET when this is done).

e. Press the PRESS FOR FILAMENT CAL button and readjust the FILAMENT CAL control for a CAL LEVEL indication on the meter test set.

f. Connect the decade resistance -box (set to 1 megohm) across resistor R4 (fig. 21.1). Connect the low-frequency ac voltmeter (set to 3. volt range) across resistor R12 (fig. 21.1) Adjust the resistance substitution box !until the low-frequency ac voltmeter .indicates 1.215 volts, rms. Install an equivalent resistor across R4 in place of the decade resistance box.

g. Disconnect the low-frequency ac voltmeter. Remove the test plug and the if. amplifier.

Page 25, paragraph 35. Make the following changes:
Add the following to the heading: (AN/URM-113).

Introductory sentences. Delete and substitute:
Connect Radio Test Set AN/URM-113 to a 115-volt ac source and allow it to warm up for 30 minutes. Perform the tests listed in the chart below.

Chart (as changed by C 2, 28 Nov 62). Make the following changes:

Delete steps 6 through 11 and substitute:

Step	Control settings	Action	Indication and limits
6	Same as step 5 except set the FREQUENCY SELECTOR switch	Adjust the RF CAL control so that the meter pointer rests at 32. Switch the FREQUENCY to L. SELECTOR switch to H.	Meter pointer remains at 32 $\pm 1/2$ division.
7	Same as step 5	Adjust the RF CAL control so that the meter pointer rests at 5.0. Remove the test plug and, using the special test setup of figure 22.1, measure the voltage at pin 2 of the IF AMPL TEST SOCKET.	Voltage at pin 2 should be 150 ± 5 mv.
8	Same as step 4	Adjust the RF CAL control for a CAL LEVEL indication on the test set meter. Switch the FUNCTION SELECTOR switch to IF TEST. Using the special test setup of figure 22.1, measure the voltage at pin 2 of the IF AMPL TEST SOCKET.	Voltage at pin 2 should be 10 ± 0.5 mv.
9	Set FUNCTION SELEC-TOR switch to INT DISCR BAL and FRE-QUENCY SELECTOR switch to L.	Adjust the RF CAL control to 30 on the numerical scale. Switch the FREQUENCY SELECTOR switch to H.	Meter pointer should remain at 30 ± 1 division.

Step	Control settings	Action	Indication and limits
10	Set FUNCTION SELECTOR switch to CAL LEVEL and FREQUENCY SELECTOR switch to CTR.	Adjust the RF CAL control for a CAL LEVEL indication on the test set meter. Using the special test setup of figure 22.1, measure the voltage at pin 2 of the DISCR TEST SOCKET.	Voltage at pin 2 should be 275 ± 10 my.

Change steps 12, 13, 14, and 15 to: 11, 12, 13, and 14.
 Page 26. Add paragraph 36 after paragraph 35.

36. Test Procedures (AN/URM-113A)

Connect Radio Test Set AN/URM-113A to a 115-volt ac source and allow it to warm up for 30 minutes. Perform the tests listed in the chart below.

Step	Control settings	Action	Indication and limits
1	FUNCTION SELECTOR to ZERO ADJ.	Adjust the ZERO ADJ control for a 0 SET indication on the test set meter.	Meter pointer can be positioned to 0 SET.
2	FUNCTION SELECTOR to DC CENTER ADJ.	Adjust the DC CENTER ADJ control until the meter pointer rests at the DC CENTER line.	Meter pointer can be positioned to DC CENTER.
3	Same as step 2	Connect the dc voltmeter from pin 6 to pin 3 of the IF AMPL TEST SOCKET. Press the PRESS FOR FILAMENT CAL button and adjust the FILAMENT CAL control for a CAL LEVEL indication on the test set meter.	Meter pointer can be positioned to CAL LEVEL and the dc voltmeter indicates 1.5 volts dc ±0.075.
4	Same as step 2 -	Connect a 30K ohm ±5%, 1/2-watt resistor from pin 4 to pin 3 of the IF AMPL TEST SOCKET. Connect the dc voltmeter across this resistor (pin 4 positive).	Dc voltmeter indicates 65 volts dc ±1.
5	Same as step 2	Reduce the ac line voltage to 105 volts ac. Allow time for the test set to stabilize, and then readjust the ZERO ADJ control for a 0 SET indication on the test set meter.	Meter pointer can be positioned to 0 SET.
6	Same as step 2	Same as step 5, and then connect a 15-ohm ±5%, 1/2 watt resistor from pin 6 to pin 3 of the IF AMPL TEST SOCKET. Press the PRESS FOR FILAMENT CAL button and adjust the FILAMENT ADJ control until the meter pointer rests at the CAL LEVEL line.	Meter pointer can be positioned to the CAL LEVEL line.

Step	Control settings	Action	Indication and limits
7	FUNCTION SELECTOR switch to CAL LEVEL and FREQUENCY SELECTOR switch to CTR.	Rotate the RF CAL control to position the meter pointer at the 18 DB line. Readjust the RF CAL control to position the meter pointer at the CAL line.	Meter pointer can be positioned to the 18 DB line. If necessary, adjust the CTR OSC ADJ control to meet this requirement.
8	Same as step 7	Rotate the RF CAL control to position the meter pointer at CAL LEVEL. Switch the FREQUENCY SELECTOR to L, and then to H.	Meter pointer should remain within the limits of the CAL LEVEL block in both the L and H positions. The L OSC ADJ control and the H OSC ADJ control may be adjusted to meet this requirement.
9	Same as step 7	Rotate the RF CAL control to position the meter pointer at 24 DB line. Proceed to step 10.	Proceed to step 10.
10	FUNCTION SELECTOR switch to IF TEST and FREQUENCY SELECTOR switch to CTR.-	Connect the ac voltmeter to the special test plug (fig. 22.2) and insert the plug into the IF AMPL TEST SOCKET.	Ac voltmeter should indicate 10.5 mv \pm 0.5.
11	FUNCTION SELECTOR switch to DISCR TEST and FREQUENCY SELECTOR switch to CTR.	Same as 10 except insert the special test plug into the DISCR TEST SOCKET.	Ac voltmeter should indicate 400 mv \pm 20.
12	FREQUENCY SELECTOR switch to CTR and FUNCTION SELECTOR switch to INT IF BAL. Insert test plug P2 into the IF. AMPL TEST SOCKET.	Adjust the RF CAL control until the meter pointer rests at the CAL LEVEL line. Remove test plug P2 and insert the special test plug (fig. 22.2) in its place. Connect the ac voltmeter to the special test plug.	Ac voltmeter should indicate 150 mv \pm 5.
13	FUNCTION SELECTOR switch to DISCR TEST and FREQUENCY SELECTOR switch to CTR.	Apply approximately -7.2 volts dc from the meter test set to pin 7 of the DISCR TEST SOCKET. Adjust this voltage until the meter pointer rests at the left edge of the blue block at the right of the meter.	Meter test set output voltage should be -7.2 volts dc \pm 0.4.
14	Same as step 13	Apply approximately +7.2 volts dc from the meter test set to pin 7 of the DISCR TEST SOCKET. Adjust this voltage until the meter pointer rests at the right edge of the blue block at the left side of the meter.	Meter test set output voltage should be +7.2 volts dc \pm 0.4.
15	FUNCTION SELECTOR switch to EXT XTAL TEST and FREQUENCY SELECTOR switch to EXT XTAL.	Insert a good 1-mHz crystal from a radio set into the external crystal socket. Rotate the RF CAL control.	Meter pointer should move upscale with a clockwise rotation of the RF CAL control.

Page 29, appendix. Delete and substitute;

APPENDIX

REFERENCES

The following is a list of applicable references that are available to the DS, GS, and depot maintenance personnel of Radio Test Sets AN/URM-113 and AN/URM-112A.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manual's (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 3190-7	U.S. Army Equipment Index of Modification Work Orders.
TM 11-2535B	Meter Test Set TS-682A/GSM-1.
TM 11-5057	Frequency Meter AN/USM-26.
TM 11-5102:	Resistors, Decade ZM-16/U, ZM-16A/U, and ZM-416B/U.
TM 11-5129	Oscilloscopes AN/USM-50A, AN/USM-50B, and AN/USM-50C.
TM 11-5820-292-10	Operator's Manual: Radio Sets AN/PRC-8, AN/PRC-8A, AN/PRC-9, AN/PRC-9A, AN/PRC-10, AN/PRC-10A, and AN/PRC-28.
TM 11-5820-292-20	Organizational Maintenance Manual: Radio Sets AN/PRC-8, AN/PRC-8A, AN/PRC-9, AN/PRC-9A, AN/PRC-10, AN/PRC-10A, and AN/ PRC-28.
TM 11-5820-292-35	DS, GS, and Depot Maintenance Manual: Radio Sets AN/PRC-8, AN/PRC-8A, AN/PRC-9, AN/PRC-9A, AN/PRC-10, and AN/PRC-10A.
TM 11-6625-200-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual: Multimeters ME-26A/U, ME-26B/U, ME-26C/U, and ME-26D/U.
TM 11-6625-261-12	Operator's and ,Organizational Maintenance Manual: Audio Oscillators TS-382A/U, TS-382B/U, TS-382D/U, TS-82E/U, and TS-382F/U.
TM 11-6625-274-12	Operator's and Organizational Maintenance Manual: Test Sets, Electron Tube TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U.
TM 11-6625-320-12	Operator and Organizational Maintenance Manual: Voltmeter, Meter ME-30B/U and Voltmeters, "Electronic ME-30B/U, ME-30C/U, and ME-30E/U.
TM 38-750	Army Equipment Record Procedures.

Figure 26 (fold-out). Make the following changes:

(As changed by C 2, 28 Nov 62). Delete figure 26 and substitute the new figure 26.

Add figure 26.1 after figure 26:

TECHNICAL MANUAL

TM 11-6625-206-35

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., 18 June 1959

RADIO TEST SET AN/URM-113

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CHAPTER 1

THEORY

Section I. BLOCK DIAGRAM

I. Scope

a. This manual covers field and depot maintenance for Radio Test Set AN/URM-113. It includes instructions appropriate to third, fourth, and fifth echelons for troubleshooting, testing, alining, and repairing the equipment.

It also lists tools, materials, and test equipment for third, fourth, and fifth echelon maintenance.

Detailed functions of the equipment are covered in this chapter.

b. The complete technical manual for this equipment includes two other publications:

TM 11-6625-206-12 (Radio Test Set AN/URM-113, Operation and Organizational Maintenance).

TM 11-6625-206-35P (Field and Depot Maintenance Repair Parts and Special Tools List for Radio Set AN/URM113).

c. Forward comments concerning this manual to the Commanding Officer, United States Army Signal Publications Agency, Fort Monmouth, N. J.

Note. For applicable forms and records, see paragraph 2, TM 11-6625-206-12.

2. General

The test set provides three crystal-controlled test signals to check equipment under test. The test signals are selected by front panel controls and are applied to the equipment under test through internal driver stages. The output of the equipment being tested is monitored by a vacuum-tube voltmeter (vtvm) bridge circuit and is displayed on an indicating meter. The signal path for the test set is shown in the block diagram (fig. 1).

3. Block Diagram

Theory The block diagram theory of the test set is described in a through m below. For complete circuit details, refer to figure 26.

a. *Crystal Bank.* Crystals CR1, CR2, and CR3 are contained within the test set. FREQUENCY SELECTOR switch S1 selects the crystal to be used in oscillator stage V3A.

b. *Oscillator.* One-half of a 12AV7 dual-triode, V3A, is used in a crystal-controlled oscillator circuit. The frequency of oscillation is determined by the crystal switched into the feedback circuit by the FREQUENCY SELECTOR. The crystal may be selected from the internal crystal bank or may be a crystal inserted in the EXT XTAL socket. The output of the oscillator is the test signal that is fed to cathode follower V3B.

c. *Cathode Follower V3B.* Cathode follower V3B serves as a buffer for the oscillator and provides a low impedance driving source for the following stages. The output of the cathode follower is applied to the FUNCTION SELECTOR switch and to the radio-frequency (RF) level detector.

d. *RF Level Detector.* A detecting network consisting of CR6 and CR7 accepts the RF output of V3B. The RF is rectified and is applied to the FUNCTION SELECTOR switch S2. This voltage is applied to the vtvm bridge and is indicated on meter M1 when the FUNCTION SELECTOR switch is in CAL LEVEL (position 3) or in EXT XTAL (position 9).

e. *Intermediate-Frequency Driver.* When the FUNCTION SELECTOR switch is at IF TEST, PULSE SW GEN TEST, or INT IF BAL (position 4, 5, or 7, fig. 1), the RF signal is applied to intermediate-frequency (IF) driver V1. The output of V1 is transformer coupled to the IF AMPL TEST SOCKET.

f. *IF AMPL TEST SOCKET.* The test socket provides the necessary operating voltages for the AM-427/U plug-in IF amplifier. The output of the IF amplifier under test is coupled from the test socket to IF limiter V2.

g. IF Limiter. The output of the IF amplifier under test drives limiter V2. A portion of the limiter grid voltage is fed to the vtvm bridge through FUNCTION SELECTOR switch S2. The magnitude of this voltage indicates the condition of the IF amplifier under test.

h. PULSE SW GEN TEST SOCKET. This test socket accepts the 0-325/U for testing. When an AM-427/U is inserted into the IF AMPL TEST SOCKET, the output signal is applied to the PULSE SW GEN TEST SOCKET through limiter V2. When an 0-325/U is inserted into the PULSE SW GEN TEST SOCKET, the 0-325/U will oscillate. The magnitude of limiter grid voltage required to stop the 0325/U from oscillating is used as a measure of the condition of the unit under test.

i. Discriminator Driver. When the FUNCTION SELECTOR switch is at DISCR TEST or INT DISCR BAL (positions 6 or 8, fig. 1), the output of cathode follower V3B is applied to discriminator driver V4. The output signal from V4 is coupled to the DISCR TEST SOCKET and to internal discriminator balance detector CR4 and CR5.

j. DISCR TEST SOCKET. This socket accepts the TF-132/U and TF-204/U. The signal from V4 is detected by the discriminator under test and a portion of this voltage is fed to the vtvm bridge through the FUNCTION SELECTOR switch.

k. Internal Discriminator Balance Detector. A detector consisting of CR4 and CR5 detects the output of V4 and applies this voltage to the vtvm bridge through the FUNCTION SELECTOR switch. This voltage is used to check the alinement of the unit under test when the FUNCTION SELECTOR switch is set in DISCR TEST or INT DISCR BAL (positions 6 or 8, fig. 1).

l. Vtvm Bridge. Meter M1 and a type 5814A tube V7 are used in a bridge circuit to indicate visually the results of all tests. The input to the bridge circuit is determined by FUNCTION SELECTOR switch S2.

m. Power Supply. The alternating-current (ac) input voltage is applied across power transformer T1. The secondary windings of the power transformer supply all the necessary ac voltages to the test set. A type 6X4WA tube V5, rectifies the high voltage as from T1. The +250-volt output is not regulated. A portion of the output of the rectifier is connected to two voltage regulators. A type OA2WA tube V6, provides a regulated 150 volts for all stages in the test set except the cathode follower stage. A type NE48 neon lamp V8 provides a regulated 65 volts. This voltage is used when testing IF amplifiers. Selenium rectifier CR8 is used in a full-wave bridge rectifier circuit that supplies 1.5 volts direct current (dc) to the filaments of the units under test.

Section II. CIRCUIT ANALYSIS

4. Oscillator

a. General. Oscillator stage V3A uses one triode section of a 12AV7 tube in a modified Pierce crystal oscillator circuit. It is designed to oscillate with any of the three internal crystals or with either the 1-megacycle (mc) or 2.15-mc crystal that may be inserted into the EXT XTAL socket.

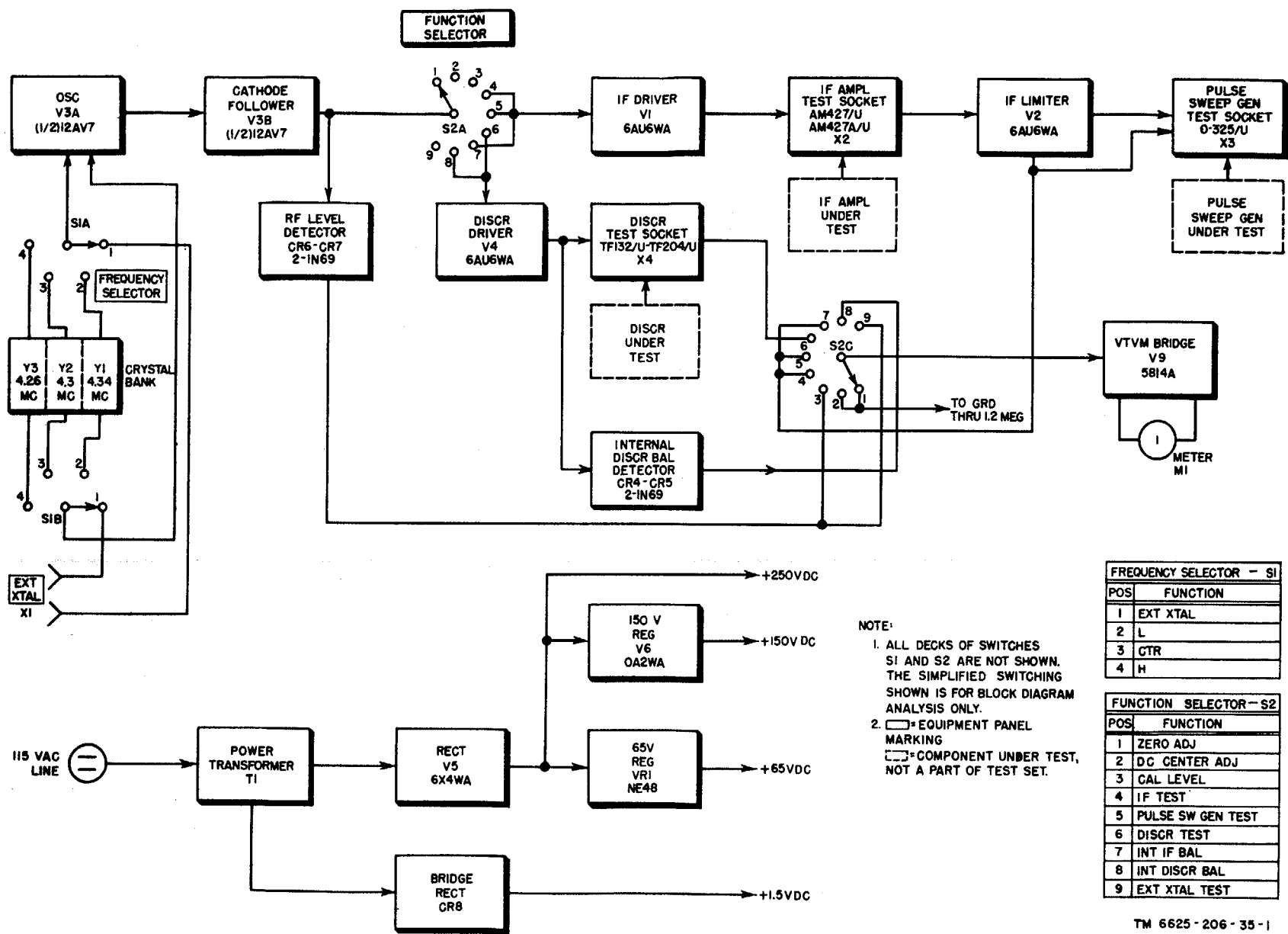
b. Operation (fig. 2). FREQUENCY SELECTOR switch S1 selects the crystal that is placed between the grid and plate of V3A. Capacitor C15, and a trimmer capacitor (CX) selected by S1, and resistor R23, provide gridleak bias for the stage. Cathode bias is provided by resistor R25. The value of C15 and the trimmer capacitor affects the operating frequency. Capacitor C11 couples the plate to the crystal. Resistor R14 is the plate load for the oscillator and C5 is a plate decoupling capacitor. Capacitor C14, together with R56 are an ac

voltage divider that attenuates the feedback current at higher harmonics, thus reducing the possibility of oscillation at higher crystal modes. Resistor RX switched in by S1 and is used to adjust the oscillator level by varying the supply voltage to the plate of the oscillator. The oscillator output is connected through coupling capacitor C12 to the grid of cathode follower V3B.

5. FREQUENCY SELECTOR switch

(fig. 3)

FREQUENCY SELECTOR switch S1 is a two-deck, four-position wafer switch. Its function is to change the frequency of the oscillator by placing different crystals and trimmer capacitors into the plate-to-grid circuit (par. 4)



FREQUENCY SELECTOR - S1	
POS	FUNCTION
1	EXT XTAL
2	L
3	CTR
4	H

FUNCTION SELECTOR - S2	
POS	FUNCTION
1	ZERO ADJ
2	DC CENTER ADJ
3	CAL LEVEL
4	IF TEST
5	PULSE SW GEN TEST
6	DISCR TEST
7	INT IF BAL
8	INT DISCR BAL
9	EXT XTAL TEST

NOTE:
 1. ALL DECKS OF SWITCHES S1 AND S2 ARE NOT SHOWN. THE SIMPLIFIED SWITCHING SHOWN IS FOR BLOCK DIAGRAM ANALYSIS ONLY.
 2. EQUIPMENT PANEL MARKING
 COMPONENT UNDER TEST, NOT A PART OF TEST SET.

TM 6625-206-35-1

Figure 1. Block diagram.

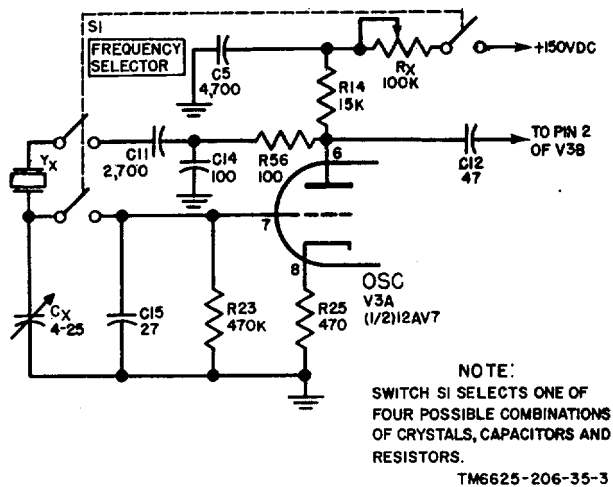


Figure 2. Oscillator stage, simplified diagram.

Individual plate voltage-dropping resistors are also placed in the oscillator stage on each position of this switch. The following circuit conditions exist when switch S1 is placed in the positions listed below:

a. *EXT XTAL.* The EXT XTAL socket, X1, is connected between the plate and grid of V3A (fig. 2). One contact of this socket is connected through section S1B, contact 1, to the grid of V3A. The other contact is connected to the plate through section S1A, contact 1, and capacitor C11. Capacitor C6 is connected from the grid of V3A to ground through section S1B, contact 1. This capacitor permits sufficient feedback to sustain oscillation. The +150-volt supply is applied to the plate of V3A through section S1A, contact Z1, and resistors R24 and R14.

b. *L.* The grid of the oscillator is connected through section S1B, contact 2, to one side of Y1, a 4.26-mc crystal. The plate of the oscillator is connected to the other side of the crystal through capacitor C11 and section S1A, contact 2. Trimmer capacitor C18 is connected from the grid of V3A through section S1B, contact 2. Variable resistor R9 is connected from the 150-volt supply through section S1A, contact Z2, through R14 to the plate.

c. *CTR.* The grid of the oscillator is connected through section S1B, contact 3, to one side of Y2, a 4.3-mc crystal. The plate of the oscillator is connected to the other side of the crystal through capacitor C11 and section S1A, contact 3. Capacitor C24 is connected

from the grid of V3A through section S1B, contact 3, to ground. Variable resistor R13 is connected from the 150-volt supply, through section S1A, contact Z3, through R14 to the plate.

d. *H.* The grid of the oscillator is connected through section S1B, contact 4, to one side of Y3, a 4.34-mc crystal. The plate of the oscillator is connected to the other side of the crystal through capacitor C11 and section S1A, contact 4. Capacitor C21 is connected from the grid of V3A through section S1B, contact 4, to ground. Variable resistor R19 is connected from the 150-volt supply through section S1A, contact Z4, through R14 to the plate.

6. Cathode Follower

(fig. 4)

The second triode section of the 12AV7 tube, V3B, is operated as a cathode follower. This stage isolates the oscillator stage from the following stages. The oscillator signal is applied across grid resistor R26 and R28. Capacitor C13 bypasses the signal at the plate to ground. Resistor R15 is the plate voltage-dropping resistor. The output signal is taken from the movable contact of cathode resistor R28, the RF CAL control, and connected to the FUNCTION SELECTOR and the RF level detector.

7. RF Level Detector

(fig. 5)

a. *General.* The circuit consisting of CR6 and CR7 functions as an RF voltage doubler and detector. A portion of this rectified voltage is applied to the vtvm bridge when the FUNCTION SELECTOR switch is in the CAL LEVEL position or the EXT XTAL position. The magnitude of this voltage is indicated on meter M1 (par. 13) and the indication is used as a reference when setting the output level of the oscillator or when checking external crystals.

b. *Operation.* Part of the output signal of cathode follower V3B (par. 6) is coupled through C22. When the signal applied to C22 is positive with respect to ground, CR7 conducts and a charge is developed across C22. On the negative alternation of the input signal, the voltage across C22 series-aids the applied voltage. Capacitor C22 discharges through CR6 and develops a rectified voltage across C25 that is approximately equal to twice the peak value of the input signal. The voltage across C25 is negative with respect to ground and is

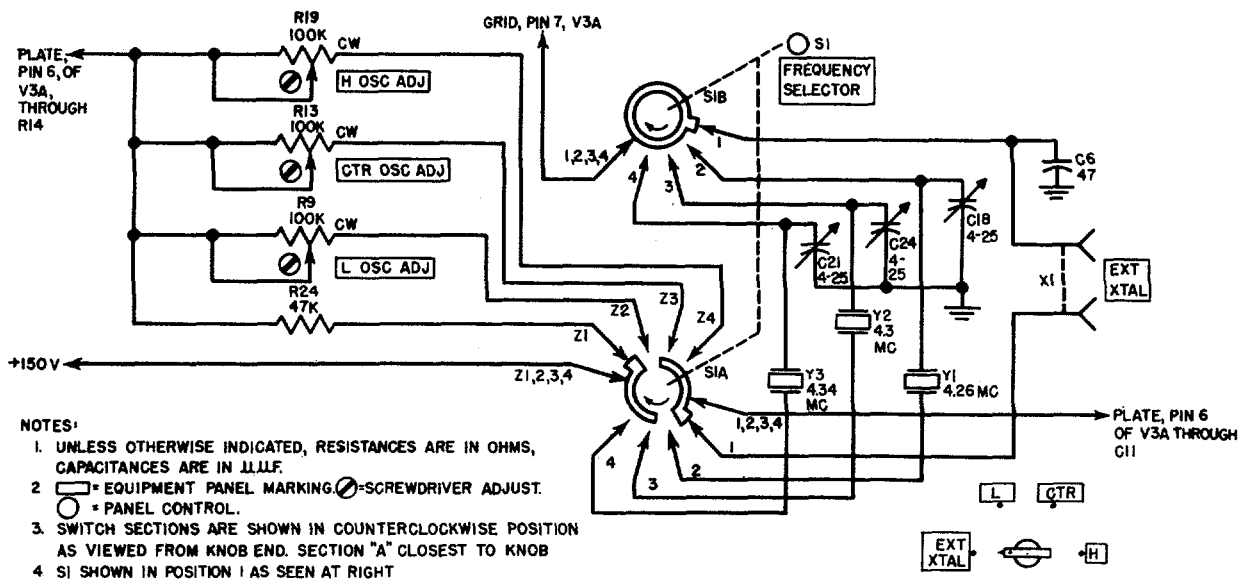


Figure 3. FREQUENCY SELECTOR switch S1.

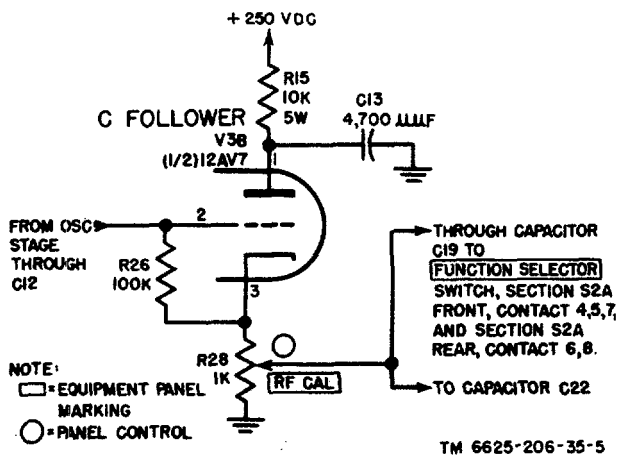


Figure 4. Cathode follower..

impressed across level calibration control R34. A portion of the voltage across R34 is applied to the vtvm bridge circuit through FUNCTION SELECTOR switch S2.

8. IF: Driver

(fig. 6)

The IF driver stage V1, uses a 6AU6WA type tube to couple the oscillator signal from V3B to test socket X2. When the FUNCTION SELECTOR is in the IF TEST position, the PULSE SW GEN TEST position, or the INT IF BAL position, the signal from the cathode follower is applied across grid resistor R10. The output signal is developed across the plate tank circuit consisting of C1 and the primary of T2. This tank circuit is tuned to a center frequency of 4.3

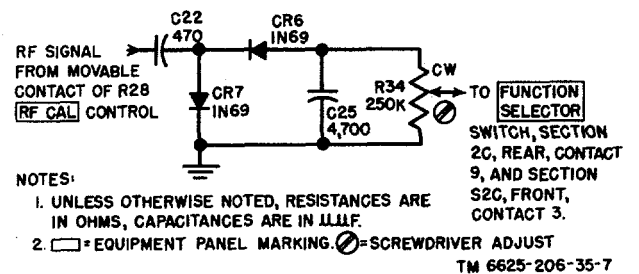


Figure 5. RF detector and voltage doubler.

mc to coincide with the center frequency of the IF amplifier under test. Resistor R2 is used to flatten the response characteristic of the tuned circuit. Unbypassed cathode resistor R11 minimizes the effects of circuit changes on the stage. Capacitor C2 is the screen bypass capacitor and resistor R5 is the screen resistor. Resistor R6 and capacitor C3 are the plate decoupling network. The signal coupled to the secondary of T2 is impressed across contacts 1 and 2 of test socket X2. Figure 7 shows test socket X2, a standard seven-pin miniature socket, connected to a unit under test.

9. IF Limiter

(fig. 8)

a. *General.* The IF limiter stage, V2, uses a 6AU6WA pentode as a grid limiter. The magnitude of the grid limiter voltage is used as a measure of the IF amplifier condition. An IF amplifier or the test plug must be inserted into the test socket X2 before an IF signal is impressed across this stage.

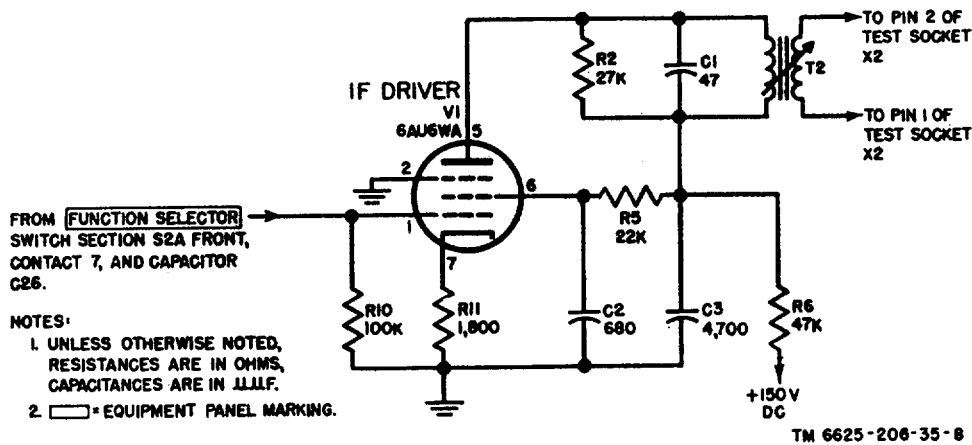


Figure 6. IF driver.

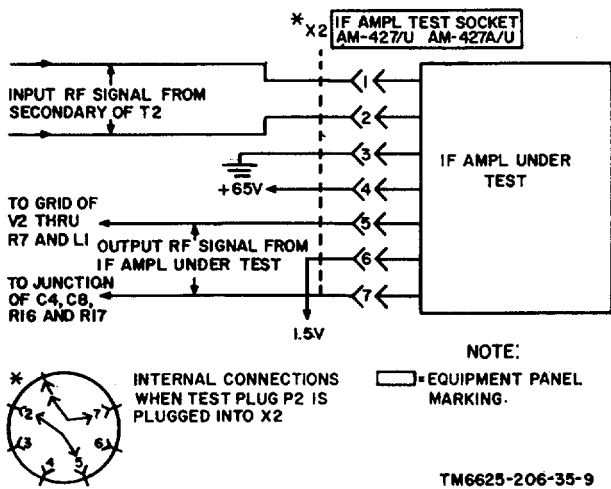


Figure 7. IF AMPL TEST SOCKET, internal connections.

b. *Limiter Operation.* The input signal from the IF amplifier under test is impressed across L1 and C4. This circuit is tuned to a center frequency of 4.3 mc. Resistor R7 broadens the response characteristic of this tuned circuit. The positive alternations of the input signal drive the grid of V2 positive, causing grid current to flow through L1, pins 5 and 7 of X2, and to ground through resistors R16, R17, and R20 (paralleled by R17) that is proportional to the amplitude of the input signal. A portion of this voltage is taken from the movable contact of calibration control R20 and applied through the FUNCTION SELECTOR switch to the vtvm bridge. Capacitor C8 is part of the grid-leak network; R18, bypassed for IF frequencies by C37, is the cathode-bias resistor; R4 is the plate load; and R8 and C9 are the screen-grid voltage-dropping resistor and screen-grid bypass capacitor respectively.

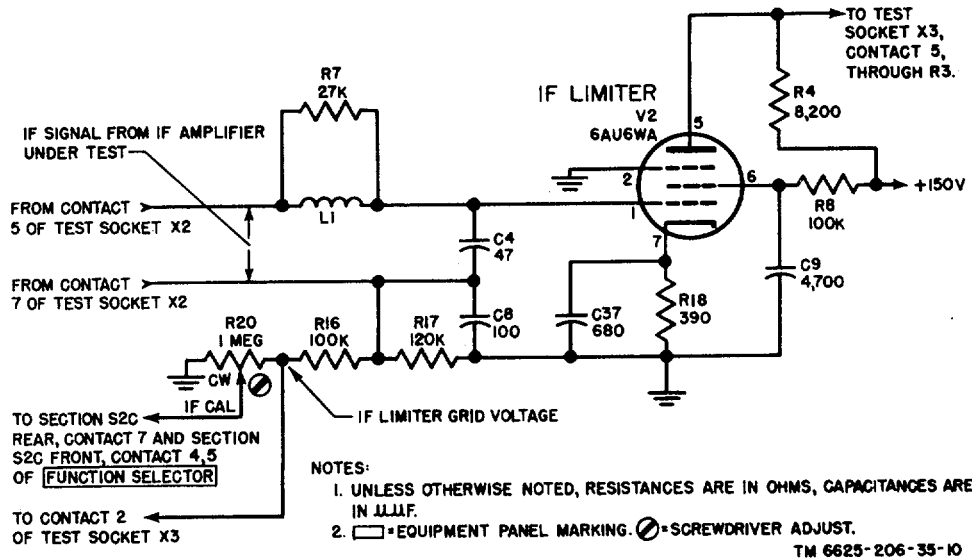


Figure 8. IF limiter V2.

10. PULSE SW GEN TEST SOCKET

(fig. 9)

The PULSE SWEEP GEN TEST SOCKET (test socket X3), is a standard seven-pin miniature socket. The signal from V2 (fig. 8) is connected across voltage divider resistors R3 and R12 to ground. Contact 4 of test socket X3 connects to the junction of a voltage divider, R21 and R22, across the +150-volt supply. Plate and screen voltage is fed to the socket at this point when the FUNCTION SELECTOR switch is in the PULSE SW GEN TEST position. The IF limiter grid voltage is connected to contact 2; when this voltage is sufficiently negative, oscillations will cease in the pulse-sweep generator under test. The magnitude of this determines the condition of the pulse-sweep generator under test.

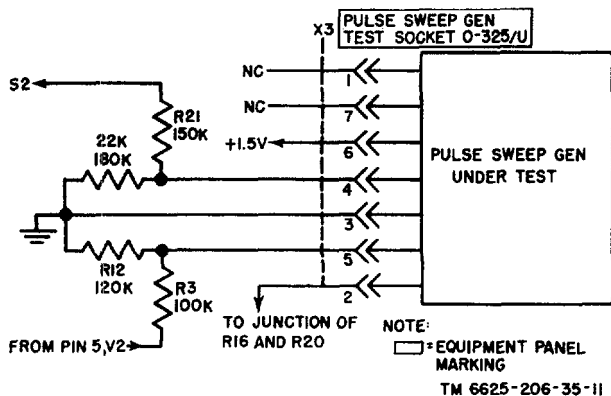


Figure 9. PULSE SW GEN TEST SOCKET, internal connections.

11. Discriminator Driver

(fig. 10)

a. The discriminator driver stage, V4, is similar to the IF driver stage (par. 8). A 6AU6WA pentode tube couples the signal to test socket X4. The input signal is impressed across grid resistor R36, and appears across the plate tank circuit consisting of resistor R29, capacitor C20, and transformer T3. The secondary of T3 is connected to test socket X4. Resistor R35 provides cathode bias for the stage. Resistor R32 and capacitor C27 are the screen resistor and bypass capacitor, respectively. Capacitor C28 and resistor R38 provide plate decoupling.

b. Figure 11 shows test socket X4, a standard seven-pin miniature socket, connected to a unit under test. The signal from the discriminator driver stage is impressed across the input of the discriminator under test. The discriminator under test produces a dc output voltage which is applied to the vtvm bridge. Contact 6 of test socket X4 is bypassed to ground by capacitor C29 that simulates the capacity found at this contact in radio sets using Discriminator Transformer TF-204/U. The dc output voltage is taken off at contact 7 through a filter network consisting of R30 and C23, an isolation resistor R33, and discriminator calibration control R37.

12. Internal Discriminator Balance Detector

(fig. 12)

The circuit consisting of CR4 and CR5 functions as a voltage doubler and detector. It

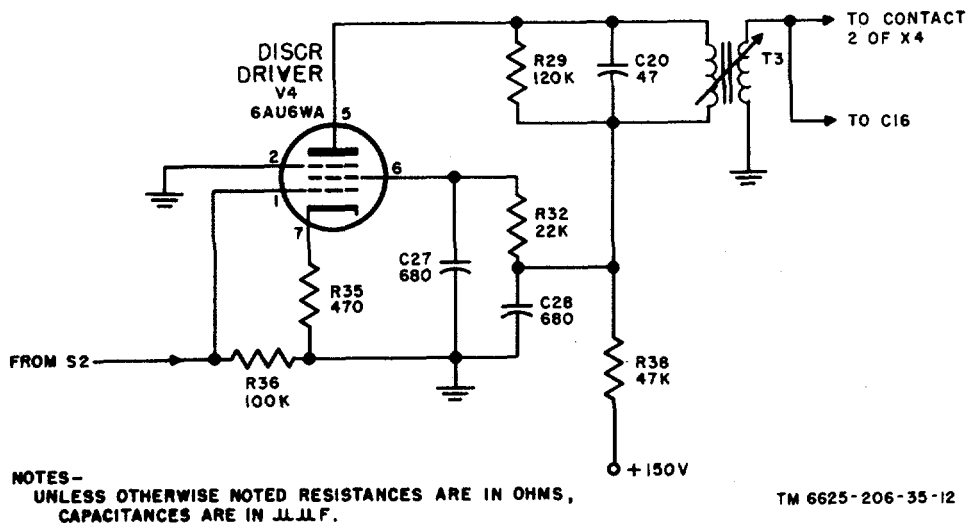
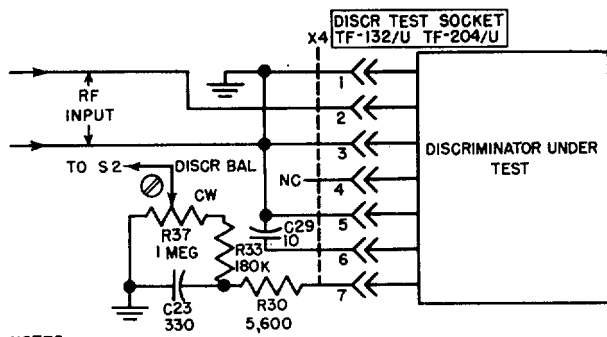
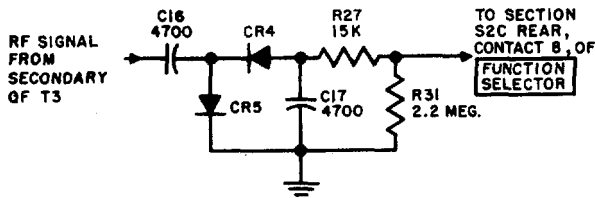


Figure 10. Discriminator driver V4.



- NOTES:
 1. RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN $\mu\text{L.F.}$.
 2. \square = EQUIPMENT PANEL MARKING. \odot = SCREWDRIVER ADJUST.
 TM 6625-206-35-13

Figure 11. DIR TEST Socket, INTERNAL CONNECTIONS.



- NOTES:
 1. UNLESS OTHERWISE NOTED RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN $\mu\text{L.F.}$.
 2. \square = EQUIPMENT PANEL MARKING.
 TM 6625-206-35-14

Figure 12. Internal discriminator balance detector.

operates in the same manner as the RF level detector described in paragraph 7. The voltage across R31 is applied to the vtvm bridge when the FUNCTION SELECTOR is in the INT DISCR BAL position. The magnitude of this voltage is indicated on meter M1 (fig. 13) and is used to check the discriminator driver stage response at the three test frequencies.

13. Vtvm Bridge (fig. 13)

a. Theory of Operation. The two triode sections of V7, a type 5814A dual triode, together with plate load resistors R41 and R42, form a bridge circuit with meter M1 connected across it. The cathodes are returned through cathode resistors R46 and R47, and common cathode resistors R50 and R55. Resistor R50 is a calibration resistor whose value is determined during calibration by the manufacturer. ZERO ADJ control R40 equalizes the plate voltage drop between the two sections of the bridge so that there is no current flow through the meter. Capacitors C33 and C34 are grid bypass capacitors. Resistor R48 is the grid resistor for the second section of V7. The grid resistor for the first

section of V7 is selected by FUNCTION SELECTOR S2. When a negative voltage is applied to the grid of the first section of V7 (pin 2), the decrease in plate current causes the plate voltage at pin 1 to increase. The decreased voltage drop across the common cathode resistance, R55 and R50, causes a decrease in cathode bias for the second section of V7. This change of bias causes a greater plate current to flow through the second section and the plate voltage at pin 6 decreases. Current flows through meter M1 because of the difference in plate voltage between the triode sections of V7. The current flow through the meter, and the indication on the meter, is proportional to the voltage impressed across the input section of V7.

b. Types of Measurements. The vtvm bridge must indicate positive voltage inputs when the 1.5-volt filament supply is checked. It must indicate both positive and negative inputs when discriminators are being tested. All tests other than these two require indications with a negative voltage input. Circuit operation with a negative voltage input is identical with that described in a above.

c. Measurement of 1.5-volt Filament Supply. The 1.5-volt filament supply must be checked to determine whether the filament voltage connected to test sockets X2 and X3 is correct. This voltage is indicated on meter M1 by impressing it across the second section grid, pin 7, of V2. It is connected to this grid through a voltage divider network, resistors R48 and R49, when the PRESS FOR FILAMENT CAL switch is pressed (par. 15b). A positive input to pin 7 of V7 causes the plate current in this section to increase, lowering the plate voltage at pin 6. This rise in current flow through the common cathode resistance causes an increase in plate voltage at pin 1. The respective plate voltage changes are in the same direction as when a negative voltage is applied to the first section of V7 (a above) and the meter indication is in the same direction.

d. Measurement of Positive and Negative Voltages. When positive voltages are impressed across the input grid of V7, pin 2, the indication on meter M1 is to the left. The normal resting point for the meter pointer must be at center scale so that both positive and negative voltages may be indicated, as required when testing discriminators. To cause the meter pointer to rest at center scale, resistors R44, R57, and R39 are

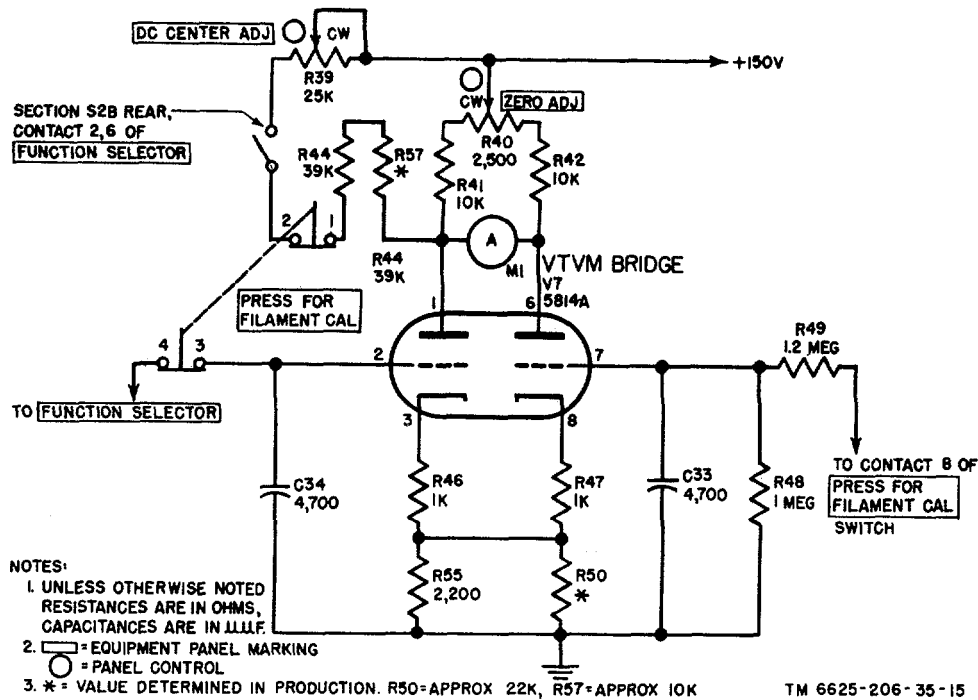


Figure 13. Vtvm bridge V7.

connected in parallel with R41. The voltage at pin 1 of V7 is then higher than that at pin 6, causing meter M1 to indicate near center scale. DC CENTER ADJ control R39 may be adjusted so that the voltage at pin 1 of meter M1 indicates exactly at center scale. Resistor R57 is a calibration resistor selected in production to insure that R39 will have adequate range of control. These resistors are connected in parallel with R41 when the FUNCTION SELECTOR switch is in the DC CENTER ADJ or DISCR TEST position (par. 14).

14. FUNCTION SELECTOR Switch

(fig. 14)

FUNCTION SELECTOR switch S2 connects the oscillator signal from the cathode follower stage to either IF driver V1 or discriminator driver V4, and selects the input to the vtvm bridge circuit. The operation of this switch is described in a through i below.

Note. The wiper contact (1, 2, 3, 4, 5) on section S2C front is connected to the input grid pin 2 of vtvm bridge tube V7, through the PRESS FOR FILAMENT CAL switch (par. 15).

a. ZERO ADJ. The input grid, pin 2 of V7, is returned to ground through section S2C front, contacts 1 and 2, and resistor R1. The zero adjustment of the meter is made with S2 in this position.

b. DC CENTER ADJ. The input grid, pin 2 of V7, is connected as in a above. Plate pin 1 of V7 is connected through the PRESS FOR FILAMENT CAL switch (fig. 15) through contact 2 of S2B rear and through DC CENTER ADJ control R39 to the 150-volt supply.

c. CAL LEVEL. The output of the rf level detector (par. 7) is connected through contact 5 of section S2C front to pin 2 or V7. The oscillator level is set in this position.

d. IF TEST. The signal from cathode follower stage V3B is taken off RF CAL control R28 and coupled through C1, contact 5 of section S2A, front, capacitor C26 and applied to pin 1 of IF driver V1. Capacitors C26 and C7 form an ac voltage divider to attenuate the oscillator signal. The IF limiter grid voltage is coupled through pins 5 and 7 of test socket X2 (test plug P2 must be plugged in) to pin 1 of V1, through isolating resistor R16, IF calibration control R20, contacts 3 and 4 of section S2C, front, of the FUNCTION SELECTOR to the input of vtvm bridge V7.

e. PULSE SW GEN TEST. The signal and the IF limiter grid voltage remain connected as in d above. In addition, plate and screen voltages are connected to test socket X3 through contact 5 of section S2B, front, of the

FUNCTION SELECTOR. This connection enables the pulse-sweep generator to be tested.

f. *DISCR TEST*. The oscillator signal from the cathode follower stage is connected to discriminator driver V4 through coupling capacitor C19, and through contacts 6 and 8 of section S2A, rear, of the FUNCTION SELECTOR. The output voltage from the discriminator under test is taken from pin 7 of socket X4 to the input of the vtm bridge through filter resistor R30, isolation resistor R33, discriminator calibrating control R16 (fig. 23), and through contact 6 of section S2C, rear, of the FUNCTION SELECTOR.

g. *INT IF BAL*. The oscillator signal from the cathode follower stage is connected to IF driver V1; through coupling capacitor C19, and contact 7 of section S2A, front, of the FUNCTION SELECTOR. In this position, capacitor C26 is bypassed. The IF limiter grid voltage is connected to the vtm bridge as described in d above, except that it passes through contacts 3 and 4 of section S2C, front.

h. *INT DISCR BAL*. The oscillator signal at cathode follower output resistor R28 is connected to discriminator driver stage V4, through coupling capacitor C19, contacts 6 and 8 of section S2A, rear. The output of the internal discriminator balance detector (par. 12) is connected through contact 8 of section S2C, rear, to vtm bridge V7. Alinement of the discriminator driver stage is made in this position.

i. *EXT XTAL TEST*. This position makes the same electrical connections as are made in the CAL LEVEL position (c above) but through different switch contacts. The output of the RF level detector is connected through contact 9 of section S2C, rear, to the input grid of vtm bridge V7. Crystals inserted in the MXT XTAL socket (fig. 3), X1, are checked in this position.

15. PRESS FOR FILAMENT CAL Switch

(figs. 14 and 15)

a. This switch permits checking the 1.5-volt filament supply connected to test sockets X2 and X3. Its operation disconnects the vtm bridge circuit from the FUNCTION SELECTOR, thereby disabling it for all other tests. In its normal position (pushbutton out), contacts 1 and 2 of S4 connect the plate of V7 through R44 and R57 to contacts 2 and 6 of FUNCTION SELECTOR, section S2B, rear, allowing the dc center

adjust circuit to work (par. 14b). Contacts 3 and 4 of S4 connect pin 2 of V7 to the wiper contacts of the FUNCTION SELECTOR switch, section S2C, front and rear, allowing test voltages to be applied to the vtm bridge input grid, pin 2. Contacts 6 and 7 of S4 connect the 1.5-volt filament supply to test socket X2 and X3.

b. With the PRESS FOR FILAMENT CAL pushbutton pressed in, contacts 1 and 2 of S4 are opened. This removes meter M1 from the DC CENTER ADJ and DISCR TEST circuits. Contacts 3 and 5 connect the input grid, pin 2, of V7 to ground through resistor R53 to prevent any voltage from energizing this grid. Contacts 6 and 8 of S4 connect the 1.5-volt filament supply to the grid of the second section of V7, pin 7, through voltage divider resistors R48 and R49 (fig. 13). The application of this voltage causes meter M1 to indicate as described in paragraph 13c.

16. Power Supply

(fig. 16)

a. *General*. The power supply provides all of the necessary dc voltages required in the operation of the test set. The ac line voltage is impressed across the primary of T1 through POWER switch S3 and fuses F1 and F2. One regulated B+ voltage and one unregulated B+ voltage are used for high-voltage requirements. A +1.5-volt supply is required for the operation of IF amplifiers and pulse-sweep generators under test; 6.3 volts ac is required for tube filaments.

b. *250-Volt Unregulated Supply*. The ac voltage across the high-voltage secondary (winding 3-5) of T1 is impressed across rectifier tube V5.

The output of the full-wave rectifier is applied to a capacitor input pi-type filter. Capacitor C30A is the input filter. Inductor L2 and capacitor C30B, complete the filter circuit. The 250-volt supply is taken from the junction of L2 and C30B.

c. *150-Volt Regulated Supply*. The 250-volt supply is connected to V6 through dropping resistor R43. This voltage is sufficient to fire gas regulator V6 which clamps at 150 volts, thus regulating the output voltage. Capacitor C32 bypasses V6 to prevent regulator hash from entering the power supply.

NOTES

1. SWITCH SECTIONS ARE SHOWN IN COUNTERCLOCKWISE POSITION AS VIEWED FROM KNOB END. SECTION "A" IS CLOSEST TO KNOB.
2. UNLESS OTHERWISE NOTED RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN μ U.F.
3. = EQUIPMENT PANEL MARKING.
4. S2 IS IN [ZERO ADJ] POSITION AS SHOWN
5. * DENOTES WIPER CONTACT.

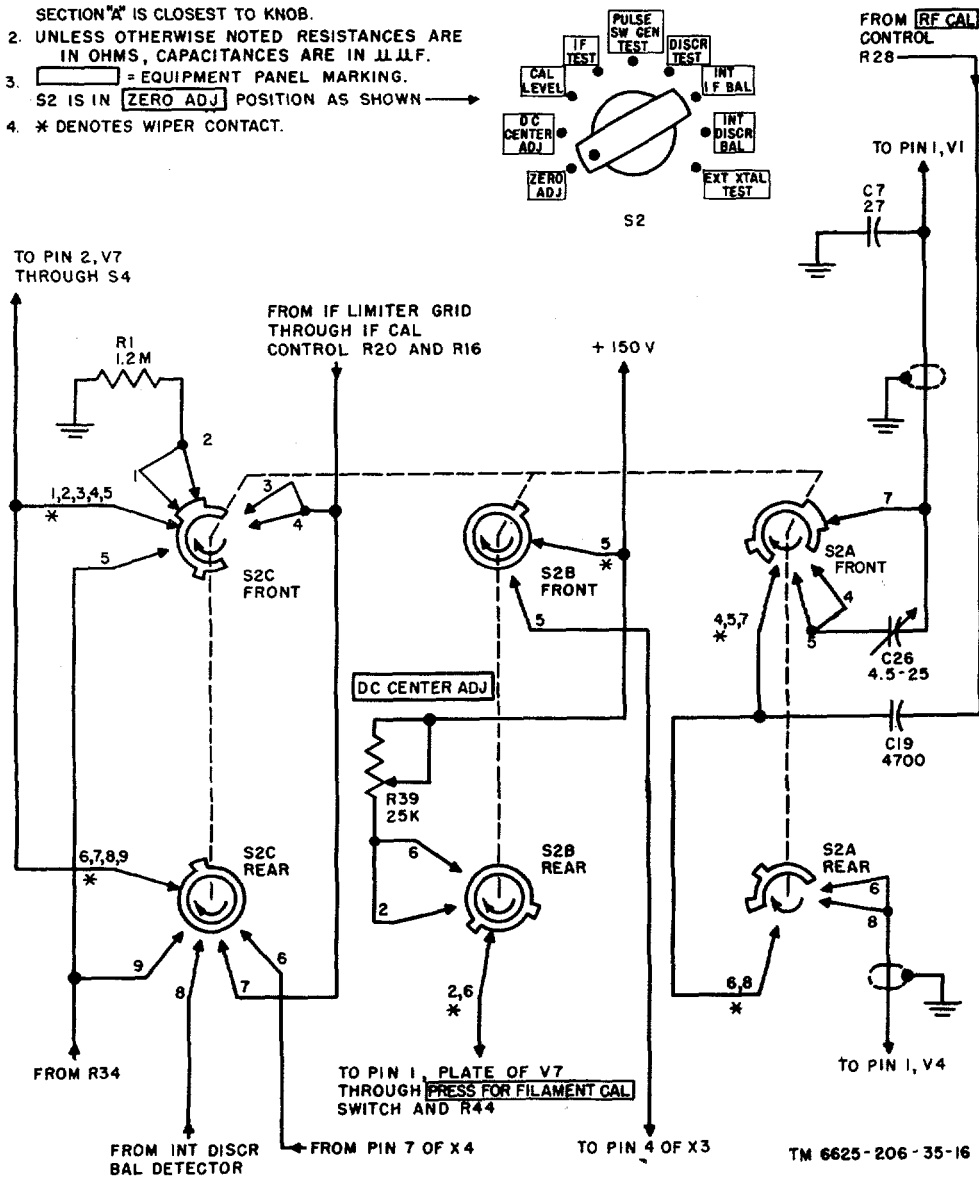


Figure 14. FUNCTION SELECTOR S2, partial diagram.

d. 65-Volt Supply. The 250-volt supply is also applied across dropping resistor R45 in series with VR1, a neon tube NE48. This series combination maintains 65 volts at the junction of R45 and VR1.

e. 1.5-Volt Supply. One 6.3-volt winding on power transformer T1 is connected across bridge rectifier CR8. The rectified output of the put. Resistor R52 permits

adjustment of the voltage applied across FILAMENT CAL control R54. FILAMENT CAL control R54 permits calibration of the output voltage at 1.5 volts. bridge rectifier is applied across a pi-type filter consisting of C35, R51, and C36. Resistor R52 and R54 form a voltage divider across the out

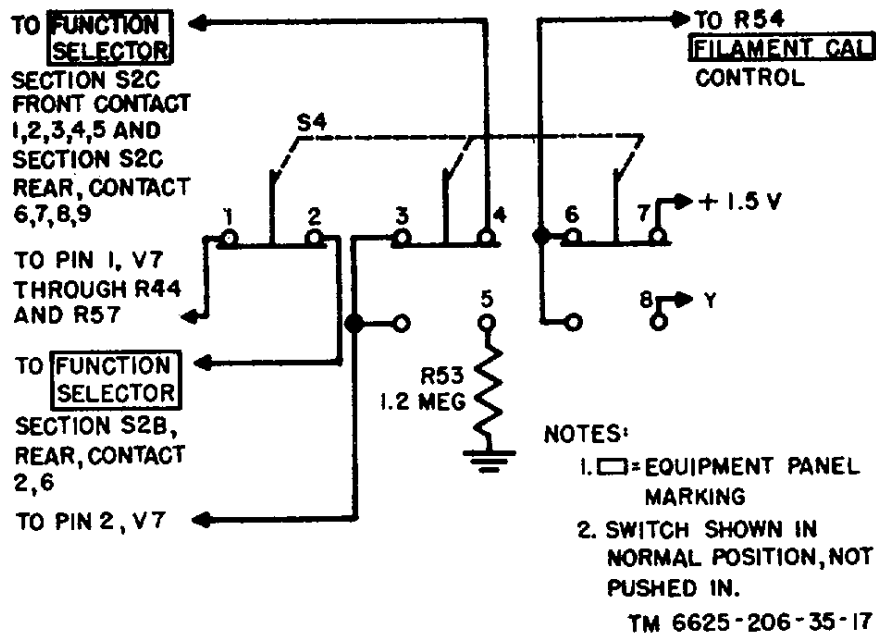


Figure 15. PRESS FOR FILAMENT CAL switch S4, partial diagram.

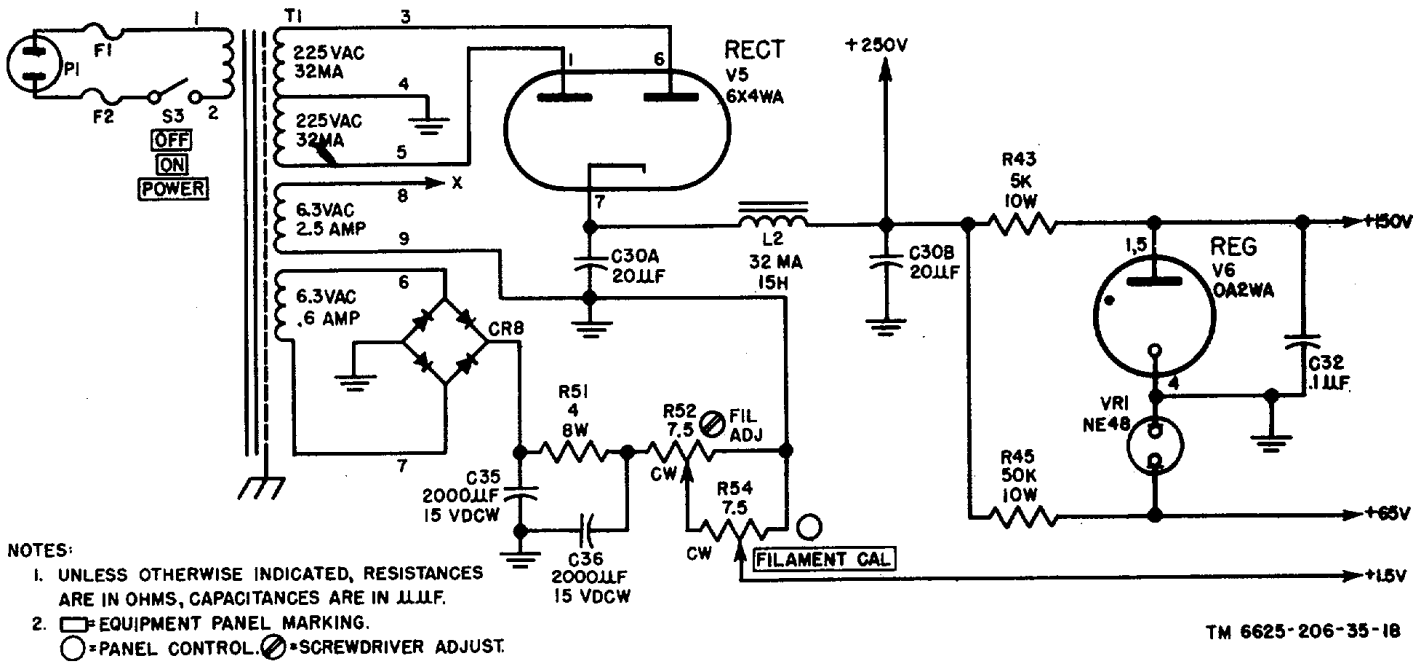


Figure 16. Power supply.

CHAPTER 2 TROUBLE SHOOTING

Section I. GENERAL TROUBLESHOOTING TECHNIQUES

Warning: When servicing the test set, be careful to avoid bodily contact with the 117-volt ac supply, and the +250- +150- and the +65-volt dc supply voltages. Remove the line cord from the supply before attempting removal of any tubes.

17. General Instructions

Troubleshooting at field and depot maintenance level includes all the techniques outlined for organizational maintenance and any special or additional techniques required to isolate a defective part. The field maintenance and depot procedures are not complete in themselves but supplement the procedures described in TM 116625-206-12. The systematic troubleshooting procedure, which begins with the operational checks that can be performed at an organizational level, must be completed by means of sectionalizing, localizing, and isolating techniques. These techniques are outlined in paragraphs 20 through 23 and must be performed at the field maintenance level.

18. Troubleshooting Procedures

a. General. The first step in servicing a defective test set is to localize the fault. Localization means tracing the fault to a defective circuit responsible for the abnormal condition. Some faults, such as burned-out resistors, arcing, and shorted transformers, can often be located by sight, smell, and hearing. The majority of faults, however, must be localized by checking voltages and resistance.

b. Localization. The test set is a self-contained, portable unit. The overall circuit may be broadly divided into five major sections for ease in servicing. These sections are the power supply, oscillator and cathode follower, IF driver and limiter, discriminator driver and detector, and the vtm bridge section. The first step in tracing trouble is to locate the circuit at fault by the following methods:

- (1) *Visual inspection.* The purpose of visual inspection is to locate faults without testing or measuring equipment. All meter readings or other visual signs should be observed and an attempt made to sectionalize the fault to a certain circuit.
- (2) *Operational tests.* Operational tests (TM 11-6625-206-12) frequently indicate the general location of trouble. In many instances, the tests will help in determining the exact nature of the fault. Additional tests are given in paragraph 21.

c. Localization. The tests listed below will aid in isolating the trouble. First, localize the trouble to a single stage, or circuit, and then isolate the trouble within that circuit by voltage and resistance measurements.

- (1) *Voltage and resistance measurements.* These measurements will help locate the individual component part at fault. Use resistor and capacitor color codes (figs. 24 and 25) to find the value of the components. Use the voltage and resistance diagram (fig. 18) to find normal readings, and compare them with readings taken.
- (2) *Troubleshooting chart.* The trouble symptoms listed in the troubleshooting chart (para. 21*d*) will aid in localizing trouble to a component part.
- (3) *Intermittent troubles.* In all these tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the equipment. Check the wiring and connections to component parts of the set.

19. Test Equipment Required

The following chart lists test equipment required for

troubleshooting the test set. It also lists the associated technical manuals.

Test equipment	Technical manual	Common name
Electron Tube Test Set TV-7/U	TM 11-5083	Tube Tester
Multimeter ME-26B/U	TM 11-6625-200-12	Multimeter

Section II. TROUBLESHOOTING TEST SET

Caution: Do not attempt removal or replacement of parts before reading the instructions in paragraph 24.

20. Checking B+ Circuits for Shorts

Warning: When selenium rectifiers fail, because of burn-out or arc-over, poisonous fumes and compounds are released. The fumes have a strong odor and should not be inhaled. Provide adequate ventilation immediately and do not handle the rectifier until it has cooled.

a. *When to Check.* When any of the following conditions exist, check for short circuits and clear the troubles before applying power:

- (1) When the nature of the abnormal symptom is not known.

- (2) When abnormal symptoms reported from other tests indicate possible power supply troubles.

b. *Conditions for Tests.* To prepare for short-circuit tests, remove the test set from its carrying case by removing the 10 screws securing it to the case and lifting with two lift rings. Remove the pilot lamp and all tubes from their sockets.

c. *Measurements.* Make the resistance measurements indicated in the following chart. If abnormal results are obtained, make the additional isolating checks outlined. When the faulty part is found, repair the trouble before applying power to the unit.

Point of measurement	Normal indication	Isolating procedure
Between pin 7 of VS, 6X4WA, to ground.	Resistance of approximately 150K ohms.	If resistance is zero, check for shorted filter C30A. If resistance is 600 ohms, check for shorted filter C30B.
Between pin 1 or 5 of V6, 0A2WA, and ground.	Resistance of approximately 150K ohms.	If resistance is zero, check bypass capacitor C32. If resistance is low, check individual plate decoupling capacitors and screen bypass capacitors.

21. Localizing Troubles

a. *General.* In the troubleshooting chart (d below), procedures are outlined for localizing troubles to a stage within the unit. Use this chart before going through extensive troubleshooting procedures. Parts locations are indicated in figures 19 through 21. When trouble has been localized to a particular stage, use voltage and resistance measurements (fig. 18) to isolate the trouble to a particular part.

b. *Use of Chart.* The troubleshooting chart is designed to supplement the operational checks detailed in TM 11-6625-206-12. If no operational symptoms are known, begin with item 1 of the operational checklist (TM 11-6625-20612) and proceed until a symptom of trouble appears.

Caution: If the operational symptoms are not known, or if they indicate the possibility of short circuits within the unit, make the short-circuit tests

described in paragraph 20 before applying power to the unit.

c. *Conditions of Tests.* All resistance measurements are made with no power applied to the

test set. All of the other tests outlined in the chart are to be made with the test set connected to a 115-volt ac power source. Remove the test set from its carrying case before proceeding with these tests.

d. *Troubleshooting Chart.*

Item	Symptom	Probable trouble	Correction
1	Pilot lamp does not light when the POWER switch is turned ON.	No ac power is applied to the power supply. Defective fuse. Defective pilot lamp.	Check input voltage and POWER switch S3. Check line cord and fuses F1 and F2. If the new fuse blows, check filter capacitor C30A and C30B. Check power transformer T1 (para. 23). Check pilot lamp.
2	Meter M1 inactive on all FUNCTION SELECTOR switch positions.	Failure of B+ supply. Defect in vtm bridge circuit.	Compare the voltage and resistance values measured between the sockets of V5 and V6 to ground with values shown in figure 18. If no B+ voltage is measured, check rectifier tube V5 and associated circuit components. Check vtm bridge circuit (step 6).
3	No indication on meter M1 when testing IF amplifiers or pulse sweep generators.	Failure of +65-volt dc supply.	Check for +65 volts at junction of R45 and VR1 (fig. 19). Check resistor R45 and regulator VR1.
		No 1.5-volt dc filament supply.	Check for 1.5 volts at center tap of R54 (fig. 20). Check resistors R51, R52, and R54. Check capacitors C35 and C36. Check selenium rectifier CR8 by replacement.
		Defective IF driver stage V1.	Check V1 (fig. 17) and replace if defective. Compare the voltage and resistance values measured between the socket of V1 and ground with values shown in figure 18. Localize defective component (para. 18).
		Defective IF limiter stage V2.	Check V2 (fig. 17) and replace if defective. Compare the voltage and resistance values measured between the socket of V2 and ground with values shown in figure 18. Check associated circuit components. Note. A signal is applied to IF limiter stage V2 only if an AM-427/U or test plug is inserted into socket X2.
4	All IF amplifiers and pulse-sweep generators test weak.	Low 1.5-volt dc filament supply.	Measure the voltage at the junction of R51 and C35 (fig. 19). If this voltage is less than 3.1 volts dc, check CR8 by replacement. Readjust filament adjust control R52 (var. 27).
5	All IF amplifiers and pulse-sweep generators test weak. With the test plug inserted in test socket X2 and the FUNCTION SELECTOR set to INT IF BAL, the meter indication is less than 50 on the numerical scale when the RF CAL control is rotated fully clockwise.	Defective IF driver stage V1.	Check V1 and the voltages and resistances at tube socket. Check resistance of transformer T2 (para. 23 and fig. 22). Check all components associated with this stage and replace if defective.
		Defective IF limiter stage V2.	Check V2 and the voltages and resistances at the socket. Check all components associated with this stage and replace if defective.
		Recalibration is required.	Recalibrate the IF amplifier sensitivity and the IF signal input (paras. 31 and 32).
6	No indication on meter MI when testing discriminators or when the FUNCTION SELECTOR is in	Dead discriminator driver stage V4.	Check V4 and the voltages and resistances at the tube socket. If no plate voltage is present, check the plate winding of transformer T3 for continuity (para. 23).

Item	Symptom	Probable trouble	Correction
7	the INT DISCR BAL position. All discriminators test weak.	Same as 6 above. Recalibration is required.	Same as 6 above. Recalibrate discriminator calibration control R37 (para. 30).
8	RF CAL control inoperative. No indication on meter M1 when testing discriminators, IF amplifiers, or pulse-sweep generators.	Dead cathode follower stage V3B, or dead oscillator V3A.	Check V3 voltages and resistances et tube socket; refer to figure 18.
9	Unable to set the meter pointer on zero.	Defective vtvm bridge tube V7. Vtvm bridge out of balance.	Check V7 and replace if defective.
10	The DC CENTER ADJ control will not adjust the meter pointer to center scale.	Defective VTVM bridge stage. Meter M1 has changed sensitivity.	Check plate load resistors R41 and R42; check cathode resistors R46 and R47. See that R50 and R57 are within 10% of their rated values. Check other components in the vtvm bridge stage and replace if defective. Check meter M1 by replacement.

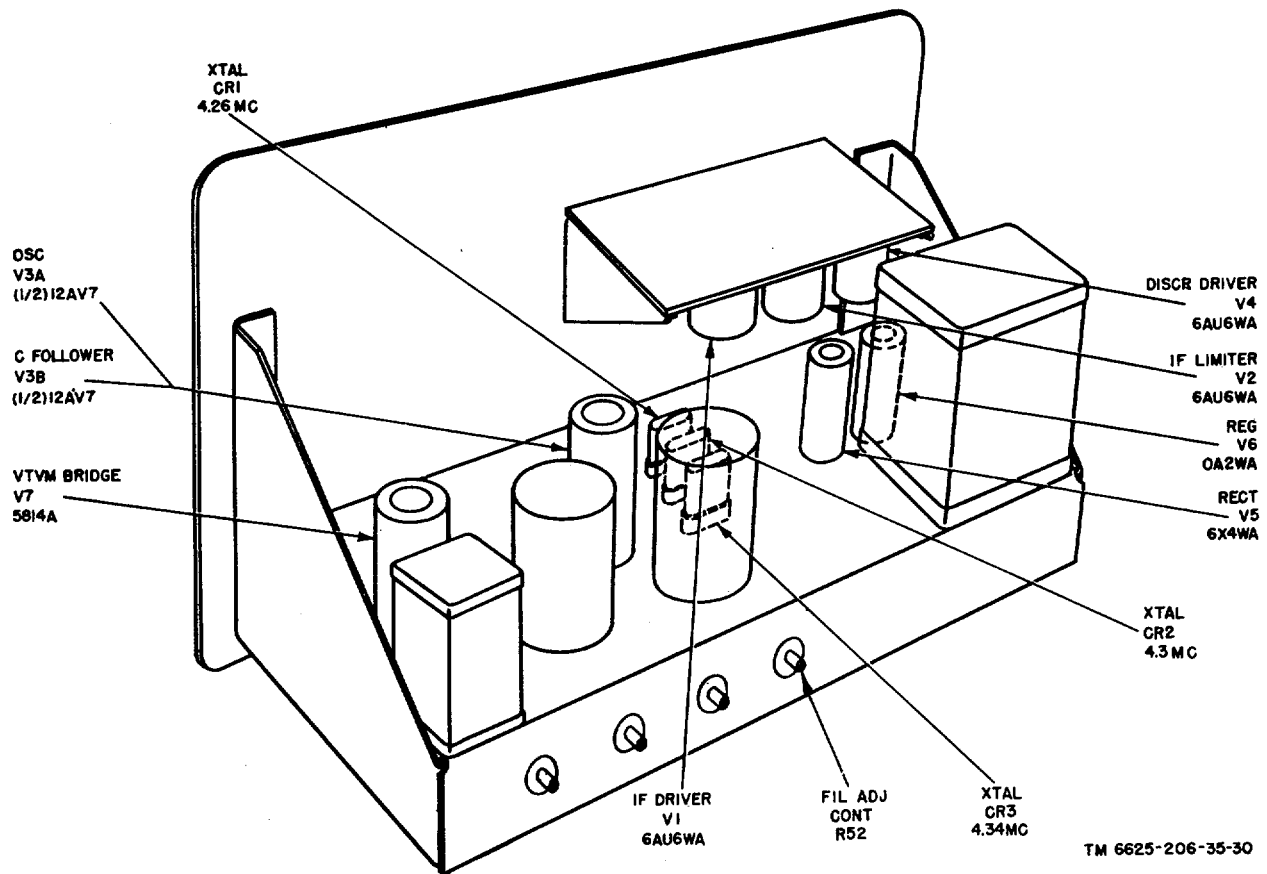


Figure 17. Tube and crystal location diagram.

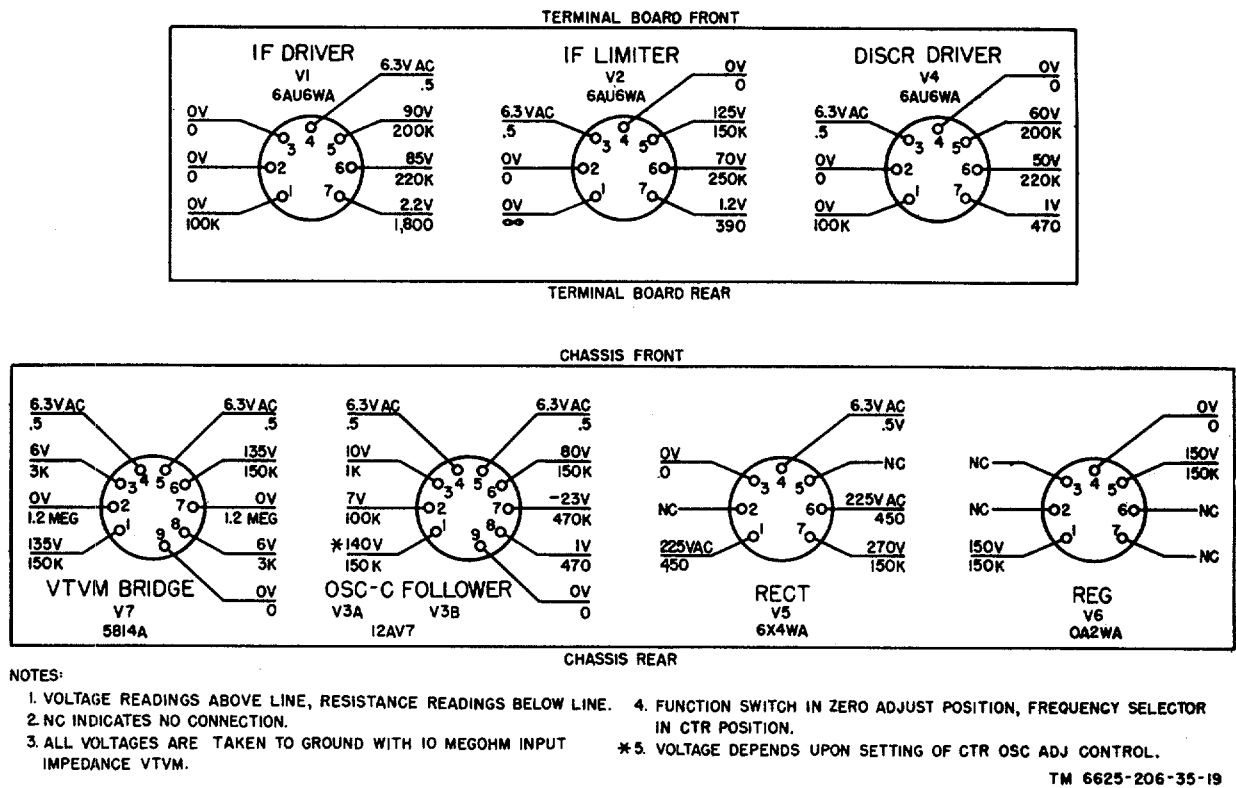


Figure 18. Voltage and resistance data.

22. Isolating Techniques Within Stage

When trouble has been localized to a stage through operational checks, use the following techniques to isolate the defective part:

a. Test the tube involved in a tube tester or by substitution of a known good tube.

Caution: Remove the line cord from the power source before removing any tubes from the test set.

b. Take voltage measurements at the tube sockets (figs. 17 and 18).

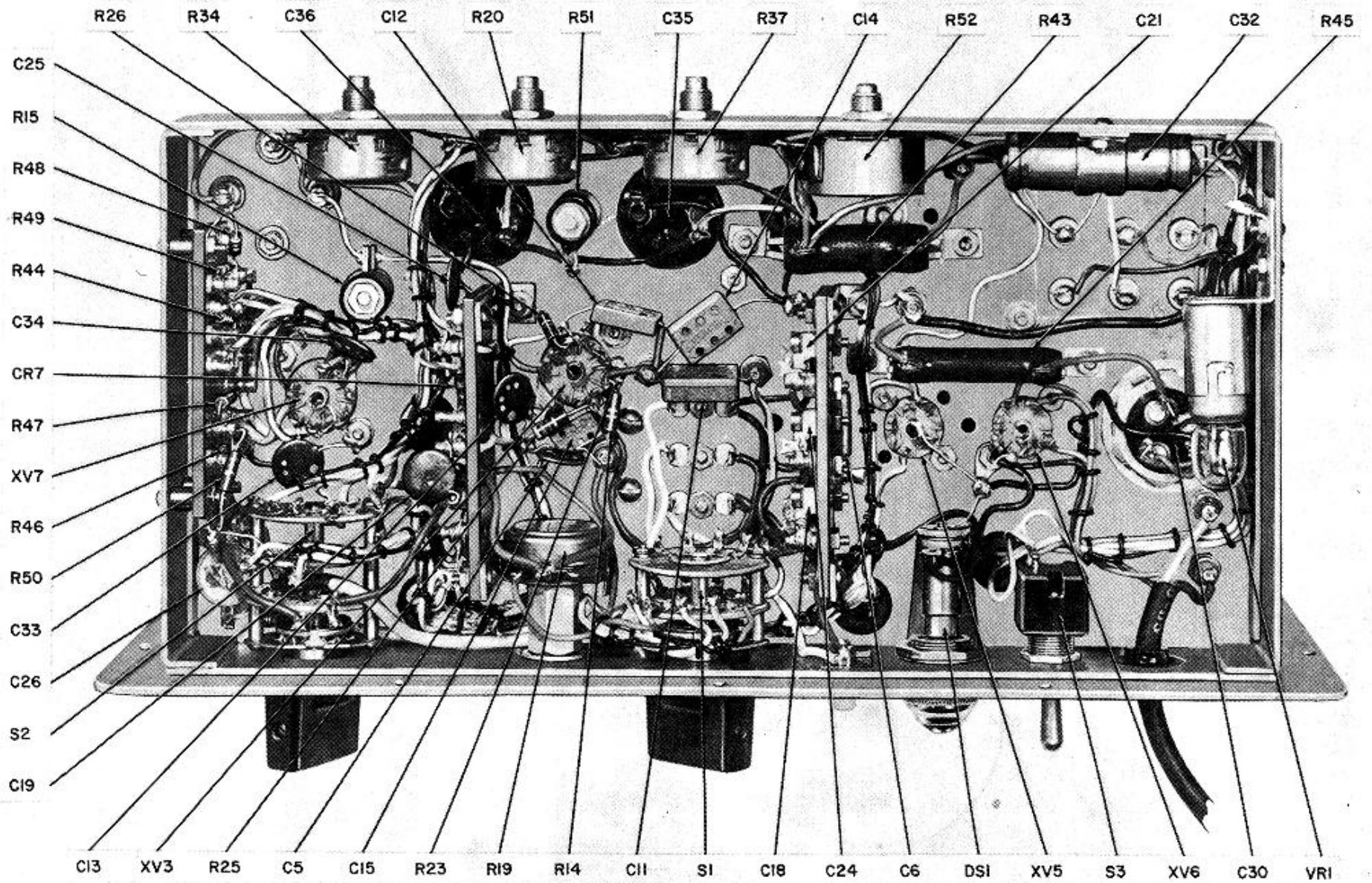
c. If voltage readings are abnormal, take resistance readings to isolate open and short circuits. Refer also to the dc resistances of transformers and coils (par. 23).

d. When all checks fail to reveal any defects, check the calibration of the stage involved.

23. Dc Resistance of Transformers and Coils

The dc resistance of the transformer windings and the coils used in the test set are listed below. See figure 22 for test point location for T2, T3, and L1.

Transformer or coil	Terminals	Ohms
T1	1-2	15
	3-4	450
	4-5	450
	6-7	.7
	8-9	.5
T2, T3	Test points	
	1-2	1
	3-4	.1
L1	1-2	1
L2		600



TM6625-206-35-20

Figure 19. Test set, bottom view.

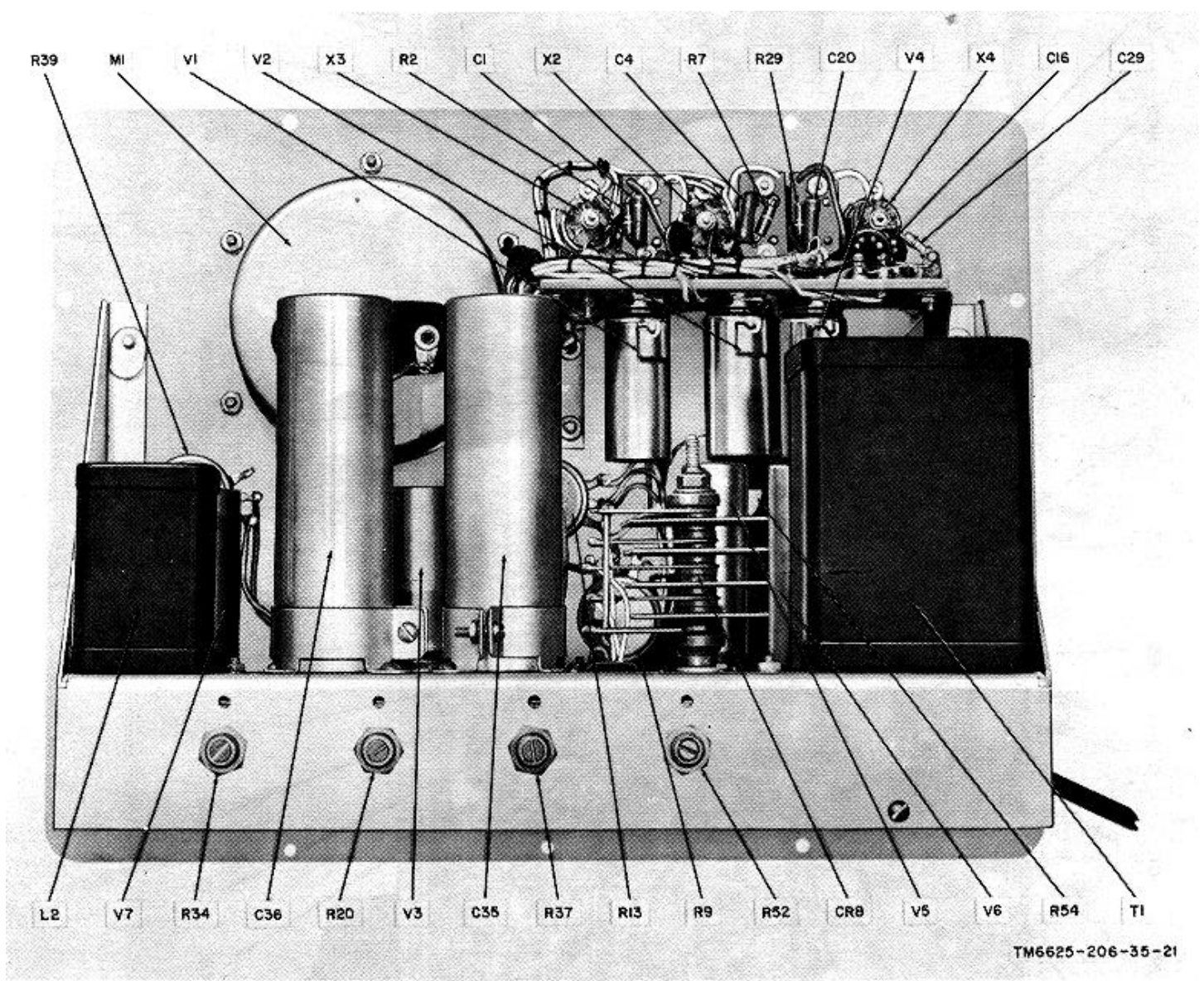


Figure 20. Test set, rear view.

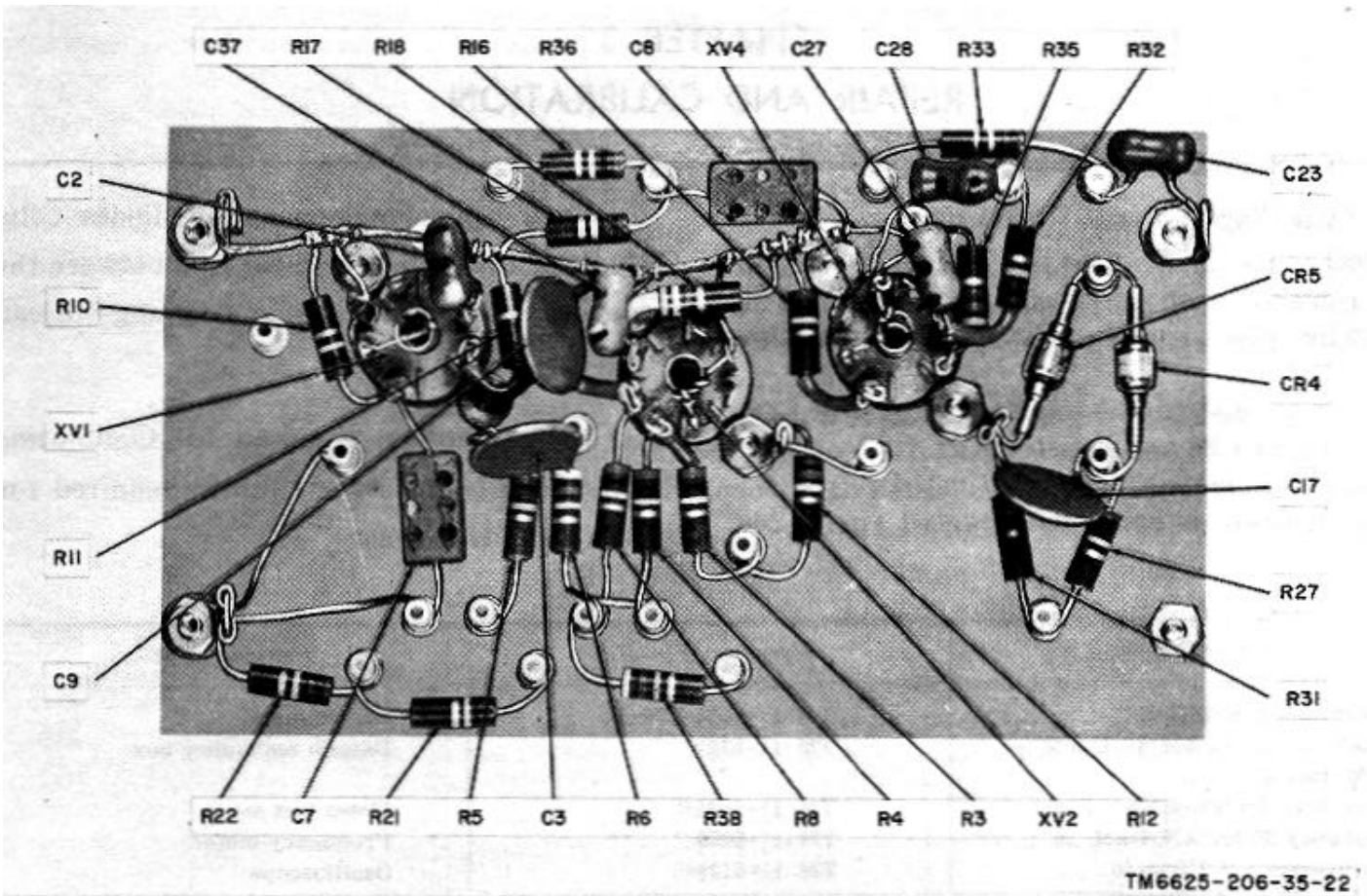


Figure 21.

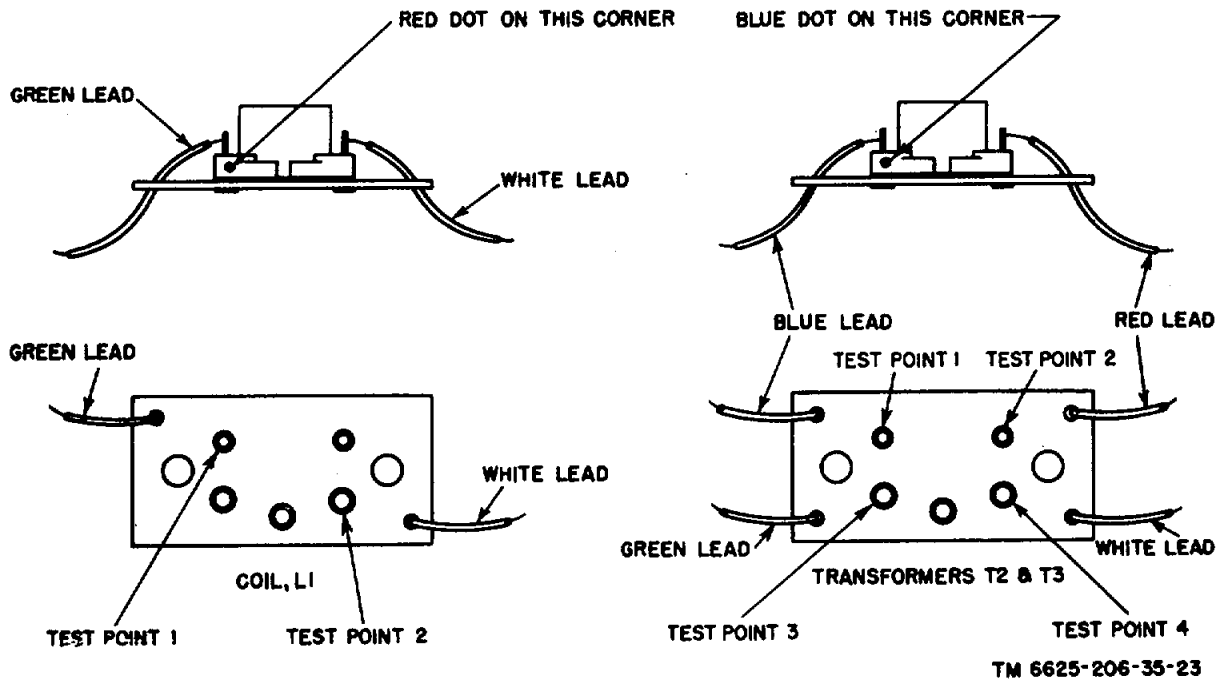


Figure 22. Terminal location of T2, T3, and L1.

CHAPTER 3 REPAIR AND CALIBRATION

24. Parts Replacement Techniques

Most of the parts of the test set can be reached and replaced without special procedures. The following precautions apply specifically to this unit:

a. Do not disturb the setting of capacitor C18, C21, C24, or C26 and resistor R52, R20, or R37. These components should be adjusted only when the instrument is being recalibrated (paras. 26-32).

b. When replacing germanium diodes CR6, CR7, CR4, and CR5, use a heat sink between the diode and the soldering iron by gripping the lead with long-nose pliers.

25. Test Equipment Required for Calibration

This chart lists test equipment required for calibrating the test set.

Test equipment	Technical Manual	Common name
Multimeter ME-26B/U	TM 11-6625-200-12	Multimeter
Decade Resistors ZM-16/U and ZM-16A/U	TM 11-5102	Decade resistance box
Meter Test Set TS-628A/GSM-1	TM 11-2535B	Meter test set
Frequency Meter AN/USM-26	TM 11-5057	Frequency meter
Oscilloscope AN/USM-50	TM 11-5129	Oscilloscope

26. Vtvm Bridge Sensitivity Adjustment

a. *General.* Set the FUNCTION SELECTOR to ZERO ADJ and adjust the ZERO ADJ control to a zero indication on meter M1. Remove resistor R50 (fig. 19) from the unit. This is a calibration resistor and must be changed to calibrate this function. Connect the decade resistance box (para. 25) in place of resistor R50.

b. *Calibration.* Apply 1.5 volts dc from the meter test set to the end of R49 (fig. 19) connected to pin 8 of S4. Adjust the decade resistance box until the meter pointer rests on the CAL LEVEL line. Remove the 1.5 volts dc and be sure that the meter pointer has not shifted off zero. Readjust the ZERO ADJ control if necessary and repeat calibration. Note the value of resistance and remove the decade resistance box. Install a resistor equal to the observed resistance ± 10 percent in place of calibration resistor R50.

b. Allow 5 minutes for the vtvm bridge to stabilize and adjust the ZERO ADJ control for a zero indication on meter M1.

c. Press the PRESS FOR FILAMENT CAL button and adjust R52 (fig. 20) until the meter pointer rests one division above the CAL LEVEL line.

27. Filament Adjust Control

a. Using the meter test set, reduce the input voltage to the test set to 105 volts ac. Rotate FILAMENT CAL control R54 fully clockwise.

28. Crystal Oscillator Calibration

The crystals in the test set are individually trimmed by trimmer capacitors C18, C21, and C24 (fig. 19). These capacitors enable the individual crystal circuits to be set to the correct frequency.

a. Switch the FUNCTION SELECTOR to IF TEST and the FREQUENCY SELECTOR to L.

b. Using the ac probe, connect the multimeter between pin 1 of V1 and ground. Adjust the RF CAL control until the multimeter indicates 1 volt root mean square (rms).

c. Connect a test lead from pin 1 of V1 to the jack marked SIGNAL INPUT on the frequency meter. Adjust trimmer capacitor C18 until the frequency counter

on the frequency meter indicates 4.26 mc.

d. Set the FREQUENCY SELECTOR to CTR and repeat the procedure given in b above.

e. Connect a test lead from pin 1 of V1 to the jack marked SIGNAL INPUT on the frequency meter. Adjust trimmer capacitor C24 until the frequency counter on the frequency meter indicates 4.3 mc.

f. Set the FREQUENCY SELECTOR to H and repeat the procedure given in b above.

g. Connect a test lead from pin 1 of V1 to the jack marked SIGNAL INPUT on the frequency meter. Adjust trimmer capacitor C21 until the frequency counter on the frequency meter indicates 4.34 mc.

h. Replace crystals in the test set if the frequency indications listed in c, e, and g above, are not obtained.

29. RF CAL Level Setting

a. The RF signal level is indicated on meter M1 when the FUNCTION SELECTOR is set to CAL LEVEL. Calibration control R34 sets the vtvm bridge sensitivity for this function.

b. Set the FUNCTION SELECTOR to CAL LEVEL and the FREQUENCY SELECTOR to EXT XTAL.

c. Apply -1.95 volts from the meter test set across R34 (fig. 19).

d. Adjust R34 until the meter pointer rests at the CAL LEVEL line. Disconnect the meter test set from R34.

e. With the FUNCTION SELECTOR at CAL LEVEL, set the FREQUENCY SELECTOR to CTR. Adjust the RF CAL control to set the meter pointer at the CAL LEVEL line.

f. Set the FREQUENCY SELECTOR to L, then H, adjusting the L OSC ADJ and the H OSC ADJ controls so that the meter pointer rests at the CAL LEVEL line in each position.

30. Discriminator Sensitivity Adjustment

a. The discriminator sensitivity is calibrated for equal positive and negative deflection, ± 1 division on the numerical scale.

b. Set the FUNCTION SELECTOR to DISCR TEST and adjust the DC CENTER ADJ control until the meter pointer rests at the DC CENTER line, 30 on the numerical scale. If this adjustment cannot be made, refer to step 10 of troubleshooting chart (para. 21d).

c. Apply -4.4 volts from the meter test set to pin 7 of test socket X4 (fig. 20). Adjust discriminator calibration control R37 (fig. 20) until the meter pointer rests at 50 on the numerical scale, $\pm 1/2$ scale division.

d. Apply +4.4 volts to the same point as in c above, and observe the indication on the meter.

Adjust R37 to set the meter pointer to 10 on the numerical scale, $\pm 1/2$ scale division. Recheck with -4.4 volts. The meter pointer should rest at 50 on the numerical scale, $\pm 1/2$ division. Readjust R37 if necessary.

31. IF Amplifier Sensitivity

a. The IF amplifier sensitivity is calibrated at 50 on the numerical scale by IF calibration control R20.

b. Set the FUNCTION SELECTOR to IF TEST and adjust the ZERO ADJ control until the meter pointer rests at zero.

c. Set up the meter test set to apply -3.2 volts at pin 7 of test socket X2 and adjust R20 (fig. 20) until the meter pointer rests at 50 on the meter scale. If it is not possible to make this adjustment, recheck the vtvm bridge sensitivity (para. 26).

32. IF Signal Input Calibration

a. The signal level applied to IF driver stage V1 is adjusted by trimmer capacitor C26 (fig. 19).

b. Set the FUNCTION SELECTOR to INT IF BAL and the FREQUENCY SELECTOR to CTR. Insert the test plug into test socket X2.

c. Connect the multimeter across R34 (fig. 19). Adjust the RF CAL control until the voltage measured on the multimeter is exactly 10 volts.

d. Connect the multimeter to pin 7 of test socket X2 (fig. 20) and ground.

e. Adjust capacitor C26 until the multimeter indicates .7 volts dc.

33. Test Socket Replacement

Three replaceable sockets are used with this equipment to minimize wear on the IF AMPL TEST SOCKET, PULSE SW GEN TEST SOCKET, and DISCR TEST SOCKET. They are secured to the sockets by a nut on the inside of the panel. Remove the nut securing the replaceable socket (fig. 23) and remove the replaceable socket by pulling straight out from the

panel. Install the new replaceable socket by inserting it in the permanent panel socket and securing it with the

assembly screw and nut as shown in figure 23.

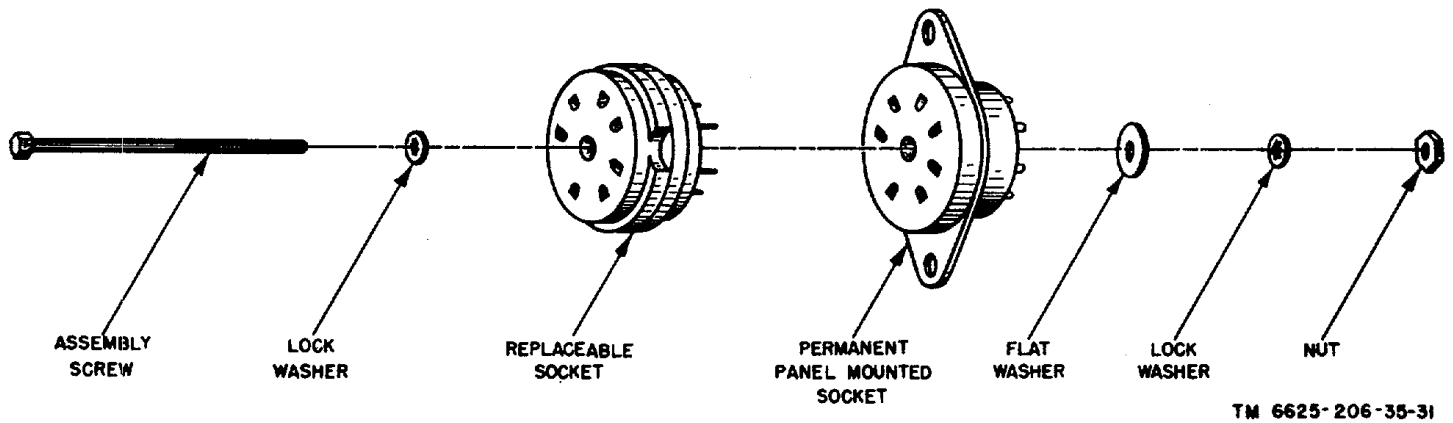


Figure 23. Replaceable socket assembly, exploded view.

CHAPTER 4 FINAL TESTING

34. Purpose of Final Testing

The tests outlined in this section are designed to measure the performance capability of a repaired test set. Equipment that meets the standards stated in the tests will furnish satisfactory operation equivalent to that of new equipment.

35. Test Procedures

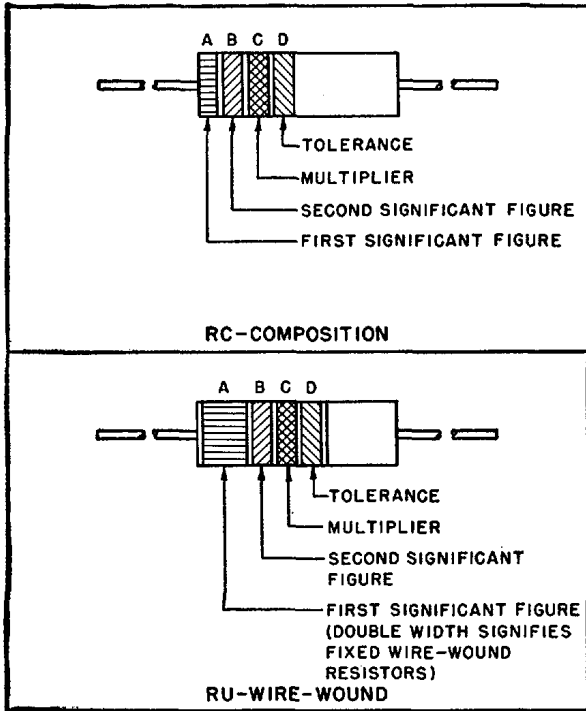
Connect the test set to a 115-volt ac source and permit it to warm up for 15 minutes. Perform the tests listed in the table below.

Step	Control settings	Action	Indication and limits
1	FUNCTION SELECTOR to ZERO ADJ.	Rotate the ZERO ADJ control fully clockwise.	Meter pointer deflects upscale at least 5 divisions.
2	FUNCTION SELECTOR to DC CENTER ADJ.	Rotate the DC CENTER ADJ control fully counterclockwise.	The meter pointer deflects not less than 1 1/2 divisions downscale from DC CENTER.
3	Same as step 2	Rotate the DC CENTER ADJ control fully clockwise.	The meter pointer deflects not less than 1 1/2 divisions upscale from DC CENTER.
4	FUNCTION SELECTOR to CAL LEVEL and FREQUENCY SELECTOR to CTR.	Adjust the RF CAL control until the meter pointer rests at CAL LEVEL. Switch the FREQUENCY SELECTOR to L, then H.	The meter pointer remains at the CAL LEVEL line $\pm 1/2$ division in all three positions of the FREQUENCY SELECTOR switch.
5	FUNCTION SELECTOR to INT IF BAL and FREQUENCY SELECTOR to CTR. Insert the test plug in test socket X2.	Rotate the RF CAL control fully clockwise.	The indication on the meter should be not less than 50 on the numerical scale.
6	Same as step 5	Adjust the RF CAL control so that the meter pointer rests at 50. Switch the FREQUENCY SELECTOR to L, then H.	The meter pointer remains at 50, $\pm 1/2$ division, in the L and H positions.
7	Same as step 5	Adjust the RF CAL control so that the meter pointer rests at 50.	Using the multimeter, measure the voltage between pins 3 and 7 of test socket X2 (fig. 20). This voltage should be -3.2 volts dc $\pm 3\%$ (± 1 volt).
8	Same as step 5	Same as step 7, then switch the FUNCTION SELECTOR to IF TEST.	The meter indication should be to 12 on the numerical scale, ± 2 scale divisions.
9	FUNCTION SELECTOR to IF TEST, FREQUENCY SELECTOR to CTR.	Measure the voltage at the ungrounded end terminal of R34 (fig. 19) with the multimeter. Adjust the PF CAL control until this voltage measures -10.0 volts dc. Measure the voltage between pins 3 and 7 of test socket X2.	The voltage between pins 3 and 7 of test socket X2 (fig. 20) should be .7 volt $\pm 3\%$ ($\pm .024$ volt).

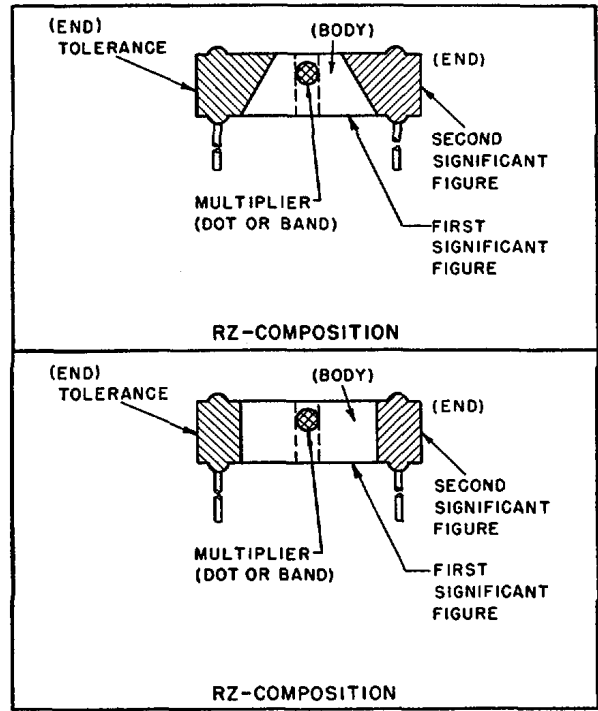
Step	Control settings	Action	Indication and limits
10	FUNCTION SELECTOR to INT DISCR BAL and FREQUENCY SELECTOR to CTR.	Adjust the RF CAL control completely clockwise.	The meter indication should be not less than 50 on the numerical scale.
11	Same as step 10	Adjust the RF CAL control to 30 on the numerical scale. Switch the FREQUENCY SELECTOR to L, then H.	The meter pointer remains at 30, ± 1 division, in both the L and H positions.
12	FUNCTION SELECTOR to DISCR TEST and FREQUENCY SELECTOR to L.	Adjust the DC CENTER ADJ control until the meter pointer rests at DC CENTER. Insert the TF-204/U and adjust the RF CAL control until the meter pointer rests at 10 on the scale.	Using the multimeter, measure the voltage between pins 3 and 7 of test socket X4 (fig. 20). This voltage should be +4.4 volts $\pm 5\%$ (.22 volt).
13	FUNCTION SELECTOR to DISCR TEST and FREQUENCY SELECTOR to H.	Same as step 12, except that deflection should be to 50 on meter scale.	Same as step 12, except that the voltage should be -4.4 $\pm 5\%$ (.22 volt).
14	FUNCTION SELECTOR to EXT XTAL TEST and FREQUENCY SELECTOR to EXT XTAL.	Insert a good 1.0-mc crystal from a radio set into the external crystal socket. Rotate the RF CAL control.	The meter pointer should move upscale with a clockwise rotation of the RF CAL control.
15	Same as step 14	Press the PRESS FOR FILAMENT CAL switch and rotate the FILAMENT CAL control completely clockwise.	The meter pointer should deflect to 2 divisions above center scale, ± 1 division.

RESISTOR COLOR CODE MARKING (MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS (INSULATED)



RADIAL-LEAD RESISTORS (UNINSULATED)



RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

* FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

EXAMPLES (BAND MARKING):

10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

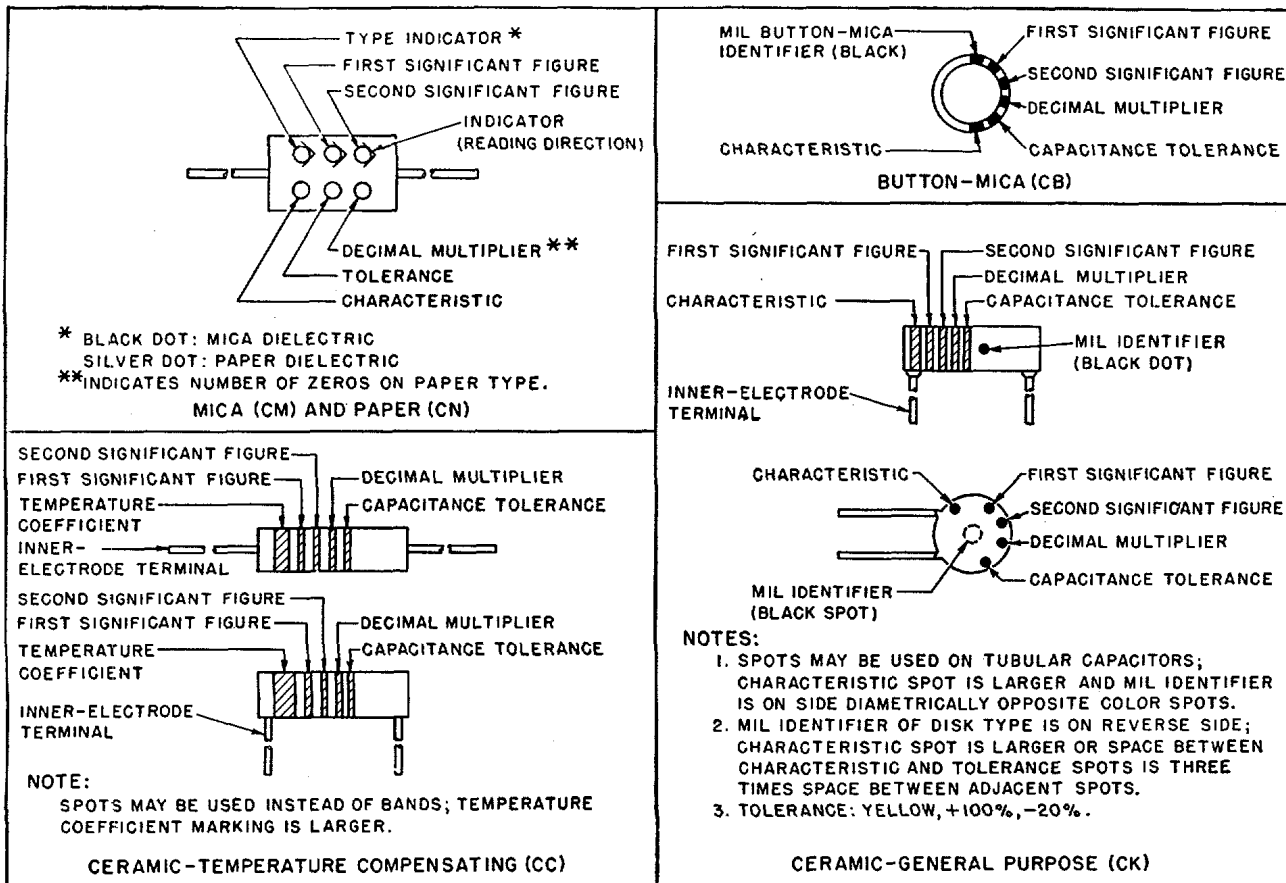
EXAMPLES (BODY MARKING):

10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-R1

Figure 24. MIL-STD resistor color-code markings.

CAPACITOR COLOR CODE MARKING (MIL-STD CAPACITORS)



CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC				TOLERANCE 2					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UUF	10UUF OR LESS	
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500) 3
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

Figure 25. MIL-STD capacitor color-code markings.

APPENDIX REFERENCES

The following is a list of applicable references that are available to the field and depot maintenance repairman of Radio Test Set AN/URM113.

TM 11-612	Radio Sets AN/ PRC-8, -8A, -9, -9A, -10 and -10A, Operation and Organizational Maintenance	TM 11-4065	Radio Sets AN/ PRC-8, -9, and -10, Field Maintenance
TM 11-2535B	Meter Test Set TS682A/GSM-1	TM 11-4065A	Radio Sets AN/ PRC-9A and -10A.
		TM 11-5057	Frequency Meter AN/USM-26
		TM 11-5102	Decade Resistors ZM-16/U and ZM-16A/U
		TM 11-5129	Oscilloscope AN/ USM-50
		TM 11-6625-200-12	Multimeter ME26B/U

[AG 413.44 (29 May 59)]

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OS Base Comd (5)
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Br Svc Sch (5) except
USASCS (25)
GENDEP (2) except
Atlanta GENDEP (None)
Sig Sec, GENDEP (10)
Sig Dep (17)
USA Ord Msl Comd (3)
Army Pictorial Cen (2)
Engr Maint Cen (1)
TASSA (15)
Mid-Western Rgn Ofc (TASSA) (1)
USA Sig Pub Agcy (8)
USA Sig Engr Agcy (1)
USA Comm Agcy (2)
USA Sig Eqp Spt Agcy (2)

USA Sig Msl Spt Agcy (13)
WRAMC (1)
AF:IP (1)
AMS (1)
Ports of Emb (OS) (2)
Trans Terminal Comd (1)
Army Terminals (1)
OS Sup Agcy (2)
Yuma Test Sta (2)
USA Elct Pg (1)
Sig Lab (5)
Sig Fld Maint Shops (3)
Fld Comd, Def Atomic Spt Agcy (5)
Mil Dist (1)

Sectors USA Corps (Res) (1)
USA Corps (Res) (1)
JBUSMC (2)
Units org under fol TOE:
11-7 (2)
11-16(2)
11-57 (2)
11-98 (2)
11-117 (2)
11-155 (2)
11-500 (AA-AE) (2)
11-587 (2)
11-592 (2)
11-597 (2)

NG: State AG (3).

USAR: None.

For explanation of abbreviations used, see AR 320-50.

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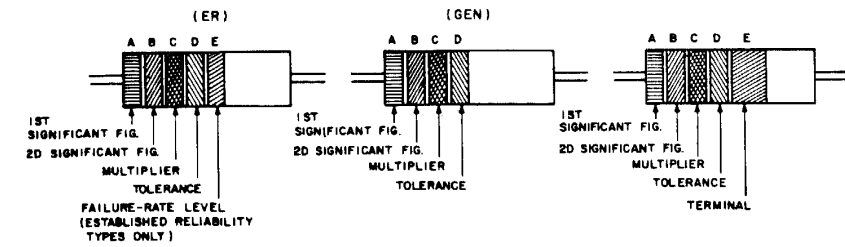


TABLE 1
COLOR CODE FOR COMPOSITION TYPE AND FILM TYPE RESISTORS.

BAND A		BAND B		BAND C		BAND D		BAND E	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)	COLOR	FAILURE RATE LEVEL
BLACK	0	BLACK	0	BLACK	1	BROWN	M		
BROWN	1	BROWN	1	BROWN	10	BROWN	P		
RED	2	RED	2	RED	100	ORANGE	R		
ORANGE	3	ORANGE	3	ORANGE	1,000	YELLOW	S		
YELLOW	4	YELLOW	4	YELLOW	10,000	WHITE			SOLD-ERABLE
GREEN	5	GREEN	5	GREEN	100,000	GOLD	±5		
BLUE	6	BLUE	6	BLUE	1,000,000	RED	±2 (NOT APPLICABLE TO ESTABLISHED RELIABILITY)		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7						
GRAY	8	GRAY	8	SILVER	1.01				
WHITE	9	WHITE	9	GOLD	0.1				

BAND A — THE FIRST SIGNIFICANT FIGURE OF THE RESISTANCE VALUE (BANDS A THRU D SHALL BE OF EQUAL WIDTH.)

BAND B — THE SECOND SIGNIFICANT FIGURE OF THE RESISTANCE VALUE.

BAND C — THE MULTIPLIER (THE MULTIPLIER IS THE FACTOR BY WHICH THE TWO SIGNIFICANT FIGURES ARE MULTIPLIED TO YIELD THE NOMINAL RESISTANCE VALUE.)

BAND D — THE RESISTANCE TOLERANCE.

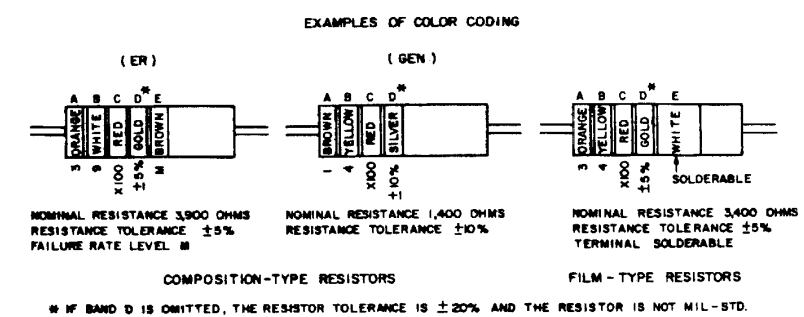
BAND E — WHEN USED ON COMPOSITION RESISTORS, BAND E INDICATES ESTABLISHED RELIABILITY FAILURE-RATE LEVEL. ON FILM RESISTORS THIS BAND SHALL BE APPROXIMATELY 1-1/2 TIMES THE WIDTH OF OTHER BANDS, AND INDICATES TYPE OF TERMINAL.

RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS (THESE ARE NOT COLOR CODED)

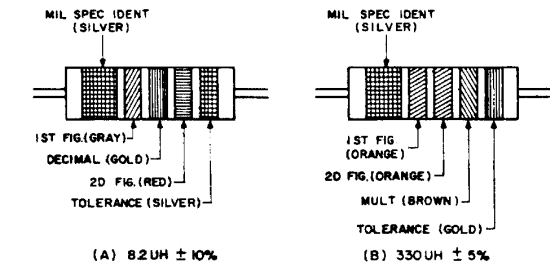
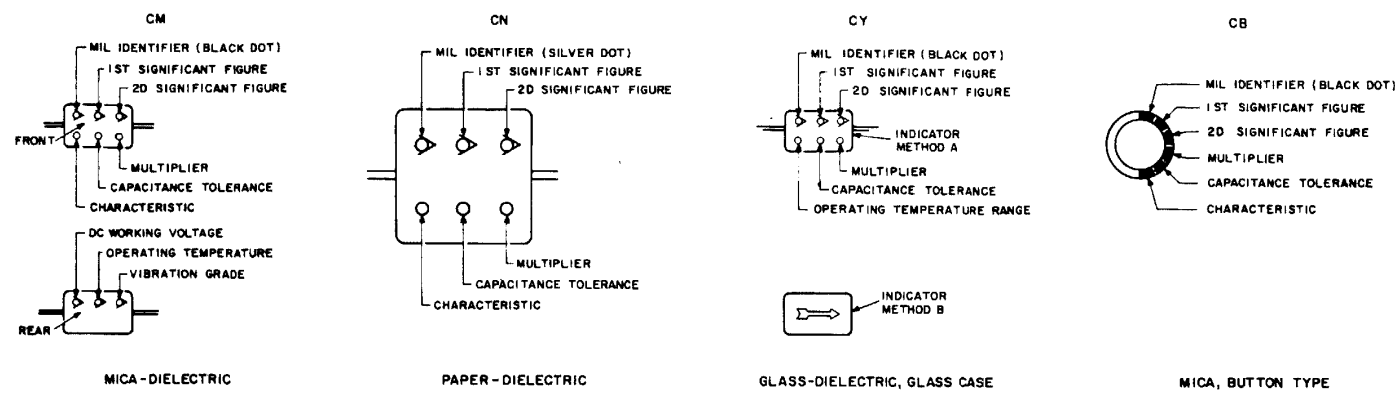
SOME RESISTORS ARE IDENTIFIED BY THREE OR FOUR DIGIT ALPHA NUMERIC DESIGNATORS. THE LETTER R IS USED IN PLACE OF A DECIMAL POINT WHEN FRACTIONAL VALUES OF AN OHM ARE EXPRESSED. FOR EXAMPLE:

2R7 = 2.7 OHMS 10R0 = 10.0 OHMS

FOR WIRE-WOUND-TYPE RESISTORS COLOR CODING IS NOT USED, IDENTIFICATION MARKING IS SPECIFIED IN EACH OF THE APPLICABLE SPECIFICATIONS.



CAPACITORS, FIXED, VARIOUS-DIELECTRICS, STYLES CM, CN, CY, AND CB.



COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES. AT A, AN EXAMPLE OF THE CODING FOR AN 8.2UH CHOKES IS GIVEN. AT B, THE COLOR BANDS FOR A 330UH INDUCTOR ARE ILLUSTRATED.

TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	INDUCTANCE TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	1
RED	2	100	2
ORANGE	3	1,000	3
YELLOW	4		
GREEN	5		
BLUE	6		
VIOLET	7		
GRAY	8		
WHITE	9		
NONE		20	
SILVER		10	
GOLD	DECIMAL POINT	5	

MULTIPLIER IS THE FACTOR BY WHICH THE TWO COLOR FIGURES ARE MULTIPLIED TO OBTAIN THE INDUCTANCE VALUE OF THE CHOKE COIL.

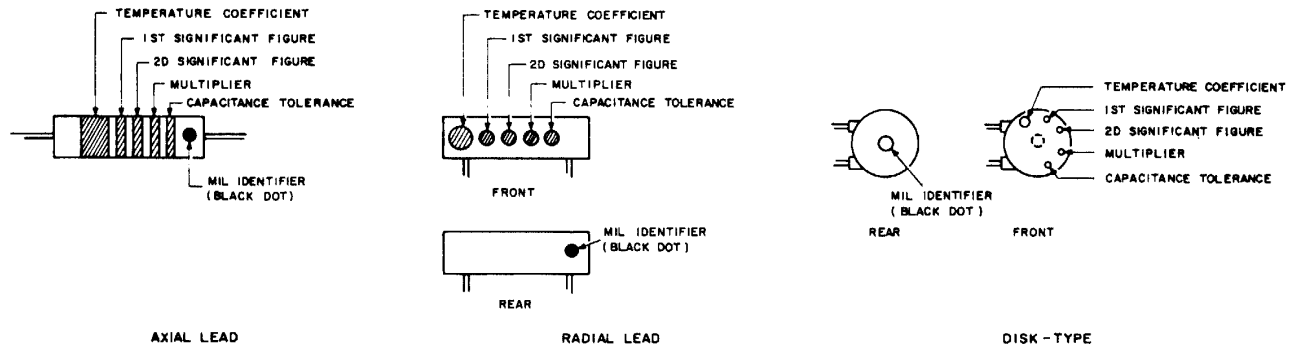


TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB.

COLOR	MIL ID	1ST SIG FIG	2D SIG FIG	MULTIPLIER	CAPACITANCE TOLERANCE			CHARACTERISTIC	DC WORKING VOLTAGE	OPERATING TEMP RANGE	VIBRATION GRADE
					CM	CN	CY				
BLACK	CM, CY, CB	0	0	1		±20%	±20%	A		-55° TO +70°C	10-50 HZ
BROWN		1	1	10				B	E		
RED		2	2	100	±2%		±2%	C			
ORANGE		3	3	1,000	±50%			D	D	300	
YELLOW		4	4	10,000				E			
GREEN		5	5		±5%			F		500	
BLUE		6	6								
PURPLE (VIOLET)		7	7								
GRAY		8	8								
WHITE		9	9								
GOLD				0.1							
SILVER	CN				±10%	±30%	±10%				

TABLE 4 — TEMPERATURE COMPENSATING, STYLE CC.

COLOR	TEMPERATURE COEFFICIENT*	1ST SIG FIG	2D SIG FIG	MULTIPLIER	CAPACITANCE TOLERANCE		MIL ID
					CAPACITANCES OVER 10 UUF	CAPACITANCES 10 UUF OR LESS	
BLACK	0	0	0	1		±2.0 UUF	CC
BROWN	-30	1	1	10	±1%		
RED	-80	2	2	100	±2%	±0.25 UUF	
ORANGE	-150	3	3	1,000			
YELLOW	-220	4	4				
GREEN	-330	5	5		±5%	±0.5 UUF	
BLUE	-470	6	6				
PURPLE (VIOLET)	-750	7	7				
GRAY		8	8	0.01			
WHITE		9	9	0.1	±10%		
GOLD	+100					±1.0 UUF	
SILVER							

- THE MULTIPLIER IS THE NUMBER BY WHICH THE TWO SIGNIFICANT (SIG) FIGURES ARE MULTIPLIED TO OBTAIN THE CAPACITANCE IN UUF.
- LETTERS INDICATE THE CHARACTERISTICS DESIGNATED IN APPLICABLE SPECIFICATIONS: MIL-C-5, MIL-C-250, MIL-C-11272B, AND MIL-C-10950C RESPECTIVELY.
- LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESIGNATED IN MIL-C-11015D.
- TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE.

Figure 25. Color code marking for MIL-STD resistors, inductors, and capacitors.

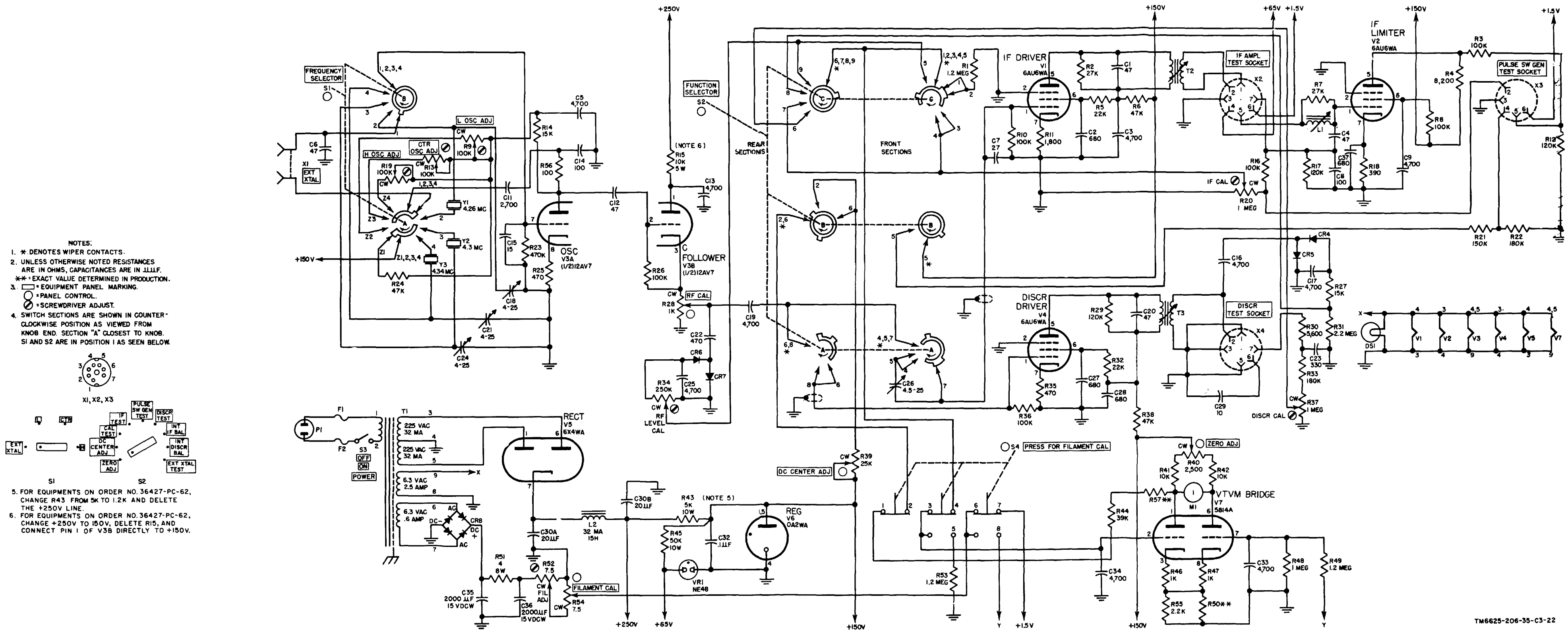


Figure 26. Schematic-wiring diagram (AN/URM-113).

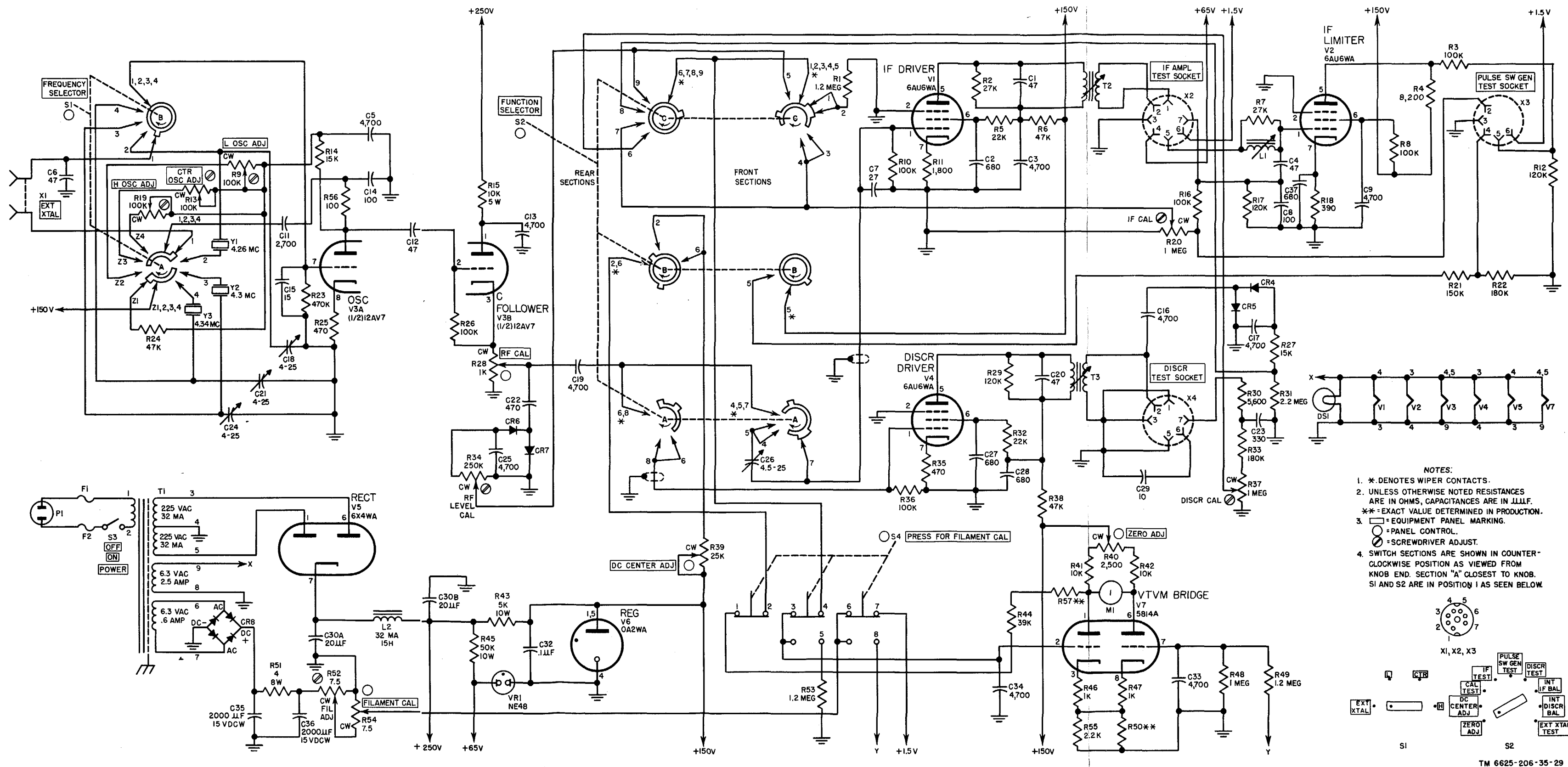


Figure 26.1. Schematic-wiring diagram (AN/URM-113A).

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL.

SOMETHING WRONG WITH PUBLICATION

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

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PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT.

PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER

SIGN HERE

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
 1 decimeter = 10 centimeters = 3.94 inches
 1 meter = 10 decimeters = 39.37 inches
 1 dekameter = 10 meters = 32.8 feet
 1 hectometer = 10 dekameters = 328.08 feet
 1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
 1 decigram = 10 centigrams = 1.54 grains
 1 gram = 10 decigrams = .035 ounce
 1 decagram = 10 grams = .35 ounce
 1 hectogram = 10 decagrams = 3.52 ounces
 1 kilogram = 10 hectograms = 2.2 pounds
 1 quintal = 100 kilograms = 220.46 pounds
 1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sqfeet
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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TM 11-6625-206-35 RADIO TEST SET AN/URM-113 - 1959

PIN: 019419-000